



Farm-level Adaptive Capacity to Climate Change

The Role of Financial Strategies and Institutions

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Executive Summary

Project

- C09X1005 Farm-level Adaptive Capacity to Climate Change: The Role of Financial Strategies and Institutions (Programme Leader Jonathan King)

Introduction

- This is the final report for the above project funded by Ministry of Primary Industries' Sustainable Land Management Mitigation and Adaptation to Climate Change fund, administered by the Ministry of Science and Innovation.
- Project partners were DairyNZ, ZESPRI International, Westpac Banking Corporation (WBC), and the IAG Group.
- Contributing researchers were the Agribusiness and Economics Research Unit, Lincoln University and the Department of Primary Industries, Victoria (DPIV).

Objective

- To identify alternative business models, financial strategies, products and services that can increase farmers' adaptive capacity for climate change, by investigating how farmers and the finance sector in Australia have responded to historical climate variability and extreme events and how the strategies they developed could be applied in New Zealand.

Methods

- An initial desktop literature review by Lincoln University was revised and expanded by the author using additional advice from New Zealand researchers and Australian researchers at the DPIV. The resulting conceptual framework was used to underpin the questions used in the semi-structured qualitative interviews.
- Context interviews and desktop research on the role of financial institutions and the role of government were undertaken by the author with our project partners in New Zealand and Australia.
- Patricia Fitzsimons of DPIV interviewed Australian federal and Victorian state officials, to gain insight into government perspectives on farm financial adaptation to climate change and the role of finance institutions in Australia (refer separate Appendix 4).
- The initial proposal was to study Australian dairy and kiwifruit examples, but no kiwifruit participants were able to be engaged, so the case studies focus solely on Victorian dairy farmers. Victoria was selected as the study area since it is the largest dairy producer in Australia and the variation in climate and hence dairying systems across the state potentially provide examples of how New Zealand's climate and dairy systems may evolve over time in the face of predicted climate change.
- An initial intention was to identify one case study around a novel insurance product (e.g. rainfall or multi-peril crop insurance – MPCCI); however, restricting our scope to the dairy industry precluded this.
- Case study participants were identified by WBC and by WestVic Dairy (the local dairy industry body in South West Victoria) following introductions by the DPIV. Interviews were undertaken in Victoria in late January 2012.

Context

- New Zealand's climate is variable and influenced by large-scale climatic systems, such as the El Niño – Southern Oscillation (ENSO Cycle). The country suffers from extreme weather events such as floods and drought. Climate change is predicted to differ in its impacts by region, broadly causing drier conditions in the east and increased rainfall in the west. Agricultural productivity is expected to benefit in some areas, but there is also increased risk of extreme weather events and the spread of pests.
- Australia covers a wide range of climatic zones, is also affected by large-scale climatic systems, and has suffered prolonged droughts and flooding in the past decade. However, there are regions where the climate is similar to parts of New Zealand. This project focused on South West Victoria, which is expected to be hotter, drier and more variable under climate change, although still moderate in comparison to the rest of Victoria.
- Whilst agriculture is a significant industry contributing around 12% of GDP in both countries, exports of agricultural, food and forestry products are 66% of New Zealand's merchandisable exports, but only 15% of Australian exports. In New Zealand, dairy, sheep and beef meat, followed by horticultural products are the dominant export sectors, whilst in Australia the biggest exports are wheat and beef.
- There are also differences in structural and production practices between the dairy industries in the two countries, with Fonterra processing 90% of all New Zealand milk, and the availability of feed and rainfall/soil moisture dictating different production practices in Australia.

Literature Review and Conceptual Framework

- An initial literature review confirmed the original research proposal's assertion that there has been little research focused on adaptation to climate change at the farm level. Also, the research that was available mostly did not focus on financial aspects of farm management.
- The climate change adaptation literature was drawn from a broad range of academic and professional paradigms (see References for the literature reviewed here). As suggested by Fünfgeld and McEvoy (2011) there are four main 'framings': a hazards/disaster approach; a vulnerability approach; a resilience approach; and a risk management approach. These framings interpret adaptation to climate change at a range of scales and from multiple perspectives and contexts.
- In an attempt to reconcile the four concepts of vulnerability, resilience, sensitivity and adaptive capacity, we drew on the work of Adger (2006). Here we view *sensitivity* and *adaptive capacity* as two elements of the resilience of a system exposed to a negative or positive shock in the form of climate change. We view *resilience* as the magnitude of disturbance that can be absorbed before a system changes to a radically different state.
- Our framework builds on the IPCC definition of *vulnerability*, whilst acknowledging that vulnerability can be a negative framing that can preclude a sense of the opportunities that may accrue to those farmers with high adaptive capacity.
- From an economics perspective current approaches to adaptation are thought to focus mainly on social determinants and socially organised systems (Williamson et al. 2010). However, local economies will be impacted by climate change and the response of economic entities and their inherent capacity to adapt will have a significant effect on the overall adaptive capacity of integrated social and economic systems. Moreover economic characteristics such as scale, diversity, organisational/ managerial capital, etc. will affect the capacity to adapt and whilst financial resources and natural capital do not fully define adaptive capacity, they are determinants of it.

- We drew on prior work by Landcare Research on institutional and organisational change that illustrates how adaptation by a farmer can be considered at different levels: the individual (the farmer), an organisation (the farm), an organisational field (suppliers, competitors, rural community, financiers and insurers, etc.) and a broader system of social structures and evolving ‘norms’ (economic structures, major changes in regulation or technology, etc.).
- Agricultural adaptation research in New Zealand and Australia has largely focused on bio-physical vulnerability, impact modelling or qualitative case studies, with Australian research considering that Australian primary producers have a high level of adaptive capacity.
- Research in Europe and the US has suggested that farm-level resilience to climate change impacts is determined by farm characteristics such as intensity, scale and land use (Reidsma et al. 2010) or production income, debt structure, off-farm income and the use of risk management tools (Antle & Capalbo (2010)).
- The farm risk management literature also highlights strategies for managing farm economic risks, such as market risk (e.g. through forward contracting, futures, insurance), leverage and financial risk, off-farm diversification (e.g. off-farm employment, off-farm investment) and on-farm liquidity and enterprise diversification. Recent reports for the OECD on agricultural risk management in New Zealand (Melyukhina 2011) and Australia (Kimura & Antón 2011) provided excellent overviews of the prior research and current practice in both countries.
- From the farm management and economics literature, notably Shadbolt et al. (2011) and Lawes & Kingwell (2012), we confirmed additional financial strategies associated with resilience – including scale, intensity and efficiency and profitability.
- A conceptual framework was developed based on the findings of the literature review to describe farm-level financial strategies for adaptation to climate variability and climate change, within the broader system and organisational field that a farm is nested within. It acknowledges that financial strategies are only part of overall farm management, which combines technological/production, economic/financial, human and social decisions, set within the local eco-biological context. The conceptual framework is visualised in the condensed graphic in Figure 1 (for the full-size version, refer to Figure 10).

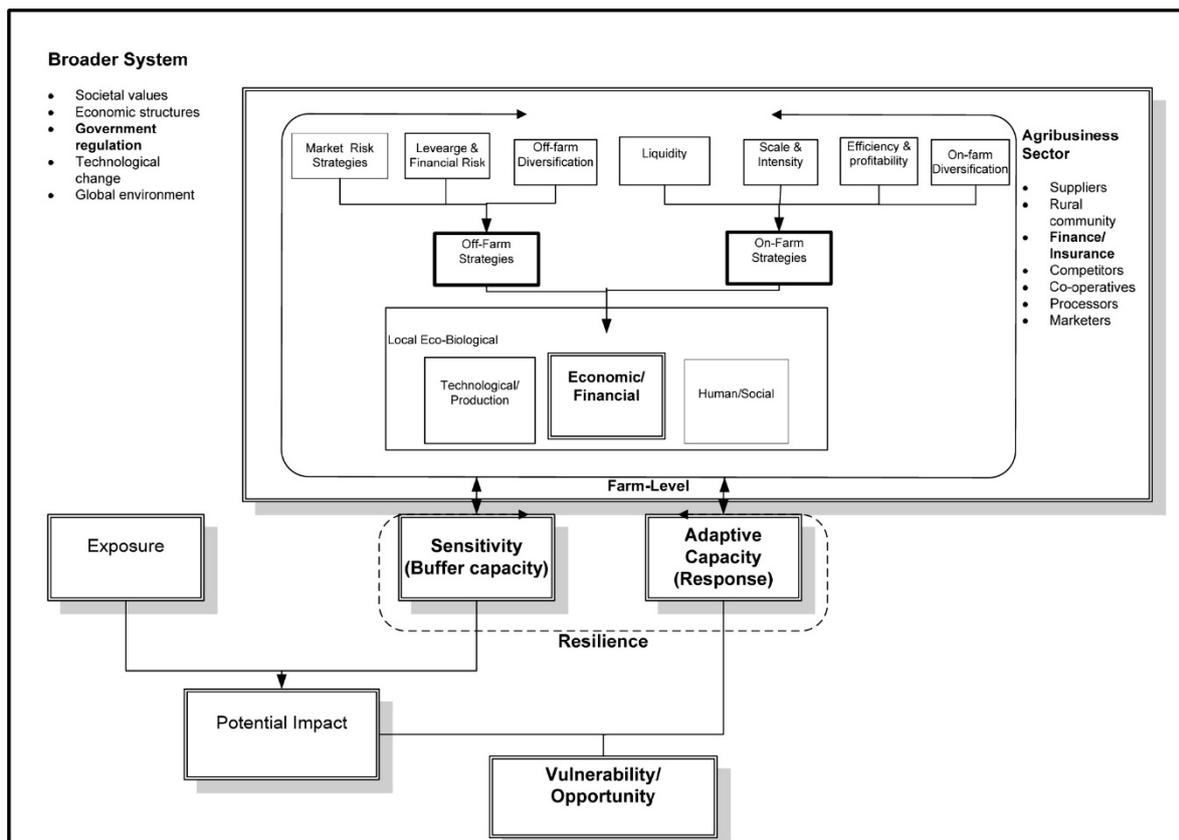


Figure 1: A Conceptual Framework for Farm-level Adaptation to Climate Variability and change (condensed).

Role of Financial Institutions – Insurance

- Rural insurance products offered in New Zealand generally do not cover farmers for the impacts of natural disasters on farm infrastructure (e.g. fences, tracks and races, etc.), the impacts of drought and floods on crops or livestock, or the impacts of diseases and pests.
- Farm business interruption is available, but is only triggered by weather damage to buildings or machinery, not damage to land, or infrastructure, etc. There is also no business interruption insurance available for biosecurity events.
- Uninsurable impacts of weather events on New Zealand farm families can be covered by the Government's On-farm Adverse Events Framework and the Framework does not preclude the development of new insurance products.
- Barriers to the development new insurance products for climate adaptation include: the maturity of the market; issues of systemic risk, moral hazard and adverse selection in such a small market; under-insurance by farmers in existing insurance products; a lack of demand for climate-related products; and a lack of appetite for such products from global reinsurers.
- The rural Australian insurance sector, whilst much larger and with a greater focus on crop insurance, broadly provides similar products to those available in New Zealand.
- There has been investigation by federal and state governments of the potential role of multi-peril crop insurance (MCPI) schemes to allow insurance against climate-related impacts. However, reviewers have concluded that MCPI is unsustainable without significant government subsidisation of premiums or in underwriting risks, due to: increased climate variability and crop yields in recent years, systemic risk requiring a

national scheme with international reinsurance, the scale of premiums required, adverse selection, moral hazard and data availability.

- Despite these arguments new products were introduced into the Australian markets in 2011, such as a variant of MCPI in Western Australia and a crop simulation insurance product (YieldShield). Whilst these are interesting innovations it is too early to see evidence of their uptake or judge their potential for replication in other countries.
- Frontier Economics (2011), in assessing of the role of insurance in climate-change-induced risks faced by Australian farmers, concluded that:
 - Farmers have an array of on-farm risk management strategies that reduce the demand for insurance, except in sectors like grains.
 - Adverse selection, moral hazard and systemic risk mean private insurance schemes for climate change, whilst logical, are not considered viable.
 - Climate change may increase systemic risk (i.e. affecting a wider population), although interactions with medium-term climate systems are still being researched.
 - The lack of commercial solutions could be perceived as market failure, but government intervention could, in a more dynamic climate, lock farmers into sub-optimal decisions at a time when flexibility is required.
 - Government intervention should facilitate the private development of insurance products, e.g. through investing in the provision of forecasting and prediction capabilities that private insurers may not fund due to spill-over effects.
- Kimura and Anton (2011) continue to believe there is potential for the development of commercial insurance products, but note the crowding-out effect of current government Exceptional Circumstances (EC) support.

Role of Financial Institutions – Other Financial Instruments

- Australian farmers have access to a range of other financial instruments through which they can hedge against the impacts of climate variability on their input or output prices.
- Use of forward contracts has increased in Australia since the removal of commodity marketing boards, and given the larger scale of crop farming, there is a wide range of forward contracting undertaken. Given their greater reliance on bought-in feed and the greater availability and range of feed inputs, Australian dairy farmers regularly enter into forward contracts.
- Agricultural-commodity futures and options have historically been limited by the scale and liquidity of markets in New Zealand, whilst futures contracts in wool and wheat are available from the Sydney Futures Exchange.
- In 2010 the New Zealand Stock Exchange (NZX) launched a dairy products futures market aimed at global processors of milk and financial markets. However, outside of Fonterra and some of the other large cooperatives, uptake of these products is thought to be highly limited. Overall, Australian interviewees perceived the New Zealand dairy sector as being more innovative in terms of these forms of financial instruments.

Role of Financial Institutions – Banking

- Historically an equity ratio below 50% has been seen as risky by farmers, but now there is a generation of farmers who have an appetite for lower levels of equity. Theoretically, as long as the cost of debt is lower than return on assets then leverage should increase returns to capital, so in periods of low interest rates and strong commodity prices increased debt makes economic sense. However, because interest costs have the qualities of a fixed cost, leverage is also linked to greater volatility in cash flows, and impacts on liquidity and potentially on default.

- In New Zealand agricultural debt has climbed from \$12 billion (10⁹) in 2000/01 to \$46 billion at June 2011, of which 64% was related to dairy farmers, and average equity levels were around 52% (DairyNZ 2011). Motives for increasing debt were attributed to business expansion, increased rural land prices (driven by dairy conversions), and the supply of ‘easy credit’ by banks pre-GFC (before the global financial crisis).
- However, in Australia average dairy farmer equity levels remain high at around 82% (Dharma 2011). Given this disparity in equity levels, it is valid to question whether New Zealand farmers’ financial structures would enable them to cope with production risks under climate change, or conversely, whether Australian farmers are comparatively inefficient and financially conservative.
- Rural banking in both countries is dominated by the ‘big six’ banks, of which all except Rabobank are Australian owned. In Australia there are also a number of smaller regional banks that undertake agribusiness.
- Over the last 20 years banks in both countries have introduced greater flexibility in repayments of loans, and liquidity based on cash reserves is being replaced by liquidity based on the ability to call down on pre-arranged lines of credit or negotiate new loans.
- Similarly, with rising rural land prices there has been a trend in the last 10 years towards interest-only loans, which rely on capital appreciation instead of repayment.
- Our review of the major Australian bank websites and discussion with interviewees did not reveal any new forms of banking product that were not available in New Zealand.
- The only exception was the Australian Government’s Farm Management Deposits (FMD) scheme, an income-smoothing mechanism designed to allow farmers to build up financial reserves for times of stress such as drought. Each of the major Australian banks provides FMD products and farmers can hold FMDs at multiple banks.
- Interviewees stressed that it was only the larger farmers who were using advanced interest rate or hedging products promoted by banks and in New Zealand there has been a backlash against some financial products (e.g. interest swaps).
- Given the relative lower equity levels of New Zealand farmers and the similarities in banking entities, the process by which farmers’ creditworthiness is assessed in each country is relevant. We undertook interviews with WNZL and WBC to confirm loan practices by a major bank; the other major banks are believed to follow similar approaches. Interviewees noted that most banks have reviewed and tightened credit practices since the GFC.
- Credit assessment processes are formulated in Underwriting Standards (UWS), including sector-specific UWS, which are reviewed regularly to reflect changes in market conditions. UWS set out requirements for debt servicing, minimum equity, security, loan periods and repayment terms as well as qualitative aspects of a farmer’s management capability.
- Debt servicing is calculated using the cash available for debt servicing (CAFDS) ratio and sector-specific CAFDS are set (e.g. 1.2 for owner-occupier dairy farmers). Minimum equity ratios and loan valuation ratios (LVRs) are also set by sector.
- Exceptions to the UWS are permitted, for example equity requirements below 40% may be granted but would require repayment of principal until an acceptable equity position is reached. The presence of water rights or irrigation is considered in the valuation of the land.
- WBC uses an identical risk grade system, but has its own set of UWS specific to the sectors in which it conducts business in Australia and which reflect local market conditions and WBC’s appetite for risk.

- As well as qualitative aspects around farm management capability, the WBC UWS focuses on the CAFDS ratio, minimum equity, and security (LVR). However, for a dairy proposal under A\$5 million, there were differences in process, notably:
 - A minimum CAFDS/interest ratio for owner operators of 1.5 (1.2 in New Zealand)
 - Scale taken into account through linking equity ratios to total milk solids
 - A ‘surplus assets test’, assumes that the higher total assets are for the same equity ratio, the greater the ability to partially liquidate assets, or absorb extra costs
 - Whilst access to irrigation/water is factored into land prices in western Victoria, in northern Victoria water rights are valued as a separate asset by banks.
- The review of credit practices across Westpac revealed significant similarities in processes, with differences accounted for by local business conditions. Specifically for the dairy sector, current equity minimums and LVRs appear equivalent or more conservative in New Zealand, whilst CAFDS ratios appear more conservative in Australia, but only for larger farms.
- However, interviewees and other research (Hargreaves & Williamson 2011) confirm that higher LVRs and lower CAFDS ratios were predominant in New Zealand up until the GFC and that lower levels of equity in New Zealand than Australia could reflect these historical credit-supply practices.

Role of Government

- In New Zealand, ‘adverse events’ are defined as ‘severe climatic events or natural disasters that are beyond the ability of the community to cope’. The On-farm Adverse Events Framework represents one current mechanism for direct government assistance to primary producers who may in future be affected by increasing adverse events under climate change.
- The framework is based on a risk management perspective and farmers and rural businesses are encouraged to take a proactive approach to risk-adverse events and to develop strategies to protect their family and business. The framework stresses the relationship between support for uninsurable risks, highlighting the need for farmers to insure where possible and not precluding the development of new insurance products.
- Melyukhina (2011) noted that aside from spikes between 2004 and 2006 adverse events expense by government since 1999 was only \$0.2 million p.a. and that the framework is supported by stakeholders and recognised as well-designed.
- In addition to direct benefit to farm families, the On-farm Adverse Events Framework also indirectly benefits financial institutions that have loans to affected farmers, although any impact is marginal compared with Australian schemes.
- The New Zealand IRD has two income equalisation (IE) schemes that can be accessed by farmers, one in the normal course of business and the other allows farmers to defer income from the sale of livestock due to adverse events.
- However, the low uptake of the Adverse Events IE scheme and the ability of IRD to grant relief through the main scheme mean it may be withdrawn.
- In any redesign of the Adverse Events IE scheme there maybe potential for the IRD IE scheme to be delivered by the private sector, in a similar manner to the FMD scheme, potentially reducing government administration costs and finance on the government balance sheet and enabling competition to drive improved uptake.
- In relation to adaptation to climate change, Australian farmers receive support through the National Drought Policy (NDP) (and the associated Exceptional Circumstance (EC) regime), Natural Disaster Relief and Recovery Arrangements (NDRRA) and Farm Management Deposits (FMDs). These policies impact on Australian banks and insurers’

ability to support farmers during extreme events and their ability to design new commercial products to help farmers adapt.

- The objectives of the NDP are to:
 - Encourage the adoption of self-reliant approaches for managing climate variability
 - Maintain and protect the agricultural and environmental resource base during periods of extreme stress
 - Ensure early recovery of agricultural and rural industries consistent with long-term sustainable levels.
- After a Government declaration of Exceptional Circumstance (EC) in a region, assistance becomes available, including:
 - The EC Relief Payment (ECRP) covering living expenses of farm households
 - The EC Interest Rate Subsidy (ECIRS); and
 - EC Exit Package (ECE)
- The Productivity Commission (2009) recommended that subject to transition arrangements the ECIRS should be scrapped, the ECRP replaced, and that greater emphasis should be placed on enhancing farmers' capability for planning. The Commission also highlighted the potential role of risk management strategies in facilitating farmers' self-reliance and the role financial institutions play during droughts.
- DAFF, in partnership with the DAFWA, is conducting a pilot of reform measures for the National Drought Policy in Western Australia. A review of the pilot's eight programmes (Keogh et al. 2011) is available. In relation to the financial adaptation of farmers, a farm planning programme aimed to enhance farmers' skills in business, natural resource management and personal planning, and to increase the number of farm businesses having comprehensive written strategic farm plans, was the only component that received full endorsement from the review panel.
- The Natural Disaster Relief and Recovery Arrangements (NDRRA) introduced in 2011 cover bushfire, earthquake, flood, storm, storm surge, cyclone, landslide, tsunami, meteorite strike and tornado, but not drought, frost, human or animal epidemic. Under the NDRRA farmers can access loans at concessional interest rates (subject to asset damage), 50% freight subsidies (for transporting livestock, fodder or water for livestock, building or fencing equipment or machinery), and a 50% interest rate subsidy on new loans and recovery grants.
- Under the FMD scheme farmers can deposit up to A\$400,000 of income which, if kept on deposit for a minimum of 12 months, is excluded from taxable income until it is withdrawn. FMDs aim to increase self-reliance by farmers by providing liquidity to reduce exposure to fluctuating incomes due to climate variability and world markets. Farmers in an EC-declared area may access their FMD inside the 12-month limit.
- There have been a number of reviews of the FMD scheme since it was introduced, the latest changes in 2011 expanding the trigger for accessing FMDs within the 12-month time limit beyond EC drought areas to primary producers accessing recovery assistance under an NDRRA event). Primary producers can also now hold FMDs with more than one commercial provider to enhance competition between providers.
- Kimura and Antón (2011) conclude that there is some evidence that crowding out by government schemes of appropriate farmer risk management strategies is occurring in Australia. They suggest ECIRS increases the incentive of farmers in EC areas to increase their debt and reduces incentives to diversify because of criteria for off-farm income and investments.
- The NDP ECIRS is also potentially crowding out market responses by banks to drought by muting the signals from interest repayment defaults and potentially encouraging higher levels of debt lending.

Case Studies

- Four case studies were undertaken, three in South West Victoria and one in northern Victoria. Two of the farmers were third or greater generation Australian farmers, whilst two were New Zealanders who had relocated and bought farms in Victoria in the last seven years. All had experienced drought, although more severely in the northern Victoria case study.
- The four Australian case studies covered some of the key strategies highlighted by the conceptual framework, but also highlighted again how different a small group of farmers can be in their approaches.
 - Giblin – a low-input low-cost and hence low-risk farming approach focused on meeting his and his family’s lifestyle choices whilst achieving off-farm financial diversification
 - Chapman – scale and productivity model to be built on leverage and trans-Tasman family financing – the modern New Zealand dairy approach transposed and adapted
 - Farley – investment in feed self-sufficiency to control input costs, maximise productivity, but self/family financed.
 - Brown – a low-cost, low-scale and low-productivity model to be built on leverage combined with innovative thinking and risk taking in the face of entrenched farm management patterns and attitudes about ownership of water.
- None of the case studies reflected the use of market risk strategies, which supports the earlier conclusion that these aren’t widespread strategies and tend to be adopted by larger farms. However, both Giblin and Chapman supported the OECD conclusions around co-variance between output and input prices.
- Three of the case studies utilised healthy amounts of leverage, but Giblin seemed more concerned to reduce his leverage to local averages than Chapman or Brown. Farley had self-financed the investment in his farm without external leverage. Only Giblin had significant off-farm investments in place, although Chapman and to a lesser extent Farley were actively considering them. None were using FMDs. Also, typically for dairying, none were undertaking enterprise diversification, although Brown was considering diversifying to cereals.
- Although not directly translatable to the New Zealand environment, trade in water shares (both permanent and temporary) – highlighted in the northern Victoria case study – appears to introduce flexibility to farmers’ decision-making processes and ability to arrange their finance and is encouraging innovative thinking.

Conclusions

- Alternative business models, financial strategies, products and services were sought to increase farmers’ adaptive capacity for climate change, by investigating how farmers and the finance sector in Australia have responded to historical climate variability and extreme events, and how the strategies they developed could be applied in New Zealand.
- No novel business models, financial strategies or products/services that maybe relevant to dairy farmers in New Zealand were discovered. The research does highlight the current rural banking and insurance practices and products available and in-development in the two countries.
- The focus on the dairy sector in the case studies limited the scope of our findings. We were unable to access kiwifruit growers for case studies in Victoria and the dairy industry’s focus on specialisation, intensification and economies of scale limited any investigation of diversification as a strategy for managing risk. The case studies are also only of smaller farmers.

- The comparative review of insurance products highlighted some nascent products that are emerging for sectors of Australian agriculture, such as grains. These products are designed to avoid the issues highlighted for multi-peril crop insurance (MPCI), but it is too early to judge their commercial success, long-term feasibility, and hence potential for transfer to New Zealand.
- Whilst government policy circles and the OECD see a potential role for insurance products to assist farmers to adapt to climate change, there is little interest in developing new products amongst New Zealand and Australia insurers and currently amongst international reinsurers.
- There is a wider range of financial instruments, such as commodity derivatives, in Australia than in New Zealand, and these have the potential to assist Australian farmers in hedging against climate variability. However, in relation to dairying, New Zealand is the more innovative market in terms of financial products but no novel financial products were identified.
- Rural banking in New Zealand and Australia is dominated by the six main banks, of which all but one are Australian owned. Whilst interviewees did comment on lags between the two countries in terms of the uptake of certain financial products, our review of banking products failed to identify any different, new or innovative banking products.
- The exception was the FMD scheme in Australia that aims to increase farmer self-reliance by providing liquidity to reduce exposure to fluctuating incomes due to climate variability, etc. Banks offer FMD deposit products, and at September 2011 over A\$2.9 billion was on deposit (DAFF 2011). Recent legislative changes have extended the mechanism to withdrawals under the NDRRA and to allow multiple-bank FMDs.
- Our review of trans-Tasman credit practices for WNZL and WBC confirmed the similarities in processes, with differences accounted for by local business conditions. For the dairy sector, current equity minimums and LVRs appear equivalent or slightly more conservative in New Zealand than Australia. The measure of interest cover (CAFDS ratio) in Australia is more conservative, at least for larger farms.
- However, higher LVRs and lower CAFDS ratios were the predominant practice up until the GFC and the lower New Zealand equity level farmers therefore could reflect the historical looser supply of credit.
- It remains an open question whether farmer equity levels of 70–80% in Australia (compared with equity levels of 50–60% in New Zealand) reflect an overly conservative approach, but following Shadbolt et al. (2001), Australian farmers appear to be structuring their businesses and finances (low intensity, low solvency, higher liquidity) to be more resilient in an environment of negative shocks.
- If climate change's impacts on certain regions of New Zealand bring an increase in negative shocks (such as drought or other adverse weather events) then New Zealand dairy farmers' business models may have limited resilience.
- Historically looser bank credit practices in New Zealand appear to have been moderated since the GFC of 2008–09, as well as through the Reserve Bank's increased capital requirements for rural loans.
- The New Zealand On-farm Adverse Events Framework is one mechanism for direct government assistance to farm families who may in future be affected by climate change. The framework stresses the relationship between support for uninsurable risks, highlights the need for farmers to insure where possible, and does not preclude the development of new insurance products.
- The New Zealand Adverse Events Income Equalisation scheme is focused only on livestock and its low uptake and the ability to grant relief through the main IE scheme mean it may be reviewed in future.

- Australian National Drought Policy, including the Exceptional Circumstances (EC) regime, is still subject to change in future. The final results of the Western Australia Drought Pilot will inform what policy choices are put forward, but the initial review of the pilot suggest increasing strategic planning capability amongst farmers.
- The New Zealand and Australian schemes differ considerably in their design, their focus, the level of direct financial impacts, and the respective costs. The financial strategies of Australian farmers appear to be affected particularly by the existence of the interest subsidies under EC legislation and EC interest rate subsidies may simply support the more highly leveraged, risk-taking farmers.
- The insurance and banking industries are potentially crowded out of development of new products to assist with climate change due to the Australian Government's assistance schemes. For banks, interest subsidies mute the signals from interest repayment defaults and potentially encourage higher levels of debt lending by rural banks.
- There were four case studies, three in South West Victoria and one in northern Victoria. Two of the farmers were third or greater generation Australian farmers, whilst two were New Zealanders who had relocated and bought farms in Victoria in the last seven years. All had experienced drought, although more severely in the case of northern Victoria.
- The four Australian case studies covered most aspects of the conceptual framework, but also highlighted again how different a small group of farmers can be in their approaches. The key gap against the framework related to enterprise diversification, which is not commonly sought by dairy farmers.
- Whilst not currently directly translatable to the New Zealand environment, the flexibility that the trade in water shares, both permanent and temporary, brings to farmers' decision-making processes and their ability to arrange their finance more flexibly was notable for encouraging innovative thinking.

Recommendations

- Given the limited breadth of the research findings the recommendations are also narrowly focused:
 - Further research on the actual uptake and impact of the weather-index insurance products identified (e.g. YieldShield) would clarify whether these products will become established in Australia and if there is potential applicability to New Zealand farming.
 - Due to the benefits of potential spill-over effects, government research funding should continue to focus on providing information about climate change impacts for farmers and the finance institutions, to facilitate better inclusion of risk information into credit-risk processes and insurance.
 - Based on a comparison of the New Zealand Income Equalisation Scheme run by IRD with the Australian FMD scheme run by ATO but delivered through private banks, there is merit in investigating the potential to transfer the IRD scheme to the private sector in a similar manner to the FMD scheme, on the grounds of reduced government administration costs and that finance currently tied up in the government's balance sheet could instead be used productively elsewhere in the economy. This recommendation has not been discussed with the IRD.
 - Further investigation of the impacts of shocks on different farm business/financial models could be commissioned by government or industry and promoted within the industry as a way of understanding optimal strategies in the face of predicted increasing variability in climate and market shocks in the future.

- Government officials should keep abreast of the final review of the Western Australian Drought Pilot and consider whether any conclusions are applicable in the New Zealand context.
- Following the recommendations of the Western Australian Drought Pilot, there may be potential benefits in the New Zealand dairy industry from working collaboratively with the banking industry to investigate and promote a joint understanding of optimal dairy farm performance and risk minimisation, collective agreement on key financial indicators, and joint training on financial management and total wealth planning.
- Whilst agriculture is not specifically highlighted, the Issues Paper for the Australian Productivity Commission inquiry into regulatory and policy barriers to effective climate change adaptation includes questions focused on the potential role of financial services (in particular insurance) in relation to effective climate adaptation and should be reviewed when the inquiry is complete (Productivity Commission 2011).
- Further research into and promotion of the financial flexibility and returns provided by water trading in Victoria may be useful in informing the debate about the advantages and disadvantages of water trading for farmers in New Zealand.

1 Introduction

This report is the final report of the project *Farm-level adaptive capacity to climate change: the role of financial strategies and financial institutions in Australia*. The project was funded by the Ministry of Agriculture and Forestry (MAF) Sustainable Land Management Mitigation and Adaptation to Climate Change (SLMACC) and contracted through the Ministry of Science and Innovation (MSI) (Contract C09X1005).

The project has been carried out in partnership with farmer/grower representatives and finance industry representatives, comprising Dairy NZ; ZESPRI International; Westpac New Zealand Ltd (WNZL); Westpac Australia (WBC); the Insurance Australia Group (IAG) – State, AMI, NZI, and CGU Insurance Australia; and WestVic Dairy, Victoria, Australia.

Contributing researchers were Glen Greer (Agribusiness and Economics Research Unit (AERU, Lincoln University) and Patricia Fitzsimons (Department of Primary Industries, Victoria – Farm Services (DPIV)). Other participants and sources of advice are listed in the Acknowledgements.

The report begins by revisiting background and objectives, and describes the methodology and the changes made to it during the project. The agricultural and climate context of New Zealand and Australia is presented in Section 5. The findings from the literature review are discussed in Section 6, drawing primarily on New Zealand and Australian sources, and the conceptual framework is presented. Section 7 discusses the role of financial institutions in farm financial adaptation and Section 8 the role of government. The key differences between the New Zealand and Australian or Victorian dairy industries are discussed briefly in Section 9 along with presentation of the four case studies undertaken with dairy farmers in Victoria. Conclusions from the research follow, along with recommendations for consideration in policy.

A separate report by Patricia Fitzsimons (DPIV) containing institutional analysis based on interviews with government officials in Australian Federal departments and the State of Victoria is attached at the end of this report (as Appendix 4).

2 Background

The project proposal was submitted in April 2010 as part of the Round 2 SLMACC funding for 2009/10 administered by MSI (then the Foundation for Research, Science and Technology (FRST)) and formed part of the FRST Understanding and Adapting to Global Environmental and Earth Processes Change (GLO) Portfolio. The RFP requested projects aligned with SLMACC Research Theme 3.1: Impacts of climate change and adaptation, sub theme Adaptation to the impacts of climate change. The Theme Research priority that a project was designed to meet was:

Alternative financial models for adapting to climate change on farm, e.g. Australian case studies.

This priority informed the agreed scope of this project, namely:

- It is focused on financial aspects of farm management, whilst acknowledging that farm management is part of an interconnected system of local eco-biological, technological and human/social factors.
- It is focused on adaptation to climate change.
- It investigates farm-level responses.
- It focuses on Australian and New Zealand research.
- The case studies are drawn from Australia.

Since project inception there have been continuing changes in the political landscape of climate change in both New Zealand and Australia, with the announcement of the deferral of agriculture's inclusion in the New Zealand Emission Trading Scheme (ETS) and the enactment of the Clean Energy Act and Carbon Farming Initiative in Australia.

Whilst mainstream international scientific consensus on climate change continues to be questioned by a minority, the scientific predictions about climate change impacts on both Australia and New Zealand have not altered. Meanwhile both countries have since suffered a number of weather-related adverse events. In Australia the breaking of the long drought (2003–2009) across the country was followed by significant flooding in Queensland and Victoria (March 2010), Victoria (September 2010), Queensland (December/January 2010) and western and central Victoria (January 2011). New Zealand has suffered from drought in Northland, Waikato and Ruapehu (December 2010), storms in Southland and South Otago (September 2010), flooding in Golden Bay (December 2010), flooding in Hawke's Bay (May 2011), and flooding again in Nelson and Golden Bay (December 2011). However, disruptive weather is an expected part of primary production in both countries and these events have not been scientifically linked to climate change.

The project also took place against a background of media commentary about banks' lending practices, increases in rural property prices and farm debt levels prior to the Global Financial Crisis (GFC) of 2008–09, and the impact of tightened bank lending practices post-GFC.

All of these factors – the political changes, incidence of adverse weather events, and the media focus on the role of banks in farm lending – contributed to the potential for resistance /sensitivity to the objectives of this project amongst potential stakeholders. It is, therefore, gratifying how willing the various agricultural and finance industry participants have been to engage with this project.

3 Objectives

...the nature of farm businesses in Australia already has been fashioned by climate variability, so many businesses are now structured to cope with gradual climate change and its associated climate variability. In general, farms are diversified, with high equity, are reliant on new technologies and agribusiness services and are strongly market-focused. Many farms also have off-farm sources of income or sizeable off-farm investments. These characteristics support farmers' adaptation responses to climate change and its associated variability. (Kingwell 2006)

Climate change is expected to provide both threats and opportunities for the New Zealand agricultural sector but current understanding of the impact of farm financial strategies and the roles of banks, insurers and other financial institutions in farm-level adaptation to climate change is limited.

This project sought to identify alternative business models, financial strategies, products and services that can increase the adaptive capacity of farmers to climate change, by investigating how farmers (as suggested by Kingwell (2006) above) and the finance sector in Australia have responded to historical climate variability and extreme events, and how the strategies they developed could be applied in New Zealand.

The key research questions for the project were:

1. What financial strategies have been developed in Australia for the farm sector in response to climate variability?
2. What role do Australian financial institutions play in supporting the ability of farmers to adapt to climate variability?
3. What conditions supported adaptation by both Australian farmers and the finance sector?
4. What opportunities exist to increase the adaptive capacity of farmers in New Zealand?

The scope of the project is clearly focused on climate change adaptation and, therefore, accepts anthropogenic climate change as its starting point; however, it does not consider the relative contribution to greenhouse gases or the potential for mitigation by the agricultural sector.

4 Methods

Our research methodology was adapted from similar research using case study approaches on agricultural climate adaptation in Australia. We focused on farm-level decision making in relation to primarily financial strategies and structures ('financial strategies'), whilst acknowledging that decision making by farmers is a complex interaction between technical/production, financial and other socio-economic factors.

The Critical Steps for our research were:

- CS 1 – Develop a conceptual framework of farm-level adaptation to the impacts of climate change through financial strategies, and the role of the finance sector and other institutions in supporting this adaptation. [Addresses research questions 1 and 2]
- CS 2 – Design and undertake interviews to develop case studies. Undertake exploratory case studies of farmer adoption of financial strategies, using semi-structured interviews. [Addresses research questions 2 and 3]
- CS 3 – End-user relevance testing, and promotion of findings and case studies. [Addresses research questions 3 and 4]

This report covers the outcome of CS1 and CS2 with partial discussion of CS3, as end-user promotion was to be carried out by project partners following the publication of the final case studies in this report.

4.1 Literature review

An initial literature review was subcontracted to Glen Greer of the AERU at Lincoln University, who undertook a desktop literature review that concentrated on Australian and New Zealand sources describing research into the determinants of farm financial adaptive capacity to climate variability and climate change.

Subsequent to this input, additional literature connections were made by the lead researcher principally facilitated via Patricia Fitzsimons and Bill Malcolm at the University of Melbourne/DPIV and Nicola Shadbolt at Massey University. In particular, this resulted in the incorporation of highly relevant material from Australian and New Zealand streams from the OECD Risk Management in Agriculture project.

Interviews or conversations were held with a number of industry participants in the New Zealand dairy industry, kiwifruit industry, insurance and banking industries. Also we met with representatives of the dairy industry, insurance industry, banking industry and Victorian State Government in Australia who provided valuable connections and material around context and existing and forthcoming research.

The resulting conceptual framework is an attempted synthesis of the literature on vulnerability and resilience with on-farm risk and financial management strategies.

4.2 Institutional analysis – Australian Government interviews

Patricia Fitzsimons of the DPIV undertook institutional analysis on the role of the Australian Government in supporting farm-level financial adaptation. She interviewed government officials in Australian Federal departments and the departments of the State Government of Victoria. Her report, including a discussion on methodology, is attached as Appendix 4.

4.3 Selection of case study participants

The initial scope of the project as proposed was on farmers and growers in one Australian state. Victoria was discussed with the advisory group members individually and selected as an appropriate focus area because:

- The state is the largest dairy producer in Australia, with 67% of the registered dairy farms and 64% of the cows in Australia (Dairy Australia 2011)
- The state is also the largest producer of kiwifruit in Australia having 60% of the total area planted (RIRDC 2011)
- Whilst Tasmania provides a more obvious comparison with traditional New Zealand dairy areas like Taranaki, climatic conditions and hence dairy systems vary across Victoria, from the wetter and pasture-based Gippsland to the dryer and irrigation-based northern Victoria. Hence, Victoria potentially provided examples of how New Zealand's climate and dairy systems may evolve over time, if, for example, as predicted the east coast of the South Island becomes drier.

The methodology proposed intended to undertake case studies for two sectors of the New Zealand Primary Sector – dairy and kiwifruit. Unfortunately, and subsequent to undertaking context-focused discussion in New Zealand with the kiwifruit industry, we were unsuccessful in our attempts to persuade any kiwifruit growers in Victoria to participate in the project. This was largely a result of the current small scale of kiwifruit production in Australia generally and in Victoria specifically, where even though it is the biggest state producer of kiwifruit, the 183 hectares under kiwifruit are held by just three producers. ZESPRI International was very helpful in obtaining introductions to the Victorian kiwifruit growers; however, one producer declined involvement on the grounds that confidentiality couldn't be guaranteed, whilst another's orchard was for sale at the time of contact. The small scale of the industry also meant that, unlike for dairy, personal connections to potential case study growers could not be brokered by contacts at the Victorian Department of Primary Industries (VDPI), who had no direct contact with the industry. This project's inability to engage with Australian kiwifruit growers is disappointing. Subsequently, we decided to increase the number of dairy case studies to four or five to compensate for this.

A second but related scoping issue was that we originally hoped to have at least one case study focus on a new insurance product, potentially focused on rainfall or multi-peril crop insurance. However, in restricting our scope to the dairy industry (which has interaction with insurance products focused on buildings, machinery, livestock and milk supply), this was also not an option.

An advisory-group structure had initially been proposed, but because of ongoing delays (due to the September 2010, February 2011 and June 2011 earthquakes in Christchurch) and the change in scope to focus solely on the dairy industry, the formal Advisory Group meetings were replaced by individual liaison with each of the Advisory Group members as the project developed.

The dairy farmer participants in the case studies were selected through discussion of the project objectives with Roddy Brown, Head of Dairy for WBC, and, via the DPIV, with Mike Weise of WestVic Dairy.

Given the financial nature of the project, potential participants were understandably concerned about confidentiality of key data and it was only possible to source four case studies (a fifth potential case study participant pulled out at the last minute due to family health issues). Three of the case studies were based in South West Victoria where the climate is quite varied but some areas are marginally more comparable with New Zealand dairying areas. The fourth example, of northern Victoria, was chosen to provide one case study of a farmer facing more extreme climatic conditions and because of the particular strategy being adopted by that farmer.

4.4 Design and process of case study interviews

A semi-structured qualitative interview of approximately two hours with each farmer was undertaken, digitally recorded, and transcribed. Each participant had the project scope explained to them and was asked the same questions. In addition, a questionnaire of physical and financial characteristics was sent to each farmer prior to the interview and either completed at the interview or subsequently completed. Refer to Appendix 1 for the Project Information sheet, Interview Questions and Questionnaires.

The questionnaires were designed to validate to the researcher the relative structure and existing strategies of the participants for the purpose of increasing the relevance of the case studies to the reader through the provision of a limited amount of key data. Due to the partial nature of participants' responses to the financial questionnaire in particular and the potential for differences in calculation/definitions, the case study key factors are not meant to be taken as comparable quantitative statistics, but more as broad indicators of the key characteristics of the case study farms.

The rough transcriptions were edited down to focus on key strategies identified for each case study. Reflecting on the case studies and the whole interview process, we then reviewed and revised the conceptual framework to better reflect any key details or differences that had been observed during the process and to note further areas of potential future research interest. Obviously, these observations need to be qualified due to the limited number of interviewees.

4.5 Ethics process

Landcare Research has a voluntary social ethics process to which social researchers can submit their research projects. This project did not follow the full social ethics review process, but adapted the basic tenets and key recommendations in its interaction with the interviewees as set out in the example Information sheet (Appendix 1).

5 Context

5.1 Climate variability, extreme weather events and climate change predictions

The New Zealand climate is highly variable between years, as the country sits in a turbulent wind belt and is influenced by components of the Southern Hemisphere climatic system, including the El Niño – Southern Oscillation (ENSO Cycle), the Inter-decadal Pacific Oscillation (IPO), and the Southern Annular Mode (SAM). New Zealand is already subject to extreme weather events, the most damaging being floods and drought (NIWA 2010).

Climate change is predicted to differ in its impacts by region in New Zealand, but the impacts are broadly described as causing drier conditions on the east of the country and increased rainfall on the west. For example, Canterbury on the east coast of the South Island is predicted to be up to 2.5°C warmer over the next 70–100 years, with coastal parts of Canterbury up to 20% drier. The region is likely to experience more varied rainfall patterns and flooding could become up to four times as frequent by 2070. Conversely, in Taranaki on the west coast of the North Island, temperatures could be up to 3°C warmer and the region up to 20% wetter, with more varied rainfall patterns, and flooding becoming up to four times as frequent by 2070. Rises in sea levels are also predicted, along with more frequent extreme weather events such as droughts (especially in the east of New Zealand) and floods.

Consequently, whilst agricultural productivity is expected to increase in some areas, there is the potential for negative impacts from drought and range extension of pests and diseases. It is also likely that there will be costs associated with changing of land-use activities to suit a new climate (MfE 2008).

Australia obviously covers a much wider range of climatic zones than New Zealand and across most of the country climate differs significantly from that in New Zealand. However, there are areas of Australia (e.g. Tasmania) where rainfall and temperatures are similar to those currently experienced in regions of New Zealand. Moreover, there are also regions of Australia whose present climate may give insights into future climate variability and increased extreme events in New Zealand regions, under climate change. For this project we have focused on the State of Victoria and specifically, through our focus on the dairy sector, on South West Victoria, which is a key dairying region and has rainfall levels close to those of drier areas of New Zealand.

South West Victoria was impacted on by the extended droughts of recent years with ‘Exceptional Circumstances’ being declared at the peak, but not to the extent of other regions such as northern Victoria. Under climate change predictions South West Victoria is expected to be hotter, drier and more variable than it is today. Although, compared with many other parts of Victoria, the regional climate will remain moderate (Tostovrsnik et al. 2010).

5.2 Agriculture in New Zealand and Australia

In 2010, agricultural, food and forestry industries contributed 66% of merchandise export earnings, 11.6% of employment and 12.2% of New Zealand’s Gross Domestic Product (MAF 2011c). In terms of export earnings the most significant agricultural exports are pastoral products, most notably dairy, sheep and beef meat, followed by horticultural products, in particular, pip fruit, wine and kiwifruit.

New Zealand farmers are recognised internationally as being innovative and highly productive and have operated in an open and unsubsidised market since the 1980s, with

government support estimated to be less than 1% of agricultural revenues (OECD 2010). Certain agricultural industries, notably dairy and kiwifruit, are represented by large farmer/grower cooperatives that have significant marketing presence in the global economy.

The dairy industry, with Fonterra processing around 90% of all milk, has grown significantly in recent years, with conversions to dairying being a prominent feature. This growth has attracted negative media attention in relation to public perceptions of the increasing intensity of farming and the management of related environmental issues.

Increases in rural land prices, farmer indebtedness and bank rural lending practices were also topics of media focus up to and after the Global Financial Crisis (GFC) of 2008–09. Concerns about bank exposure to agricultural debt levels (which at NZ\$47 billion (10⁹) is around 15% of bank private lending; Reserve Bank of New Zealand 2011) resulted in the Reserve Bank of New Zealand introducing strengthened capital adequacy requirements in June 2011. However, levels of rural indebtedness have fallen back from their peak as farmers continue to pay down debt on the back of strong commodity prices. Recently media focus has shifted to foreign investment in New Zealand following the Overseas Investment Office's review of the sale of the Crafur farms to a Chinese-backed consortium.

In Australia agriculture and its closely related industries also contribute around 12% of GDP; however, due to the predominance of its mineral industries, agricultural exports contribute only 14.7% of total merchandisable exports, but provide 17% of employment (National Farmers Federation 2011). The most significant agricultural exports are wheat and beef, followed by wine, wool and dairy and barley.

Australian farmers also operate in an open market and by OECD standards receive little government support, estimated to be 4% of agricultural revenues (OECD 2010). What support they do receive is largely linked to the provision of drought support for farmers under the Exceptional Circumstances (EC) legislation.

Whilst Australian agricultural processing or commodity markets are not dominated by one entity to the extent that Fonterra does for dairying in New Zealand, there are still some significant sized co-operatives, for example in the dairy sector.

Severe ongoing drought conditions in Australia over nearly a decade have already affected production, reduced productivity and reduced the number of farms. Farmer indebtedness climbed significantly in the last decade but has stabilised and bank lending over the last two years at around A\$60 billion represents around 9% of total bank lending (Reserve Bank of Australia 2011). However, whilst the drought broke in 2009–10 to be replaced by major floods in some states, the topics of farm consolidation, corporatisation of farming and overseas investment in agricultural land have also been in the Australian media.

5.3 Climate change impacts on agriculture

The OECD (2009) notes that the IPCC 'does not report on the expected changes in the variability of yields and livestock productivity due to climate change. At first glance nevertheless, it is likely that variability of production will increase due to more frequent extreme weather conditions or events (at least at the individual farm level), but this hypothesis has not yet been confirmed by IPCC reports'.

There has been only limited research into the potential economic impacts of climate change on agriculture in New Zealand. Tait et al. (2005) modelled several scenarios of drought-

induced reductions in national milk production of the order of 10% and found impacts on private consumption and GDP of between 0.3 and 0.5%. These authors found that doubling the reduction in milk production would lead to GDP falling by 1.1%.

Costs and benefits of climate change on agriculture have also been discussed at a national level (Wratt et al. 2008). Most recently, Stroombergen (2010), building on earlier research, concluded that impacts on New Zealand real GDP could be negative 0.5% via the impact of climate change on agricultural output, but notes that theorised impacts of carbon fertilisation mean this could be a positive 0.5%.

Different regions are expected to gain positively or negatively depending on the type of agriculture practised and the nature of regional climate impacts. Overall, the economic impacts on New Zealand agriculture are expected to be mild compared with the impacts on other countries, and may enhance returns to New Zealand farmers through global commodity prices.

The agricultural sector was expected to begin mandatory reporting under the NZETS in 2012, with financial obligations commencing from 2015. Following a review process, in September 2011 the New Zealand Government deferred the agricultural sector's entry into the ETS dependent on the availability of practical mitigation technologies for farmers and the progress of trading partners in reducing emissions.

In Australia, research by ABARES (2011) indicates that soil moisture is the key to climate change impacts and that the south west of Australia is particularly at risk, with northern Australia less affected. Cropping industries are likely to be more adversely affected than livestock industries, but welfare impacts of climate change vary across regions and broad-based regional economies are likely to be less impacted by climate change. Productivity in the Murray–Darling Basin is particularly at risk.

Government advice to Australian farmers is that aside from the expected challenges of these regional impacts of climate change, there are potential market opportunities due to benevolent changes in weather patterns in some regions, opportunities for changes to more profitable agricultural activities, and a negative impact of climate change on agriculture in competitor countries.

6 Literature Review and Conceptual Framework

6.1 Climate change adaptation

Fünfgeld and McEvoy (2011) discuss various ‘framings’ that have been applied to the discussion of climate change adaptation. They describe ‘framing’ as a way of making sense of a topic (e.g. climate change) from an individual perspective, but which can also be used to arrive at a shared meaning and sense of purpose. They identify four main ‘framings’ that are either explicitly or implicitly adopted in academic literature, private enterprise response, government research and policy around climate adaptation:

- **Hazards/Disaster risk management approach.** This natural-disasters frame has been a dominant consideration in policy discussion on climate change, particularly in relation to developing nations. Increasingly broader notions of climatic hazards are being adopted and linked with other socio-economic and environmental trends, for example population expansion into bushfire-prone areas in South East Australia.
- **Vulnerability approach.** This focuses on who or what will be affected and in what way. A wide range of policy responses to vulnerability are possible. For example, outcome vulnerability relates to the residual impacts (e.g. on a habitat, an ecosystem, or a municipality) after all feasible adaptation responses have been taken into account. A contextual framing of vulnerability considers vulnerability in the broader context of interactions between climate and society.
- **Resilience approach.** The ‘resilience’ concept originated in the field of ecology where it was first associated with the work of Holling (1978, 1986), but it is now applied to human systems. It is defined as the ability of groups or communities to cope with external stresses and disturbances as a result of social, political, or environmental change.
- **Risk management approach.** This is seen as the dominant approach for dealing with many types of uncertainty in government and the private sector. Central to the notion of risk are uncertainty and perception. Risk is defined as the combined product of hazards, exposure and vulnerability and there is a close connection between hazards, vulnerability and risk-management approaches (Fünfgeld & McEvoy 2011).

Of these four framings we focus briefly on the literature on vulnerability, resilience and risk management before discussing the overarching and connected concepts of adaptation and adaptive capacity.

6.1.1 Vulnerability

Vulnerability is the propensity to suffer some degree of loss from a hazardous event (Etkin et al. 2004). Turner et al. (2003) define vulnerability as the extent to which a system is likely to be harmed through exposure to a hazard, either a perturbation (disturbance or shock) or a stress.

Adger (2006) defines vulnerability as the state of susceptibility to harm from exposure to stresses associated with environmental and social change and from the absence of capacity to adapt. This definition is reflected by the IPCC (Adger et al. 2007) who define vulnerability as ‘the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity’. We discuss adaptive capacity further below.

The components of vulnerability are frequently visualised in the climate change literature and government publications as in Figure 2 (commonly attributed to the Allen Consulting Group (2005) in Australia, although Pearson et al. (2008) attribute it to earlier resilience literature such as Holling (1978)).

Pearson et al. (2008) note that the alternative frameworks for conceptualising vulnerability to climate change ‘are so diverse that it is difficult and controversial to even organise them into a single classification system’. They state that one of the most successful syntheses has been by O’Brien et al. (2007) who note that vulnerability is also conceptualised along a continuum from outcome to contextual vulnerability.

The IPCC definition relates to outcome or end-point vulnerability, that is, what remains after exposure to climate change impacts and intervention through adaptation. By contrast, contextual vulnerability (also referred to as the ‘starting point’ or ‘bottom-up’ approach), which has emerged from the political–economy literature, considers both climate variability and change in the context of political, institutional, economic and social structures and changes, which interact dynamically with contextual conditions associated with a particular ‘exposure unit’ (e.g. a business, a region or a nation).

Füssel (2009) acknowledges that these two interpretations of vulnerability are predominant and argues that they suggest different strategies for reducing vulnerability. For our conceptual framework we selected the outcome approach of the IPCC because of its acceptance through intergovernmental frameworks and its linkages to the risk management frameworks and farm-level risk management that we discuss below. However, we discuss its location within a broader institutional framework in Section 6.2 below.

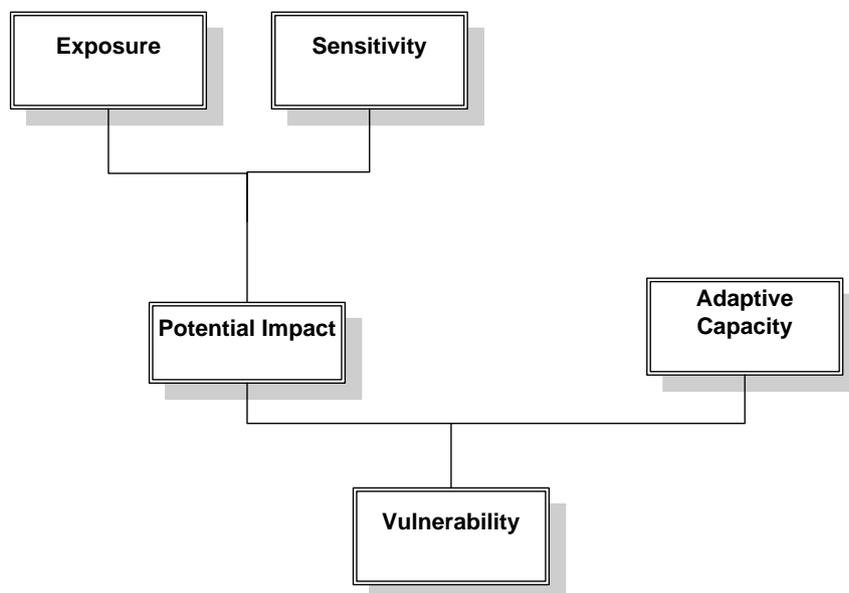


Figure 2: Outcome Vulnerability and Its Components.

6.1.2 Resilience

Berkes (2007) describes resilience as being the flip side of vulnerability, as it places emphasis on the ability of social–ecological systems to deal with the hazard and facilitates insights on how to make a system less vulnerable.

Perrings (2006) considers that a system’s resilience depends on two attributes: robustness and adaptive capacity. Robustness refers to the system properties that allow it to accommodate perturbations without additional adaptation and without losing functionality. In economic systems, robustness and adaptive capacity affect the ability of the system to withstand market or environmental shocks without losing the capacity for efficient resource allocation (the functionality of the market and its supporting institutions) or to deliver essential services (production system functionality). In the context of financial institutions such as banks robustness seems a similar concept to the ability to ‘buffer’ shocks through retention of adequate reserves.

Alternatively, Kaine and Tozer (2005) distinguish between two qualitatively different dimensions to measuring a system’s capacity to withstand external shocks: stability and resilience. Stability is ‘the propensity of a system to attain an equilibrium condition’ (Holling 1986). The authors further describe stability as ‘the presence of repeated patterns of behaviour in the absence of disturbance, the extent to which disturbances can be experienced without disruption to such patterns, and the speed with which there is a return to these patterns once the system has been disrupted’ (Kaine & Tozer 2005).

One could note that robustness and stability are similar by definition to sensitivity, although robustness relates more directly to a system’s adaptation (Kaine & Tozer 2005).

When considering concepts of stability and robustness, it is also worth noting Gallopín’s (2006) comment that an insensitive or ‘armoured’ system may exhibit low resilience, as it is the repeated exposure to perturbation that builds resilience in natural systems. Sensitivity may leave a system open to threats, but an insensitive system may be unable to adapt and seize opportunity. He also notes that the concept of resilience does not include exposure but refers to the reaction of the system when exposed to perturbations.

Fünfgeld and McEvoy (2011) believe that the application of resilience as a guiding concept for climate change adaptation is problematic due to the fact that the ecological dynamics that underpin it (perturbations, equilibrium, etc.) are difficult to apply in the context of human socio-economic systems where climate change adaptation is underpinned by regimes of political power, knowledge creation and reflexive decision making.

Adger (2006), in seeking to reconcile resilience and vulnerability, notes that in the context of social–ecological systems, resilience refers to the magnitude of disturbance that can be absorbed before a system changes to a radically different state, as well as the capacity to self-organise and the capacity for adaptation to emerging circumstances.

At risk of oversimplifying a complex and rich body of literature, we draw on the last author and incorporate a limited view of resilience within our conceptual framework as in Figure 3.

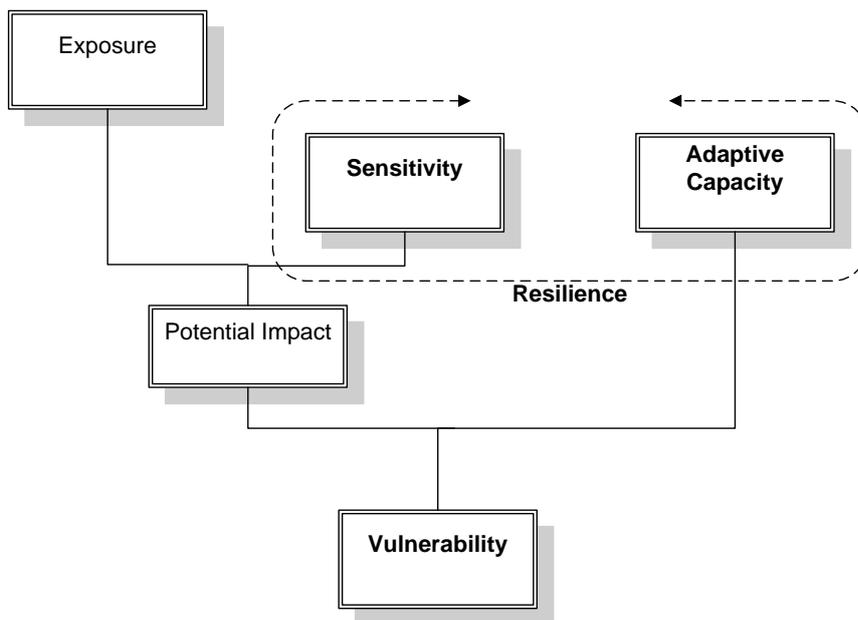


Figure 3: Resilience, Sensitivity and Adaptive Capacity.

6.1.3 Risk Management

Risk management approaches to climate change arose out of the natural hazards/disaster research. Fünfgeld and McEvoy (2011) note that in the 1990s a group of researchers challenged prevailing hazards/disaster theory by arguing that human actions, not forces of nature, were mainly responsible for the fact that large numbers of humans were at risk from natural disasters.

Secondly, risk management approaches have strong roots in economic theory and management approaches in both private and public organisations that seek to minimise the negative consequences of uncertainty. Risk management approaches are widespread in project management, engineering, financial management, insurance, and occupational health and safety. Most relevant for this project is that there is a well-established literature around farm-level risk management (discussed in Section 6.4).

Common risk strategies include risk prevention/avoidance, risk transfer, risk minimisation/mitigation, and risk coping.

Fünfgeld and McEvoy (2011) note that two different definitions of risk are related to climate change. The first, emerging from the hazards literature, is:

$$\text{Risk} = \text{Hazard (climate)} \times \text{Vulnerability.}$$

This shows again the link to the vulnerability framing discussed above.

From an economics and organisational management perspective, risk is defined as:

$$\text{Risk} = \text{Consequence} \times \text{Likelihood,}$$

where ‘consequence’ is defined in terms of the impacts of climate change on an organisation and ‘likelihood’ is a function of the probability and frequency of the event occurring.

Risk-based approaches to climate change have been widely promoted and adopted in private and public organisations in Australia, New Zealand and other Anglo-Saxon countries and are promoted by the OECD. Jones and Preston (‘Adaptation and risk management’, 2010, unpublished) argue that ‘risk management is the most appropriate overarching framework for assessing climate change adaptations’ and that other frameworks such as vulnerability and resilience can comfortably be encompassed within it.

6.1.4 Adaptation and Adaptive Capacity

The IPCC defines adaptation as ‘adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory, autonomous or planned adaptation’ (Adger et al. 2007).

Adaptation practices are rooted in ‘place’ and ‘climate risk decisions will be made by the decentralised decision makers in the private sector, local government and by households’ (Allen Consulting Group 2005) because the drivers of adaptation such as geographical, political, topographical, cultural and social conditions differ spatially (Adger et al. 2005) as well as across temporal and sectorial scales (Howden et al. 2007).

Adaptation practices also have the potential to be maladaptive, which is defined as ‘action taken ostensibly to avoid or reduce vulnerability to climate change that impacts adversely on, or increases the vulnerability of other systems, sectors or social groups’ (Barnett & O’Neill 2010).

Adaptive capacity is defined by the IPCC as ‘the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences’ (Adger et al. 2007).

A system’s ‘adaptive capacity’ is its ability to prepare for and adjust to stress so as to reduce negative impacts and make the most of opportunities (Smit et al. 2001). As noted in the vulnerability framing, adaptive capacity is the ability of a system to reduce vulnerability arising from exposure to an impact and a system’s sensitivity. It is sometimes hard to separate adaptive capacity from sensitivity in the literature, although Gallopín (2006) notes that sensitivity has an *ex ante* quality and that adaptive capacity has an *ex post* quality.

As also previously noted, adaptive capacity is also considered as an element of resilience, and is viewed as having the potential to link the two frames (Nelson et al. 2010). Walker et al. (2004) consider adaptability to be mainly a function of the social component of a socio-economic system – the individuals and groups acting to manage the system. The greater the adaptive capacity/adaptability of a system, the more resilient it is to stress. Adaptive capacity is also used in relation to the transformation of a system to a new state following a disturbance.

According to Adger and Vincent (2005) adaptive capacity is a collection of resources and assets that form a base from which adaptive actions can be pursued. The resources and assets

create a base-level adaptive capacity, which can be drawn upon to modify exposure to risks and losses as well as to draw on opportunities stemming from climate change.

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) define adaptive capacity as the community's ability to draw on its resources to adapt or respond to change. Rural communities are constantly adapting but some communities are more capable of adapting to change than others. The availability and mix of activities and assets that people can draw on makes a big difference in their ability to deal with changes (CSIRO 2011).

Young et al. (2006) see adaptation and adaptability as a system's response to disturbance or change that occurs now or in the future. Adaptation refers to the process of structural change as a response to external circumstances while adaptability applies to the capacity to adapt to future changes in the environment of the system concerned (adaptive capacity). Adaptation and adaptive capacity additionally have connotations of reactivity to changing exogenous circumstances.

Similar to the criticism levelled at outcome vulnerability, Young et al. (2006) view adaptation and adaptability as general concepts that ignore the why and how of underlying system dynamics. They view resilience, robustness and (contextual) vulnerability as pointing to structural characteristics of the systems concerned and to whether or not adaptation is necessary.

The economics profession has been late in coming to the debate on adaptation and adaptive capacity. However, Williamson et al. (2010) discuss how, under an economics framework, there are rational and logical reasons why different individuals and human systems have different levels of adaptive capacity and that these differences do not necessarily correlate to differences in vulnerability¹. They suggest an alternative approach of determining the factors leading to socially inequitable or economically sub-optimal investment in adaptive capacity 'assets' or reduced effectiveness of adaptive capacity assets resulting in what they term 'adaptive capacity deficits'.

Significantly for this research project Williamson et al. (2010) identify that much of the current focus of adaptive capacity approaches is on social determinants and socially organised systems. However, local economies will also be impacted by climate change and the response of economic entities and their inherent capacity to adapt will have a significant effect on the overall adaptive capacity of integrated social and economic systems.

They suggest that the economic characteristics such as scale, diversity, organisational/managerial capital, substitutability of inputs, factor mobility, liquidity of assets, etc. will affect the capacity to adapt. Moreover they note that whilst income, financial resources, and natural capital do not fully define adaptive capacity, they are determinants of it; that is, they influence the amounts of adaptive capacity assets and resources that can be obtained.

¹ This conclusion assumes efficient allocation and that rational agents have factored climate change considerations along with other factors into decisions about adaptive capacity holdings. If, however, agents are irrational or if there are systematic barriers and failures in allocation mechanisms (be they market, social, or political in nature) then there may be either underinvestment in particular adaptive capacity assets or underutilisation of these assets resulting in adaptive capacity deficits and heightened vulnerability (Williamson et al. 2010).

Given the long history of the vulnerability approach and its endorsement by the IPCC we have retained it as our conceptual framework and note the identification of economic or financial determinants of adaptive capacity identified by Williamson et al. (2010).

6.2 Institutional and organisational change

From the prior discussion it already emerges that agricultural adaptation to climate change operates at a range of scales and faces barriers and enablers that are attributed to a wide range of individual and collective actors and frameworks, stretching from the farmers' own abilities to the role of international trade. Discussion about the contextual vulnerability approach, and the potential or not for resilience approaches to locate climate change adaptation within a broad socio-economic system, highlights that any conceptual model of farm financial adaptation must similarly acknowledge the broader systems and relationships it sits within.

Landcare Research has developed a framework for understanding changes in organisations and institutions (Potter et al. 2009, unpublished Landcare Research Working Paper) conceptualised into four levels (see Figure 4): the broader system; the organisational field; the organisation itself; and individuals within the organisation². This framework draws upon Structuration Theory, New Institutional Theory, and the organisational change literature in order to understand how organisations adopt sustainable practices.

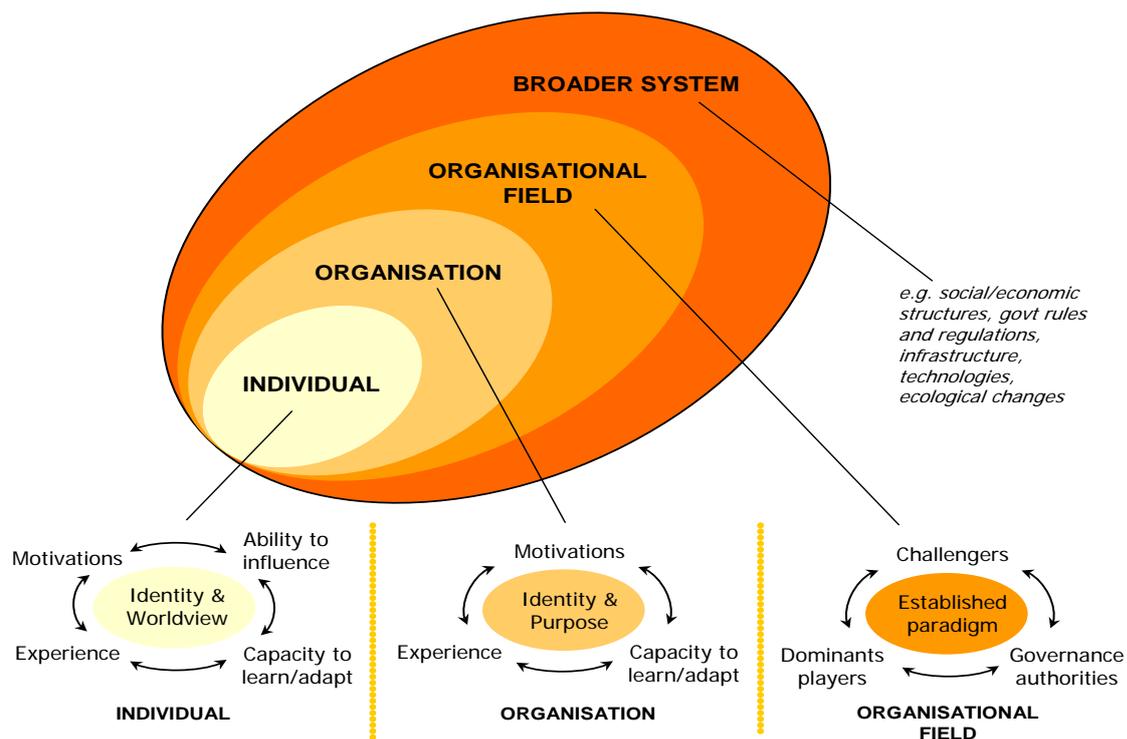


Figure 4: Framework for Understanding Changes in Organisations and Institutions (Potter et al. 2009 unpubl.).

² The following section draws on a previous explanation of the institutional and organisational change approach by Claire Mortimer, Landcare Research.

Structuration Theory (Giddens 1984) focuses the principal unit of research on social practice, which has both a structural and an agency component. The structural environment constrains and enables individual behaviour, while at the same time individuals or ‘agents’ reinforce or change social structures. In understanding organisational change, therefore, it is critical to understand both the agents and the social structures within which they operate.

Scholars working with New Institutionalism Theory (DiMaggio & Powell 1983; McAdam & Scott 2005) highlight the role of organisational fields in shaping organisational behaviour (Potter et al. 2009, unpubl.). An organisational field can be defined around industries, sectors or geographic areas and can include businesses, citizens and consumers, regulatory agencies and non-government organisations. Over time, actors within the field, and social structures from the broader system, shape institutions (note ‘institutions’ are not just entities or groups but also the informal and formal social rules) that determine what organisational practices are considered desirable or normal within that field (Larrinaga-Gonzalez 2007). Institutional theory has been criticised for focusing on external drivers of organisational change and underestimating the ability of individual agency (Potter et al. 2009, unpubl.).

The third theoretical perspective drawn from the organisational change literature provides insights into the nature of why and how organisations change. Literature suggests that for intentional change to occur an organisation requires: a strong and articulated sense of purpose and identity, which is compatible to the specified change; strong motivations for change; high levels of adaptive capacity; and for significant change, processes for reflective learning.

Whilst this model has been developed to interpret the behaviour of larger businesses and the individuals within them, it can be applied to the farming context. For example, the farmer is an individual imbued with certain production, management and financial capabilities who is located within an organisation (the farm) that involves family members and employees and has a certain form of business (e.g. dairying). The farm itself sits within the agribusiness ‘field’, which in its broadest sense consists of competing farmers, suppliers (e.g. feed, grain, machinery and finance), the rural community, cooperative processors and marketers, current regulators, etc. and is shaped by the social rules within that field. The agribusiness field is influenced by the broader system of social structures and evolving ‘norms’ (e.g. public views and values around farming), economic structures and influences (e.g. free trade or the GFC of 2008–09), major changes in government regulation (e.g. the ETS), major technological shifts (e.g. the adoption of electric fencing) and non-local ecological changes (e.g. climate change).

Many barriers and enablers to financial adaptation of farmers to climate change are referred to in the literature. The risk management approaches discussed above identify human, farm-level, market and institutional sources of risk and management strategies. However, the additional insight provided by the institutional model (besides their interactions as economic actors) is that behaviours within and between fields are influenced by accepted social norms and values and their ecological context. Major events such as an economic collapse or ecological disaster can disrupt established patterns in the organisational field and trigger an opportunity for innovation to occur (Potter et al. 2009, unpubl.).

The scope of this research is focused on farm-level change and the role of the financial industry and the government in facilitating this change. In this context we define farm-level as consisting of both individual (farmer) and organisational (farm) levels. The financial industry mainly interacts with farmers from within the organisational field, except when a

major disturbance such as the GFC causes a major shift in the ‘norms’ of business. The government, through established regulations and support packages, also interacts through the organisational field, but major changes such as the introduction of the ETS to agriculture have the potential to shift the norms of doing business.

6.3 Agricultural adaptation to climate change

The discussion so far has been about climate change adaptation across all sectors and scales. As noted in Section 5.3 climate change is expected to impact both positively and negatively on different sectors of primary production in both New Zealand and Australia. Agriculture is constantly in a state of adapting to climate variability and this section reviews relevant research on climate change adaptation in agriculture in Australia and New Zealand for reference to financial strategies.

In New Zealand most agricultural adaptation research to date has focused on biophysical vulnerability, adaptation or participation based on potential adaptation responses by farmers and growers, in the form of case studies (Kenny 2008, 2011).

Cradock-Henry (2012) has investigated farm-level vulnerability to climate change in the Eastern Bay of Plenty, New Zealand, in the context of multiple stressors. He notes there are few examples of research incorporating an assessment of the multiple climatic and non-climatic stressors to which agricultural producers are exposed. Using a mixed-methods approach, including semi-structured interviews and temporal analogues, a conceptual framework of farm-level vulnerability was developed and applied. It shows that pastoral farmers and kiwifruit growers are exposed/sensitive to a range of climatic and non-climatic conditions that affect production, yields and farm income and returns. Producers had developed a range of short- and long-term adaptive strategies in order to better manage climatic conditions.

Cradock-Henry (2012) includes a discussion of the significance of market and financial factors amongst other multiple stressors on farmers, including the role of commodity prices and foreign exchange, input costs, and market access. It also discusses adaptive strategies to market and financial factors including control of spending, forward contracts, monitoring input costs, and diversification and ‘pluriactivity’ (off-farm employment).

In Australia research on the potential for adaptation by the primary production sector and dependent communities has mainly concentrated on the biophysical aspects and impact modelling (Pearson et al. 2008; Nelson et al. 2010), past cross-sectional research work by Heyhoe et al. (2007), and on specific primary production sectors, such as wine, grains, and livestock (Stokes & Howden 2010).

From an economic perspective Kingwell (2006) concluded that Australian broad-acre (large-scale cropping) farms have been characterised as having high levels of equity, diversified on-farm enterprises and off-farm investments, and with geo-spatial diversification amongst larger farms – factors that equip them to cope with the financial impacts of climate variability.

Pearson et al. (2011), reviewing the state of research on agricultural vulnerability to climate change, concludes that current understanding of agricultural vulnerability uses the outcome vulnerability conceptual framework, which is linear and dependent on the biophysical models that have been developed. Whilst priorities for biophysical modelling research were

identified, there is little known on the contextual vulnerability of the Australian agricultural sector, and strategic investment into contextual vulnerability frameworks is necessary.

Although primary production is considered vulnerable, especially within some specific sectors and/or regions, there is generally considered to be a high adaptive capacity amongst primary producers (Hennessy et al. 2007; Nelson et al. 2007).

Agricultural actions regarding climate change adaptation fall into four categories: technological developments; government programmes and insurance; farm production practices (e.g. crop timing/mixes); and farm financial management practices. However, these categories are interrelated; for example, altering production practices changes input cost.

Milne et al. (2008), using a qualitative case-study approach in Victoria, identified farm-level risk management strategies for climate change adaptation. They identified these as tactical (short term) or strategic and grouped them between production level and business level. Production-level strategic strategies included growing the farm size and on-farm enterprise diversification, as well as water efficiency measures, minimal till methods, etc. Business-level tactical strategies included reduced drawings and capital spending and Farm Management Deposits (FMDs) (discussed in Section 8.2.3). Whilst strategic-level strategies included increased efficiency, off-farm diversification and industry exit (Milne et al. 2008).

An extensive, multi-phased assessment of current research, key stakeholders, primary producers and urban dwellers conducted in Australia by Donnelly (2010) identifies determinants of adaptation to and mitigation of the impacts of climate change and drought. The key financial barriers and motivators for primary producers were:

- Barrier: more than two-thirds claim they can't afford to adapt or undertake mitigation.
- Barrier: younger producers are struggling with the costs of succession and capital costs and are less likely to be in a position to have the capacity for adaptation.
- Barrier: older producers have greater capacity and appear to be open to initiatives for adaptation, but at some point age and lack of family succession make investing in the long-term future difficult to justify.
- Motivators: for change to occur it must pay its way.
- Motivators: initiatives that 'demonstrate' improved productivity and/or financial return attract uptake.

Hogan et al. (2011), in a study of 4000 Australian farmers, discuss the financial struggles that Australian farmers currently face in the short term, which go beyond the longer terms trends of climate change. In measuring adaptive capacity, they found that identifiable personal pressures to adapt to climate change include the presence of sufficient financial resources to cover the costs of on-farm adaptation, as well as access to information and support services.

Whilst this report is mainly concerned with attitudes and/or the decision-making process of farmers in response to climate change, it does mention that the financial viability of adaptation is of high concern for farmers in this process. However, this process is set within a larger social framework wherein questions concerning farmers' financial capacity to adapt to climate change are set against a broader context relating to farmer well-being and aspirations, and may not be as specific as is required in determining farm-level financial adaptive capacity.

Given the limited amount of research available in Australia and New Zealand, some selected overseas literature on farm-level adaptation was also reviewed with a focus on farm-level economic or financial adaptation.

Smit and Skinner (2002) identify a range of adaptation options for Canadian agriculture organised under the headings Technological Developments, Government Programmes and Insurance, Farm Production Practices and Farm Financial Management. Under the latter category they identify crop insurance, crop futures and options, income stabilisation programmes and diversifying household income.

Reidsma et al. (2010) undertook a quantitative study of the adaptation of European Union crop farmers to prevailing climatic conditions, climate change and climate variability over a decade. They note that most studies that addressed the vulnerability of agriculture to climate change have focused on potential impacts without considering adaptation. When adaptation strategies are considered, socio-economic conditions and farm management are often ignored, but these strongly influence current farm performance and are likely to also influence adaptation to future changes.

For the purpose of this research the significant conclusion was that actual impacts of climate change and variability were largely dependent on the following farm characteristics: the intensity of fertiliser use and pest control; economic size and land use, which influence management and adaptation. However, the actual impacts varied by region and could not be generalised, apart from economic size.

Also considering economic size Antle and Capalbo (2010) suggest that in the United States farm structure and income are significant for the climate resilience of farm households. Smaller farms often produce a more diverse mix of crops and livestock, and also depend to a large degree on off-farm income. Larger farms tend to be more specialised and thus more vulnerable to climate change, but are stronger financially, have greater wealth, and receive a larger share of their income from government subsidies. Larger farms, whilst specialised, are also more likely to use market-based risk management tools and to sell into national and international markets that are less vulnerable to local climate variation.

They go on to identify financial vulnerability of farms as another relevant consideration that has largely been ignored by the climate change adaptation literature. They suggest financial vulnerability to be a function of production income, debt structure, off-farm income and the use of financial-risk-management tools such as futures markets, crop insurance, and agricultural subsidies. They note that in the past, US farms faced periodic financial crises when adverse climatic or economic conditions occurred, because of high debt-to-asset ratios and imperfect capital markets, but conclude this is less true for modern commercial US farms, which are mostly financially sound. State average debt-to-equity ratios range from 5% to 20%, and farm failure rates are far lower than non-farm rates. However, family farms tend to have a larger share of total wealth invested in the farm business, potentially increasing vulnerability.

6.4 Farm risk management

Research into climate change adaptation in the agricultural sector has been described as being just one aspect of farm risk management (Howden et al. 2007). The classical five sources of risk in agriculture (Harwood et al. 1999) are:

- Production (or Yield) Risk (PR): The risk of events such as weather events, pest and diseases disrupting the normal patterns of production. Technology plays a role in mitigating (e.g. new, hardy crops) or, if poorly implemented, causing production risks
- Market (or Price) Risk (MR): The risk of changes of the prices of outputs or inputs that occur after a commitment to produce has been made, e.g. changes in global dairy prices
- Institutional (or Regulatory) Risk (IR): The risk of changes in government regulation (e.g. changes in environmental regulation or animal welfare regulations)
- Human (or Personal) Risk (HR): The risk of the death or incapacity of the farmer
- Financial Risk (FR): The risk resulting from the structure of farm capital – most commonly due to the balance of owner equity and debt and the resultant impact of interest rates on overall farm returns. However, even a 100%-owned farm faces financial risks in the form of potential reductions in the owner's net worth. It also includes liquidity risk, i.e. the ability to pay expenses as they fall due

In the literature the first four sources of risk are frequently grouped as 'business risk', with 'financial risk' seen as separate because it is a result of business decisions. Sometimes 'human risk' is incorporated into 'production risk'. Climate change, in the form of greater climate variability and adverse weather events, is most likely to affect farmers through weather effects, which would be 'production risk', but this has a flow-on effect, especially in terms of 'financial risks'. Climate change may also affect 'market risk' through impacting (either positively or negatively) on commodity prices or on input costs.

The OECD (2009) also distinguishes between the risk sources in terms of whether their effect is at the individual level (e.g. hail, health), the local level (e.g. rainfall, land prices) or the regional or national level (e.g. drought, interest rates, global commodity prices). Their conclusion is that government involvement in farm risk should be limited to the last category given that mechanisms exist for normal and marketable risk.

Previous surveys of the relative importance of risks to farmers in New Zealand include Martin (1996) and, for the dairy industry, Pinochet-Chateau et al. (2005a, b). The latter study reviewed how the two studies reflected changes in dairy farmers' attitudes to sources of risk between 1992 and 2004, and found that:

- Changes to product prices (MR) remained the highest-ranked risk.
- Weather or rainfall (PR) fell from 2nd in 1992 to 6th in 2004.
- The global economy/world outlooks (MR) were 3rd and 2nd, respectively.
- Input prices (MR) climbed from 5th in 1992 to 3rd in 2004.
- Accidents and health risks (HR) rose from 7th to 4th in 2004.
- Interest rates (FR) climbed from 8th to 5th ranking by 2004.

Compared to the definition given above, the only additional source of 'financial risk' identified was changes in land prices (or rental cost).

Dotterer (2010) surveyed 50 dairy farmers on their attitudes to risk, comparing seasonal risks and strategic risk (5–10 years out). Variation in risk attitudes is influenced by 'inside the farm gate' characteristics (i.e. farm structures and business life cycle stage) and 'outside the farm gate' characteristics (i.e. geographical location, market structure and macro-economic factors). Dotterer also notes that perceptions of risks change over time as conditions change.

The threats identified in the survey, in order of importance, were:

- Seasonal: production prices (MR), weather conditions (PR) and input costs (MR)
- 5–10-year time frame: local body laws and regulations (IR), input costs (MR), unexpected weather conditions (PR) and government laws and policies (IR)

Financial risks associated with interest rates, credit availability and land prices had middle to low ranking as threats; however, the survey participants had higher debt levels than national averages, potentially indicating a greater level of comfort with financial risk.

Participants noted that previous surveys focused only on the negative aspects of uncertainty and that dairy farmers saw that uncertainty also allows opportunities. Interestingly, amongst the seasonal sources of variability with the highest potential to create opportunity, interest rates were third, after farmer skills and knowledge and global demand, although they were much lower for the 5–10-year time frame.

With respect to risk management strategies and how farmers rank them, Melyukhina (2011), again drawing on Martin (1996) and Pinochet-Chateau et al. (2005a, b), provides a comprehensive review of past research in New Zealand. The findings of the 2004 survey of strategies is summarised in Figure 5.

As can be seen from Figure 5, besides two main production strategies (feed reserves and spraying and drenching) and the ‘overall response strategies’, which are vague at best, the majority of dairy farmer strategies are grouped as ‘financial responses’, which are largely around debt and cash-flow management. Within the ‘financial response’ group the reduction in focus on debt being kept low and an increase in a focus on debt management (i.e. the ability to manage higher levels of gearing) are notable for the discussion of debt and banks in Section 7.4. A notable inclusion is the role of managing capital spending, which reflects a farmer’s ability to defer capital expenditure for the maintenance or running of a farm as a short-term response to difficult conditions.

Similarly the low rankings of forward contracting and futures are discussed in Section 7.3.

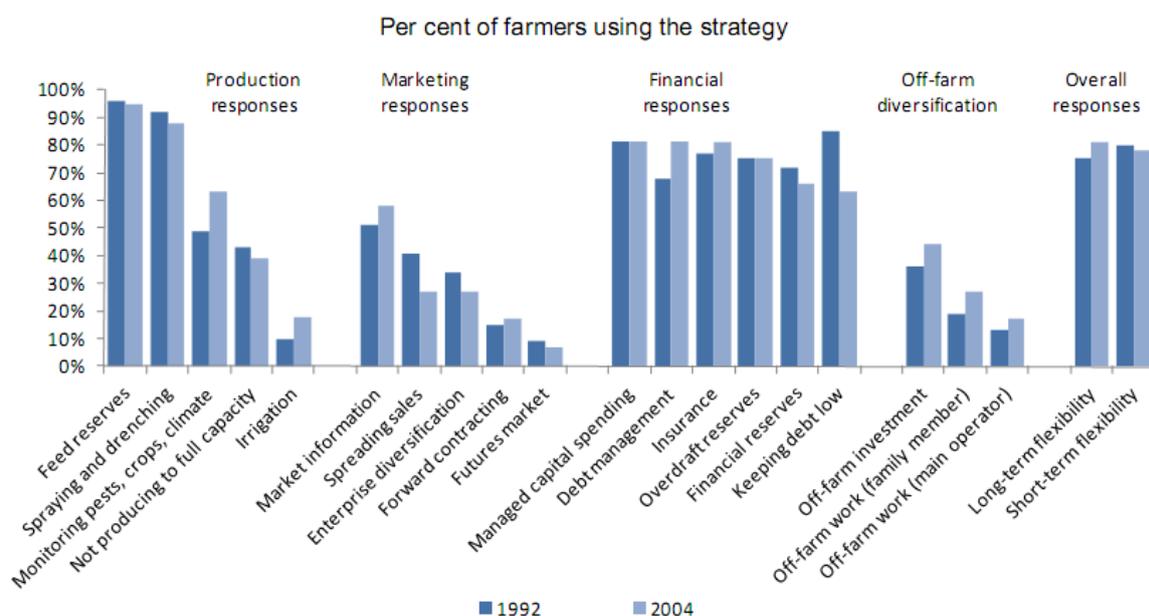


Figure 5: Use of Risk Management Strategies by Dairy Farmers (Melyukhina 2011).

The off-farm diversification grouping reflects research and policy interest in off-farm income and investments (Parminter 1997; Taylor et al. 2003; Narrea & Webster 2008). However, as can be seen from the survey results, such strategies remain marginal to dairy farmers at least.

However, there are some groupings within this analysis that are questionable, for example insurance is added to financial responses, whereas in the literature it is usually grouped with market responses (e.g. contracting out risk thorough forward contracting). Similarly, in Melyukhina (2011) enterprise diversification (e.g. spreading on-farm activities between mixed crops or mixed crops and livestock) is grouped with the other diversification strategies rather than market response. Lastly, all of the off-farm diversification strategies are ‘financial’ in their nature and impact, and in the case of off-farm investment, interacts with financial responses such as debt levels and debt management.

A United States resource for farmers (Sharp 1999) provides a summary (Table 1) focused on the elements of financial risk that are considered to make a farm resilient in a financial sense.

Whilst not focused on climate change/drought, Sharp (1999) is instructive with regard to the accepted US farm industry norms around the key farm financial ratios of liquidity, solvency (reflecting the definition of financial risk above), but also profitability and financial efficiency. Sharp acknowledges they differ by farm sector and production system.

Table 1: Farm Financial Risk Measures (Sharp 1999)

Measure	Ratio	Risky	Resilient
Liquidity	Current ratio	< 1	> 1.5
Profitability	Return on Equity	< 5%	> 10%
	Return on Assets	< 3%	> 8%
Solvency	Debt to Assets	> 50%	< 35%
	Equity to Assets	< 50%	> 60%
Financial Efficiency	Operating Expense	> 80%	< 65%
	Asset Turnover	< 10%	> 20%

Instead of attempting to match risk management strategies to the source of risk, the OECD (2009) groups strategies in terms of ex ante risk reduction (i.e. strategies to reduce the probability of an event occurring) and risk mitigation strategies (i.e. to reduce the potential impact), as well as ex post risk-coping strategies (i.e. to reduce the impact once the event has occurred). They then group these by the source of the strategy as in Figure 6.

	Farm/household/community	Market	Government
Risk Reduction	Technological choice	Training on risk management	Macroeconomic policies Disaster prevention (flood control...) Prevention of animal diseases
Risk Mitigation	Diversification in production Crop sharing	Futures and options Insurance Vertical Integration Production/marketing Contracts Spread sales Diversified financial investment Off-farm work	Tax system income smoothing Counter-cyclical programs Border and other measures in the case of contagious disease outbreak
Risk Coping	Borrowing from neighbours/family Intra-community charity	Selling financial assets Saving/borrowing from banks Off-farm income	Disaster relief Social assistance All agricultural support programs

Figure 6: Menu of Possible Risk Management Instruments and Strategies (OECD 2009).

This identification of ex ante and ex post risk strategies is useful for the following discussion on financial sensitivity and financial adaptive capacity.

Whilst the previous discussion has covered the sources of farm risk (of which financial risk is just one) and the risk management strategies available (of which a range of strategies seem predominantly financial in nature), the impact of these risks or opportunities is mainly viewed by farmers in terms of its financial impact on their farm business. Additionally the identification of risk sources and risk management strategies tends to ignore any potential for correlation between risk sources.

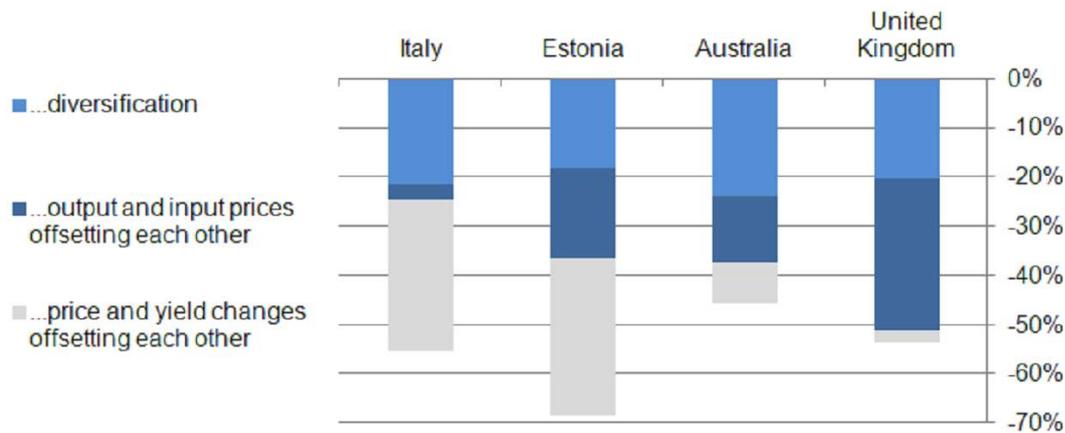
The OECD has had a work stream on agricultural risk running for a number of years, but, in relation to agricultural adaptation to climate change, the focus of the work has been on the extent to which agricultural income variability will be affected, not the structural changes that may result from climate change (OECD 2009).

Kimura et al. (2010) focused on agricultural risk management strategies and farm income variance. They discuss three mechanisms that reduce agriculture income variance, being:

- **Diversification:** Whether on-farm (enterprise) or off-farm (e.g. different locations, vertical integration), diversification allows variations in returns between farm products to be exploited. Portfolio Theory states that a combination of products whose returns are not perfectly or negatively correlated reduces the variability of total income.
- **Positive co-variance of production prices and input costs:** When the price of an input (e.g. fertiliser) goes down at the same time as product prices (e.g. milk pay-out) go down, the impact on farm net returns is reduced.
- **Negative co-variance of production prices and yields:** When yields go down (e.g. in drought), scarcity of product can cause product prices to increase.

The modelling used databases for mixed farms and the results for diversification were mainly from cropping farms. The results suggested significant reduction in income variances from the above mechanisms. Australia was included in this work (summarised in Figure 7).

Farm income variance is reduced by...



Decomposition of the variance of income of arable crop farms. The reference level of risk is the calculated variance in the counterfactual case of zero correlations, co-variances and diversification. Based on time series of individual farmers.

Figure 7: Reductions in Farm Income Variance (OECD 2011).

For New Zealand, Melyukhina (2011), using modelling based on livestock data, predicted that income variance can be reduced by almost 25% by output diversification and 40% due to positive co-variance between production prices and input costs. They could not model for the covariance of price and yields and, given the different industry basis, the results are not directly comparable with Kimura et al. (2010). Off-farm income appeared to be only weakly negatively correlated with farm revenue, implying that farmers don't seek off-farm employment when revenues fall, although they noted that data on off-farm income may be incomplete.

Essentially, the OECD work concludes that a significant element of variance in agricultural incomes can be managed by market mechanisms. However, they did also note wide fluctuations between returns by New Zealand farms, which support the importance of farm-level risk management strategies.

The focus on diversification may seem against the trends in New Zealand agriculture, particularly for the dairy industry, which traditionally has not used enterprise or off-farm employment diversification as a risk management strategy. This appears to be due to a mixture of the regularity of effort required for dairy milking compared with cropping, as well as an industry focus on increasing efficiency and returns to scale. However, OECD (2011) states:

Diversification is ... not an ... outdated risk management strategy. Diversifying on and off farm is likely to be an efficient risk management strategy, particularly if farmers are well informed about all their possible choices. Of course, farmers need to trade off the gains in terms of reduced variability of returns with losses from reduced scale economies.

The risk management framework described above with its categorisation of Financial Risk as a secondary or resultant aspect of the various Business Risks, seems representative of a time when there was less of a focus by farmers on cash flow, returns to the owners' equity, and

leverage as a core farm strategy. For example, are decisions about growing a dairy farm production-decisions or economic-decisions driven by the search for economies of scale so as to optimally spread fixed costs across a greater productive base? Is enterprise diversification a production strategy or is it driven by a desire to reduce the risks to farm income of dependence on one commodity price or to control the price of inputs?

A further consideration of the use of risk management in the conceptual framework for this project is that the finance sector uses structured risk assessment and management approaches in everyday business and has applied these to climate adaptation in some instances (UNEP 2006). Therefore a conceptual framework based around risk-management concepts should be more readily understandable to the finance industry.

6.5 Farm-level financial adaptation to climate change

Farmers increasingly regard their farms as a financial system and focus on managing cash flows, rather than just on the physical production processes (attributed to Federated Farmers) (Melyukhina 2011)

The previous sections have reviewed the broad climate-change adaptation, agricultural adaptation and risk management literature as well as some insights from institutional theory.

In most of the adaptation literature there are warnings that adaptive actions should not be considered in isolation because of the multiple interrelationships among the elements of adaptation albeit at the level of a socio-economic system such as a country, region or at an organisational level (Howden et al. 2007). This is to avoid too narrow a focus on particular levers of adaptation, which may cause maladaptation in other parts of the system.

At the farm level, the farm management literature generally recognises the interdependence between the various production/technological, economic/financial, human/social and ecological elements of farming (Shadbolt & Gardner 2005).

There has been a successful drive by New Zealand farmers to become more productive, efficient and business focused over the years, something for which they are globally renowned. In the last 10–15 years, there has also been an increasing focus on the farmer within the context of concepts like net worth, wealth generation and the role of farmers as investors in agribusiness (Gardner et al. 2005; Shadbolt 2006). So whilst the Federated Farmers quote above may be seen as a retrograde narrowing of focus back to solely financial or economic considerations, it also reflects the farmer as an increasingly sophisticated financial manager.

Moreover, the scope of this project is on farm-level financial adaptation to climate change. We therefore acknowledge that farms are complex systems sitting within socio-economic systems in which financial/economic considerations are not the sole source of decision making and focus on identifying a set of strategies, drawing from the risk management and economic approaches discussed previously, that are most ‘financially driven’ in nature.

A review by Lincoln University found virtually no literature that makes connections between farm financial aspects and drought, climate change or financial resilience. We discuss below a small number of studies that specifically draw connections between financial strategies, drought and climate change.

In 1998, MAF reviewed a number of studies on recovery from drought in order to establish the key factors that would contribute to farm recovery following drought. Recommendations dealt primarily with the necessity for planning and rapid response, but several financial strategies were also identified. The recommendations were repeated in MAF (2008); they include:

- Focus on profitability.
- Establish a financial buffer of 10–20% of Gross Farm Income (GFI) once debt servicing has been reduced to below 20% of GFI. Remove this buffer from working capital to enforce better cash-flow management.
- Determine whether the current structure of the business is the most appropriate to minimise tax, maximise flexibility, and access assistance available for the farm family.
- Recognise the separation between property investment (the capital business), food and fibre production (the operating business), and lifestyle, and weigh up the returns to each activity separately when making long-term strategic decisions.

Pinochet-Chateau et al. (2005a, b) note that whilst much research has focused on the importance of physical parameters on the profitability of New Zealand pastoral systems, there has not been much focus on the financial perspective. They consider that as farms get bigger, identification of the drivers of economic viability becomes increasingly important.

Utilising Return on Equity (ROE) as a measure of risk in pastoral systems Pinochet-Chateau and colleagues analysed 5 years' worth of data on owner-operated dairy farms. They note that high positive ratios of ROE are normally associated with profitable farm businesses, but may also indicate an undercapitalised or highly leveraged farm business; on the other hand a low positive ROE, which normally indicates an unprofitable farm business, could also indicate a more conservative high-equity farm business.

The objective of the research was to identify the main variables affecting risk, using ROE as a proxy, and the impact of these variables on risk at the farm level. They found that the debt-to-asset ratio (DTAR), operating profit margin and asset turnover ratio were all significantly negatively correlated with risk (i.e. as they increased as risk decreased).

Whilst it makes intuitive sense that higher operating profits and asset turnover imply less risk, the DTAR reflects the leverage of the farm and therefore highly leveraged farms are traditionally considered as high risk. Pinochet-Chateau et al. (2005a) see this result as consistent with the theory that when non-equity capital is used efficiently and return on assets is greater than the interest rate, highly leveraged farms can increase their ROEs sharply and would be able to increase their rates of business growth.

The debt servicing capacity (DSC) was positively correlated with risk and significant for the 5-year period; it was the most dominant variable in determining risk. The DSC measures the ability of a farm to service its debt repayments³. As the level of debt influences profitability

³ It is commonly expressed as Earnings before Interest, Taxes, Depreciation or Amortization' divided by the loan payments due (both principal and interest).

through interest costs, it was expected that farms with lower risk would have a lower DSC. The size/area of the farms (scale) was positively correlated to risk, but not consistently so.

Pinochet-Chateau et al. (2005a) concluded that improving economic efficiency and reducing leverage (both the amount borrowed and interest rates) are key issues to managing risk under New Zealand conditions. This is notable as under the farm-risk-management approaches previously discussed greater farm efficiency is not normally identified as a financial risk strategy.

Shadbolt et al. (2011) discuss how New Zealand dairy farmers are moving into an increasingly turbulent business environment (in terms of milk prices, climate change, environmental and animal welfare regulations, etc.), which poses risks to their survival. They take a resilience approach drawing on literature on ecosystems, organisational management and farm management and note that limited research has been undertaken about resilience, particularly in relation to New Zealand dairy farmers.

They also used a quantitative approach to measure the resilience of a sample of dairy farmers, using surrogates for three aspects of resilience: latitude, resistance, and precariousness.

Drawing on Walker et al. (2004) they identify that 'latitude' refers to the amount of stretch a system can allow without losing the ability to return to its original form; the farm financial surrogate they use for this is liquidity. 'Resistance' is the difficulty or ease required to create a unit change in the system; the surrogate is financial efficiency. Lastly 'precariousness' describes how close a system is to a threshold or tipping point and the financial surrogate chosen was solvency ratios.

Drawing on the likes of Gunderson & Holling (2001), Milestad & Darnhofer (2003) and Darnhofer et al. (2008) they identify a continuum of the elements of resilience moving from buffer capacity to adaptive capacity and transformability (Figure 8).

Buffer capacity is defined as the magnitude of shock a system can absorb and remain within a given state (Carpenter et al. 2001); in this interpretation it is close to the concept of sensitivity in the vulnerability literature. They note that adaptive capacity is identified by the farm management literature as a key attribute of farming systems (Darnhofer et al. 2008). Whilst buffer capacity is seen as the farm's ability to cope with the normal dynamics of the farm, adaptive capacity is a learning aspect of system behaviour that enables the farm to develop new strategies to deal with a change in state.

However, they note that adaptive capacity works up to a point beyond which transformation (or exit) becomes the only option. Transformability is 'the capacity to create fundamentally new systems when ecological, economic or social conditions make the current existing system untenable' (Walker et al. 2004). Interestingly, Shadbolt et al. (2011) cite a conversion from a sheep to dairy farm as an example of transformation. However, in the context of climate change more radical transformations may include the conversion of pastoral land to forestry for carbon credits or even to wind farming.

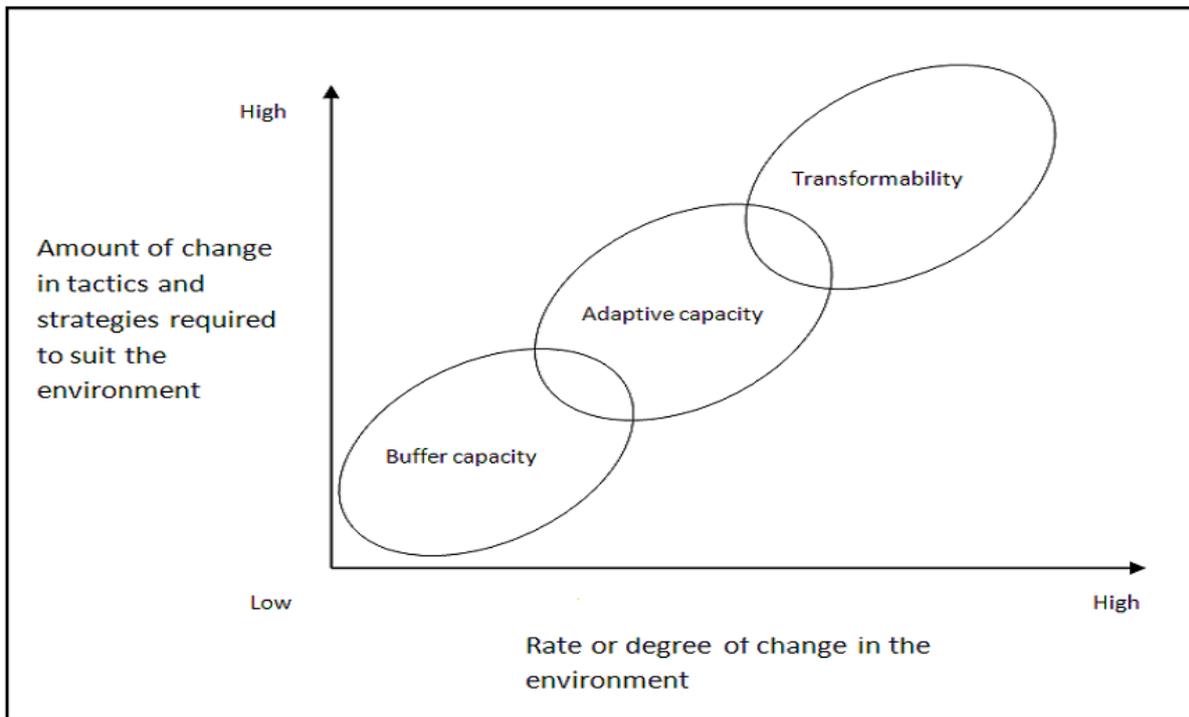


Figure 8: Illustration of the Continuum of Resilience (Shadbolt et al. 2011).

They studied two periods, one of positive shocks due to high milk prices in 2006–07 to 2007–08 and one negative-shock period due to low milk prices and higher input costs in 2007–08 to 2008–09. Using positive change in both ROE (efficiency or resistance) and discretionary cash per hectare (liquidity or latitude) as proxies for those farms able to best capture the opportunity of high dairy prices during the positive shocks, Shadbolt et al. (2011) concluded that for the farms studied:

- Resilient farms (the top quarter) generated the most net cash income and discretionary cash generated, through higher output levels rather than cost control (latitude).
- Resilient farms were larger in terms of area and more intense as measured by stocking rates, kg MS per cow, etc.
- Resilient farms had the highest operating profit margin and higher asset turnover ratios (efficiency/resistance)
- The resilient farms had significantly higher debt-to-asset ratios, implying they were less solvent (solvency/precariousness)

During negative shocks, more resilient farms were those that were able to minimise losses to buffer the business. Therefore, farms that buffered the shock of low milk price and high input costs were those that had the least reduction in ROE and the highest positive change in discretionary cash per hectare. They concluded the following (Shadbolt et al. 2011):

- Resilient farms had higher ROE but were less intense (lower stocking rates, lower kg MS per hectare) and smaller in area.
- Farm working expenses per kg MS were lower for resilient farms (i.e. they had a cost-control focus).
- In terms of liquidity/latitude, resilient farms had similar net cash income per hectare, but higher levels of discretionary cash per hectare (cash available after interest and tax for

drawings, capital purchases and debt repayments). They also linked resilience to the holding of cash reserves and matching debt repayments to cash availability.

- Resilient farms had a lower debt-to-asset ratio and higher debt servicing capacity. In the downside period, high leverage resulted in negative equity growth consistent with the principle of increasing risk.

In summary, efficiency measures and liquidity measures were a good proxy for resilience in both study groups (i.e. in both positive and negative shocks). However, during negative shocks, low solvency ratios (debt-to-asset ratios and debt servicing capacity) and smaller size and less intensity were predictors of resilience. Conversely, during positive shocks high solvency ratios, larger size and greater intensity were predictors of resilience.

In relation to the following discussion of Australian and New Zealand attitudes to debt, it is significant to note that farms with characteristics more like Australian dairy farms (low intensity, low solvency, higher liquidity) are more resilient under the negative shock model.

Finally, Lawes and Kingwell (2012), investigating the effect of drought on farmers, studied the economic performance of 123 cropping farms in a rain-fed agricultural region of Australia from 2004 to 2009, a period that included severe droughts in 2006 and 2007. Similarly to the last study they focused on the financial indicators of business equity (the inverse of debt-to-asset ratio), operating profit per hectare, return on capital, and the debt-to-income ratio (an alternative measurement of ability to repay debt).

Severe drought dramatically reduces operating profit through reductions in yield, despite cost-control measures by farmers. These reductions in crop revenue worsen debt-to-income ratios, reduce operating profit and lead to increased borrowings, reducing equity.

They found that over the study period the equity position of just over 60% of farms declined, although 55% of these had more than 80% equity in the business initially and were able to absorb a short-term decline in equity caused by the drought. Interestingly, 9% of farms had levels of equity below 80% at the start of the investigation, but actually improved their equity position by the end of the study. This isn't investigated further by Lawes and Kingwell (2012) who simply hypothesise that the farmers (who actually had the lowest levels of equity but were able to enhance their equity position) 'had no choice but to improve their financial position'.

Positive links were found between yield and the financial indicators, and farms that were able to capitalise on favourable conditions in other years were better placed to enhance or recover their financial position. Farms that cropped a higher proportion of their farm area were at an advantage. The percentage of area cropped had a small but significant effect on the debt-to-income ratio, the return on capital and operating profit. Farm diversity also favourably lessened the debt-to-income ratio, but farm size did not influence the outcome of any financial indicator, implying that average farm sizes are close to the plateau for economies of scale.

In summary, the findings of Lawes and Kingwell (2012) are similar to the findings of Shadbolt et al. (2011) in relation to negative shocks. Farms that remained resilient despite the serious droughts were those that cropped more than 50% of their farm area, were prudent in their expenditure, maintained some enterprise diversity, and often generated wheat yields in each year that were near the yield potential for that year.

Having summarised some of the more recent literature on farm financial management relevant to adaptive capacity and resilience, and combining it with the farm-level risk management strategies that seem most driven by financial considerations identified in Section 6.4 on farm-level risk management, we present in Figure 9 a summary representation of the financial strategies adopted by farmers and most commonly identified in the literature review. Even if, as discussed in Shadbolt et al. (2011), those strategies can differ in their impact on adaptability dependent on whether the exposure of the farming system is to a negative shock or a positive opportunity.

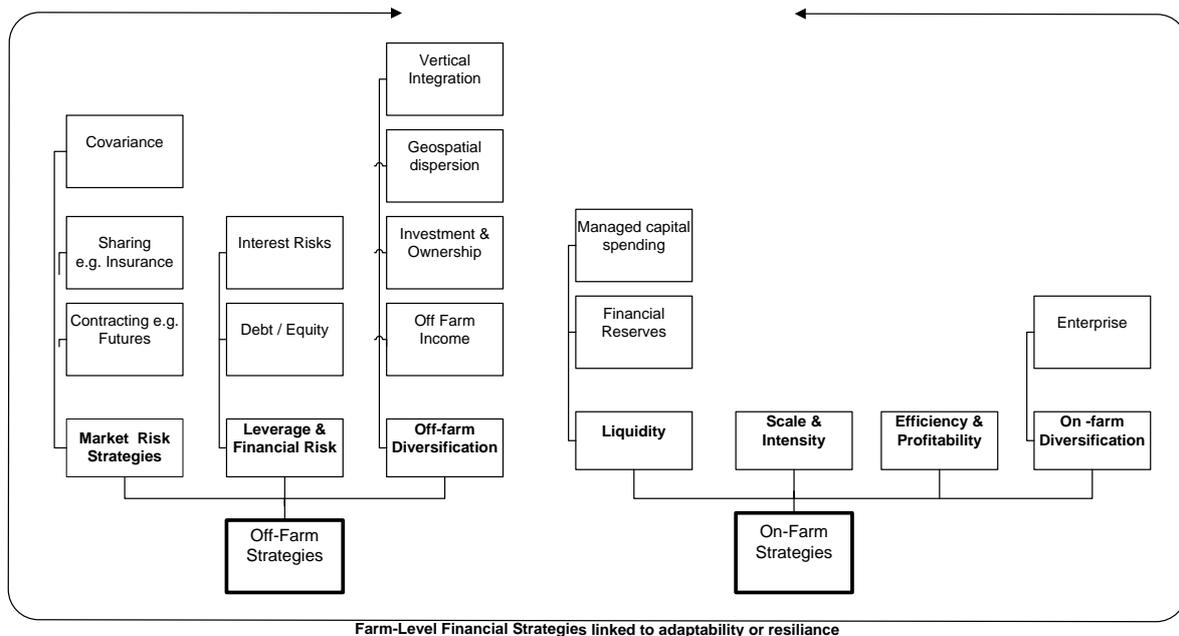


Figure 9: Farm-level Financial Strategies Linked to Adaptability or Resilience.

6.6 Conceptual framework

The development of a clear, end-user-endorsed conceptual framework is necessary for understanding and communicating the actions and inactions of farmers and the finance industry with respect to adaptive financial strategies for climate variability/change. It enables the researchers to carry out semi-structured interviews informed by a generally accepted model of the factors involved and the interactions between them.

We developed the conceptual framework through:

- Reviewing existing Australian research and discussion of farm business models, financial strategies and the role of the financial sector in both academic and trade literature
- Engaging with relevant Australian researchers
- Working with Lincoln University AERU, MAF Monitoring and our research partners to confirm our understanding of existing New Zealand farm financial strategies
- Interviewing our New Zealand bank and insurance partners to understand their current role in farm adaptation to climate variability.

Having discussed the context and the literature in the previous sections we set out in Figure 10 a proposed conceptual framework underlying farm-level financial strategies for adaptation to climate variability and climate change.

The framework seeks to build on the widely accepted IPCC definition of vulnerability, whilst acknowledging that vulnerability can be a negative framing that can preclude a sense of the opportunities that may accrue to those farmers with high adaptive capacity.

Sensitivity (or buffer capacity) is linked to the immediate impact on a system and in the literature is conflated with robustness, coping ranges and buffering capacity. We suggest that it is the tactical or short-term response to an exposure that relies on prior strategies undertaken by the farmer to optimise off-farm strategies (market risks, leverage & financial risk, off-farm diversification of income and assets) or on-farm strategies (liquidity, scale and intensity efficiency and profitability and on-farm diversification).

Adaptive capacity (or response) is viewed as the ability to respond to the exposure with the intention of changing the farming system in some way. It could be a strategic or longer term response designed to move the farming system to a new form of equilibrium within a farming environment or even, at the extreme, to transform it out of the current farming system whilst remaining an economic agent.

Strategies can have both positive and negative impacts on resilience depending on the nature of the exposure due to climate change. For example, in the case of a significant negative shock, high levels of leverage or scale may be detrimental to resilience/adaptability. However, in the case of a positive shock, leverage and scale may enable the farmer to seize opportunities.

Farm-level financial strategies are only part of overall farm management undertaken by the farmer, which is a combination of technological/production, economic/financial or human and social decisions and factors within the local eco-biological context within which the farm operates.

The farm itself sits within an institutional field loosely called the ‘agribusiness sector’, which is made up of its competitors, cooperatives/processors, suppliers, the rural community and its financiers and insurers. In this project our focus is on financiers and insurers as part of the agribusiness sector.

The agribusiness sector is itself influenced by the broader and longer-term changes that emerge from changes in societal values, economic structures, government regulation and major technology advancements. Whilst we acknowledge these influences, they are not within the scope of this project.

Following Adger et al. (2007) we view resilience as the combination of the tactical sensitivity of the system and its strategic adaptive capacity.

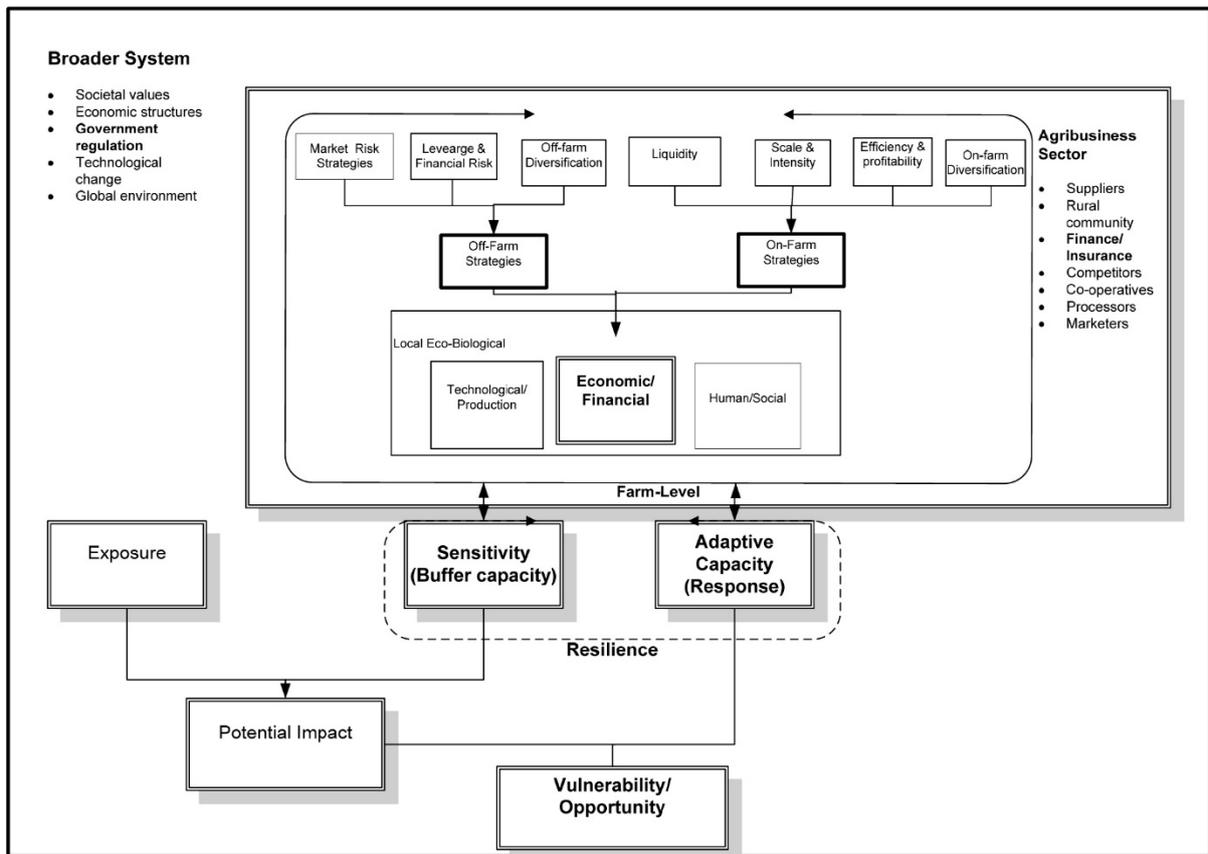


Figure 10: Conceptual Framework for Farm-level Adaptation to Climate Variability and Change (bolded terms were within the scope of this project).

7 Role of Financial Institutions

7.1 Financial institutions and climate adaptation

The UNEP – Finance Initiative (UNEP-FI; <http://www.unepfi.org/>) is a global partnership between the United Nations Environment Programme and the finance industry (banking, insurance and fund managers). As of January 2012, over 200 of the largest global financial institutions were signatories to the UNEP FI Statement of Commitment to Sustainable Development; 17 Australian and New Zealand banks and insurance companies are signatories including ANZ, Commonwealth Bank, NAB, Westpac and IAG.

The UNEP-FI has acknowledged that aside from their commitment, members have clear commercial incentives to support customers' adaptation to climate change (UNEP 2006). Notably the publication sets out the risks and opportunities for each subsector based on 'the classical six-point risk analysis' that banks use to review proposals for credit, including market, operational, reputational, counterparty, political/legal, and business risk. The Climate Change Working Group of UNEP-FI is developing tools and training materials for financial institutions around the risk and opportunities that climate change presents for the industry.

The UNEP-FI is also currently consulting on a set of Principles for Sustainable Insurance, a set of voluntary and aspirational global principles – including possible actions – to address environmental social and governance (ESG) issues in the insurance business. Those involved in the consultation process visited New Zealand in August 2011 and were hosted by Sovereign Insurance. However the current focus appears to be on operational sustainability issues within the industry rather than a client or product focus that would extend to rural insurance (Neilson 2011).

The IPCC has also discussed the role of financial institutions in climate change adaptation. Vellinga et al. (2001) provides an overview of the literature on impacts on the insurance industry and adaptation practices up until 2000. In relation to adaptation they note the insurance industry's role in (1) risk spreading (e.g. sharing risk with government or spreading risk through reinsurance) and in (2) risk reduction (e.g. partnering in the development of GIS systems to understand impacts, or weather forecasting). They note that the banking industry was not as well served by the literature at that time, but note the emergence of climate change as an issue within loan risk assessment processes and the ability of banks to rapidly develop new products and services in response to the business environment. Products identified in relation to adaptation included weather derivatives and catastrophe bonds.

Adger et al. (2007) summarily discusses that the insurance sector – especially property, health and crop insurance – can efficiently spread risks and reduce the financial impacts of extreme events and that, to date, most adaptation practices have been observed in the insurance sector. As a result of climate change, demand for insurance products is expected to increase, while conversely climate change impacts could also reduce insurability and threaten the viability of insurance schemes.

In summary, the potential for involvement of Australian and New Zealand insurance and banks in agricultural climate change adaptation is reinforced through companies' membership of global bodies.

7.2 Insurance

7.2.1 New Zealand Rural Insurance

A succinct overview of the New Zealand rural insurance market is provided in Melyukhina (2011); the following section highlights key points and developments only.

In New Zealand the three largest underwriting companies providing rural insurance are the Farmers Mutual Group (FMG), NZI and Vero. FMG is a New Zealand mutual fund (owned by its policy holders) specialising in rural insurance, whilst NZI (part of Insurance Australia Group (IAG)) and Vero offer a range of insurance products and have Australian parent companies. Other rural insurers include Agricola, Allianz, AMI (a mutual insurer that was currently in the process of being bought by IAG), Tower and Zurich.

Appendix 2 sets out a comparison of insurance products available from FMG and NZI; it highlights the commonality of insurance products offered, which include livestock, refrigerated goods, buildings, contents and materials, vehicles and fire. Business interruption products are also commonly available. Various tailored policies also exist for sectors (e.g. horticulture/viticulture, dairy, sheep & beef).

Most banks offer insurance products in partnership with one of the insurers mentioned above. Similarly, rural supply chains PGG Wrightson and RD1 offer specialised rural insurance, but again these are underwritten by the insurers mentioned above. Banks will typically broker mortgage loan insurance, whilst those lending to larger dairy farms are also increasingly requiring 'key man' insurance policies.

No official data exist for total amounts of insurance cover or premiums in the rural sector, or the relative uptake of policies, although the majority is thought to be in farm buildings, vehicles and crops (arable and horticultural) for which hail is the main risk insured against. The Insurance Council of New Zealand maintains a list of natural disasters showing total claims against the industry (ICNZ 2011).

In relation to climate variability and extreme weather events, the above insurance products generally do not cover farmers for the impacts of natural disasters on farm infrastructure (fences, tracks and races, culverts and water supply systems); the impacts of drought and floods on pasture, crop plantings, crop yield or livestock performance; or the impacts of exotic diseases and pests.

Whilst business interruption can be insured for by a farm, it is only normally triggered if there is damage to the farm buildings or machinery, not by damage to the land, or other infrastructure, etc.

There is also no business interruption insurance available for biosecurity events, as insurance companies consider biosecurity events too risky to insure against and impossible to price. This may be an issue in the longer term if climate change affects pests' ability to establish themselves in areas previously not climatically suitable.

Part of the reason for the lack of coverage is due to the lack of demand from farmers when products existed. For example FMG offered flood coverage in 1999, but withdrew it in 2001 due to suffering losses due to lack of demand and purchase of insurance only by those farmers who knew they were at high risk of flooding (commonly known as 'adverse selection').

The dairy industry mainly takes out insurance for farm buildings, machinery and vehicles, but insurance products are also sold around risks to milk supply from refrigeration failure, contamination or failure of pick-up.

Livestock insurance (covering accidental death due to fire, lightning etc.) is only taken up by a minority of farmers due to a perception of high premiums and low risks. However, a new product introduced by FMG in April 2011 covers sheep farmers for livestock loss as a result of a natural disaster or climatic event including flood, storms, snow storms and tornadoes, but excluding drought. The product is claimed to be unique in New Zealand and is initially being trialled with 1000 farmers (FMG 2011).

There are only two sectorial self-funded insurance schemes in existence in New Zealand, wheat and kiwifruit. ZESPRI kiwifruit growers are insured for hail damage under a scheme which is 50:50 grower self-cover and insurer (Allianz) top-up; the cost of insurance is levied through fruit payments. The industry stopped fully self-insuring after the 2009 hail storm damage exceeded the cover that was in place. Frost cover was also previously provided, but was withdrawn as a result of increasing numbers of growers installing their own frost protection systems; however, there are private providers of frost cover (e.g. Agricola).

MAF (2006), reviewing the On-farm Adverse Events Recovery Framework, discussed a potential role of compulsory insurance through either an industry levy or requiring private insurance. Both suggestions were overwhelmingly rejected by submitters on the grounds of inequity between high and low risk farmers; insured farmers not undertaking adequate risk management strategies (moral hazard); and the costs of implementation.

In discussing the potential for the development of new products to help farmers adapt to climate change, our New Zealand insurance research partner highlighted a number of arguments for the lack of new insurance products (J. Marsick, pers. comm. 21 February 2011):

- The maturity of the New Zealand insurance market (i.e. NZI has been in existence for 150 years, State for 100) and the density (similarity) of insurance products mean margins are tight.
- The small population base in New Zealand and its geographic size mean that there are low insurance pools and increased chance of systemic risks (i.e. risks that are correlated with each other – most insurance schemes work on the basis of uncorrelated risks, i.e. an impact on one insured party is offset by ongoing premiums on the rest).
- There are problems in the design and commercial viability of new insurance products for climate impacts due to moral hazard and adverse selection, as mentioned above.
- Most insurance is sold through brokers and there are existing perceptions of underinsurance by brokers.
- The perceived gap in current insurance product is potentially around remediation of land and non-insurable infrastructure following extreme weather events, although in the case of major events this is addressed through the government's Adverse Events framework. However, the development of new insurance products for these assets is not precluded by the Adverse Events framework.
- There is a lack of any perceived demand for land-based products, although the inclusion of agriculture and particularly forestry in the ETS may influence this (e.g. forestry that is generating credits may require additional insurance for fire risks).
- Even if there was a local demand for products, local insurers would need to spread the risk through reinsurance, which would need to come from Europe and following the

Christchurch earthquakes the reinsurance industry appetite for New Zealand based risks is limited.

Despite these concerns, meaning that there was currently a lack of demand and insurance industry appetite for new climate-related insurance products, it was also noted that one of the rural supply chains had initiated discussions with insurers concerning the viability of a weather hedging product. This also aligned with a casual announcement by the NZX that they were in formative discussions around a rainfall futures product (*NZ Herald* 2011).

7.2.2 Australian Rural Insurance

The general insurance sector in Australia is characterised by six companies who write around A\$5 billion worth of premiums between them. In order of size they are QBE Insurance Group, IAG, Suncorp, Allianz Australia Group, Wesfarmers, and Zurich Australia (KPMG 2011).

All of these companies except Allianz are involved directly in rural insurance, although in the case of IAG it is through its subsidiary CGU, which claims to be Australia's largest regional and rural insurer. Allianz operates through multiple brokers. IAG, Suncorp and Wesfarmers are active in climate issues, for example, through sustainability reports (IAG 2009) and submissions on climate change (IAG 2011).

Kimura and Antón (2011) state that most farmers in Australia use crop and livestock insurance, asset (buildings, machinery and vehicles) and third-party-liability insurance. Crop insurance against hail, frost and fire covers around A\$7–10 billion of crops by value and 85% of this value is covered through reinsurance. Frost and hail insurance is available for horticulture, and insurance of assets (including livestock) against fire is widespread. A number of sectorial insurance offerings exist (e.g. viticulture, grains).

Most discussion on new insurance products for climate variability in Australia in the last 10 years has focused on the potential role of multi-peril crop insurance (MPCI). Available in the US, Canada and parts of Europe, this form of insurance aims to insure against a loss of crop yield due to a wide range of natural perils (i.e. of interest for climate change adaptation because it includes drought). In Australia MPCI has been the subject of periodic interest from government, in 1999 (a Federal review), 2001 (Western Australia trials) and most recently Western Australia (DAFWA 2009).

MPCI provides cover for the loss of crop yield. For each crop covered under the policy, the insurer agrees with the grower on projected yield and projected value of the crop. In effect, the MPCI limits downside risk on farmer income, since a pay-out will occur if income falls below a certain trigger level. An MPCI would generally include a deductible amount or excess, to try and make the scheme (and premiums) commercially sustainable. However, Hertzler (2005) notes that US and Canadian schemes have not been commercially viable, with the costs of the schemes being substantially greater than the premiums paid by farmers and therefore requiring significant government subsidies.

DAFWA (2009), noting both the previous reviews' conclusions that MPCI was not feasible without government subsidies, concludes 'the prospects for a commercially driven scheme are now less likely and ... more substantial financial assistance would probably be required'.

The main arguments against MPCCI were:

- Statistically significant increases in variability in crop yields and weather over the last decade meant insurers' enthusiasm would have waned further.
- Due to systemic risks, a state-level scheme or even a federal scheme would require international reinsurance and the GFC meant this was unlikely.
- Whilst farmer interest in MPCCI may have heightened due to drought, the scale of premiums in a commercial scheme would be a barrier.
- Issues of adverse selection, market size and data availability still persisted.

Despite these arguments, in 2011 a variant of MPCCI was launched by Cooperative Bulk Handling (CBH) Mutual, for wheat and barley growers in Western Australia. The insurance covers growers for the production cost (rather than covering crop revenue) of wheat and barley production for the 2011–12 season. Government was lobbied to subsidise the scheme, but declined. Frontier Economics (2011) note that the prospectus makes clear that pay-outs will be made only if there are sufficient funds and at the trustees' discretion, implying that the scheme is designed to avoid losses due to low uptake and/or adverse selection.

DAFWA (2009) and Kimura and Antón (2011) discussed the suitability of index-based insurance schemes for Australia. An index-based insurance scheme differs from a traditional MPCCI by using an index measured against a pre-specified threshold (e.g. crop yield over a region, a minimum temperature over a period in a region, or cumulative rainfall in a region) that is used as the trigger for indemnity payments irrespective of the actual farmer's yield or any damage. Index-based insurance is meant to avoid moral hazard and adverse selection and to reduce transaction costs due to the fact it requires no assessment. However, the disadvantages include increased basic risk (e.g. where pay-outs may occur without an actual loss), and there has been low uptake of index insurance schemes internationally (Molnar 2010).

Another crop insurance product launched in 2011 is YieldShield by Primary Underwriting Agency (in partnership with the Allianz Group). YieldShield is a crop simulation insurance scheme, and it has attributes of both an MCPI and an index-based scheme.

The YieldShield product was designed for wheat and sorghum crops and was made available for the 2011–12 growing season. It covers traditional hail and fire perils, but extends cover to rainfall using the 'Oz-Wheat' crop yield simulation model, which is based on rural shire seasonal data (rural shires with irrigated farms are excluded from the product). The simulation model was developed by the Agricultural Production System Research Unit (a joint venture between Queensland State Government and CSIRO) (Molnar 2010).

Farmers can assess the modelled yield data for their shire and compare the data to the performance of their farm. They can select a grain price they want to insure their crop for and select an excess linked to a percentage level of yield loss, which reduces their premiums. Pay-outs to farmers are based on the simulated yields for the season, not on their actual crop yield. As the season progresses, the forecast rainfall for each month is replaced by actual rainfall and the model revises the expected shire yield. With lower rainfall the simulated yield drops and if the end-of-season yield is lower than the start-of-season predicted yield for the shire by an amount greater than the grower's excess then a potential pay-out occurs. The simulation model excludes losses from other factors (e.g. pests). Unlike an index product,

crops are inspected by an insurance assessor to ensure an actual yield loss due to water stress eventuated.

Both the CBH and YieldShield products were only made available during the latest growing season, and hence it is too early for any evidence of their uptake and commercial feasibility or their potential for replication in other countries. Anecdotally we understand that interest in both products was low.

Interviews with our Australian research partner CGU Insurance reinforced the general arguments discussed above for the lack of new insurance products, i.e.:

- The maturity of the Australian insurance market
- Problems in the design and commercial viability of new insurance products for climate impacts due to moral hazard and adverse selection
- The catastrophic and widespread nature of recent extreme events, which increases the perception of correlated/systemic risks in Australian agriculture
- A perceived lack of any significant demand for new land-based products; the products described above were considered to be too early in their introduction for the wider insurance to be able to gauge grower interest
- Even with local demand for products, local insurers would need to spread the risk through reinsurance, and the global reinsurance industry's appetite for climate-related risks in Australia following recent drought, flooding and storms and considering global insurance market profitability was considered to be limited
- Any attempt at MPCl or variant insurance was considered to be too expensive as a solely commercial product and would require government subsidies to enable it to function. The scale of subsidies was such that it could only be funded by transferring funding from the EC scheme, which would be politically difficult.

A recent unpublished paper for DPIV (Frontier Economics 2011), reviewing the role of insurance and other financial instruments in climate-change-induced risks faced by farm business in Australia, makes the following similar points:

- Farmers have an array of on-farm risk management strategies for smoothing income that are relatively flexible and which reduce the demand for risk-transfer tools such as insurance, except in certain sectors like grains.
- Whilst the development of insurance products seems logical, adverse selection, moral hazard and systemic risk in private insurance schemes mean they have not been viable previously.
- Climate change may only increase systemic risk (i.e. causing extreme events that affect a wider population), although its interaction with medium-term South Pacific climate systems is still being researched.
- A lack of commercial solutions could be perceived as a form of market failure, but government attempts to intervene would not avoid the issues of moral hazard or adverse selection and in what could be a more dynamic climate could lock farmers into sub-optimal decisions at a time when flexibility is required.
- Government intervention is best targeted at initiatives that facilitate the private development of more insurance products, for example through investing in the provision of forecasting and prediction capabilities that private insurers may not fund due to spill-over effects.

Kimura and Antón (2011), in their analysis, continue to believe there is potential for the development of new products in Australia, and believe that index/hybrid products may have a future, but highlight issues with state transaction taxes levied on insurance products and the crowding-out effects of current EC support.

In conclusion, some nascent insurance products are emerging for sectors of Australian agriculture such as grains, where there is comparatively little control over the factors of production. These products are designed to avoid the issues associated with MPCIs; however, it is too early to judge their commercial success, long-term feasibility and hence potential for transfer to New Zealand.

Unfortunately, the new products' confinement to the grain sector meant that they fell outside the scope (dairy sector) of the case studies for this project.

7.3 Other financial instruments

As well as general insurance, which can be viewed as a form of risk transfer, farmers in both New Zealand and Australia are able to access a range of other contractual financial instruments, such as forward contracts and hedging through futures and options, which allow them to reduce exposure to volatility in prices for their outputs or in some sectors for the price of production inputs (e.g. grains). These sorts of instruments, therefore, can potentially assist farmers having to deal with increased volatility of their inputs and outputs under climate variability, helping them adapt to climate change.

Kimura and Antón (2011) note that since the removal of commodity marketing boards and deregulation of the grain markets in Australia there has been an increase in wheat growers' ability to sell their product to multiple markets, increasingly making use of forward contracting. The two most common forms of contracts are spot and forward contracts. A spot contract is simply a series of individual purchases that occur 'on the spot' as feed requirements for each month are due. Forward contracts cover several months forward at a fixed feed price, but the farmer still takes delivery and pays each month as the grain is used. Spot and forward contracts vary in use depending on trends in the underlying input price, that is, in a declining grain market most dairy farmers will use spot contracts so as to benefit from potential drops in price.

On-farm storage has also increased, which enables growers to hedge by selling throughout the year and into different markets.

A future is a contract to buy or sell a standardised product, at a fixed price, for cash or physical delivery at a given date. An option provides the buyer of the contract the right, but not the obligation, to buy or sell something at a fixed price in the future. Futures and options are forms of 'derivative' product (i.e. they derive from another product, usually the underlying physical market). Financial institutions are increasingly providing over-the-counter products for futures pricing, and futures and options products for a range of commodities are available. However, these activities are limited to large growers/farmers of grains, cotton, beef, lamb and wool and commodity processors/marketers in those supply chains. Futures markets for contracts in wool and wheat are available at the Sydney Futures Exchange. Wheat futures are also traded using the Chicago Mercantile Exchange (CME). Historically, there have been futures markets for lamb and beef cattle, but over the past two decades several futures contracts have ceased because of lack of interest.

In relation to the Australian dairy sector, the majority of milk is processed and sold by farmer-owned dairy processing co-operatives, who undertake some smoothing of the commodity price dependent on whether the milk supplied is for domestic or export markets. Domestic contracts tend to be volume based and at a set price, whilst export contracts tend to be more open ended with regard to volumes and based on the international price. In December 2011 one of Australia's largest cooperatives, Murray Goulburn Cooperative, announced it would be joining the Fonterra Global Dairy Trade platform.

Given the availability of and their general reliance on bought-in feed in the form of grain and concentrates, Australian dairy farmers regularly enter into forward contracts.

In relation to managing price risks, the Sydney Futures Exchange provides futures products for New Zealand skimmed milk powder and whole milk powder, and from our research we anecdotally understand that an Australian milk futures product may be in development. However, whilst these products may be used by manufacturers and processors, they have limited uptake by farmers directly.

Melyukhina (2011) noted that there were no futures markets for agricultural commodities in New Zealand, citing the small scale, or small number of potential traders and hence the liquidity of markets; or for horticulture the lack of a standardised product. It noted that attempts had been made to establish wool and lamb futures but these had failed.

However, subsequently to that report, the New Zealand Stock Exchange (NZX) launched a dairy futures market with whole milk powder futures (Global Dairy Futures) in October 2010, followed by skim milk powder and anhydrous milk fat futures in early 2011. In November 2011 NZX also launched options on whole milk powder futures, which are expected to be the first of a suite of dairy-options contracts.

Volumes have grown gradually over the 12 months, with 5000 lots traded by the end of the first year. The dairy futures trade has been supported by global futures firms and local participant brokers. The products are predominantly aimed at global players and NZX wants to position the product as a global solution for both fundamental (i.e. processors, manufacturers) and financial markets (i.e. brokers), similar to the role CME grain futures play globally.

However, the extent to which farmers are directly using these risk management products in New Zealand is still thought to be highly limited aside from Fonterra, the other dairy co-operatives and some of the larger corporate farms. Fonterra, representing the majority of dairy farmers, is 'a sophisticated price hedger' (Melyukhina 2011) active in managing dairy prices for its farmer owners (through the Global Dairy Trade platform) and also in commodity price hedging on the CME and through the NZX, as well as exchange rate hedging.

More importantly at the farm level Fonterra provides a sophisticated form of forward contracting for its farmer owners through the milk supply agreements, effectively predicting and managing movements in dairy commodity prices across the whole cooperative through its scale and vertical integration of the supply chain (through farm gate to processing to export) and therefore manages the price risk faced by New Zealand dairy farmers, compared to sheep or other commodities.

With regards to forward contracting outside dairying, Melyukhina (2011) notes that contracts on price, quality and quantity have been in place in many sectors for some time. ZESPRI is one example of a buyer who seeks to maximise returns to its grower base over a marketing year by managing market pricing and exchange rates. This has the effect of smoothing income fluctuations for the growers.

In conclusion, there is a wider range of commodity derivatives in Australia than in New Zealand, which has the potential to assist Australian farmers to hedge against the impacts of climate variability on their farming enterprise, either through output or input price risks. However, in relation to our sector focus on dairying it appears that New Zealand is the more innovative market in terms of financial products and that no novel financial products exist in Australia. This conclusion was shared by the majority of Australian interviewees in the banking and dairy sectors.

With relation to inputs to the dairy sector, the greater availability and reliance due to climatic variability on a range of feed inputs in the Australia industry has driven a broader market for the forward contracting of feed inputs than in the largely pasture fed New Zealand industry.

7.4 Banking

There have been many studies in Australia that have shown that the level of grower or farmer equity is a vital factor in their ability to survive the periodic cycles of low market returns or drought that are endemic to Australia (Chatterton & Chatterton 2001)

A bank's main interaction with a farmer from a risk-management perspective is reflected in the farmer's 'financial risk'. As defined previously, financial risk arises from debt financing (leverage), through which farmers can increase their potential return from their own equity. Unfortunately, due to 'the principle of increasing risk', leverage also increases the variability of returns on equity and multiplies losses in a poor operating period.

Other aspects of financial risk are through non-price sources, such as differing loan limits, security requirements, and maturities, and the availability of loan funds over time. In coping with difficult times, farmers also tend to utilise their 'credit reserve' – the difference between what can be borrowed and what has been borrowed.

Historically, a farmer's 'rule of thumb' was to minimise financial risks by paying off bank debt, so as to minimise interest costs and to limit the potential for foreclosure by their creditors if faced with extended commodity price downturns or risks to production such as drought. An equity ratio⁴ below 50% was therefore seen as very risky.

Whilst this is still the approach of many farmers, there is a new generation of farmers in New Zealand and Australia who, having lived through historically low interest rates and high credit availability (up until the GFC), have an appetite for higher levels of debt and the associated interest cost. Theoretically, as long as the cost of debt (interest) is lower than the return on assets then leverage will increase returns to capital and so is positive. So given a

⁴ Equity ratio and debt ratio are two sides of the same coin, equity ratio = equity / (equity + debt = total assets), debt ratio = debt / (equity + debt), there is a tendency to use the term equity ratio in Australia.

period of low and stable interest rates and relatively strong returns to New Zealand dairying, increased debt may make economic sense.

Per RBNZ (2011) agricultural debt had climbed from \$12 billion in 2000/01 to peak at \$47 billion by September 2010, since then it had fallen back slightly to \$46 billion by June 2011 over the last year. As of June 2011 loans to dairy farms were 64% of all agricultural debt.

DairyNZ (2011) notes the average equity level of its surveyed farms was 52% and Figure 11 indicates around 56% of farms have equity levels of 70% and below. By contrast Dharma (2011) indicates that in the Australian dairy industry average equity is 82% and only around 25% of farmers have less than 70% equity.

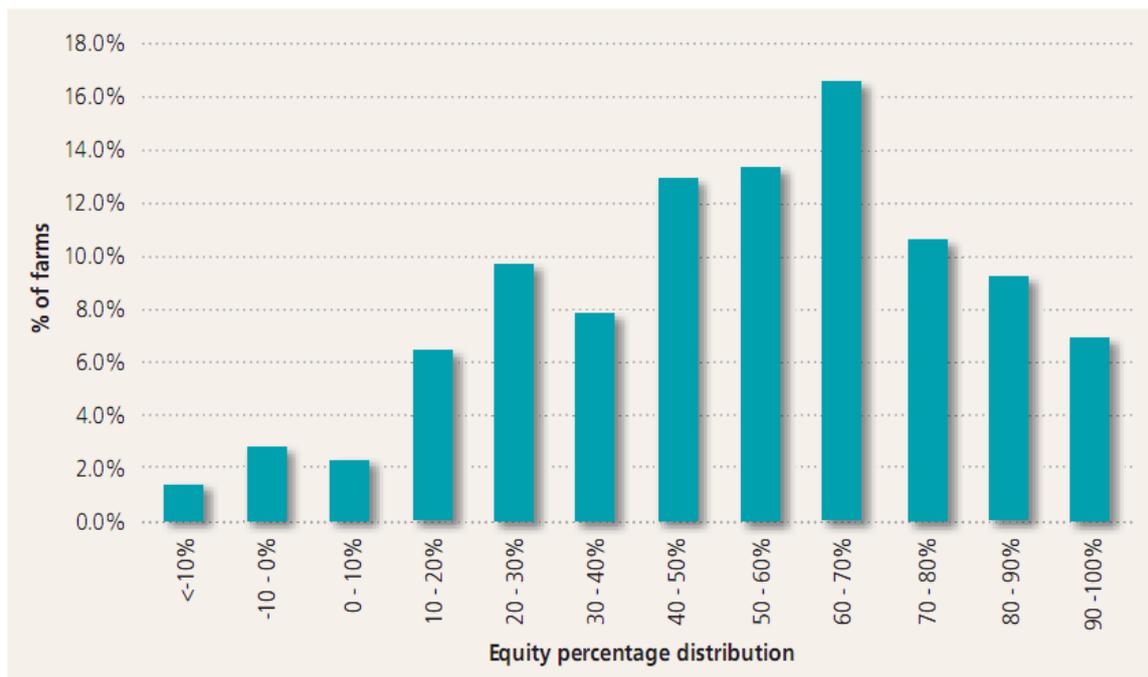


Figure 11: Equity Distribution of Owner Operators (DairyNZ 2011).

Motives for increasing debt include: expanding the business; increasing income; increasing the return on the farmer’s own equity (leverage); increasing scale to ensure efficient use of machinery, labour etc.; and when returns are higher than the cost of capital it pays to increase leverage and borrow (Greig 2010). The increase in debt in New Zealand can also be seen as the result of rising rural land prices linked to the success of dairy conversions or less productivity due to investment in rural land for capital gains. Finally, some commentators also point to the role of the banks themselves in terms of supplying ‘easy’ credit and a push for increased market share against a backdrop of high global credit availability pre-GFC. Whatever the reasons, the impact has been lower equity levels amongst some New Zealand farmers particularly in the dairy industry and in comparison to their Australian counterparts (Greig 2010; Fox 2011).

Because interest costs have the qualities of a fixed cost, low equity ratios (high levels of debt) are theoretically linked to higher volatility in cash flows, and greater risk of insolvency, although farmers can offset some of this financial risk through managing their production and market risks.

However, given the relatively low equity levels of New Zealand farmers compared with their Australian counterparts, it seems valid to question whether New Zealand farmers' financial structures would enable them to cope with increased production risks from increasing climate variability and extreme weather events under climate change, or conversely, whether Australian farmers are comparatively inefficient and financially conservative.

7.4.1 New Zealand and Australian Bank Structure and Products

Rural banking in New Zealand is dominated by the big five or six banks⁵. By market share of rural banking they are ANZ/National Bank, Bank of New Zealand (BNZ), Rabobank, Westpac New Zealand (WNZL) and ASB. All of these banks, except Rabobank, are owned by an Australian parent bank (ASB by Commonwealth Bank, BNZ by National Bank of Australia (NAB)). Rabobank is a specialist agribusiness bank. There are other smaller institutions involved in lending to farmers (e.g. Heartland Building Society), as well as providing shorter term credit (e.g. PGG Wrightsons and RD1).

Based on a review of their websites, the main New Zealand banks offer a similar range of products (refer Appendix 2):

- Working accounts (cheque and/or online)
- Saving and investment products – varying accounts, term deposits; access to sharebrokers
- Fixed or seasonally fluctuating overdraft facilities
- Term loan/s secured by mortgage over land, farm buildings, livestock, dairy cooperative shares, etc. Most offer revolving loans. All offer interest-only loans although periods vary
- Foreign currency management – spot, forward buying, options
- Interest rate caps, swaps, or collars (ANZ, ASB, National Bank, Rabobank and WNZL)
- Life and general insurance (through third-party underwriters or brokers)
- Other advisory services are advertised, including: succession planning; equity partnerships; etc.

Traditionally, loan principals were repaid from retained earnings (i.e. after tax and personal drawings); this meant that in difficult years farmers may have had to reduce drawings, use working capital, sell liquid farm assets or increase short-term overdrafts. Often at some point a structural increase in an overdraft would be refinanced through a term loan.

Over the last 20 years banks in New Zealand and Australia have introduced greater flexibility in repayments of loans alongside the development of revolving loan products. This has encouraged farmers to use any savings to pay down loans that are at higher interest rates than earned on savings accounts. Hence, liquidity based on cash reserves is being replaced by liquidity based on the ability to call down on pre-arranged lines of credit or negotiate new loans (potentially on assets that have not already been pledged for security).

Similarly, with rising rural land prices there has been a trend in the last 10 years towards interest-only loans for land and buildings, instead of the more traditional repayment loan. From the banks' perspective, whilst the client is credit worthy this means they do not have to write new loans to replace the principal repaid. From the farmers' perspective land can be

⁵ ANZ acquired the National Bank from Lloyds TSB, but whilst they should be considered as one bank they are most frequently treated separately.

seen as a non-depreciating asset (i.e. if well managed it is not used up by the production process) and hence, as long as the net farm cash flow after tax, drawings and necessary capital investment exceeds interest costs and equity levels are adequate, an interest-only loan may be a valid option (although allowance has to be made for cyclical changes in land values).

With regard to the services banks provide there was a general acknowledgement that bankers had moved away from the days of helping write the farmer's budget and now, due to concerns about independence, had pushed that role back onto the farmer and his/her professional advisors (accountants and farm consultants).

Rural banking in Australia is dominated by the same big five banks as New Zealand, with NAB and Rabobank holding the largest market share of the agribusiness banking sector. Westpac Corporation (WBC) is ranked third or fourth in the marketplace, alongside ANZ and Commonwealth Bank. A number of smaller regional banks also undertake significant agribusiness, for example, Suncorp, Bank of Queensland, and Bendigo and Adelaide Group. There also exist smaller government initiatives such as Rural Finance Victoria, which offers finance to the rural sector for a range of purposes as well as administering schemes on behalf of the federal and Victorian governments.

The Australian banking sector has also acknowledged it has a role to play in assisting farmers to adapt to drought, climate variability and the investigation of new products (Australian Bankers Association 2008).

Both South Australia and Queensland have financial strategies that have been co-developed by the Australian Bankers Association and the respective Farmers Federation (SAFF & ABA 2007; QFA & ABA 2008). However, the focus of both initiatives is on providing a framework in which primary producers and financial institutions can resolve financial problems, for example, through financial planning and proactive communication of difficulties, rather than how banks can more directly assist farmers.

A review of the major Australian bank websites and discussion with WBC staff and interviewees did not reveal any new forms of banking product that were available in Australia but not in New Zealand. However, there was some comment by interviewees that uptake of more recent products like interest-only loans and revolving credit lagged in New Zealand, at least in the dairy industry.

The only exception was the Australian Government's Farm Management Deposits (FMDs) scheme. This is an income-smoothing mechanism designed to allow farmers to build up independent financial reserves and hence improve liquidity in times of stress such as drought. Each of the major Australian banks provides FMD products with varying terms and competitive interest rates, and recent legislative changes now mean farmers can hold FMDs at separate banks, increasing competition (see Section 7.2.3 for further discussion).

Moreover both New Zealand and Australian interviewees stressed that it was only the larger, more financially sophisticated farmers who were using the more advanced interest rate or FX hedging products promoted by banks. In New Zealand there has been a backlash by farmers against interest swaps after some of the major banks promoted them against a backdrop of predicted higher interest rates that subsequently was not borne out, tying farmers into higher rates as variable rates fell.

7.4.2 New Zealand and Australian Bank Credit Processes

Given the relative lower equity levels amongst New Zealand farmers, the process by which farmers' creditworthiness is assessed in New Zealand and Australia is relevant. Shadbolt and Gardner (2005) set out the key criteria for eligibility for borrowing:

- Financial viability – a proposal must generate a cash surplus within a specified time frame and that cash surplus has to be able to cover interest costs (debt servicing)
- Security – the lender will take a mortgage over land and buildings but now will commonly also secure the loan on livestock or dairy cooperative shares
- Personal factor – the management ability (particularly financial acumen and budgeting skills), integrity, determination, and normally a track record
- Limits/margins – lenders only loan a percentage of the security asset values (known as the loan valuation ratio (LVR)), and which differs by asset type (e.g. 60% of the value of land and buildings; 50% livestock)⁶.

Hargreaves and Williamson (2011), whilst modelling bank stress testing for rural loans, used maximum LVRs of 75% against the value of land and buildings, 75% dairy company shares, 50% for stock and 20% for plant and machinery.

We undertook interviews with our research partner WNZL (A. Hill & D. Chamberlain, pers. comm. 26 & 30 January 2012) to confirm current loan practices by the major banks. Whilst the following description is specific to WNZL, the other major banks are believed to follow similar approaches; some information has been withheld as it reflects WNZL's commercial IP.

The bank lending process can be broken down into the following steps:

- Origination – by a relationship manager in the field with the customer (relationship managers will have different levels of authority with respect to size and complexity dependent on their seniority)
- Assessment and analysis – by the relationship manager
- Credit submission and assessment – the relationship manager presents on paper and makes recommendations that are then assessed by an appropriate credit authority
- Approval – undertaken by the credit function
- Offer and negotiation – between the relationship manager and the customer
- Acceptance – between customer and relationship manager
- Settlement

All steps are done in New Zealand by business units of WNZL, except certain high-debt-level proposals are submitted to a Global Risk team in Australia for consideration of wider connections. WNZL acknowledged that in the past and dependent on the bank in question relationship managers may have greater or lesser degrees of independence. Their view is that since the GFC, credit practices have tightened across most banks. Relationship managers do have some limited discretion to lend additional money to existing customers but not to

⁶ Interviewees also commented that LVRs are based on conservative valuations, not market price, hence introducing a further element of buffer.

originate new approvals. Discretion varies depending upon the managers' experience and the nature of their portfolio (scale and type of clients).

In the past land valuations were also able to be undertaken by the rural bankers, which raised concerns about independence during times of volatility in land prices. This practice has generally been tightened up and in WNZL's case only senior relationship managers who are registered valuers can still provide valuations up to a set value.

Credit assessment processes are formulated in Underwriting Standards (UWS), which are the rules of engagement under which the bank does business in any specific sector. There is an overarching agribusiness UWS for all sectors and more detailed UWS for dairy, sheep and arable. UWS are regularly reviewed to reflect changes in market conditions (e.g. pay-outs in the dairy sector).

The overarching UWS sets out debt servicing requirements, minimum equity requirements, security, loan periods and repayment terms. All proposals are measured against these criteria, as well as the more qualitative personality/management capability factors, and ranked using an internal risk grading system.

Debt servicing is calculated using the cash available for debt servicing (CAFDS) ratio, calculated as:

$$\text{CAFDS} = \text{Farm income} - \text{costs of production} - \text{drawings} - \text{tax} - \text{net capital expenditure.}$$

$$\text{CAFDS ratio} = \text{CAFDS}/(\text{Interest} + \text{leases \& rent paid})$$

Specific CAFDS ratios are set by sector type and by the scale and ownership of the operation. For example, the largest owner-occupier dairy operation may require a ratio of 1.2, but for a contract milker the ratio may be 3.0. WNZL commented that all of the banks had tightened CAFDS ratios since the GFC and that prior to that some banks were lending on CAFDS ratios of 1 (implying no margin for variation). Exceptions may be allowed but require clear plans for how the client will get back within acceptable limits in a set time frame and an exit strategy agreed with the client.

Loan term and repayment methods vary by assets type, for example a loan on dairy land could be up to 15 years with a 5-year interest only available for sound customers.

Recognising their more limited productive life and loans on livestock, dairy company shares and plant and machinery are for shorter periods, with fully amortisable terms being between 3 and 5 years.

The minimum equity requirements and LVRs are set by UWS for each sector, but exceptions are possible and are subjectively assessed against the whole inherent risk in the proposal (or for an existing client). If business is done with equity less than 40% then mitigating factors must exist, and usually the client will be required to repay until the equity position is at more acceptable levels.

The presence of water rights or irrigation will be considered in the valuation of the land under consideration. A major proposal shared with the researchers by WNZL as an example included discussion of key risks including the climate-related risks such as the historical propensity for drought and the farmer's mitigation strategy of reducing stocking rates and growing and storing supplementary feeds.

The proposal is rated against an internal risk grade matrix specific to Westpac (although all banks use similar systems). WNZL internal credit risk grades are an alphanumeric ranking representing a one-year probability of default of a customer. Taken as a whole, they are summary indicators of the degree of risk inherent in the bank's individual credit exposures.

WNZL is autonomous in most things it does as far as its risk settings, business target segments and how it engages with them. It is also broadly autonomous in its authority levels (i.e. ability to approve credit exposures) except at the higher, more complex debt levels (e.g. institutional borrowers) for which things such as global sector exposures and concentration risks have to be considered. The bank may choose to amend its UWS to reflect changes in the macro market or it may increase its pricing to certain sectors to reflect perceived adversity in the macro market in that sector.

WBC uses an identical risk grade system, but has its own set of UWS specific to the sectors in which it conducts business in Australia. While they can be different (as they rely on an appreciation of Australian market conditions and WBC's own risk appetite), the intent is the same.

The other key aspect of any loan proposal is interest rate pricing. Most loans are priced off a 'base rate' (e.g. 30-day bill rate) plus a 'risk margin' (reflective of the customer's risk profile when benchmarked against other similar businesses) and in some cases an additional Global Liquidity Cost (GLC), which reflects the bank's cost of funds in the current market. The GLC element was introduced in response to the increases in cost of money to the bank since the GFC. The pricing structure is disclosed in the loan document.

In New Zealand, regional managers have some discretion over risk margins but WNZL has pricing guidelines, governed by an agribusiness pricing committee and overall by internal Treasury and finance requirements.

Discussion with WBC in Australia (Chapman, pers. comm. 24 Jan. 2012) confirmed the basic credit processes were similar to those in New Zealand. The relationship manager's analysis and assessment is submitted for approval through a Credit Manager in Melbourne who has sign-off up to A\$5 million. Proposals larger than this are handled by the most senior relationship manager locally and would be reviewed in Sydney Head Office.

As well as the usual qualitative aspects around personality and farm management capability, the UWS for the WBC Agribusiness Dairy Team focuses on the same three key quantitative aspects: CAFDS ratio, minimum equity and security (LVR). However, there were differences to the WNZL UWS for a dairy proposal under A\$5 million, notably:

- The CAFDS/interest ratio for owner operators must be greater than or equal to 1.5 for owner operators (1.2. in New Zealand)
- Scale is taken into account through linking equity ratios to milk solids produced; for example, a farmer producing more than 150,000 kg MS can have the lowest equity ratio of around 50%; for the smallest producers equity ratios should be between 60 and 65%.
- Scale is also taken into account through a 'surplus assets test', that is, a presumption that the higher total assets are for the same equity ratio, the greater the ability to fund difficulties through partially liquidating assets, or absorbing extra costs.
- Access to irrigation/water is factored into the pricing of land in Victoria. In northern Victoria's tradable water schemes the permanent water rights are separately valued by the banks based on market prices. In South West Victoria irrigation availability is built into

land price in comparison to rain-fed land and is therefore built into the total asset value of a farm and the amount of money that can be borrowed.

A small sample of LVR ratios in Australia and New Zealand are compared in Table 2.

Table 2: Selected Comparison on WNZL and WBC Dairy Loan Valuation Ratios (LVR)

Asset Type	New Zealand – LVR	Australian – LVR
Dairy land	65%	70%
Productive livestock	60%	60%
Off farm – Investment properties	95%	80%

Regarding loan pricing, the structure is similar to that described for WZNL (i.e. a base rate plus margin/s). The base rate is essentially set by the market (e.g. 90-day bank bills) and it is the margin that is customer specific and variable, set from a matrix that is driven off the customer’s eventual risk grade. WBC indicated that the margin was also partially at the discretion of the relationship manager, subject to the agreement of the Head of the Agribusiness Dairy Team.

Reviewing the trans-Tasman practices of one major bank is not representative of the whole market. For example different banks will be undertaking expansion strategies at different times, which will affect their UWS and loan pricing strategies. During the period of research WBC was actively seeking increased share of the dairy market in Australia, whilst in New Zealand it was more selectively seeking clients in certain regional locations to balance its portfolio.

In conclusion, the review of credit practices across Westpac reveals significant similarities in processes, with differences at the sector level to account for local business conditions. Specifically with regard to the dairy sector, for the period reviewed, current equity minimums and LVRs appear equivalent or more conservative in New Zealand than Australia. The CAFDS ratio at 1.5 in Australia appears more conservative than in New Zealand, but only for larger farms.

However, all interviewees and the evidence LVRs used in Hargreaves and Williamson (2011) confirm that higher LVRs and lower CAFDS ratios were predominant in New Zealand up until the GFC. It therefore appears likely that the lower levels of equity in New Zealand than Australia reflect the historical conditions of the supply of credit and the demand by farmers. Whilst, theoretically, lower levels of equity are associated with greater financial risk, it is possible these can be offset to an extent in some farms through productivity gains. As one interviewee commented lower levels of equity may be a symptom of borrowing to adapt for climate change, for example through building wintering cowsheds in Southland.

8 Role of Government

8.1 New Zealand Government

8.1.1 On-farm Adverse Events Framework

In New Zealand, aside from the ongoing SLMACC programme of research and information dissemination (e.g. MAF case studies), there is no direct financial assistance for farmers to adapt to climate change. However, there is some direct financial assistance for qualifying farm families impacted by extreme weather events, through the On-farm Adverse Events Recovery Framework.

Adverse events are defined as ‘severe climatic events or natural disasters that are beyond the ability of the community to cope’. MAF (2006) stated that adverse events needed to be seen within the bigger picture of climate change, so if New Zealand suffers from more extreme events under climate change, the On-farm Adverse Events Framework represents one current mechanism for direct government assistance to affected primary producers.

Under the framework, individuals are primarily responsible for their response and recovery following adverse events. The framework is based on a risk management perspective and farmers and rural businesses are encouraged to take a proactive approach to risk-adverse events and to develop strategies to protect their family and business. The framework stresses the relationship between support for uninsurable risks, highlighting the need for farmers to insure where possible. The review acknowledges that the primary impact on primary producers is on their assets and cash flows and notes a range of on-farm risk management tools including, from the financial perspective, production diversification, insurance, and financial reserves/buffers.

Farmers are also encouraged to work with their communities and their local Rural Support Trust (<http://www.rural-support.org.nz/>). Rural Support Trusts are involved in helping people in the rural community who experience an adverse event – climatic, financial or personal. Trusts are made up of community volunteers and services vary between trusts but generally they include advice on business options, provide mentors, advocate for financial assistance and stress management services.

Direct government financial assistance depends on whether the severity of the event is deemed small (localised), medium or large. A National Adverse Events Committee may be activated on an ad hoc basis to coordinate recovery and assist MAF and the Minister to determine the scale of the event using a published matrix of government criteria and responses. Direct financial assistance includes (MAF 2011b):

Small-scale events

- Task Force Green: a wage subsidy programme for projects on affected properties
- Tax relief (administered by IRD): variations to the income equalisation scheme (discussed below) and extending flexibility on provisional tax, time for filing, etc.
- Welfare relief (WINZ): standard community welfare payments, e.g. unemployment benefits, emergency benefit, recoverable assistance payment grant, which are means and asset tested.

Medium-scale events

- Rural Assistance Payments (RAPs) (WINZ): payments specific to affected rural families to assist with essential living expenses set at the same rate as the unemployment benefit. Means and asset tested. During the National drought of 2008/09 less than 150 families qualified for this payment.
- New Start Grants (MAF): a one-off grant for families to permanently leave commercial farming when there is no adequate financial viability due to an adverse event. This measure has not been implemented since the 1980s. Strict criteria apply.

Large-scale events

- Special Recovery Measure (MAF): discretionary reimbursement of a share of costs for:
 - restoration of uninsurable on-farm infrastructure
 - re-establishment of uninsurable pasture, crops and forestry; and
 - initial clean-up of silt and debris (where uninsurable)
- Reimbursement is 50% of costs, with an excess of \$10,000 or 10% of damage costs (whichever is greater) and capped at \$250,000 per farm

The number and dollar amount of RAPs paid to farm families by IRD is not publicly available. Neither are the numbers of farm businesses that used the IE adverse event account for smoothing tax liabilities. MAF grants are not made to individuals but generally to rural support trusts to perform one-on-one visits, tech transfer and any other recovery measures required.

The scale of payments in relation to adverse events made by IRD and WINZ is not publicly disclosed. MAF now discloses the total of grants from its adverse events contingency fund and, for example, in 2010/11 (MAF 2011a) appropriated \$830,000 for the fund, although no new grants were made that year. Melyukhina (2011), working from MAF-supplied figures, comments that aside from spikes between 2004 and 2006, largely due to \$35.1 million for the flood in the lower North Island and \$6.1 million for the Bay of Plenty floods in 2004, annual adverse events expense since 1999 was \$0.2 million p.a.

MAF (2006) and Melyukhina (2011) indicate that the framework is supported by stakeholders and recognised as well-designed.

For this project it should be noted that in addition to direct benefit to farm families, the On-farm Adverse Events Framework also indirectly benefits financial institutions that have loans to affected farmers, although any impact would be marginal compared with the interest rate subsidies under the Australian EC and NDRRA schemes discussed in Section 8.2.

8.1.2 Income Equalisation

The IRD has two income equalisation (IE) schemes that can be accessed by farmers, one in the normal course of business and the other specifically due to adverse events. The policy intention is to allow primary producers relief from fluctuations in their income, reflecting the assumption of the greater variability of primary producer income.

The main IE scheme allows eligible taxpayers to even out fluctuations in income by spreading their gross income from year to year for tax purposes and works in a similar way to a savings bank account. First, an income equalisation account is set up with the IRD. Next, a deposit is made, which cannot exceed the farm net income in the year of deposit, and is held

for a maximum of 5 years. The minimum period a deposit must be held is 12 months, but in certain circumstances a refund can be paid out before this. IRD pay notional interest (currently 3%) and when the refund occurs it is treated as taxable income in the year of withdrawal.

The IRD has discretion over the main IE scheme, which means it can be used to cope with adverse events. For example farmers may be able to access a refund before the minimum 12-month period if they suffer from hardship following an adverse event.

The Adverse Events IE scheme allows farmers to defer the income from the sale of livestock due to adverse events. The farmer can self-assess an adverse event, which is an event that materially affects the business of the taxpayer through fire, flood, drought or other natural event or sickness or disease among livestock. A deposit is allowed up to the cost of all livestock sold due to the effect of the adverse event. Deposits earn interest at a rate of 6.5% per annum and farmers can only remain in the scheme for 12 months.

The total amount of deposits in the IE schemes is not routinely published; however, Melyukhina (2011) indicates that deposits in the main IE scheme were \$30–\$60 million between 2004/05 and 2007/08 before jumping to \$290 million in 2008/09. The same report shows that Adverse Events IE scheme deposits have fluctuated between \$0 and \$1 million over the same time periods. The New Zealand Treasury (2011) indicates an annual appropriation for interest of \$10,000 on the Adverse Events IE scheme and \$7 million on the main IE scheme; this implies total deposits are around \$150,000 on the Adverse Events IE scheme and \$230 million on the main IE scheme.

The low uptake of the Adverse Events IE scheme and the ability of IRD to grant relief through the main scheme means it may be withdrawn (J. Gordon, pers. comm. 17 November 2011).

In reviewing the IE scheme and comparing it with the FMD scheme discussed below we believe there is potential to transfer the IRD IE scheme to the private sector, in a similar manner to the FMD scheme. This is on the grounds of reducing government administration costs, reducing finance on the government balance sheet, and enabling competition and greater promotion to drive improved uptake.

8.2 Australian Government

Australian farmers receive lower levels of government-funded support than farmers in any other OECD nation except New Zealand. In relation to adaptation to climate variability and hence climate change, the main way this support manifests itself is in the National Drought Policy (NDP) (and the associated Exceptional Circumstance (EC) regime), Natural Disaster Relief and Recovery Arrangements (NDRRA) and Farm Management Deposits (FMDs). All three of these have significant implications for Australian banks and, to a lesser extent, insurers in relation to their ability to support clients during extreme events due to government interest rate subsidies, and their ability to design new commercial products to help farmers adapt.

8.2.1 National Drought Policy

NDP is an Australian federal policy, in terms of its decision making and funding. In relation to farmers the objectives of the NDP are to:

- Encourage the adoption of self-reliant approaches for managing climate variability
- Maintain and protect the agricultural and environmental resource base during periods of extreme stress
- Ensure early recovery of agricultural and rural industries consistent with long-term sustainable levels. Providing short-term assistance to long-term-viable producers is the key operational policy objective of NDP.

After a Government declaration of Exceptional Circumstance (EC) in a region, assistance becomes available. ECs are defined as ‘rare and severe events outside those a farmer could normally be expected to manage using responsible farm management strategies’. The criteria used to determine an EC are that it:

- Must be rare, i.e. not have occurred more than once on average in every 20–25 years
- Must result in a rare and severe downturn in farm income over a prolonged period (e.g. greater than 12 months)
- Must be a single event that is not part of long-term structural adjustment processes or of normal fluctuations in commodity prices

These operational criteria are assessed, within the context of local practices, on the basis of meteorological conditions, crop yield, pasture and stock conditions, water supplies, and farm income levels. Once an EC has been declared, three programmes are made available to farmers:

- The EC Relief Payment (ECRP) covers the living expenses of farm households suffering from extremely low incomes due to EC events, with payments equivalent to the unemployment allowance for the non-farm sectors. It is subject to an asset test, excluding assets essential to the running of the farm, allowing farmers with high-valued farm assets access to ECRP.
- The EC Interest Rate Subsidy (ECIRS) covers up to 50% of the interest payable on all loans in the first year and up to 80% in subsequent years up to a maximum of A\$100,000 in any 12-month period and A\$500,000 over 5 years. Eligibility criteria include an off-farm asset test of A\$750,000.
- EC Exit Package (ECE) is designed to assist non-viable farmers to leave the sector. It consists of an Exit Grant, which provides a taxable one-off payment of up to A\$150,000, an Advice and Retraining Grant (a further A\$10,000 available for advice and retraining) and a Relocation Grant (up to A\$10,000 for relocation expenses). It has historically had low uptake due to its assets test.

In 2008 the National Review of Drought Policy was instigated by Australian primary industries ministers who agreed that current approaches to drought and EC were no longer appropriate in the context of a changing climate. They agreed that drought policy must be improved to create an environment of self-reliance and preparedness and to encourage the adoption of appropriate practices for managing climate change.

As part of the national review, the Australian Productivity Commission undertook an inquiry into the economic aspects of government drought support (Productivity Commission 2009). It recommended that subject to transition arrangements the ECIRS should be scrapped, that the ECRP be replaced, and that greater emphasis should be placed on enhancing farmers' capability for planning. The inquiry highlighted that more than 70% of Australian broad-acre and dairy farmers received no government drought support over the period from 2002/03 to 2007/08, despite this period being considered by many to be the worst period of extended drought in southern Australia for over 100 years.

The Commission also highlighted the potential role of risk management strategies in facilitating farmers' self-reliance, including:

- Undertake regular business planning
- Access professional financial advice on the business and future options
- Talk through financial issues with financiers, including how risks can be managed
- Diversify income through off-farm employment
- Diversify assets through off-farm investments
- Lease out land so as to obtain a low-risk source of income
- Lease land or enter into share-farming arrangements instead of purchasing land
- Offload drought and other risk by entering into a share-farming arrangement
- Spread land holdings geographically to avoid the entire farm business in drought at once
- Build up financial reserves in FMDs and other products
- Use financial instruments such as price hedging
- Draw down financial reserves or access carry-on finance
- Reduce stocking during drought according to a predetermined plan

The role financial institutions play during droughts was highlighted as well, including:

- Providing carry-on finance to meet short-term needs
- Restructuring existing loans, to reduce annual payments or defer payments
- Direct communication with customers about the bank's view about drought issues
- Support of specialised advice to industry groups such as dairy farmers
- Similar support for affected small businesses that provide services to agribusiness
- Targeted courses to help farmers plan to recover from drought

DAFF, in partnership with the DAFWA, is conducting a pilot of reform measures in part of Western Australia. The pilot tests a package of new measures developed in response to the National Review of Drought Policy. The measures are designed to move from a crisis management approach to risk management. The aim is to better support farmers, their families and rural communities in preparing for future challenges rather than waiting until they are in crisis to offer assistance. The pilot was rolled out in July 2010 for a trial period of 12 months and then extended in May 2011 for a further 12 months and covering an expanded area, including the entire south-west region of Western Australia.

A review of the pilot has been released (Keogh et al. 2011). Eight programmes were trialled. In relation to the financial adaptation of farmers, a key programme in the Drought Pilot focused on farm planning and was aimed at enhancing farmers' skills in business, natural resource management and personal planning and to increase the number of farm businesses having comprehensive written strategic farm plans.

Farm businesses undertook training to develop or update a strategic plan for the business. Participants identified priority activities to help improve the management and preparedness of the farm business to respond to future challenges, including drought and a changing climate. It was the only component that received full endorsement from the panel.

The Drought Pilot Review also discussed taxation treatment, FMDs, payments for ecosystem services (including the Carbon Farming Initiative) and multi-peril crop insurance. With regard to the latter it reiterated the previous findings that such a scheme would require government subsidies or compulsory levies on farmers, both of which they concluded precluded the uptake of this form of insurance in Australia.

The Drought Pilot financial planning programme and its possible interaction with banking are discussed further in Appendix 4.

8.2.2 Natural Disaster Relief and Recovery Arrangements

The Natural Disaster Relief and Recovery Arrangements (NDRRA) introduced in 2011 cover bushfire, earthquake, flood, storm, storm surge, cyclone, landslide, tsunami, meteorite strike and tornado, but not drought, frost, human or animal epidemic. It is an arrangement under which the Australian federal government partially reimburses state government expenditures in relation to natural disasters. The NDRRA is driven by decisions at the state/territory level, and framed by a co-financing arrangement, unlike the NDP.

Primary producers can access the following assistance:

- Loans at a concessional interest rate dependent on establishing that the borrower's assets (including fodder) have been significantly damaged by the natural disaster
- Freight subsidies, which reimburse a maximum of 50% of the costs of transporting the following as a direct result of a natural disaster:
 - livestock
 - fodder or water for livestock
 - building or fencing equipment or machinery
- A 50% interest rate subsidy paid by the state to an authorised deposit-taking institution to reimburse the authorised deposit-taking institution for the concessional interest rate it gives on new loans
- Recovery grants of up to A\$25,000 for primary producers where farmers are severely affected, with threats to viability and disruption of production likely beyond the current season. Grants to primary producers are aimed at covering the cost of clean-up and reinstatement, but not at providing compensation for losses.

Due to the recent timing of the introduction of NDRRA we were unable to access any reviews or consider its impact on the financial institutions and farmers besides the obvious comment that it provides again for interest rate subsidies on new loans in response to the events, thereby reducing any demand for insurance or alternative financial products.

8.2.3 Farm Management Deposits (FMD) and Tax Relief

The Farm Management Deposits (FMD) scheme was introduced in 1999, and replaced the Income Equalisation Deposits Scheme. FMDs allow farmers to deposit up to A\$400,000 of income which, if kept on deposit for a minimum of 12 months, is excluded from taxable income until it is withdrawn from the FMD. There is no maximum limit on how long FMDs can be held. All farmers/farm trust beneficiaries are eligible if off-farm income is below \$65,000, but not companies.

FMDs aim to increase self-reliance by farmers by providing liquidity to reduce exposure to fluctuating incomes due to climate variability and world markets. Farmers in an EC-declared area may access their FMD inside the 12-month limit.

FMD account providers are the commercial banks, who compete on interest rates and terms provided. They liaise with the ATO who administers the scheme.

In September 2011, there were 38,406 FMD deposits totalling over A\$2.9 billion (DAFF 2011). Whilst that implies an average deposit of A\$75,000, the amounts vary between industry sectors and regions. The total number of deposits has been relatively stable since June 2002, with an average of around 40,000 holders.

The scheme was reviewed in 2006 (DAFF 2007), which found that despite the appearance that FMDs were being used for tax planning, for retirement planning or to leverage EC interest subsidies, there was adequate policy justifications for the scheme based on improving the timing of farm expenditure. The scheme cost the government A\$110 million in 2006/07.

Changes were announced to the FMD scheme in December 2011, expanding the trigger for accessing FMDs within the 12-month time limit beyond EC drought areas to primary producers accessing recovery assistance under an NDRRA event (e.g. bushfire, floods and cyclones). Primary producers can also now hold FMDs with more than one commercial provider to enhance competition between providers (Australian Treasury 2011).

Primary producers are also able to access a tax averaging scheme that allows their current taxable income to be assessed at the tax rate applicable to their average income in the current year and the four preceding years. Under this scheme, farmers pay lower taxes when they have higher taxable income than the average of the previous five years, but a higher tax is imposed when the taxable income is lower than the average of the previous five years.

8.2.4 Clean Energy Act 2011 and Carbon Farming Initiative

In November 2011 the Australian Government introduced the Clean Energy Act (the CE Act), which introduces a carbon price for a number of sectors. Agriculture is omitted from direct inclusion under the CE Act, although there will be indirect cost increases through carbon pricing flowing on to farm energy and fuel usage once the legislation comes into play.

Of more direct relevance to Australian agriculture is the Carbon Farming Initiative (CFI), which was passed in August 2011. The CFI is designed to help farmers, forest growers and land managers earn income from reducing emissions from nitrous oxide and methane through changes to agricultural and land management practices. The CE Act and the CFI are discussed further in Appendix 4.

In September 2011 the Australian Productivity Commission announced an inquiry into regulatory and policy barriers to effective climate change adaptation. Whilst agriculture is not

specifically highlighted, the Issues Paper includes questions focused on the potential role of financial services, in particular insurance, in relation to effective climate adaptation and should be reviewed when the inquiry is complete (Productivity Commission 2011).

8.2.5 Crowding Out and Adverse Selection

Kimura and Antón (2011) discuss the crowding-out effects of the NDP, NDRRA and FMDs (i.e. where government support mechanisms reduce the incentives on farmers to adopt their own risk management strategies). Based on Kimura et al. (2010) they conclude that there is some evidence that crowding out is occurring in Australia. They suggest ECIRS increases the incentive of farmers in EC areas to increase their debt, pointing to evidence of ECIRS recipients having lower equity levels and less liquidity. They also suggest ECIRS reduces incentives to diversify because of eligibility criteria around off-farm income and off-farm investments. Again ECIRS recipients have lower levels of both forms of off-farm income than non-recipients in the EC area. In relation to known drought responses (i.e. selling livestock down and reducing fodder), they note that the Productivity Commission (2009) found that ECIRS recipients tend to have higher stocking rates and higher fodder expenditure per animal.

One additional point made by Australian bank representatives is that the NDP ECIRS is also potentially crowding out market responses by banks to drought by muting the signals from interest repayment defaults and potentially encouraging higher-than-sustainable levels of debt lending by rural banks.

Kimura and Antón (2011), again summarising the Productivity Commission (2009), also note that due to asymmetries of information and the relatively greater financial value of the ECIRS over the EC exit packages, potentially non-viable farmers self-select to access ECIRS instead of the EC exit package and no structural adjustment of the farming sector occurs.

In conclusion, the New Zealand and Australian schemes of government assistance for adverse weather events differ considerably in their design, their direct financial impact on farmers, and the respective costs to government. This is significant when trying to compare the financial strategies of farmers in both countries, as the financial strategies of Australian farmers are affected by the existence of the significant loan interest subsidies under EC, the existence of FMDs as a liquidity/tax spreading tool, and the potential crowding out of development of new products by the insurance and banking industries.

9 Case Studies

9.1 A brief comparison of the Australian and New Zealand dairy industries

There are a number of key differences between dairy farming in Australia and New Zealand that need to be appreciated as context to the case studies. Appendix 3 contains a comparison of key physical characteristics and financial characteristics between average New Zealand, Taranaki and Marlborough/Canterbury dairy farms and average Australian, western and northern Victoria dairy farms.

- New Zealand farms are predominantly pasture-based and dryland (reliant on rainfall) farming although there has been an increasing number of farm irrigation conversions in drier areas like Canterbury.
- Australian farms are a mix of dryland, bore irrigation and major gravity/channel irrigation like the Goulburn–Murray scheme. Due to lower rainfall and limited pasture throughout the year there is a much heavier reliance on and availability of purchased feeds and concentrate from crop farmers.
- New Zealand farms tend to be smaller, have higher stocking rates per hectare, and generate more kg MS per cow and per hectare than in Australia.
- Australian farms are larger as land is more available and cheaper, have lower stocking rates and are on average less productive in terms of kg MS, although in some areas of Australia productivity can be comparable with some areas of New Zealand.
- On average New Zealand farms have lower equity and higher debt levels. Reasons given for the low equity ratios include land prices and up-front investment in Fonterra shares. Very high debt ratios are attributed to younger farmers gearing up to buy land and a small percentage of larger farms in newly converted areas, e.g. Canterbury.
- Australian farms' higher equity / lower debt is seen as being more financially conservative.
- Both New Zealand and Australian dairy industries aim for specialisation and increased productivity. Enterprise diversification is uncommon and off-farm income and investments tend to be at lower levels than in other farming sectors.
- Vertical integration in the milk processing chain is common in both countries.
- Fonterra, a cooperative processor, controls 90% of New Zealand milk supply and New Zealand represents 50% of world exports. Australia has four large milk processors, including Fonterra, as well as a number of smaller processors.

9.2 Case Study 1: Lifestyle farming as risk management

Key Facts

Name/s: Joe & Julie Giblin, Jinjarra Farm	Feed Purchased: 0.5–1.0 tonnes/cow
Status: Owner-Operator	Milk as % Gross Farm Income: 83%
Location: Terang, western Vic	Farm-Grown Feed: 24% of cost of production
Total land (milking land): 141 ha (135 ha)	Return on Assets: 15%
Rainfall + Irrigation: 800 mm/ha + Dryland	Equity Ratio: Less than 60%
Herd size: 216 mixed breeds	FMDs: Less than \$25,000
Stocking rate: 1.6 cows/ha	Off-Farm Income: Less than \$25,000
Production: 714 kg MS/ha	Off-Farm Investments: Investment property
Owner and staff FTE: 1.2	

Joe Giblin's (Figure 12) parents first came to Jinjarra Farm in 1980; it has always been a dairy farm. Having grown up with farming Joe first worked for the Victorian Electrical Commission for 10 years, until it was privatised. Joe decided to get into farming, got married and leased two different farms over the mid-1990s. When his parents retired, Joe bought the family farm. Joe is the oldest of four siblings; Joe and a sister both farm, a brother is working in mining and the other sister is in banking.



Figure 12: Joe Giblin, January 2012.

South West Victoria was only lightly impacted compared with northern Victoria during the droughts of the last decade. However, the droughts affected the local price of grain and fodder. Joe and Julie run a low-risk, low-input system, with a stocking rate of 1.6 cows/ha, compared with an average for West Victoria of 1.8–2.0, so the only effect on Joe was a higher price of grain. In the worst year (2007) they had to cut silage 8 weeks earlier than normal and so had to buy in 100 tonnes of low quality canola hay due to shortages of pasture hay. Being a dryland farmer, access to water wasn't an issue; however, some local farms with higher stocking rates and a higher reliance on grain were hit hard.

With the breaking of the drought the farm was affected by floods in September 2010, November 2010 and January 2011 (Figure 13). The farm sits on a natural flood plain and historically they'd expect a flood every year for a day or two during peak rainfall in winter. But January 2011 was abnormal due to La Niña seasonal conditions and the amount of tropical rain that fell in northern Victoria. Whilst water levels were only marginally higher than in September 2010, the water stayed for 10 days. However, they had some warning and suffered no loss of stock, just damage to fences, silage and hay.



Figure 13: Farm in Flood January 2011 and a Similar View in January 2012.

Temperature extremes aren't problematic with only a few 'hot' days in the summer, but bushfires are an issue. Five people died locally during the Ash Wednesday⁷ bushfires of February 1983.

Besides the climate, Joe believes that other main impacts on dairy, through milk price and input prices, largely come down to self-management. Whilst milk is part of a global commodity market, his personal view is that commodity prices (grain, milk, oil, etc.) travel together, with a 6-month lag for milk prices. Therefore, there is always a margin available, between input and output prices, to be exploited for profit given the correct on-farm management practices.

Joe doesn't specifically anticipate climate variability in his farm financial strategy. Whilst having a 'buffer' through financial reserve, such as FMDs, would be ideal, paying off farm debt is the first priority. Plus, there are advantages with putting cash back into the farm or even in investing off farm over building up cash reserves.

⁷ The Ash Wednesday Bushfires occurred on 16 February 1983. Within 12 hours, more than 180 fires fanned by winds caused widespread destruction across the states of Victoria and South Australia. Years of severe drought and extreme weather combined to create one of Australia's worst fire days in a century. Across Victoria and South Australia there were 75 deaths, including of 17 volunteer fire-fighters. Over 3,700 buildings were destroyed or damaged and 2,545 individuals and families lost their homes. Livestock losses were very high, with over 340,000 sheep, 18,000 cattle and numerous native animals destroyed. [Adapted from Wikipedia http://en.wikipedia.org/wiki/Ash_Wednesday_fires accessed 26 Jan. 2012]

Joe sees fodder conservation and a low stocking rate as risk mitigation strategies for climate variability and its financial consequences. Fodder is conserved in silage or hay during spring and early summer. They use a small amount of grain either when it's wet or as silage runs low in the run-up to drying off (March to April) and they don't supplement feed for the months when the cows aren't productive. So if drought hits they generally don't have to buy feed in or try to sell their livestock into a depressed market, thus avoiding the main financial pressures.

Another risk strategy is working with the natural growing season of May to November as opposed to chasing milk price incentives for off-peak production from processors. Joe believes the additional money put into feeding the cows outside of the natural season doesn't generate enough return to offset the additional risks you are being exposed to. However, due to the abnormal seasonal conditions in the last two years they have milked 30–40 cows right through.

The decision not to chase milk price premiums is also driven by Joe and Julie's focus on maintaining work–life balance and maximising family time. Since one can't just feed grain, one has to work more hours in the day feeding hay, using more machinery, more fuel, etc. Joe believes a lot of farmers underestimate their own labour involved in sitting on a tractor feeding cows. Obviously farmers can employ labour to free up their own time, and Joe and Julie do employ relief-milkers, but that comes with cost and management input.

This hasn't been the way they have always operated; when they first started farming they milked out of season, moved calving patterns around and purchased feed. However, this was in 2001/02 and, even with good dairy prices, they didn't make the returns anticipated. Kids were also coming along and they wanted to incorporate lifestyle, so both factors combined to make them reassess their situation and after consulting with farmers and consultants they decided to focus on doing what they wanted, not what the industry or the consulting 'wizards' said they should do. So choosing a low stocking rate and following the growing seasons has given them that lifestyle element, but also is good risk management, as Joe says:

Now if they [the processors] rang up and said the milk price was dropping by 30% we wouldn't be happy, but we aren't as exposed as a lot of other people are and we could get through for 12 months.

Joe and Julie don't want to still be milking at age 60; they want to travel. So, besides their on-farm risk management, they have invested off farm in a residential property at Port Fairy at the beach. They bought it 3 years ago and whilst it is the worst house on the best street, it has increased in value and is used by the family, and may be an option for Joe and Julie to eventually retire there (although no decision has been made as to where they will retire). Whilst they do still have more farm debt than they'd like, the rental income from the property means it is not financed by the farm and Joe sees it as part of an overall strategy to generate wealth and to spread the risk of investments.

They also are about to invest in shares and are considering superannuation vehicles with the intention of eventually having a self-managed Super fund. A key consideration will be to maintain liquidity and lock finance into superannuation arrangements until they are 55–60.

Joe believes liquidity is important (i.e. the ability to access cash quickly to get out of trouble) and that is one reason they aren't using FMDs at this stage, as they lock in funds for 12

months⁸. An additional consideration for FMDs is due to interest differentials, i.e. if you're using an overdraft why would you put the money into an FMD at 6% interest when you can pre-pay grain and avoid putting it on your overdraft at 10%.

Tax payments can impede cash flow for farmers through initial payment in a good year and subsequent provisional tax payments. So, tax minimisation is seen as another strategy for minimising risks to cash flow and liquidity. However, the dairy industry has other legitimate tax-smoothing mechanisms besides FMDs, such as pre-payment of fertiliser and grain in June, which becomes a deduction in that year, and not paying cash out for grain from July to October.

Joe and Julie both work on the farm, so there is no off-farm employment income. Whilst the dairy industry promotes specialisation, increased productivity and margins ahead of enterprise diversification, Joe would love to diversify risk by getting into beef livestock farming, but it comes down to current returns, relative land prices and the amount of labour you are willing to put in. They'd consider an out paddock if they could afford 100 acres 1 km away, as it's a way to shift risk, but equally investing in a dry cleaning business in town may be a way to make money at minimal risk.

However, Joe notes that timing is everything. During the drought there were people who went and bought out paddocks as a risk management strategy and paid A\$4,000 – \$5,000 per acre. Now they are there every second day, feeding cows and still buying in hay and grain and making repayments on the interest. Meanwhile the paddock is now only worth A\$3,000 and they can buy dry cow hay for A\$90 a tonne.

Vertical supply chain diversification into processor shares isn't as expensive as in New Zealand. As a supplier to Murray–Goulburn, shares in the cooperative are taken out of their milk payments, not paid up front as with Fonterra, although there may be up-front requirements if moving to another Murray–Goulburn factory or processor. If you're supplying a million litres, your shares may be A\$6,500 a year and these shares then become part of your overall financial strategy.

Joe and Julie are with Suncorp Bank, which was willing to finance the purchase of the farm when the larger banks wouldn't. They are proactive with the bank and have an open relationship, but haven't needed to speak for the last two years. They run an overdraft facility and have an interest-only loan, but they don't use the bank for forward contracts, hedging, etc.

The last 12 months have been a consolidation year for most farmers as land prices have dropped back and few properties are getting sold. This might expose the bank to those clients who are more in debt, but Joe is aware of a tightening up of practices by the banks since the GFC of 2008–09; interest rate cover requirements and equity levels have tightened. A few farmers may have been forced to sell by their banks, but they have sold their cattle, not the land, which is instead leased out because of a lack of demand.

⁸ Though existing and new law changes discussed in Section 9.2.3 mean FMDs can be accessed earlier than 12 months by those in Exceptional Circumstance declared areas or areas of declared natural disasters.

Joe couldn't identify a specific role for banks and insurers around climate variability or change, but noted that barriers to entry and the ageing dairy farmer population mean there is an emerging number of banks promoting vendor finance (i.e. where retiring farmers leave money in the farm in the form of debt for a period) or equity partnerships (i.e. the 'New Zealand model' where money is left in the farm as equity). However, both approaches expose the retiring farmer to risk of management and risk of timing their exit in terms of market or climate cycles, and Joe maintains that earlier diversification is a preferable strategy.

With regard to government support around finance and climate variability, the drought and then floods meant Exceptional Circumstances (EC) were declared for short periods locally. Joe has no issue with those eligible making claims, and acknowledged that some farmers may try to massage figures to access the support. However, he thought government would eventually catch up. When they got flooded out, Rural Finance provided a grant for clean-up, which was paid on receipts for work done. With the floods not many farmers knew they were eligible, but for most the damage was pasture damage and so many didn't bother to apply.

Whilst they have participated in a number of farm care / environmental programmes and have undertaken greenhouse gas measurements so as to have an understanding of what they are producing and whether they need to do anything, Joe is neither worrying about the carbon tax until it is compulsory nor looking at the incentives under the carbon farming initiative.

With regard to Australian Government pilot initiatives to build farmers' strategic and financial capabilities, Joe stressed that the implicit reactive nature of farming tends to undermine the perceived value of longer term strategising. He supports attempts to build farmer financial capability, but it needs to be realistic and focused at the farmer's level of understanding and not become a barrier to accessing finance.

Joe agrees that the variability of climatic conditions in Australia means farmers have had to become more adaptable. He doesn't see any longer term shift in the climate yet and thinks we suffer from short memories. However, this can work both ways as with regard to the current low interest rate and higher debt environment Joe noted that 17–18% interest rates were common in the 1980s and he believes they can happen again.

Joe knows he has higher gearing than average for South West Victoria, but he is comfortable that their low-input system means they have the ability to ride out impacts and change strategies if a climatic or financial crisis should happen. However, the forecast couple of degrees change in temperatures due to climate change impacts in South West Victoria is expected to make the land drier in winter, which is the worst period for dairy farmers, but they still expect to cope through summer because they aren't reliant on irrigation water like farmers in northern Victoria. However, Joe thinks there will be some negative impacts and it will undoubtedly cost them money somewhere along the line, but he won't worry until it happens.

Joe and Julie Giblin's low-input system, lifestyle focus and diversification into off-farm investments are in opposition to the general trend in dairying towards greater productivity, scale and specialisation. Joe knows some people may equate their low-risk, lifestyle approach with being 'work shy', but believes it gives them the mental space to consider and follow-up alternative options/strategies that can spread their risk from shocks such as climate variability, changes in markets prices and interest rates, and even climate change.

9.3 Case Study 2: Leveraging for expansion

Key Facts

Name/s: Fraser & Alice Chapman, Naringal Farms	Feed Purchased: 1–2 tonnes/cow
Status: Owner-Operator	Milk as % Gross Farm Income: 93 %
Location: Naringal, western Victoria	Farm-Grown Feed: 17% of cost of production
Total land (milking land): 183 ha (158 ha)	Return on Assets: 9%
Rainfall + Irrigation: 735 mm/ha + Dryland	Equity Ratio: 60–70%
Herd size: 330, mainly Holstein-Friesian	FMDs: Less than \$25,000
Stocking rate: 2.1 cows/ha	Off-Farm Income: Less than \$25,000
Production: 1156 kg MS/ha	Off-Farm Investments: Land Investment
Owner and staff FTE: 1.5	

Fraser Chapman (Figure 14) studied at Lincoln University, Canterbury, where he met Alice. After a short time farming in the South Island he returned to his parent’s family farm near Whangarei, Northland. Initially they investigated purchasing a farm neighbouring his parent’s farm, but the land value meant Fraser would have been working until he was 60 just to pay off any loan. When his parents went on holiday to Victoria, he asked them to look at farms and come back with photos. Fraser and his father headed back to South West Victoria a week later, identified some land they liked, and established that on a kg MS basis they could get it for a third of the price of a New Zealand farm.

It was no brainer you can’t pass that sort of thing up.



Figure 14: Fraser Chapman, January 2012.

In January 2012 they had been at Naringal for nearly 5 years and so they experienced the tail end of the worst of the drought in 2007. However, compared to northern Victoria the drought impact locally was much less severe. Dairy farmers in the north don’t make supplement and

they are heavily reliant on irrigated water to grow grass. In South West Victoria, dairy farmers make the supplement and don't grow grass for the summer, so during the drought northern Victoria farmers had no supplement or grass whilst locally a fair number of farmers had their own supplement, but even with this supplement available there was hay being transported from Western Australia for South West Victorian farmers. At the end of the drought Fraser was buying poor quality hay at \$500 a tonne.

The floods of 2010 and 2011 missed Naringal, but the farm is constantly in a bushfire risk area as it is a fairly built up, bushy area. However, there has been no fire through the property since Ash Wednesday in 1983, when the neighbour's houses and their trees burnt.

With regard to other major impacts on farm finances, at the end of the 2007 season milk prices were reasonably good, but the following year, prices reached a record high. Fraser does observe that input and output prices tend to track together (i.e. when milk prices are low, input prices are lower), but Fraser thinks that it is largely due to the symbiotic relationship between farmers and suppliers of inputs: when you have a good milk price everyone wants a share of it, but conversely when times are harder suppliers match prices to the market.

We've had drought, but we can handle drought in a normal year, droughts are easy.

In South West Victoria, the climate affects farm management most severely in the wet winters. Fraser has a herd of mainly Holstein–Friesians and in winter they can go into a paddock where you think you have 3 tonnes of pasture cover, but it's only 1.5 tonnes by the time the cows have trampled it all in. Fraser doesn't have a feed pad and so in trying to feed hay or silage in the paddock his feed losses go from 5–10% up to 20–30%, which can significantly impact feed costs. So whilst summer is hot and dry there are greater feed choices plus you get only 5–10% wastage.

Fraser notes that whilst New Zealand dairy farmers generally make grass, silage and a bit of grass hay, in drought there are few alternative feed sources (although lately New Zealand farmers have been buying in palm kernel). In Australia there is easy access to a range of reasonably cheap feed. All grain for supplements comes from cropping specialists, with billions of tonnes of wheat grown a year (virtually no dairy farmers grow their own grain). Additionally, although Australia is such a big country, grain and hay are easily shipped around on the trains and can be transported to climate-affected regions.

In Australia there are also nutritional consultants dispensing advice on how to use feed to keep the cows at an optimal body condition through the whole season. In New Zealand cows calve in good condition but then slowly get worse, are dried off and then the farmer tries to get them back to optimal body condition for calving again. So Fraser now believes that instead of simply trying to save money by not buying in feed, a farmer is better off spreading some feed over the year, instead of trying to feed up cows when they are dry.

With regards to other major impacts on his farm finances beside climate, the high AUD/USD exchange rate hadn't impacted milk prices as some forecasted in the last 6 months. However, there had been some notable fluctuations in the last two years in input expenses particularly with regard to diesel and fertiliser. In South West Victoria a lot of dairy farmers will put on one application of super and 4–6 applications of urea. Being a Kiwi, Fraser puts on two applications of fertiliser at lower rates and then 4–6 applications of urea plus sulphur or phosphate. This approach helps to spread his costs, but he also believes he gets better utilisation of the fertiliser.

Fraser and Alice jointly purchased Naringal Farms in a 50:50 partnership with Fraser's parents. The farm purchase price was around A\$2.5 million and the Australian banks required a minimum of 50% equity before they would loan. Fraser's parents sold to a neighbour some land in Northland that was surplus to their needs. They borrowed the rest of the 50% against the family farm via an interest-only loan from the ASB bank in New Zealand. ASB had a long-term relationship with Fraser's parents and were happy to lend with the New Zealand farm as security for the Australian purchase. There was no consideration by ASB of the Australian farm asset being in a drought- or climate-affected area, because Fraser's parents had high equity in New Zealand so the loan was serviceable from the New Zealand farm, even if Fraser and Alice couldn't make the ASB interest repayments. The deal was structured through family trusts, split between the land and the trading entity, with Fraser's parents owning 50% and Alice and Fraser 50%, with a personal debt back to Fraser's parents. At that time the NZ\$1 was A\$0.80.

The local Australian bank reviewed the security available and evaluated Fraser and Alice as low risk, and so didn't require any financial reporting or budgetary control, etc. in loaning the remaining 50%. Because of the trust structure, the local bank viewed the money brought from New Zealand, whether borrowed or not, as equity. However, if you worked it out strictly their equity wouldn't be as high because of what's owed to the family trust. So Fraser and Alice are paying interest on the loan in Australia, whilst also leasing the land off the family trust, which covers the interest on the borrowing from ASB.

Fraser and Alice consider the Australian banks to be more conservative in their lending: in South West Victoria dairy farmer equity ratios are around 60% whereas in New Zealand younger and larger farmers have pushed those equity ratios down. Although Fraser thought lending practices had been reined in more recently in New Zealand, he still thought the Australian banks were too conservative and that there fundamentally needs to be a balance, between sensible leveraging and excessive borrowing.

...if a guy's been farming in Aussie for 30 years and he's only got 50% equity but needs a 100% loan the banks will say no, but hasn't he already proved he can farm the land? As long as the person's capabilities are there, the figures are so changeable, next year we could be on a record pay-out.

With regard to future financial strategies to avoid climate variability, a neighbouring farm with water bores on it recently came up for sale. Naringal is rainfall dependent and whilst they do farm all year around, they achieve this by Fraser making as much supplement as possible over the spring flush (200–400 tonnes of silage) and then feeding that out over the dry summer. The neighbouring farm would have been more climate resilient and able to grow grass all year, so you could increase the stocking rate, use less supplements and have more milk in the vat all year around. However, when Fraser and Alice did the figures the NZD exchange rate had fallen to A\$0.68–0.70, so they pulled out because of the cost of funding the exchange-rate gap.

They are still keen to expand, although they also want to continue to pay off debt. The expansion strategy is a drive for economies of scale and neighbouring farms will come on the market in the next 2–8 years. So, one longer-term plan would be to buy both of those farms and amalgamate them into one farm and have Naringal (Figure 15) as a separate farm. Fraser has no plans to diversify into other farming enterprises.

They are interested in off-farm investments, and depending on the debate around capital gains tax in New Zealand, were considering rental properties as a low-risk investment before they came over to Australia. In the local city, Warrnambool, you can buy houses for A\$180,000 and rent out an A\$400–500 a week so there are investment opportunities, although capital gains tax applies. Fraser would also like to start building a share portfolio to earn some diversified and passive income.

However, currently they have limited resources to invest off farm or for additional debt repayment. Fraser admits he's one of those farmers who spend money now to make it easy in the future; that is, if fences are 100% right and the tracks are good, he won't get lame cows, he'll produce more milk and that's money in the bank. However, it's a fine line between appropriate maintenance/upkeep and just having the fancy ute.

His father is more 'old school' and likes to see loans paid back as it is compulsory saving, and also reduces your interest cost. He didn't like the concept of interest-only loans until recently, with interest rates comparatively low and stable in New Zealand. Fraser recognises that in the long run it's better to have lower debt in case of trouble, as if you only have 40% equity and are forced to sell up you may be still be in debt with no farm. However, currently Fraser works on the basis that as long as he can pay his bills every month he's doing ok.

Although they started out with ANZ, Fraser and Alice now bank with Westpac Banking Corporation (WBC). They negotiated a new low-rate loan with WBC because of their relatively high security and with WBC seeking to increase its share of the local dairy market. Westpac provides a permanent overdraft, the mortgage loan, credit card, life insurance and income protection.



Figure 15: Naringal Farm.

Fraser feels banking in Australia is generally like it was in New Zealand 15 years ago (i.e. banks still treat young farmers as if they are doing them a service), but believes they have recently been improving. During the GFC, land sales diminished. Nothing was selling, but Fraser is not aware of any forced sales.

Fraser and Alice have already paid back enough debt to increase their equity to consider buying a small block of land close to Warrnambool. They would use it as a run-off block, that is, an out paddock for young stock. However, it is also subdivisible and has capital

appreciation potential. They would invest 50:50 with a local family and finance through vendor term financing⁹, so they would only have to put a small deposit down and pay the balance in 18 months' time. The vendor would retain debt on the land during that period.

With regard to the strategic purchase of neighbouring land, that would rely on using the equity in Naringal Farms, potentially requiring further investment from New Zealand. Fraser and Alice are keen to hold their equity above 55%, but if they can repay debt and get to a 70–75% equity position before purchasing other farms, they could borrow against their own equity.

Banking products available in New Zealand are also available in Australia. Their loan is structured as part variable and part fixed, with the variable element being a revolving loan that allows cash to be repaid and redrawn against the limit as necessary. He isn't aware of any banking products that would be helpful in adapting to climate variability.

When they arrived at Naringal, Exceptional Circumstances (EC) had been declared. However the entitlement rules were changed in 2001 to exclude New Zealand farmers who had arrived on special entry visas and who weren't Australian citizens, so they couldn't access the EC subsidies or flood relief.

Fraser notes that there is nowhere near the same level of support in New Zealand for farmers; in Australia the government looks after everyone. They are a larger, wealthier country and due to the mining of resources aren't reliant on agriculture to the point that New Zealand is. However, since agriculture is a smaller percentage of GDP, the government can afford to assist it.

Fraser hears the arguments about whether the current subsidies support the least efficient farmers, and arguments about free riders were raging after Black Saturday¹⁰ and the fires in northern Victoria where only 20% of people were insured.

Regarding whether he thinks Australian farmers are more adaptable than Kiwi farmers due to their exposure to climate volatility, Fraser points out that the average age of farmers in Australia seems to be higher than in New Zealand and that those older farmers say 'this is the way dad did it' and they still talk in gallons and acres (although contractors talk hectares). However, he acknowledges there are younger farmers chasing big goals and adapting amazingly well.

There is also quite a difference between farming sectors: Australian sheep farmers are very conservative; cropping farmers are a bit more adaptable. But Fraser thinks dairy farmers are

⁹ A vendor terms contract, also known as a terms sale contract, is a method of buying and selling real estate property where the purchaser pays the purchase price to the vendor in instalments, rather than paying the full amount of the purchase price by way of a home loan secured by a mortgage over the property. The vendor retains the title to the property until the full amount of the purchase price is paid.

¹⁰ The Black Saturday bushfires were a series of bushfires across northern Victoria and western Gippsland in February 2009. They resulted in Australia's highest ever loss of life from a bushfire: 173 people died and 414 were injured. (Adapted from Wikipedia http://en.wikipedia.org/wiki/Black_Saturday_bushfires accessed 27 Jan. 2012).

the most adaptable in their practice, as there is constantly new research available around new ways of farming. He also thinks that younger dairy farmers are more likely to try new things:

...the older guys some of them don't even feed grain ... they tick along on 100 cows and 120 hectares, but they have no debt. But it depends on your stage of life and if you have no debt and are happy to continue making an earning then ... you'll still retire nicely.

Fraser knows the prediction for climate change impacts in his area is that it should get slightly hotter and slightly dryer, so winters could get dryer, which would be a positive for dairy farmers as they could raise stocking rates as long as they could access the supplementary feed/grains. Climate change in general is obviously a major global concern. As to whether or not local conditions will get worse, Fraser hopes they don't, but locals have been saying they haven't had a decent rain since 2002, when the older farmers say it would rain from March until December. Now they say it starts raining in May/June and stops around November, so it definitely seems the local climate has changed. How will he cope with any further change?

We will continue to adapt as we go along ... they keep coming out with products that will grow grass for dryer conditions and as long as we can maintain that animal intake we will just keep doing it.

Their strategy of expansion through further leverage and focus on production improvements through purchased feed places Fraser and Alice alongside the mainstream of dairy farmers. Through increased scale, productivity and access to water Fraser intends to grow his farm business whilst securing it against future shocks through generating greater efficiency and financial scale.

9.4 Case Study 3: Self-sufficiency in feed

Key Facts

Name/s: Darren & Claire Farley, Distant Meadows	Feed Purchased: 0.5–1.0 tonnes/cow
Status: Owner-Operator	Milk as % Gross Farm Income: 85–90%
Location: Port Fairy, western Victoria	Farm-Grown Feed: Information not available
Total land (milking land): 183 ha (158 ha)	Return on Assets: Information not available
Rainfall + Irrigation: 750 mm/ha + 36 mm/ha	Equity Ratio: Greater than 70%
Herd size: 210, mixed breeds	FMDs: Less than \$25,000
Stocking rate: 1.6 cows/ha	Off-Farm Income: Less than \$25,000
Production: 705 kg MS/ha	
Owner and staff FTE: 1.6	

Distant Meadows Farm is a third-generation dairy farm close to Port Fairy, South West Victoria. Darren Farley grew up on the farm, but initially chose to go into computing. Eventually his father was looking at retiring and Darren thought that the farm could provide a good lifestyle, and although his wife, Claire, wasn't of farming stock, she was at least interested. After agreeing a structure for the farm purchase with his other siblings, Darren farmed for a couple of years with his father and brother. Eventually, he decided to go it alone and went through the process of acquiring the whole property. He has now been farming there for 14 years.



Figure 16: Farley Family at Distant Meadows Farm.

Distant Meadows Farm is close to the sea and sheltered from most weather extremes, so it wasn't greatly affected by the long drought; however, EC was declared in the area at its worst in 2006–07. Whilst he grew up on the farm he admits he didn't take much interest in the seasons until he owned it. Whilst the records may prove otherwise, he says the seasons

seemed very regular. However, in the last 14 years, it feels like there haven't been two seasons that have been the same. Darren personally isn't sure whether this might be attributed to existing longer term climate cycles or to climate change.

The farm was also affected by the flooding during 2010 and January 2011, but not significantly.

Farming for winter and the wet is the hardest part of dairy farming in South West Victoria, but Darren has a range of soil types across the farm, including sandy loam that can carry stock well as it doesn't pug/compact. Instead, it levels out so he can move stock around. In the really wet seasons, the water runs off the farm fairly quickly.

For feed Darren is able to make enough silage to be largely self-sustaining, only purchasing a small amount of pellets for the cow shed. He feels whilst he has to pay for the pellets, it's an easy feed option, it helps cow flow and movement in the milking shed, and causes little wastage.

There is also irrigation water available from bore holes on the farm, so they are guaranteed to grow pasture. On the area of the farm that is irrigated they are getting nearly 30 tonnes of feed per year. Although the farm is close to the sea, salinity in the bore holes isn't currently an issue.

Historically they haven't milked 12 months a year because the farm is seasonal based with one calving a year. Over the last 4–5 years, he has tightened the calving pattern to late April, May and June through conditioning of the cows and an Artificial Insemination (AI) plan so he can take a month's break from the farm. This is less important now that the farm has full-time staff, freeing up time for Darren. The staff also means that the farm may now start milking all year long.

Over the last 4–5 years Darren has been mitigating against the effects of climate variability and in particular the wet winter season by investing in subsurface drainage across the low areas of his farm where the soil type was black, cracking clay. During the years of drought, other farmers probably thought he was crazy as it was a relatively expensive investment and not many farmers do it locally, but he had the cash resources available. Now he can renovate the pasture through getting a more productive species of grass planted and lift the stocking rate on the farm. So the investment in the drainage will have increased his land value.

They have also accessed extra land through leasing, which helps guarantee them enough supplement supply and in fact they were able to sell excess hay this year. So even if it now didn't rain they would have a good 12 months' supply of feed available. They produce all feed through their own labour and machinery. They have used their own cash flow to invest in the farming machinery necessary to grow and move feed from one part of the farm to the other. Whilst 90% of local farmers in South West Victoria would use contractors for these roles, Darren chooses this strategy as he feels the contractors are overpriced, he doesn't mind dealing with the machinery and it also means he can guarantee the quality of feed and its timing (e.g. for bailing). He admits the additional work can put pressure on his own time and lifestyle, but he's very keen on ensuring high-quality feed.

Darren and Claire's long-term vision is to be completely self-sustainable in feed, and it works to their advantage if they can keep the silage and hay 18 months ahead of the stock. They have only recently been able to get into this position because of the extra land they have

leased. During the drought they had to purchase feed as they weren't farming as much land and didn't have their own machinery.

The decision to invest in being self-sustainable in feed wasn't only driven by the high prices on purchased feed during the drought, but also by the difficulty of sourcing, the quality of the feed supplied, and the impact on cow condition and production. When feed was in high demand sellers weren't too bothered about ensuring quality; although they were doing tests on the quality of the hay/silage, you didn't know if it was your load that was being tested. Additionally, because you hadn't been working with these suppliers on a regular basis you had no long-term relationship in which to develop trust and ensure quality. So, Darren's primary adaptation in response to the droughts has been to adopt what some might see as a conservative strategy to developing the capability and capacity to produce a sufficient stock of feed to meet their ongoing needs and as a buffer against shocks.

With regard to future financial investment strategies, Darren and Claire are taking on further leased land, which will make their feed strategy even more robust and which they are negotiating to buy with financing out of their own or, if necessary from family, capital.

Another financial investment they are considering is investing in a feed pad because consultants suggest feed wastage rates in the paddock could be as high as 25%. If you value feed at A\$200 per tonne, saving a quarter of that represents a potentially large financial saving. However, they also aim to increase the herd to 230–250 cows going forward, which will put more pressure on workloads, so there are a number of factors to look at for investment purposes.

Initially the farm purchase was all financed through the family, so having 100% equity means Darren and Claire haven't had much dealing with the bank. They use online banking and only visit the bank once or twice a year, if that. They did have a loan to buy one purchase over 15 years, but paid it off in three.

Darren acknowledges that leverage is obviously a useful tool for younger farmers trying to get ahead and increase productivity and that it may appear crazy for them to have 100% equity, with money effectively doing nothing. With A\$4 million in total farm assets, even if they left 50% equity in the farm they would have A\$2 million to invest and logically all they'd need to do is get better than the current interest rate on any loan. However, it does also depend on how keen you are on risk, given term deposit rates have out-performed share returns in the last 5–10 years for example, and the current financial uncertainties globally. Ultimately Darren feels that a farmer's strategy needs to be based on age, how long he or she has been farming, and appetite for risk, so each farmer's strategy will be completely different.

With historically high land values, Darren's concerned about whether young farmers can acquire enough equity to purchase their own farms. Obviously banks have their own ratios for acceptable equity levels driven by their own assessment of risk, but he wonders whether there is a role for government in facilitating entry into farming somehow. Generally all the banks are fairly competitive and most understand farming pretty well, having their own agribusiness groups and researchers. He believes the banks are more switched on than they were 10–15 years ago, with more of a customer-driven service focus. They recognise that farming, particularly in South West Victoria, represents a good lending option from a banking perspective.

Local rain patterns have changed slightly; rain used to hit the coast and not travel far inland, but now the rain will travel further north. Some farmers think this is related to recent forestry planting in South West Victoria, which was promoted through government incentives. Many farms and out paddocks were converted to blue gum plantations due to up-front taxation incentives, which included the value of the land, so companies facing higher tax rates were willing to pay double the land value that farmers could afford. It was highly distortionary and was subsequently withdrawn by the State government.

Regarding current government support for climate-affected farmers Darren acknowledges that one argument is why support farms that are sustainable with Exceptional Circumstance, especially on the marginal land and in those regions that have been deemed 'EC' 9 out of the last 10 years. However, he also points out that EC benefits those farmers who take risks and that are highly leveraged because conservative farmers with a high equity rate who can maintain their income won't qualify for support.

It's all about the risk you want to take, if you look at the long-term forecasts and you're highly geared and it's a large farm with a lot of infrastructure and you're willing to gamble on the rain and milk prices, then you go for it, but if you are going to reap the rewards, then why should the government pick you up when it doesn't work out?

Darren sees FMDs as being useful depending on where in your business cycle you're in, and the level of necessary investment in the farm. He needs to do more research in FMDs before investing in them, but they seem to be a useful tool for income smoothing as is the tax-averaging mechanisms available for smoothing out the good and bad years.

The impact of the new Carbon Farming Initiative is an unknown because the amount of work to gain those credits and the associated book keeping on individual farms is unknown, but those requirements will probably inhibit a lot of smaller farmers from using it. However, overall the climate change legislation will increase costs through fuel, freight and diesel, etc. There is a big variation between the Australian milk processing companies in how they plan to pass on those costs; some say it will cost A\$6,000 per farm, some A\$20,000 per farm on average. However, there is also an opportunity to access offsets through the milk companies managing group schemes, and giving rebates, for example for pills to reduce emissions from livestock.

The Australian Government also needs to look at the fact that only the largest top 100 companies have to pay carbon tax and two of the milk companies fall outside that range, which gives them a competitive advantage.

As mentioned before, Darren thinks the local climate has been more erratic, and being conservative, Darren keeps the worst years at the back of his mind. However, he believes you can't just work to the worst year, as you won't make any money if you do, so depending on how keen you are on risk you work up from that worst position (e.g. carrying forward feed to the next season).

Overall, climate change is predicted to make his corner of South West Victoria both warmer and wetter, so it's not necessarily a negative as they might have warmer, drier winters and wetter summers. In 2011 the farm didn't have a dry period and, like New Zealand, the cows feed on pasture year round. However, that was also the first time in his 80-year-old father's lifetime that the water didn't get beyond the root zone.

Whilst climate change is on everyone's mind Darren doesn't think it will be a massive or overnight shift; he thinks farmers will have plenty of time to adapt to it.

Darren sees a switch back to perennial pasture planting as farmers now recognise that perennials don't cause the lag times that occur when growing annual grasses. Farmers had previously moved away from them because the old perennials were tired and because they were seeing big tonnage gains from annuals, particularly with increased fertiliser. Now there are new perennial species that are probably outperforming the annuals. Looking to the future Darren notes that CSIRO at Bundoora are doing gene analysis on certain plants from Antarctica that can survive in all sorts of environments and could be up to 50% more productive.

Darren and Claire's focus on being self-sustaining in feed has grown out of their experience in having to deal with the impacts of past drought. Their high equity position provides them with the financial capacity to invest further in the farm and machinery necessary to provide a level of feed that also allows them to consider increasing their herd size and to consider year-round milking.

9.5 Case study 4: Valuing water in northern Victoria

Key Facts

Name/s: Cam & Lana Brown, Wainuku Farm	Feed Purchased: 1–2 tonnes/cow
Status: Owner-Operator	Milk as % Gross Farm Income: 90–95%
Location: Shepparton, northern Victoria	Farm-Grown Feed: 24% of cost of production
Total land (milking land): 120 ha (120 ha)	Return on Assets: 29%
Rainfall + Irrigation: 480 mm/ha + 340 mm/ha	Equity Ratio: Less than 60%
Herd size: 500, mixed breeds	FMDs: Less than \$25,000
Stocking rate: 4.2 cows/ha	Off-Farm Income: Less than \$25,000
Production: 1792 kg MS/ha	
Owner and staff FTE: 3.5	

Cam Brown (Figure 17) is originally from a farming family in Northland, New Zealand. He and his wife Lana had been share milking 800 cows in Southland for 7 years, but couldn't afford to buy land in New Zealand. So in December 2004, in the middle of the big drought, they visited South Australia and Victoria to look at farms. They came over five times during a 2-year period to visit various locations, but settled on the Shepparton area in northern Victoria because of the land price and the access to irrigation. Even though the drought was near its worst they felt they could make it work.



Figure 17: Cam Brown, January 2012.

Initially they entered into a 50:50 partnership arrangement with an older Australian couple. Cam managed the farm and the older couple took a lifestyle approach. They experienced the worst of the drought in the first year, spending A\$1 million on silage alone. Cam disagreed with some of the decisions that were made, so he decided to get out of the partnership early. There was a cost, but Cam learnt valuable lessons about the local conditions and business practices before branching out on his own.

They bought Wainuku Farm (Figure 18) 12 months ago and have just bought a second, abandoned farm 7 km away. The key factor for Cam was that the tradable market in water in the area meant they were able to purchase Wainuku Farm, including dairy farm infrastructure and a couple of houses, separately from the associated permanent water right, significantly reducing the amount of equity they needed. They still have access to water as needed through the temporary market.

The climate and the long drought have obviously had significant impacts on the landscape, farming practices and land values, with many farms being abandoned. In northern Victoria, a dryland farm could be purchased for A\$1,000–1,500 per acre, whereas a dairy farm with irrigation was A\$2,000 – \$3,500 per acre.



Figure 18: Wainuku Farm, January 2012.

Shepparton sits in the Goulburn Basin, and the local landscape is dominated by the irrigation supply channels of the Goulburn–Murray scheme. So during the drought periods the main focus has been on trading water allocations. During the drought, prices for temporary annual water rights rose to A\$700–\$1,000 per mega litre (ML). Thus, a farm with an annual 100 ML allocation could sell that allocation for A\$70,000; the transfer would be recorded through an allocation account maintained by Goulburn–Murray, and the seller would no longer have access to that allocation for that year.

Cam argues that in most of northern Victoria hay, silage and grains are always available, as long as you can structure your business to afford it. Rain still fell during the ‘droughts’ here, unlike in Northland in 2010, when no rain fell for 7½ – 8 months, and there was only limited feed available to fall back on (e.g. palm kernel and maize).

In 2011, there were floods through the area, including a small flood through their property, but water was only standing for 2–3 days.

To survive you work out your best year and your worst year and as long as you can get through the worst one you’ll make money.

In their previous partnership, they had milked 800 cows on 444 ha, but Cam is now milking 500 on 120 ha, using lucerne as the main pasture. In northern Victoria the water table is 2 feet down, so farmers need a plant that is able to reach the water. Lucerne can survive for a month

without being watered. With rye grass, the typical local pasture crop, without water and with the heat it just dies, so the local farmers keep watering every 7 days.

However, Cam is currently establishing his own lucerne crop. He has no inter-cropping currently although he might start putting a cereal crop in some of the lucerne paddocks to try to realise more tonnage. Cam eventually hopes to not have to buy in any hay; although currently cheap at A\$160, a tonne of hay sold for A\$400 during the drought.

Cam doesn't use urea or solid fertiliser; this season, he has just applied lime at a tonne to the hectare and 10 tonnes of chicken manure, so overall Cam is running a very low cost system.

Lucerne is grown successfully in the area and can be bought as hay, but not many dairy farmers are growing it so everyone is watching to see how it goes. But Cam had half the partnership farm sown in lucerne by the time he left and it was working, and he's already helped plant two neighbouring farms with lucerne. As Cam points out, this isn't a new approach; the benefits of lucerne have been promoted in Victoria by the government and it's effectively what dairy farmers feed in the US (where it's called alfalfa), although they will feed 70% alfalfa and 30% maize.

The only known problem with lucerne is the establishment cost, which is about 3 times higher than for an annual grass crop. However, the lucerne will be in production for at least 5 years, and bloat is counteracted by varieties and remedies.

The decision to not purchase the permanent water rights for their farm is a key financial strategy for Cam and Lana. When they were looking to acquire the farm, a 600 ML per annum permanent water share was available, but at A\$2,200 per ML, it was worth 2½ times the land value. If you own the permanent water share you may only pay A\$5–7 per ML to access your allocation, but you also get charged an annual storage charge of around A\$24,000. The permanent water share can be traded separately from the farmland, so you can negotiate for the vendor to retain the water share to sell separately.

Not buying the permanent water share doesn't mean that Cam and Lana can't access water, as the farm came with four 'delivery shares' (which in the Shepparton irrigation region were worth 170 ML per delivery share, i.e. a right to put 680 ML through the farm) for that year and which cannot be sold separately from the land.

There is a cost per annum of owning the delivery shares, but Cam acknowledges that someone has to maintain the water supply channels, flume gates and other infrastructure, so he has no issue paying for usage on top of a fixed delivery-share charge. The irrigation is controlled through automatic Flume Gates™ and is measured and allocated electronically; Cam just telephones or emails Goulburn–Murray Water and they remotely open the gate by radio link.

So, the cost of owning and accessing the permanent water rights is between \$40 and \$50 a ML plus the interest on the asset, whereas Cam reckons that over a 5-year period he will buy temporary water at an average of \$100 per ML. For example in the latest season, he bought temporary water at \$20 per ML plus the annual delivery-share costs, but he may occasionally have to pay as high as \$900 per ML.

Cam reckoned that by using lucerne, over a 5-year period he could use two-thirds less water than a similar-sized rye grass pasture based farmer, so in times of drought, he could afford to

pay three times more for temporary water than the rye-pasture farmer. That is, if the rye-grass-based farming model is based on A\$300 per ML, they can afford to pay up to A\$900 per ML on the temporary water market and still farm successfully.

Additionally there was ongoing debate about the longer term value of permanent water, for example the banks would only lend A\$1,400 per ML against permanent rights. However, Cam thinks prices have been artificially inflated by the government's intervening to buy water at A\$2,500 per ML during the drought. He believes it should currently be around A\$900 per ML or less, based on availability.

In January 2009 Lake Eildon, which supplies the Goulburn–Murray system, was only 20% full. Within 6 months of the drought breaking, it was 100% overflowing. Currently, the lake is 94–96% full and the majority of the rain comes between the end of January and October, so there is only 4–6% room before the lake is full.

Additionally, actual water usage has been declining because farmers aren't wasting it as they were prior to the drought; they are now using it more efficiently, trading it and making money from it, so even in harder years there should be more of the available storage to go around.

Cam acknowledges that the downside to not owning the permanent water share is that inputs are dearer in a drought. However, a declared drought theoretically means there is no rain in the hills that feed the storage lakes, not that there is no rain in the area of their farm. So, he believes that even in a drought year, whilst they may reduce their watering by 1 or 2 times a year, with the lucerne-based feeding system they will still be watering the farm only 3–4 times a year, whereas people with rye pasture will be watering every 7–10 days in the growing season (12–15 times a year) even if it rains locally.

Therefore, Cam and Lana believe they can afford to pay significantly more for water in the harder years simply in terms of less usage for their production level.

Cam's biggest concern about buying the permanent water share is the cost of the equity tied up in it, or, alternatively, the level of borrowing and the finance cost required. So by not taking on debt to finance the purchase of the permanent water rights, his finance costs are less than for a comparable farmer who has to finance those water shares.

To buy a farm your investment in water is 'dead money' on your balance sheet on which you are paying interest, so, let a businessman or the government own your water, because you can always buy water.

So, whilst working on the partnership farm, Cam and Lana decided they wouldn't buy the permanent water right. The water right stayed with the previous owner, who is still trying to sell it.

More recently, Cam and Lana have just bought a second farm 7 km away; their driver is to use the equity they have in Wainuku Farm as they believe that there are large opportunities in the area. They have bought 360 acres for A\$500,000 without the permanent water shares, two homes, a cow shed and a dam with 170 ML water storage on-farm. The previous owners pulled out during the drought and it has not been milked for 3 years, so they will have to spend another A\$250,000 to get the farm fully operational.

The local banks have been good to work with, but Cam feels they are more conservative than banks in New Zealand. They will generally only lend to 50% of equity over the longer term. Cam sees himself as a risk-taking, progressive farmer who wants to have a go. Cam and Lana are with the Commonwealth Bank of Australia (CBA); they looked at three other banks and all would back them, but they have been with CBA since the start. They have a new manager, who is good, and Cam shares his Intelact (farm management software) data with the bank a lot and talks to his bank manager 3–4 times a month to keep in touch and stay ahead of any problems.

The CBA were happy to support purchasing the second farm. Cam and Lana had to work out their equity position and provide budgets, but the bank put some faith in them because they have only been on this farm for a couple of years. The bank keeps an eye on their quarterly BAS (GST return) and the overdraft.

We can make the land more productive, Aussies say 300 acres can't produce 300,000 milk solids, but we are going to do it this year at low cost.

Fundamentally, if you can irrigate a farm, you'll grow feed. However, there are more farms sitting idle in northern Victoria than there were 5 years ago, devaluing operating farms. This has caused banks to re-evaluate values of the farms in northern Victoria and has caused them to curtail loans.

Cam observed that government support during the drought, whilst harder to access as a Kiwi, was very generous compared to the situation in New Zealand. A few years back some of his New Zealand friends had to become citizens to try to access the subsidies. The EC declaration gave an interest subsidy of A\$100,000 for those with losses. There were Centelink grants of A\$20,000 for special circumstance to relieve financial pressure and irrigation grants to ensure that delivery shares were paid for. Cam believes that some farms made more money than they had before the drought, and with little requirements for records, there were new cars, new tractors, etc.

Instead of the interest subsidies and grants Cam believes that the Australian Government should tie assistance to the milk pay-out. A 2–5 cents per litre pay-out would be such a huge driver for the areas. Grants simply went to people who could 'prove' they deserved them. A subsidy tied to milk pay-out would go to everybody based on productivity, not just those who are clever enough or who employ accountants.

Cam isn't sure he would characterise the Australian farmers as adaptable, because from his observations during 7 years in northern Victoria, he believes whilst they know the local and historical conditions well, the older farmers don't like changing their farm practices, are slow to adopt new innovations, are cautious about taking on risks and leverage, and are insulated from the real effects of the drought by government subsidies.

He still believes that even having been through the drought there are opportunities for young Kiwi farmers if they are prepared to come with an open mind, forget what they had previously learnt, are prepared to listen and follow the changes that they think they can farm with. A young farmer can make A\$100,000 managing a 250-cow farm in Victoria versus NZ\$50,000 in New Zealand. He acknowledges that there have been Kiwi farmers who themselves have failed to adapt to the Australian conditions and have sold, but he believes that the farmer who thinks outside the square is generally successful and you can always go back to New Zealand for holidays.

With regard to climate change in the longer term, Cam remembers when people said they'd be growing bananas in Northland due to global warming. He'll keep using deep-tap-rooted plants and will diversify into cereals to fill in gaps if he thinks it will be a wet winter.

Temperatures reach 50°C in summer, so Cam and Lana are changing to calving in autumn (February) and drying off the cows in mid-December, to get away from milking in the heat and to become less reliant on expensive summer irrigation. This means they will be milking when they should be getting more rainfall, although to protect the lucerne in the paddocks, they may need to feed more hay and stand cows off on the cow yard or rock pad at the back of the milking shed, ... *'no different to Southland'*.

Overall Cam reckons they will have 80% drought proofed themselves by using the lucerne (with its ability to gather moisture from deeper in the soil). However, he's keen to enter the Australian Farmer of the Year competition so his approach can be judged by his peers. In the meantime he's achieved his biggest goal, even if he couldn't achieve it in New Zealand.

I've dreamt of owning my own farm since I was a kid, milked cows, shorn sheep, did whatever I could, I just loved farming. I think New Zealand has now got to the stage where it's just out priced itself for a young guy.

9.6 Discussion of case studies

The four case studies appear to fall neatly into characterisations of two relatively older and ‘conservative’ Australian and two relatively younger ‘innovative’ New Zealand farmers, but we should resist this classification because the New Zealanders were likely to display attributes that differed from the accepted practice by virtue of having moved to Australia. It should be noted that both Giblin and Farley are well respected within the dairy industry, and whilst describing themselves as ‘hobby farmers’ compared with larger New Zealand farms, both are successfully making choices that fit their respective philosophies.

The four Australian case studies covered some of the key strategies highlighted by the conceptual framework, but also highlighted again how different a small group of farmers can be in their approaches.

- Giblin – a low-input (feed and labour), low-cost and hence low-risk farming approach focused on meeting his and his family’s lifestyle choices whilst achieving off-farm financial diversification
- Chapman – scale and productivity model to be built on leverage and trans-Tasman family financing – the modern NZ dairy approach transposed and adapted
- Farley – investment in feed self-sufficiency to control input costs, maximise productivity, but self/family financed
- Brown – a low-cost, low-scale and low-productivity model to be built on leverage combined with innovative thinking and risk taking in the face of entrenched farm management patterns and attitudes about ownership of water

None of the case studies reflected the use of market-risk strategies, which supports the earlier conclusion that these aren’t widespread strategies and tend to be adopted by larger farms. However, both Giblin and Chapman supported the OECD conclusions around co-variance between output and input prices.

Three of the case studies utilised healthy amounts of leverage, but Giblin seemed more concerned to reduce his leverage to local averages than Chapman or Cam. Farley had self-financed the investment in his farm without external leverage. Only Giblin had significant off-farm investments in place, although Chapman and to a lesser extent Farley were actively considering them. None were using FMDs. Also, typically for dairying, none were undertaking enterprise diversification, although Brown was considering diversifying to cereals.

The most innovative strategy from a New Zealand perspective may be Brown’s decision to not buy permanent water rights. This strategy is growing amongst farmers in northern Victoria, although it is dependent on timing in the water-value cycle. We heard stories of farmers who’d sold their temporary rights during the drought and made more money than they could have had they continued farming. Conversely we also heard of farmers who had sold the permanent rights at the insistence of their bankers in order to restructure their balance sheet and equity/debt levels.

Whilst some water trading occurs in New Zealand, it isn’t at the level occurring in the Murray Basin. Water values are separately identified on the balance sheet, encouraging farmers to make decisions about whether to free up capital that would otherwise be tied up in the balance sheet.

10 Conclusions

10.1 Objectives

The objective of this research was to identify alternative business models, financial strategies, products and services that can increase farmers' adaptive capacity for climate change, by investigating how farmers and the finance sector in Australia have responded to historical climate variability and extreme events, and how the strategies they developed could be applied in New Zealand.

Given the research findings Landcare Research has concluded that this research has not highlighted any novel business models, financial strategies or products/services that may be relevant to dairy farmers in New Zealand.

The research does however highlight the current rural banking and insurance practices and products available and in development in the two countries. It also discusses differences in the attitudes of farmers to debt/equity levels between the two countries, which are driven by a mixture of factors.

10.2 Methodological limitations

The initial focus on the kiwifruit and dairy sectors in the case studies limited the breadth of our findings more than was initially anticipated. This is, firstly, because of our inability to access kiwifruit growers for case studies in Australia, despite Victoria being the biggest State producer of kiwifruit. Secondly, the dairy industry, unlike Australian broad-acre farming, tends to focus on specialisation, intensification and economies of scale rather than diversification as a strategy for managing risk. This limited our research in relation to diversification, although one form of diversification in dairying is vertical diversification (i.e. investment in the processing chain through cooperatives).

The case studies in this project only focus on smaller farmers and given the ongoing media commentary around the corporatisation and increases in scale in farming in New Zealand it is disappointing that we could not attract a larger-scale farm as a case study. As noted by Antle and Capalbo (2010) smaller farms tend to manage a wider range of crops/livestock and rely more heavily on off-farm income, whilst larger farms tend to be more specialised, stronger financially and use market-based risk management tools.

10.3 Role of financial institutions

The comparative review of insurance products highlighted some nascent insurance products that are emerging for sectors of Australian agriculture such as grains, where there is comparatively little control over the factors of production. These products are designed to avoid the issues highlighted in various government reviews of multi-peril crop insurance (MPCIs), but it is too early to judge their commercial success, long-term feasibility and hence potential for transfer to New Zealand.

Whilst there remains interest in the potential role of insurance products in assisting farmers to adapt to climate change within government policy circles and amongst influential bodies such as the OECD, there is little interest in developing new products amongst New Zealand and Australia insurers and currently amongst the international reinsurers.

There is a wider range of other financial instruments, such as commodity derivatives, in Australia than in New Zealand, and these have the potential to assist Australian farmers in seeking to hedge against the impacts of climate variability, either through output or input price risks. However, in relation to dairying, interviewees suggested that New Zealand is the more innovative market in terms of financial products and no novel financial products were identified as being used in Australia that weren't available to New Zealand dairy farmers. However, the greater availability of cereal-based feed inputs in Australia provides a broader market for forward contracting of feed inputs than in the largely pasture fed New Zealand dairy industry.

Rural banking in New Zealand and Australia is dominated by the same big five banks, of which all but one are Australian owned. Whilst interviewees did comment on lags between the two countries in terms of the uptake of certain financial products (e.g. interest-only loans and revolving credit), our review of banking products failed to identify any different, new or innovative banking products available in Australia but not in New Zealand.

The exception to this was the Australian Government-backed Farm Management Deposits scheme FMDs. This income-smoothing scheme was introduced in 1999 and aimed to increase farmers' self-reliance by providing liquidity to reduce exposure to fluctuating incomes due to climate variability and world markets. Farmers in EC-declared areas can access deposits within the 12-month time frame. Whilst administered by the ATO the scheme enables private banks to offer FMD deposit products to farmers, the level of uptake varies between sectors and states but at September 2011 there were 38,406 FMD deposits totalling over A\$2.9 billion (DAFF 2011), implying an average deposit of A\$75,000. Recent legislative changes have extended the mechanism to allow withdrawals under the NDRRA (e.g. for adverse events other than drought) and to allow farmers to hold multiple FMDs with different banks, thus increasing competition between the banks.

Our review of trans-Tasman credit practices for WNZL and WBC revealed significant similarities in processes, with differences at the sector level to account for local business conditions. For the dairy sector, current equity minimums and Loan Valuation Ratios (LVRs) appear equivalent or slightly more conservative in New Zealand than Australia. The measure of interest cover (CAFDS ratio) in Australia is more conservative, at least for larger farms.

However, higher LVRs and lower CAFDS ratios were the predominant practice in New Zealand up until the Global Financial Crisis of 2008–09. Lower levels of equity amongst New Zealand farmers therefore reflect the supply of credit, as well as demand by farmers. Whilst general agricultural land is more readily available and hence comparatively cheaper in Australia than New Zealand, Australian land suitable for dairy farming and which is more like New Zealand in its characteristics or at least with water availability is expensive in Australia and closer to New Zealand prices (e.g. Gippsland, Victoria).

From the Australian perspective, it remains an open question as to whether farmer equity levels of 70–80% in Australia (compared to equity levels of 50–60% in New Zealand) reflect an overly conservative approach to leverage by the majority of Australian farmers and their bankers, or reflects experiential knowledge by the Australian farmers of the necessity of maintaining the capacity to buffer or adapt to shocks caused by climate variability and extreme weather events.

Conversely, from the New Zealand perspective, farmers have been increasingly using higher levels of leverage as a way to access land and to increase the productivity of their herd, whilst

from the banks' point of view, their willingness to lend against lower levels of equity, particularly for dairying, reflects the perception of the security of cash flow from dairying in what is viewed as a relatively benign climate.

From the literature review it's worth reiterating Shadbolt et al.'s (2001) conclusions that efficiency measures and liquidity measures are good proxies for the resilience of dairy farmers to both positive and negative shocks. However, during negative shocks, low solvency ratios (i.e. high equity levels and debt servicing capacity) and smaller size and less intensity are predictors of resilience. Conversely, during positive shocks high solvency ratios, larger size and greater intensity were predictors of resilience.

From this conclusion we could suggest that Australian farmers have structured their businesses and finances (low intensity, low solvency, higher liquidity) to be more resilient in an environment of negative shocks, whilst in New Zealand dairy farmers are structured to maximise returns under positive shocks. If climate change's impacts on certain regions of New Zealand bring an increase in negative shocks (such as drought or other adverse weather events) then New Zealand dairy farmer business models may have limited resilience.

Whilst historically there may have been looser bank credit practices in New Zealand than was desirable, these appear to have been moderated by the banks themselves since the GFC of 2008–09, as well as, to a degree, through the mechanism of the recent Reserve Bank intervention to increase capital requirements for rural loans.

10.4 Role of government

The New Zealand On-farm Adverse Events Framework is one mechanism for direct government assistance to primary producers who may in future be affected by climate change. The framework is based on a risk management perspective and farmers and rural businesses are encouraged to take a proactive approach to risk-adverse events. The framework stresses the relationship between support for uninsurable risks, highlights the need for farmers to insure where possible, and does not preclude the development of new insurance products.

The New Zealand Adverse Events Income Equalisation scheme run by the IRD is focused only on livestock-related losses. Its low uptake and the ability of IRD to grant relief through the main IE scheme means it may be reviewed in future.

Australian National Drought Policy, including the Exceptional Circumstances (EC) regime and its associated interest rate subsidies, is still potentially subject to change in future in Australia. The final results of the Western Australia Drought Pilot will inform what policy choices are put forward for the scheme; however, the breaking of the prolonged droughts of the last decade has brought significant relief to many states and reduced the political priority placed on further review of the current system. Currently the emphasis of the initial review of the pilot suggest outcomes in line with the Productivity Commission's (2009) focus on increasing strategic-planning capability amongst farmers.

The New Zealand and Australian schemes of government assistance for adverse weather events differ considerably in their design, their focus on farm families versus the farm business, direct financial impacts, and the respective costs to government. This is significant when trying to compare the countries, as the financial strategies of Australian farmers experiencing extreme weather events appear to be affected by the existence of the interest subsidies under EC legislation and the existence of FMDs as liquidity/tax-spreading tools.

What also seems to pass unremarked in the Australian Government literature is the conclusion from Kimura and Antón (2011) that EC interest rate subsidies support the more highly leveraged risk-taking farmers.

Additionally, the insurance and banking industries are also potentially crowded out of development of new products to assist with climate variability/change through these Australian Government assistance schemes. In the case of banks, the existence of government interest subsidies potentially mutes the signals from interest repayment defaults and potentially encourages higher than sustainable levels of debt lending by rural banks.

As discussed under Financial Institutions above, FMDs are the only banking instrument for which there is no direct equivalent in New Zealand and have been recently extended in Australia to wider triggering circumstances and wider private provision. However, there are valid criticisms in Australia as to whether they work as originally envisaged (i.e. to enhance liquidity) given that they are competing with modern loan developments such as revolving loans. It is possible FMDs are simply just providing a tax-smoothing mechanism for older, more cash endowed farmers and growers instead of younger farmers with higher debt who may be more in need of assistance.

10.5 Case studies

We undertook four case studies, three in South West Victoria and one in northern Victoria. Two of the farmers were third or greater generation Australian farmers, whilst two were New Zealanders who had relocated and bought farms in Victoria in the last seven years. All had experienced drought, although more severely in the case of northern Victoria.

The four Australian case studies covered most aspects of the conceptual framework, but also highlighted again how different a small group of farmers can be in their approaches. The key gap against the framework related to enterprise diversification, which is not commonly sought by dairy farmers.

Whilst not currently directly translatable to the New Zealand environment, the flexibility that the trade in water shares, both permanent and temporary, brings to farmers' decision-making processes and their ability to arrange their finance more flexibly was notable for encouraging innovative thinking.

11 Recommendations

Given the limited breadth of the research findings the recommendations are narrowly focused:

- Further research on the actual uptake and impact of weather-index insurance products identified (e.g. YieldShield) would clarify if these products will become established in Australia.
- Due to the benefits of potential spill-over effects, government research funding should continue to focus on providing information about climate change impacts for farmers and the finance institutions, to facilitate better inclusion of risk information into credit-risk processes and insurance.
- Based on a comparison of the New Zealand Income Equalisation Scheme run by IRD with the Australian FMD scheme run by ATO but delivered through private banks, there is merit in investigating the potential to transfer the IRD scheme to the private sector in a similar manner to the FMD scheme, on the grounds of reduced government administration costs and that finance currently tied up in the government's balance sheet could instead be used productively elsewhere in the economy. This recommendation has not been discussed with the IRD.
- Further investigation of the impacts of shocks on different farm business / financial models could be commissioned by government or industry and promoted within the industry as a way of understanding optimal strategies in the face of predicted increasing variability in climate and market shocks in the future.
- Government officials should keep abreast of the final review of the Western Australian Drought Pilot and consider whether any conclusions are applicable in the New Zealand context.
- Following the recommendations of the Western Australian Drought Pilot, there may be potential benefits in the New Zealand dairy industry from working collaboratively with the banking industry to investigate and promote a joint understanding of optimal dairy farm performance and risk minimisation, collective agreement on key financial indicators, and joint training on financial management and total wealth planning.
- Whilst agriculture is not specifically highlighted, the Issues Paper for the Australian Productivity Commission inquiry into regulatory and policy barriers to effective climate change adaptation includes questions focused on the potential role of financial services (in particular insurance) in relation to effective climate adaptation and should be reviewed when the inquiry is complete (Productivity Commission 2011).
- Further research into and promotion of the financial flexibility and returns provided by water trading in Victoria may be useful in informing the debate about the advantages and disadvantages of water trading for farmers in New Zealand.

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13 Acronyms and Glossary

ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ATO	Australian Taxation Office
CAFDS	Cash Available for Debt Servicing
Climate change	Climate change refers to any change in climate over time, whether due to natural variability or as a result of human activity (Adger et al. 2007). The IPCC notes that the UNFCCC attributes climate change to anthropogenic causes. This usage of the term is reflected on New Zealand government websites (e.g. MAF) and in the New Zealand media. By contrast, Australian government websites (e.g. DAFF) at least at the surface level discuss climate change in relation to a ‘global trend’, rather than attributing it to human activity.
Climate variability	Variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc..) of the climate on all spatial and temporal scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability). (IPCC 2007)
DAFF	Department of Agriculture, Fisheries and Forestry – Australia
DAF WA	Department of Agriculture and Food – Western Australia
DPIV	Department of Primary Industries Victorian
ECIRS	Exceptional Circumstances Interest Rate Subsidy
ECRP	Exceptional Circumstances Relief Payment
Extreme weather event	An event that is rare within its statistical reference distribution at a particular place. Definitions of ‘rare’ vary, and the characteristics of what is called ‘extreme weather’ may vary from place to place. Extreme weather events may typically include floods and droughts (IPCC 2007)
FMD	Farm Management Deposits
GFC	Global Financial Crisis of 2008–09
IPCC	Intergovernmental Panel on Climate Change
IRD	Inland Revenue Department New Zealand

MAF	Ministry of Agriculture and Forestry – New Zealand
MfE	Ministry for the Environment – New Zealand
MPI	Ministry for Primary Industries – New Zealand
NZETS	New Zealand Emission Trading Scheme
ROE	Return on Equity (also commonly referred to as Return on Capital)
UNFCCC	United Nations Framework Convention on Climate Change
WINZ	Work & Income New Zealand

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Appendix 1 – Interviewee Questionnaire

Project: Farm-level Adaptive Capacity to Climate Change: The role of Financial Strategies and Institutions

Interview Questionnaire

Details

Interviewee/s: _____

Location: _____

Farm/ Business name/s: _____

Nature of farm business: *(e.g. 100% Dairy)* _____

How long have you been farming ? _____ (years)

How long have you been on this farm ? _____ (years)

What is your ownership status? Owner –Operator/ Share milker/Corporate/Other _____

How is your farming activity legally structured (Family Company, Family Trust _____

Is this farm your primary source of income? _____

Background

Whilst farm management is made up of interactions between financial decisions, production decisions, social/family decisions, the natural environment, etc this project is focusing on farm financial decisions or strategies that may assist other farmers faced with increased climate variability.

Examples of financial strategies could potentially include:

- low/high gearing rates compared to Australian averages
- maintaining liquid reserves(e.g. through high farm management deposits)
- management of input costs (e.g. choices between on-farm and off-farm feed inputs)
- diversification of income on farm (e.g. grain sales)
- diversification of income or assets off farm (second jobs, or property/shares, etc)
- specialising for larger scale or greater intensity to increase margins
- deferring or investing in capital (e.g. for increased feed storage)
- asset management (e.g. selling tradeable water rights)
- equity partnerships/corporate models; and other strategies

Interview Questions

1. Tell me about how you came to be farming here?
2. What have been the impacts of climate variability and drought/floods or other weather related events on your region and your farm over the last five –ten years? Have any other factors been as/more significant?
3. Do your farm financial strategies allow for the impacts of climate variability or extreme events?
4. Have you changed them or introduced new financial strategies over time? Do you have any planned strategies for the future?
5. What role did financial institutions (banks, insurers, others) play in supporting farmers through the recent drought and floods?
6. What role did those financial institutions play in the financial strategies you have described above? How could they assist with your future strategies?
7. What role did government (Federal, state, local, others) play in supporting farmers/your farm through the recent drought and floods or in for future?
8. What role did government play in the financial strategies you have described above? How could they assist with your future strategies?
9. Are there any other conditions that you think have supported farmers and the finance sector to cope with Australia's variable climate?
10. How do you think predicted climate change will impact on your farming business and financial strategies in the future? Will you alter what you are doing?

Physical characteristic of your farm

NB: All items will be treated confidentially, except (with your agreement) those marked *. Feel free to indicate a range or to leave blank and discuss during the interview. For both tables all definitions are as per the Dairy Industry Farm Monitor Project /Taking Stock (Dairy Australia software). If the data you have to hand is in different units e.g. cents/litre of milk just enter those and I will convert.

	<i>WestVic Average</i> ¹¹	<i>Your Farm</i>
<i>Period</i>	<i>2010-11</i>	
<i>Annual Rainfall (mm/ha)*</i>	<i>1,021</i>	
<i>Water Used (Irrigation+ rainfall) (mm/ha)*</i>	<i>1,099</i>	
<i>Total Useable Land (ha)*</i>	<i>322</i>	
<i>Stocking rate*</i>	<i>1.2</i>	
<i>Description of On Farm Feed types (e.g. hay/silage)</i>	<i>-</i>	
<i>Description of Bought in Feed types (e.g. grains , mixed, concentrates)</i>	<i>-</i>	
<i>Use of grain (tonnes per cow)*</i>	<i>1.0-2.0t</i>	<i><0.5t 0.5-1.0t 1.0-2.0t > 2.0t</i>
<i>Description of On Farm Non-dairy activities/crops, etc.</i>		
<i>Milk sold (kg MS/ha)</i>	<i>585</i>	
<i>Ave Price received /kg MS (or litre)</i>	<i>\$5.64</i>	
<i>Own and employed labour (Full Time Equivalent)</i>	<i>4.2</i>	

¹¹ 2010/11 South West averages from Dairy Industry Farm Monitor Project, available from <http://www.dairyaustralia.com.au/Statistics-and-markets/Farm-facts/Farm-profitability-statistics.aspx>

Financial characteristics of your farm

All items will be treated confidentially, those marked * may be published (with your agreement). If uncomfortable please leave blank and we can discuss during the interview.

	<i>Indicator</i>	<i>WestVic Aves 12</i>	<i>Your Farm</i>		
<i>Gross Farm Income</i>	<i>Cash receipts (\$/ha)</i>	\$3,698			
	<i>Milk receipts*</i>	87%	<i>% of Gross farm Income</i>		
	<i>Livestock trading</i>	9%	<i>% of Gross farm Income</i>		
	<i>Other Farm Income</i>	4%	<i>% of Gross farm Income</i>		
<i>Cost of production</i>	<i>Variable, Overheads, Depreciation, and Own Labour (\$/kg MS)</i>	\$4.63			
<i>Variable Costs</i>	<i>Purchased feed, etc*</i>	29%	<i>% of Cost of production</i>		
	<i>Home grown feed cost*</i>	17%	<i>% of Cost of production</i>		
<i>Overheads</i>	<i>Overhead costs/kg MS</i>	\$1.06			
<i>EBIT</i>	<i>EBIT /ha</i>	\$1,022			
	<i>Interest payments/kg MS</i>	\$0.95	<i>Lower – Average- Higher</i>		
<i>Return on Assets*</i>	<i>EBIT/Total Farm Assets</i>	5.5%	<i>%</i>		
<i>Return on Equity*</i>	<i>Net farm Income/ Equity</i>	5.8%	<i>%</i>		
<i>Assets</i>	<i>Land values (\$/ha)</i>	\$11,721	<i>Lower – Average- Higher</i>		
	<i>Liquid assets inc FMDs¹³</i>	\$113,400			
	<i>FMDs (\$)*</i>	\$27k	< \$20k	\$20-\$40k	> \$40k
	<i>Off Farm Investments(\$)*</i>	-	<i>Types only</i>		
	<i>Total Assets (\$/ ha) *</i>	\$15,457	<i>Range</i>		
<i>Ave Equity</i>	<i>Equity/ Total Assets*</i>	65%	< 60%	60-70%	>70%
<i>Off Farm Income *</i>	<i>E.g other employment, govt payments, etc</i>	21,630	<i>Lower – Average- Higher</i>		

¹² Per Dairy Farm Monitor Project (2010/11) (Dairy Australia).

¹³ Source ABARES Australia Dairy Financial Performance 2008–09 to 2010–11 (2009–10 figures)

Appendix 2 – NZ Banks’ Products and Services

Publically offered products and services as per banks’ websites accessed 21 November 2011

Products/ Services	ANZ Rural	ASB Rural	BNZ Agribusiness	National Bank Rural	Rabobank Rural	Westpac Agribusiness
Market Share	With National ~ 36-39%	10–11% (14% 2009)	20%	With ANZ ~ 36–39%	~15%	~14%
Working Capital	ANZ Business Current ANZ Phone Direct ANZ Direct Online	Rural Cheque	Farm First Transact	Business FreePlan National Bank eSaver National Bank Online	All in One account	Business Transact account
Deposits		Business saver	Farm First Call account	Business Premium Call	All in One account	Business Online Saver Business Interest
Overdrafts	ANZ farm credit line ANZ redraw credit line (linked to variable loan)	Committed cash advance facility	Farm First Transact (optional overdraft)	Business FreePlan Pre-approved overdraft	All in One account	Covering cash short-falls Minimising the impact of seasonal fluctuations
Farm Loans	ANZ Farm Finance loan - Fixed & floating rate - Optional Interest only to 5 years	Fixed, Floating rate, Revolving Credit	Farm First term loan Fixed, Floating rate, 90 days – 10 years Farm First Rapid Repay (Revolving)	Fixed, Floating rate,	All in One account - Interest only to 15 yrs. - Interest payments to peak income matching Online fixed interest booking	Longer-term finance with fixed, fixed-forward, or floating interest rates

Products/ Services	ANZ Rural	ASB Rural	BNZ Agribusiness	National Bank Rural	Rabobank Rural	Westpac Agribusiness
Asset Finance	Via UDC Finance Ltd	Not separate from farm loans		Not separate from farm loans	Equipment finance > \$100,000 Lease and hire options	We can help with: Buying new equipment
Interest Hedging	ANZ Forward start (fix rate 1 yr in advance) Interest rate caps Interest rate swaps Interest rate collars	Interest rate swaps Interest rate swaptions (i.e. option on a swap) Interest rate collars Interest rate caps	Capped Rate Loans Loans with optional interest rate structures Forward Start Loans Interest Rate Swaps		Via Business pages: Interest rate hedging	
FX Hedging	NZD spots and forwards FCCY options FXOnline (Per Global Markets webpage)	FCCY deposits Global Mkts team	FCCY Term deposits Spot, forward, swap, and options BNZ Order Board eFX Dealing	FCCY Term deposits	FCCY spots and forwards FCCY options	FCCY spot rates FCCY insurance
Commodities	Agricultural products ETUs		Wheat, corn, and canola			

Products/ Services	ANZ Rural	ASB Rural	BNZ Agribusiness	National Bank Rural	Rabobank Rural	Westpac Agribusiness
Investments	Fixed & variable Term Deposits Otherwise via Business webpage only NB Direct Broking is a subsidiary	Easy Funds (Funds management) ASB Portfolio Series (\$500,000+) ASB Cash Fund (Unit Trust) Term Deposits Share trading Kiwisaver	Term Deposits	Term Deposits - 30 days to 5 years National Bank Term Fund (PIE) National Bank Call Fund Share & Bond Trading	Term deposits Short-term deposits Long-term deposits At call deposits Additional services for Corporates	Term deposits Term PIE funds Corporate Bond Fund Multi sector Unit Trusts Kiwisaver Mortgage Investment Fund Retirement Plan Cash Plus Fund
Insurance	Via Business webpage only (not rural specific)	Generic business operations (not rural specific)	Generic business options (not rural specific)	Rural Protect: Asset, vehicle, operations interruptions cover Some disaster cover EQs, landslips		Farm buildings and equipment, home and contents & vehicles. Accident or death.
Other Services		Equity Syndicates Succession Farm purchase negotiations	Buying or selling land, stock or equipment Budgeting/financial literacy Wealth management Succession and exit Business governance	Equity partnerships Business planning & succession Cash Manager RURAL(links to accounting product)	Equity partnerships Succession Education: Farm managers program Trade facility (importing and exporting)	

Products/ Services	ANZ Rural	ASB Rural	BNZ Agribusiness	National Bank Rural	Rabobank Rural	Westpac Agribusiness
Accessibility	Branch, phone, internet & mobile	Branch, phone, internet & mobile	Branch, phone, internet & mobile	Branch, phone, internet & mobile	Branch & Internet	
Website	http://www.anz.co.nz/rural/	https://www.asb.co.nz/rural	http://www.bnz.co.nz/business-banking/your-industry/agribusiness	http://www.nationalbank.co.nz/rural/	http://www.rabobank.co.nz/Rural/Pages/Rural.aspx	http://www.westpac.co.nz/olcontent/olcontent.nsf/Content/AgriBusiness+HomePage

Appendix 3 – Comparison of NZ and Australian Dairy Statistics

	2009–10 Dairy NZ Economic Survey			ABARE	2009–10	
	New Zealand			Australia	Dairy Monitor	Dairy Monitor
	All	Taranaki	Marlborough Canterbury	All	West Vic	North Vic
Physical Indicators						
Average Annual Rainfall (mm)	1250	1200–1600	500–1000	n/a	849	556
Milking Land (ha)	134.2	96.1	208.8	249.0	322.0	216.0
Total Herd/Peak Cows	377	274	692	340	369	282
Stocking Rate	2.8	2.9	3.3	1.4	1.1	1.3
Milk Production kg MS	129 049	90 531	299 532	90 247	185 607	145 230
Milk kg MS/ha	962	942	1435	362	665	806
Owner and Staff FTE	2.6	2.2	4.2	n/a	3.8	3.1
Milk Solids per FTE	49 339	41 179	70 479	n/a	43 392	46 880

Notes

Data sourced from Ryan et al. (2010), DairyNZ (2011) and Dharma (2011).

Note use of maximum cows milked at least 3 months in Victorian statistics, means herd sizes are not directly comparable.

	2009–10 Dairy NZ Economic Survey New Zealand			ABARE Australia	2009–10 Dairy Monitor Dairy Monitor	
	All	Taranaki	Marlborough Canterbury	All	West Vic	North Vic
	<u>NZD</u>	<u>NZD</u>	<u>NZD</u>	<u>NZD</u>	<u>NZD</u>	<u>NZD</u>
Financial Performance						
Gross Farm Income	841,784	583,711	1,941,631	631,050	1,222,312	889,197
Gross Farm Revenue /ha	6,273	6,074	9,299	2,534	3,796	4,117
Gross Farm Revenue /kg MS	6.52	6.45	6.48	6.99	6.59	6.12
Cash/Working Expenses						
Wages/Hired Labour	78,139 17%			31,346 7%	106,699 13%	67,190 9%
Net Feed Made, Purchased, Cropped	83,985 18%			162,621 35%	280,143 35%	322,620 44%
Fertiliser (incl. Nitrogen)	70,422 15%			37,991 8%	97,723 12%	31,937 4%
Electricity	13,240 3%			15,422 3%	16,627 2%	15,045 2%
Repairs and Maintenance	32,798 7%			42,505 9%	65,685 8%	46,975 6%
Other	180,206 39%			169,517 37%	229,210 29%	250,152 34%
Farm Working Expenses	458,790	279,741	1,048,362	459,401	796,088	733,918
Farm Working Expense/ha	3,419	2,911	5,021	1,845	2,472	3,398
Farm Working Expense/kg MS	3.56	3.09	3.50	5.09	4.29	5.05
Cash Operating Surplus	382,994	303,971	893,269	171,649	426,224	155,279

Notes

Grey shaded or n/a – not available or not applicable

	2009–10 Dairy NZ Economic Survey			ABARE	2009–10	
	New Zealand			Australia	Dairy Monitor	Dairy Monitor
	All	Taranaki	Marlborough Canterbury	All	West Vic	North Vic
Change in Dairy Livestock Valuation	327			18,055	-4,768	-6,094
Feed Inventory Gain	0			0	36,456	22,807
Less Labour Adjust/Imputed Owners Labour	52,969			75,856	128,118	115,267
Less Depreciation	56,300			41,000	47,348	37,442
Less Owned Run Off and Other Adjustments	11,379					
Net Adjustments	-120,321	-101,872	-193,163	-98,801	-180,235	-158,802
Dairy Operating Profit	262,673	202,098	700,106	72,847	245,989	-3,523
Operating Profit /ha	1,957	2,103	3,353	293	764	-16
Operating Profit /kg MS	2.04	2.23	2.34	0.81	1.33	1̄0.02
Return on Assets	4.6%	3.5%	11.5%	1.2%	3.0%	0.8%
Return on Equity	2.7%	1.9%	16.3%	0.6%	4.2%	-3.9%
Equity Ratio	54%	56%	50%	82%	66%	58%
Debt Servicing (Interest/Total Income)	23%			9%	15%	10%
Liquid Assets incl FMDs	n/a			148,453	52,081	131,892
Farm Management Deposits	n/a			27,835	21,941	11,389
Average Land Price/ha	27,894			n/a	17,231	9,570

Notes Exchange rate used annual average July 2009 to June 2010 of 0.79756

Appendix 4 – Institutional Analysis: Australian Government Interviews

Refer separate report

