

Learning from past adaptations to extreme climatic events:

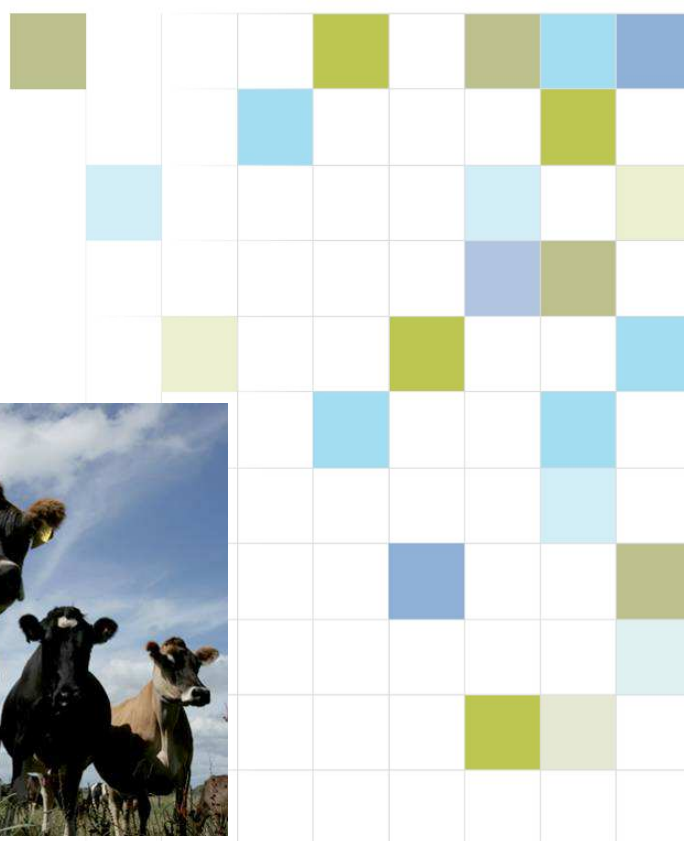
A case study of drought

Part C: Main Report

June 2008

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Learning from Past Adaptation to Extreme Climatic Events: A Case Study of Drought.

Main Report

June 2008

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Executive Summary

The potentially damaging impact of drought on agriculture and human populations is not a recent phenomenon but has been observed for almost as long as we have records of human civilisation. In the modern world drought remains a serious issue despite improvements in agricultural technologies such as irrigation and plant genetics.

Historically agricultural drought in New Zealand has not been uncommon and this trend will continue. Indeed, climate models have predicted that under global warming drought conditions will extend northwards to cover the entire east coast of New Zealand and droughts that were 1 in 20 year events could soon become 1 in 5 year events. As a result, developing strategies for coping with agricultural drought is likely to become a critical part of New Zealand agriculture and agricultural policy in the coming decades. There is therefore an urgent need to examine responses to specific drought events to aid in the development of adaptive capacity in New Zealand.

Understanding how New Zealand's farmers have historically adapted to extreme climate events will play a critical role in developing effective adaptation plans for the future. While the temperate climate in New Zealand has meant that much of the country has not been subject to frequent, widespread or prolonged climatic extremes, farmers in certain areas of New Zealand *have* needed to respond to climatic events on their farms and have developed many coping strategies accordingly.

This report focuses on these past adaptations of farmers to the extreme drought events. The research will explore the 'strategic responses' of farmers in the regions of North Otago and South Canterbury, areas which have previously experienced extreme drought events. Having gained an understanding of what farmers have done historically to cope with drought events, this research aims to use this knowledge to develop future adaptive and mitigation strategies for New Zealand's farmers.

Most importantly this will also lead to the development of suitable methodologies to enable future applications of more extensive and broader investigations – covering additional climate responses such as flooding and cyclone events. Thus this study will contribute towards building adaptive capacity in New Zealand's farming systems to cope with extreme climate events.

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1. Introduction

Adaptation to climate change is likely to benefit from experience gained in reaction to extreme climate events, specifically by implementing proactive climate change risk management adaptation plans (IPCC, 2007).

The potentially damaging impact of drought on agriculture and human populations is not a recent phenomenon but has been observed for almost as long as we have records of human civilisation. For example, Russill (1998) refers to the “great drought” of 1276 and 1299 that occurred in the southern USA and led to the abandonment of many local indigenous settlements. Similarly Haug et al. (2003: 1732) observe in a study of northern Venezuela “Our data show a clear link between the chronology of regional drought and the demise of the Classic Maya culture” between 760 and 910 AD. In the modern world drought remains a serious issue despite improvements in agricultural technologies such as irrigation and plant genetics. In fact, predictions suggest that if global warming continues many parts of the world are likely to experience increased frequency and severity of drought events – and this includes increase of drought along the east coast of New Zealand (IPCC, 2001).

Understanding how New Zealand’s farmers have historically adapted to extreme climate events will play a critical role in developing effective adaptation plans for the future. Much of this knowledge, however, is ‘tacit knowledge’ – i.e. it is unwritten and exists within the farming community’s ‘knowledge culture’ rather than being directly available to the scientific community. This report explores how valuable this knowledge is for developing responses to climate change in New Zealand farming. There are four reasons for believing this kind of study is critical for effective climate change adaptation:

1. The breadth of knowledge farmers have for responding to climate change is likely to be far greater than anything research could deliver within the medium term. Thus we can greatly accelerate our understanding of climate adaptation and use this as a base to build future research programmes.
2. As observed by the IPCC (2007), knowledge gained from past experience can be critical in implementing proactive climate change risk management adaptation plans, and, importantly, can aid new farmers who have no previous experience with climatic hazards.
3. Adaptive measures based on existing systems and beliefs are likely to be directly compatible with existing systems and thus cause minimum disruption to implement. Providing farmers with ‘ownership’ of the response in this way is also likely to enhance their willingness to take adaptive measures (Burton et al., 2007).

4. Understanding how farmers currently respond to climatic change will assist in the development of models that predict the financial and environmental impacts of climate changes on the agricultural industry.

Why is tacit knowledge important? Polanyi (1966) argued that knowledge could be divided into two types – tacit and codified. Codified knowledge represents scientific knowledge which is “explicit, standardised and easily transferable” whereas tacit knowledge is personal and context dependent. As such, tacit knowledge is “difficult, if not impossible to communicate other than through personal interaction in a context of shared experiences, and this seems to set a premium on physical (as opposed to virtual) proximity for transactions that involve a strong tacit dimension” (Morgan & Munton, 2000: 161). Ironically, given that much information has in the past been gathered in a codified manner (for example, quantitative surveys and psychometric measures) it is widely believed that tacit knowledge is more important in determining behaviour (Gao et al., 2003).

As a consequence, social science across numerous disciplines has been increasingly moving away from quantitative approaches to research and towards qualitative approaches. These promote a more personal context dependent analysis and involve the in-depth analysis of discourse rather than statistical analysis of quantitative or numeric data. What qualitative studies do, therefore, is to represent the world as the respondent (in this case farmer) sees it, complete with the context within which the knowledge is applied.

For understanding farmers’ response to climate change this is particularly important for one key reason. As we outline in the literature review (Part A of the report) the impact of and response to drought is often heavily context dependent. Each drought occurs in a different economic, technological, climatic, micro-climatic and even political context and, similarly, every farm has a unique combination of labour, land types, soil types, topography, access to water, and so on. Optimum strategies for drought response are thus often developed through the farmer’s tacit experience of drought in his/her own context, rather than being obtainable in a codified form. In this study we gather this tacit knowledge within its context and illustrate the options available to farmers for drought adaptation. The study, therefore, does not present an ‘optimum’ strategy for drought response, but rather analyses experienced farmers’ (i.e. farmers with high levels of tacit knowledge) responses to drought, and presents a series of possible drought response choices (chapter 3) and an analysis of the importance of context (chapter 4).

1.1 Report focus and structure

This report focuses on gathering and understanding farmers' historic responses to extreme drought events in North Otago/South Canterbury. The objective is to provide information for improving adaptive measures for drought under a climate change scenario and to analyse the usefulness of the approach of gathering tacit knowledge for application on other climate change phenomena. Thus there are three main questions addressed:

1. How have farmers in the study area historically adapted their farms to cope with the extreme drought events of the 1980s and 1990s and how did the context of the drought influence their response?
2. What adaptive strategies do farmers need to follow to best cope with any increase in drought events in the future?
3. Are the methodologies applied here for the exploration of tacit knowledge useful for future applications to other extreme climatic events (for example, increased flooding or cyclones)

To address these questions, this report has been divided into 6 chapters and a separate literature review. These are:

Chapter 1: Introduction: This chapter introduces the study, setting out the research question and outlining the structure of the report.

Chapter 2: Methodology – researching tacit knowledge. This consists of a methodology detailing the qualitative research process employed in the study

Chapter 3: Drought adaptation strategies – an analysis of the experiences of farmers in North Otago/South Canterbury. This is the first analysis chapter. This chapter uses discursive analysis techniques to explore farmers' experiences with drought and provides a classification of the adaptation strategies used.

Chapter 4: The importance of contextual issues in historical drought adaptation in New Zealand – an analysis of the 1980s, 1990s and 2000s. This chapter deals with the issue of context in drought. This chapter is divided into sections to deal with the 1980s and 1990s droughts, and current 'dry' separately, exploring how farmers adapted their behaviour with experience and how the context of the drought influenced their response.

Chapter 5: Understanding tacit knowledge – a key to effective climate change response? Chapter 5 is a brief analysis of the methodology, assessing its possible application to deal with other climate change issues.

Chapter 6: Conclusion. The conclusion chapter will synthesise the discussion and findings of this report. It will also reflect on the contributions the report has made to academic debate, underlining the affirmations and challenges to previous research, along with its contributions to current literature.

Literature review: Learning From Past Adaptation to Extreme Climatic Events: A Case Study of Drought. Part A: A literature review of drought adaptation.

While this report covers the fieldwork (and main part of the study) a literature review is included as a separate report (Part A). Note, this is kept as a separate document as it is a reference document for the main report – rather than being fully integrated into the analysis. Where relevant, the reader is directed to the report in the text.

2. Qualitative research methodologies

2.1 Introduction – why qualitative interviewing?

As noted in the introduction, in order to explore farmers' tacit knowledge of drought adaptation, this study will be employing qualitative research techniques. While some researchers suggest that quantitative research methods, consequently, are now seen by many as passé as they represent "mindless quantification and measurement" (e.g. Hamnett, 2003) others have argued that this is not the case, and that quantitative research approaches in social research can still be valid (e.g. Johnston et al., 2003). We acknowledge, as with Johnston, that such techniques can be used in some circumstances. However, we contend that in order to understand complex adaptive responses to drought qualitative techniques offer the best means of allowing us to address the research question. There are two key reasons for this.

First, we wished to understand how farmers construct a complex system to cope with drought (at the farm, individual, family and community level) and, furthermore, how this system is then adjusted to cope with external pressures such as changes in the value of livestock, economic conditions, or numerous other potential external influences. Quantitative research makes certain assumptions concerning the regularity of relationships within the social world (i.e. that people behave in the same stimulus/response manner as objects in the natural environment), but, in reality, social worlds do not follow simple mechanistic rules but are chaotic, uncertain, unstable, complex and even contradictory. In this environment quantitative assessments are not effective (Borch, 2007).

Second, quantitative techniques have been criticised for failing to produce results of relevance to the real world as they reduce the world to a series of statements for assessment – rather than allowing people to describe the processes of decision-making or the feelings that may accompany the act. As a result, they are seen by many to "provide 'idealised' accounts of attitudes and behaviour which, because they are rationalisations have an uncertain relation to actual situations" (Silverman, 1985: 15). In effect, quantitative studies primarily reflect the interviewer's interpretation of the situation and not the interviewees, as well as making strong assumptions about the cognitive-rational nature of the decision-making process. They remove the act from the complex, confused everyday life context in which it takes place. Qualitative research, on the other hand, involves seeking a detailed appreciation of human behaviour, embracing lived experience through a reflection on, and interpretation of,

the understandings, experiences and shared meanings of peoples within their everyday realities (Dwyer and Limb, 2001)

The rejection of prescheduled standardised interviews means that the results obtained between individual cases are not statistically comparable. In fact, qualitative interviews (and interpretivist theoretical positions in general) place more importance on the interviewee as a source of knowledge (someone who can explain the situation) and less on the researcher's ability to interpret knowledge emerging from statistical comparison. Open-ended interviews based on a loose interview schedule (where questions can be asked in any order, questions may or may not be asked, and questions can be added as more is learnt about the situation of the interviewees) have three main advantages over scheduled questionnaires (Silverman, 1985):

- 1) They allow the respondents to explain their unique way of seeing the world. In the case of this study, we learn not only what the farmer is doing, but their rationale behind it, historical acts that led to this position, the influence of other family members, and so on.
- 2) It assumes that no fixed sequence of questions is suitable to all respondents. Because of the differing structures of their farms and economic situations, farmers are in a myriad of different situations – and this enables the researcher to follow questions relevant to the farmer's position rather than ask generic questions which may or may not be relevant.
- 3) It allows respondents to raise important issues not contained in the questionnaire. Scheduled questionnaires limit the number, nature and type of responses the interviewee can make – rather than allowing the respondent to present new issues that he/she may consider important.

Rather than searching for regularities and differences representative of wider society, qualitative researchers focus on understanding complexity and difference within the population (Guyer et al., 2007). As a result, some researchers have contended that qualitative, case-based studies are problematic because the results cannot be generalised (Herbert, 2000). With the qualitative vs quantitative debate it is always a trade off. While it may be possible to generalise from quantitative approaches (where the sample is a statistically representative one) they reduce the level of understanding that can be achieved in the study - thus, yes, we can generalise, but how well do we understand the behaviour under investigation (particularly in a

complex environment)? Qualitative research on the other hand cannot be generalised, but it can show us the variety of responses and allow us to understand why people have responded in a particular way. As our objective is to understand the processes behind climate change adaptation it therefore provides a more appropriate methodology. Some researchers prefer to use mixed-methods, e.g. by using qualitative techniques to generate categories and understanding and then, if required, quantitative methods if the researcher is interested in the representativeness of basic responses (e.g. Walter et al., 2007). However, this is often done as a second stage of a project and in this case the time-frame excluded this possibility.

This study adopted a qualitative case-study approach to develop a greater understanding of the experiences and actions of individual farmers within the broader contexts of their farm businesses and the climatic/economic situation of the time. The study will enable a greater critical awareness of how farmers have historically adapted to drought from the participants' perspectives, and how they are connected to the broader structures and frameworks that create, or prevent, the realisation of different opportunities and possibilities in their farming businesses.

2.2 Identifying a research population

For this project, the research is confined to a detailed study of farmers who have farmed in drought in two regions of Southern New Zealand; South Canterbury and North Otago. These neighbouring regions collectively cover nearly one-quarter of the South Island and are dominated by mountainous landscapes with a long history of agricultural drought. One reason for choosing this area was the occurrence in the late 1980s and late 1990s of two extreme drought events of similar magnitude (He, 2000). This enabled us to explore (a) the different context of the two droughts and how this influenced the response, and (b) whether farmers had adapted their behaviour after the first drought in a manner that improved their position in the second. In the event it turned out that some farmers were experiencing a drought (or at least a 'dry') during the fieldwork and thus there was a third point of comparison – one that was at the forefront of many farmers' minds at the time. In particular, some farmers in the Hakataramea Valley were in drought conditions but farmers in some areas were faring better.

2.3 Interviewee selection

The selection of respondents for the study was derived from a multi-method approach aimed at securing a diverse range of farmers. For this a number of criteria are selected and a sampling framework devised in order to try to sample from across the spectrum – thus avoiding the possibility of interviewing only one type of farmer. Key criteria for the matrix were the size of the farm, irrigation access, the farm type and the geographical location (to avoid clustering farmers in a single area and ensure a range of distances from an urban centre). In order to ensure farmers had personal (and lengthy) experience with drought, farmers had to be living on the farm (owner occupier or manager) and should have experienced both the 1980s and 1990s droughts (at least as a young adult on a farm in the case of the 1980s drought).

In selecting farmers no bias was shown for farmers perceived to be ‘leaders in their field’ (as is sometimes the case in such studies – e.g. MAF 2008). The reason for this is that, in order to understand the context behind drought response, we wanted to hear from a range of farmers experiencing different situations – both those who were doing well (and therefore have a large number of potential response options available) and those not doing so well (for example, farmers on smaller farms with no irrigation). Details of the final sample are presented below in Table 1.

Study No.	Farm Size ha.	Fmr Age	Mgmt Exp	Farm Type	Rainfall mm/yr	% irgtd	Length on farm
53	805	50/45	28	S/B	600	0	25
54	345	58/58	40	S/B/D	950	0	30
55	13600	49	28	S/B/D	750	0	28
56	1600	57/55	34	S/B/D	585	0	34+
57	260	44/35	16	S/B	560	0	16
58	14400	55	30++	S/B/D	360	4	27
59	1050	55	28	S/B	610	0	28+
62	510	60/55	30	S/B	616	0	14
63	700	50/50	25	S/B	620	0	15
64	278	57/52	36	DY	740	100	14
65	367	49	27	S/B	550	22	27
67	15000	55	35	S/B/D	700	3	8
70	1100	45	25	S/B	665	0	25
72	1032	50	27	S/B/D	1000	0	27
73	326	58	28	C/S	762	93	23
75	280	46	28	DY	588	80	3
76	626	43	15	S/B/C	370	10	8
77	160	65	41	S/C	508	0	41
78	167	66	45	S/B	500	0	45
79	3000	40	20++	S/B	600	0	4
80	Rural Trust Advisor						

Points of clarification:

1. Farmer age in years: Male/Female (if present)
2. Management Experience in a position of responsibility
3. Farm Type: S=sheep; B = beef; C = crops, D = deer; DY = dairy
4. Rainfall is an average over the year
5. Percentage of the farm irrigated
6. Length on their current farm in a management position.
7. ** = manager of a corporately owned farm (otherwise family farm owner/operator)
8. + = 5th generation family farmers
9. ++ = NOT from a farming background

Table 1: Interviewee summary

The pastoral farms ranged in size from 160 to 15,000 hectares. The minimum age of the farmers involved was 45 years – meaning that this farmer would have been 25 at the time of the 1988 drought. In total the farmers represent over 500 years of experience in dealing with farming in dry conditions with an average of 29 years general farming experience, and 22 years farming on their current farms.

2.3.1 Assessing validity

In qualitative interviewing the ‘validity’ of the study is not assessed in the same way as quantitative studies. As the objective is not to get a representative sample but to get a sample that represents the diversity of the population, statistical analysis is not appropriate for establishing validity. Approaches for establishing validity in qualitative methods include the analysis of the same documents by more than one researcher and a comparison of results against key ‘expected’ results. In this study the results were analysed by two researchers who arrived at similar conclusions concerning the key messages from the research. Further, the ‘adaptation strategies’ arrived at are a good match to those from literature on adaptation in Canada, the US, Australia and New Zealand with almost all of the adaptation strategies listed being detected in this study (see tables 3.1 and 3.2 in the literature review for a list of tactical and strategic strategies). Thus, although the sample is small, we can be confident that the results concur with the general literature on drought adaptation.

2.4 The interviewing process – semi-structured interviews

Fieldwork for the research was conducted between April and May 2008, with a total of twenty farmers and their spouses (where available) and one drought advisor from the Rural Trust. The spouse was included in the interview as research in Australia has suggested that the family plays an important role in drought response (Stehlik, 2003 a,b) and we wished to ask questions concerning the role of other family members.

The key data collection method employed in this project is in-depth, semi-structured face-to-face interviews. Semi-structured interviews were used because they take on a conversational form, whereby dialogue between the interviewed and the researcher ebbs and flows through a range of researcher prompted issues, or forays into other matters. These latter topics, unanticipated by the researcher, provide rich additional insights and contextual information (Valentine, 2001; Bennett, 2002). The value of such interviews and resulting narratives lies in their capacity to expose differences, contradictions and complex, unique experiences (Somers, 1994; Bennett, 2002; Peoples, 2007).

While conducting the interviews this study focused on consistency to ensure that each interviewee received the same information and that they were asked common questions from the key themes¹. A regular procedure was also followed. Upon arrival, and after an exchange of pleasantries, the focus of the study and how it was being achieved was explained to the participants. This was followed by a reiteration of the ethics associated with the interview process. During this initial discussion all participants were given the opportunity to ask questions of the researcher.

The decision to record the interviews was also made taking into account the experiences of previous research. Recorded interviews provided the dialogue verbatim, and whilst some emphasis and body language may be lost in transcribing, a full record of their words was gathered. Recording the interview also removed the need to focus on note-taking which can interfere with the quality of the listening by the researcher, along with discussion facilitation and the rapport which can build up between the interviewer and interviewee. Overall, the interview process provided the information required to gain an understanding of how farms respond and adapt to drought, retaining the specific language and meanings of the participants as much as possible.

2.5 Ethics

This study has operated within AgResearch's ethical expectations for research involving human participants. This ensured that issues of confidentiality, informed consent and the participant's right to withdraw if requested were observed. Furthermore, the intended uses of the data gathered and data storage comply with research requirements. All participants received a written and verbal outline of the project and a commitment to maintain participant confidentiality.

¹ See Appendix One

2.6 Positionality

In utilising an interview methodology a researcher visited the farmers at their farms at a time of their convenience. The researcher is female in her forties and works as a social scientist for AgResearch. She clearly explained her occupation and her experience in farming. Due to her background, the researcher's interpretation of observations is not entirely objective but every effort has been undertaken to accurately represent respondent behaviour and feedback. The objectivity of the research was confirmed through the checking and co-analysis of the transcripts by another AgResearch social scientist with international experience in qualitative methodologies.

3. Drought adaptation strategies – an analysis of the experiences of farmers in North Otago/South Canterbury.

3.1 Introduction

In the literature review we suggested that there are two basic ‘types’ of farming responses to drought – tactical decisions (short-term decisions such as when to sell animals or when to plant crops) and strategic decisions (long term decisions involving adjustments to the farm structure) (e.g. Risbey et al., 1999; Smit & Skinner, 2002; Bradshaw, 2004). However, in the analysis we suggested that this classification may be a little simple – in particular because it excludes familial and social responses to drought. Analysis of the 20 farmer interviews suggested that rather than the scale/type of the decision made by the farmer, a more useful classification could be developed based on the key components farmers need to cope with drought. In particular, there are three main problems that farmers face to make the farm drought resistant.

1. Farmers need to develop the farm such that it is able to resist drought (should it occur) as well as build up resources that may be needed to fight drought in future years.
2. Farmers need to develop a farming system that provides them with some flexibility to deal with drought when it occurs (i.e. on recognition of a drought to act immediately and effectively).
3. Once the drought is perceived the farmer must have strategies capable of dealing directly with the drought situation and minimising the impact of the drought on livestock, capital and family.

The first group involves responses that are generally applied during good years on the farm – when the farmer has the capital and ability to make structural improvements to the farm to make it more drought resistant. Building up the resources also involves ensuring that there are sufficient reserves of both capital and feed to survive in drought conditions. The second group is again structural but, in this case, it acknowledges that, in order to survive drought, farmers must have developed farming systems that are suited to drought conditions – in particular, that can adapt rapidly should the onset of a drought be perceived. Splitting the ‘structural’ group in this way acknowledges that structuring the farm to survive drought will not be effective if the farmer’s system cannot cope with the economic conditions in which he

has to feed or sell his/her livestock. The third set of strategies is comprised of the tactical decisions that the farmer takes during the drought. However, in this case we refer not only to decisions such as feeding livestock or reducing costs, but also to social components such as farmers' strategies for coping with stress. Dealing with the psychological problems associated with drought emerged as an important part of drought adaptation.

This chapter will outline in greater depth the strategies farmers in the survey (averaging 29 years experience in farming in dry conditions) have developed to cope with these issues. It is divided into sections according to the problems faced by farmers (as listed above) with each section containing a number of different strategies as reported by farmers. Note that while the three issues need to be addressed, the selection of these strategies is likely to be very dependent on (a) the economic, familial, and structural (physical, geographical, environmental etc.) position of the individual farmer, (b) the nature of the drought itself in terms of timing, severity and location and (c) the economic conditions of the farming industry as a whole (see Chapter 4 for a more in-depth discussion with reference to droughts in the 1980s, 1990s and 2000s). In short, *there is no single correct approach to take* – they simply represent options open to farmers.

3.2 Making the farm drought resistant

There are two main requirements for making a farm resistant to drought. The first is to develop the farm so that its structure is resistant to drought (e.g. putting in irrigation, developing grass resistant grasses) and the second is to ensure that there are sufficient reserves of food and capital (or access to capital) to last through drought years.

3.2.1 Structure the farm for drought conditions

3.2.1.1 Distribute land over different areas or climate zones

A feature of droughts and 'drys' is that they are often distributed in an irregular fashion on a horizontal plane as even low rainfalls at the right time can make a big difference to pasture availability. Rainfall is also variable vertically with higher altitude areas almost invariably receiving more rainfall than lower areas. This creates a potential strategy for farmers to create drought resistance by constructing their farms so that they own both high country and lowland and/or distribute their farm holdings over a wider geographical area. The difference in rainfall between two blocks of land can be considerable. For example, farmer 65 suggests that "we're in a dry spot but

we're just, the difference between here and the hill, which is only three miles away, is 10 inches per annum, yeah, 250 ml."

Having a block of high country can assist during drought as (sheep) farmers have the option of turning sheep out onto the high country if a dry period emerges. For example, farmer 67 observes "we're lucky because we've got scope and we have, you know we always tip sheep out into the high country over the summer" and farmer 55 that his higher altitude pastures receive 1000 mls per year – whereas his sheep generally graze on land that receives 750 mls. Farmers are able to use this difference in moisture to make their systems more flexible, for example "we had a dry season with it being a bit more moisture up there, we tend to keep stock up there longer before we bring them home for you know wintering hoggets and stuff like that" (farmer 59) however, as the farmer cautions, care must be taken not to overgraze at the higher altitudes. High altitudes can also provide drinking water as farmer 67 suggests, but there is also less grass availability.

The alternative to owning high country land is to distribute the farm over a wider geographical area. Farmer 62, for example, has a number of rented blocks of land dispersed over a wider area and observes that, "once we spread a little from the initial lease, we had diversity of country, which gave us that flexibility". In addition to flexibility in drought, this farmer also refers to flexibility to deal with snowfalls – which can be equally important in drought through its influence on the winter use of feed. Farmer 58 manages a large farm (sheep/cattle/deer) in a dry area and has been trying to convince the farm owners to buy land elsewhere. He suggests:

If we can't get that in, um, at the same time I've been putting proposals because I only manage this place for others, okay, and I have done for, I've been here 27 years, at the same time I've been putting in, um, the alternative of buying a down country place where there is different risks. You hardly ever get droughts in the two areas at once. You know it's very seldom that a drought is everywhere at the same time.

3.2.1.2 Select vegetation and livestock to suit drought and farm

Selecting varieties of vegetation and livestock that are suited for drought conditions (both in terms of their ability to survive in low moisture conditions and how well they fit in with the farmer's system for drought response) is essential for drought survival. In the literature review, numerous authors suggested this as a common strategic response to drought (e.g. Smit et al., 1996; Topp & Shafron, 2006; McLeman et al., 2007). There were not many discussions on this issue during the interviews. However, when it was mentioned, it was clear that farmers clearly put a lot of thought

into the composition of their pastures (farmers 58, 76 and 78). In terms of selecting livestock for their drought resistance qualities, farmer 76 uses perindale ewes because they provide him with both a high lambing percentage (150%) and he can “crew them down pretty hard if I have to”. Others match the stock to the specific characteristics of the farm. For example, farmer 55 operates a merino-lucerne system, with lucerne being grown “because of its growth patterns” and merinos because they are “ideally suited to the ingestion of lucerne”. The same farmer also grazes cattle “so that I had a different type of feed requirement in a different area of the property”.

3.2.1.3 Plant shelter belts

Only one farmer mentioned the use of shelter belts as a drought resistance strategy. Farmer 57 suggested that they had planted shelter belts as the farm is vulnerable to drying out under a south-west wind. He suggests “We’ve got a lot of shelter on this farm compared to some so we’ve grown and that’s for wind resistance. We definitely grow more grass behind the shelter.” That this was not mentioned more frequently does not mean it was not used, but rather that farmers do not immediately think of it as part of their strategy to cope with drought – other issues are perhaps more pressing. However, in areas where drying winds are a problem it is likely to be a useful solution (as farmer 57 observes). The planting of shelter belts is an advised strategy for coping with climate change in New Zealand (Kenny, 2001).

3.2.1.4 Invest in irrigation and/or water storage

Irrigating land is an obvious solution to drought. By irrigating the land it is immediately made immune to meteorological drought – but not to hydrological drought (i.e. if the groundwater or river supplies are exhausted). The growth of dairy has seen a considerable premium put on the purchase of water rights and water is by no means a cheap option – that is, even if farmers are able to get it. A number of farmers are currently in the process of applying for irrigation rights – a lengthy process that may not only cause concern for the fairness of the process but can also be the cause of major disputes. For example, farmer 64 (a dairy farmer, 25 years experience) signed a consent for his neighbour to put in a deep bore, but when he requested the same favour of his neighbour, his neighbour refused to sign thus “It’s made us feel quite bitter, yeah. (Interviewer: Bit of trust lost?) Yeah. And I mean I think what we’ve gone through is mild compared to what some of the horrible ones I’ve heard.”

One key advantage to irrigation is that (a) it provides farmers with a much greater ability to plan ahead and (b), when a drought occurs, the farmer does not act the

same as other droughted farmers (i.e. put stock to the works when prices are low and purchase replacements when prices are high). While both dairy farmers interviewed had all of their land under irrigation, 4 sheep farmers also had relatively small amounts of irrigation to provide a crucial option in the case of drought. For example:

I mean you've got to be flexible and one of the things here, I mean we run merino sheep and we have a half-breed flock as well which we fatten all the lambs off and we've probably drought proofed the property by putting a little bit more irrigation. (farmer 67)

You know if we didn't have irrigation we would have been just selling on a store market and taking what we could get, which wouldn't have been very much. (farmer 65)

Our ultimate aim is to breed and finish everything on the place because we do have some irrigation. That is one of our drought things. We put in some irrigation, we put in another pivot, we're hoping to put in another one, which is a drought insurance. It's not so much, we're trying to put another 400 acres of spray irrigation, we have been for the last couple of years and we're still trying to put it in. That's not going in to expand, that's going in as a drought insurance. (farmer 58)

Accessing irrigation is not the only important part of irrigating as a drought strategy as it also requires that the irrigated water is applied in an efficient manner (also see Bryant et al., 2000; Topp & Shafron, 2006). Farmer 64 observes that he has invested in a new rotary irrigation system and this has improved the efficiency of his system: "This is the first year that we've ever had that - we've had a drought and kept the production up." It is also important to note that irrigation is only open to some farms, because it depends on having suitable access to water and on being able to obtain (and afford) the rights to use water. As observed above, irrigation is a guarantee against meteorological drought but not hydrological drought. Thus, even for irrigated farms there is the possibility of water restrictions and, in such a case, these systems are likely to become highly vulnerable (as happened in the recent Australian drought – Topp & Shaffron, 2006). In the study region, however, the likelihood of this is diminished by the fact that an increase in westerly wind flow that is expected to accompany increasing drought is likely to see increased rainfall in the Southern Alps (Fitzharris, 2007).

Another means of coping with water shortages is through the construction of dams to provide water for stock – as in the case of farmer 58 (300mls average rainfall).

3.2.2 Build up reserves during good years

3.2.2.1 Ensure there is sufficient stored feed

Growing and storing feed for livestock appears to be the most important single drought adaptation strategy for farmers in the North Otago/South Canterbury area. For example, when asked what advice he would give to new farmers, farmer 62 (30 years experience) suggests “conserve feed” to which his wife adds “we’ve got a silage pit over here that’s always full, well not always full but it’s always got enough for two years.” Farmer 65 (25 years experience) suggests that by the time of the drought at the end of the 1980s

We most probably were into silage and starting to conserve feed in a silage pit which most probably for us has been one of the better strategies we’ve had for droughts.

and farmer 78 (41 years experience)

Well that’s what keeps us going. But often if you’re low in stock numbers it costs you heaps to stock up again and then you just get stocked up again and the dry starts again so really you’re looking to fill hay barns up and conserve feed, as dry insurance.

The figure often quoted by farmers for storage is 2 years worth: sufficient to get through two dry years and a bad winter (e.g. 62, 72, 78, 75). Some farmers, however, suggest that they will store as much feed as they possibly can, regardless of how long it remains in storage “So having silage on, I’ll dig extra pits, and it doesn’t worry me if it sits there for five years.” (farmer 65, 25 years experience). The problem with placing too much feed in storage is, as he admits, that it is expensive and, for this reason, he and farmer 62 both note that there is some reluctance to store too much feed. On the other hand, both farmers believe that the cost is worth it when the situation begins looking difficult. For example, farmer 65 suggests:

I always say, and farm discussion groups most probably criticise me, they say it’s too expensive. I said it’s money in the bank and it pays interest very handsomely when you need it, until such time yes, it has cost you a certain amount to put it away.

Farmer 62 suggests that it can be a difficult decision to put feed away – particularly in years where the cashflow is not good “but then all you’ve got to think about is why you’re doing [it] and you do it.” The strategy of spending money on storing large quantities of feed is likely to pay dividends in the case of drought because of the cost of feed and, more importantly, the cost of restocking after a drought when prices are high (according to farmer 78). Storing silage in particular can be useful because of

the length of time it can last. Farmer 78 tells an anecdote of a friend with a silage pit that was sealed for 14 years, and adds “I know it’s expensive to make, but droughts are expensive.” Putting away surplus grass, however, is not always easy – particularly in very dry country. Farmer 58 (in a very dry region) suggests that, while he used to be able to put grass away, the strategy has not worked for the last 5 years meaning “we’ve had to go out and buy our extra when the drought years have kicked us”.

The dairy farmers interviewed had a slightly different experience with drought and, consequently, their feed requirements are different. With 100% irrigation their main problem is not drought in the summer, but rather the winter period where grass ceases growing. Farmer 75 observes that “I like at least a winter in front of me, a winter’s supplementary feed” and farmer 64 suggests “We have paths, I mean we can make another half extra winter if you like. Don’t usually go too silly with it because we know it will grow as soon as it warms up in September.”

3.2.2.2 Use capital wisely during good years

In Chapter 4 we discuss the importance of farmers’ economic position to the perception of drought. Essentially, if farmers have stored up sufficient capital during good years they have a far wider range of response options available to them than if they have little capital (or access to capital). While only a few farmers in the survey directly mentioned building up capital as a strategy for drought survival (55, 63 and 67), many talked about the problems created by the lack of capital during the 1980s drought (see Chapter 4). One farmer (farmer 55 – a high country farmer), however, suggested that using capital wisely during the good years had been his key lesson for farming for drought. He states:

This is a key lesson I learnt and it goes like this. The decisions that we make during those dry periods are quite clearly very important. But they are not your most crucial decisions. The most crucial decision that a farmer can make are when that bank account is looking really good and things are very prosperous because the decisions made at that time are the ones that are really going to count when it gets tough.

3.3 Making the farming system drought resistant

3.3.1 Develop and implement flexible farming systems

Many farmers in the survey talked about the need to keep the farming system flexible in order to respond to drought if it occurs. In particular, three strategies were used: (a) agricultural diversification to ensure that the farmer has the flexibility to capitalise

if one part of the market is doing better than others, (b) the creation of pivot points in the system so that, should a drought be detected, the farmer has a predetermined option for response and can act before serious problems emerge (without losing significant income from capital stock) and (c) the keeping of a core system with a flexible periphery (e.g. 75% capital stock, 25% trading stock or feed production) to provide farmers with options in the case of drought. Other structural features already discussed (e.g. distributing land over different climate zones, irrigation and building up capital and feed reserves) also act to add flexibility to the system.

3.3.1.1 *Diversify production types on farm*

A key difference between drought in the 1980s and the current situation is that, at the time of the 1980s drought, farmers were much more reliant on a single production system (for example, sheep or sheep/beef) and, as a consequence, when the price of sheep (in particular) reached the bottom there was no alternative source of income that may have compensated. For example, farmer 72 (27 years experience) reports his own father's experience with the 1980s drought:

I think they grain fed, feed out hay and they'd get in the pooh because they'd only have large numbers of sheep so they just, yeah, the sheep got skinner and they just wishful thinking it was going to rain.

In contrast, many farmers now run mixed systems as is outlined below:

5 farmers:	Sheep, cattle and deer
6 farmers:	Sheep & cattle
3 farmers:	Livestock (unspecified)
2 farmers:	Dairy (irrigated, so no need for diversification)
2 farmers:	Intensive cropping (irrigated)
1 farmer:	Sheep & cropping
1 farmer:	Sheep only (high country)

The opportunity (in many cases) to diversify production on the farm (in particular the growth of the deer industry) has placed farmers in a different position to that of the 1980s.

Farmer 72 continues:

And there's also, when you have a mix like that, there's always something that's going, that's flavour of the month. Like at the moment, you can't really get rid of cows, beef cows, and certainly no-one wants dry sheep but the deer are doing really well so we can unload. (farmer 58 makes a similar comment)

Farmer 55 places a similar emphasis on diversification as a drought resistance strategy. He notes that through experience in past droughts he learnt of the need to diversify. Consequently, he raised his cattle numbers by 50% and went into deer farming “so that I have surety of income from other sources.” He also observes that the strategy of increasing the beef component had other advantages as they had a different type of feed requirement in a different area of the property – thus he was able to better utilise his property. Similarly, farmer 67 (sheep & beef) has diversified the farm he took over 7 years ago. At that stage the farm was reliant on merino wool for 80% of its income (and had been since 1928) but, over the last 7 years, the farmer has been able to reduce this reliance to 30% because of adopting alternative approaches such as finishing lambs, cattle and ‘bits and pieces’. Farmer 65 was also farming only sheep (intensively) in the 1980s, but is now also farming cattle to diversify the income base.

In addition to these options, the growth of the dairy industry and its impact on feed prices (see Section 4.2.1.5) has now provided farmers with the opportunity to either graze dairy cows on their land or grow surplus feed for sale to the dairy industry (or for general sale). This has huge benefits for drought prone systems. As farmer 57 observes, the recent growth of the dairy industry has enabled him to reduce his stocking rate to 75% of his stock units (a good position to be in in the case of drought) as if you grow an extra paddock of feed as silage, barley or hay you can always sell it to dairy farmers (farmer 59 has similarly moved into growing feed). He observes:

What have we learnt this year? I think as far as drought goes, we wouldn't have changed much from this year. Just to keep that flexibleness in there, have 25 percent stock units at least. That's just got to be able to be shifted every year. Every year is different. Some years if grazing is cheap, you might be better to graze away than kill them. Might be better to own the stock but still have them grazing away. Each year is just different, different markets.

A further advantage of diversification as a strategy is that, when it comes to slaughtering stock, different demand levels exist for different animals. Farmer 58, for example, observes that although he had problems getting rid of his sheep the deer were easy to get rid of because “they were desperate for them”. Thus, through diversification he was able to reduce some of the pressure on his grazing.

It should be noted that not all farmers have the same range of choices. In particular, farmers on (predominantly) tussock land “do not have a lot of choices – it’s sheep and beef country” (farmer 79).

3.3.1.2 Develop a system with a pivot (decision) point for drought response

Diversification of the type of produce enables farmers to take advantage of higher prices for one particular commodity. Equally important, however, within single commodities, is the time at which they enter the market, what stage they are at when they enter the market (e.g. lambs or in-lamb) and how they fit in with the farmer’s overall management system (e.g. stores or capital stock). In normal conditions, this is simply a matter of which part of the market the farmer is targeting. In drought, however, it becomes more important as the system needs to be flexible enough to rapidly change at the point where the farmer considers there is the likelihood of a drought – a pivot point around which the farmer can instantaneously switch from a normal farming system to a drought system. For this, farmers determine the time of the year that a drought is likely to first become apparent (generally after the spring) and plan to be able to destock at this point if required. If a drought does not eventuate, the stock can be fattened and sold for slaughter, new stock can be taken on or the land could even be used for feed production if the price is high. The advantage of such a system is that the farmer is likely to get good prices for livestock if a drought occurs as they can get rid of them at the first sign of dry conditions.

An example of how farmers develop their farming systems so that there is flexibility around a pivot point was outlined by farmer 72. The farmer suggests that their system was prompted by the fact that they “got so sick of being landed with thousands of lambs and drought and just having to ditch them for terrible money” and revolves around “being able to unload huge amounts of stock very quickly” without selling as stores. The farmer suggests:

We grow a lot of winter feed so we store them all on and then we use our spring flush which just about guaranteed because we’re high rainfall and we get a good, really reliable rain normally between October to December so we use that flusher feed to get all our livestock up to hopefully cullable weights and then, if after Christmas it doesn’t dry out, well then, good, they can just put on more weight. But if its drought, the drought is here and we haven’t got any feed, they can go. And we do that with different classes – that’s the bulls and we also do that with weaner deer.

Farmer 72 has also been experimenting with improved lamb growth rates by changing the breeds in order to try to “get those lambs really flying off their mothers and into the works” by January before any drought problems emerge. Note that in this case the strategy is enabled by the ‘guaranteed’ high rainfall and reliable rain in spring and the predictability of the drought period (nevertheless, the farm is still relatively drought prone because of the high stocking rates operated). Farmer 65 operates a “flying mob” “these are old ewes so they’ve gone to ram early, or bulls which we’ve most probably done more of since the mid-80s. We’ve most probably got into more bulls which gives you a mob that can go quickly or generally by Christmas, because generally a dry doesn’t catch us here until post-Christmas.” A similar pivot strategy is operated by a smaller coastal farm (farmer 56) operating mainly dairy support and stores. In this case, where the farmland is allocated for grazing in the spring:

We raise bulls for the dairy farmer so they’re always gone by about the 12th December, aren’t they? So then XXXX would decide whether or not he was going to buy in calves for the next year at that stage or like it’s been dry this year and we haven’t bought anything.

Another possibility to create a pivot point for drought response comes from combining cropping with livestock. Farmer 55, for example, purchased a header for storing barley with the intention of selling the barley as a crop in itself (and thus reducing the dependence on livestock) but, as he points out, “if you have to dump your seed that particular season, you’ve still got a feed source so there are strengths within this” although in recent years the barley has predominantly gone for his own usage.

Of key importance to the success of pivot points is that the decision to switch systems needs to have been made previously and, once the point is reached, action needs to be taken immediately. As farmer 55 observes:

You don’t know that with a drought and so droughts, um, and so to deal with that, we as farmers need to recognise decision points and we need to become aware of when those points kick in and when they kick in, they kick in ... and we as stock managers need to be quite hardnosed about those decision points.

There is a strong suggestion – both in the results from this study and the advisory literature from MAF (2008) – that making decisions early (and sticking with them) is of key importance to effective drought response. Delaying any decision can make it more problematic to cope with the drought later as, once a significant loss must be

taken (and the stock are in a poor condition), the temptation to wait until rains rather than getting rid of stock increases (see Sections 3.4.1.1 & 3.4.1.4). By working a pivot or decision point into their system the farmers above have essentially made the critical decision already and may avoid losing significant amounts of money once the drought becomes more widespread as “the value goes out of animals quite quickly when it is dry.” (farmer 79).

3.3.1.3 Keep spare capacity to allow flexibility

As noted above (Section 3.3.1.1) keeping spare capacity on the farm can be an important part of a drought resistance strategy. The advantage of this approach is twofold. First, it allows the farmer to keep stocking rates low and thus not overgraze the fields or put too much pressure on the feed reserves in case of drought. Second, it provides farmers with the flexibility to use the remaining capacity as they see fit – depending on the climatic and market conditions. Farmer 58 suggests that his strategy for coping with drought is to “carry your stock to the level where you know, so in the good years, you actually put a bit extra away or you may finish something.” This capacity can then be used for whatever is suited to the time. This year (2007/2008) he recognised there may be feed problems due to a long dry spell and reduced stock numbers in November.

Overstocking can be a problem in drought prone areas. Farmer 59, in noting that his main piece of advice to new farmers would be not to overstock, observing that the temptation to increase the stocking rates can be strong: “Yeah, basically, just don’t over stock and that can be hard sometimes too. If you see opportunities there and the market place to make a dollar and you think at the time, well I’ve got plenty of feed” (farmers 59 and 75 made similar comments). The problem, farmer 67 suggests, is to know where the maximum limit is and this, he suggests, is generally learned by practical experience rather than by calculations. As noted in Section 4.3 of this report, the strategy of keeping stock levels low is something that younger farmers or recent arrivals may have problems with because of their stage of development and debt levels. Another (similar) strategy is to change the ratio of capital to trading stock on the farm. Farmer 63 suggests that following the 1980s drought they adjusted their system to take more trading stock relative to capital stock – which means that the number of stock on the property can be easily adjusted depending on conditions. Farmers 65 and 77 have also both increased their proportion of trading stock in order to cope with drought.

Note that as in the example of drought in the US, farm systems tend to emerge that fit with the production capability of the land. The problem is that in normal situations where farmers are trying to make farms as economic as possible, it is more probably that farmers will farm beyond the capability of their land than below it. For example, until farmers had experienced the drought of the 1980s the high density sheep system apparently suitably matched the capability of the land. An interesting question is whether the dairy expansion into dry areas may not, under an extreme hydrological drought, experience similar kinds of problems – forcing farmers to change their practices and even some farmers to leave the industry. The balance between the carrying capacity of the land and the actual number of livestock managed is subject to a continual ‘tooting and froing’, with the outcome determined by climate changes and events of the time.

3.4 Strategies to survive in drought conditions

Making structural changes to the farm and running drought resistant flexible farming systems are the key strategic measures required for effective drought adaptation. However, these strategic measures alone may not be sufficient to survive a drought. Once the drought is upon the farm there are a number of tactical decisions that need to be taken to survive the direct pressure of the drought. Questions like: ‘Where do I get feed from?’, ‘When do I sell my stock?’ and so on are critical and need to be thought through as much as the strategic issues.

3.4.1 Responding quickly to drought

3.4.1.1 Make decisions fast and take action early

Whatever the farming system operated, a rapid response to drought requires decisions (such as prioritising the stock – farmer 67) to be taken rapidly. As noted above, systems that have pivot points in them encourage rapid decision-making – although there is no guarantee that the farmer will perceive the drought and act on it. As farmer 79 observes “you have to read the signs quite quickly and make decisions quickly” because “the value goes out of animals quite quickly when it is dry”. As he further notes, it may be that it is the wrong decision “but, at least, it’s money in the bank” and, if a drought occurs, the farmer has both a reasonable return for the livestock and lower grazing pressure on the remaining feed. As farmer 67 suggests, “if you leave it too late, you tend to then get into the fire sale situation where it actually really costs you and it’s better perhaps to take a \$5 hit on a lamb, you know early than it is to take a \$20 hit three weeks late because it didn’t rain and everyone

else has had to bail out.” Not taking a decision early can create problems for effective response in that the longer the stock are held onto the more “people seem to get themselves into a knot” (farmer 64) and, as noted above, it becomes increasingly difficult to make the decision. Farmer 59 suggests that the natural instinct for farmers is to “hang on as long as you can” and consequently farmers end up sitting around waiting for rain rather than taking action to deal with the drought. “Another day goes by, you’re not still you know, I think I should have done this, or I should have done that. (Interviewer: Can’t afford to resonate on them?) No, no. With the weather, who knows what’s around the corner.” So in the end “they actually don’t end up making a decision.” (farmer 67).

3.4.1.2 *Wean lambs early*

One key drought survival strategy that a number of sheep farmers have developed as a result of drought was to ensure that lambs were weaned as early as possible – enabling farmers more options for getting rid of livestock at a pivot point around Christmas time. Farmer 55 (a high country farmer) changed his strategy between the 1980 and 1990 droughts. In the 1980 drought he failed to wean labs early because:

I was concerned that the lambs hadn’t done as well and I felt that if I was going to wean them now, I’d lose some and they wouldn’t do very well and that it was just going to be hopeless. I also um, and that early period, um, fat lambs were worth something and I knew if I could at least get them up to a minimum weight I’d be right and the best way to achieve that was to get mum to help me so there were a number of factors as to why I wasn’t weaning earlier but that in hindsight, I would never do that again.

By the 1990s drought his strategy had changed to focus on being punctual about the weaning date so that they could go quickly onto the summer country – enabling them to utilise the higher land on a nearby range better during the dry period (note the range receives more rainfall than the enclosed paddocks which were used for replacement stock). The farmer suggests that, as a result of the new strategy, “I was able to get through that period without using any winter feed reserves through the drought itself and not only that, I still had some opportunity to lift animals and condition for tupping and so forth going into the winter, so it worked much better.” Other farmers also consider the weaning times as important for their drought strategy. Farmer 59 regrets his decision not to wean his lambs early as his feed crops had failed as a result of drought and he was forced to get rid of his lambs when his paddocks of rape ran out. He notes that “in hindsight I should have ditched them at weaning really because there was a market then.” Farmer 63 on the other hand,

notes that one year “we got dry really early” and, at the same time, he read that the Wairarapa was having an exceptional growth season. He then weaned immediately, sent the lambs off and got a good price for them. Farmer 67 (35 years experience) suggests his strategy “all my life” has been to “look after capital stock first” (merino) and, in the case of drought:

I mean you can wean early. I think our mean lambing dates are about the 8th of November or something and normally don't wean until February/early February but we had everything weaned and the ewes away out in the high country by about the 25th of January this year.

3.4.1.3 Adjust stock grazing depending on drought conditions

Moving stock quickly when fields are in a droughted condition to allow the vegetation time to recover is important because, farmer 58 suggests, “if you leave stock on it, it snaps and breaks and just becomes nothing.” Farmers can also adjust to drought by changing their system of stock grazing, in particular the speed of the rotation. Farmer 76 (15 years experience) describes the changes in his grazing regime during drought:

Our grazing regime is that we're set stocked through that lambing period. But then after weaning we go onto a big long rotation all the ewes go into one mob and they go into about 100 day rotation. So we are trying to build up a bank of feed in front of us. And the wet years we'll speed that rotation up so we may try and get around in 40 days. But in these true dry years like for this year we'll make that 100 day rotation last 100 days. So that we are building up a bank of feed in front of us and protecting our pastures. Now you get a paddock you've had the stock off it for 3 months even with very limited rainfall those pastures survive and do provide a certain amount of feed.

In the literature review it was noted that changing the sizes of mobs was one tactical response to drought conditions – according to two Australian studies. Stehlik (2003a) observed that farmers in her study ran their stock into a single mob in order to make management easier (lack of labour), whereas Austen et al. (2002) reported that farmers were running their sheep in smaller mobs to better manage the pasture that was available. These two strategies were also mentioned in our survey. Farmer 57 had cut the paddocks up smaller in order to graze more effectively but observes that some farmers still open the gates and allow stock to graze the whole farm (this open gate policy is the strategy that farmer 55 abandoned after the 1980 drought as it resulted in a “free for all” and took a week to reconstruct his mobs).

3.4.1.4 Cull surplus stock

One way of relieving pressure on grazing is to cull stock that are surplus to requirements. Farmer 79 suggests that this is the first thing farmers should do after a drought is perceived.

3.4.2 Raising capital to survive drought

Having economic capital allows farmers many additional options for coping with drought that may not be available if the farm is in a poor economic condition.

3.4.2.1 Selling land to raise capital for farm

In a desperate situation a farmer may consider selling land to cope with drought response. However, this is probably a last choice strategy as it both diminishes the farm's productive capacity and is generally against farmers' mindset. Farmer 56 gives an example of where they had to sell a bit of land (not on the original farm) and how their son was unhappy with the decision. With land prices high it may provide a good option but, on the other hand, with land prices high it is probably better to borrow against the equity held in the farm (as is the current situation).

3.4.2.2 Sell stored feed to take advantage of high prices

In a situation like the current one where the prices for feed are high and there is the possibility of drought, farmers may consider getting rid of sheep and selling the feed (silage or baleage) (farmer 56). This solves two problems by reducing the grazing pressure on the land and, at the same time, providing farmers with a considerable cash injection to maintain income flows. There are two problems with getting rid of capital livestock in order to sell feed. First, the current prices for sheep are too low to make this an option. For example, farmer 70 grew barley anticipating \$250 a ton, but finds that it is now worth \$450 a ton and, as a result, would like to sell the barley rather than the sheep. However, the price of sheep at the moment means that this is not a financially viable option as the money lost on the sheep would not make up for that gained on the barley. Thus problems with getting rid of livestock makes this option not flexible enough to act as a standard drought adaptation measure (though it may work in some years). Second, if the drought breaks then in the following year everybody is going to be looking to restock and the prices are thus likely to be high – at a time when farmers' financial situation may be weakened because of the drought. Farmer 78 (small farm) suggests that he got through this problem after the 1980s drought by "We could crop, which we did. What else did we do? Well that was it, then you just have to build your stock numbers up again as you could." In the case of farmers who have no breeding stock and can get rid of stock immediately this may

prove to be a successful strategy. Likewise, it is more likely to be effective if the farmer is following a strategy of not keeping the farm at full capacity (see Section 3.3.1.3).

Some farmers choose a different approach. Farmer 57 intends to hold onto his supplementary feed (despite the high prices) and keep an eye on rainfall during the winter season. If the winter is a wet one, he proposes to sell the supplementary feed, however, if it is dry he will keep a hold of it so that there is feed available for the spring. He contends that, even if the spring is dry on his farm, there will be somewhere in the country with good early growth and he will be able to get rid of his stock somewhere.

3.4.2.3 Off-farm employment for farmer or spouse

In the 1980s some farmers coped with the drought by finding work off the farm (57, 76, 78). There is some question though as to whether this would be an effective solution under current conditions. As farmer 57 suggests, the ratio of costs in agriculture compared to the possible income made off the farm are now completely different. Whereas an off-farm income used to be sufficient to keep the farm ticking over, it is now more expensive to farm and the income from the off-farm job would be relatively lower (assuming a job could be found). An additional issue is that the effectiveness of off-farm income as a strategy is dependent on the size of the farm. On larger properties the farmers' labour is likely to be more valuably applied to managing the farm. As researchers have noted, cutting labour costs is an important strategy when trying to reduce costs in drought conditions (Stehlik, 2003a; Topp & Shafron, 2006) and this generally means the farmer taking on more farm work. Farmer 65 suggests that they responded to the 1980s drought by going out and shearing to bring in income but that "[a]t that stage, there was only half an area so we had - the home farm was 196 hectares, so it was a smaller proposition at that stage and so when it got dry it got down to maintenance".

3.4.3 Reduce costs

On the flip side to increasing income, farmers are also able to improve the economic position of the farm by reducing their expenditure.

3.4.3.1 Reduce household and farm expenditure

Reducing expenditure at the time of drought is probably one of the most common strategies for responding to drought (be "tight fisted with the cheque book" farmer 65 – e.g. farmers 55, 59, 64, 65, 72, 77, 79) – although it is not always an explicit part of

a drought strategy. This strategy was particularly important in the 1980s drought where the economic position of many farms and low price for lamb meant that many farms were in a very poor economic position. As farmer 65 suggests “through those middle 80s to early 90s you were quite ruthless with how you went about spending and stuff.” Farmers 55 and 64 economised to the extent where they were, respectively, living off mutton and home grown vegetables (see Section 4.2.1 for more discussion). This was, however, not so much a matter of choice but rather, as farmer 55 explains, “the only reason it was the right option, um, I really didn’t think I had any choice. I’d run out of equity.”

A dilemma that many farmers face when economising is whether to cut back on the application of fertiliser. Some farmers were adamant that fertiliser needed to be applied throughout a drought in order to maintain soil fertility. Farmer 78 (45 years experience) sums up the reason for this as:

It’s easy to cut your fertilizer when your expenses are going up but it’s foolish because that’s your bank, in effect, even though your money bank might be empty your land bank’s got to be kept topped up. And I’ve heard quite a few farmers over the years that have kept their fertilizer going through and they’ll get feed growing into and out of the dry periods a lot more than you would if your nutrients were lower.

Some farmers even specifically list it as a strategy for coping with drought (farmer 76 & 79) and farmer 65 suggests he will cut out labour before fertiliser. This strategy has, indeed, been advocated in the MAF (2008) advice document to farmers. However, while this may be an ideal situation, farmers may economise on fertiliser if the price is too high even when they perceive it as important for drought survival. For example, farmer 56 proclaims at one stage of the interview that “it’s always gone on at maintenance rates” (fertiliser) but, adds at a later stage of the interview that “this year it might be different because it’s so damn expensive”. Similarly, farmer 79 from a farm severely affected by drought observes that while “the fertiliser has been put on ... we have trimmed back a fair bit”. Essentially, the need to put on fertiliser is recognised by all, but if it comes down to simple economics, fertiliser may be one of the first things to be cut back. Farmer 59 has also cut back on fertiliser in the belief that “[w]ell it wouldn’t be working anyway when it’s so dry.”

3.4.3.2 *Increase family workload (and decrease labour)*

The reduction of hired labour generally means that farm families need to pick up the additional work. Farmer 72 describes his experience of drought in the 1990s:

I was, I remember, it was a bit hard because I was having to get up and go forward in the dark, 7 o'clock in the morning to feed a lot of animals because we had a lot of stock units. We couldn't afford, sort of one of our goals when we took on the lease is we were going to employ a labour unit but we just couldn't because it was too, we didn't have enough money so I was doing sort of 10/12 hour days/seven days a week. So it was a bit hard but ah, got through it.

He notes that he is using the same strategy to cope with the current dry conditions – cutting labour rather than reducing fertiliser. Farmers 55 and 65 also noted that their labour workload increased during drought events.

3.4.4 Finding extra feed for stock

Coping with the need to feed the livestock can cause considerable problems for farmers. In the current situation, where feed prices are high and many farmers have been left with excess stock because of a lack of space in the works, the search for feed can place considerable stress on farmers. Strategies for finding feed, on the other hand, are well known to farmers and need little explanation.

3.4.4.1 Buying in feed

Farmer 59 observes that in the 1990s buying feed was a relatively good option for farmers as it was at a “competitive price”. However, currently, because of the nationwide dry conditions and the high prices paid by dairy farmers, buying feed is an expensive option for farmers. One problem with buying in feed observed by farmer 58 is that it needs to be properly treated otherwise it can lead to the introduction of weeds to the farm.

3.4.4.2 Agistment of stock

Agistment features widely in the literature on potential adaptive strategies for drought (Topp & Shaffron, 2006; Marwick & Davies, 2006). In the drought of the 1990s agistment of stock to neighbouring regions was a viable option for farmers. For example, farmer 57 reports that during the drought of the 1990s he sent large numbers of sheep away. He observes:

Ah, we had a lot of stock grazing in South Otago. The thing I can remember really is at one stage we had 1500 sheep grazing in South Otago and sheep were actually grazed out for a 12 month cycle during those two years because we sent, might have sent hoggets down and they stayed there right round, we sent one lot down on the truck and the other lot came home, the next year's hoggets or something like that so it was a bit of, grazing and feeding out, that's what you remember most I suppose. Grazing away, so you're paying bills for grazing, but you're also feeding a lot out.

Asked why he sent them away for grazing, he observes that the rates at the time were reasonable at 30 cents per unit – and that it would have cost more in feed to have fed them on the farm. In comparison, he observes that the current price for agistment \$1.00 to \$1.20 the practice is not so economically viable. To avoid having to agist stock in the future he has changed the stock mix to reduce the number of sheep, increase the number of beef and incorporate more trading stock units in the forms of lambs, cattle or dairy grazing. Only one farmer (farmer 79) had placed his hoggets on agistment in Southland due to the current dry conditions. In this case it is very much a last choice scenario as although agistment is expensive in the current market the cost of baleage was even higher than the cost of agistment. He reasons that agistment will cost \$13–15,000 and that this would not buy enough baleage to take them through the winter. Moving them to a better climate may also enhance the stock. Given the growth of the dairy industry it seems unlikely – barring a sudden and dramatic collapse in dairy prices – that agistment will be as important a strategy for farmers in this region as it was in the 1990s.

3.4.4.3 Putting stock on the roadside

Some farmers use the roadsides as a source of extra feed for stock (e.g. farmers 62 and 77). For example, during the interviews the interviewer came across one road with an electric fence across it and cattle grazing the roadsides. Farmer 62 observes that in a past drought putting the sheep on the roadside was a reasonable strategy because “We had the sheep on the road and they had plenty of water and plenty of shade and that was the biggest thing in the drought and they survived and came through very well.”

3.4.5 Strategies for learning and facilitating relationships with industry

While not directly related to problems with finding feed for livestock, the results also suggested that having strategies to maintain the social connections between farmers and between farmers and industry can be critical for keeping the farm running in times of drought. As these involve personal relationships they are perhaps not so much strategies but rather the inadvertent consequences of maintaining social and economic contacts outside the farm during drought.

3.4.5.1 Talk to other farmers and listen to what they are doing

The importance of other farmers for developing drought survival strategies cannot be underestimated. In particular, as micro-climatic conditions can vary over a relatively short area, talking to farmers in a local region or in a similar position can be particularly useful. For example, farmer 63 advocates:

Just talk to people, listen, be receptive. Make yourself talk to the right people or who you think might be the, you know recognised farmers in the area.

And similarly farmer 76:

They need to identify a person who knows how to deal with the situation whether it be an existing dryland farmer who they can see handles it well. Or a farm consultant or anybody it could be anybody they need to identify somebody who has got the skills who knows how to handle the situation and take advice from them. (also farmer 70)

Farmer 78 also suggests finding out what to do from other farmers in the area – as well as monitor farms.

Find out what other people are growing, what they're doing. There's a heck of a lot of information with people doing that many different things but that's one thing about the monitor farming you can pick what suits your farm, even though there might be 3 or 4 different suggestions made. You can pick what suits you and go with that. But a lot of things you wouldn't even think about by yourself or reading farm papers or whatever.

He thus notes that the key is to pick up from these sources ideas that suit your farm and apply them – and that a lot of the ideas are not obtainable from reading farm papers. Learning directly from local farmers provides a context for farmers to understand their own problems (e.g. farmers in the Hakataramea Valley were the only ones to consider themselves in drought conditions) and, in addition, may act to reduce stress during the drought (see Section 3.4.6).

3.4.5.2 Keep in close contact with industry

Running finely tuned systems to cope with drought vulnerable areas requires that the planned actions are executable fairly quickly. For example, if a farm that is finely balanced in terms of feed availability is forced to keep stock on the farm for longer than anticipated the results can be costly. Farmer 72, for example, runs a system with a critical point at which a large number of bull cattle must be slaughtered at one time. To facilitate this they keep in regular contact with the works and provide them with progress reports on when they believe the bulls are likely to arrive. Keeping the works informed in this manner enables them to keep a place open for the stock. The drought advisor interviewed (Interview 80) strongly advises that farmers keep in contact with the works. She suggests:

So if you booked in at the beginning of the season to have 300 ewes away by the end of January just don't expect you're agent to come at the end on a season that's pressured but ring him a fortnight beforehand and

say 'look I'm still expecting those ewes to be away on the 22nd'. It's continually keeping in contact with people.

Developing good personal relationships over a number of years (e.g. using the same firm rather than seeking the highest price) can bear dividends during drought. For example, farmer 76 (dryland) had supplied the same works for 20 years with lambs and had a good personal relationship with the procurement manager. On first approach the works said they could not find a place for his lambs and ewes, however, with the situation desperate, the farmer went back and “put the pressure on them” and the lambs and ewes were taken. The ability to do this depends on being a long-term reliable customer and building personal links with people in the industry. The result was that, while his lambs were slaughtered (and a relatively good price received), “most of my neighbours who were going to battle on and it will rain took an absolute hiding.” Farmer 77 similarly observes that loyalty to one company can help in drought. The use of such networks and relationships as a means of surviving drought has also been noted in Australia by Stehlik (2003a).

Talking to the bank manager is also a valuable exercise – particularly if the farm is under financial stress. Farmer 56 (34 years experience) says that a visit from the bank manager was a turning point in his experience of the 1980 drought as it emphasised to him the seriousness of his situation and “That was the turning point, wasn't it? ... So the sheep went. Changed the whole system of doing it and it's worked.” Dairy farmer 64 (36 years experience) advises that it is better to do this sooner than later as “[t]hey're better when you're coming from a position of strength.”

3.4.6 Strategies for dealing with stress during drought

While they do not lead directly to changes in the economics of a farm, having strategies for dealing with the psychological stress of a drought can be critical to ensure that decision-making can be done with a clear head. That farmers suffer considerable stress during drought periods is well established in the literature (Stehlik, 2003b; Ziervogel et al., 2006; Alston, 2007) which can even lead to an increase in suicide rates and the need for suicide prevention measures (e.g. Stehlik, 2003b; McLeman et al., 2007) . Farmer 55 suggested that one reason for the increased stress experienced during a drought is because of the centrality of the livestock to the mentality of the farmer. He suggests:

Because feeding of livestock is the number one issue that is in the mental makeup of a farmer drought goes to the very heart of that ... And so drought is the number one thing that also threatens that same thinking

because you can't feed if you've got no food. So therefore that's why farmers do get very stressed in drought.

He adds:

One [source of stress] is that the stock don't have any or very much feed in front of them so, as a farmer, you tend to carry the burden of that in your mind and that's a weight that you bear. Farmers are very reluctant to admit that but they do. In the back of their mind they're thinking, now mob of ewes in paddock 3A – where do they go to next? Most farmers in their minds eye know where the next move is for their stock. In a drought you honestly don't know sometimes where you're going to go next. That plays on the mind. The second thing - are those bank statements. You see that you're unable to keep any sort of decent cash flow going and that becomes very, very stressful too.

Events like flooding are over relatively quickly, whereas drought, as the same farmer suggests, "... is insidious, um, and it just eats away, it's, yeah it just eats away at your operation and it's, you can never be sure when it's going to come or when it's going to go." Farmer 58 similarly suggests that drought eventually begins playing on your mind and prevents clear decision-making:

When it gets quite bad, it tends to build up to a level where you actually don't think clearly. And you know things start, well likes of the freezing works stuff. You know you know you've got, you're running short of feed and you've got 1000 ewes still eating feed for two months that they shouldn't have been. They should have been in the works so you focus on blaming the freezing works and you forget about anything else. And every day you wake up with a ... bloody freezing works and they become the total target and sometimes that became a ... almost become obsessed with that rather than thinking about how you actually can clear it and get round it.

In addition, a number of farmers observe that farmers are often very quiet about their farms, often only mentioning to others that they are dry and short of feed rather than discussing their problems openly (farmer 57) and being too embarrassed to tell others when their stock are suffering (farmer 64). As a result, strategies to deal with stress and to prevent what some farmers have described as a siege mentality (farmers 55 & 64) whereby the farmer does not leave the farm and gradually becomes more and more isolated from the community. This can result in the farmer losing perspective on their own situation, thus slowing down the speed of their recovery. Farmers interviewed in the survey had a number of key ways of dealing with stress during drought.

3.4.6.1 *Getting away from the farm*

The main means of stress relief for farmers in the survey was to get away from the farm for a holiday (e.g. 55, 56, 58, 65, 70, 72, 76). This can have huge benefits not simply for the psychological health of the farmer, but also for the business as it provides farmers with a fresh perspective on the drought. For example, farmer 65 observes that a family holiday provides him with the motivation to “go again”:

F65: “We still will take family holidays so a holiday is a great way to get away and generally I get off the farm if I’ve left someone in charge, I can just let it go and just have a holiday and then come back and be refreshed to face it again.”

Int: “Yeah, does it help you look at it slightly differently if you’ve been away?”

F65: “I’m sure it does. You know, well last year it wasn’t that it was dry, it was just that it wasn’t a particularly profitable season and yeah, after three weeks I came back and I was ready to go again.”

Similarly farmer 58 describes how holidays allow him to think clearly again:

When you’ve got real pressure on, sometimes a few days away, you actually see it a hell of a lot clearer from outside than you do when you’re in there but at the time you can’t go away because there’s so much pressure on. Can’t is something that shouldn’t be accepted. You know, it’s easier to go away for a few days and see it clearly then come back in.”

In this quote he also reveals a key problem with getting farmers to take holidays. During a drought there is, as he suggests, “so much pressure on”, meaning that during the drought farmers may not want to take time off their farms. Farmer 55 suggests that one of the best things that can happen to farmers during a drought is that they get “hailed off their property for a brief time. ... Farmers are very reluctant to do this so I think the trick is basically to con them into going and seeing something about farming but in a different setting.” One possible means for forcing oneself off the farm is to pre-book a holiday or tickets to the rugby with no reimbursement options (as is the strategy of farmer 70’s spouse - “If you pre-book it, they have to go”).

3.4.6.2 *Playing sport*

Playing sport is an option that is perhaps more open for younger farmers. As our sample was selected on the basis farmers would be able to recall historical droughts we cannot exclude the possibility that sport is a more important form of stress relief than our results would suggest. The one farmer who suggested sport as a good

means of stress result was farmer 78 who played golf during the 1980s drought to relieve stress. He observes that the main advantage of playing sport is that it gets you out and talking to other people rather than shutting yourself up on the farm: “[I]f you went and had a round of golf and a couple of beers, had a good yarn and come home feeling a lot better.”

3.4.6.3 *Keep taking decisions (be positive)*

A number of farmers observe that a key to reducing stress is to keep a positive approach to the drought by (a) keeping on making decisions, and (b) keep doing positive things on the farm that represent progress (e.g. 65, 79, 67, 63). Farmer 65 observes that farmers get stressed mainly when they are sitting around doing nothing except waiting for it to rain. He notes:

Probably one of the big decisions is, big things that I realise is actually, I've got the power to make the decision and when you empower yourself again and say, actually it's me that holds the key here and if we've gone passed that date, this stock is going and you just, you're making decisions rather than waiting for them to be made for you and I think that's a big part of it.

Farmer 67 similarly observes that “a half-pie decision is better than no decision” because there is no point sitting around and waiting for rain. Farmers 63 and 79 both advocate that if there appears to be nothing else to be done during the drought focus on making improvements to the farm.

Farmer 79 comments:

You know, go prune some trees or do something, you know, that's still going to be of benefit in the long run. Rather than just choosing to mope or put the blinkers on, shut up shop and you know, there's still an awful lot of things you can do on the farm that don't cost a lot of money but need your time. You know the farm would still be better off and it's just your time and you can do some of those things and I always say they give you a positive feeling.

Acts like continuing to apply fertiliser (see Section 3.4.3.1) may have benefits in this regard. Not only does it help to maintain soil fertility, but it may also help farmers to feel they are progressing on the farm rather than going backwards during the drought. Thus, although, as noted, farmers are likely to cut the application of fertiliser during a drought as a cost saving measure, applying at least some fertiliser may help alleviate the stress of the drought.

3.4.6.4 *Talk to people*

It is interesting that a couple of farmers mentioned that the social survey process in itself was a positive experience for farmers during drought in that “even just discussing it with people helps. That you know that people are aware that things are not too good.” (farmer 79 – currently severely drought affected). Another farmer (farmer 55) suggested that there was a role for the Rural Assistance Trusts in this respect during the drought. He suggests that older trusted farmers in the community could be used to conduct surveys which would provide “an immediate excuse as to why you’re going up the driveway” and that they could ask simple questions but not too obtrusive: “But more importantly, what was the look in the farmer’s eye, did he cry, and so there needs to be some access way into these situations.”

3.5 **Conclusions**

This chapter has sought to create a typology of drought response. One fact that emerged from the surveys is that the possible combination of strategies is large and varies considerably depending on the context of the farm situation. In addition, an issue raised by farmer 70 is whether there even can be an optimal strategy for drought response. For example, if all farmers were to buy and sell the same type of stock at the same time (following a formula for drought response), the impact on the market would be catastrophic. What we have presented here, therefore, is not a single “best strategy” for drought response, but rather a collection of strategies that dryland farmers in North Otago/South Canterbury have developed over many years in response to drought events. Whatever strategies are chosen, there are three key issues farmers need to deal with to build a drought resistant farm:

1. Farmers need to develop the farm such that it is able to resist drought (should it occur) as well as build up resources that may be needed to fight drought in future years.
2. Farmers need to develop a farming system that provides them with some flexibility to deal with drought when it occurs (i.e. on recognition of a drought to act immediately and effectively)
3. Once the drought is perceived the farmer must have strategies capable of dealing directly with the drought situation and minimising the impact of the drought on livestock, capital and family.

Selecting the best strategies for any individual farm requires that the farmer considers the context of his/her own farm (climate, soils, labour supply and so on). However, as noted in the literature review and throughout the chapter, optimal response is often dependent on factors outside of the control of the farmer. What is

important is that the farmer has some safeguard against drought. As farmer 58 suggests, once there is a safeguard in the system it is easy to make it stretch a bit further. In the following chapter we examine these contextual factors – focusing specifically on the major events in the late 1980s and 1990s and the current ‘dry’ conditions affecting farmers.

4. The importance of contextual issues in historical drought adaptation in New Zealand – an analysis of the 1980s, 1990s and 2000s.

4.1 Introduction

In the literature review it was noted that the context within which the drought occurs is of key importance in determining the extent and severity of the drought. In the dustbowl drought of the 1930s, for example, the low prices for cotton, the lack of opportunities for off farm income generation and the lack of security on small and tenanted farms combined to limit the adaptation possibilities for farmers affected by drought (McLeman et al., 2007). Similarly, the Australian drought of 1991-1995 occurred when many farmers were still recovering from the drought of the 1980s and this created many problems for farmers trying to adapt to the dry conditions (Stehlik, 2003a).

In this chapter we look at the contextual features surrounding the 1980s, 1990s and current (2000s) droughts in North Otago/South Canterbury. The objective of this analysis is to assess the impact of external drivers is on farmers' experience of drought. While the focus of the study was initially on the historical droughts of the 1980s and 1990s many farmers related their experiences not to past droughts, but to the current dry conditions – thus the recent drought/dry is also included in the analysis.

4.2 Contextual factors in farmers' experiences of drought in the 1980s, 1990s and 2000s.

4.2.1 The importance of the political and economic context during the 1980s drought

Drought in the 1980s took part in a unique context for agriculture in North Otago and South Canterbury (and the whole of New Zealand). Farming in New Zealand prior to the 1980s had been based on a system of supplementary minimum prices (SMPs) – a subsidy approach that guaranteed farmers income for their produce. The rolling hills, high country pastures and valley flats of the regions offered farmers an opportunity to produce large quantities of sheep and, over the decades, sheep farming became part of the culture of the regions. Farmers had not had to think about diversifying their enterprises (an important structural response to drought as it

spreads risk over a number of enterprises – Bradshaw et al., 2004 – also see Section 3.3) and, as such, when the drought of 1988-89 arrived, the majority were strongly dependent on sheep production. Furthermore, because sheep production had been the main form of production for many years in the region, a culture of sheep production had developed. Farmer 57 (sheep & beef) observes that many farmers at the time

...didn't know anything else to farm. They hadn't farmed cattle or dairy grazing wasn't really around then either as an option. So sheep was the only thing they'd done and that was what they stuck to. But I think it was probably, the farms needed to be partly something else in their stock units.

This was a particular problem with the 1980s drought. It was the first time in the area that farmers really had to face the fact that sheep production alone may not provide them with a reliable income. It is likely, from what we know in the literature about farmers' strong identification with their enterprises and forms of production (Gray, 1998; Burton, 2004; Burton et al., 2008), that changing enterprises was quite difficult for farmers and would have involved a major cultural change as well as a managerial one. As farmer 63 observes, it was not only the droughts that caused problems, but the whole restructuring process (what would happen to the sheep industry?) "and I felt it so undermined your confidence and I felt it took a long time to get that back."

Two other economic conditions were present at the same time. Farmers recall that the removal of the SMPs had had a major effect on land prices with the equity held in the farm being very low and, where farmers had borrowed money to purchase the farm, high inflation and high interest rates made servicing mortgages difficult "The 1980's were terrible years for income and expenditure as [we had] the high interest rates and high inflation." (farmer 77). At the same time, the removal of SMPs left sheep prices open to the vagaries of the market and in the late 1980s the prices for sheep plummeted. As farmer 56 observes, "[y]ou went from a high value for your products and suddenly all that was gone all at the same time." Thus there were a number of contextual conditions at the time that made this drought so severe:

1. Inflation and interest rates were high - making it difficult for farmers to service debts.
2. Equity in land prices was low – meaning that banks were less willing to lend money to farmers to service debts.
3. The decline of lamb prices meant that, as well as costs increasing, incomes received for produce were declining.

In better years farmers may have had the money available to agist their stock or to purchase feed for the livestock but the severe lack of capital meant that there was simply not the income available to spend on feeding livestock. With many strategies for dealing with drought closed to them, some farmers dealt with it by reducing almost all expenditure during the drought as a last option. For example, farmer 65 argues: “you were quite ruthless with how you went about spending and stuff. If it didn’t fit, it didn’t fit.” One high country (farmer 55) from Inland Rangitata farmed his way through the 1980s drought using a ‘bottom draw policy’. This strategy, as he describes it is:

... where you uplift your cheque book and you turn round, you’ve already got your bottom draw open, and you drop it in it and you throw the cheque book in it and shut it. Now high country properties used to be able to do that, so I just shutdown. (Interviewer: no development?) No expenditure. Nothing. (Interviewer: No fertilising, no new stock – nothing?) No. Even to the point you consciously hop on a motorbike, not in a truck [...] I thought about every cent. It just became, and we lived on mutton. It was just pretty crazy stuff. So we just cut back on any expenses and that’s how we got through.

Faced with no alternatives, other farmers in the 1980s drought had made similar choices in order to survive the drought. For example, farmer 64 (dairy, 25 years experience) had just moved to the region and had paid for his farm at the top of the market when the drought occurred. While not facing the same problem with income as the sheep farmers, the economic conditions of the time were nevertheless sufficient to cause him major problems. He observes “suddenly the mortgage was worth more than what the farm was worth and things were pretty dire then.” The response of the family was: “[W]e approached it probably very conservatively - we simply didn’t spend money. We didn’t go anywhere, we didn’t do anything” and his wife recalls that during the period they did not even have \$5.00 to go to the local social. As with farmer 55, they also tried to live off the farm as much as possible, growing their own vegetables so that, as his wife notes: “[W]e have milk, so - milk and vegetables - so we managed. We had basic food, nothing fancy or anything. No treats.” – a situation which lasted for 4 years until it improved.

The drought of the 1980s had a lasting impact on farming in both regions. While most farmers were not able to state specifically what they changed on their farm in response to the drought, some farmers suggest that it created a new attitude to farming in the region. For example, farmer 55 (Inland Rangitata, high country) suggests that much of his resolve in farming came out of the dry period in the 1980s: “A real ‘tough it out’ attitude developed from that, yeah.” Similarly, two other farmers

were left with the opinion that, if they could survive that situation, they could survive anything (Farmers 59 and 64). Farmer 56 went so far as to suggest his key lesson from drought in the 1980s was learning “not to fall in love with your stock ... they are always replaceable”. While this may seem like a relatively minor issue, the speed with which drought adaptation decisions need to be made is critical to effective drought response (see Section 3.4.1). However, research has shown that farmers throughout the world often have a strong attachment to their animals (Holloway, 2005; Yarwood & Evans, 2006; Burton et al. 2008), particularly when they have spent many years breeding a flock to suit their particular farm environment (Gray, 1998). Farmers in regions not used to drought may thus experience difficulties in making the hard decisions required for drought survival when adapting to a new climatic regime.

Some farmers could attribute change on their farm directly to the drought of 1980. For example, farmer 78 suggests that one of his strategies for coping with the 1980s drought was to diversify into cropping (although a farmer in a dryer valley suggested that the drought in the 1980s pushed him out of cropping because of crop failures – farmer 76). Other farmers began to look for off-farm income as a means of surviving the drought. For example, Farmers 59 and 65 suggest that they responded to the 1980s drought by going shearing to bring in money for the farm (also noting that this strategy is less likely to work today because of lower salaries relative to the cost of agricultural inputs).

Clearly, for some farmers badly hit by drought in the 1980s their experience provided them with motivation to develop drought resistant farming systems. Farmer 55 from the high country suggested that he changed his strategy during the 1980 and 1990 drought. In the first drought, he (or, rather, a farm worker) opened all the gates on the farm and let the sheep run as a mob. The result was “an absolute free for all” requiring a week to draught them back into separate mobs and back into a boxed situation and using up much of the winter feed reserves. By the 1990s drought the strategy had changed with the farmer becoming much more punctual about the weaning date so that they could go quickly onto the summer country – enabling them to utilise the higher land on a nearby range better during the dry period (note the range receives more rainfall than the enclosed paddocks which were used for replacement stock). The farmer suggests that, as a result of the new strategy: “I was able to get through that period without using any winter feed reserves through the drought itself and, not only that, I still had some opportunity to lift animals and

condition for tupping and so forth going into the winter, so it worked much better.” In the first drought he had failed to wean early because:

I was concerned that the lambs hadn't done as well and I felt that if I was going to wean them now, I'd lose some and they wouldn't do very well and that it was just going to be hopeless. I also um, and that early period, um, fat lambs were worth something and I knew if I could at least get them up to a minimum weight I'd be right and the best way to achieve that was to get mum to help me so there were a number of factors as to why I wasn't weaning earlier but that in hindsight, I would never do that again. I'd still wean earlier but I would plan ahead far more, use the lucerne strategically far better for fattening purposes.”

4.2.2 The 1990s drought: a non-event?

When thinking back about drought, farmers had a tendency to think back to the 1980s drought – or even other droughts that were on a regional scale, hydrologically and meteorologically, not as severe as the 1987-88 drought. One interesting feature of the survey was that, despite being prompted to talk about drought in the 1990s, very few farmers recalled it as a drought event despite the hydrological and meteorological conditions of the time. This was despite the fact that, according to the climate records, the drought of 1988-89 and 1997-99 were equally as severe in North Otago (He, 2000). Whereas farmers referred to the 1980s drought as a stressful event, little mention was made of the 1990s drought by any of the farmers interviewed. It is difficult to draw many conclusions about an event people do not perceive. However, that it has not left a strong mark in people's memories suggests that the experience of drought in the 1990s was rather different to that of the 1980s. There are a few features which could account for this.

First, as one farmer observed, “some of our best years were probably in the 90s, relatively speaking in profit terms.” By this stage interest rates had declined significantly, land prices had increased (possibly as a result of greater confidence in the agricultural industry) and, importantly, prices for lamb had recovered significantly by the late 1990s – in part as a result of global concerns for BSE in beef. As a result, farmers were in a better financial position and thus able to cope better with the drought. In particular, drought adaptation options that had not been available in the 1980s were now open to them. Farmer 57, for example, recalls his best memory of the drought in 1998 was that :

... we had a lot of stock grazing in South Otago. The thing I can remember really is at one stage we had 1500 sheep grazing in South Otago and sheep were actually grazed out for a 12 month cycle during those two years because we sent, might have sent hoggets down and

they stayed there right round, we sent one lot down on the truck and the other lot came home, the next year's hoggets or something like that so it was a bit of, grazing and feeding out, that's what you remember most I suppose.

In the 1980s farmers were severely cash strapped and, while there was grazing available in Southland, for farmers economising to the extent of growing their own vegetables or living on a diet of mutton, agisting 1500 sheep to Southland would clearly not have been an option. Lower interest rates, higher equity in their farms and higher sheep prices meant that in the 1990s food could be purchased or stock agisted with little concern for the cost. Thus a lot of the stress and concern that is associated with drought (e.g. Stehlik, 2003a) was not there and the dry conditions appear to have made less of an impact on farmers.

Second, as noted above, the 1980s drought may have created a different 'tougher' attitude in farmers to drought, leading farmers to adopting better strategies for coping with drought – as in farmer 55's change in policy to weaning lambs early.

Third, it is possible that the institutional arrangements for dealing with drought were better in the 1990s than the 1980s. Interestingly, one of the interviewees (80), who has worked as an advisor/coordinator for the rural trust since the early 1980s, observed that the 1999 drought had "affected everybody and it didn't matter if you did have money or you didn't have money" (interview 80) and that this led to "really great community support". One potential explanation for this discrepancy could include better coping mechanisms including better coping mechanisms so while the 1990s event was an event that affected all, farmers simply did not compare the two. The 1980s drought may provide the benchmark.

The key lesson to learn from the difference between the 1980s and 1990s drought is the role of economics in agricultural drought. As noted in the literature review, the definition of agricultural drought is based on hydrological and meteorological conditions (Wilhite, 2002; Isendahl & Schmidt, 2006; UN/ISDR, 2007). However, for farmers, the presence of adverse conditions on these two dimensions is not necessarily sufficient to cause them to perceive drought – as long as there is sufficient feed and capital stored from previous years (or available from the bank) to enable them to feed their livestock by buying feed, feeding with their own stores or agisting the stock. For example, farmer 57 observes that the main reason the drought in the 1990s was less severe than the 1980s one was that livestock prices were higher. In comparison, during the 1980s interest rates were very high and land prices

were low – meaning that banks were fairly ruthless about ensuring their debts were repaid. The farmers observe that the drought “was a financial thing” as “[p]eople were unable to feed their stock but ..., actually, farmers could handle that”. In contrast, with no financial pressure on farmers in the 1990s, it was perceived as a very dry period – but without any of the stress present that accompanied the 1980s drought a serious drought was not evident. The importance of economics for perceiving drought was also observed by the drought coordinator interviewed (interview 80). In detecting a drought she monitors not just rainfall but also stock sales and stock prices. Further, she observes that the impacts of drought are not evenly distributed but “somebody that has plenty of money, good cash flow... normally doesn’t have high mortgages, doesn’t have great outgoings, can sell his stock off for a lesser price in January and relax through the rest of the season.”

4.2.3 Drought in the 2000s?

The main purpose of this study was to examine historical droughts from the 1980s and 1990s. However, in the period between the submission of the proposal and the undertaking of the research it became apparent that a new drought may be upon us – with farmers experiencing dry conditions almost right across the country. In some parts of the study area farmers experienced record low rainfalls. For example, farmer 76 (farming in the Hakataramea Valley) observed that while the average rainfall for his farm is 525mls, in 2007 only 370 mls had fallen (a record low for his farm) and only 100 mls had fallen up to May 2008. The occurrence of low rainfall has been further exacerbated by a bad winter in between the last two seasons - meaning that some farmers have very little feed stored (according to farmer 79). This left farmers in this valley facing the possibility of a severe drought if they fail to have a good winter/spring this year. Other farms in the study area were also reporting dry conditions, although the situation was not as critical as in the Hakataramea valley. As farmer 57 put it: “I don’t actually call it a drought at the moment. It’s just very dry. Very dry.” As a result of this ‘dry’, farmers are beginning again to think about the possibility of drought in the next year – the timing of which allows us to address the issue of what are the main contextual issues that farmers face at present?

At the same time, with the exception of dairy (and deer to some extent), prices for livestock have been low. Farmer 59 observes that, while in the 1980s wool prices were good and in the 1990s lamb prices were good, in the recent drought “wool, lamb – everything is low and there’s no demand for stored stock.” One of the key changes in agriculture since the drought in the 1990s is the rapid growth of the dairy

industry and its current high level of prosperity relative to sheep and beef production. According to farmers this has profound consequences for their drought response – in both positive and negative ways. While the issues are real, the attribution of them to changes in the dairy industry represents the view of participating farmers only. However, while changes in the dairy industry are unlikely to be the sole driver in all cases, they may contribute to the trends observed by farmers.

4.2.3.1 High land values

A number of farmers contend that agricultural land prices are currently being supported largely by the success of the dairy industry. For example, farmer 56 contends: “Our values around here wouldn’t be anything like they were if it wasn’t for the dairy farmers. Especially now they’re moving in, you know pretty much next door.” (see also farmers 59, 64, 79). These high land prices have two major impacts on farmers’ drought response. First, if they wish to borrow money against the farm (or even sell part of the farm) they are able to as the value of the farm as collateral is high. In the case of one farmer experiencing drought at the moment, he contends that it is the land prices that are keeping him afloat financially (farmer 76). Second, farmers wishing to leave farming during the drought can do so with a considerable lump sum for establishing themselves elsewhere (farmer 59). While not attributable to drought, the ability of farmers to get out with a large lump sum is obvious. Farmer 56 observes of a neighbouring farm:

Like XXXX and XXXX; had to sell their farm down there. They bought a block of old scrubby land at, what’s it, XXXX. Now they’ve built a new house and it must be sitting on a million dollars of land there, looking out over the Taieri. You’ve got to say it was a good move.

In the drought in the 1980s farmers observed that low land prices were an important cause of stress for farmers who risked losing everything if the farm failed. In this case, even if the farm fails, farmers are better able to retain some equity from the farm. On the other hand, high land prices can be somewhat of a double edged sword. As farmer 57 observes, while higher prices provide greater equity, it reduces the possibility of expansion for farmers.

4.2.3.2 Market for dairy services

The growth of the dairy industry provides an opportunity for farmers in terms of the dairy service industry (providing grazing and feed for dairy farmers) which, farmer 56 enthuses, is “a pretty good option”. For farmers in this drought region this option was not available in earlier times. The key value of dairy service is that it enables farmers

to lower the stocking level of their capital stock. For example, farmer 57 suggests that as he now sells feed and grazing to the dairy industry (which he can vary on a year to year basis) he has less need to maintain capital stock of his own. Instead he is able to limit himself to 75% of his stock units and, should there be a good season, he is able to grow extra feed as silage, barley or hay for sale to the dairy industry. If a drought occurs he is thus not stuck with the problem of needing to divest his farm of capital stock (at a low price). Dairy farmer 64 has an agreement with his neighbour where they are leasing a block of land and “doing a lot of heifer grazing and grazing cows in the winter.” Farmer 59 observes that the practice of providing dairy support is becoming increasingly widespread “there’s a lot of guys getting out of sheep to, um, just to support the dairy. They’re going dairy support really, for winter grazing and stuff like that.” However, he also suggests that this is not an option available for all farmers, particularly those on hill farms in the region.

4.2.3.3 Increasing cost of buying in feed during a drought

The influence of dairy on the current high prices of feed (including agistation) has not been quantified, but it is clear that the industry currently has substantially greater resources for purchasing feed than the sheep/beef industry and the pressure applied is therefore upwards. For some of the sheep and beef farmers, there was considerable concern that high dairy prices have left them unable to compete for feed with the dairy industry – making one of the key strategies for drought adaptation more difficult (e.g. 56, 58, 70 76, 79). Farmer 58 runs a large dryland farm and suggests that, in the current dry conditions, “you’re out looking for other feed, like we have to this year and it’s excessive because of the dairy things gone crazy.”

Even one of the interviewed dairy farmers (farmer 64) observed that the dairy industry can afford to pay extortionate prices for feed as it makes good business sense from a dairy perspective:

We’ll buy it at whatever it costs because they’re paying us for the milk, which is a relatively new thing, where we might have culled more cows. This way we can afford, if we can keep the cows in milk, then they’re going to pay for it even, even at extortionate prices.

While the high price of feed was creating problems for some farmers, for others it was creating financial opportunities in the dairy service sector. As observed above, farmer 57 has adapted to this by lowering the number of stock units and, to replace this lost income, is now growing feed for the dairy industry (a far more flexible system

should a drought occur. Farmer 76 (a dryland sheep farmer) has calculated the economics behind his land use choices as:

Sheep	5c/kg/dry matter
Dairy service	15-16c/kg/dry matter
Barley	35-40c/kg/dry matter
Silage	35c/kg/dry matter

Consequently he is on the verge of changing his system to provide more dairy support and reduce the sheep numbers (similar to farmer 57). Again, this appears to be an economically sensible option under current conditions as it can provide farmers with good money as well as the flexibility drought response requires. Another possible response to the high prices of feed is to buy a different type of feed. Farmer 72, for example, suggested that rye grass straw is “so expensive and we weren’t prepared to pay dairy farm prices for it so we bought a lot of wheat straw instead” (although he is uncertain of the impact on the livestock).

The result of the difficulties obtaining feed is that some farmers are unable to respond to the current drought through the traditional means – becoming much more self-sufficient (according to farmer 70). This raises an interesting issue. If the current situation with the relative economic advantages of the dairy industry continues and widespread drought becomes more common (as predicted) then it is likely that sheep and beef systems will become much more dependent on internally grown and stored fodder. If this is the case, then improving the production and storage of feed may be a key area for research and development in the sheep/beef industry.

4.2.3.4 Inability to get stock slaughtered to relieve drought pressure

Increases in the cost of feed may be having a knock-on effect in the current dry conditions. The drought advisor interviewed (interview 80) contends that the biggest impact of the dairy industry is not directly through dairy conversions flooding the works (as farmer 58 suggests), but more because of their impact on the high price of feed. With dairy farmers “paying big money” for feed, the costs to sheep/beef farmers have doubled to an uneconomic level (as farmers themselves observed). As a result, “this year basically they’ve really got to make the stock decisions and sell off” – leaving the works flooded with stock. This is a case where a number of contextual aspects have come together to create a problem – the high value of dairy products,

the low value of stock, continued dairy conversion in sheep areas, and, on top of everything, the dry conditions leading farmers to try to get rid of stock.

The inability to get stock slaughtered is causing farmers problems and increasing the likelihood of food shortages. For example, farmer 65 reports that he “should have had 1,500 [ewes] away, three weeks ago” and some of his stock has now been waiting three months. Farmer 69 has 500 lambs that have been kept for an extra month. Another farmer (farmer 58) has 1500 ewes that had been booked for the works but have had to be kept through the Autumn. He notes: “You try and keep them just on a maintenance plan but, you know, that amount of feed that they’ve eaten could have carried other stock into the winter, another two months.” For one farmer (farmer 76) in a full drought situation the condition became very serious when the works could not take the 2000 lambs and 400 ewes he had previously booked in. He reports his conversation with the procurements manager as: “I said ‘I’ve supported you guys for 20 years. I need more than this’ ... I mean, I held head in my hands. That was devastating.” For farmers with dry conditions the lack of space in the works has created both problems and opportunities but, it appears, for those in a full drought the impact can be more severe.

High prices for feed create a bit of a catch 22 situation for farmers as observed by farmers 56 and 72. On one hand, current market conditions have pushed feed prices to a level where farmers could make a lot of money selling to the dairy industry but, on the other hand, the works are full (partly as a result of the high price of feed) preventing farmers from taking advantage of the high prices for feed.

... this year a lot of farmers who would normally feed out their silage through the winter, they’ve probably decided we’re going to kill the old ewes if they could kill them and will sell the silage. Because silage is so valuable, they’ve then got an income from the silage this year. But they can’t get their ewes killed. (farmer 56)

4.2.3.5 The impact of dairy on rural communities

A further way in which the dairy industry may influence drought response is through its impact on communities. While there was little animosity towards dairy farmers, there was an underlying concern that the rural communities are being changed through the arrival of dairy farms and dairy workers. The predominant concern is that, because of the nature of dairy farming, the farmers were simply not able to participate in many community activities and thus “[i]t’s affecting the community because you know they have, those people are less able to be involved in the community because of their hours and things, you know and in sporting, coaching

sports and taking clubs, it's changing the community that way" (farmer 63) or "[t]hey're not part of the community. They're too busy" (farmer 72, also farmers 57 & 62). While there is no direct economic implications from not participating in the communities, communities provide very important moral support and a source of shared information for farmers in times of crisis such as drought (see Section 3.4.6 and Stehlik 2003a; McLeman, 2007). On the positive side, as farmer 57 observed, the dairy industry creates a lot of opportunities for farmers' children to find employment in rural areas and has "actually brought some of those back for our kids to do in the community" – something that clearly helps to strengthen the community and keep skills within the local area. The impact of dairy on the role of community in drought adaptation is unknown. However, given that dairy farmers experience drought in a completely different way (as a result of the use of irrigation, the ability to know their returns and budget accordingly and the financial condition of the industry at the moment), their increasing presence in many communities is likely to have some impact.

4.2.3.6 The geographical extent of the drought

A key feature of the present drought is its geographical extent. Farmers observed that the 1980s and 1990s droughts were regional, meaning they were able to send stock away for grazing or purchase food grown near the region (with relatively low transport costs). In contrast, as farmer 67 describes, "one of the worse features I think of this 2007/2008 dry spell is that it's dry everywhere. It's dry from the North Cape to the Bluff, or has been." A geographically widespread drought creates far more problems for farmers than a local drought of the same intensity. First, as observed in Section 3.2.1, one strategy for farmers to survive in drought is to purchase blocks of land with different micro-climatic conditions – so that, should one be badly affected by drought, the other may provide some relief grazing. As farmer 56 observes, "where people traditionally may have got some feed from up the road or shifted the stock up the road, up the road has got the same problem". Second, as noted above, the nationwide nature of the drought means that farmers from across the country are responding to drought simultaneously – buying feed, seeking agistment, selling stock (and buying stock after the drought) and so on. For example, farmer 76 suggests that as past droughts have been regional "the store lamb market was a bit better. We had markets for stock and you could still get a reasonable return." As a result, the price pressure placed by the drought on all factors of the market (returns for produce, cost of grazing, cost of agistment, and so on) is much greater, leaving farmers in an economically weaker position than they would be in a

regional drought. In the current situation, agistment has been hard to find as a result of the widespread nature of the drought (farmer 77).

A particularly unusual aspect of this drought is the combined impact of the geographical extent of the drought and the economic strength of the dairy industry. As a result, to alleviate drought conditions dairy farmers from Waikato are able to afford to buy feed from the North Otago region and transport it to the North Island. Dairy farmer 64 observes that he had a problem buying baleage locally because of this issue:

[W]e went to a farm sale where they were selling some baleage. We thought we might get it for \$80/90 and there was a reserve, a North Island bid on everything there for \$100, so goodness knows what it was worth when it went to the Waikato, by the time it got there. So we just didn't do that.

If droughts become more widespread (as is forecast under climate change conditions) this kind of issue is likely to become even more problematic – making the economics of buying in feed increasingly difficult and increasing the importance for farmers of storing any additional grass they can grow.

4.3 Other contextual considerations for drought – new entrants and experience

It has been noted above that the 1980s drought had a considerable impact on farmers in terms of both changing their practices and providing them with a tougher outlook on farming. In a drought prone area, experience with both the farmed land (e.g. knowing microclimatic impacts, when the land is droughted, how to manage the farm in drought, etc.) and the best response to external economic factors (to sell stock early, take decisions immediately, etc.) is a key ingredient to survival. Farmer 67, for example, (who began managing the property 30 years ago at 21) describes the way he has learnt, through experience, how to farm his land:

[I]t's just one of those things sometimes you'll do something and you'll look at it and say in hindsight, I should have done such and such. But if you can kick in up here, you know what's happened – next time, or, I mean, on this stuff, when we traditionally (as I said) put sheep out and ewes out in the high country, really high country in the shingle for two sort of months in the summer and it's just a matter of knowing even in a dry year how long you can leave them without upsetting that, the balance that's out there so that you've got something again for re-growth the next year or how much weight you can drop off your ewe.

Similarly, farmer 58, when asked if he would have known what to do in response to the current dry spell if he had not been on his farm for 27 years replies emphatically “No. No.. No. You would have thought ‘it’s a dry spell. It will rain.’ No” and observes later that new farmers to the area – even if experienced at farming in other regions – would be caught out by the conditions.

One of the most difficult times in drought can be when it coincides with changes in management. As observed in Section 3.2.2, a key strategy for adaptation to drought is to build up feed and economic reserves during good periods to survive during dryer spells. One of the farmers interviewed, however, had taken ownership of the farm four years ago with “a fairly big mortgage” and was immediately faced with three years of dry weather conditions causing him to place the farm in “survival mode” as “[w]e were not able to make hay and silage because of the dry weather” (farmer 79). Again, this has been influenced by the detrimental conditions for sheep farming at the moment as he is currently being forced to hold onto 700 ewes that are unable to be killed because of the current overload of the freezing works. On the other hand, he suggests that, in terms of the actual productivity of the farm, “our production figures are actually going quite well”. He has followed key production maintenance strategies such as continuing to apply fertiliser, trying to build up reserves, exploring projected budgets via the computer and seeking the advice of neighbours and farm advisers.

The important issue to note here is that developing a drought resistant system requires a lead-in period to build up reserves and, when a drought coincides with a lack of reserves and a high cost of feed and agistation, there is really very little a recent arrival can do to resolve the situation. In this case, the farmer observes that the reason he is still in farming is the fact that the value of the property has increased significantly since he bought it and therefore the bank is “comfortable enough” with his debt level. It is in this kind of situation where the most important adaptation may be developing strategies to cope with stress (see Section 3.4.6) rather than economic or production solutions.

New entrants into agriculture have similar problems. Farmers related their own experiences with starting off farming in drought conditions and how the additional debt burden could accentuate the impact of the drought event. Developing a drought strategy is something that many farmers admit relies on experience and there are differences between the economic position, the level of experience and even the psychological state of young farmers.

As farmer 59 explains:

Of course when you first take over a property, you tend to ... because you've got mortgages and what not, you tend to try and take the maximum out of it. And we probably did stock up to a fair degree. And, of course, you know - how the forebears say - you know not to push it. You know North Otago dry land was only ... you know, you can only stock for a dry season. You learn quickly I think.

This statement outlines the key issues for young farmers. First, without substantial capital input from elsewhere (e.g. money provided as part of an inheritance), new entrants begin with a considerable debt load – which, as the experiences of the 1980s have shown (see the discussion in section 4.2), creates cash-flow problems for drought stricken farmers. Second, there is the psychological aspect that the new farmer often sees him/herself in a growth stage of development – wanting to “take the maximum out of it” (farmer 59) – whereas in a drought being understocked and providing a degree of flexibility is a better strategy (see Chapter 3). Farmer 70 began farming in the mid 1980s and describes himself as a bit naïve at the time as after a good growing year they stocked up. When the drought hit they had no money for fertiliser which led to further problems with the stocking level. In retrospect he suggests “We probably didn’t de-stock quick enough, no. So we got a dreadful lambing the next year type of thing.”

Other farmers made comments about the mental attitude of new farmers. For example, when the wife of farmer 56 suggests that their son would not wish to sell off land to pay debt if the farm was drought stricken, her husband suggests: “Yeah, but he’s probably not at the stage yet where he’s seen the sort of tougher side of it, I guess. You know the financial impact of it all.” Farmer 65 suggests he, himself was “green” in the beginning “not wanting to sell cattle stock” in the drought of the 1980s. Experience can also be important for dealing with stress as farmer 67 observes:

As you get older you get a bit more mellow and stress doesn’t... Things that would have stressed you once don’t... Well, that’s human nature, that’s people, that’s sheep, that’s whatever it is. Bugger that, let’s go on and just tidy it up.

Understanding the drought responses of new entrants may become more important in the future. As prices for better land increase (especially land suitable for dairy farms), new farmers may increasingly have to start on poorer land, such as land that is prone to drought and lacks irrigation. This has already happened to some extent in the past. Farmer 57, for example, began farming in North Otago and observes that one of the reasons he chose the area was that:

...it costs you too much to try and start, like in South Otago or Canterbury – for young people getting into the farming side of it, that you just can't actually afford to do it, so North Otago is probably quite a good area for the young ones starting out.

This throws up some interesting issues. As we have observed from the interviews, survival in drought conditions is something that is learnt through experience and it can be a tough experience for farmers to go through. If droughted areas are places where young farmers can get a start, it may be beneficial to pay particular attention to this group (aspiring future farmers) during any future severe weather events. In particular, if land prices remain relatively high and the extent of droughted areas spreads there may be an increasing number of young farmers farming droughted areas as their first experience of farming. On the other hand, this may be beneficial in helping to create a new generation of farmers with a background in coping with dry weather conditions.

4.4 Conclusion

Assessing drought in the 1980s, 1990s and 2000s has revealed how important the context of the drought is on farmers' experience of drought. In the 1980s the farming industry had been recently set free on the market, interest rates and debts were high, equity in land was low and prices for stock were low (although wool prices were still high). As a consequence, many farmers suffered considerably when the drought arrived. On the other hand, those that survived learnt a lot from the drought. Their experience and the development of more drought resistant systems may be in part responsible for their survival of the 1990s drought. In contrast to the 1980s, farmers in the 1990s had experienced some very good years prior to the drought and, as a result, debts were lower. Coupled with good prices for lamb, farmers had many more options for feeding their livestock – being able to either graze them outside the area (as one did for two years) or purchase food to make up for any shortfall.

The current 'dry' in the 2000s is a different situation again with the dairy industry having a major impact on the drought response of farmers. Some of the impacts such as the increase in prices of feed and grazing, difficulty getting stock into the works and the impact on the structure of rural communities can be negative. On the other hand, however, the role of the dairy industry in maintaining high rural land prices (and therefore in providing farmers with equity to use to survive the drought) and the new market for dairy services mean that the overall impact is probably positive in the long term. Dairy services, in particular, could fit in well with a long term drought system as it provides farmers with a simple flexible option for land management in the case of

drought (around a lower core of capital stock) – something that was not evident in the droughts in the 1980s and 1990s. As farmer 57 suggests, “[n]ow we can sell replacement new lambs, kill them and we can always buy some more back in somewhere else - maybe not exactly the same as yours but some more.” As a result, even though sheep and beef prices are very low and feed is in short supply, drought does not yet seem to be a problem for much of the study region (with the exception of the Hakataramea Valley).

As this analysis of farmers’ experiences of drought has revealed, ‘agricultural drought’ is about more than simply a combination of the hydrological and meteorological conditions. Rather, experiencing drought is more probable when a combination of contextual issues emerge at the same time, with the impact on farmers dependent on a huge variety of factors ranging from the geographical extent of the drought to the economic condition of other industries. As an illustration of this issue, the final comment in this chapter is left to farmer 58 who describes why the current dry spell has been particularly problematic for him:

You know like it's been, this one has been pretty stressful really because it's been, I anticipated the drought coming but I didn't anticipate the problem of picking up the extra feed even from outside. *I didn't anticipate the other problems on the outside.* The freezing works one was the most frustrating thing. That's been two months and not being able to kill stuff that should have been long gone and that's actually more annoying than anything. You know that the stuff are here and it should have been in there and it's pre-booked and all in, so that's pretty much a bummer and then to go out and try and buy extra feed and the pressure is on and you know where you can pay to within reason and um, then you've got competition out there for the same feeds, that is just ridiculous.

In other words, no matter how well a system is prepared for drought or how experienced the farmer (in this case, 27 years), external factors can always interfere with your drought adaptation plans. Dry conditions in a region make farming difficult – but it is the contextual factors that can make it almost impossible.

5. Assessment of the methodology

5.1 Introduction

One of the objectives of the study was to develop a methodology for exploring farmers' adaptation to climate change events. As suggested by the IPCC (2007) we focused on adaptation to extreme events – namely two specific drought events in North Otago/South Canterbury from the 1980s and 1990s. We used a qualitative methodology, face-to-face interviewing and a semi-structured question schedule in order to explore the complexity of farmers' drought adaptation systems. In particular, we were focusing on farmers' tacit knowledge of the events – knowledge that is personal, often experience based, and context dependent rather than being explicit, standardised and easily transferable

5.2 Was the methodology useful?

We surmised that the methodology would be useful for gathering knowledge about climate adaptation strategies in New Zealand and thus we could accelerate our understanding of climate adaptation. One of the key criticisms of qualitative research is that the number of interviews means that they do not cover the range of respondents to provide the full spectrum of responses (Herbert, 2000) so one obvious question is: Were the results comprehensive enough? One indication that suggests this is the case is the fact that the 21 interviewees identified at least 27 different adaptive strategies to drought. In contrast (as an indicator as results are not directly comparable), Austen et al.'s (2002) quantitative questionnaire survey of 62 Australian farmers returned 33 different adaptive strategies to climatic events. A similar result with only a third of the interviewees.

Has the research “accelerated our understanding of climate adaptation” as we hoped? One area not discussed much in the literature is the impact of the context of the drought on perception of and response to drought. Yet, as we demonstrated through our analysis of historic droughts, the environmental, economic and even political contexts of the drought plays a key role in how serious it is and how farmers respond. Hydrological and meteorological drought alone does not necessarily lead to an agricultural drought. In the 1980s farmers were severely affected by the drought because of a lack of capital, but the drought in the 1990s of similar magnitude had little impact largely because farmers could afford to agist stock or buy in feed.

The flexible nature of the methodology directly led to another important finding. As we note in the report, at the time of the interviews farmers were on the verge of another drought (and a couple of farms were already experiencing drought). As farmers were already considering the possibility of a new drought, we were able to explore contextual factors existing at the current time (i.e. the impact of changing rural communities, increased land values, ability to provide dairy services, the geographical extent, inability to get stock into the works, and the increased cost of feed). From this we learned the importance of considering structural changes in the farming industry and how that may influence drought adaptation in the future. The impact of the dairy industry growth on drought adaptation of sheep and beef farmers is an interesting issue for future study – but would not have emerged using structured techniques.

The results may also aid farmers with little previous experience with drought. As we note in the analysis chapters, a key mistake of young farmers in droughted areas is a tendency to be too enthusiastic and maintain high stocking levels (some farmers even admitted this of themselves in earlier droughts) – whereas experienced farmers (without irrigation) often operate flexible farming systems and/or pivot points to enable rapid response to dry conditions. This may become an issue in future if climate change causes more widespread drought and, at the same time prices for better land increase. This could force new entrants increasingly onto poorer land such as that affected by drought or lacking in irrigation – meaning that knowledge of how to approach drought may become more important in the future.

We also suggested that the understanding developed here can assist in future climate change modelling by developing a greater understanding of how farmers are likely to respond to increased drought. Perhaps the most important lesson for modellers here is the importance of incorporating more than climate data into models of agricultural drought, but to consider the high impact of drought context on the response of farmers. In all three periods of drought (10 years apart), the key contextual drivers for droughted farmers have been different and the responses differ accordingly. In an extreme case, we could have extended droughts in New Zealand but if the price for produce is high enough and the industry in good enough condition, farmers may be able to import the feed they need to get through dry periods.

5.3 Farmer's memories of extreme events.

One issue that needs to be dealt with is whether farmers were able to recall sufficient information about the drought to make an historical analysis of extreme climate events possible. The results supported Moser & Kalton's (1971) supposition that ability to accurately recall any event is related to its significance – with highly significant events being more easily recalled than those of low significance. In particular, the drought of the 1980s had a serious impact on farmers, with families, for example, needing to eat mutton off the farm or grow their own vegetables in order to survive. In contrast, no such stories emerged from the drought in the 1990s and few farmers remembered much about the drought itself other than that they were able to buy in food or agist stock to other areas.

From this we can conclude that studies of historical extreme weather events can produce useful results, but these events need to be very significant. The dry conditions of the 1990s did not involve any major adaptations outside of farmers' normal strategies of buying in feed and agistment – even though the climatic conditions themselves were quite severe. Thus they appear not to have made a great impact on farmers' memories. In contrast, in the 1980s farmers reported being under considerable stress at the time and it is this stress, the economic conditions of the time and some of the failed practices they were following that farmers remember most. Instead, farmers seemed to have turned their attention to the current dry conditions and, while few farmers actually believed they were in a drought (2 of the 20) many were beginning to think of adaptation should they experience a poor winter. Information could thus readily be gathered on the current conditions.

This has implications for the study of other extreme events. For drought the methodology has worked (specifically for the 1980s drought) and provided farmers with a useful anchor for considering their drought responses. Drought, as one farmer suggested “goes to the heart” and is therefore likely to be remembered. However, if we are to extend this historical approach to other climate hazards such as cyclones or floods, the events would need to be very extreme in order for farmers to be able to refer to specific events. It may, in fact, be better to focus on very recent events and current practices rather than historical ones – unless these historical events had significant implications for farmers.

5.4 Future applications

This methodology can also be applied to other climate events expected to increase in frequency under climate change. However, given that farmers barely mentioned one of the historic drought events examined here (from only 10 years ago), it is doubtful whether it would be useful for exploring short term events unless they were very extreme. An extreme cyclone, flood or snow event may warrant study but in general, these are short term events and do not require the level of adaptation (or cause the level of stress) that droughts may.

There are three areas where more work of this kind would be useful:

1. The impact of the growth of the dairy industry on drought adaptation in the sheep/beef industry suggests that the relationships between the industries are important for drought survival. Because of problems getting interviews our study involved only 2 dairy farmers (both irrigated). A study specifically on drought adaptation in the dairy industry (in non-irrigated areas particularly) would provide a more complete picture of how the NZ agricultural industry will respond to drought events in the future.
2. Our research focused on the drought adaptation of farmers but not on rural communities as a whole (e.g. other industries in the agricultural sector). As (a) some researchers have suggested community response is critical to drought adaptation (Stehlik, 2003a), and (b) communication between farmers and other farmers/industry was identified as a key adaptation strategy, work focusing on the role of the broader community may also be beneficial.
3. This study has clearly shown the importance of the geography of the farm and the location for the experience of drought. For example, some farms in the survey had access to high country land with higher rainfall that they could incorporate into their drought resistance strategy, or the location of the North Otago/South Canterbury area close to the Southland plains (a formerly predominantly sheep growing area with different climatic conditions but within easy transport distance) have shaped farmers' options and responses in the past. While we are certain that the core strategies as regards adaptation have been explored here, understanding the spread of drought into other regions of New Zealand will require a greater understanding of the geographical and economic context of different farming regions. In this case a more extensive (and representative)

survey of farms across the East Coast of NZ would aid our understanding of the context of drought adaptation on a regional basis.

6. Conclusions

This study explored farmers' experiences of historical extreme drought events in North Otago/South Canterbury – a drought prone area of New Zealand. In particular, it focuses on historical adaptation to two of the most serious droughts in the region in the periods of 1988-89 and 1997-99 (He, 2000). Consulting farmers on their drought adaptation measures recognises that the real innovators and experts for drought are those farmers who experience drought as a regular occurrence – they deal with drought not as a matter of scientific or managerial interest, but as a matter of survival. Thus, rather than seeking codified knowledge which is “explicit, standardised and easily transferable” we examined knowledge which is personal, often experience based, and context dependent.

From our interviews we sought to create a typology of drought response. One fact that emerged from the surveys is that the possible combination of strategies is large and varies considerably depending on the context of the farm situation. Thus, there does not seem to be a single “best strategy” for drought response, but rather a collection of strategies that dryland farmers in North Otago/South Canterbury have developed over many years in response to drought events. Whatever strategies are chosen, there are three key issues farmers need to deal with to build a drought resistant farm:

1. Farmers need to develop the farm such that it is able to resist drought (should it occur) as well as build up resources that may be needed to fight drought in future years.
2. Farmers need to develop a farming system that provides them with some flexibility to deal with drought when it occurs (i.e. on recognition of a drought to act immediately and effectively)
3. Once the drought is perceived the farmer must have strategies capable of dealing directly with the drought situation and minimising the impact of the drought on livestock, capital and family.

Selecting the best strategies for any individual farm requires that the farmer considers the context of his/her own farm (climate, soils, labour supply, and so on). However, as noted in the literature review and throughout the chapter, optimal response is often dependent on factors outside of the control of the farmer. The 27

strategies farmers employed are outlined in Table 6.1 (also see chapter 3 for further discussion).

1. Make the farm drought resistant	Structure the farm for drought	Distribute land over different areas or climate zones Select vegetation and livestock to suit drought and farm Plant shelter belts Invest in irrigation and/or water storage
	Build up reserves	Ensure there is sufficient stored feed Use capital wisely during good years
2. Make the farming system drought resistant	Implement flexible Farming systems	Diversify production types on farm Develop a system with a pivot point for drought Keep spare capacity to allow flexibility
3. Have strategies to survive drought	Respond quickly to drought	Make decisions fast and take action early Wean lambs early Adjust stock grazing depending on drought conditions Cull surplus stock immediately
	Raise capital to survive drought	Use land to raise capital for farm Sell stored feed to take advantage of high prices Off-farm employment for farmer or spouse
	Reduce costs	Reduce household and farm expenditure Increase family workload (and decrease labour)
	Find extra feed for stock	Buying in feed Agistment of stock Putting stock on the roadside
	Dealing with people	Talk to other farmers and listen to what they are doing Keep in close contact with industry
	Strategies for dealing with stress	Getting away from the farm Playing sport Keep taking decisions (be positive) Talk to people

Table 6.1 Classification of strategies for drought adaptation

Asking farmers to think back on historical droughts and discuss how they were affected (and responded) at the time revealed how important the context of the drought is on farmers' experience of drought. In the 1980s the farming industry had been recently set free on the market, interest rates and debts were high, equity in land was low, and prices for stock were low (although wool prices were still high). As a consequence many farmers suffered considerably when the drought arrived. On the other hand, those who survived learned a lot from the drought. Their experience and the development of more drought resistant systems may be in part responsible for their survival of the 1990s drought. In contrast to the 1980s farmers in the 1990s

had experienced some very good years prior to the drought and, as a result, debts were lower. Coupled with good prices for lamb, farmers had many more options for feeding their livestock – being able to either graze them outside the area (as one did for two years) or purchase food to make up for any shortfall.

The current 'dry' in the 2000s is a different situation again with the dairy industry having a major impact on the drought response of farmers. Some of the impacts such as the increase in prices of feed and grazing, difficulty getting stock into the works and the impact on the structure of rural communities can be negative. However, on the other hand the role of the dairy industry in maintaining high rural land prices (and therefore providing farmers with equity to use to survive the drought) and the new market for dairy services created mean that the overall impact is probably positive in the long term. Dairy services, in particular, could fit in well with a long term drought system as it provides farmers with a simple flexible option for land management in the case of drought (around a lower core of capital stock) – something that was not evident in the droughts in the 1980s and 1990s. As a result, even though sheep and beef prices are low and feed is short, drought does not yet seem to be a problem for much of the study region (with the exception of the Hakataramea Valley).

One issue of note here is that the notion of 'agricultural drought' widely used in the literature may not be entirely appropriate. In particular, this study has shown that drought is not just the result of precipitation, transpiration, evapotranspiration, groundwater levels, and so on, but rather tends to be experienced only when these factors coincide with structural drivers in the wider economy. Responding to climatic variation is part of the job of the farmer and, as Le Houereu (1996: 146) observes, through careful management some areas of the Sahel have managed to maintain agricultural production through a 25 year drought without any 'visible long-term harmful consequences'. If the farmer has enough financial reserves built up during good years, is running a system within its limits (i.e. is not overstocking the land), has organised the system with a buffer to account for drought possibilities (i.e. managing the ratio of capital to trading stock), and has sufficient stores of feed again accumulated from good years and, at the same time, land prices are high, the cost of inputs is low, slaughtering options are available, prices for livestock are high, and agistment is available at a reasonable cost, then it is possible that there may be no drought experienced at all even in a 'very very dry' period.

7. Appendix One – Semi-structured interview schedule



Interview No. _____ Location _____

Section 1: Basic farm data

• Total size of property	_____ ha
• Effective farm area (if diff)	_____ ha
• Topography - % land area	1. Flat land _____% 2. Rolling hill country _____% 3. High country _____%
• Pasture composition	1. Flats = _____ 2. Rolling hills = _____ 3. High country = _____
• Av. dry matter production/ hectare (include range from _____ to _____)	1. Flats = _____ 2. Rolling hills = _____ 3. High country = _____
• Soil Type	1. Flats = _____ 2. Rolling hills = _____ 3. High country = _____
• Soil Fertility (L/M/H)	1. Flats = _____ 2. Rolling hills = _____ 3. High country = _____
• Stock carrying capacity	1. Flats = _____ 2. Rolling hills = _____ 3. High country = _____

<ul style="list-style-type: none"> ● Stock ratio 	1. _____
<ul style="list-style-type: none"> ● Climate characteristics (if known) 	1. Sunshine hours per annum _____ 2. Rainfall per annum _____ 3. NIWA 10 year av. rainfall ____mm 4. frost days _____/year 5. rain days _____/year

Family Characteristics	
Family members on the property	Adult 1 Gender _____ Age _____ Adult 2 Gender _____ Age _____ Children C1 Gender _____ Age _____ C2 Gender _____ Age _____ C3 Gender _____ Age _____ C4 Gender _____ Age _____ Other _____ _____
Farming experience in total	A1 _____ years A2 _____ years Other _____ years
Farming experience on this farm	A1 _____ years A2 _____ years Other _____ years

Focus on the droughts of the late 1980s and late 1990s. Which years in these periods did you experience drought in?

Referring to the

- *1980s drought*
- *1990s drought*

Ask section 2 and section 3 questions for each respective drought

Section 2: Assess the conditions at the time of the drought

1. Please describe the Weather conditions during the drought
 - How long did it go on for
 - What sort of temperatures were reached
 - What/when did you get rainfall?
2. What was the farm family position before/during the drought?
 - Labour
 - Capital
 - Succession status
 - Other?
3. What was water availability like in these droughts?
 - Irrigation
 - Water for stock
4. What were commodity prices like at the time of the drought?
5. What was the feed availability like at the time of the drought? (N.B. was agistment available and where?)
6. What government aid did you receive during the drought?

Section 3: Assess response to the drought

NB. Try to get a feeling for (a) how effective the measures were, and (b) how they work in combination?

1. What was your response in terms of livestock and field management? Who was the strategic decision maker? Did this change through the drought? Who was responsible for the tactical decision making on a more day to day, week to week basis?
 - What did you do, when and why?

e.g. Reduce inputs to cut costs?

Sell livestock?
Agist livestock?
Introduce irrigation?
Buy in feed?
Prioritise livestock sales?
Change livestock breed?

- How was this response influenced by the conditions of the drought (as above)

2. What financial adjustments did you make?

e.g. Reduce household expenditure
 Sell farm assets
 Use cash reserves
 Borrow money
 Government aid

3. How did your family respond to the drought

e.g. Children move off farm
 Spouses role during the drought
 Family members take off farm job

How important was this to your business survival?

4. What was the response of the local community to the drought?

e.g. Greater community cohesion / support from other farmers
 Support groups established

How important was this to your business survival?

As the drought proceeded, did your response change? If yes, please describe changes and why the response changed.

- Start of drought
- Middle of drought
- By the end

5. After the drought did you make any long-term adjustments to cope with future droughts?

6. Looking back what do you think were the key elements behind surviving this drought?

7. In hindsight, is there any action you should have taken?

Section 4: Future drought

8. What should be done by others (government, MAF, industry bodies) to help farmers to prepare for future droughts?
9. [for sheep and beef] What impacts (if any) will the recent expansion of dairy have on your ability to cope with drought – and why?

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