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Global Vision, Leadership and innovation in Agriculture

Navigating Constraints: Primary producers coping in changing contexts

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Executive Summary

This report investigates the wide variety of ways that producers (farmers and fishers) have coped with constraints. These constraints include industry restructure, market pressures and environmental restrictions. How environmental limits have been navigated, and even utilised, is a major focus of the report since this is a current issue for New Zealand (NZ) farmers. In looking at the overseas stories and in 'bringing it home' to the experience of farmers in the Lake Rotorua catchment, the report explores what producers have done, how they have thought and what may be useful to them in the future.

Farming is an interaction between the individual farmer (often with family), the physical features of the farm and the wider environment it operates in. Because of the complex and adaptive nature of this farming system, a useful way of framing this report has been to use 'resilience thinking'. Resilience is defined as a system's capacity to respond effectively to change. Resilience thinking assumes that change is normal not unusual, and considers the adaptive capacity of the people involved with the farm system. It has also provided a useful model of responses to change – strategies of **Exploit**, **Absorb**, **Adjust** or **Transform** (EAAT) (Darnhofer et al., 2010b). Resilience thinking allows us to view farming as a dynamic system that is shaped and re-shaped by changing contexts.

Overseas producers that have successfully coped with constraints seem to accept this inevitability of change, and are anticipating what that might mean for them as far as they can. Two major strategies for coping with a gradual 'expected' change pressure, such as environmental limits, are Exploit or Adjust. The first strategy is Exploit where the farm takes advantages of successful existing activities to compensate for the stress in other aspects, – adaptation is thus marginal. Farmers that successfully respond with Exploit often drive efficiency in their operation and/or increase scale; they have a clear understanding of what their resources are and how best to use them. The second strategy is Adjust. Here the disturbance requires more adaptation of farming – maybe new production methods, new products, on-farm processing, etc. Both Exploit and Adjust farming strategies employ excellent business management, have a range of networks from which to glean new ideas and consciously adapt farming practices to reduce impact on the environment (and often to otherwise respect what non-farming people consider important). Farmers who have successfully made more adaptations in their farming business have experimented or diversified – both to test options and to provide a 'broader base' to their business. These farmers also recognise the importance of their own relational skills. Final aspects of successful adaptation using an Adjust strategy involve farmers choosing actions that mesh well with their values and that in some way satisfy their identity as a farmer. This report includes many quotes and two farmer case studies that showcase these elements. Strategies for sudden change are Absorb and Transform – these parallel Expoit and Adjust, with Absorb coping with the crisis out of the farm system's capacity to buffer shocks (eg using equity) and Transform responding to the shock with major changes to the farm activities. They are not considered in depth as they do not relate so well to environmental limits.

Rotorua farmers have been working with regulatory limits to achieve water quality outcomes for over 10 years. However now they face a 'step change' from staying within a nutrient cap to making significant nutrient loss reductions. While they have so far generally been able to respond with the marginal changes of Exploit, these farmers may soon need to adapt further and Adjust. A survey of Rotorua farmers shows that there is significant scope to support how New Zealand farmers cope with environmental limits. Outside influences are most helpful with actions taken alongside their farm businesses (e.g. learning about the environmental issue, or increasing their involvement with community or industry groups). Both 'thinking' (e.g. considering different future possibilities for their farm) and actions within the farm business (e.g. experimenting with farm management

strategies) also have significant influence by an outside person/experience. Rotorua farmer responses to open ended survey questions pointed strongly to: their need for confidence in the wider change process; a desire for multidisciplinary solutions; the deep value of interaction with others; and the contribution of personal resilience factors to how they think about change.

The main findings of this project come from aligning overseas experiences with the responses from Rotorua farmers, which reveals several areas that require action in order to better support farmers to live with and shape change. These are listed below.

Social/situation enabling

- Develop a strategy for understanding and fulfilling farming's social licence to operate.
- Support farmer confidence in the processes of achieving environmental outcomes.
- Initiate reflection to reexamine farming beliefs and re-form meaning and identity.

Mind-set enabling

- Train rural professionals to lead the way with the skills and language of adaptation, and to focus on the process of making choices in their work with farmers.
- Widely explore what diversity may mean in NZ agriculture settings.
- Develop a self-evaluation process for farmers to identify strengths and opportunities in their farming 'change-ability'.

Relational enabling

- Facilitate farmers entering into a multidimensional web of networks, which may have to utilise a range of means.
- Creatively work relational skill development into more than human resource (HR) activities.

Functional enabling

- Continue to build business, technology and systems understanding to provide a robust base for adaptation and a 'library of innovation options'.
- Work with the technology sectors that provide tools that will support NZ agribusinesses' ability to retain their social licence to operate and remain profitable.

Industry transformation

- Integrate the above and lead industry adaptation that answers society's desires and thus protects future competitiveness.

Readers of this report will thus gain insight into the wide variety of ways that producers have coped with constraints and the experience and desires of NZ farmers now coping with environmental limits. Overall, this report signposts current opportunities to support adaptive and resilient farming in a changing New Zealand context.

Foreword

I grew up on a dairy farm, studied Agricultural Science, married a sharemilker, but did not end up pursuing dairy farming as a business. I understand some of the drivers that can trigger a complete transformation of direction – in my case a family tragedy and an unexpected dynamic in our sharemilker-owner relationship were most significant. However, while I 'gave up farming' I have never really left it, reinventing my connection to dairying several times through part time roles on farms, tutoring agriculture and working in extension. The significance of the human element in extension particularly reflects my own experiences of change and its drivers: the farmer responding to and creating signals constructed out of a myriad of personal motivations, goals, resources, relationships, interpretation of significance etc.

The Lake Rotorua catchment has been my home for nearly 20 years, and I've seen a number of changes to the local context. These include acknowledgement of Māori ownership and values, land use intensification, greater understanding of the mechanisms of nitrogen cycling and leaching particularly from farms running female cattle, and greater societal recognition of the value of fresh water. The journey of the farmers in the catchment as both affected by limits enacted to improve water quality *and* as influencers on the process and shape of those limits has been marked by uncertainty, new understandings and different relationships. I have been privy to aspects of this from both a farming and industry perspective.

In applying for a Nuffield scholarship it was easy to choose the topic of producers coping with constraints as this so well encapsulates much of the tapestry of my own experience in and alongside farming. I've had the outstanding opportunity to investigate how producers in different settings have responded to environmental and other limits. What I think I may have sensed subconsciously has become very clear: responding to changing contexts is not just dependant on the situation of the farm or on the named limit, but also how it intersects with the farmer, their goals and thinking, their family (or other ownership structure), their other relationships… and so much more.

Acknowledgements

I have often jumped through windows of opportunity – but one must first see them. Many have helped me see, or jump, and I'm pleased to recognise these people. However it was the Nuffield NZ trustees that opened this window to me, when it may have been left closed – I am very grateful.

Knowing my husband Ross is absolutely committed to me as his life-partner, and to who I'm becoming, is both humbling and supremely empowering: "I belong to you." My children, Clara, Riordan, Lewis and Sofia, have both released and inspired me – meanwhile each in their own way developing into world-aware, questioning and caring adults. Leigh's and Lynley's sisterhood has been motivating, not to mention the warm airport sendoffs of my brothers and family members. Mum, Jan, you have been my longest and staunchest fan; you and Dad, who we both miss much, made me believe I could do and be anything. Family: this has been firstly because of and for you.

My employer DairyNZ has facilitated a renewed career and supported this Nuffield journey. Many have aided, including: my managers, Craig then Andrew, and our regional leader team, making room for me to grow; the fabulous Bay of Plenty (BOP) team, Wilma, Natalee, Moana, Kevin, Julian, Kim and Simon, sending me with blessings and continuing their great work with BOP dairy farmers; and the numerous others who have been interested in my journey (and my blog!).

The BOP dairy farmers we work with have encouraged me and welcomed me home. Thanks to the Lake Rotorua farmers that have had me tagging along on their change journey– especially Colin, who got me into it in the first place, and those who completed the survey for this study.

Countless crucial contributors to my travel logistic: organising (Anne, Desley, Julian and Jim); mentoring (Murray and Corene); accommodating (over 30 wonderful hosts, many Nuffielders, two of whom had me for long stints – thanks Olivier and Maire); accompanying on the Global Focus Programme; arranging contacts to visit (especially the multiple connections from John T, John W, Jean, Alfons, Wayne, Maire, Clayton and Jim); and sharing lives, contexts and insights so freely.

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I dedicate this report to the memories of: Zachary, who could have become; and Dad, who enabled my becoming and shared in many things that delighted.

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List of Abbreviations

BOPRC	Bay of Plenty Regional Council
DELF	Dairy Environment Leaders' Forum
EAAT	Exploit, Absorb, Adjust or Transform – Model of strategies responding to change
EU	European Union
FFNZ	Federated Farmers of New Zealand
HR	Human resources
LRPPC	Lake Rotorua Primary Producers Collective
NDA	Nitrogen Discharge Allowance
NGO	Non-government organisation
NPS-FWM	National Policy Statement for Freshwater Management
NVZ	Nitrate Vulnerable Zone
NZ	New Zealand
OAD	Once a day (milking)
PGP	Primary Growth Partnership
RMA	Resource Management Act
SETF	South East Trawl Fishery
SETFIA	South East Trawl Fishing Industry Association
SFF	Sustainable Farming Fund
StAG	Stakeholders Advisory Group (mandated by BOPRC)
WWF	World Wide Fund for Nature

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Introduction

Given the increasing tendency for change in the matrix of contexts within which a farm business operates, the question of how farm businesses navigate those changes is significant. Some New Zealand (NZ) farmers are already farming with environmental limits. Dairy farmers in the upper Waikato River catchment have had to apply for a consent to use water in their farm dairy if they use more than 15 cubic metres daily. Farmers in the Lake Taupo catchment have had to supply farm management information from 2001- 2004 in order to establish their farm's maximum nitrogen leaching allowance per year; this has been followed with a requirement for a consent to farm and the associated documentation and monitoring to demonstrate they are indeed farming within their allowance. Implementation of the *National Policy Statement for Freshwater Management* (NPS-FWM) will extend a similar situation to all NZ farmers. For industry the question that follows is "what interventions will deliver new levels of support to NZ farmers in the midst of that?"

External drivers, whether they are anticipated or sudden, require a response – sometimes in how the farm business is operated, but always needing different actions or thinking by the manager of that business. Adapting is complex; it may not be comfortable for individuals or straightforward for a farm, yet in order to persist as a primary production business, adaptation is increasingly vital. With globalization linking events in far off places to local settings, society demanding higher standards of resource stewardship and the usual vagaries of weather now exacerbated by climate change, farmers face a contextual landscape where change driven by external expectations is the rule rather than the exception. The stakes are high in this for both industry and individual producers.

The conceptual framework of resilience thinking is briefly described as it relates to farm systems. A model is outlined that describes four broad strategies for coping with change – Exploit, Absorb, Adjust and Transform. The author then describes some of the wide variety of things farmers have done to cope while navigating change, based on farmers visited overseas as part of fulfilment of a Nuffield Scholarship. Out of those stories the aim of this report is to give industry and farmers that are facing forced change both inspiration and guidance to assist them to adapt.

In addition to the overseas interviews, farmers in the Lake Rotorua catchment (for whom environmental limits have been a reality for many years) have been surveyed. Their responses are compared to those from offshore and outside influences on their changes are identified. These outside influences are examined in relation to other literature.

The EAAT model of strategies for responding to external change is tested for applicability to a whole sector, with the report concluding it is not only applicable but represents an imperative for dairy sector transformation. The conclusion to this analysis discusses interventions that could be delivered by industry/farmer leaders to provide new levels of support to NZ farmers in the midst of their changing contexts and to lead agriculture into a new era of operating with a comprehensive social licence.

Changing contexts

"All primary producer industries are subject to change," J2, fisher

One of the biggest current context challenges in New Zealand (NZ) is environmental limits, which takes shape for famers at multiple change matrix points: national, regional, local, technological, social, internal understanding and motivation, and as a gradual pressure. Environmental limits require that farmers know what their farm's impact is on the 'limited' resource – maybe how much water they are using for their farm dairy, or how much nitrogen is leached from their system. In some situations farmers are required to obtain a consent for specific activities within their system (eg to discharge diary effluent) or even to conduct their farming business (as dairy farmers in the Lake Rotorua catchment will need to). To this end, increased monitoring, recording and understanding is required of farmers.

Changes affect both physical and social aspects of farming (Milestad, Dedieu, Darnhofer & Bellon, 2012a). The internal situation of the farmer is one of change too – goals evolve, understanding changes, as do family needs. One can infer "both the means and the ends of farming evolve" (ibid.). External disturbances occur at different scales, as detailed in the 2011 research report from the Agricultural Research Group on Sustainability: local; regional; national; and global. It is noteworthy that 26 such trigger events were detailed over the 40 year study period (van den Dungen, Rosin and Hunt, 2011). All the types of changes encountered are also qualitatively different; change may be gradual, even if not known precisely, (e.g. approaching retirement age) or sudden, even if not completely unexpected (e.g. damage from a flood) (Darnhofer, Fairweather, & Moller, 2010b). Figure 1 illustrates this matrix of change as being like a Rubik's cube.

Figure 1
The 'matrix points of change'

While many resources are utilised in the effective operation of a farm system, of particular note for contemporary New Zealand agriculture's context is the government's direction within the NPS-

FWM which supports improved freshwater management ("About the NPS-FWM," 2015). Farmers as water users (e.g. irrigation, farm dairies), water quality 'affecters' (e.g. soil erosion, nitrate leaching) and community participants are being involved in identifying local values for specific water bodies, and working with and responding to both regulators and the community to achieve negotiated local limits. These intersecting dynamics offer fertile space for farmers to respond innovatively and show resilience to the changes posed by the NPS-FWM.

Resilience reviewed

Resilience thinking is a concept used in various settings including social-ecological systems, and psychology (Darnhofer, 2014). Increasingly it is being used in the context of achieving sustainable farming systems for: improving environmental impact; continuing in the face of change; and accommodating the life stages and drivers of the people that both operate and live within them (Darnhofer et al., 2010b; Milestad et al., 2012). It is beyond this report's scope to review resilience literature in its entirety as much has been written on aspects of resilience in various contexts. To further investigate applicable research, see the recommended reading in Appendix 1. For aspects of individual resilience see Appendix 2.

Key concepts from resilience thinking related to this study follow (and see side bar for quick definitions).

Change – underpinning resilience thinking is the rejection of equilibrium as an enduring outcome in social-ecological systems (Scoones et al., 2007) and acceptance of "changing" as a normal aspect of organisations (Weick and Quinn, 1999, cited in Tsoukas and Chia, 2002), and the world. Furthermore the pace of change has accelerated in recent years, demanding not only acceptance from producers but responsiveness.

Resilience – a commonly used definition is: 'The capacity of a system to absorb disturbance and reorganise while undergoing change so as to still retain essentially the same function, structure and feedbacks, and therefore identity, i.e., the capacity to change in order to maintain the same identity' (Folke et al., 2010, cited in Darnhofer, 2014). Resilience literature notes: that the social system and ecosystem are coupled and interdependent (both in larger ecosystems and farms as subsets of them (Gunderson et al., 1995 cited in Schiere et al., 2012)); that resilience is not so much an outcome as an on-going development in coping with inevitable pressure; and that resilience is less about managing risk from known threats than about accommodating an unknown future (Darnhofer, 2014). As a process resilience is a relational concept.

Complex adaptive systems – are systems that involve many components (agents) which adapt (learn) as they interact (Holland,

Quick Definitions

Resilience:
A system's capacity to respond effectively to change.
An emergent outcome.

Change:
Everything becomes different; variations occur at different scales, in both social and physical areas and as both stresses and shocks.

Complex adaptive system:
With many parts that adapt as they work together.

Co-evolution:
Producing and responding to change in other connected systems.

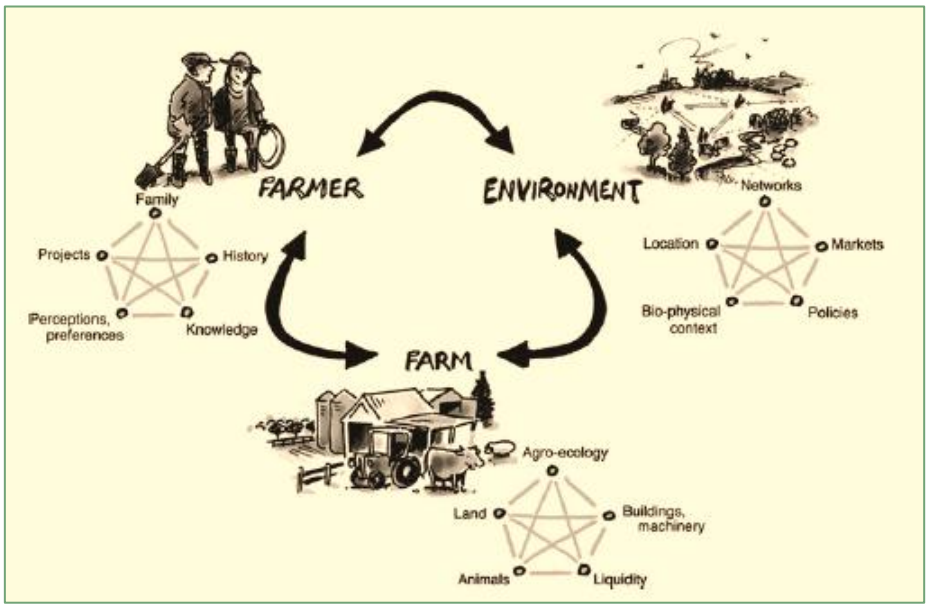
Adaptive capacity:
Ability of humans to manage resilience.

Bricolage:
Creative 'making do', reusing the old to make the new.

Farming:
Interdependence of farm, farmer and context.
Emerging.

2006, cited in Schiere et al., 2012). Schiere et al. (2012) use the phrase 'the ghost in the machine' to point us away from the notion of the farm as a simple mechanism, toward an understanding that there are multiple underlying dynamics in a farm system. In many places the farm is depicted as an adaptive complex system (Darnhofer, Bellon, Dedieu, & Milestad, 2010a; Darnhofer et al., 2010b), shown in Figure 1. The 'farm' is emerging from the web of interactions of the farmers, its environment and its physical components. Significantly these interactions are not static – the linkages between the elements change and agents change their perception as a result of learning.

Figure 2
Family farming as a complex adaptive system
(from Darnhofer, pers comm, 2015)



Co-evolution – borrowing from the concept of biological evolution, co-evolution recognizes that different agents within a complex system change and are changed by each other. A farm system is therefore dynamic; over time it both generates and adapts to changes such as technologies, business practices, institutions and farm practices. Farm system development is needed to maintain its 'fitness' relative to the systems with which it is co-evolving. An adequate level of diversity is implied in this concept, increasing the possibility of coping with unpredicted change.

Adaptive capacity – is a system's ability to respond marginally to change in order to sustain its long-term survival, principally through the human actors in that system. It relies in the first instance on the learning and resourcefulness of the human farmers. Taking the wider view of the farm as belonging to multiple systems (e.g. a Rotorua dairy farm being part of the dairy industry, working to limits set by the Bay of Plenty Regional Council, supplying a certain dairy company, etc.), adaptability is the collective capability of all the human actors in the wider social-ecological systems (Walker, Holling, Carpenter, & Kinzig, 2004). When these supporting actors are working well, with effective wider processes in place this is termed environmental efficacy (Boxelaar, Sharma, & Paine, 2006) and the farmers involved with change are encouraged to adapt to achieve the collective outcomes. Adaptive capacity is developed by continuous learning processes that utilise experience, sense-making, bricolage and experimentation (Darnhofer, 2014). Schiere et al. compares 'default' farmers with 'design' farmers, pointing out the importance of choice, making fundamental attitudes explicit and understanding underlying dynamics in consciously deviating from the old 'business as usual' practices (2012).

"Farming" as emerging from relations – Darnhofer, Lamine, Strauss and Navarette (2016) describe the farm system as even more than all its physical and social 'things' and processes, choosing the term "farming" – using a verb rather than a noun emphasises relations and dynamics rather than separateness and stability. Thus all of the above thinking is bundled into one concept whereby resilience emerges from the changing configurations and dynamics of relations between farm, farmer and context.

The question of whether a farm is resilient or not is not so much a question about that farm's ability to survive a particular hurdle at a particular time, it is rather a question of whether the farm's adaptations over time are toward a more sustainable and resilient orientation (Darnhofer et al., 2010b).

What fresh meanings and new patterns of diverse resource relations …

• • •

…enable on-going, creative and responsive change in the process of emerging farming resilience?
(Darnhofer et al., 2010b)

What are farming strategies for coping?

Based on concepts from resilience thinking, Darnhofer et al. (2010b) provide a useful framework for considering farm level responses to either predictable slow change, "stress", or sudden major disturbance, "shock", shown in Table 1. Just as drivers of change come in these different forms, resilience may emerge differently – both from resistance to change and from adaptive renewal. Resistance to change doesn't signify not recognizing a changing context, rather it is a determination to retain an identity (perhaps as a certain type of farmer) or to continue on a certain path *despite* the external pressure (hence Exploit or Absorb); change may still occur at the margins in recognition of both the context and the determination. Adaptive renewal, however, occurs within the Adjust and Transform strategies.

In reality, given the layering of co-evolutionary farm and context changes and changes within the farmers or their family, it can be hard to tease out just which response has been to which driver. What may start out as an adjustment could evolve into a complete transformation over time. Additionally what may have been a gradual stress can culminate in a more sudden shock (e.g. tobacco quota reductions followed by a complete quota buyout). Nonetheless, how each producer business appears to have changed up until the time at which they were interviewed is labelled Exploit, Absorb, Adjust or Transform, or a combination if appropriate (capitalised to distinguish strategies according to this EAAT model).

Table 1
Overview of the strategies used by farms to navigate various changes: EAAT Model
(From Darnhofer et al., 2010, p. 193)

Nature of Change	Response at Farm Level		
	Approach	**Strategy**	**Description, examples**
Stress (predictable, slow change)	Persistence; no or marginal change (change is 'resisted')	Exploit	The farm takes advantages of successful activities (i.e. those that are well adapted to the current environment). Farms might shift more resources to these activities (specialisation) and exploiting economies of scale, thus compensating for the stress in certain activities
Shock (sudden, major disturbance)		Absorb	The shock is absorbed without changes being required. The farm has sufficient buffer capacity to be able to cope with the crisis.
Stress	Adaptation; explore new options, change activity mix, use resources innovatively	Adjust	The disturbance requires some adjustment at the farm level; by bricolage previous successes are adjusted to new needs. These can include new production methods, new crops, introduction or removal of animal husbandry, on-farm processing, direct marketing, etc.
Shock		Transform	The perturbation requires a major realignment of the resources and may involve the introduction of activities from outside the traditional realm of farming. These can include agri-tourism, care farming, energy production, etc.

Environmental limits take shape for farmers primarily as gradual predictable change. While the exact specifics of a regulation may not be known until it is written into law by regional authorities, the nature of desired environmental outcomes are apparent. Since response to environmental limits is the focus of this report, the strategies of Exploit and Adjust will receive the most attention in the analysis.

Figure 3
Landscape view of Timoleague Catchment, part of the Agricultural Catchments Monitoring Programme, Cork, Ireland

Navigation nuanced 1: overseas data

Methodology (overseas)

Forty five farmers and fishers were interviewed from seven different countries, situated in the contexts described in Appendix 3. Each person (or farming couple) was interviewed following a semi-structured approach using the question prompts listed in Appendix 4. Responses were recorded in note form and are held by the author. The results are discussed mostly in their qualitative form without having been subject to rigorous statistical analysis.

Survivor bias disclaimer: of all the producers interviewed most are still actively farming/fishing. In several of the contexts encountered, those interviewed told of how few remained in their sector compared to 20-30 years earlier (e.g. scallop fishers have gone from over 100 to 12 in the south east Australian region). Only three people who were no longer directly involved with their original farming or fishing business were interviewed.

Results

Constraints

Sixteen of the 45 interviewed discussed two notable constraints; the rest discussed their response to just one key issue (constraints shown in Table 2). Other changes (either shocks or pressures) mentioned were input costs or availability, cost to buy more quota, land fragmentation, reporting requirements, planning constraints or bureaucracy, lack of interaction with others (i.e. a mismatch with personal values) and co-operative failure. Producers did not always name the constraint expected by the author. Most have elements of environmental regulation in their current context, whether it was named or not. For example, for the fishers interviewed, while quota was most significant, other controls to try and improve environmental outcomes also exist (e.g. Marine Preservation Areas, by-catch records).

Figure 4
Anaerobic digester on town-edge 800 cow dairy, Pennsylvania, USA. The farm has a private nutrient trade deal with the town authorities.

Key Constraints

- Environmental regulations
- Public perception
- Industry restructure
- Flooding
- Disease
- Market pressure

Response themes

- Productivity or scale efficiency
- Product value
- Check goals and values
- Inventory
- Experiment or diversify
- Support networks
- Business management
- Act for social license
- Family
- Retain identity
- Belief in industry
- Relational skills
- Local focus
- Industry action

Table 2
Number of producers in each constraint category

Constraint	Environmental Regulations	Public Perception	Industry Restruc-ture	Floods	Disease	Market pres-sure	Other	*Total Indi-vidual Responses*
Number with this as main constraint	17	2	12	4	2	3	7	***45***
% of producers with this main constraint	38	4	27	9	4	7	16	
Number of producers that discussed this constraint	24	6	12	4	3	3	9	***61*** *(45+16)*
% Producers with this as a constraint	39	10	20	7	5	5	15	

As shown in Table 2, environmental regulation was the most common main constraint discussed during the 45 producer interviews; this was followed by industry restructure. Public perception was only noted by two producers as their most significant constraint (both fishers), although it was noted by an additional four producers from a range of contexts.

NB: Tables detailing all responses are included in Appendix 5

Themes
Periodically during the time the interviews were undertaken the author reflected on the responses of the farmers. By the conclusion of the travel the following themes stood out as aspects of how farmers had coped with constraints. In particular, farmers had

- acted to reinforced their social license;
- maintained a local focus;
- developed relational or human resource skills;
- consciously examined and acted out of their values and goals;
- engaged with industry action to do with the limit;
- used support networks;
- experimented (in small steps) or diversified;
- sought efficiency gains via increasing productivity or scale;
- inventoried their resources and skills;
- sought to retain their identity;
- focused on wider business management;
- increased the value of the product they sold;
- acted because of aspects of family interaction with farming, and
- believed in their industry.

Change quotes

"I think I've stayed more attached to future possibilities than past comforts… in looking ahead you can identify future threats." ***J10***

"You meet people and your world expands." ***J4***

"Change has required more connections." ***D5***

The notes from each interview were coded to the above 14 themes and collated according to the constraint identified by the farmer/fisher and by the general response strategy employed in the farm business to cope with change.

Of the 14 themes identified by the author, across all the farmers/fishers in all their various contexts, those discussed by two thirds or more of respondents were, in descending order of frequency:

- wider business management;
- inventoried their resources and skills;
- used support networks;
- sought efficiency gains via increasing productivity or scale;
- experimented (in small steps) or diversified, and
- choices that reinforced their social licence.

In order to draw conclusions significant to this report, data on themes coded in interviews with producers that named environmental limits either as their sole or joint constraint are shown in Table 3, alongside those from the 45 total interviews.

Table 3
Discussion of themes by farmers with environmental limits/constraints compared to all producers and of themes discussed by Exploit and Adjust strategy for navigating sole environment constraints

Constraint	Environmental Limits (Sole or joint) (%)	All Producers & all constraints (%)	Deviation of Env. Limits group from All Producers (%)	Solely Env. Limit & Exploit Strategy (%)	Solely Env. Limit & Adjust Strategy (%)	Solely Env. constraint (Ex & Ad) (%)
Number in Group	***24***	***45***		***11***	***8***	***19***
Theme						
Actions for Social Licence	96	**64**	49	100	100	100
Local Focus	54	**38**	43	64	75	68
HR/Relational Skills	54	**44**	22	27	88	53
Values Assessed/Response	67	**56**	20	45	88	63
Industry Initiative	50	**44**	13	45	50	47
Networks/Support Utilised	92	**82**	12	82	100	89
Experiment/ Diversification	79	**71**	11	73	88	79
Other	46	**42**	9	18	75	42
Efficiency/Scale	88	**82**	6	100	75	89
Resources Inventoried	83	**82**	1	91	63	79
Identity Retention	38	**38**	-1	9	88	42
Business Management	88	**89**	-2	91	88	89
Product Value	46	**47**	-2	27	50	37
Family Impact/Factors	50	**53**	-6	45	50	47
Passion/Belief in Industry	25	**31**	-20	9	25	16

Table 3, shows the themes evident in the actions discussed by producers with environmental limits compared with the group of all producers. In decreasing order, themes more significant to those with environmental limits were:

- acted to reinforced their social licence (96%);
- maintained a local focus (54%);
- developed relational or human resource skills (54%);
- consciously examined and acted out of their values and goals (67%);
- engaged with industry action to do with the limit (50%);
- used support networks (92%), and
- experimented (in small steps) or diversified (79%).

In common with all the producers interviewed, the following featured for over 80% of producers with environmental limits:

- sought efficiency gains via increasing productivity or scale;
- wider business management, and
- inventoried their resources and skills.

Strategies for Adaptation to Environmental Limits

• • •

Exploit (58%)

Adjust (42%)

Strategies

Some farms had adopted more than one of the four EAAT model strategies over the course of time, reinforcing the divergence of reality from tight models. Certain constraints present as both a pressure and a shock – for example industry turbulence and restructuring by decreasing quota followed by a complete quota buyout. As mentioned, some producers described more than one constraint, and often family (or internal) drivers can precede/follow/align with an external constraint. Add this to experimentation and learning and the employment of multiple strategies over time is not surprising. The model is still useful and is discussed further here.

Where environmental regulations featured as the *main* constraint to the producer (whether the producer named one or two constraints) the only two significant response strategies employed were Exploit (58%) and Adjust (42%). This makes sense as environmental regulations manifest as gradual pressures rather than sudden disturbances. One producer had initially used Exploit in response to environmental regulations but then transformed his business in response to industry restructure. Table 3 (on page 19) includes the proportion of each of the Exploit and Adjust strategies for coping with environmental limits whose discussions demonstrated the various themes. Data in Table 3 has been used to create a representation of the relative significance of the different themes

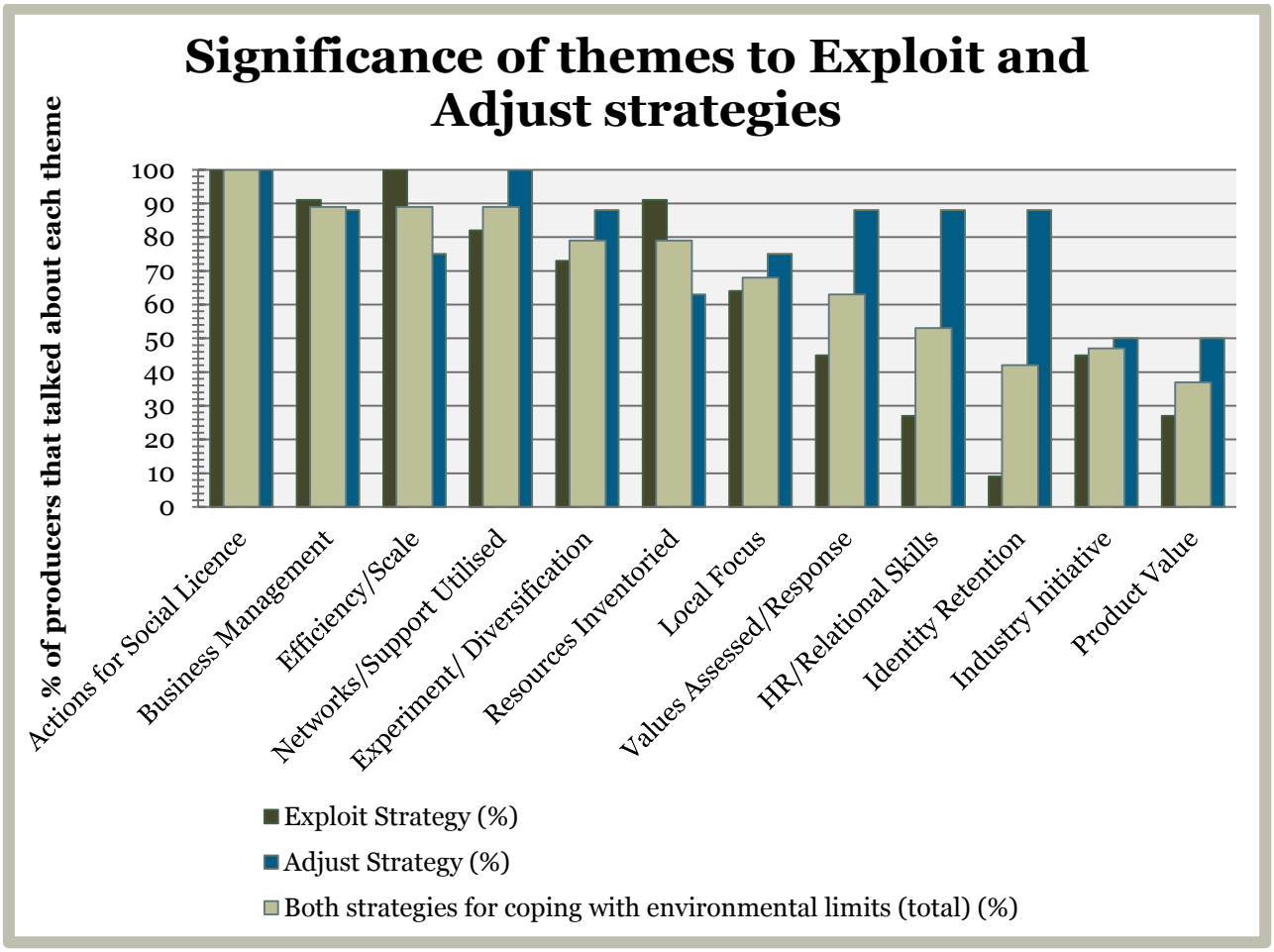
Keys to success (from overseas interviews, in no particular order)

• • •

Focus on your goals
Strategy, planning, monitoring ("empowers")
Farm to fit your values
Talking and listening widely
Challenges already faced
United family
Taking an opportunity
Being proactive
Efficiency
The (various) network
Hard work
Broad perspective
Watching other farmers
Determination
Faith in the industry
Keep contacts up
Happy to try things
Coping with debt pressure
Staff, farm relationships
Understanding the science
Reflecting
Involvement with government/agencies
Brand / Get a good name for yourself / Quality
Turning a limit into a story
Future thinking
Go beyond comfort zone
Early exposure to other ways
Having a buffer (money, replacements…)
Knowing impacts of farming activities
Love where you live

across both the Exploit and Adjust strategies, as shown in Figure 5.

Figure 5
Comparative significance of action themes for Exploit and Adjust strategies employed by producers navigating environmental limits



Discussion
Only a small sample of producers was interviewed. The research could be improved by sampling a bigger number and specifically following up on the aspects highlighted here, and by subjecting the data to rigorous statistical examination.

Farmers/fishers have done a wide variety of things in responding to changing contexts. Nearly all producers with environmental limits responded in a way that reinforced their social licence – by and large they commented on doing things because of the positive impacts they would have. In contrast to New Zealand, however, overseas farmers talked of supportive funding options. Of the £9 million invested in new or extended slurry storage for 40 farmers in the Piltanton Burn area for example, about £5 million was sourced from the EU and a dry-stock farmer in Exmoor discussed how environmental services are another farm 'product' for him. While this funding often has 'strings attached', it nonetheless mitigates the outright cost of some adaptations.

In common with producers with different constraints, sound business management is fundamental to providing a secure platform to adapt to either sudden or gradual change. The significance of networks, the contribution of efficiency or scale and the value of consciously taking stock of the resources available for reorganisation applied to many interviewed.

As listed on page 20, for environmental limits, along with awareness of their impact, is a heightened attention to their location. The other important themes for this group that sets them apart from producers with any constraints are relational skills, responses according to their goals and values and engagement with industry initiatives to do with the limit; the first two of these themes are much more significant for an Adjust response than Exploit, as are identity (see sidebar quotes, pg. 23, "Who I am..."), support networks and experimentation.

By definition, producers that used the Exploit strategy to respond to environmental limits employed a much narrower range of adaptations than those that used Adjust. What is not clear is whether that is because that was simply the best response, or if they somehow perceived fewer options to choose from and hence implement.

Figure 6
Wydon Farm, Minehead, Exmoor National Park – alongside the Bristol Channel, with tourists, Celtic archeological sites, protected species/areas and public walkways.

Mindsets

• • •

"We designed a system to meet our own values and goals and to fit our perceived future context... I am confident we can face any future limits." ***F1***

"Dad was an outdoorsman. [I've adopted] his philosophy...leave the land better and keep quality water." ***A1***

"Wide industry and community involvement has kept the business on the forefront of change and of meeting regulation... allows you to help in making regulations workable." ***A2***

"You've got to look for the positives in the midst of the problem!" ***E1***

"I try never to forget a single thing someone tells me, even if I disagree... it may be an important piece of the puzzle in the future... I enjoy problem solving." ***J10***

Selected Overseas Case Studies

The first two of the following three case studies are from farmers and Nuffield scholars that the author stayed with for two or more days during August to September of 2015, while utilising the Nuffield network to meet and interview farmers that have coped with constraints. Staying multiple days and thoroughly touring the farm and locality enabled good insight into the farming constraints and adaptations. These farmers were both interviewed and used in the overseas data already discussed, but have also been included here in an expanded 'story form' to demonstrate some of the range of complex external change encountered and adaptations adopted within individual businesses. Both of them demonstrate aspects of resilience. The final case study is of an industry association mentioned by the fishers interviewed in Victoria, Australia; the author was able to interview and capture some the adaptations made by the CEO (and board) of this association in their efforts to develop resilience within this industry.

A long story of a co-evolving farm business.

GAEC Trévarn (GAEC is Groupement Agricole d'Exploitation en Commun, an agricultural partnership business structure) is a family dairy farm operated by two brothers, Jean-François and Olivier, near Saint-Urbain in Brittany, France. It has a milking area of 29ha, running 90 cows. Additionally, about 5 minutes' drive away is a 15ha heifer block and a further 20 minutes' away at Rosnoen a crop/silage block of 22ha.

The brothers have learnt to work together well since their dad passed away at a relatively young age. Their mother still lives on farm.

The physical context of Trévarn Farm is an average annual rainfall of 1000mm. Winter temperatures can be at or below 0° C, with virtually no pasture growth for 2 months. The soils are silt on sandstone and can have a compaction layer; drainage is poor and the ground is easily pugged. The combination of low water holding capacity soil and only around 50mm rain per month through summer also makes the place drought prone. Summer temperatures are usually 20-25° C, occasionally reaching 30° C. All this gives an annual pasture harvest of around 8 TDM per ha.

Increasing compliance represents the regulatory context for this farm: times that certain activities such as pasturing animals and applying slurry or fertiliser cannot be carried out (necessitating storage and management to cope with non-application times); and a limit to total organic N output from the farm (calculated based only on time on pasture (months equivalent divided by 12) and milk production per cow). The farm is not constrained by how much nitrogen fertiliser they can use, however the biggest implication has been they cannot apply before mid-February when they used to apply mid-January to get some early pasture growth. One of the reasons they have decided to use more straw bedding is they are able to spread solid manure more freely, especially on slopes, and it reduces the storage demand. There had also been the long standing milk quota system, introduced in 1984 and removed in April

Who I am

"I am actually happy to be different... or even provocative," Olivier, Gaec Trevarn

"Although I was afraid of what the future may hold, if I wanted to continue pig farming, I had to change..." ***F3***

"[earlier] we'd had serious droughts... dust blowing everywhere. I would wake to the sound of the wind, worried about my cattle. Since the flooding has become more frequent and more serious I've had the same feelings of anxiety about my stock." ***H1***

"I grew up in the area... went fishing at 16. When our quota was reduced by 25% we faced a big question: Do we get out or consolidate?" ***C4***

"We have been cheese producers for generations. We've stayed with that, while many have stopped." ***D4***

"I consider myself a grass farmer more than a dairy farmer... I guess I was a grass farmer before too, when I was a beef farmer." ***G4***

2015. The social perspective is partly what drives the environmental obligations, but has the added aspects of the strong sense of Breton identity, a return to artisan products and a desire for locally sourced healthy food.

Around 20 years ago, this was a 70 cow herd to fill a quota of 490 tonnes of milk, high input farm that was operating with the participation of an outside investor. In 2000 the partnership broke down and the investor left the business. Jean-François and Olivier re-evaluated their goals – they were happy to continue to work together, but wanted to be able to earn a reasonable salary each from the farm business. At this stage they felt they really had 2 options – buy a new farm or stay small at 70 cows. While direct marketing was also an adaptive option they were not very comfortable with that idea. They decided to work toward enlarging the farm. This coincided with a course run by the local Chambers of Agriculture on low cost dairy systems. With quota restricting output growth, they elected to drive costs down and focus hard on profit rather than production. Once a day milking (OAD) emerged from this bricolage process – Jean-François and Olivier milked a part season in 2000 and from April (near the beginning of their season) the following year. They also reduced the volume of purchased feed. Olivier described even this marginal change of going to OAD for only a 'part-season' as a 'revolution' with regard to local dairy norms.

With the change to OAD, the brothers decided to switch to a Jersey cross herd and purchased extra Jersey cows. These turned out to be carrying Johnes disease, which is treated much more seriously there than in New Zealand, and meant the end of selling surplus heifers with integrity. It also changed Jean-François and Olivier's attitude to purchasing in stock.

In 2002 Jean-François and Olivier took the opportunity of buying the block at Rosnoen to grow their own maize and gain some more quota. By this stage they had shifted the business' profit to a bit above the average for their accountants' farms. Over time the decision was made to reduce the amount of maize grown at Rosnoen (mainly due to uneconomic yields and partly to public perception of the effects of cropping on water quality). It is worth noting that the heifer block is subject to high public interest – having a picturesque arched train bridge running through it (Figure 6) and a stream on its boundary – both features have popular adjacent public walking tracks. Jean-François mows along the stream and they recently added a seat in a stream-side glade; apart from the personal satisfaction, they are very conscious of being good neighbours.

Figure 7
Brittany landscape with viaduct through heifer block of Trévarn Farm

In 2001 Olivier was awarded a Nuffield scholarship to further explore applying OAD milking – although at that time OAD farms were fewer in number than they would be even five years later. A few years ago they decided to go back to twice a day milking in order to preserve as much production as possible from the resources of a lower input system, seasonal system. By gradually changing the calving dates (and not bringing in outside stock), the dairy production system has been reorganised to better fit the grass production curve, rather than rely heavily on brought on crops or purchased concentrates – the 14/15 winter was the first time the dairy was shut down over winter. Olivier recognises that the co-op prefers an even, year-round milk supply curve; however as

there are not many who have a seasonal pattern, Trévarn Farm's is not a threat to the co-op's manufacturing costs.

One rule that doesn't yet affect Trévarn is the requirement for herds over 100 cows to have certification to show that they meet all the relevant regulations, which includes such things as mapping the farm, soil testing and checking slurry storage. This must be done by external auditors at a cost of about €5-6,000. Jean-François and Olivier, operating out of a 'design farmer' mind-set, have already had this done, 'just in case'.

With the option of selling surplus heifers eliminated, Jean-François and Olivier wondered what they could do to add value to calf sales. A few trips to the sale yards gave them their answer – use Belgian blue bulls over selected cows and sell the progeny as milk fed vealers at about one month of age. They started this about 4 years ago and budget on receiving €500 per head, estimating that they can turn one litre of milk into one euro through these calves.

Meanwhile, as with many long established farms throughout Europe, the farm was rich with buildings in various states of repair. Responding to the social context, one barn was leased to a man from the local town who has established a craft beer business. A corner field was also leased to a young woman to set up an organic vegetable business supplying regular packs to customers (Figure 7).

Both Jean-François and Olivier have never cared for trying to compete with the neighbour, happy with their identities of being different or even provocative. Olivier did the practical component for his agricultural college education in Ireland and feels this has contributed to his desire to 'not just do what everyone else does' – he also reads very widely. Jean-François has remained 'very French', maintaining that English isn't necessary for him and requiring that most of the communication between himself and the author be carried out with Olivier as the interpreter. He has a passion for ecology and has personally added hundreds of species identified on or around their farm to the National Inventory of Natural Heritage. Interestingly one of the very many small local churches is on the farm. While it is not used for regular services, both brothers take an active interest in any community events hosted there and are part of a group that aims to maintain its original condition as far as possible. During conversations with Olivier his connection to the local place was plain – he discussed being part of a legal challenge to planning consent for a local business that would be out of place in their village, he was readily able to connect with a wide range of local people (from environmentalists to dairy to pig farmers to researchers) and took great pleasure showing the author around 'his place', which proved a rich fabric of relational, historic, cultural and agricultural threads.

The dairy is still a dairy, but it is notably different from many locally, having adjusted over time; Trévarn is a farm with wide community relations and has added the multifunctionality dimension that is becoming something of a hallmark of, especially small, European Union (EU) farms (Jongeneel, Polman, & Slangen, 2008). Everyone on farm at that time of day has lunch at Jean-François and Olivier's mother's house; GAEC Trévarn is creating its own new social dynamic of partnership.

In the future Jean-François and Olivier are thinking they may aim to produce a bit more in order to add staff into their operation. Meanwhile farming is proving to be a good means by which to achieve their goals.

A short story of a dairy farmer with environmental regulations… and two disease shocks

Andrew and Claire farm in the UK, milking around 700 cows once a day. Through their local farm discussion group they were introduced to Michael Murphy, a successful Irish (and multinational) dairy farmer who is a strong practitioner and proponent of goal focused, low-cost, grass-based milk production ("About Us: Positive Farmers Conference,"). As at 2012 Andrew and Claire were running a spring calving, pasture focused system, with learning and network links to other pasture based dairy farmers throughout the UK and Ireland.

The farm is not within a designated Nitrate Vulnerable Zone (NVZ), but lies quite close to the major Cornwall NVZ. Not having NVZ status exempts the farm from many regulations and much specific record-keeping; however, such things as a Manure Risk Map and records to qualify for the Single Farm Payment are still needed. Winters are wet and the soils easily pugged. Andrew believes more accountability will be required in winter management in the future. Taking actions now that will help guard their social licence to farm is one reason they have built a new barn in which they are trialling the use of 'enviro-bedding'. This is made from short fibre paper 'fluff' and can be spread on paddocks after the winter. They are testing its impact as a soil conditioner and nutrient supplier. Andrew is also experimenting at the margins with different fodder options for winter feed, to maintain as far as possible their low-cost ethos. Having a Jersey herd and seeking better returns from calf sales they commenced a rosé veal programme in 2012, selling the contracted bull calves at 9 months (Figure 9). This has had a surge in popularity with consumers who feel it is 'better' than disposing of bull calves as new-borns. At a similar time they installed an industrial grade (500kW) windmill as another income source.

In 2013 the couple had plans to expand their business further. They have always carried extra heifers for either sale or to give them capacity to grow their herd if an opportunity arose. However, when 90% of the rising 2 year heifers were empty all their thinking had to change. The herd had been infected by Schmallenberg Disease, a virus transmitted by biting insects that causes early pregnancy failure or foetal abnormalities. With a strong farm team, they sat down together and brainstormed "what to do with what we've got?" Everyone was engaged in finding a solution and staff were happy with the final decision of an autumn calving herd, especially since they only milk once a day. The simplicity of their daily dairying regime gave them capacity to add diversity which otherwise may have been too great a burden on workload. The empty heifers were mated for an autumn calving. It took 2 years and experimenting with insect spraying regimes to get on top of the disease. Meanwhile a positive TB reactor 'out of the blue' drove further tests of the herd – 130 were condemned. Numbers have had to be rebuilt slowly with their own replacements.

"Well…"

• • •

You get a bit bloody minded… you won't be beat."

"I had a thought:"

• • •

"One major consequence of a disease storm is the increase in attention to detail that has to come to get through and the improvement not only in protocols regarding animal health but throughout the whole farm business i.e. budgets, health and safety etc. Every successful business will encounter periods of pain which in turn brings resilience."

Gems?

• • •

"…our ability to travel as a family. I put that down to the suitability of our system to cope with the challenges and its simplicity."

All quotes by ***Andrew, Ennis Barton Farm, Cornwall***

Andrew and Claire have maintained the autumn calving. This year they will calve 580 in spring, from which all replacements will be kept, and 200 in the autumn, mated to Hereford bulls. Both calvings are only six weeks long. Although not how they had planned to farm, they feel the current system has some positives for them now: autumn milk is more valuable, they have a milk production profile that makes them attractive to a competing processor (should they wish to change), their cashflow has improved, empty cows and heifers get a second chance to stay in the herd.

Interestingly, by keeping good relationships with not just their on-farm team, but also the likes of their accountant and banker, and with their strong focus on excellent business management, in the midst of this 'disease storm' they have nonetheless been able to take an opportunity to buy an extra block of land.

Andrew believes their farming has evidenced resilience partly because they are goal focused and had already been through 'the normal family disturbances'. In the face of the disease challenges they did not rewrite their goals, but did reorganise the plans for how to achieve them. A facility designed with environmental limits in mind and that could cope with feeding milkers in winter, the extra income from the rosé veal, and carrying 'spare' replacements were all buffers that aligned with their own determination to guard time to think and so "be in charge of their business direction". The environmental limits have not gone away; when the author visited the farm, Andrew and Claire's farming response to those featured more than the disease storm they had weathered, the latter perhaps having already been 'chalked up to experience'.

Figure 8
a. Andrew with his milking herd; and b. rosé veal calves.

A story of one small industry association in a big ocean

Incorporated in 1990 the South East Trawl Fishing Industry Association (SETFIA) "promotes the interests of members in the South East Trawl Fishery (SETF)" (Boag, 2011). Although predominantly a supply based organisation, it includes many marketing members. Membership is voluntary and is open to anyone with an interest in the SETF. The SETF runs southward from north of Sydney to Kangaroo Island in South Australia and encompasses Victoria and Tasmania. At a fundamental level SETFIA's value to members is assessed by members on their businesses financial performance.

The author was able to speak with Simon Boag, who has been SETFIA's CEO since 2009. He was forthright in his assertion that in the face of environmental limits (or other social licence related issues) industry must identify emerging issues and respond head on, acting during "the period of calm". They can either "defend, deny, delay... or solve!" (Boag, 2015). Wild catch fishing has traditionally been an industry that has received a lot of negative attention from environmental non-government organisations (NGO). It is a relatively small industry and that, along with its great diversity, has contributed to a lack of cohesion.

SETFIA operates a balanced scorecard to set and achieve its strategy (Boag, 2011). This plan is to maximize members and funding, use this to improve industry culture, use both to improve on-the-water practices and then communicate this to stakeholders. Seeing an increase in accountability for seabird interactions (death or injury of birds due to their interaction with fishing operations) associated with fishing, SETFIA acknowledged the problem and set about to find solutions. They now have several devices that can be used by fishers to reduce bird 'interaction' by up to a staggering 96% ("SETFIA and seabird conservation,").

This is a story of co-evolution – where the perspectives of both SETFIA's members and of the public are being reshaped. SETFIA has developed a series of 2-day courses for fishers (under the national qualifications framework), covering such things as the value chain, consumer research, social licence, the threat from aqua-culture etc. Part of the aim is to shock fishers into understanding that some of their key 'supplies' cannot be bought – for example fish and 'ground' for fishing – and that access to those is based on relationships and the demonstration of stewardship. To that end, SETFIA has entered into a strategic relationship with WWF and Coles as shown in the logo in Figure 4 ("Fishery Improvement Project,").

Figure 9
WWF logo for SETFIA and Coles partnership

Fisher regard for SETFIA

"SETFIA has achieved some successful projects, but their most significant victory is that they've got most of the industry working together through membership."***J10***

"...working on perception [has helped]." ***J7***

"...has revolutionized the industry ." ***J4***

"I'm very happy with SETFIA." ***J6***

Of the nine current fishers interviewed, four volunteered the good work being done by SETFIA and/or Boag (see sidebar, page 28); although one also remained a bit nervous of the WWF/Coles alliance.

In contrast to SETFIA's record, and backing up the comments by Boag, an EU dairy farmer (#F2), now subject to very tight environmental limits, said:

> "I feel the industry hindered progress as they didn't accept the problem was real."

Figure 10
Fishing vessels and support infrastructure at Lakes Entrance, Victoria, Australia

NZ farmers in a changing context

Lake Rotorua is a volcanic caldera lake in the Central North Island of New Zealand. Increasing community concerns over eutrophication in the 1990-2000s led to development of lake health targets and nutrient caps (set at 2001-2004 levels), with significant reductions in N and P from the catchment also required over the next 16 years. The final regulatory drivers for reducing farm nutrient losses are still evolving, and will probably take several years to emerge from the legal Resource Management Act (RMA) process. Bay of Plenty Regional Council (BOPRC) released rules (Plan Change 10) aimed to give effect to the targets in the Regional Policy Statement on 29 February 2016 ("Draft Rotorua Rules," 2015). The weak regulatory imperative for significant action means many farmers have chosen to 'wait and see' rather than implement major on-farm changes. Nonetheless there is behaviour change – farmers both participate and lead, seeking to constructively question policy and science, better understand nutrient mitigation practices and discover opportunities to innovate ("LRPPC: What we do," 2015). There is evidence that recent efforts by catchment dairy farmers to reduce costs and improve productivity have also reduced average N leaching rates by about 8% per effective hectare (Park et al., 2015).

Methodology (NZ)

Farmers in the Rotorua catchment have thus been engaged in aspects of environmental limit setting and changing contexts for 15 years – since well before the NPS-FWM was released. The challenge of limits is faced to some degree (or will be soon) by farmers across the whole country. A survey was created for farmers in the catchment to identify:

- what changes have been made within and 'alongside' the farming business;
- how farmers have thought about change;
- what outside influence(s) have assisted aspects of their changes;
- any feedback that has affected them, and
- their thoughts on what may be beneficial in helping in the future.

The survey was sent to 44 farmers associated with the Lake Rotorua Primary Producers Collective (LRPPC), which includes dairy (both owners and sharemilkers on the same farm) and dry-stock farmers. The author's thesis here is that there would be more changes made 'alongside' their farm businesses as opposed to within them. A second thesis is that farmers that were positive about the continuation of their business in this place would indicate a larger number of changes in their thinking. A final thesis is that key outside influences would be LRPPC, industry groups and other farmers.

Results (NZ)

The timing of this survey was not ideal at less than a month before BOPRC were to notify Plan Change 10: the nitrogen reduction rules that have been anticipated, debated and dreaded for around 10 years. Farmers in the catchment at the time of the survey were preparing themselves for the submissions part of the Resource Management Act (RMA) process. Nonetheless complete responses were received from 15, with 14 of those being dairy and 1 sheep and beef. The 14 dairy responses are out of around 27 dairy farms that will be subject to the new rules of the catchment.

Navigation nuanced 2: New Zealand survey

Changes

As expected, while the 15 respondents identified 82 farm business changes (out of a total possible responses of 195 and 5.5 each), the areas where they described most change was 'alongside' their businesses (96/180 possible responses and 6.4 each) and 'thinking' (119/210 and 7.9 each).

Farm business changes described by 50% or more of respondents were (in decreasing frequency):

- improved the farm's impact on the environment (in any way);
- changed some or all of the farm's production system;
- experimented with farm management strategies;
- made the farm business more self-sufficient, and
- undertaken actions that will be viewed favourably by non-rural neighbours/society.

Changes alongside the farm business described by 60% or more of respondents were (in decreasing frequency):

- learned more about the environmental issue;
- increased involvement with industry or community groups;
- become involved with industry action concerning the limit;
- learned more about resource management;
- reassessed your family goals, and
- created new connections with people previously not part of your normal 'circles'.

In comparing with the overseas producers with environmental limits, three of their four most notable themes (mentioned by more than 88%) featured for Rotorua farmers:

- acted to reinforced their social license;
- used support networks, and
- experimented (in small steps) or diversified.

Thinking

Table 4 details the kind of thinking identified by Rotorua farm businesses that helped them navigate environmental limits. Seven of the fifteen respondents said they were either somewhat or very positive about the future of their farm business in the catchment. These farmers did identify more helpful thinking (9 items per person in the group versus 7.9 for all respondents) and attributed similar impact of outside influence (57% versus 61%).

Farm Business Changes Influenced

- Changed some or all of the farm's production system;
- Improved the farm's impact on the environment (in any way);
- Creatively used existing resources;
- Experimented with farm management strategies; and
- Undertaken actions that will be viewed favourably by non-rural neighbours / society.

'Alongside' Changes Influenced

- Undertaken some form of further formal education;
- Developed your human resources / relational skills;
- Learned more about resource management;
- Learned more about the environmental issue;
- Strengthened your connection to the wider community;
- Sought out more local knowledge; and
- Increased involvement with industry or community groups.

Table 4
Helpful thinking identified by Rotorua farmer survey respondents

	% indicated of total (all respon-dents)	% of people positive about farm future ('Positives')	% items to which an outside 'influence' is attributed by all respondents	% items to which an outside 'influence' is attributed by 'Positives'
Considering different future possibilities for your farm business	73	86	73	83
Reassessing what you have as resources and how you could use them	73	71	73	80
Thinking about what it means to be a farmer	47	43	43	33
Accepting that working within environmental limits are part of running a farm business	73	71	73	60
Believing in your capacity to overcome the challenge	67	71	50	40
Seeking knowledge from a wider range of sources	73	86	82	67
Attempting to give structure to things that are unknown	40	57	67	75
Having confidence in your industry/sector	60	57	67	75
Changing how you think about what it means to be a steward of the environment	47	57	57	50
Looking for the opportunities in risks	40	43	50	67
Reconsidering how you think about having a social licence to farm	13	14	100	100
Confidence in your own ability to respond to the external limit	80	100	33	29
Broadening your view of outcomes from the choices you make	53	71	50	60
Optimism	53	71	50	20
Average %	***57***	***64***	***57***	***51***
Actual Number in group	***15***	***7***	***15***	***7***

NB: Tables detailing other survey responses are included in Appendix 6

Outside Influences
The figures in Table 5 suggest that there is significant scope to support how farmers navigate environmental limits. Respondents had attributed outside influence as helping them with more than half of all the actions or thinking they had employed. In the case of the changes that had made alongside their business, 71% of these had been helped by an outside influence.

Table 5
Change items to which the help of an outside influence was attributed

Outside Influence Attribution	No. of items identified per respondent	No. with outside influence attributed	% Influenced
Changes in farm business	5.5	3.2	59
Changes alongside farm business	6.4	4.5	71
Helpful thinking	7.9	4.8	61

Respondents were prompted to identify what people, groups, learning, experiences, industry (or other) influences these had been. Many of these are well represented in the open-ended responses, especially the people and groups noted, as shown in Table 6. However it is worth noting the following themes:

- Other people, mentioned not just in the 'people' section, with the focus on support, networks, sharing, sounding board – especially in the sections on changes alongside and thinking.
- Information related influences, mainly in 'learning'– dominated by science/research related to nutrient management - either farm management impacts or the wider water quality dynamics. This included references to field trips.
- Leadership and advocacy mentioned in the sections on changes alongside and thinking.
- Positive process aspects appeared in all three change areas (called 'environmental efficacy' and described as farmers needing "confidence in the functioning of the broader change process," by Boxelaar et al. (2006)). One farmer said they gained early insight about options from involvement in the 'process'. This topic was also well aired from a negative perspective in the section about feedback.

In the survey an open question asked was, "What have been the most valuable outside influences on you in navigating environmental limits?" Answers can be grouped as shown in Table 6. The most mentioned was LRPPC. LRPPC representatives have sat on the Stakeholders Advisory Group (StAG), working with others and BOPRC to develop rules to achieve the mandated nutrient reductions. With support from industry policy specialists they have had a strong advocacy and information flow role ("LRPPC: About Us,"). There was a clear sense of the various helpful influences being like a matrix, with most people naming more than one influence in their answer. Specialist policy help is valued, as is deeper understanding of the issue and possible future scenarios.

Other farmers valued for:

- Interchange of ideas and experience - "Interacting with other farmers," #8, "different points of view," #10, "farmers in outside areas," #14;
- Support – "all in it together," #6;
- "Peer pressure to meet a standard," #6;
- Showcase "top performing farmers that maintain/ improve profitability whist reducing environmental impacts," #10; and
- Discussion Groups.

Table 6
Influences named as most valuable

	Number of respondents that identified this influence
Lake Rotorua Primary Producers Collective	6
Farm Consultants	5
DairyNZ	4
Farmers (in a general sense)	2
FFNZ policy staff	2
Top farmers (to showcase successful adaptation)	1
BOPRC Policy staff	1
Balance Farm Environment Awards	1
Rural professionals	1
Financial advice	1
Farm nutrient output knowledge	1
Unbiased scientific information	1
Interacting with many, bringing understanding... choices available	1

Future contribution of other farmers and industry
Themes evident in these responses lined up very well with those related to influences (page 33). What farmers want most from their industry is research and information leading to solutions. There are elements of strategic thinking about future options evident:

- "thinking outside the square giving us more options," (#2);
- benchmarking and analysis;
- multidisciplinary solutions;
- "approaches to strengthen the business within the limits," (#8), and
- "development of farming systems which enable farmers to remain profitable," (#13).

One respondent had a strong comment on the need for the supporting processes to be effective,

> "Push for a STANDARD measuring. NDAs in Water Accord, Fert Companies and Regional council differ with same info going into Overseer. Going forward farmers need to be able to clearly monitor and understand there (sic) NDA etc. without constant changes. Should be standard approach that we can access through Dairy NZ (for example) with Water Accord," (#6).

Three others also support this desire for the wider process to be trustworthy, efficient and effective.

Other open-ended responses

Twelve people responded to "…how you approach preparing yourself and your farm business to navigate environmental limits". Five of these expressed concerns regarding environmental efficacy, or lack of 'faith in the wider process' with comments such as:

> "…the impact that the whole political process plays in the nutrient debate, the $40 million influencing all decisions made, the lack of acknowledgement of changing science understanding in that the lake is phosphorus limited but Council are locked into a process and are not prepared to deviate," (#6); and "frustration at changing horizons (targets)," (#7).

Responses from eight farmers reflected aspects of individual resilience (Duranovich, 2015). It is noteworthy that six out of the seven farmers that are positive about the future of their farm business in this catchment made such statements:

- willingness to accept change – "I am ready and willing to change, adapt," (#10);
- strategic thinking – "…reviewed farm operation to see what changes could be made without greatly impacting profitability," (#2);
- open mindedness – "I keep an open mind," (#10);
- locus of control – "Keeping ourselves updating [sic] on the changing limits," (#5);
- self-efficacy – "…optimism that we will prevail in the end," (#10); "…determination," (#15), and
- sense-making – "…education," (#7), "…we will use the knowledge gained from the Rotorua Catchment experience," (#13), "Fully understanding Overseer," (#16).

I need to…

"Draw on [farmer experience, research] to find an appropriate path to pursue for my farm." ***#8***

"…remain profitable [to] have the ability to make changes in the future." ***#2***

"Continue to monitor farm nutrient outputs." ***#5***

"Continue to develop a system that meets our needs and the environments'" ***#12***

Figure 11
Sustainable Farming Fund (SFF) Field Day, Parekarangi Trust Dairy Farm, Lake Rotorua catchment

Discussion: What will help farmers be most "change-able"

What can be taken from the overseas cases and extrapolated into the future for Rotorua farmers and others in NZ? What can be taken from Rotorua and spread to other producers in NZ? How can industry and leading farmers best support those facing environmental limits? How should the opportunity afforded by "the period of calm" best be used?

As seen in the overseas case studies, with the outlook of resilience thinking, changing contexts provide strategic opportunities; opportunities for reinterpreting the current situation, triggering social action, reconfiguring learning sources and stimulating innovation (Folke et al., 2010). Farmers in the Rotorua catchment have largely adopted an Exploit strategy thus far – their environmental limit context has taken the form of a nutrient cap, with still uncertain reduction requirements. An Adjust strategy is likely to follow, as most farmers will be required to greatly reduce nitrogen leaching (e.g. dairy sector average reduction of 35% ("Draft Rotorua Rules", 2015).

Figure 5 on page 21 demonstrates the themes that will be important for farmers who Adjust. Many of the foundational themes that hold for both Exploit and Adjust strategies are attended to within 'the matrix of industry support'. This 'matrix' takes the form of quality assurance, advocacy, research, development, extension etc. from organisations such as processing companies, FFNZ, Beef and Lamb NZ and DairyNZ. The themes of business management and efficiency are well supported by industry with well-developed industry courses (e.g. Mark and Measure, PITO Diploma), reporting (e.g. DairyBase), modelling (e.g. Farmax) and systems (e.g. Livestock Improvement Corporation's MINDA programme), available for farmers to utilise if they wish. Achieving the strategic targets of the dairy industry strategy will go a long way to having dairy farms equipped with the resources and processes associated with robust farm systems ("Dairy Industry Strategy," 2014). While increasing engagement is on any industry body's agenda, many of the 'tools' for this technical support are available; in the words of a soil fertility expert at a Farmers' Field Day, "We have the technology!" (Edmeades, 2016). It is worth noting the current concern about an insufficiency of certified rural professionals must be remedied in light of how significant the influence of these people has been for Rotorua farmers (Table 6). Importantly, the other 'softer' themes that are significant to Adjust require us to think further about what must be offered.

From the overseas cases we can extrapolate several themes for NZ producers, many of which will overlap in implementation. These will be expanded on below, and are:

- act for social licence;
- HR/relational skills;
- experiment/diversify;
- networks/support;
- goals/values;
- identity, and
- local focus.

Figure 12
One of Brittany's many inlets: water quality concerns are driving tight farm nutrient regulations.

Act for social licence

Acting in recognition of a social licence has three distinct aspects: farmer education (1) about the external effects of their activities; respecting society's boundaries (2) and influencing society's perception of agriculture (3).

1. Knowledge sharing and education about farming's effect on the environment facilitates farmers taking appropriate action to improve the impact of their farm management. Of the Rotorua farmers included in the survey results, 93% said they had improved their farm's impact on the environment, 53% that they had undertaken actions that will be viewed favourably by non-rural neighbours/society, 93% had learned more about the environmental issue and 80% had learned about resource management. All of these actions had been aided by significant outside influence. It is interesting that while some farmers commented on the negative feedback about perceptions of agriculture's impact on the environment, many of these same farmers also noted they had benefited from learning about the effect of farm practices on the environment. It is important to share knowledge about nutrient management in a non-emotive and empowering way, helping farmers recognize their part and to adopt beneficial changes willingly, going beyond pure compliance. The potential role of Overseer® in this is substantial – but first farmers need to have confidence in the model, its regional validity, in the processes by which it is updated and improved, and the impacts of these on their regulations.

2. When farmers recognise that society's values are real and deserve to be responded to, not dismissed, a more productive conversation can be had about how their industries should co-evolve. According to Leeora Black (2013),

   > *"*The 'social licence to operate' began as a metaphor to bring attention to the need for companies to earn acceptance from their host communities… a social licence strategy is essentially a stakeholder engagement strategy for navigating complex socio-political environments."
   >
   > "[Mining sector] respondents spoke about Social Licence to Operate in terms of the processes required to maintain it rather than as an end state in itself, with strong emphasis on understanding the expectations of communities and continual relationship and trust building.*"* (Lacey, Parsons, & Moffat, 2012).

   This report also concluded that a social licence to operate is

Social Licence Influence

• • •

"Our connection to the consumer helped us embrace some of these tools in being environmentally responsible… then it helps as a selling point," ***A2***

"I write because I want other people to be able to understand even if they only have limited knowledge themselves." ***D1***

"I'm worried about our social licence." ***H5***

"I watch the weather more closely now… I want slurry to stay in the paddock." ***G5***

"I like to farm in a way that is appreciated by society," ***D4***

"It's important to fulfil the obligations we signed up for the environment schemes." ***E3***

"We're doing our bit to fish sustainably." ***J7***

"If the regulations came off, we wouldn't change much of this low cost, [low impact] system."***F2***

a complex concept: it is easier to define when an operation doesn't have a social licence than when it does. Furthermore there can be a significant discrepancy between the 'facts' of the sustainability performance of an industry and the public's perception of the same, as described in the case of wild catch fishing (Warren, 2013). Going beyond compliance is an outcome of the interplay between the farmer's perception of social boundaries and their economic constraints. Gary Mitchell, the NFUS regional chairman (Dumfries and Galway) farms in the Piltanton Burn catchment where they have been working to have a positive effect on water quality and thereby avoid being designated a NVZ ("Annul New Nitrate Designation," 2015). Mitchell commented to the author that he felt that the threat of regulation was more effective than regulation itself. Now they have been designated after all and in saying "I am worried that now farmers will care less," Mitchell wasn't talking about achieving compliance – he was talking about the interest of the farmers in taking actions that would have a real and significant impact on water quality and of their desire to 'think beyond the farm gate'. Compliance, although it may require some new action, is essentially 'default farming', whereas consciously farming for impact and social licence is 'design farming' (Schiere et al., 2012).

3. Telling the good story of what farmers are doing (e.g. Figure 14) and why will influence society's perception so that social licence boundaries are relaxed or met – co-evolution can then occur. As with the example of SETFIA, industry can take the lead on this. Ideally such stories will be of how farmers are going beyond pure compliance, as in point 2, above.

Figure 13
Runoff detained in a voluntary farm detention bund, allowing phosphate laden soil particles to drop out before the rainwater enters permanent waterways, Kaharoa, Rotorua, NZ

It is the author's opinion that there is an overarching aspect to farmers acting for a social licence: it is the industry's responsibility to create and implement a strategy for tackling this vexatious issue 'front-footed'. As one aspect of evaluating farm business investment, practices and reporting, it is important for producers to determine what the boundaries of their social responsibilities are – this will lie somewhere between what societal demands are perceived to be and how prepared the producer is to act to meet those. While it is difficult to capture the size and direction of social

demands, industry nonetheless has a role in identifying social accountability in a way that will satisfy "society" (which may represent global consumers, a nation or a local community) and be meaningful to farmers (Shepheard & Martin, 2008). Industry may also have to engage with producers to help deepen their understanding of the significance of social expectations, similar to the SETFIA example described earlier.

HR/relational skills

An Adjust strategy will require different skills, some of which could be 'contracted in' or employed. Since resilience is a relational concept, many farmers will benefit from improved HR and general relational skills. This is evidenced by the responses of overseas farmers that Adjusted. This is not yet a feature for the Rotorua farmers surveyed: only 20% said they had developed their own relational skills – but all of these attributed an outside influence on this. This area is clearly a present and future need. Industry will have to be creative in providing ways for farmers to develop in this area: some farmers may automatically discount the relevance of these skills to themselves because they are not employing many staff. Packaging these skills as applicable across an increasingly wide range of interactions, including tying them into effective participation in varied networks, will help.

Experiment/ diversify

Rotorua farmers have gone some way down the experimentation track with farm management strategies. Diversity as a 'less efficient' but more resilient attribute is discussed a great deal in the literature (e.g. Darnhofer et al., 2010a , Milestad et al., 2012). NZ dry-stock farms already have an element of diversity of products, stock classes and landscapes. However dairy farms tend to be quite specialized, with the focus mainly on producing solely milk from the dairy land platform. Some investigation into what diversity in this context might look like is warranted.

Networking/support

Just as change occurs at different scales, networking too should span many levels and areas of interest. Farmer involvement with multiple networks aids responsiveness, identification of opportunities and influences the kind of thinking that is beneficial in navigating environmental limits. Hunt, Fairweather, Rosin and Campbell (2011) discuss how a wider social breadth of view can contribute both 'know-how' and innovative thinking to farmers. Industry groups should think outside the square in helping create such learning networks in anticipation of farmers facing change. These may include: 'sister' farmer areas (enabled through social media platforms and, if possible, exchanges or 'field trips'); cross-sector groups within a specific location 'context'. The Dairy Environment Leaders Forum (DELF) is a good example of a learning and motivating network that spans NZ dairying ("DELF," 2015). There is the additional role of networking in shaping farmers' identities, and contributing to environmental efficacy, both described below.

How can other farmers contribute to your ability to continue farming with environmental limits?

- "Basically the sharing of knowledge with honesty," #16

Goals/values

When farmers are clear about their goals (the 'ends') it is easier to reorganise the 'means' of achieving these as required. Assisting NZ farmers to have clarity about what are 'means' versus 'ends' will help them as they face having to Adjust (EAAT model) in navigating environmental limits. The Trévarn farm case study is a good example of farmers changing their plans, while maintaining, or even coming closer to, their goals. As part of their 'Whole Farm Assessment'

process for analysing the needs of a dairy farm business, DairyNZ staff customarily place a farm's resources and how the farmer is employing them within the context of the farmers' goals (Sankey, 2015). All rural professionals dealing with producers should elicit and use the farmers' goals as the foundation for their advice or support.

Identity

While it is hard to quantify the impact of identity, many studies of primary producers point to its significance in influencing farmer behavior and decision making (e.g. (Burton, 2004)). When people working with farmers initiate processes of reflection on all aspects of farming, they facilitate a conscious reexamination of socialised beliefs of the goals of 'good farming' and how these are achieved. Hunt et al. (2013) describe NZ farmers now seeing themselves as business-people – there is the opportunity to incorporate investing in a social licence to operate into that identity. Reflection and purposeful language used by rural professionals may give farmers an opportunity (over time) to reform their identity as 'a farmer' (Sutherland & Darnhofer, 2012). In addition, simply existing as a farmer is not what makes a farmer meaningful in their social system. The network of relationships a farmer (or group of farmers) has provides that meaning within their community, region or nation and the quality of those relationships dictates how indispensable they are (Dwiartama & Rosin, 2014). Thus how farmers see themselves may be influenced via the breadth of networks they are part of. The internet and social media provide new platforms for trying out different identities; however, as rural users tend to have smaller groups of connections than urban users there may be a place for industry groups to facilitate building trust in both the platforms and the people connecting to them (Gilbert, Karahalios, & Sandvig, 2008). Industry groups should work with farmer leaders already experimenting with these to investigate how to leverage such platforms in assisting farmers to cope with change.

Local focus

This is another theme that closely relates to that of networks. In addition, show-casing local 'early adopters' (or in the context of this study, 'early adapters') not only gives other farmers a model to follow but confidence that their peers are adapting (or will). This is especially important for farmers responding to environmental limits. The literature suggests that a prerequisite for their own adaptation is having confidence in the wider change process: in the networks and other agents that facilitate, and in their peers as partners in acting to achieve the desired outcomes (Boxelaar et al., 2006). This was effective in the Piltanton Burn example mentioned earlier. Adaptations were showcased on the nearby dairy research farm, Mitchell's and others, and advice integrated there from environmental agencies and SAC Consulting, the knowledge exchange consultancy that had largely driven the initiative.

Environmental efficacy

This is worth noting as a separate point: although environmental efficacy wasn't highlighted distinctly in the overseas data, it featured in the Rotorua survey. In the context of this report, this is about stakeholders, peers and processes working effectively toward achieving the outcomes targeted by an environmental limit setting and implementation method. There are many ways industry can contribute to farmer confidence in this wider change process. Some of these are:

1. The NPS-FWM Guide (page 63) shows a possible model for collaboratively identifying values for a water body and eventually actions to achieve those (*NPS-FWM 2014 Guide*, 2014). Regional authorities are embarking on this kind of process in places now (e.g. ("Water advisory groups - BOPRC," 2015)). Industry groups should encourage their members to become involved in these processes and offer their support as required; however it is important that such support doesn't take away from the individual's responsibility to genuinely engage in the process, which may mean they both change and are changed by others.

2. Farmer collectives and landcare groups have already proven to be valuable in some areas. The LRPPC has benefited greatly from funding of administrative support by the regional council. The person so funded is experienced with RMA and council processes, which has helped the farmers to learn about and engage in these further. In other areas, if local government funding is not available for such support, industry should consider supplying it – the value of LRPPC to the surveyed farmers was very clear. Other forms of support should also be delivered as appropriate (e.g. technical).
3. Navigating environmental limits is going to require significant recording and monitoring by farmers. It will be important that in meeting the dairy industry target of "farmers having access to an information system that supports single entry and comprehensive data storage and links this data to key farm applications" ("Dairy Industry Strategy," 2014) that environmental reporting requirements are covered. This will necessitate negotiation with regulatory bodies as well as industry organisations to align these. The role of Overseer® has been mentioned already in the context of education. Overseer® is a key tool in giving farmers confidence in the process of achieving environmental outcomes. Industry needs to provide farmers with the confidence that the tool is fit for purpose and should also describe the creative opportunities to adapt that this output-oriented model allows.
4. It follows that communication technology platforms that underpin rapid, efficient, low-cost and secure recording and sharing of the information described in point 3 are also vital. Access to ultra-fast broadband, 4G and reasonably priced plans will facilitate the necessary monitoring.
5. A final tool to mention in this area is interactive research involving multiple stakeholders along with farmers. SFF projects as a local method for this is well established (Oakden, 2014). Resilient farming has a multitude of reorganisation options, so it is important for research and development not to come up with 'best' solutions – what farmers need from research is a 'library of innovations' (Meynard, Dedieu, & Bos, 2012) that contain many solutions to achieve an outcome (or several parallel outcomes) – and, imperatively, to be involved in the process of the development of these.

In conclusion, there are several themes that can be strengthened to offer further support to farmers navigating environmental limits. In offering these interventions to producers, we must ask, "What manner of technology and personnel will best facilitate and interact with farmers in these new ways?" A vital aspect to working with farmers proactively regarding such things as multiple learning networks, identity, and diversity will be the nature and role-modelling of those doing this work. Extension personnel and other rural professionals need to be learning networkers, skilled in the discourse of adaptive farming and excellent information brokers. Farmers too must understand what manner of person they are and the farming they engage in with regard to change – a robust process for self-evaluation of their strengths and opportunities in this area would be valuable.

Figure 14
Nutrient management trials at Trevarez Dairy Research Station, Brittany, France

Extending EAAT to a primary industry

Resilience thinking assumes that change is normal not unusual, and considers the adaptive capacity of all aspects of a farm system. It has provided a useful model of individual business responses to change – strategies of Exploit, Absorb, Adjust or Transform (EAAT). This report has considered particularly what may be needed to support individual farmers shifting to an Adjust strategy in the face of increased environmental limits. It has argued that change is normal, multi-faceted and often rapid, includes pressures from wider sources than ever before, and is very exposed to societal desires. This leads to critical questions about what this could mean for whole sectors, not just individual businesses. How far can we extrapolate the EAAT model? It is the author's opinion that the model could serve a sector well and, in fact, represents an imperative for significant adjustment.

On Exploiting

Focusing on the NZ dairy industry, its history since the structural changes made to agriculture by the Labour government of the early '80s has largely been one of Exploit, with larger shocks Absorbed and some individuals Transforming (usually by exiting the industry). Posed at the time as a sunset industry, the determined response has been to increase productivity and efficiency to manage 'the cost-price squeeze'. This has involved increasing the intensity of farming. Initially this was achieved via the use of nitrogenous and other fertilisers to increase the carrying capacity of land and more recently by including imported feed supplements (generally maize silage, grains and concentrates and/or palm kernel expeller). Part of this drive for efficiency has led to the specialisation mentioned earlier. Where once replacement animals would have been carried on the 'home dairy farm', they are often grazed off farm and, similarly, a portion of the herd is wintered off the dairy platform. Such dairying changes have been well documented up until the late 1990's by Rauinyar and Parker (1999). They also point out the contribution of farmers' individual resilience and of the integrated farmer-owned Dairy Board (now Fonterra) in maintaining international competitiveness. Dairy processors themselves have focused on technological efficiency and scale, with a series of mergers culminating in the formation of Fonterra in 2001. The new company, which remained farmer owned, represented about 96% of NZ milk supply and also incorporated control of what had been the single desk marketing aspects of NZ's statutory entity, the NZ Dairy Board. It is fascinating to read a quote about the Dairy Board, under the leadership of Warren Larsen, in Clive Lind's account (2013) of the development (and success) of the dairy industry to this historic point. Lind picks up concluding remarks on Larsen's Dairy Board from the book *Global Literacies* (Lind, 2013, p. 392):

> "New Zealanders teach us resourcefulness and change-readiness. They show us what it means to have a truly multi-cultural and global perspective, shored up by social sensitivity."

Should the industry continue to focus on Exploit, taking advantage of those activities and philosophies that are well adapted to the current environment? The problem is that 'the current environment' changes so quickly and is now subject to 'external opinion' to an extent never before imagined. Exploit has been a successful strategy to date, although with externalities that haven't been well accounted for, and which may not serve a whole industry well in new 'current' contexts. However, as with the case study comparison of two tobacco farmers (Appendix 6), the danger is that when a business that has pursued an Exploit strategy encounters a sudden shock there may be neither personal nor system capacity to cope with that.

On Adjusting

If the approach thus far has evidenced the hallmarks of Exploit, what might we see in a NZ dairy sector that recognises a strategic imperative to Adjust, or even Transform, and which truly reflects

Lind's quoted description of New Zealanders? In the first instance the conclusions drawn in the previous section about supporting farmers to Adjust must become industry culture. Fundamentally, we will see an industry that leaves behind a prevailing mentality of "what we do is different to everyone else and no one understands what we do" (Gallaway, pers comm. 2016, speaking on generalised rural attitudes to Health and Safety responsibilities), with the inference being that farmers shouldn't be expected to have to meet the compliance demands expected of others. We will also see an industry that recognises responsibilities more than it focuses on 'rights' (thereby truly generating a social licence to operate), that explores genuine diversity and cross-disciplinary and global initiatives, and that does not attach stigma to those who choose to leave (or dilute) dairy farming. Creating or facilitating increased links between farmers and their consumers will stimulate a desire to Adjust; farmers visited overseas live with consumers on their boundaries – or, via public walkways, even *within* their boundaries – hence the needs and desires of consumers are acknowledged and responded to. With the distance between the NZ farmer and the vast majority of their consumers, this will need to be approached creatively.

In order for this culture change to occur as the dairy industry strategically Adjusts, farming leaders will need to embrace the industry's imperative to identify and respond to society's boundaries. The Dairy Industry Strategy is sub-titled "Making dairy farming work for everyone" and has two major themes of competitiveness and responsibility (2014). Broadly, the targets within the competitiveness section reinforce the earlier assertion that the technological and systems areas such as business management and efficiency are high on industry's existing and future support agenda. The responsibility section largely targets meeting obligations, with some acknowledgement of wider social boundaries (e.g. "80% of New Zealanders agree dairy farmers are good stewards of the environment by 2020"). It is the author's opinion that discourse analysis would reveal that 'meeting requirements' features more than 'doing what is "right"'. Leadership that aspires to go beyond meeting the minimum standard to achieving a gold standard is vital. There are individual farmers that do this in different areas already and their attitude wants to become the industry norm. However, there are instances of good practice being encouraged for the sake of 'covering one's butt'; this only produces a culture that works against accountability and avoids taking real responsibility. While this is certainly not evident in the strategy, rural professionals and industry leaders must be careful not to fuel this sentiment in their interactions with farmers. It is the author's contention that the ultimate cost of meeting only minimum standards may be the cost of losing access to resources that are granted to farm businesses by the community, with an ultimate loss of international competitiveness.

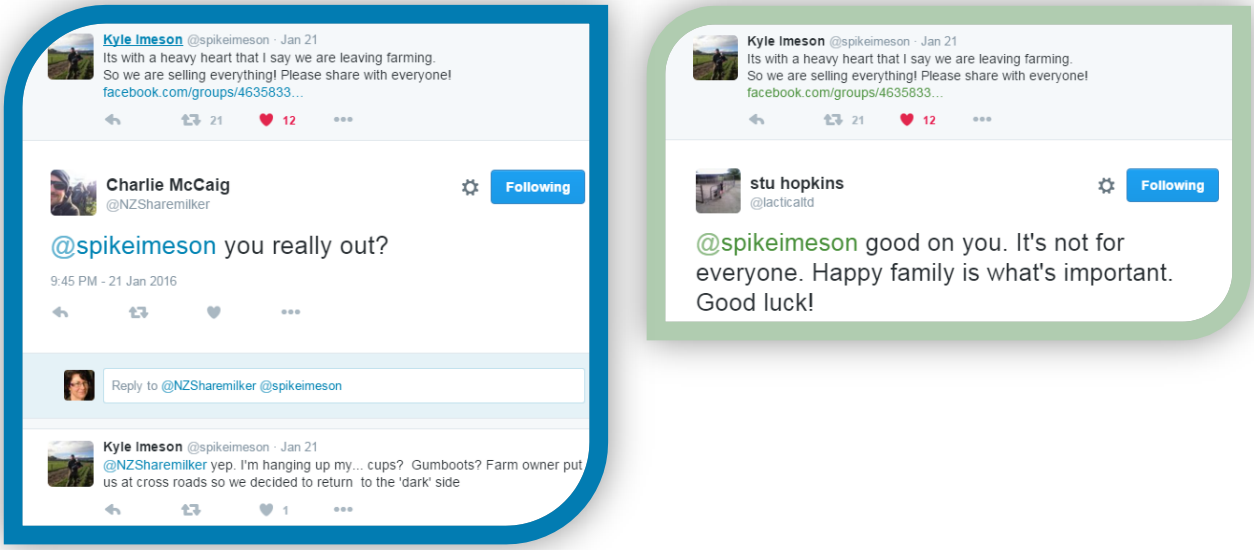
The final strategy in the EAAT model is transform. In resilience thinking Transform means completely reinventing some or all of the activities of a farm and/or the farmer, and from the perspective of a levy-funded organisation this may represent the departure from or 'diminishing' of that levy paying business with respect to their industry. At this difficult financial time in the dairy sector, where a third low milk price season is anticipated alongside the developing environmental limits, there are already farmers indicating they will exit dairying. In this instance the individual farmer Transforms, while the farm itself may continue with a new farmer in charge. Other forms of Transforming may be an extension of Adjust, and already there are good examples in the dairy industry.

On Exiting

During a Twitter conversation as this report was being written one farmer announced their plans to leave dairying, as shown in Figure 16 (Imeson, 2016). One reply seemed not sure whether to believe this was true (McCaig, 2016). Many were hopeful and wished the exiting farmer well, including saying that the important thing is family happiness (i.e. a reference to greater 'ends') (Hopkins,

2016) and referring to new beginnings. Significantly the exiting farmer at one point says they are "returning to the dark side" hinting at the unspoken stigma on those who 'give up dairying'.

Figure 15
Twitter conversations about exiting dairying



In fact if the higher 'ends' are truly considered, along with a resilience perspective of all the possible options for achieving these, then exiting dairy farming to pursue another 'means' may be the best thing for that particular person/family. Facilitating conversations that allow this to be explored without shame will be a hallmark of a transformed industry. Given the need for rural professionals that are both empathetic and skilled in working with adapting farmers, de-stigmatising people that exit from the farming side of dairying and promoting the value of retaining such people 'in' the industry by remaining 'alongside' farmers would be of great benefit.

On Transforming

The current work being carried out through the Transforming the Dairy Value Chain Primary Growth Partnership (PGP) is about finding alternative options that add more value to the dairy industry from both within and beyond the farm gate. It is a good example of multiple stakeholders working together to innovate and experiment to discover and test new possibilities. This PGP work has specific projects that are being targeted, including Synlait's "designer milks" where a combination of on-farm practices, processing capability and marketing are able to deliver higher value dairy products ("PGP Dairy Value Chain," 2011). Products such as higher melatonin content milk to help people sleep are being produced by milking cows at night when their own melatonin levels are elevated. These "designer milks" are excellent value-add examples and may indicate that in the future there will be a wider range of farm management practices undertaken to generate specific milk products. The industry will need to reassess how this diversity is supported by extension programmes – and how the diversity can be harnessed to stimulate further innovation and adaptability. Other forms of diversity – such as varied land use – already happen in pockets. In the Rotorua survey, 4/14 dairy farmers indicated forestry as an income source additional to milk. Around the coastal BOP many dairy farmers have kiwifruit orchards. Similarly, two of the Rotorua farmers named tourism or hospitality as an additional income source. Stimulating cross industry events and initiatives that recognise the challenges and foster the benefits of this 'combination' farming will help grow the confidence of farmers to diversify.

The Netherlands has a sector-wide initiative targeted at improving the dairy chain's sustainability (called Sustainable Dairy Chain), in order to "strengthen their position within the market and society," Reijs (2012). This acknowledges the imperative for their industry to build support from both the market and society and is being supported at all levels of the dairy industry. The difference between this initiative and NZ's Dairy Industry Strategy is that the Dutch Sustainable Dairy Chain is isolated to the equivalent "responsible" aspects of the NZ strategy. Their goals are toward a future-proof and responsible dairy sector, with aspects of profitability conspicuous by their absence ("Sustainable Dairy Chain Vision," 2014). While the NZ Dairy Industry Strategy benefits from being comprehensive, the author believes this makes it more difficult to tell a story to society of the recognition of social accountability and our pursuit of that. While the Sustainable Dairying Water Accord is focused solely on the industry's commitment to New Zealand and hence paves the way for reporting fulfilment of responsibilities in a similar fashion to the Dutch Sustainable Dairy Chain, it only covers water. As discussed in the section on "Act for social licence" (page 37), the author believes it is incumbent on every agricultural sector of NZ to develop a strategy that responds to all aspects of social accountability in order to gain a complete social licence to operate. This should be kept separate from the still very necessary elements of growing competitiveness and farm profitability. New Zealanders need to hear and understand the real efforts agriculture is making in order to acknowledge and respond to them – there is the danger that if society is not satisfied in this way that uninformed and potentially erroneous decisions could be made that will seriously limit our industry's abilities to remain competitive, to retain good people and ultimately to contribute to NZ's economy.

In conclusion, there is an increased demand from society for farming to be accountable in areas that had been previously 'granted' and perhaps 'taken for granted'. To remain meaningful in NZ's social system as well in its economy, strong leadership is required for a concerted effort to farm with a renewed 'dairy social licence to operate'. This leadership needs to take NZ's agricultural sectors through a strategic Adjust into wide-ranging diversity, active and responsive co-evolution, 'gold standard' accountability, and creative conversations that assist and retain those who tactically Transform their individual farm businesses. While there may be initial resistance to such industry transformation from individual farmers, the author believes that once a social perspective is established that truly grants dairying a social licence to operate, farmers would be buoyed by this new context.

Transformers

"Dairying wasn't meeting my need for high energy interaction with people, so I started this business." ***D7***

"Bitterness probably influenced our choice to sell up the operational aspect of our farm business and rent our land out." ***C4***

"We had always run a diverse operation to manage risk. Now, with the implications of the extra floods we have disbanded most of the cow-calf pairs and are using financial instruments for that." ***H1***

"We put every cent into the new sheep milk co-op – when it failed we had to sell the farm. By working off-farm I could keep up milking a few sheep on a share-farm basis - I was then able to grow the share-farming business." ***E2***

Recommendations

Resilience is not reached, it develops. Based on the conclusions from interviews with farmers overseas and in Rotorua, in order to better support the management of farms to live with and shape change, particularly increased environmental limits, the following 'enabling' aspects require focus and action from industry groups and farmer leaders:

Social/situation enabling

- Create and implement a strategy for tackling the vexatious social licence issue 'front-footed', including an industry culture change in this area. A social accountability strategy that seeks to confirm agriculture's social licence to operate should stand separate from industry competiveness aspects.
- Support farmer confidence in change processes. This will require a raft of undertakings: stakeholder engagement; appropriate advocacy (on two 'tracks' – influencing rules and achieving compliance); efficient and secure data collection and use; education on the external impacts of farm management choices; and support of farmer collectives and individuals engaged in local collaborative processes.
- Initiate reflection to facilitate farmers reexamining their farming beliefs, establishing the relational meaning they have in their context and re-forming their identity as a farmer.

Mindset enabling

- Extension and rural professionals leading the way in the language of adaptation, learning and 'becoming' – encouraging equal attention to 'what did not work' as to 'what did work'; focus on options, 'trying', examples of bricolage, including transforming 'out of farming'.
- Focus on the process of making choices, showcasing farmers that have demonstrated attributes of personal resilience in their own journey of reorganisation and challenging others with questions such as, "How would you think about that?"
- Explore widely what 'diversity' may mean, particularly in the specialized NZ dairy farming context, and support both individual farm and industry diversity.
- Develop a self-evaluation process for farmers to identify strengths and opportunities in their farming 'change-ability'.

Relational enabling

- Networking, networking, networking – develop a strategy for facilitating and strengthening interaction webs, for connection, exchange, learning and context awareness. This should involve a variety of platforms to connect NZ farmers with those in other contexts.
- Creatively work relational skill development into more than HR activities.

Functional enabling

- Continue NZ's established and vital strengths in the traditional aspects of agricultural business management, technology and systems research, development and extension to provide a robust base for adaptation and a 'library of innovations'.
- Work with the technology sectors that are critical to providing the tools that will support NZ agribusinesses' ability to retain their social licence to operate and remain profitable.

Industry transformation

- Integrating the above, lead industry co-evolutionary culture change that answers society's desires (and thus protects future competitiveness), seeks to go beyond compliance, and empowers and retains those who choose personal Transformation in the pursuit of resilience.

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Appendices

Appendix 1: Recommended Reading

The following are recommended for readers interested in more background to the ideas of farm systems, resilience and change:

Defending the Social Licence of Farming: Issues, Challenges and New Directions for Agriculture (2011). Editors: Jacqueline Williams and Paul Martin. Publisher: CSIRO Publishing. ISBN: 9780643101593

Farming Systems Research into the 21st Century: The New Dynamic (2012). Editors**:** Ika Darnhofer, David Gibbon, Benoît Dedieu. ISBN: 978-94-007-4502-5 (Print) 978-94-007-4503-2 (Online). Particularly chapters 1, 15 and 16

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Sharon's Nuffield Scholarship Adventure 2015: sharonmmorrell@blogspot.com.au

Appendix 2: Attributes of individual resilience

Duranovich (2015) presents a summary of six attributes of individual resilience, largely derived from literature on psychological resilience. These attributes are described below.

- Self-efficacy is described as the internal belief a person has that they are capable of performing the tasks needed to attain the goals they have set, which may involve overcoming stressful situations and perceiving opportunities where others sense risk.
- Locus of control can be seen as an aspect of self-efficacy. However it specifically indicates the extent to which a person believes they have the ability to *control* to external events. A person with a high locus of control is motivated to respond to external triggers and committed to planning and problem solving.
- Willingness to accept uncertainty and change is valuable – especially if change is indeed the norm and farmers must adapt in response. Recognition of the reality of uncertainty can prompt learning about the situation related to the 'uncertain'.
- Sense-making is a process whereby unknown things are somehow given shape. When a person purposes to understand various connections or relations and their possible pathways they are better able to give meaning, and therefore to respond, to uncertain situations.
- Open-mindedness confers a willingness to acknowledge multiple perspectives; when a person respects the opinions of others and holds their own lightly, they are well placed for meaningful ideas exchange and learning. An open-minded person viewing strategy as an unfolding process is well placed to adapt to change pressures.
- Strategic thinking explores many possible futures to identify genuine options to implement to reach goals. There are many elements to this attribute, but it is worth noting that an effective strategic thinker sees the 'whole system', recognising the interdependencies within it and between the system and the external environment.

Appendix 3: Situation summaries

Countries travelled during the author's Nuffield journey presented a range of context change situations experienced by the farmers visited. In order to better understand these contexts the author interviewed both producers and a variety of others, as appropriate – educationalists, dairy co-operative staff, farmer's union representatives, industry organisation staff, NGO representatives, government conservation and national park staff, and extension officers.

The Exmoor National Park in the UK is comprised of around 60% farmland, and surprisingly 71%of the park area is privately owned. It is an area that has been highlighted as worthy of support because of the combination of climate (altitude and exposure), isolation and both planning and environmental constraints imposed by virtue of the National Park status. Farmers face other challenges too – TB incidence and the contingent animal movement controls, partly because of the relocation to their environment of badgers from other more intensively farmed areas, and a lack of affordable local housing for retiring tenant farmers to move into, thus blocking up entrance/progression opportunities for young people on local farms. The constraints identified as currently affecting them personally by the three farmers interviewed there were disease (and hence movement control) and planning restrictions, land rental hikes and environmental regulations.

Throughout the European Union environmental outcomes have been prescribed, with each of the member states applying negotiated rules in order to meet their own obligations to the Union. Two significant pieces of environmental legislation from the EU have been the Nitrates Directive and (more recently) the Water Framework Directive. Farmers in catchments identified as degraded or at risk have been subject to tighter restrictions, manifesting in such things as greater reporting accountability, 'shut periods' for application of chemical fertilizer and/or slurry, rules about how slurry may be applied to land, areas that must be set aside from cropping, and/or maximum stocking and chemical fertilizer application rates. One catchment visited was the Piltanton Burn in SW Scotland, where farmers (with significant industry support) have worked to improve local water quality and avoid designation as a Nitrate Vulnerable Zone. Another catchment was Timoleague, a closely monitored area in southern Ireland under the Agricultural Catchments Programme; here a close relationship has been developed between the monitoring personnel and farmers, and farmers are being well informed by the wealth of data collected from their farms and waterways. Another area visited was Brittany, France, where the many coastal bays can be subject to unwanted algal blooms; restrictions on farmers have often resulted in responses that keep inputs and costs low.

Same context, different constraints named

• • •

Three farmers farming in the Exmoor National Park named three different constraints as most significant to them.

In both the Netherlands and France, pork farmers were interviewed that described their most significant current external limit as being consumer perception, combined with lack of differentiation of their product from that of other countries that may have access to cheaper inputs. Farmers in both countries have also long lived with strict environmental rules about dealing with manure – in France a moratorium on increasing pig numbers was put in place in the early 1990's as one means of dealing with that.

Ontario is home to an area that is known for the production of tobacco with a flavor favoured in blends; it had been a high value crop from soils and growing conditions that didn't seem to provide for many viable alternatives. However with the changes in society's attitude to smoking, market pressures also due to taxes and black markets, the industry and producers experienced a great deal of turmoil through the 1990's and 2000's. Like many of Canada's primary industries, this was a supply managed sector, based on a quota system that had existed since the middle of last century. Through the early 2000's quotas were reduced significantly – some farmers choosing to purchase extra quota to 'top up' and some focusing more on alternatives. In 2004 there was a voluntary partial buyout of quota and in 2008 all remaining quota was compulsorily bought out. Tobacco farmers had to choose alternatives, or accept supplying tobacco on contract (but as another entity to the one that had sold quota).

Further west in the province of Manitoba, which is essentially the receiving 'basin' for an enormous catchment that spans provincial and national boundaries, flooding has always been a risk. In a province where the largest proportion of the population lives in a city that is situated on the confluence of two rivers, in a flat landscape, with snow melt swelling waterways every spring, the drive to protect the city is paramount. In the last few years the severity, timing and human management of flood waters have conspired to create severe pressure over consecutive years for farmers on the edges of the Assiniboine River, or beside the Floodwater Diversion Channel at Portage la Prairie. Arguments are had over how much the floods are caused, or worsened, by human action – but the impacts on farmers' river flats cannot be denied.

Southeast Victoria, Australia, is home to a well-established commercial fishing industry – although the numbers of fishers now has greatly reduced since the 1980's. Characterised by diversity of species fished and style of fishing, this is a small and quite fragmented industry. Perhaps driven by the depletion of orange roughy numbers, the poster child for bad fisheries management, a series of measures to avoid over-fishing of all fish stock have successively been introduced. Measures include input controls such as net lengths, area exclusions and licenses, and output controls in the form of quota, the allocation of which can vary from year to year. Additionally, accountability requirements such as catch reporting, on-board observers and mitigation against by-catch have increased greatly.

Appendix 4: Questions covered during semi-structured interviews of farmers and fishers

Name:

History on farm / in the area:

Farm business description / stats:

Any wider community / industry involvement:

What is the limit?

How long has it existed / been a conscious thing / been responded to?

What did you do?

Who/what helped?

What would you do differently?

What were the key factors in success of change?

Gems?

Where to from here?

Openness to change / innovation:

Notes taken during the interviews are retained by the author.

Appendix 5: Additional tables of data from overseas interviews

Table 7

Proportion of producers using each strategy that named each constraint (note, where more than one constraint was identified, each constraint is counted in that strategy; similarly where more than one strategy has been employed by a single farmer, the constraint data appears in both strategies)

Strategy	Con-straints named per key strategy (number)	Environ-mental Limits %	Public Percep-tion %	Industry Restruc-ture %	Flooding %	Disease %	Market %	Other %
Exploit	**30**	47	17	13	7	0	3	13
Adjust	**32**	31	6	28	3	9	9	13
Trans-form	**11**	9	0	36	9	0	9	36
Absorb	**6**	17	0	33	33	17	0	0

Table 8

Proportion of producers within each constraint that used each of the four strategies

	% of total using each strategy	Environ-mental Limits	Public Percep-tion	Industry Restruc-ture	Flooding	Disease	Market	Other
Exploit (%)	**38**	54	71	21	33	0	20	33
Adjust (%)	**42**	38	29	47	17	75	60	33
Trans-form (%)	**13**	4	0	21	17	0	20	33
Absorb (%)	**7**	4	0	11	33	25	0	0

Table 9
Proportion of farmers/fishers with a particular constraint that discussed actions within each theme (where more than one constraint was named, those producers were counted in both constraint categories)

Constraint	Environmental Regulations	Public Perception	Industry Restructure	Floods	Disease	Market pressure	Other	Total Constraints Mentioned
Number that named this constraint	*24*	*6*	*12*	*4*	*3*	*3*	*9*	***61***
Theme Mention Rate (%)								
Efficiency/ Scale	88	100	75	50	67	67	83	**82**
Product Value	46	67	58	0	33	100	50	**47**
Business Management	88	67	100	100	67	67	83	**89**
Experiment/ Diversification	79	100	67	50	100	67	67	**71**
Values Assessed/ Response	67	67	50	50	100	33	67	**56**
Resources Inventoried	83	100	75	100	67	100	83	**82**
HR/ Relational Skills	54	33	50	0	100	0	50	**44**
Actions for Social License	96	100	33	25	100	67	33	**64**
Family Impact/ Factors	50	50	75	25	67	33	50	**53**
Identity Retention	38	50	42	0	67	67	50	**38**
Passion/ Belief in Industry	25	50	50	0	0	100	50	**31**
Networks/ Support Utilised	92	67	75	100	100	67	50	**82**
Local Focus	54	17	8	50	67	0	17	**38**
Industry Initiative	50	83	50	25	0	100	17	**44**
Other	46	67	33	50	33	100	33	**42**

Appendix 6: A short story of two tobacco farmers

Canada's tobacco industry had been a 'golden' sector particularly on the sandy country of southern Ontario where no other crop could match the potential income offered by good quality tobacco. Tobacco with a flavor preferred in mixes was produced and cigarettes manufactured there. However, the industry experienced tumultuous times through the 1990's and 2000's where tax differentials, societal disapproval and tobacco company desire to dispense with the tobacco marketing board's quota system led to decreasing prices and quota. One family's Exploit response was to become the most efficient and productive tobacco growers they could be. In a yearly rotation not all the area of their farm was required for tobacco, so surplus area was rented out to neighbours for soy or corn and this family concentrated on tobacco: sowing, watering, successive pickings, drying in the purpose built kilns, grading and packing. In the year 2000 a neighbour's property came up for sale, along with an auto-harvester. The family saw this as a great opportunity to gain scale and both increase efficiency and reduce the reliance on seasonal labour. Prior to a 2003 obligation to convert the kilns over to a heat exchange system, theirs were already altered – a tornado had damaged some and they recognized the change coming and dealt with the rest before this was legislated.

At their peak they held quota for 100 acres, but the maximum they grew was 84 in 2005. This was the year the industry offered a voluntary buyout, where growers tendered a price at which they would be happy to sell their quota. This family felt they had a great system and weren't close enough to retirement to opt for the buyout – they also hoped their own quota would be more valuable once a portion of the industry's quota had been 'retired'.

The second grower in the story faced the same challenges with their 60 acres of tobacco quota. However, their change strategy was Adjust. Perceiving tobacco was a shrinking industry as long as 30 years ago, they had already diversified, growing asparagus and other cash crops alongside the tobacco. In the early 2000's they ventured into spring onions, then purchasing a neighbour's horseradish growing and processing business. The total area of land they had to farm was much larger than the first family's and their debt level was very low. At the first buyout, they set their tender price high, leaving them in possession of quota that was unable to be used fully. However, their sense was that this was a shrinking industry, so despite only about 30 acres allowed to be grown with the quota they owned, they didn't consider purchasing more. Thirty acres was barely viable, so they teamed up with neighbours for the planting and harvesting to reduce costs.

During both buyouts, laws were put in place to prohibit entities that had sold their quota from entering into contracts to supply it in the future. Just prior to the compulsory buyout of 2008, the first family sold the auto harvester, recognising that the industry was in a difficult position. In 2008 they took their payment, but were disappointed about only receiving about 60% of the voluntary buyout payment in 2005. Closer to retirement now, and perhaps disillusioned, they decided they would lease out their whole farm and proceeded to sell their remaining specialist equipment to USA farmers. This was a transformation of identity, described by one of the partners as being "a very emotional time" (C4); having once been entirely engrossed in tobacco production, although they still own the farm, they no longer see themselves as "farmers".

The second family ceased tobacco production with the compulsory buyout, but with low debt levels and other crops to fall back on, they decided to hold their gear and see what (legal and workable) possibilities there may be for future tobacco production by another family member. Their son later returned home, and in 2010 he commenced tobacco growing using his parent's gear and expertise. They have since increased their asparagus area, their son has developed a beef feedlot operation and their daughter is now interested in the tobacco and in experimenting with organic leafy greens for the local market.

Appendix 7: Survey results from Rotorua farmers

Table 10
Changes made in farm businesses by Rotorua farmer survey respondents

	% indicated of total	% of people positive about farm future	% items to which an outside 'influence' is attributed (of all respondents)
Been willing to increase debt	13	14	0
Increased the size of your operation	27	43	25
Ignored the limits	0	0	0
Diversified how your assets are used to generate income	47	43	43
Improved your farm's impact on the environment (in any way)	93	86	79
Increased technical/labour efficiency	40	43	50
Creatively used existing resources	33	43	60
Changed some or all of your production system	73	71	82
Made your farm business more self-sufficient	60	57	56
Actively reduced debt	27	0	25
Undertaken actions that will be viewed favourably by non-rural neighbours / society	53	57	63
Increased the value of your products	27	29	25
Experimented with farm management strategies	60	86	67
Other: "bought land outside catchment"	13	14	0
Actual Number in group	***15***	***7***	
Average %	***42***	***44***	***59***

Table 11
Changes made alongside farm businesses by Rotorua farmer survey respondents

	% indicated of total	% of people positive about farm future	% items to which an outside 'influence' is attributed (of all respondents)
Obtained off-farm employment	31	0	13
Learned more about resource management	80	83	80
Increased involvement with industry or community groups	80	83	80
Sought out more local knowledge	53	50	53
Added a new business to your farm business	33	33	33
Learned more about the environmental issue	93	83	93
Strengthened your connection to the wider community	53	33	53
Reassessed your family goals	60	33	60
Created new connections with people previously not part of your normal 'circles'	60	67	67
Undertaken some form of further formal education	13	0	0
Developed your human resources / relational skills	20	0	0
Become involved with industry action concerning the limit	80	83	83
Actual Number in group	***15***	***7***	
Average %	***53***	***43***	***75***

Complete survey results are held by the author.