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Resilience in Retrospective: Analysis of Response to Shocks and Stress in the New Zealand Kiwifruit and Sheep and Beef Sectors

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Executive Summary

Sustainability forms a key concept within the Agriculture Research Group on Sustainability (ARGOS) project. Since the project was initiated in 2004, however, sustainability has been exposed to increasing scrutiny as an operational concept in the assessment and promotion of improved social and environmental outcomes in agriculture production. This report, thus, involves the further elaboration of two alternative approaches to sustainable practice: resilience theory, a concept given initial application in the work of the ARGOS environmental objective (Maegli et al 2007); and the capitals approach to assessing sustainable practice, which has been addressed by the economic objective (Saunders et al 2010). Here the focus is on the narratives of change told by the farmers and orchardists participating in the project.

For the purposes of this report, resilience theory is used to provide means to frame processes of change. In particular, the analysis examines the capacity of the farmers and orchardists to develop successful strategies in response shocks and stress relating to economic, environmental or social events. The expectation is that such events have the potential to disrupt existing patterns and relationships (or the system) of production leading either to the consolidation of management practice along similar lines or the complete reorganization of the system with subsequent impacts on the economic, environmental and social outcomes. In addition, the relationship between the capitals approach to sustainability and resilience perspectives provides a vehicle for examining the role that the economic, environmental and social context plays in enabling or constraining the capacity to respond to shock.

One of the principle limitations to examining the contribution of a resilience perspective to the assessment of sustainable practice in the ARGOS project lies in the temporal focus of the research. During the initial period, all ARGOS research objectives used contemporary data gathered since 2004. Given that the participating farmers and orchardists were exposed to a limited range of shocks or stresses during this period, it proved difficult to provide a comprehensive assessment of resilience of the individuals or sectors participating in the project. In order to capture a greater diversity of shock and response, the research used retrospective interviews in which participants were asked to relate their experience with change in management practice. Given the emphasis placed on the potential or discrete events to impose shock or stress on management systems, the interviews used a timeline of such events to guide discussion.

The principle finding of the research was that the interview participants' understanding of shocks and stress was quite different from that of the research team. Whereas the research team was able to list over 20 potential shock events for the sheep and beef and kiwifruit sectors, the farmers and orchardists only indentified a single shock in each sector between 1970 and 2010. Each of the shocks (the 1980s agricultural policy reforms for sheep and beef and the 1990s kiwifruit market collapse) was associated with a period during which the respective sector was exposed to successive events with the additive impact of initiating a crisis. Where these events were recognised as shocks, the broader narrative of the interviews was one of continuity.

The data from the interviews challenged the straight-forward application of resilience theory and the associated use of capitals.

1. The adaptive cycle of growth, accumulation and rigidity, crisis and, then, reorganisation proposed in resilience theory proved best suited to periods surrounding disruptive shocks. Throughout the remainder of the period examined, the cycle appears to involve relatively slow and gradual development of strategies designed to deal to experience.
2. The response of individuals to shock and stress was diverse and the different trajectories of response that emerged could not be associated with better or worse outcomes.
3. A further implication of the diversity of response and impact involved the difficulty in disentangling optimum responses or sets of practice from the range that were employed in response to the various events. In fact, this diversity arguably added to the resilience of the sector by maintaining the different combinations necessary to respond to variety of shocks.
4. It was difficult to establish relative amounts of capital types (human, social, cultural, human-made, natural) and their variation over time in retrospective interviews, in part because such categories were not always clear to the interview participants.
5. While some recognised the value of high amounts of a given capital (financial, natural, etc.) in meeting the challenges of particular events, not all participants claimed to have benefited in this way. It was apparent that shared metrics for assessing the capitals were nonexistent.
6. Intensification can be viewed as a response to shock and stress, but it is applied in distinctive ways by farmers. This variation in adoption of intensive practice suggests that it does not necessarily involve a reduction in resilience. A more appropriate assessment of resilience impacts may involve a more concerted focus on the extent to which reliance on ecological, social or economic subsidies is increased.

Despite the limitations to the application of a resilience perspective identified through the analysis, concepts from resilience do provide the basis for conclusion regarding the potential to encourage or increase the resilience of agricultural sectors.

1. A principal distinction evident in the interviews involves the relative level of collaborative purpose in the kiwifruit and sheep and beef sectors. Based on the interviews, kiwifruit orchardists appear to operate in an environment with greater buffers to shock. There also appears to be capacity to enhance collaboration within the sheep and beef industry.
2. Advantages for resilience at the sector level are evident in the greater capacity for learning and a more stable infrastructure and support services in the kiwifruit sector.
3. Future disruptive shocks (including climate change and peak oil) have yet to impact on New Zealand farmers and orchardists to the extent that existing mitigation strategies fail to provide coping mechanisms. A danger of the desirability of continuity is that existing mitigation strategies may underestimate the impact of future shocks and leave farmers, orchardists and industries ill-prepared for the potential disruption.
4. Quality assurance (QA) audits offer a potential mechanism for increasing resilience in a sector by introducing a common purpose (a uniform criteria for quality in the sector) as well as a shared reward system (through verification of practice and possible price premiums). The experience of the kiwifruit industry also demonstrates the need for good management at all levels of the value chain to ensure the interests and vulnerabilities of all stakeholders are recognised and respected.
5. There is further potential to improve QA audits by retaining their 'reflexivity' (response to social, environmental and economic feedbacks) and learning capabilities.

The assessment of the retrospective interviews demonstrates that farmers and orchardists can be very resilient to shocks and stresses of agricultural production. Unfortunately, this may involve periods of severe self-exploitation or economic stress. The current production environment requires the active efforts of industry, local and national government and community to support the development of more resilient management on farms and orchards in New Zealand.

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Sustainability in the ARGOS project

Sustainability is a concept that has been subject to increasing criticism as a palliative that fails to adequately address the growing threats to the environmental health of places, regions and the globe more generally. Since it first achieved popular traction in policy circles stimulated by its utilisation in the Brundtland Report (produced by the United Nations World Commission on Environment and Development, WCED 1987), sustainability has entered popular parlance as a declared objective of government policy, business strategies, research programmes and alternative social movements among others. In the process, its definition has been diluted and expanded to the point that inconsistencies of usage emerge (Lele 1991). The resulting fractured usage has led to attempts to better qualify sustainability (e.g., as having three pillars – economic, environmental and social), to develop appropriate and accessible indicators (e.g., the capitals approach to sustainability from ecological economics, see Saunders, et al 2010) and to propose alternative conceptualisations (e.g., resilience theory, see Folke, et al 2002).

Despite its inclusion within the title of the research project, sustainability is also a source of debate within ARGOS (the Agriculture Research Group on Sustainability). Initially, the general conception of maintaining the viability of agroecosystems (as key points of human-environment interaction) was a sufficient basis for designing research with the objective of comparing the environmental, social and economic conditions of distinct management practices in New Zealand's kiwifruit and sheep and beef production sectors. Upon arriving at the point of making definitive statements regarding the relative or absolute sustainability of the different practices (and their interaction within the sectors as larger-scale systems), however, the need for more clearly defined and policy relevant terms and measures became apparent. As a result, two (potentially reinforcing) approaches to sustainability have been mooted within the project, namely the capitals and resilience approaches (Campbell et al 2012). The capitals approach offers a means to identify and measure indicators of sustainability across a range of aspects (including social, cultural, human, natural and human-made) facilitating temporal accounting of change in the capacity to invest or exploit resources for sustaining a given production system. The merits of the capitals approach and its potential application within the ARGOS project have largely been documented (see Parsonson-Ensor and Saunders 2011; Saunders et al. 2010). By comparison, interrogation of the resilience approach within ARGOS has been limited by the project's focus on contemporary practice during a period of limited exposure to diverse systems shocks. Thus, the objective of this report is to provide an evaluation of the resilience approach as a means to assess the sustainability of the kiwifruit and sheep and beef sectors in New Zealand and to assess the potential of integrating insights from the capitals and resilience approaches.

The concept of resilience offers the potential benefit of greater insight to the process (and the space for policy interventions within that process) through which a socio-ecological system evolves, especially in regard to the impact of negative stress or shocks (Abel and Stepp 2003; Adger 2000; Walker et al 2004, Young et al 2006). The first section of the report provides a brief review of the conceptualisation of system process and evolution in the literature on complex socio-ecological

systems. In order to address the emergent nature of the systems postulated in this literature, ARGOS proposed and conducted a series of retrospective interviews in which participating farmers and orchardists were asked to relate their experiences of change in management practice. The analysis of the resulting narratives facilitated the assessment of a diverse range of potential shocks or stresses and their impacts on farming practice. In the report, two exceptional events or sets of conditions were recognised as causing perturbations in the wider management strategies and practices utilised within the respective sectors. The first section of the analysis examines the unique characteristics of these events such that they are commonly recognised as causes of change among the participants. The subsequent analysis addresses the less disruptive shocks and stresses relative to their origin in environmental, economic and social dynamics. In this case, the general characterisation of response among the participants is one of continuity in relation to management, challenging efforts to distinguish specific points (tipping points) at which significant alternation of the system occurred. In light of a persistent tendency toward intensification in agricultural production in New Zealand, a final section of the interview analysis examines case study farms representing extreme trajectories (either in pursuing or limiting) of intensification within the ARGOS participants to assess the systems' repercussions of this type of response. In the following sections, the findings from the interview analysis are used as the basis to assess the potential impact of likely future shocks or stresses in each sector. Based on this analytical framework, the report concludes with observations on the implications of resilience and capitals perspectives for assessments of sustainability and recommendations for policy in the context of New Zealand agro-ecosystems.

Resilience theory and sustainability

Resilience is a concept that is increasingly utilised in discussions about sustainability (Abel and Stepp 2003; Adger 2000; Fiksel 2003; Walker et al 2004), although it is generally conceived as an aspect of more comprehensive complex systems approaches (Fraser 2003; Janssen and Ostrom 2006; Walker et al 2004; Young et al 2006). Within this literature, the value of a resilience approach lies in its greater capacity for both theoretical application and illumination of process (thus facilitating policy intervention). The most common usage of the concept of resilience (leading to the designation of 'resilience theory') is within complex ecological systems approaches developed by authors such as Holling (1973; 2001; 2004), Folke (2006), and Gunderson (2000). In his study on ecosystem dynamics, Holling defines resilience as "a measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables" (Holling, 1973: 14). The potential value of a resilience approach within ARGOS as a research framework has been identified by Moller et al. (forthcoming).

One of the underlying premises of the resilience approach is that uncertainty is the one constant in SESs. In this context, sustainability of a given system rests not in achieving a set and fixed target, but in the capacity to maintain beneficial elements of the system despite the perturbations caused by long-term stresses or sudden unexpected shocks. It is important here to distinguish between the concept of stress and shocks. In many discussions of ecological systems, shock (or disturbance) is described as a dynamic that has a direct impact on physical entities in such a way that changes the

system's minimal structure (Picket et al., 1989)—that is, the structure necessary to maintain the system's identity. By contrast, stress exerts negative impact on system's processes without imposing change on the minimal structure. Stress can, over time, weaken the resilience of a system, making it more susceptible to shock. Similar discussions on social vulnerability (Turner et al., 2003; Adger, 2000) distinguish between perturbations (or shocks) and stress based on the range of variability and continuity of an event. The distinction between shock and stress is useful when formulating strategies to respond to changes. Darnhofer et al. (2010) assert that stresses occur in a slower and more predictable way, hence providing farmers sufficient time to adjust the farm structure or exploit more resources. Thus, shocks, by definition, are sudden disruptions that might lead to system changes and hence require more transformative response trajectories. The differentiation of shocks and stress is pertinent to the analysis in this report given that the producers recognised few shocks, challenging the perceptions of the research team that more events would be recognised as such.

In the development of the theory, researchers seek to adopt resilience thinking within studies of other complex systems, including economic (Brock et al, 2002), political (Pritchard & Sanderson, 2002), institutional (Moore & Westley, 2011), as well as agriculture and food systems (Ericksen, 2007; Darnhofer et al, 2010). The basis for such a wide application of resilience theory is that, like an ecosystem, these various systems similarly display attributes of Complex Adaptive Systems (Levin, 1999), with characteristics such as feedback mechanisms, emergent properties, and adaptive changes. Study of resilience in a coupled human-natural system was initiated by Holling (1986) in showing how societies have taken part in disturbed and managed ecosystems. From that point, many related studies have played a role in shaping the course of a new concept in resilience thinking, namely Social-Ecological Systems (SESs) (e.g. Carpenter et al, 1999; Walker & Abel, 2002; Olsson, 2004; Allison & Hobbs, 2004). The SES forms a single unit of analysis from which to identify emergent properties which remained unobserved in studies of social or ecological systems alone (Westley et al, 2002). Within this perspective, human actions are viewed as integral elements of a self-organising system rather than external forces that disturb the operation of the system. At the same time, Davidson (2010) also argues that social systems comprise features that are not found in the natural system, in particular symbolic constructions and reflexivity. This reflexivity is the basis of human agency (individual and collective), that is the capacity to actively adapts to as well as transform the trajectories of system development.

It is then apparent that there are two ways of understanding a farming system in resilience thinking. The first is by looking into the system as a complex adaptive system that behaves according to a particular pattern involving periods of growth, collapse, and reorganisation into either essentially the same system or an entirely new system's configuration that is more or less adapted to the changing environment (Gunderson & Holling, 2002). Each system encompasses smaller systems (e.g., nutrient cycling within the larger farm system) and is itself nested in a larger one (e.g., the value chain as a system encompassing numerous farming systems). The relationship between these adaptive systems at different scales is called panarchy. To some extent, the larger system performs as a 'state space' within which the focal system may reside and toward which it is attracted, a situation that is described by the idea of a 'basin of attraction'. By seeing a system through this

Folke et al. (2003)	Berkes (2007)	
Learning to live with uncertainty (Adaptability)	Social memory, “expect the unexpected”, increasing capability to learn from crisis	Being aware of changes, keep the farm flexible, keep debt at a reasonable level relative to assets, avoid long investment, alternative resources, exploit opportunities and new potential
Nurturing diversity	Spreading risks, increasing options in the face of hazards, range of economic opportunities, diversity of partnership, diversity in the constituencies in the policy arena, diversity of players	Biodiversity, diversity of economic opportunities, diversity of resources, information sources, communication partners, and relationship types; off-farm employment help ensure a connection to a variety of social networks
Combining different types of knowledge	Local and scientific knowledge	Various information, practical knowledge, skills
Creating opportunities for self-organization	Strengthening community-based management, building cross-scale management capabilities, strengthening institutional memory, nurturing learning organizations and adaptive co-management	Not to rely on external resources, energy autonomy

Table 1 – Four components needed in building social resilience

perspective, we might be able to understand a complex system such as global human food production systems in a more comprehensive way. The analysis of the kiwifruit sector using data from the ARGOS project and presented by Darnhofer et al. (2010) provides a good example of the usefulness of this perspective in identifying local to global factors that contribute as shocks and stresses to the farming systems. These characteristics of the approach indicate its potential for formulating recommendations for more sustainable agriculture in New Zealand at a broader (such as regional or national) scale.

However, it is also apparent that this perspective alone is an insufficient basis for developing specific farming recommendations, particularly if concrete indicators are used to measure resilience. Darnhofer et al. (2010) have identified at least three hurdles of using such indicators. Firstly, there is

a temporal hurdle where, as the farm evolves, the indicators also change accordingly. Secondly, a spatial hurdle is encountered when we observe that surrogates are also dependent on the social, economic, ecological and political context within which a farm exists. Thirdly, the human component of the farm becomes a challenge in a way that farms are also the product of the farmers' perception and reflection. This leads us to consider the second way of understanding the resilience of a farming system. In this case, we must see the human component as an agency that, although interacting with and depending on the farm as a discrete system, can also make decisions that impact on and are influenced by conditions beyond the boundary of the farm level.

Building social resilience in agricultural system

In a more recent discussion of resilience theory, more emphasis is placed on the ways in which the human component of the system can build resilience, while also acknowledging the capacity of the ecosystem to provide feedbacks and resources. Scholars have come up with several prescriptive solutions to increase society's adaptive capacity toward shocks. For instance, Folke et al. (2003) propose four components needed in building social resilience: adaptability, diversity, knowledge, and self-organization. Table 1 gives a summary of these components and their implementation in an agriculture system. *Adaptability* refers to how people learn to live with uncertainty. This can be achieved through many ways, such as building social capital and networks (Abesamis et al., 2006), increasing capability to learn from crisis, and 'expecting the unexpected' (Berkes, 2007). In the farming system, it may also include keeping debt at a reasonable level relative to assets and maintaining the farm flexible to changes (Darnhofer, 2010). *Diversity* embodies a broad range of components, including biodiversity, economic opportunities, resources, actor groups and partnerships. One important aspect of nurturing diversity is to distinguish between functional and response diversity (Walker et al., 2006). Functional diversity could be diverse functional actor groups in a social system or a variety of crops and multifunctionality in a farming system. Yet, functional diversity does not necessarily guarantee a resilient system, as the way the functional groups respond to shocks is also important. Response diversity helps farm system to manage resilience better by providing a buffer against and strategies for different types of shocks.

Diversity can be nurtured by increasing the capacity for the system to learn through a variety of different types of *knowledge*, both scientific and tacit. At the farm level, it is important to equip farmers with diverse knowledge and a variety of practical skills to increase their capability to adapt to changes. Lastly, social resilience can be built by creating opportunities for *self-organization*. Berkes (2007) interprets the idea of self-organization through strengthening of the community as well as the building of cross-scale management capabilities. This means broadening the scope of management across spatial and institutional scales. However, Darnhofer (2010) argues that opportunities for self-organization can be created through lessening farmers' dependency on external groups and resources.

Other researchers offer similar approaches in building resilience to the one proposed by Folke *et al.* (2003). Several additional solutions include promoting positive attitude (Buikstra et al., 2010;

Darnhofer et al., 2010), providing strong infrastructure and support service (Keil et al., 2008; Buikstra et al., 2010), and building good mental models among farmers (Walker et al., 2006). However, an interesting approach that of relevance to ARGOS is offered by Walker et al. (2006) as they address means upon which social adaptability can be built through a combination of all forms of capitals: social, human, natural, manufactured, and financial (Walker et al., 2006). In their argument, a limiting amount of any of these capitals could render shifting to undesirable state unavoidable. In light of this proposition, we see that capitals approach can be further incorporated to resilience perspective by outlining each capital as indicators for building resilience of farming systems.

Capitals approach in building resilience of farming systems

The literature on capital based sustainability indicators have been thoroughly reviewed by Saunders et al. (2010). In their article, a broad range of capitals are classified into five categories—consisting of human, social, financial, human-made and natural—based on the origin and characteristic of each. So, for instance, human capitals are those embodied in individuals that would nurture personal, social, and economic well-being, such as knowledge, skills, and physical labour. In contrast, social capital refers to those “... descend[ing] from the manner in which individuals interact” (Saunders et al., 2010:8). Examples of social capital can include mutual relationship, trust, social networks, as well as leadership. Many studies on social resilience put a particular emphasis on this type of capital, not only because it is the hardest to measure (Goodwin, 2003, as cited in Saunders et al., 2010), but it also relates strongly to the capacity of the society to improve its adaptability and resilience (Ostrom & Ahn, 2003). In addition, natural capital is of particular importance because it directly connects both social and ecological systems. It is through this latter type of capital that the concept of socio-ecological resilience operates most clearly.

In the farming system, sustainability indicators for each capital can appear in many examples, as shown in Table 2. In a way, capitals can also be loosely linked to components in building social resilience as described in the previous section. By doing so, the role of the capitals approach in understanding a farm’s resilience becomes apparent. Yet, it is also revealed that not all components of social resilience can be fully addressed by the capitals approach. As exemplified in Saunders et al. (2010), measurement of sustainability is sometimes limited to the tangible indicators of capital. For human-made and natural capitals, measurement of those indicators is relatively straightforward (buildings, assets, and debt-equity ratio for human-made and soil microbes, minerals, or earthworms for natural capital). In contrast, several measurable indicators of social capital (voting in elections, providing financial support to communities) are unlikely to represent those aspects of social capital prescribed to build resilience. Another difficulty in applying the capitals approach to an assessment of a farm’s resilience is the changing nature of the farming system according to which the social, economic, and ecological context is evolving—a situation that has been stressed by Darnhofer et al. (2010). The assessment of capital-based sustainability indicators in Saunders et al. (2010) shows that the target levels for indicators have to be continually evaluated as the farming system changes over time and across space. The way farmers utilize their combination of capitals to adapt to shocks and changes vary between farmers and farming system. In this sense, capital has to be seen in its

Type of capital	In farming systems (Saunders et al., 2010)	Components in building resilience
Natural	Soil components, microbes, water, atmosphere, animals, surrounding natural vegetation	Equitable and rapid access to resources (Darnhofer et al., 2010); Biodiversity (Darnhofer, 2010)
Human	Farmers, labourers, humans providing intellectual input	Positive attitude (Buikstra et al., 2010; Darnhofer et al., 2010); Labour capacity and technical efficiency (Keil et al., 2008); Knowledge (Berkes, 2007)
Social	Systems providing labour and marketing support and information related to agricultural services	Social networks and support, trust among stakeholders (Darnhofer et al., 2010); Adaptive co-management (Berkes, 2007)
Human-made	Facilities, roads and means of transport, factories for processing of farm produce	Infrastructure and support services (Buikstra et al., 2010); Easily liquidated assets (Keil et al., 2008)
Financial	Markets for purchase and sale of goods, a credit system supplying funds	Access to credit (Keil et al., 2008); Debt:asset ratio (Darnhofer, 2010)

Table 2 – Capitals approach in farming system and its relations to building social resilience

relation to the type of shocks farmers are experiencing and their individual strategies for responding to those shocks.

One means of relating capitals and resilience approaches is utilised by Parsonson-Ensor and Saunders (2011) in their study of the resilience of New Zealand’s farming systems during periods of hardship. By examining the different ways farmers that respond to various economic and environmental shocks, it is easier to identify which aspects of the five capitals play a major role in enhancing farmers’ and farming systems’ resilience. In their analysis, Parsonson-Ensor and Saunders (2011) reveal that, although farmers adapt to economic stress in different ways, most responses are narrowed to the strength of the human capital (positive attitude) as demonstrated in the willingness to take risks, to try new technology and farm management, as well as to develop niche products. Nevertheless, other capitals also act as supporting factors for the adaptive measures to be successfully implemented. For instance, the farmers’ access to new sources of investment and to new innovations (social capital), the farms’ ecological capacity to endure climatic shocks (natural capital), the amount of liquidated assets to ensure solvency (human-made capital), and the availability of off-farm income and family funding (financial capital) have proven to act as buffers against shocks.

Two important conclusions can be drawn from the Parsonson-Ensor and Saunders (2011) study of the relationship between the capitals and resilience approaches. First, although it is possible to

categorise the determining factors of a farms' resilience according to given types of capital, a broader definition of each capital is required in order to successfully account for the key concepts of social resilience. In particular, human capital appears not to be constrained merely to the knowledge and skills embodied within an individual; but, and perhaps more importantly, human capital involves the individual's positive attitude, mental models, and sense of purpose (Buikstra et al., 2010). Second, there is no single configuration of capitals that creates a resilient farm and farmer. The way capitals have enhanced farmers' adaptability towards shocks and stresses depends as much on the contingency of the context within which farming systems are situated. In a condition where one or more capitals form as a limiting factor, farmers seem to adapt to such conditions through creative and compensatory utilisation of other available capitals. Indeed, the report has provided empirical data on how farmers' response to shocks can be perceived as ways to shape the resilience of New Zealand's farming system. Yet, its conclusions underpin several factors that are left unexplored in the discourse. In order to develop a better understanding of the role of shocks (and stress) and of diverse capitals in defining the sustainability of farming systems in this report, we will use farmers' narratives of change in their farming practice over time. This method of backcasting through the use of retrospective interviews provides the opportunity to assess response to a greater variety of shocks and under diverse configurations of capitals.

Methodology: Understanding farms' resilience retrospectively

In order to develop a more appropriate data set from which to assess the nature of resilience and the role of capitals within the New Zealand sheep and beef and kiwifruit production systems, it was necessary to expand the temporal horizons of the ARGOS research. The existing database, while very detailed and rich, was largely focused on the existing context of management within each system and the seven-year period of data collection was defined by a very limited set of shocks and pressures that might be considered perturbations initiating change. A partial solution to this limitation was identified in the collection of the experiences of agroecosystem change among the participating ARGOS farmers and orchardists. Thus, a retrospective interview was designed with the purpose of recording and documenting the participants' narratives of change as related to their farm or orchard management. The collation and comparison of these potentially diverse representations of farming practice was facilitated by the use of a timeline of likely drivers of change (largely referred to as shocks by the research team). Further discussion of the interview process is provided in the initial interview reports (van den Dungen, et al 2011a; 2011b).

The initial analysis of the interviews (as reported in van den Dungen, et al 2011a; 2011b) provided a descriptive reporting of the participants' response. This involved the transcription of interviews and the subsequent coding of the transcriptions according to both specific events as listed on the timelines developed by the research team and more general categories of environmental, economic or social dynamics or factors. While largely focused on recounting the combined responses of the participants, this analysis established the important conclusion that participants generally avoided reference to the concept of shocks which drove system-wide disruption or change, or perturbations. Instead, the common representation of change in management practice was that of continuous

adaptation within a proven management approach. This sense of continuity was interrupted across the production systems as a whole in only two distinct periods: the neoliberal policy adjustments of the 1980s for the sheep and beef farmers and the market collapse and sector restructuring of the early 1990s for kiwifruit orchardists.

The analysis in this report is a further elaboration of the initial coding and interpretation in order to more comprehensively address questions raised by insights from resilience theory and the capital approach to sustainability. This analysis involved additional coding of interviews to address issues raised by the whole of the research team in response to the initial report and to inform a transdisciplinary engagement with the interview data. The resulting coding (of responses and themes) was analysed for patterns that contribute to a more comprehensive understanding of the resilience of the respective production systems.

Interview analysis:

To this point within the ARGOS project, the concepts of resilience and capitals as approaches to the assessment of sustainability have largely been employed at a theoretical level. That is, they have been considered as alternative perspectives on sustainability without necessarily having sufficient or appropriate data within the project to apply them as analytical tools. As a result, understandings of these concepts as they related to the context of the ARGOS farms largely involved the identification and assessment of indicators that could be derived from existing data and interpreted in light of the relevant literatures.¹ The initial assessment of the relevance of shocks and pressures and their occurrence in the narrative of producers was completed in two sector-oriented reports (van den Dungen, et al. 2011a, b). These reports offered a largely descriptive presentation of change in management practice over time as this related to a timeline of events which were anticipated to have the potential to act as significant shocks to normal practice. In this report, we build on these existing understandings of change over time by framing the analysis more specifically within both resilience and capitals approaches.

The analysis of historical shocks at the level of the production system is limited within the context of the New Zealand meat and kiwifruit sectors due few disruptive events being recognised by interview participants. For a resilience theory approach, this suggests that, from the perspective of the participants, each production system has remained within its respective basin or domain of attraction. In other words, at the production end of the supply or value chain, circumstances have not dictated that the underlying objectives and conditions of production required radical alteration – at least not in the eyes of the producers themselves. (It is necessary to acknowledge the fact that,

¹ There was some initial work completely in this manner for the capitals approach in Saunders, et al. (2010). The success of this exercise was, however, hampered by the need to interpret data to conform with accepted capitals indicators. In addition, the analysis in the report was limited to the current context and thus unable to examine the impact of fluctuations in capitals. The corresponding analysis for resilience approaches is found in Darnhofer, et al. 2010. In this case, farm level analysis was limited by the lack of data that corresponded to a diversity of shocks or pressures.

among the participants, it is common to represent oneself as having the skill to withstand, outlast or overcome unfavourable circumstance. As such, the narratives or explanations of past events and processes are often interpreted not as change, but as a slight moderation or alteration of successful management strategies as discussed below.) Nonetheless, the analysis in the following sections distinguishes a range of response which suggests that a limited number of response types were utilised at the time of the disruptive shocks in each sector. This, arguably, confirms the assertion that the combined impact of events and circumstances during these periods placed survivors within new (or at least significantly altered) basins of attraction. The extent of the shock was such that a particular set of strategies were favoured and these established 'best practice' going forward.

Based on the narratives provided by the interview participants, the New Zealand sheep and beef and kiwifruit sectors have experienced very limited frequency of perturbations or shocks that initiated disruptive changes to the respective production sectors. By contrast, the representations of the historical development of each sector are dominated by a sense of continuity interrupted by a single shared systemic perturbation in each (the restructuring of New Zealand agricultural policy in the 1980s for sheep/beef and the kiwifruit market collapse in the early 1990s). The participants' emphasis on continuity holds true across the various types of stress and shock (i.e., economic, environmental and social) identified by the research team.

The sense of continuity incorporated within the participants' presentations of their own response to stresses and shocks largely reflects two aspects of the context of agricultural production in New Zealand: 1) a relatively benign environment (inclusive of social and economic aspects); 2) the self-organising nature of the socio-ecological systems. Over the period covered in the interviews, very few events were of a nature that seriously threatened the whole of a production sector. The environmental shocks identified were portrayed as being intermittent and cyclical (especially in the regions included in the study) and did not exert pressures over extended time periods. Similarly, economic shocks were of an extent and duration that the participants could, by and large², outlast. As a result, such economic events are largely incorporated within management strategies as cyclical pressures, reflecting the participants' experience with price fluctuations and strongly held expectations that the viability of a given sector will revive if conditions improve. Social pressures³ in New Zealand are, to this point at least, incorporated as elements of standard practice – albeit they are the target of complaints about external assessments that fail to acknowledge the realities of farm or orchard management. Overall, the participants have developed narratives which frame shocks as events that can be compensated through proper and skilful management or overcome by

² It must be acknowledged at this point that the value of the interviews for an assessment of resilience was limited by the lack of farmers who had failed to survive past shocks. In other words, each of the farms and orchards exhibited sufficient resilience to past shocks to avoid surpassing a tipping point in the economic, social or environmental viability of the enterprise.

³ In the sector-scale analysis presented in this report, we have largely excluded reference to social or personal shocks such as death in the family or health issues, which can exert extreme pressures on management systems but are very context specific. Such shocks are frequently identified as points of change, especially if they correspond with other pressures or shocks.

appropriate application of technological solutions.

Disruptive shocks

This section examines the two disruptive shocks recognised by the participants and for whom these form an element of their experience⁴: the restructuring of agricultural policies in the 1980s by the New Zealand government (for the sheep and beef sector) and the collapse of the export market in the 1990s (for the kiwifruit sector). Both of these periods have been examined in existing literature (see Barnett and Pauling 2005; Britton et al. 1992; Curtis 2001; Johnsen 2003; Le Heron and Roche 1996, 1999; Liepins and Bradshaw 1999; MacLeod and Moller 2006; Smith and Montgomery 2003; Smith and Saunders 1995; Wilson 1994) and the retrospective interviews do not contradict existing analyses. The response of the ARGOS participants does, however, provide some insight to the application of resilience approaches. Most notably, these two periods are distinct in their impact on management across whole sectors as a result of the combined effect of diverse shocks or pressures (economic, environmental and/or social). Thus, these shocks were the product of circumstances that challenged not only the financial viability of the respective sectors, but the identity of the producers in the sectors as well. In other words, in each case the result was a shared sense of threat not only to individual farms or orchards (the navigation of which was the responsibility of the individual and success dependent on that individual's skill and capacity to deal to the threat), but to the sector as a whole. Furthermore, from the perspective of the farmers and orchardists, the survival of individual producers was strongly influenced by existing (financial and social) conditions of farm families and the actions of organisations (banks for the sheep/beef farmers and the Kiwifruit Marketing Board for kiwifruit orchardists). The following two sections summarise the participants' response to these disruptive shocks. Together the impact of these events on farming and orcharding practice offers insight to the self-organising capacity of the socio-ecological systems involved in the study.

Neoliberal reforms and sheep/beef farming

While the sheep/beef farmers generally provided narratives that emphasised the success of their management systems over time, they commonly recognised the implementation of neoliberal policies in the 1980s as having substantial impact on the practice of meat production in New Zealand. In addition to the impact of the removal of subsidies on the financial viability of the sector, the resulting situation introduced a greater emphasis on production efficiencies and on the business aspects of farming. The latter changes were perceived as having the more lasting impact on farming practice, given that strategies to deal to low prices were quickly developed. Several participants also claimed that the political discourse around these policy changes had a detrimental impact on the social status of sheep/beef farmers, exposing them to criticism as a declining industry that no longer represented the backbone of the New Zealand economy. These responses closely reflect existing analyses of the period (Campbell, Le Heron and Pawson, MacLeod and Moller, etc.) and are more fully documented in van den Dungen, et al. (2011).

⁴ That is, not all of the interview participants experienced these events as the principal on farm/orchard decision maker and, therefore, were not able to refer to them as drivers of change in their own practice.

In the interviews, the farmers recognised the 1980s reforms as a ‘shock’ which required a re-evaluation of management practice and strategy in the meat sector. Most acknowledged that the reforms resulted in a change in focus from stocking as many sheep as possible (to take advantage of the guaranteed SMP price for each animal) to, eventually, one of meeting processor demands in regards to weight and fat characteristics of lambs. As expected, many described this change in management as involving a response to several financial factors including increase cost of inputs and increased variation in prices for their product. In some cases this was accompanied by increasing diversification of farm incomes.^a (Note that the alphabetic superscripts indicate relevant quotes taken from the interviews that are found in Appendix 1.) For those who had experience farming with the subsidies on sheep meat production, their removal was uniformly identified as an impact on the relative viability of the sector. The resulting threat to their livelihoods involved significant changes in the practice of sheep and beef farming, beginning with a reassessment of the relative potential of other types of agricultural production.

In addition to the well documented impact on sheep numbers, the reforms also impacted on the farmers’ access to credit and their relationship to financial institutions. Many farmers recalled the impact on the farm’s financial situation that ensued. For some, the abrupt introduction to financial uncertainty was referred to as a wholly unique situation that elicited a reactive response.^b The changed relationship with the financial institutions also contributed to more conservative attitudes toward debt as the result of both sharp increases in interest rates and stricter conditions. This attitude is still an element of management for many to the present day—and, in some cases, it influenced relationships within the farm family as well.^c A further result of the altered economic environment for sheep meat production was the growing awareness of farming as a business that required stricter control of management, especially costs. This shift, and its growing influence on success and viability, was seen as a significant factor in who was able to (and, likely, wanted to) continue to farm.^d Thus, in terms of resilience theory, the reforms of the 1980s introduced a shock that shifted sheep and beef production (as a system) into a new basin of attraction. Compared to the basin formed in response to the more secure and consistent income provided by subsidies, the new basin selectively rewarded the ability to behave according to more a demanding set of financial criteria. These criteria have become a factor in the self-regulating process of the sector, discouraging participation of those who were not inclined to conform.

Despite the common acknowledgement of the impact of the 1980s reforms, many of the farmers also indicated that the perceived severity of the shock had diminished over time. In retrospective, the anxiety and suffering associated with the period appears to have lost some of its intensity, especially as many of the changes it engendered have become everyday or normalized practice.^e Such comments demonstrate the process by which the narrative of continuity (discussed below) begins to supplant that of the shock and response. The farmers’ narratives also begin to obscure the cyclical patterns described by resilience approaches and disrupt simple applications of resilience to the lived experiences of farming.

A further aspect of the shock associated with the reforms involved the indirect impacts of the policy changes. Foremost among these were the social implications. Several farmers indicated that the manner in which the reforms were imposed equated to a betrayal of the sector by the government. In particular, they pointed to the apparent hypocrisy in policies that, shortly after encouraging farmers to accumulate debt as drivers of the national economy, exposed them to the much higher market interest rates. The inadequacy of financial or social safety nets for the worst affected or most vulnerable farmers was viewed as further evidence that the government no longer supported the sector. This period was also associated with a serious rupture in the status of pastoral farmers in New Zealand society more generally. As opposed to being the primary source of international earnings to support the national economy, farmers reported an increasing sensitivity to perceptions of farming as an irrelevant (or sunset) industry in terms of contributing to New Zealand's economic security. Others noted that the financial implications of the reforms impacted on farmers economic relationships. A common point of reference was the fact that farmers were no longer identified as the owners of the latest model cars. For the farmers, these demonstrations of the declining status of the meat sector are compounded by a growing rural-urban divide, which was particularly evident in challenges posed to the environmental and animal welfare outcomes on farms.

Strategies in response to the reforms

The shock of the 1980s reforms elicited a variety of responses from the farmers. Given that all of the participants currently employ management strategies that allowed them to persist in the post-subsidy environment, it is not possible to establish a single, optimal response trajectory for similar financial and policy related shocks. In addition to the diversity of response trajectories, the frequent lack of purposeful planning of these trajectories (persistence was as much the result of timing and context as it was of the implementation of a particular strategy) further complicates the assessment of the relative benefits for resilience of the individual farm or orchard.^f The farmer narratives frequently referred to unexpected good fortune, as opposed to a well planned strategy for dealing to potential shocks. For example, several reported that having diversified into deer just prior to the reforms helped to reduce the severity of the loss of the SMP for lamb. The full benefit of this strategy was only fully realized by those who also decided to sell their deer herds prior to the collapse of that market, although not necessarily in expectation of that collapse.

Whereas some of the farmers attributed their successful negotiation of the turbulence of the 1980s to the ability to make sudden or even rash decisions, an equally successful response trajectory involved the adoption of a much more conservative approach. In most cases, this reflected the continuation of an existing tendency to limit exposure to financial risk.^g In other cases, the severe repercussions of interest rate rises following the reforms caused farmers to reassess their willingness to take risks. As a result, they have been less likely to invest in more land unless they were able to avoid what they considered to be excessive debt—a response that has in most cases continued to the present.

From the perspective of a resilience approach, the farmers' response to the crisis of the 1980s provides several insights to the evolution of practice and management in the sector. While the

shock was rooted in various origins (social, political, economic, and environmental with a drought following closely on the policy changes in many regions), the sectoral response encouraged and rewarded a particular set of strategies among farmers. The most direct and immediate example involved the banking sector which selected among farmers with high debt, identifying those most likely to succeed according to financial criteria. Those unable to hold the banks' confidence were subject to foreclosure and exit from the sector. This established certain financial practices as more appropriate with repercussions for the approach to farm management. In the narratives of the farmers, many (who appear to have more successfully withstood the 'shock') refer to the removal of SMPs as simply another form of price variability, while simultaneously describing how they have learnt to emphasise the business side of the farming profession. In comparison to the 'shock' response in the kiwifruit sector discussed below, it is also noteworthy that the meat farmers are more likely to 'excuse' those who did not survive the change, claiming that those who left farming were often very good farmers. The inability to conform to the demands of banks and the processing industry did not, in other words, distinguish a capacity to farm well. It was, however, incompatible with the basin of attraction that emerged as a result of the shock.

In the development of the interview schedule, the ARGOS team fully anticipated that the removal of subsidies would be recognised as a shock by the sheep/beef farmers. For the most part, however, the response of the farmers was expected to correspond to the economic implications of the policy change. Thus, we expected to hear narratives of the strategic responses to the increasing costs of production (loss of fertiliser subsidies, withdrawal of subsidised interest rates, etc.) and less certain and lower product prices (removal of Subsidised Minimum Price scheme). These expectations left us less prepared for the variation—in intensity and extent—of the impact on individuals and families in diverse social and economic situations. Furthermore, while the policy changes of the early 1980s were a shared shock at the sector level, some participants have developed a narrative of successful response and moderate change in existing practice.

Kiwifruit market collapse

In the kiwifruit sector, the commonly recognised disruptive change was associated with the period in the early 1990s when oversupply of the market threatened the profitability of kiwifruit orcharding. The supply situation was exacerbated by challenges to the entry of kiwifruit exports originating from the U.S. (anti-dumping charges) and Italy (pesticide residue implications), which seriously damaged the reputation of New Zealand kiwifruit in particular. A shared narrative of a successful response to this shock has been embraced by the majority of kiwifruit orchardists, including those who entered the sector subsequent to its re-branding under ZESPRI and the introduction of KiwiGreen (and later, GlobalG.A.P) protocols to regulate management practice. Previous ARGOS social research has established the impact that the sectoral response has had on the identity of orchardists, including increased awareness of and reference to the impact of their management practice on biodiversity on orchards and the exposure risks of neighbours as well as the strengths of collaborative marketing (Hunt, 2010; Hunt et al, 2005; Rosin et al, 2007, 2008). It is also noteworthy that, during the period in question, kiwifruit shifted from being a speculative diversification option to a conservative investment opportunity for those wanting some engagement with agriculture.

The shock also influenced the perception of sector as held by those within it and by the wider community. Among the orchardists, the implications of the negative reception of their product in export markets were a cause for concern. This was especially true for those who had recently entered the sector.ⁱ Decisive action by the Kiwifruit Marketing Board and the success of the ZESPRI rebranding largely dispelled such concerns, however, and the perception of those who remained in the sector through the difficulties is positive.

The resilience of the kiwifruit sector was further enhanced by the response of the community. Compared to the sense of abandonment reported by the sheep and beef farmers, the orchardists generally refer to support from the community. Occasionally, the shock was seen as having pushed absentee owners (usually referred to as investors from Auckland looking to take advantage of the rapidly growing sector) from the sector to the advantage of real orchardists. Overall, there is a better sense of their contribution to the economic success of the local community among the orchardists—although this has been challenged to some extent in the Keri Keri area where there is land development pressure due to expanding tourism activities. The positive engagement with the local community is also, to some extent, the result of response to the 1990s shock. In the process of developing more regulated pesticide application programmes, awareness of the potential impacts on neighbours increased encouraging the uptake of practices to reduce drift and spray notification procedures.

Strategies in response to market collapse

Typical strategies for responding to the impacts of the kiwifruit market crisis included a similar range in risk to that employed by the sheep and beef farmers. Among the more risk tolerant approaches were the orchardists who either shifted attention to alternative crops or adopted alternative management systems.^h The more conservative approaches generally involved an increasing emphasis on cost cutting strategies involving reduced capital investment, increased reliance on family labour or shifting to a smaller orchard.^j As with the sheep and beef sector, neither type of strategy appeared to be more appropriate or successful in the context of the market crisis—the orchardists who have persisted through the period engaged equally in riskier or more conservative responses. The choice of a particular trajectory was described as reflecting the existing financial and social conditions of the family as well as a continuation of past strategies. In comparison to the response to disruptive shock described by the sheep and beef farmers, the narratives of the kiwifruit orchardists tend, however, to emphasise the role of the Kiwifruit Marketing Board (as the forerunner to ZESPRI) in coordinating the response to the shock. Thus, there was a generally shared narrative of the marketing organisation providing the successful strategy and thereby operating as a buffer to the full impacts of the shock.

Role of disruptive shocks in management practice

Analysis of the interviews shows that the farmers and orchardists each identified a single event or period (one in each sector) that interrupted their overall narrative of continuity of practice. In terms of a resilience approach, these events can be interpreted as shocks of a sufficient magnitude to shift production from a given basin of attraction—at least from the perspective of the orchardists and

farmers involved. The producers interviewed are evidence of a group who demonstrated the ability to persist. Similarly, based on the fate of those who had been unable to continue despite a desire to remain as described in the interviews, each event caused the failure or exit of producers. This situation raises questions as to whether the former group demonstrated greater resilience than the latter and to what extent any such resilience would enable a successful response to future shocks.

While the interview participants shared narratives of their response to and survival of the shocks in each sector, they did not fully regard these responses as strategies developed specifically in light of the shock. In most cases their responses involved either the continuation of strategies to deal to the normal economic uncertainties of agriculture or the good fortune of a decision taken for reasons other than response to the shock. The lack of an optimal response trajectory relative to the shocks is further evident in the extent of variation among individuals in each sector, with no apparent favouring of greater risk taking or more conservatism. Rather than individual success stories, the farmers and orchardists more commonly referred to the impact of the general situation of the respective sector at the time of the shock. In the sheep and beef sector, the shock was associated with the beginning of a slow decline in the viability and status of the sector. As a result, the response trajectories generally secured only marginal, short-term improvements and many expressed concerns about the long-term viability of the sector. This somewhat pessimistic perspective on the sector further encouraged the more conservative strategies or risk taking in other areas (e.g., crop farming, dairy conversion, etc.). In the kiwifruit sector, the narrative of response to the crisis of the 1990s is one of revitalisation. The more optimistic perception of conditions and the strength of the sector (at least prior to the recognition of the impact of PSA) provided positive reinforcement of individual responses, without favouring a particular 'optimal' trajectory. That said, the relative financial success of gold kiwifruit caused several green kiwifruit orchardists to lament a missed opportunity when their conservative approach kept them from adopting the new cultivar.

It was also apparent in the interviews that the shocks introduced changes in management practices in both sectors. From a sectoral perspective, these changes included the adoption of practices that were of benefit to the marketing of the product and attempts (more successfully in kiwifruit) to promote the quality characteristics of the New Zealand product. Thus, the shock and associated crisis appears to have facilitated the adoption of efficiency enhancing practices in lamb production (e.g., in breeding and ewe management) and of reduced pesticide use in kiwifruit orchards. Farmers and orchardists often claimed that they were already employing elements of these practices prior to the shocks, suggesting that these shifts were not as radical as they appear; but, overall, the events increased the perceived value and legitimacy of alternative practices. The impact of the shocks for the individual producers is more often reported as a change in the farming or orcharding identity. That is, the rationale behind the utilisation of new practices experienced an abrupt change in response to the shocks. The sheep and beef farmers characterised this as a necessary shift from farming by feel or intuition to assuming a more specifically business orientation dictated by the financial implication of decisions. Kiwifruit growers, on the other hand, emphasised their growing awareness of the implications of management for product quality and the local community and environment. Going forward, these shifts have influenced the development of the sectors such that

the alternative practices have become normalised as accepted (and expected) practice in each sector.

Stresses or cyclical shocks

While the impact of the two disruptive shocks is readily subject to assessment from a resilience perspective, the lack of recognition of more frequent shocks in the retrospective interviews presents a challenge to the expectations of the ARGOS research team (as these were framed in resilience). Generally, the events that the research team had anticipated would emerge as shocks to the farming and orcharding systems were perceived more as stresses or, perhaps, *cyclical* shocks. As such, the reported strategies for dealing to these were incorporated within normal practice and did not evoke a temporally defined change in management practice. This understanding of the evolution of orcharding and farming practice changes the emphasis within the explanations emerging from the interviews from that of the relative resilience to shocks to that of the self-regulating mechanisms of the socio-ecological agri-food systems.

The following section summarises the farmers' and orchardists' response to distinct types of pressure or cyclical shock including economic, environmental and social—a categorisation that was recognised and utilised by the participants. In each case, it is possible to identify a range or continuum of responses that facilitate the grouping of farmers according to response strategies for a given type of pressure. The analysis of the historical narratives of response demonstrates the lack of clear distinctions among the participants in regard to their response trajectories in that there is little correspondence in the groupings between pressure types.

Economic events

Economic events or conditions (for example a severe decrease in the prices received for the product of a system or an increase in the cost of inputs to it, including access to capital) are largely portrayed by the participants as a cyclic stress as opposed to a shock. Exceptions are found in the disruptive shocks that were recognised in each sector, both of which involved economic aspects—namely a threat to the economic viability of the sector—in combination with other pressures. At this point, however, the analysis focuses on those events defined (from an etic perspective) as shocks by the research team, but generally treated as conditions of production (from an emic perspective) by the participants. In most cases, the participants have developed response strategies that they are able to rationalise within their management objectives and as an element of their subjectivity within the respective sector.

The reference to price volatility or rising costs of production as *expected* conditions (or pressures) of production is especially true of the meat sector, where there is greater recent experience with price fluctuation than in the kiwifruit sector. Over time, the significance of any given economic shock has been blunted as the immediacy of the event recedes. In other words, for the period 2004-2009, the prices offered for lambs in particular set a significant challenge to the viability of meat production. In some cases, this led to a re-evaluation of family circumstances and the conversion to dairy farming. In others, there was an increasing attraction to off-farm income alternatives or, in extreme

cases, the sale of the farm. The financial stress also encouraged increased critique of the processing and marketing elements of the supply chain. The subsequent rise in prices in 2010-2011 has renewed optimism and confirmed the value of an approach that views price fluctuations as cyclical stresses.

Further shock events for the sheep and beef sector identified by the research team and the participants' response to these are reported in van den Dungen, et al. (2011a). These included the market instability caused by the loss of preferential access to the UK market as that country joined the European Union in 1973 followed by a period of high inflation and the oil crisis. Few farmers had strong recall of the various events, although the car-less days were a source of anecdotes about strategies for dealing to the situation. Ignoring the removal of the Single Minimum Price (SMP) for lamb in the early 1980s at this point, additional economic stress was associated by some farmers with steeply rising land prices in the 1990s, the loss of a guaranteed price for wool and a second oil crisis in 1995. A final period of economic pressures were noted for the period from 2002 to 2010 as lamb prices fell to very low prices and the cost of inputs rose. While the participating farmers generally recognised these periods (especially those closer to the present), they did not associate them with long-term changes in their management. For the most part, adverse economic conditions were portrayed as a stimulus for short-term coping strategies including the reduction of inputs and participation in off-farm labour opportunities. For example, in response to the period of high fertiliser prices in 2010, many farmers either reduced fertiliser applications or reduced their investment in plant, machinery and maintenance (Parsonson-Ensor and Saunders 2011; van den Dungen et al. 2011a).

The analysis of response to economic stress is more limited in the kiwifruit sector, with the exclusion of the collapse of the export market in the early 1990s which is examined above. This is in part due to the generally positive market position for kiwifruit since rebounding from situation in the 1990s. Earlier variations in price or input cost appeared to have been displaced in the participants' memory by the overwhelming threat of the market crisis. The interviews did, however, reflect the growing realisation among Hayward (green kiwifruit) growers that prices for their product had peaked and the viability of their orchards was being challenged. This market situation, coupled with the attempt by Turners and Growers to end ZESPRI's position as the single-desk export marketer, hastened the introduction of new kiwifruit varieties targeted at market niches in order to side-step competition with the increasing supply of green kiwifruit from Chile and other southern hemisphere producers. Thus, many of the Green orchardists in the interviews faced the decision of whether to adopt these new varieties (along with the inherent uncertainties and risks of re-grafting vines and of unfamiliar vine habits) or not. At the time the interviews were conducted, this uncertainty illuminated possible cracks in the sector's resilience that will be addressed in the section on future shocks below.

Generalising across the diverse events associated with economic stress in the interviews, it is possible to identify two consistent trajectories of response employed by the participating sheep and beef farmers. These categories result from placing the reported response to a given event along a continuum from risk acceptance to risk aversion. The first group, comprising eight farmers,

demonstrated a consistent willingness to engage in financial risk taking demonstrated by a greater willingness to assume debt, pursue diversification strategies or engage in off-farm investments. A sub-group of five saw such calculated financial risks as an essential feature in the application of business-oriented strategy to farming. Despite the current similarity in approach to financial stress, the group did not reflect on their response to the 1980s shock in a consistent manner. Members of the group were as likely to describe their response as adaptive and as they were to claim they merely persisted in established practices and strategies. Similarly, the financial and social situation of the farm at the time of the crisis did not determine membership in this group.

The second group included eleven farmers demonstrating a more consistent level of financial risk aversion. Of these farmers, eight specifically targeted financially conservative approaches and the others focused on minimising their debt exposure. The strategies for achieving this were generally identified as low or reduced inputs (especially of nitrogen fertilisers) or self-exploitation of labour (either on- or off-farm). Much as was the case for the risk taking group, those risk averse farmers who experienced the 1980s shock as primary decision makers were as likely to explain survival as a result of proactive adaptation as that of persistence. By comparison, the latter group was more likely to refer to stressful experiences with high debt levels and escalating interest rates as factors in their current approach to debt.

The remaining eight farmers related a more inconsistent trajectory in relation to their relative risk aversion. Throughout the period covered in the retrospective interviews, their response to specific economic events was at times more similar to that of the first group (risk taking) and other times more risk averse. In some cases, this was closely related to changing circumstances—for example, shifts in the life-cycle of the farm family especially in regard to the number and age of dependent children or in levels of debt. As with the other groupings, the lack of consistency in response does not appear to have impacted on the capacity to persist through the crisis of the 1980s or on the specific strategy utilised at that point in time.

In comparison to the meat farmers, the kiwifruit orchardists employed a distinct focus in response to the recent weakening in prices for green kiwifruit. In particular, there appeared to be less flexibility with regard to low-input management for the orchardists, many of whom emphasised the necessity of proper and sufficient fertiliser and pruning inputs. Rather than the radical reduction in fertiliser use evident among some of the sheep and beef farmers, the orchardists were more likely to look for means to reduce the costs of contracted labour through either self-exploitation of family labour or with less time consuming pruning strategies. In part, the strong commitment to soil fertility inputs is the result of the basin of attraction that defines the kiwifruit sector. In previous analyses, the ARGOS research team has noted a strong sense among the orchardists, and more consistently so with green kiwifruit producers, that they are participating in a relatively secure and safe productive sector. This sense of security was reinforced by the well-established set of management practices and guidelines that, if followed closely, to a large extent ensured the viability of individual orchards. The apparently increasing stress imposed by the weakening market for green kiwifruit suggests that the introduction

of new varieties will likely challenge the more conservative approach of the Green orchardists going forward.

The timing of the interviews with the orchardists was somewhat problematic in regard to discerning response to shock as the sector was facing another potential period of restructuring with the failing viability of the green fruit. As a result of increasing competition from other Southern Hemisphere producers including Chile, very few green orchards remained profitable enterprises. Coupled with renewed pressure from Turners and Growers to participate in the international kiwifruit market, this situation led to the introduction of new kiwifruit varieties by ZESPRI as an attempt to define more profitable market niches and alternative products. These conditions appear to have unsettled some of the green orchardists who expressed either a loss of passion for kiwifruit production or the desire to exit the sector—responses that were not heard in previous interviews dating to 2004. The green orchardists were also the more likely (7 of 11) to emphasise the need to reduce costs in the current context. The extent to which these conditions would lead to a significant readjustment of the agroecosystem was not apparent during the interviews, although the subsequent detection of PSA disease (*Pseudomonas syringae* pv. *actinidiae*) is likely to have intensified the pressure experienced by these orchardists to modify their management systems.

Based on the more limited data regarding orchardists' response to economic events, it is more difficult to identify coherent response trajectories. The historical narratives did not, however, contradict existing representations of difference between the initial ARGOS panels such as the greater likelihood of gold orchardists to invest in potentially risky technological innovation or the more conservative financial orientation of green orchardists (often reflecting their investment in kiwifruit as a means toward retirement). The prevalence of organic orchardists (5 of 7) among those who characterised challenges as largely the product of economic factors was, however, less expected. This may reflect their concerns about the viability of their management systems if the price premiums they enjoy were to be removed.

Environmental events

Response to environmental shocks (climatic extremes are the most commonly recognised of these shocks, although disease or pest outbreaks are considered potential threats⁵) receives very cursory attention from the participants. Climatic variation is considered to be an integral part of the farming or orcharding lifestyle and strategies used in response to past extreme events are generally incorporated within current practice. The participants' discussions of climatic events as either shocks or sources of changed practice conform to those in a separate set of interviews on climate change in which the natural variation of climate was anticipated and formed part of management strategies (Rosin et al 2008). The fact that none of the participants considered themselves to be currently experiencing unexpected extreme conditions further limited the perception of impact.⁶

⁵ Note that PSA was not yet recognised as a threat at the time of interviewing.

⁶ It is a well recognised aspect of response to climatic extremes that the 'memory' of the event diminishes relatively quickly, that is within 3-5 years (see, for example, Brondizio and Moran 2008).

Previous interviews with the same group of participants did, however, demonstrate the potential for more immediate climatic factors to impact more deeply on management and orcharding or farming practice (Hunt et al 2005, 2006; Rosin et al 2007a, b). Some of the kiwifruit orchardists, for instance, related the harrowing experience of a killing frost early in their orcharding careers. In such instances the climatic event was one that challenged the viability of their practice and was treated as a shock. All of those who described this situation also indicated that they had found solutions or mitigating strategies for dealing to similar events in the future. The installation of frost protection measures is fairly much common practice in frost-prone areas, with either irrigation or fans providing relatively simple solutions that can be rationalised from a profitability perspective. Similarly, several meat farmers recalled the traumatic effects of late season cold fronts that killed large numbers of lambs. In some cases, these experiences encouraged management changes (e.g., new shelter belts, the more timely use of paddocks with established shelter belts, or winter shearing of ewes to encourage them to seek shelter with their lambs). Generally, the significance of such response was downplayed relative to established practice—as an adjustment rather than a significant change. It should be noted, however, that the climatic conditions were very likely an important contributing factor to the sale of the Marlborough cluster organic farm.

To a limited degree, environmental conditions can be a cause of stress for given farms or orchards when they impede the producer's response to economically or socially driven demands of practice. For example in the kiwifruit sector, several orchardists with properties in more marginal production areas complain about the TasteZESPRI premiums based on dry matter in the fruit. They believe that the criteria used unfairly favours orchards in particular locations—in other words, it is a reward for circumstance (the good luck of being in a particular microclimate) and not for good practice. Due to their inability to consistently realise high dry matter levels despite inputs of labour and capital, these orchardists experience greater stress and less satisfaction in their practice. For the sheep and beef farmers, the similar issue is related to the growing concerns about the water quality in rural streams and rivers. Several farmers argued that demands to fence waterways on farms unfairly punished those in hill country who were likely to face more fencing and on more difficult terrain. In this case, the environmental characteristics of the farm imposed social stress and threatened financial stress as well.

Because of the relative similarity of response trajectories, there is little on which to base a grouping of farmers or orchardists in regard to environmental events. That is not to say that all of those interviewed would be equally resilient in the face of such events—in fact, the current challenge of PSA in the kiwifruit sector may prove some less capable in their response. At the time when the interviews were conducted, however, none of the participants indicated that environmental events would be a likely impediment to the continued viability of their farms or orchards.

Whereas response to individual environmental events evaded the grouping of orchardists or farmers according to distinct trajectories, it is possible to distinguish between the objectives that orient their approach to the environment. The groupings identified here generally correspond with those developed in previous ARGOS research, although some of the inconsistencies between approach and

practice are more evident in the retrospective narratives. For example, in the sheep and beef sector, it is possible to distinguish between those who refer to conservation or sustainability as specific targets of their management practice (8 of 27), those who emphasised the cost implications of more environmentally oriented practice (12 of 27) and those who were willing to be 'green' within reason (5 of 27). What is noteworthy to the argument here is the fact that this grouping of farmers did not consistently correspond to their attitudes regarding the necessity of ecological subsidies (e.g., either chemical fertilisers or imported feeds) or the desirability of further intensification of their farming. As a whole, the kiwifruit orchardists believed that the established practices in the sector (following KiwiGreen and GlobalG.A.P. criteria) were approaching best environmental practice. As a result, insufficient reference was made to environmental objectives in the retrospective interviews to draw similar conclusions.

Social events

Response to social pressures was highly variable among the participants, with the social implications of the disruptive shock in each sector being the only commonly identified events to impact on farm or orchard practice. The distinct nature of these events discussed above has led to sector specific responses to social pressure. In the kiwifruit sector, the 1990s 'shock' discussed above (and as has been noted elsewhere) was to some extent a 'wedge' that increased its exposure to social (and associated environmental) concerns. Many of the kiwifruit orchardists recognised the impact of consumer demands on their freedom to act in relation to management practice. While most of those interviewed accepted these constraints as elements of ZESPRI's high brand recognition and quality reputation (Rosin et al 2007b), some did claim that such controls unfairly impacted on their orchard's production. This was especially the case in regard to the choice and timing of pesticide applications, with some orchardists referring to what they considered a trade-off between greater pest control and less than accurate perceptions of toxicity in the non-orcharding public. In response to local community concerns, most kiwifruit orchardists are eager to demonstrate their respect for or attention to the sensitivities of neighbours by alerting them when planning to spray—especially in the case of Hi-Cane.

The meat farmers largely did not indicate a similar level of response to societal pressure via the commodity chain. By contrast, they were very insistent that they farmed how they wanted without deferring to external opinion, which conforms with previous ARGOS findings that they appear not to have internalised external audit demands to a noticeable extent (Rosin et al 2007a). Despite their apparent indifference to societal pressures on farming practice, the sheep and beef farmers were much more prone to claim that they received insufficient (if not inappropriate) recognition from the rest of New Zealand society. As note in the section on the 1980s policy reforms, many farmers sensed that their sector was exposed to unfair charges by urban or environmental interest groups (including comments that farmers needed to have 'thick skin'). In all, 19 (of 27) suggested some level of resistance to such pressures while nine believed that social pressures would increase in the future and only two admitted that meat farming needed to change.

Specific social events that were acknowledged as having an impact on management practice and/or

strategy were those related to personal relationships in the farming family, such as the death or failing health of a family member. The frequency of such events was limited across the participants, making it difficult to distinguish trajectories of response or groupings of farmers or orchardists. It was evident, however, that such events could threaten the resilience of a farm or orchard when combined with other stresses or shocks occurring simultaneously. Most who had experienced such an event indicated that the impacts had, with time and adjustments, been overcome. There are, however, several cases in the ARGOS farms and orchards where social stress within the farming family was the decisive factor in exit from the respective sector.

Capitals as context

The retrospective interviews also proved to be a difficult data set from which to examine the role of different capitals in the resilience or sustainability of the individual farms and orchards. As a concept, capital did not emerge consistently within the interviews other than in the more typical reference to financial capital. Thus, neither the farmers nor the orchardists explicitly associated their choice of response to an event with their existing levels of capital save for the constraints imposed by high debt levels or lack of capital to invest in inputs, machinery or maintenance. While it is possible (although still somewhat difficult as discussed below) to make an external assessment of human, cultural or social capital that contributed to or supported individual response trajectories, the fact that the participants do not commonly make such distinctions raises questions about the potential accuracy of their recall if asked to do so. Furthermore, it would be difficult to establish a common 'currency' among the participants with which to measure the relative levels of capital—for example, some thrived on relatively little social capital, while others required access to a broad range.

As part of the research methodology, an attempt was made to provide a temporal assessment of the levels of the capitals (human, cultural, social, human-made, natural) for each of the participants. The procedure was limited by the fact that the retrospectives were punctuated by reference to particular events and responses, lacking a clear insight to the condition of the farms and orchards during the intermediary periods. Furthermore, while it was possible to derive some understanding of capitals contributing to the situation and to decision making, it was never evident for the full suite of capitals. In other words, participants never referred to (what could be interpreted as) more than one or two capitals when explaining their response to a particular event. This omission in the data inhibited the analysis of any interaction or compensatory effects among the capitals at a particular point in time as well as any variation in levels of capital over time.

Despite the limitations in the analysis and accounting of capitals, it was often apparent that an aspect of what the research team referred to as capitals was considered to be of particular importance to the response to a given event. This was especially the case when participants reflected on their ability to persist during the disruptive shocks that were the cause for exit of colleagues. From the perspective of the participants, it was common to associate increased resilience in the face of shocks to their access to particular relationships or conditions that would fit the list of capital types developed within the ARGOS project (see Saunders et al 2010). It is

particularly noteworthy, with regard to the literature on social capital, that the participants commonly identified the value of a single influential relationship. The concept of a bundle of relationships building or contributing to social capital was not evident in these representations.

Among the sheep and beef farmers, there were several references to the impact of the life cycle stage of the farming family at the time of an event. Involvement with a well established farm where there was little pressure to meet mortgage costs was considered to be a benefit when confronting the 1980s policy reforms. This situation was referred to as being at a 'lucky' or 'fortunate'^k life cycle stage, as the cycle from high debt at the early stages of farm ownership to more debt secure conditions at later stages was commonly recognised among the farmers. For others who were at the early stages of their life cycle, the stress imposed by the policy changes was obscured within the broader stresses of new ownership.^l These comments suggest that a stronger financial position associated with a later life cycle stage could offer a buffer to the severity of a disruptive shock; whereas extreme stress related to similar factors but from more commonly experienced sources could obscure the influence of such shocks. As a result, it is possible to interpret increased resilience in responding to a disruptive shock associated with very different access to capitals.

A further reference to the influence of context on response that appeared in both the sheep and beef and kiwifruit interviews was to the state of the property at the time of the event. For some, the crisis periods in the respective sectors was viewed as an opportunity allowing them to purchase land under the previously inflated values.^m In other cases, the condition of the currently owned farm was the source of greater resilience in response to the disruptive shock. Translate into concepts of capitals, the natural or human-made capital could provide a buffer to the financial stress associated with the shock.ⁿ These examples demonstrate that the exploitation of the opportunity associated with accumulated natural or human-made capital could be realised through very distinct processes and individual strategies.

Finally, there were diverse references to the equivalent of social capital in explanations of successful response to disruptive shock. These references all referred to the benefits of particular social relationships that facilitated the successful survival of the disruptive shocks. A common reference involved other family members, often referring to the sacrifices of partners or parents which helped to mitigate the financial impact of the shock.^o Similar contributions from neighbours were also evident in the interviews, but to a more limited extent and frequency. The sheep and beef farmers' relationships with the banks were also predominant in their response to the policy reforms. In this case, access to affordable credit was portrayed as an important element of the continued viability of a property, although the basis on which seemingly preferential treatment was received was not always apparent to the farmers.^p For the kiwifruit orchardists, beneficial relationships with a particular packhouse, with ZESPRI or the industry more generally were more frequently identified than those with financial institutions. The distinction between the sectors in this regard reinforces the extent to which resilience in the former remains predominantly a characteristic of individuals whereas in the latter there is a greater sense of resilience as a condition shared by the whole of the sector.

A noted in the discussion of the disruptive shock in the sheep and beef sector, farmers came to view their relationship with the government in a very different light. As the source of the shock and exacerbating factors, the government betrayed the expected loyalty to an important and deserving and sector of the economy.⁹ In terms of social capital, this perception of their relationship to the government placed these farmers in an antagonistic position relative to subsequent policies and regulations, limiting their capacity to develop strategies which enabled constructive engagement and flexibility in practice.

Rather than a reference to capitals, the participants tended to present their access to and exploitation of such factors as elements of the context in which the response was adopted. In most instances, they were only recognised when a particular relationship or condition helped to mitigate the impact of a particular event. This representation as context conformed to their belief that, in most cases, failure to survive the shocks was a factor of circumstance more than one of poor or inadequate farming acumen. The participants' understanding of the contribution of context to shock response further suggests that they did not actively engage with these factors as 'capital'. This does not, of course, indicate that assessments of capital as a basis for sustainability or resilience are misplaced. Rather, the evidence from the retrospective interviews indicates that the concepts of human, cultural, social and natural capital, in particular, likely need to be translated into terms that are more relevant to farmers and orchardists either when conducting research or offering feedback. Furthermore, those conducting the research need to better assess the extent to which such factors are, in practice, utilised as capitals.

Shock, stress and resilience

The analysis of historical shocks at the level of the production system is difficult within the context of the New Zealand meat and kiwifruit sectors due to the limited number of disruptive shocks that are recognised by participants in those sectors. From a resilience theory perspective, this suggests that the production systems utilised by these farmers and orchardists have largely remained within respective basins or domains of attraction as they are understood by the participants. In other words, at the production end of the supply or value chain, circumstances have not dictated that the underlying objectives and conditions of production have been radically altered—at least not in the eyes of the producers themselves. (It is necessary to acknowledge the fact that, among the participants, it is common to represent oneself as having the skill to withstand, outlast or overcome unfavourable circumstance. As such, the narratives or explanations of past events and processes are interpreted not as change but as slight moderation or alteration of practice.) Nonetheless, the analysis in the preceding sections distinguishes a range of response which suggests that a limited number of response types were utilised at the time of the single recognised disruptive shocks in each sector. This, arguably, confirms the assertion that the combined impact of events and circumstances during these periods placed survivors within new (or at least significantly altered) basins of attraction. The extent of the shock was such that a particular set of strategies were favoured and these established 'best practice' going forward.

The evidence from the interview indicates, however, the need to examine the value of the concept of a basin of attraction. In the resilience literature, a basin of attraction frequently has a normative implication—that is, the existing relationships that structure and help regulate the system are considered to have either beneficial or detrimental impacts for the long-term sustainability of that system. Thus, as a positive or progressive process, resilience either facilitates the maintenance of a beneficial basin or enables the shift to an improved one. Based on the retrospective interviews, a simple analysis would suggest that resilience in the kiwifruit sector would involve maintaining the beneficial relationships through which consumer concerns about the environmental and social impacts of orchard management are translated into industry practices that have encouraged reduced use of pesticides; conversely for the sheep and beef sector, resilience would arguably involve a shift from the types of relationships which impede the constructive exchange of information regarding the environmental and social impacts of farm management. The challenge of such a normative position lies in the need to distinguish between the positive and negative aspects that can be expected in any system. In other words, are there aspects of the kiwifruit sector which are more detrimental than beneficial—and can the basin of attraction remain stable if these are changed? Similarly, would a shift to another basin of attraction for the sheep and beef sector be of equal benefit to all participants in that sector?

The need for the careful usage and application of language and metaphors from resilience thinking is also apparent when determining whether a crisis has initiated a new basin of attraction. For example, it is possible to argue that the kiwifruit sector entered a new basin of attraction following the 1990s crisis. There are, however, several orchardists who describe the introduction of the KiwiGreen programme as either an extension or a continuation of existing practice. In other words, if we were to focus solely on orcharding as a set of management practices, it would appear that the basin of attraction had evolved rather than abruptly changed. This raises the issue of the criteria we would use to establish what is or is not a ‘flip’ and how we would justify this. Remaining with the kiwifruit example, one could argue that the basin of attraction defined by a focus on a single variety, monocrop orchard has persisted to the detriment of the sector given the impact of the PSA disease. This example again demonstrates the potential for the analysis to become subjective.

The analysis of the retrospective interviews also raises a further caution in regard to concepts drawn from the resilience literature, namely the interpretation of an event as a shock. As noted in the discussion of the methodology, the research team was more likely to identify events as shocks—or, at least, potential shocks—to management systems. By contrast, the interview participants only referred to two events (or, more accurately, interacting sets of events) as shocks of sufficient impact to impose change in management practice. Furthermore, as noted above, the extent of these latter shocks is also less clear as farmers and orchardists continue to make sense of their experience in the sectors. Thus, while designating a selected innovation or regulation as a response to a particular event (or shock) provides a level of analytical logic, such linkages between shock and response may not fit the explanatory logics utilised by the practitioners. This disparity in logic between the *etic* and *emic* understandings of change can have significant impact on the development of policy intended to encourage new practice. Evidence from the retrospective interviews suggests that rapid uptake of

significant change in management practice should only be expected in specific circumstances of crisis during which continuity of practice can be disrupted. Exposure to stress or more temporally distanced impacts is more likely to encourage moderate and gradual change to existing practices, which farmers and orchardists consider to be successful adaptations to the conditions of production in their sector. Here, the slow response of pastoral farmers to pressure related to greenhouse gas mitigation in agriculture are a prime example. Resistance to change is as much about the lack of an immediate challenge to the viability (economic, environmental and/or social) of existing practice as it is about the perceived uncertainty of climate change science.

Intensification as a response

“What we did while we were leasing was that we bought our machinery, so that when we came here we had the tractor and the header. And that’s why [he] did that extra contracting, so that he could justify having the bigger machinery because one day we knew we wanted to own a slightly bigger farm than what his dad had. It was a good wee farm, but it actually wasn’t – for a family it was small enough, wasn’t it”

“It was just barely economic.” (Conventional Sheep/Beef)

Following MacLeod and Moller (2006), we identify intensification⁷ as a primary response trajectory in agroecosystems in New Zealand. At issue is whether the current conditions of production—or, in resilience theory terms, the basin of attraction—is configured in a manner such that intensification is a usual (and, potentially, promoted or encouraged) response. To the extent that we are able to identify patterns of social, economic or environmental outcomes among those who actively pursue intensification, we can begin to make statements about the impact of this trajectory on the resilience of the respective sectors. (We will also need to acknowledge the general theoretical implication that intensification, due to growing reliance on externally sourced inputs or ecological subsidies, reduces the resilience of a given system). In this report, the discussion is confined to the assessment of intensification orientations in the retrospective interviews with the participating sheep and beef farmers. To the extent such orientations are consistent, later analysis can draw on input from the transdisciplinary data collected within the ARGOS project to assess the relative impact of the diverse emphases on intensification among farmers and orchardists.

In order to facilitate the initial assessment of intensification, the five most and five least intensive farms in the sheep and beef sector have been identified (see table, which includes the criteria used for selection). The focus on the extreme cases in the ARGOS data set is an attempt to get beyond the difficulties of qualitative distinctions of “relative intensity” as the majority of farmers pursue intensification strategies which lie somewhere between the extreme endpoints. If intensification impacts on the resilience of farms and farmers, the extreme cases should clearly demonstrate this relationship. Where such evidence exists in the case studies, the analysis can be extended to establish if there are gradations and limits (tipping points) related to the relative intensification on the remaining farms.

⁷ Intensification involves the increased application of inputs—be it fertilisers, time, capital, etc.—to a given property with the intension of raising the output per area on that property.

Intensive	In terms of	Extensive	In terms of
South Canterbury, conventional	Use of fertiliser, chemical, diesel, time	East Otago, integrated	Dry & low input & low stocking rate
South Canterbury, integrated	Use of fertiliser, chemical, diesel, time	North Canterbury, conventional	Dry & low input & low stocking rate
South Canterbury, organic	Use of diesel, time	North Canterbury, integrated	Dry & low input & low stocking rate
South Canterbury, conventional	Stocking rate in a dry climate	East Otago, organic	Dry & low input & low stocking rate
Southland, integrated	Stocking rate	Waitaki, organic	Dry & low input & low stocking rate

Table 3: Listing of most intensive and extensive sheep and beef farms and their criteria for selection.

A quick comparison of the farms included in each of the groupings suggests that the trajectory employed reflects the relative opportunity for intensification. Three of the five most intensive are able to use irrigation and produce a variety of crops as well as keeping animals for meat production. The Southland farm among the most intensive is in a relatively beneficial climate with the farmers (the son is in the process of taking ownership responsibilities from the father) expressing a strong interest in achieving levels of production among the highest in the region. The dry climate farm in South Canterbury is distinct for this group in that the owners actively push the climatic boundaries for stocking rates by rationalising the sale of store lambs if necessary. In all of these cases, more intensive production is an unquestioned target because it is possible. For the first three case studies, the opportunity afforded by irrigation also brings a responsibility to farm to the best of the farmers' abilities, which means doing more if possible. This was especially the case for those who had experienced the limitations of dry land farming. For the dry country farm, the current property is 'wetter' than the family farm that was sold in order to purchase the current one. The farm owners perceive a similar opportunity to achieve beyond the limitations experienced earlier. Because the Southland farm is undergoing a succession transition, the intensity of current efforts has been increased in order to justify the presence of an additional labour unit. From their perspective the additional return from higher production and, in some cases, the diverse incomes sources from an integrated pastoral/cropping system provide greater security of access to financial capital and, thus, ensure greater resilience.^r

By comparison, the farmers on the less intensively managed farms all refer to their desire to build the resilience of their properties with respect to (and for) known environmental vagaries—especially dry periods that reduce the availability of feed and limit lamb growth rates. These farmers took great satisfaction in their ability to farm within more difficult conditions, with survival or persistence being the principal reward followed by a viable income. Thus, these farmers employ management strategies that appear more resilient in regard to environmental constraints—although they are potentially vulnerable to 'surprises' where environmental events exceed past experience. On the

other hand, given that their farms are located in more marginal areas in terms of consistent production, they are more vulnerable to other shocks, including economic and social.

In regard to the farmers' perception of the intensity of their management systems, those in the more intensive group readily acknowledged this characteristic of their practice. For all of them, intensification is equated with the most efficient exploitation of available resources, especially as relates to irrigation. They also insisted, however, that their farm was not excessively intensive. In other words, they recognised and remained within limitations to intensification that lay in the associated impacts on social, environmental and financial wellbeing. It is also noteworthy that each of these farmers identified neighbours who employ more intensive—and more environmentally damaging—practices. In particular they reported the negative repercussions for neighbours who remove too many shelter belts and are exposed to wind damage, who waste water through excessive irrigation or who fail to protect streams adequately.

At the same time that these farmers emphasised the efficiency and productivity of their farming practice, they also acknowledged that the increased intensity reduced the resilience of the farm. In some cases, and especially with regard to irrigation systems, this was the result of their reliance on specialised machinery requiring specialist repair services^s that were not always available when needed. Similarly, the financial resilience of the farm could be threatened by the costs of keeping up-to-date with advancements in machination with several farmers indicating that they were 'locked-in' to such technologies through their cultivation of specialty crops^t or use of irrigation. Reliance on specialty crops and intensive rotations also created tight timing windows for planting and harvesting^u, adding a further potential for failure to the challenges of risky crops and marketing strategies. Beyond the pressures and stress placed on the management system, the farmers also recognised that the attention necessary to manage the intensive systems easily impinged of their time for family or themselves. Thus, while they drew great personal satisfaction from achieving high output systems, the brittleness imposed by intensification involved the trade-off of some financial resilience from a higher income with greater exposure to climate, technology and market issues.

Where the farmers utilising more intensive management strategies emphasised the productive potential, the least intensive farmers referred to objectives that did not involve production. The foregrounding of environmental or climatic constraints on production is often the result of a bad experience in which taking a risk (e.g., a higher stocking rate) to increase production met with failure. In other cases, personal circumstance made the pressures of intensification less attractive. For some, this was the personal satisfaction of developing a farm that conformed to their perceived ideal farm, be it appearance or sustainable work load. Not taking on the responsibility of farming for the good of the country and its economy also reduced the pressure to focus on production. Others relied on alternative income sources, either on- or off-farm, to supplement the return from sheep or beef production. For these farmers, the lifestyle was the main attraction to farming and any pressure to push production detracting from that lifestyle.

The comparative analysis of farms at either end of the intensification spectrum, offer several insights to the impact of intensification on resilience for New Zealand sheep and beef farms. The first point is that intensification is not inevitable; rather it is a practice that is attractive within particular parameters and subject to diverse sensitivities. The situation of the least intensive farmers, for instance, suggests that location (including environmental and climatic conditions) can narrow the opportunity and thereby limit the ability to intensify. This raises the question of whether location is a lifestyle choice or the result of the individual's capacity to purchase land. For some of the least intensive farmers, lifestyle is a definite objective that reduces the attraction of intensification. For others in this group, established cultural practice reinforces the need to respect the perceived natural limitations of the farm and its environment. On the other hand, the most intensive farmers reported similar cultural influences on practice referring to the need to remain a leading farmer in the community^v or a sense of achievement from producing more than neighbours or colleagues. One result of this type of pressure is being subject to a technological treadmill that increases their dependence on on-farm services. The most common example amongst the ARGOS farmers involves the uptake of irrigation. The access to reliable water provides the benefit of reduced vulnerability to climatic variation; but it also introduces higher capital investment and labour costs that must be compensated through greater cash flow. Thus, neither intensification trajectory provides an unmitigated pathway to resilience—the least intensive farmers are more subject to low prices and the most intensive face pressures of debt and rising demands on their labour. It is apparent, however, that for the individuals engaged each trajectory has been selected as a strategy to best meet the challenges of the uncertainties surrounding agricultural production.

From retrospective to application: what has been learned

The underlying intent of the research project at the basis of this report was to add to the empirical basis for understanding the application of resilience and capitals perspectives to research on the sustainability of agriculture conducted by the ARGOS project. Having identified the limitations to our observations of shock (both preparedness for and response to) imposed by the contemporary timeframe of the research, we sought to employ retrospective interviews as a means to gain a better understanding of response trajectories as farmers and orchardists dealt to diverse sets of (economic, environmental and social) events. The resulting data set enables an assessment of theoretical and normative claims within resilience thinking as well as deriving from the capitals approach to sustainability. The small sample size and participation of only those who successfully (in terms of persistence in a given sector) navigated the variety of events belies any attempt to develop a final statement on the value of these approach; we are able, however, to identify the extent to which these approaches (and the explanations they facilitate) resonate with the lived experience and understanding of change among a group of farmers and orchardists in New Zealand. Within the constraints of the funding cycle and of transdisciplinary research, the resulting product should be read as a critical assessment of the theoretical approaches largely from the perspective of social researchers in the project.

The small sample size and lack of narrative of 'failed' response admittedly limits claims to generality of the findings. Within those constraints, however, it is possible to draw conclusions of three sorts

from the interview data and the reported social scientific analysis. First, it is possible to employ a comparison of the two sectors included in the analysis on the basis that a) similarities in the two value chains would be expected to elicit similar response trajectories and b) distinct conditions would help to highlight the influence of factors recognised in the social resilience literature. Thus, the greater individualism in identity coupled with a weaker sense of common objectives and concerns, the relative stability the industry and associated organisations as well as more negative external (outside the value chain) assessments of practice within the sheep and beef sector can be related to resilience concepts of social networks, infrastructure and support, positive outlook and sense of purpose as identified in Hegney, et al (2008). Additional concepts identified in such works as Darnhofer, et al (2010) and Hegney, et al (2008) are more in evidence in the response of individuals

A consistent element of the interviews involved the extent to which the sheep and beef farmers referred to the independence of their management strategies compared to the more frequent acknowledgement of a collaborative effort in the kiwifruit sector facilitated through the role of ZESPRI. Based on the interviews and prior ARGOS research findings, it is possible to assert that the kiwifruit orchardists enjoy greater buffers to shocks or pressures given the likely support from the social networks that pervade the kiwifruit value chain. Such a finding is similar to the emphasis in the literature on the development of social networks as an important factor in promoting social resilience and on social capital as a primary feature of sustainability in agricultural as well as other social-ecological systems. What is more unexpected is the demonstration by the sheep and beef farmers of a capacity to mitigate for the relatively limited social networks in the value chain through their reliance on a strong identity of independence. The limits to their capacity for self-reliance are also evident, however, in reference to the crisis of 1980s during which many did participate in discussion groups to help cope with the situation. Thus, while it is likely impossible to impose greater participation in social networks in the sheep and beef sector, there is a large gap in active network creation in the sector. This gap becomes increasingly dangerous as the farmers are faced with events beyond the normal variation that they have experienced and points to a likely avenue for greater collaboration within the sector moving forward.

A further aspect of this distinction lies in the extent to which participants in the two sectors share a common set of objectives and concerns. The payment scheme and fruit quality reward system that is uniformly applied by ZESPRI in the kiwifruit sector establishes a common baseline for assessing the achievements of both the sector and the individual grower. The system provides a mechanism for rewarding top producers as well as supporting the broader population in the sector. Regular benchmarking of a season's product against the quality criteria contributes to the shared sense of pride and purpose that manifests in complaints about the quality of their product seen while on trips to Europe or North America. The interviews with the sheep and beef farmers suggest a sector that experiences a substantially greater level of competition among both farmers and processors. As a result, loyalty to a commonly achieved quality of product is much less evident. Thus, it could be expected that the sector would be slower to respond to a shared shock. While the sector still demonstrates the capacity to respond to localised climatic events (drought, flooding, etc.), it is not apparent that collaborative response to more universal shocks would eventuate quickly enough to

facilitate resilience. Again, this points to the value of a greater collaborative orientation within the sheep and beef sector that likely requires initiative from the processors or industry or government organisations.

A further related feature of the distinction between the sectors involves the more tangible forms of infrastructure and support. Again, in this case, the kiwifruit sector appears to have established a more resilient basis of support for orchardists and the industry more broadly. From the perspective of the orchardists, the relationships and dependencies that have developed between ZESPRI (as the marketing agent) and the packhouses (as the in-country processing facilities) are well balanced to the extent that collaboration and cooperation reap greater benefits than competition. The tangible evidence of available infrastructure and support is in the efforts by packhouses to provide both extension and labour contracting service to support production and quality on the orchards that they rely on for supply. Furthermore, despite being an imposition on orchardists' time, the GlobalG.A.P auditing is a uniform source of information on best practice criteria and also provides a baseline for expected conduct and reliability of suppliers and contractors. Among the sheep and beef farmers there was more limited reference to a supportive infrastructure for producers. Similarly the media includes frequent reports of tensions between processors and their suppliers. While the conditions in the kiwifruit sector suggest a greater capacity for resilience, the current shock of PSA appears to be testing the strength of the infrastructure and support available.

Beyond these obvious distinctions between the sectors, it is possible to identify aspects of individual response that demonstrates aspects of social resilience. Some of these such as early and formative experience (in agriculture and in life), a desirable environment and lifestyle, the strength of beliefs and leadership (all included in Hegney et al 2008) largely involve personal attributes of those involved in production. As such, these are less subject to the structure or operation of the value chain—although a given value chain may be more appealing to people with a particular set of personal attributes. Realising potential resilience related to strength in these categories, thus, involves creating means to strengthen and enhance the positive outcomes that are achieved. Others, such as learning and diversity in income streams can be promoted through the active engagement of industry and other actors in the value chain.

Evaluation of future shocks

While the analysis of retrospective interviews suggests some need for caution in the application of concepts and metaphors from resilience thinking, the approach provides significant insight to the consideration of future shocks. Here, the findings from the analysis will be used to consider the potential for events to cause disruption within the sheep and beef and kiwifruit sectors similar to that of the 1980s and 1990s, respectively. As with the list of potential shocks used during the interviews, the future shocks proposed here are based on the expectations and experience of the research team and may not correspond to the types of impact that encourages the need for change among farmers and orchardists. In the following discussion, patterns identified in the retrospective data provide a basis from which to predict the general trajectory and speed of hypothetical shocks in the near and medium term future.

Based on the current conditions of production in the sheep and beef sector, three events appear to have the potential to disrupt management practices: 1) the relative economic viability of meat production compared to dairy; 2) government policies related to greenhouse gas mitigation; and 3) the introduction of market driven audit criteria. The weakening financial viability of sheep and beef farming, especially in comparison to dairy, threatens to achieve crisis proportions as the national sheep and lamb numbers are reduced to the extent that the viability of the processing and export industry becomes untenable. As an event, this situation appears very difficult to distinguish from the cyclical pricing stress that farmers have incorporated within their management strategies—that is, the change that has occurred would quite readily fit within the narratives of continuity evident in the interviews. To date, response within the sector largely follows established patterns with evidence of the adoption of low-cost strategies (see also, Parsonson-Ensor and Saunders, 2011) followed by a return to ‘business as usual’ when prices rebounded. At the sector level, by contrast, the perceived threat to the processing and exporting appears to have initiated both innovation and collaboration in the form of Primary Growth Partnership funding proposals. Based on similar conditions of a universal threat to sector viability experienced in both of the disruptive shocks discussed above, there appears to be good potential for a shift to a more viable set of relationships (or basin of attraction in resilience terms). A strong element of such a response would involve the development of a collective strategy involving as many participants in the value chain as possible to address the economic, environmental and social challenges facing the sector. What is not clear, however, is the level of crisis necessary to make the current production relationships sufficiently unpalatable to leverage the commitment to change. Whereas for the processing and exporting firms the threat of diminished flexibility and throughput are the main trigger for such response, for the farmers this may lay in the opportunity to reassert their role as valued contributors to the New Zealand economy and society. The disparity between the financial viability of meat and dairy production has become a recognised feature of New Zealand agriculture for nearly a decade without a notable rupture in accepted practice in the former sector.

From the perspective of many pastoral farmers, the proposed emissions trading scheme (ETS) in New Zealand would initiate a major rupture in the viability of their properties. Much of their reaction is related to the association of the cost of carbon credits with a fine or tax. This understanding leads to the implication that the practices to which the costs are attached are bad—that is, the ETS is seen as an indictment on pastoral farming that negates the beneficial outcomes currently achieved. For the rest of the value chain, the ETS can largely be perceived as a cost of production that is mitigated through more efficient production. As such, it is a similar event to current price fluctuations and instability of supply to processors and forms an element of the current ‘basin of attraction’ for meat production. Farmers have learnt to deal to this uncertainty through some level of self-exploitation (often dependent on the life-cycle stage of the farming family, current debt status, etc.). When and if the ETS is actually applied to methane emissions in agriculture, the policy has the potential to initiate a change in production systems—and possible shift to a new basin of attraction—to the extent that carbon cycling becomes an element in the evaluation of ‘good farming’. As with the financial uncertainty caused by uncertain prices for lamb and beef, the impacts of the ETS are potentially mitigated largely within existing strategies and established relationships. Similarly, the strongly

promoted emphasis on technological solutions to ruminant methane emissions is more likely to elicit a gradual change involving the incorporation of a new treatment or narrowly focused management practices. More substantive, disruptive change will eventuate only if greater attention to carbon cycling on farms becomes a necessary feature of selling meat in export markets. It is expected that such a shift could result in a change in identity among the farmers from being a producer of a quantity of meat to being the manager of a stock of carbon on pastoral land. There is potential to manage such a change to encourage improved environmental outcomes from meat production while simultaneously providing the social and financial rewards recognising these benefits.

Somewhat related to the ETS as a form of market-based regulation of on-farm practice, the sheep and beef sector is likely to face increasing pressure to introduce audit criteria to verify intangible qualities expected in consuming markets. To this point, such audit schemes have only impacted on select segments of New Zealand lamb and beef production through contract agreements with specific UK retailers (Rosin et al 2007a). The lesson from the horticulture sector is, however, that the use of audits to verify claims to meet customer concerns in high value export markets are likely to cut across the whole of the sector, with GlobalG.A.P. having developed an auditing protocol for beef from Uruguay through that country's INAC (National Institute for Meat, see www2.globalgap.org). The uptake of uniform auditing across the New Zealand meat sector can be expected to pose a disruptive moment for sheep and beef production, challenging both the fractured nature of the supply chain and the individuality of the sheep and beef farming identity. In other words, the use of best practice auditing would likely require a collective or collaborative objective, which is directly in opposition to the emphasis on individuality and competition in the sector – and often promoted by processors and other actors. Successful navigation of this type of shock necessarily involves the active commitment of the whole of the value chain—a proposition that is undermined by existing competition and rivalries.

In kiwifruit the obvious future shock, given its actual occurrence, is PSA. The potential for the disease to act as a disruptive shock is reinforced by the extent to which it remains a sector-wide, shared threat as opposed to the result of the poor practices of individuals. For example, had PSA been isolated on those orchards where it was initially identified and successful mitigation practices identified, response to the event would largely be encompassed within the established relationships in the sector. As the impacts of the disease continue to impact on the viability of the sector, there is growing potential for the accumulating stress to have disruptive effect. In this case, the emergence of a viable control measure is of utmost importance. If the control of PSA is closely associated with ZESPRI initiatives and does not require substantial change to the underlying orcharding practice, the sector is also likely to persist in same basin of attraction. On the other hand, a solution coming from another participant in the value chain (for example, one of the pack houses, Turners and Growers, etc.) might prove the impetus for shift from the current socio-economic framework of sector and cause a shift to a new basin of attraction. In this sense, the collaborative spirit that is a strength of the sector needs to be actively reinforced to maintain the resilience of the existing system. On the other hand, the event has exposed rigidity in a system that relies heavily on a small number of varieties grown in monoculture orchards.

By comparison, the declining profitability of the Hayward variety appears to have been incorporated into a narrative that emphasises the role of individual, as opposed to collaborative, response. The poor market performance of the green kiwifruit has been an impetus for some to exit the sector—coupled with other factors such as movement into retirement, increasing dissatisfaction with a system controlled by audit protocols and ZESPRI investment and marketing strategies, etc. Other orchardists view the situation as a means to reinvigorate the sector—a new challenge, the need for greater diversification of product, the opportunity for similar benefit to that realised with gold kiwifruit, etc. As such, the event does not appear to be the basis for disruptive change in the sector; rather it has hastened the exit of some orchardists who were already considering that option or provided further opportunity for diversification. Despite some suggestions by orchardists that the introduction of new varieties was in response to the pressure that ZESPRI experienced from the legal challenge to their marketing position posed by Turners and Growers, the majority of orchardists remain committed to ZESPRI's approach to the situation further reinforcing the existing system relationships.

Two further events with potential to act as disruptive shocks in both the sheep and beef and the kiwifruit sector include the local impacts of climate change and peak oil. The impacts of climate change will largely be determined by the extent of change in variation from present climate patterns as interpreted by the farmers and orchardists. To this point, most of the farmers and orchardists dismiss the possibility that climate change might have a disruptive impact on their practice given that they have largely experienced it as a moderate alteration of the climatic variation around which they have designed their existing management practices (Rosin and Campbell 2012; Rosin et al 2009). Because of the strong sense of achievement associated with overcoming hardships related to climatic events, response to climate change is likely to remain individualised especially within the sheep and beef sector. The fact that the extent of variation from experienced climate is predicted to differ regionally further inhibits the likelihood of a shared, sector-wide response that would lead to more radical change in management practice. In contrast to climate change, peak oil presents a temporally mitigated exposure to an extreme economic and likely technological shock associated with rising prices for petroleum products and the need for alternative tools for mechanisation of agriculture. As a potential disruptive shock, however, the two events appear to have a similar impact on the farmers and orchardists interviewed—namely, that they are experienced as similar variations and uncertainties to those already incorporated in management practice. The most likely initial response will involve increasing cost cutting and self-exploitation of labour, which would persist until economic, environmental or social crisis points are met. Due to the fact that the rising costs associated with peak oil can generally to be attributed to the acts of particular industries or individuals, it is more probable that a concerted response will develop—either in resistance to the price increases or in collaboration around lower input practices. Given the distinct characteristics of these two events, therefore, the resilience of individuals (in particular locales and contexts) is more threatened by climate change and that of industries (depending on the petroleum intensity of production) by peak oil.

Final recommendations

Summarising across the analysis and application of findings from the retrospective interviews, it is possible to offer a set of observations regarding the application of concepts from resilience thinking and from a capitals approach to sustainability. The principal observation involves the note of caution that concepts readily employed is the discussion of resilience and capitals are not necessarily recognised by the participants in agricultural or other socio-ecological systems. The utility of the concepts remains significant in academic discussion and to facilitate increased understanding of the conditions within which resilience is performed. It should not, however, be expected that those outside these discussions can incorporate the associated theoretical relationships within their management strategies. Rather, there is a need to develop appropriate translations of the academic concepts into explanatory forms that are intelligible and meaningful to stakeholders. Merely referring to particular types of relationships as social networks or social capital does not automatically enable the farmer or orchardist to utilise them as such. It has already been noted that there is a diversity of ways through which individuals engage with and utilise capitals (Hegney et al 2008). Here the point is that to some extent this diversity involves differences in the way such factors are conceived that can lie in perceptual, ethical or cultural understandings of good and appropriate use. In both the assessment and promotion of resilience, such differentiation needs to be taken into account. One necessary, although not entirely sufficient, step in realising this translation involves increased participation of stakeholders in the construction of policy frameworks to encourage resilience.

Related to this issue is the potential for diverse understandings of risk in regard to future events that may act as disruptive shocks. For example, what a soil scientist may view as a dangerous degrading of soil physical and chemical qualities, a farmer may interpret as the most efficient utilisation of natural 'capital' when confronted with constraints on labour or financial investment in the soil. This issue is particularly relevant in regard to the discussion of future shocks above, where the immediacy of catastrophic climate change varies between climatologists and farmers. The awareness or recognition of risk goes beyond the provision of more or 'better' information and lies in the capacity to persuade farmers who have spent a lifetime developing an appropriate strategy for dealing to the context of production (social, environmental and economic) that unexpected climate variation—to the point of catastrophic impact—is a real possibility. This again requires more than the current reliance on market mechanisms given that new costs are as easily interpreted as unfair punishments as they are incorporated as price disincentives. Successful mitigation of and adaptation to climate change will require the development of a collective willingness and desire to avoid the multiple social, environmental and economic costs.

Based on both the interview analysis and the theoretical literature, the greatest gains for the resilience of New Zealand agriculture, and the sheep and beef sector in particular, lie in the construction and reinforcement of the collective. As noted above, this involves at this first level the achievement of a positive outlook supported by a common sense of purpose. It is noteworthy that these objectives have been strengthened in the kiwifruit sector through the introduction of a universal quality assurance (QA) audit. While the audit involves certain costs—especially in terms of

the time required of farm and orchard owners to document practice—it also establishes a common basis of good practice in the sector that is verifiable through external assessors. If managed well, such an audit enables claims to socially and environmentally responsible practice while also realising the rewards of more secure market access and, potentially, price premiums. It must also be stressed, however, that audit practice and marketing claims based on that practice are continually subject to consumer assessment. A label is only worth its legitimacy, with the result that the criteria being audited is likely to increase as consumers concerns evolve and awareness of environmental and social impacts increases.

A further caution to the utilisation of QA audits to encourage resilient practice lies in the tendency toward uncritical application of ‘tick box’ lists of practice. If by adopting an audit procedure, the farmer or orchardist complying with the criteria expects to realise only positive outcomes into the foreseeable future, the practice is likely to reduce the flexibility of management and its resilience. On the other hand, of auditing remains a ‘reflexive’ practice in which feedback from consumers, neighbours, employees, plants, soil, water, etc. remains an active part of the continued evolution of the audit criteria and the learning and skill development of the farmer or orchardist, an audit scheme holds much potential to contribute to resilience.

The evidence from the retrospective interviews strongly suggests that farmers and orchardists are resilient in practice. Perhaps too frequently, that resilience manifests only in periods of extreme shock or disruption. This characteristic reflects, to a great extent, a proven confidence in their capacity to persist either through severe self-exploitation of labour and individual wellbeing or through rash good fortune. The challenge in the current production environment is to develop a shared sense of purpose within the diverse productive sectors that prioritises the quality of products that a desirable in international markets and also takes the risks of potential disruptive (or even catastrophic) shocks seriously. By increasing the resilience of sectors, it may be possible to avoid the severest impacts of climate change, peak oil and disease outbreaks.

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Appendix 1

^a Did it change management on the farm at all going through that sort of, the mix of stock that you had?

Yeah, that was partly when we started to drop sheep numbers through the late '80s, so we moved to the cattle 'cause they're more disposable. *(Conventional)*

^b I was very young and, like anybody you send off to war, you think you can change the world. You think you can fix it. If you work harder and tear into it, it'll all come right. And so '85-'88 came off the SMPs, and I mean there was debt there for the first time since 1951. *(Conventional)*

^c Um, I think there was a Trust Bank that had a 'buy a farm' account thing. You put money in and you got a tax rebate and that was a start; and then I was shearing probably half to two thirds of the time and then working on the farm. And then we... Um, my father bought a block out on the plains. It was 170 acres and I think, yeah, the plan was for me to stop shearing; but the interest rate was at 25%, and we were getting... I think there was one year we got \$10 for our lambs. And when you're paying 25% interest... Admittedly the farm was probably only... Yeah, it must have been about \$170,000 I think we paid for it. Now it would be cheap. It was only \$1000 an acre; but you couldn't do it. And I couldn't stop shearing because there was no money. And so we ended up selling it and my father came back to the farm... made this place debt free and he when got to 60, I suppose, he bought a house in Weston and I lived in it until he wanted to retire. And then we swapped over. Dad still, um, he still carries a wee bit of the debt on the farm. Yeah, so it let me in. *(Integrated)*

^d Made you sit down. [The removal of the] SMP made you sit down and farm. *(Integrated)*

Well, yeah, I do remember that, 'cause that's when... That was more stress related than droughts I think. Because that was a whole new, um, industry that no one knew what to expect. Where a drought, you've learned through the years how to farm. But this was totally different to a farming industry that, ... 'Cause it was all related to money and bits and pieces. They weren't gonna get their cheque at the end of the month [laugh] ... *(Integrated)*

^e Well that's actually, well because I can't remember the date or whatever or when that actually physically came off, I it can't have been any big deal at the time, I think we were that squeezed at the time, probably when things, what year did they go up do you know?

I think it was '85.

So that was just prior to the drought?

Yeah, it was just a year.

So they probably just squeezed us just in time for the drought probably. But, well I just imagine we would've been, well we didn't have much choice, you had to adjust or, yeah it was just a bit more tightening up. Those bloody interest rates, I think even at the time, even around then it was still, I

think 22 or 23% interest; and our mortgage as well as overdraft. It was, yes, they were tight, they were hard times, they weren't easy times. *(Conventional)*

So again in the 80s, when the subsidies went off fertiliser, that was something that you were able to sort of take in hand and go with?

You complain about it at the time, but a year or two down the track, you forget about it and you know, we still put on quite a lot of fertiliser. In those early years, we put an awful lot on and lime, but fertiliser was really cheap then and that was before the price started to creep I guess, we were a bit lucky there. *(Conventional)*

^f Ah it was incredible, like my equity halved, and the price for the stock halved. Like we went from getting \$20 to \$25 dollars for a lamb down to \$13, you know 12-13 dollars a lamb; and, also at the same time not long after Labour came in, they, you know, removed all the subsidies. But, then they broke up the Rural Bank which made... I'd also diversified into deer which was probably my saviour and made good money on with deer. Built a deer farm at [lowland Marlborough], and caught deer. So, I brought them [to the farm] and then, when they split up the Rural Bank, they wrote off a lot of the mortgages; but because I was in deer they deemed me to be well off enough to not be so lucky. Which irritated me because my brother did [receive a write off]. So, I sold the deer when I moved to [the high country farm] and that helped with purchasing some property [there]. And that was a good move because deer prices crashed after that as well. *(Organic)*

^g And also you can - like probably we always lived on the smell of an oily rag, kind of thing. So, we just screwed it down even more, I guess. And we're probably still like that. And you don't realize that that's how you live until you probably move to the city or see what people do there. In Wellington, I think, "Oh my gosh." We just don't do things like that. When you're out for meals and that kind of stuff, we just don't do that. We've kind of become - not quite social hermits, but almost compared to some town people. *(Organic)*

^h Yeah, so probably during that '90s period when the kiwifruit were looking pretty grim we had an avocado nursery here. My son was running that. So we were selling avocado trees, and planting up and surviving. Because we could do that with very little expense really.

OK. And then you did keep the kiwifruit going. There wasn't any thought of...

Of taking them out? Oh yeah. Quite often. Um, quite often you'd look at them and think now do we get rid of that block and plant that in avocados instead? I was heavily involved in the avocado industry at that stage as Chairman of the industry council, and so I guess my um... I was quite, not distracted, is that the right word? I got out into politics for a few years, and just kept the business slowly developing here and the boys were running it. *(Gold)*

Well that was probably early '90s when it was, what, real down and that's when I then decided that I had to do something and I looked at organics, the return seemed a bit higher and that's when I changed really, and I've got to be honest, I changed for the money originally, yeah I couldn't see any point in saying where I was, oh I think it was about \$4 a tray or something like that, the returns were shocking but yeah, I made the decision then well I'm gonna have a go at organics, I can't see why it couldn't be done, yeah. *(Organic)*

ⁱ Ah, and it probably gave me the sense that kiwifruit was a bit of a dodgy operation; but I'd been through booms and busts, farming too. Um, never perhaps to quite to the same depth as the kiwifruit industry plummeted to ... *(Gold)*

^j We certainly put the wallet, ah, the cheque book away for a couple of years. But we were in a pretty good... We didn't owe anybody any money. So I think that's, you know, that's why we sort of came through it. And we had reasonably good production at that stage. *(Green)*

No, it was worse than that. You know, I had to spend a lot of time on governance matters with the Board and away a fair bit; but, we actually couldn't afford to have more staff. So I had to come home and we used to stay all night and all that. You know, later on it comes a bit tough. So we worked very, very hard just to survive. And, you know, it was the same for their mother. She was [in] the orchard all the time and she used to help driving a tractor and doing all those sort of things. *(Gold)*

But that lasted for a couple of years and then, what you were just saying, you know, it dipped again ... And that's when we sold the orchard, because it had dipped and so we sold and brought another one on a smaller mortgage. *(Green)*

^k Son: Yeah, but you were quite lucky in that time in that you didn't have much debt when that came off.

Father: No, no. Um, it was - in fact, in the days when Roger Douglass came to power, we - our debt was virtually nil. And we, um, the money that went into the bank for one year - because the interest rates shot up, you know they were paying over 20% at one stage - we actually lived off the interest that the farm account brought in for the year. But, you know, those days are long gone. So, yeah, we were a bit fortunate, because we hadn't bought in much land at that stage, and, uh, yeah, that certainly made a difference. *(Integrated SB)*

Um, '85 SMP stopped. Righto. We were fortunate, because it was my parents' farm, so we were at that stage working on it, but we were also um doing contracting for a couple of neighbours, and that is actually what sort of got us through. Well, the other thing was yeah, we just sort of, how do you put it? We just battened down the hatches and didn't spend any money, as you would. *(Conventional SB)*

^l And I guess, in thinking about that time, when you looked at going into sheep and beef, did those recent changes affect the outlook on where you thought the industry was going at all, or?

No. No, 'cause it was such a shock going from just being a married couple to having to do everything yourself and think it all out. You didn't have time to worry about anything. What, you know, the bigger picture was - the picture here was big enough. *(Organic SB)*

^m Yeah, it was a cheap farm.

But in 1986 it was, yeah the land values were down and because of it's condition, was probably cheaper again, so in some ways there are benefits. *(Conventional SB)*

Yeah, so when I bought it in '93 people said I was mad, and I said well there's only one way hopefully it can go and that's up. And it took at least three years, well it was about three years didn't move much, and I think the fourth year it moved a bit and then we went through some good times, and now we're back to tight times again. (*Green KF*)

Ah, well I was actually looking for a dairy farm rather than...you know, before we bought this orchard. But unfortunately the dollars didn't stack up to get a foot in the door with dairy. But in 1994, the land was pretty cheap, so getting a five hectare block of fully developed orchard with a nice modern house. It was high risk at the time though because, ah, the industry was just starting to recover about then and could have gone either way. But fortunately, the industry got back on its feet and has consolidated since. [...]

Yeah..., I'm quite well aware of certainly some of those developments even though I wasn't really living there then. I know that all of the cushy sales-rep jobs that disappeared while I was at Lincoln, so that put paid to that idea; but on the positive side, there was no way that I would have ever bought an orchard if those good times had've continued. So the door was open in that way. That was actually achievable to buy the orchard rather than just to manage or work in the post-harvest sector ... (*Organic KF*)

ⁿ Kept on looking at the dairy farm. Kiwifruit's never been a major...part of our income. It's always been a means to stay in an area we want to stay in. And if we get a good return, well that's a bonus. (*Gold KF*)

OK. Now, I guess you were saying that you got sort of more involved in the farm in about 1980 and that of course is not too long before the loss of SMPs and...

Yeah um, it didn't have too much effect on us.

No?

Um, we weren't yeah, it's a kind property. It had had money spent on it, and because we were prepared to make relatively radical decisions that... Well, not exactly radical; but change the game plan far more so me than my father. Um, that even through those hard times, really through the worst of those times the deer were good. (*Organic SB*)

^o So what did you do to survive?

Ah, what did we do? Well we just farmed. We didn't waste money. It was always... The farm we were on was never big enough. I actually bought more land, bought another 100 acres. And [my partner] was working all those years. We had four kids and she worked right through, so it sort of helped things along.

And so the buying more land was part of your strategy to...?

Well it was a wee bit of land near home that came on the market so we bought it. But it wasn't sort of big enough to make a big difference; but it made a wee bit of a difference. And, yeah, my father actually went out and got off farm work as well in the early '90s. (*Conventional*)

^p Yes. That was a fun year. We lived off three and a half thousand dollars that year I think. It was good fun (laugh).

Well were there any issues with the bank as far as ah you guys were concerned?

Um...the banks always been very good with us. Yeah ... They told us that we're one of the few farmers they've got that do a budget and then at the end of the year it's almost the same as what the budget is. (*Integrated SB*)

Yeah, it was probably new for me, um, borrowing as such. Although, yeah, I [mumbles] ... The other change I did mention was coming here after the subsidies and what have you. That was in about the mid-'80s. My neighbour, he sold up, so this 300 hectare block back here we sold and basically did a swap and bought another 180 hectares over there. So I suppose that was the first borrowing I did then. (*Integrated SB*)

And the bank was really taking the view that farming had no future ... end of story. And I don't know what they thought the Country was gonna survive on, or what the land was gonna be utilised for; but they really did take the view that farming [had] had it. So we took over in this drought in a time where everybody was saying, 'Well, farming's had it. SMP's has all gone, and inflation and inputs is up through the roof, and product prices are out the bottom. And, so we started farming at that. Decided we were gonna show them all! [laughs]. (*Conventional SB*)

^q I think it's more to do with the sort of way the Government were talking in those days, rather than the subsidies. (*Organic SB*)

Male: But that's how it started and then of course in '85, there was a change of Government and everything changed and everybody went broke.

Female: And a total change of attitude from us, 'cause that's when our interest rates went up to, were we paying about 27% at one stage?

Male: But that was just the annoying part and this is why we've become so conservative, we were the bright young men coming into farming and we were increasing production and it wasn't just me, the whole of Otago was booming...

Female: For the good of the country if you like.

Male: But we honestly believed we were doing it for the good of the country, it wasn't so much creating wealth for us as creating wealth in the long term for the country, the country was going to benefit from it and then we were told in '85 we were a bunch of fools, you'd made your own stupid decisions and now we've changed the rules on you, tough and that's exactly where we were left. (*Integrated SB*)

^r There's not that many areas that are capable of combining the whole lot [both cropping and pastoral systems] into an intensive operation. And it gives a degree of flexibility that, while our interests are cropping, if the bottom dropped out of that [and] sheep climbed through the roof, because the farm's equipped with cattle yards, sheep yards, silos, irrigation, we can pretty quickly change our farming system either partially or completely. (*Conventional*)

^s As we're moving to more modern irrigators and more efficient labour-wise, we are moving a wee bit more to specialist machinery required. We can probably work [with it]. We've tried fixing it and we have done it from time to time. (*Conventional*)

^t And I put the second one [irrigation well] in, in 2001. Yeah, that is the other thing—is, that soon as we'd all had it all up and going, then dad died and then we had to start paying out everybody else and we had a \$100,000.00 well going down and ... It was just, everything sort of snowballed; but, I think, we've done the right thing, you know. But it's just being a bit tough. (*Integrated*)

I think the thing is, ...the other one, you were just on the treadmill in a way. You were in it. I mean we're on a treadmill in a different way.

We are on a treadmill.

But we're probably more... It's a different, ah, journey; isn't it? And more creating as the driver. (*Organic*)

^u Like that's the biggest thing is that our window can be pretty small in between getting it in the ground and getting it off the paddock ... So that's why we had to get the header, um, and that's why we sort of upgraded our gear to, to shift a bit of dirt in a hurry. so that's, that's the main reason. (*Integrated*)

^v [His family] have a lot of leadership roles in the community. I think that [he] would have some feeling that [he] has been, not forced, but really encouraged to do things. He's benefited from it and he's learnt a lot from it; but at times it's been extremely stressful. (*Conventional*)