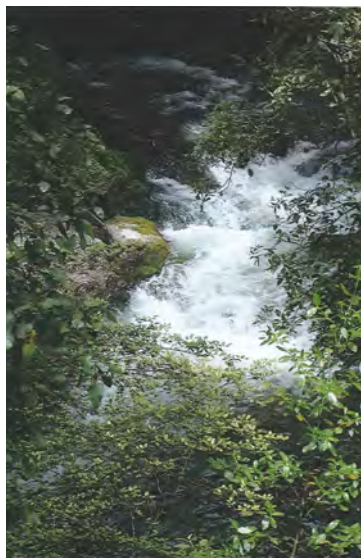




# **Farmer Adaptation to Change with the Threat of Regulation**

**- The Carrot or the Stick? –**



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**A Report for the New Zealand Nuffield Farming Scholarship Trust**

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## Foreword

It is important that before beginning this report, I provide some information about myself as this will help put this project and some of my perspectives into context.

From my early years of growing up in agriculture, I have developed a passion for the agriculture industry which was strengthened throughout my time at university and various short term on-farm jobs. I completed a Bachelor of Applied Science with Honours (majoring in Agriculture and Agribusiness) at Massey University in early 2008. Following this, I was lucky enough to secure a job with AgFirst Waikato as a farm consultant, predominantly in the dairy industry. This role consists of both one-to-one consultancy as well as project work for various organisations within the agriculture industry. This combination of work has enabled me to develop an understanding of many issues both at the farm level and at the industry level.

One issue that has continued to gain force in the Waikato is the issue of water quality and the contribution from agriculture. Addressing this issue could potentially impact all facets of the agriculture industry. Being involved at the industry level has enabled me to understand what the issues are, how agriculture is affecting water quality and the pressures that are mounting for the industry to deal with this issue. On the other hand, being involved at the individual farm level has provided me with a valuable understanding of the potential impacts that policy around water quality could have, not only on the individual farm businesses, but on the livelihood and lifestyle of these farmers. To add to this rumors about the implications to the farm business have been running rampant with some suggestions of compulsory feedpads, blanket stocking rate caps, or a significant increase in compliance costs that would put significant strain on the financial viability of many businesses. These stresses are additional to other current external pressures such as global financial recession, three years of ongoing drought, and mounting debt and financial strain within the industry. As a result, I can understand where the farmer's fear and anger around issues such as this come from. It is the natural protection mechanism of the human species when faced with forced change in which they currently have no control of.

The frustration that I had was that science has proven declining water quality and the government has agreed at a national level that action is required to address this issue; therefore, change is in my view inevitable. The way I saw things potentially progressing at this stage was that farmers would spend all their time fighting the regional council against any regulation (even though the government indicated they would be taking action). This would be countered by the regional councils developing their regulation with no input from farmers in a way that would see significant additional compliance costs to the farmers and the industry, without the desired outcomes being achieved. This regulation would then be fought by farmers once introduced and the outcomes would not be achieved hence the industry would become more fragmented.

Therefore, in response to this I set out to investigate how other countries have begun to address the environmental conservation issues. Have they used a stick (regulation) or a carrot (incentive and education) approach and what had been successful? What can we learn from them? I wanted to find out if NZ farmers and regulators could be open enough to work together and learn from each other acknowledging they need to be on the same team.

## Executive Summary

Over the past decade, water quality has become increasingly important to the New Zealand public. The effect of 150 years of clearing land, developing and intensifying agriculture is taking its toll on the environment.

Agriculture and tourism are among NZ's largest export earners bringing in \$22.3 billion (Statistics New Zealand, 2011) and \$22.4 billion NZD respectively in 2008 (Statistics New Zealand, 2011).

New Zealand has built a reputation on the uniqueness and pristine nature of the country. This 'clean and green' reputation has been estimated to be worth \$80 million dollars per annum to the agriculture and tourism industries. To strengthen New Zealand's 'clean and green' brand may not lead directly to obtaining additional markets but it will help to maintain New Zealand's current markets that.

Not only is water quality important to attract tourists and for export markets, but it is important to local communities. Rivers and lakes provide not only a source of food and recreation for many New Zealanders, but are a source of national pride. However, increasing nutrient loadings has led to a steady decline in the quality of these waterways and has resulted in an increase in the occurrence of algal blooms and decreased water clarity.

In response to this, the NZ government has made a clear statement that actions need to be taken to address water quality issues. This has been incorporated into the 2011 National Policy Statement on freshwater. As a result, this will require Regional councils to develop a plan to address declining water quality in their regional policy statements. It is therefore inevitable; change is coming!

### **Purpose of report**

This report investigates how countries within Europe and the USA are addressing the issue of water quality and the impact that agriculture has on water quality. Have they used the carrot (incentives) or the stick (regulation) approach? Has the selected approach been successful? What can NZ learn from their successes and mistakes? The aim was to obtain a balanced viewpoint from various levels of the agriculture industry in order to gain a good representation of the process to initiate the required changes.

### **Methodology**

This report compiles information after interviewing a range of people within various sectors and levels of the agriculture industry from parts of Europe and USA. It provides recommendations on how New Zealand should approach the issue of reducing the environmental footprint of agriculture. This information has then been developed into a proposal for how the author believes this issue should be dealt with in NZ using a case study of the Waikato region.

## Background

The removal of government intervention in New Zealand in the 1980s led to a revolution with a shift in focus within agriculture towards productivity and profitability. This led to significant gains in technology and on-farm efficiency but is now known to have contributed to increasing nutrient loading in both ground and surface water.

During this same period in the European Union (EU), government intervention increased. Since then subsidies have been used as a method of influencing on-farm practices with an increasing focus towards conservation. Additionally agri-environmental schemes have been introduced to financially incentivise farmers to implement conservation practices. This has led to a shift in focus away from productivity towards conservation in order to maximise profitability.

In the USA a combination of subsidies, incentives and regulatory methods are used to influence on farm practices.

## Keys to success of creating change

Regulation is necessary in order to achieve change in the early majority, late majority and laggard sectors of the population. Providing support and incentives to the innovators and early adopters to encourage their involvement in the policy process can lead to the development of practical workable policy which achieves the desired outcomes. In order to achieve farmer involvement in regulatory issues the following factors are important:

- Develop acceptable targets and goals that **satisfy** all parties and are **based on science**. In order to achieve, stakeholder involvement is important. These stakeholders need to be clear on what their needs are (distinct from their wants!) and be prepared to listen to various perspectives and negotiate
- Empower farmers by involving them in the process of policy development
- Transparency with target setting and throughout the regulation process
- Having flexibility to allow farmers choices of mitigation to suit their circumstances
- Having the right people on the ground to achieve the buy-in from farmers at the implementation stage
- Minimising the duplication in paperwork required for compliance
- Monitoring and measuring the progress and success of proposed policy to ensure the targets and goals are being met

## The Waikato

The Waikato Regional Council (WRC) has identified the Upper Waikato catchment (from Huka Falls, Taupo to the Karapiro Dam, Cambridge) as a sensitive farming catchment. Consequently, the WRC and various industry organisations have carried out a significant amount of work to increase the understanding and awareness of the issues and how agriculture contributes. This has resulted in farmers and industry in this area having a much greater understanding compared to those in other parts of the region. It has also led to greater collaboration between organisations in this area.

WRC have been collecting information through various case study based projects including the Integrated Catchment Management project (Waikato Regional Council, 2009) and the Upper Waikato Nutrient Efficiency Study (Waikato Regional Council, 2010) that use modeling to identify mitigation options and the impacts of these mitigations.

There are also a number of educational programs such as 'DairyPush' and 'Tomorrows farms Today' aimed at increasing the awareness and understanding of water quality issues amongst the farming community. These integrate environmental with financial and productivity discussions.

Practical on-farm case studies now need to be carried out to 'road-test' proposed targets/policy. This road testing needs to include innovator/early adopter farmers, policy makers and industry. It must be a collaborative approach to develop practical, workable policy that achieve desired targets but also has the buy-in from farmers and the industry.

Alongside the case studies, industry capability and capacity gaps need to be identified to ensure that enough support is available during the implementation period of the regulation.

### **Who Pays?**

After considering a range of perspectives the author concludes that the costs should be shared by the all New Zealanders including farmers, government and the urban community. This is a problem that has been caused by our forefathers' activities as well as recent farming and community activities and all New Zealanders benefit from improvements. Therefore, NZ needs to be working together to address this problem. Funds should be allocated to science, research and providing the support networks to initiate and encourage changes.

### **Recommendations**

- New Zealand needs to continue to emphasise the importance of collaboration between policy makers, industry and farmers throughout the policy development process
- When 'selling' the concept to farmers it is important to use a multi-faceted approach; improving water quality and maintaining markets through strengthening the NZ brand
- A combination of the carrot (incentives) and stick (regulation) approach should be used
- The next set requires policy makers to collaborate with farmers and the industry throughout the policy development process
- Farmers need to be prepared to have open conversations around regulation with the councils and policy makers and be prepared to get involved
- Programs need to cater for different sectors of the farming community; innovators, early adopters, early majority, late majority and laggards
- The cost needs to be shared among the all New Zealanders including the agriculture industry, government and the urban community
- Funding should be utilised in the development of initiatives using case studies to 'road test' proposed policy
- Work needs to be done to increase the capability and capacity within the industry

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## Introduction

Over the past decade, water quality in New Zealand (NZ) has become more important to the general public. The effect of 150 years of clearing land, developing and intensifying agriculture has started to take its toll on water quality. In the past, one of the major causes has been point source pollution from towns and industrial areas but these have been largely targeted and dealt with. The majority of the pollution identified nowadays is in the form of diffuse pollution (i.e. not from one point) which is more difficult to deal with when compared to point source pollution. Agriculture is the major source of this diffuse pollution (Ministry for the Environment, 2008).

The 1980s was a turning point within agriculture around the world. During this time, the NZ government ceased all government intervention including subsidies and tariffs. This led to a significant improvement in productivity and innovation as farmers focus shifted towards efficiency, productivity and profitability in order to survive. In contrast, during this period the European Union (EU) was increasing their subsidisation of farmers, which has resulted in the governments and the EU having an increasing influence on farming practices throughout Europe.

The separation of direction can be viewed in a scale context (Figure 1) where NZ farmers have prioritized production and profit to survive and succeed. Farmers in the EU have not moved away from profitability, more that the EU has made conservation profitable through the use of agri-environment schemes and subsidies.

Over the past 30 years farmers in the EU have focused more towards conservation, biodiversity, maintaining the aesthetic value of farmland, and ensuring small farming communities are able to survive. In addition to subsidies, agri-environmental schemes have also been developed to influence change. The general direction of

agriculture is established at the EU level but the priorities and development of individual programs and schemes are generally developed at the country level with funding for these coming from both the EU and the government of the country concerned.

The USA appears to be on various parts of the scale, depending on the state considered, with the government using a combination of incentives such as subsidies, as well as regulations.

Over the past decade there has been increasing pressure for a shift of NZ farmers closer towards the middle of the scale with more consideration of impacts of agriculture on the environment. Dairy farming has been targeted as the main contributor to declining water quality; the term 'Dirty Dairying' has been conjured by the media to describe these impacts.

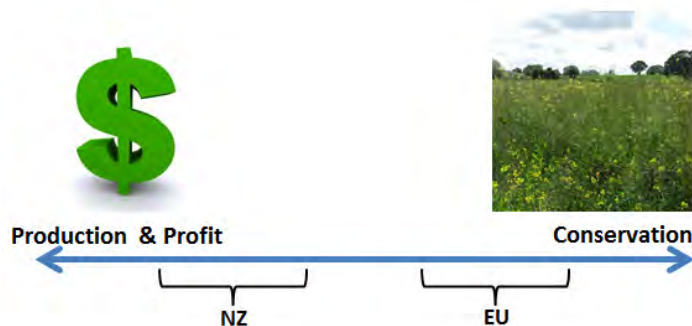


Figure 1: Scale of direction since changes in the 1980s.

In addition to the pressure from the wider communities, there has been added pressure in the Waikato from the five local Maori Iwi groups who have each signed deeds with the Government that states that the quality of the water in the Waikato River must be maintained or improved over the next ten years. Government funding has been allocated to help with this process.

Consequently, there will be changes needed in the next five to ten years around reducing the diffuse pollution from farmland to waterways throughout NZ.

In response the industry has been grappling with the idea of regulation of nutrient losses, what this would look like, how it would be done and who pays; whilst farmers, particularly dairy farmers have been feeling 'picked on' and fearful of any regulation and how it would impact on their farm business. There has been talk of all dairy farms requiring a feedpad to contain their effluent, stocking rates being capped and other significant changes being imposed on agriculture. A large portion of farmers and rural professionals within the agriculture sector have limited knowledge on nutrient cycles, and the environmental impact of agricultural practices. It is a topic of great contention and with a lot of fear of what the regulators may do.

In light of this I was really interested in investigating how other countries around the world that were further down this path had dealt with the situation, what had worked and what NZ could learn from them. Some of the key questions that I had regarding our situation were:

- How could we, as an industry, work collaboratively together on this issue?
- How can we increase the uptake of practices by farmers?
- Can we influence the development of policy so that it is in a workable, practical form that satisfies all parties whilst having minimal impact on the farm business as this is the backbone of our economy and many of our communities?
- In other parts of the world, who pays for changes of this nature (where there can be significant costs on the landowner to make improvements to negate the generational impacts of farming on the environment and where the benefactors are the entire community)?

## Methodology

This report has been written in a way that compiles information gathered from various parts of the world (predominantly the UK, Ireland, the Netherlands, France, Germany and Iowa, California and Washington State in the USA) and identifies what can be learnt from their approaches. This information was developed into a proposal for how I believe this issue should be dealt with in NZ using a case study of the Waikato region.

I also travelled through other parts of Europe, South East Asia and parts of the Middle East. These countries provided me with additional background information and global context, but have not been specifically mentioned in this report.

The process of information collection was largely through interviews with a range of people within various sectors and levels of the agriculture industry. In each country, I aimed to obtain a balance of views by interviewing people from various parts of the industry including:

- Governmental departments
- Regulatory bodies
- Research institutes/universities
- Industry bodies
- People within extension (both publically funded and private bodies where applicable)
- Farmers
- Farming unions (where possible)
- Environmental groups
- Some processors

This provided a good background to the compliance requirements faced by farmers; the approach of government around regulation and policy development; and a wide range of views from throughout the industry. Discussions were not confined to dairying, but rather included a broad range of sectors of agriculture including dairy, sheep & beef, pork production, poultry producers, orchards, arable farmers, energy 'farmers' (both wind and bio-digesters) and a salmon farmer. This introduced different issues, perspectives and methods of dealing with compliance.

Background case studies from which the proposal has been developed can be found in the Appendix of the report.

## Background

NZ is a country that relies heavily on agriculture to provide income and jobs. It is the highest export earner bringing in \$22.3 billion NZD in 2010 (Statistics New Zealand, 2011). NZ has built a reputation on producing high quality, secure and safe food products. Not only this but unlike numerous developed countries around the world our animals are grown using a 'natural' outdoor grazing system, which many consumers appreciate and prefer.

NZ has also come to rely on tourism as a key export earner. The total direct value added from tourism was worth \$6.7 billion NZD to the economy in 2010 (Statistics New Zealand, 2011). Indirectly<sup>1</sup> the tourism industry is valued at \$22.4 billion NZD in 2010 (Statistics New Zealand, 2011). Two and a half million people visited NZ in the year ended April 2010 (New Zealand Tourism, 2010).

Agriculture and tourism are intrinsically linked with many of our lakes, rivers and wetlands well known locally and globally for their natural beauty (Ministry for the Environment, 2011). The NZ tourism board utilise not only the mountains and lakes (Figure 2) but also the iconic farmland, which NZ is famous for as a significant part of their marketing strategy. The 'clean and green' brand alone is



**Figure 2: Lake Wanaka; one of NZ's iconic lakes**

estimated to be worth \$18 million NZD to both the agriculture and tourism industries (NZBCSD & SKM, 2008). The NZ tourism board has built on this brand with the 'Pure NZ' brand that has been developed to encompass all of these assets along with the culture, open spaces and experiences unique to NZ.

NZ's branding strategy will be significantly impacted if increasing nutrient loadings lead to increasing incidences of algal blooms, murky waterways and waterways unsafe to swim or fish

in. This could have substantial implications for the national economy and employment as a result of the loss of our brand and reputation.

It is not just tourism that is at risk of being detrimentally effected if water quality in NZ is not maintained or improved; agriculture is also at risk. NZ has been using the 'clean and green' and 'sustainably produced' in branding of products for many years. Consumers trust that NZ products are produced in a sustainable, safe manner with the highest concern for animal welfare and the environment. However, this brand is far from secure!

<sup>1</sup>This goes beyond the value generated by producers directly supplying tourism products, and embraces the total value and flow-on effects of businesses' intermediate purchases, e.g. intermediate purchases in the accommodation and café/restaurant industries include items such as electricity, bedding and food purchased from other industries or imports.

Information flows faster and further than ever before with the increased use of the internet and social media. Photographs can be taken, uploaded to the internet and sent to the other side of the world within minutes. This increases the potential risk and impact of a pollution event or algal blooms on our 'clean and green' brand. All media publications are also now posted on-line which enables countries to download and use articles of their choice to serve their own purposes.

NZ competes with most developed countries both in their markets and in emerging developing markets. Countries including the Netherlands and Ireland are currently investing in further developing their sustainable milk production brands. These could become strong competition to our brand in the future particularly if markets lose trust in the integrity of the brand. If credibility is lost, it will be incredibly difficult to rebuild. Therefore, strengthening and protecting these brands is vital to NZ's future. Investing in this may not lead to the opening of new market opportunities, but it will help maintain the markets that are currently hold. Markets are always looking for honesty, trust and transparency; NZ needs to be able to continue to provide this in all aspects of agriculture and tourism.

The quality of waterways in NZ has been important for more than just attracting tourists. These water bodies have been an important part of our communities and are often used as a food source and as a source of recreation. However, the quality of these waterways has increasingly been under the spotlight due to growing occurrences of algal blooms and decreased water clarity caused by increased nutrient loadings. Fish and Game launched a 'dirty dairying' campaign in 2002 in response to the intensification of agriculture from sheep and beef to dairying in the South Island (Ministry for the Environment, 2003).

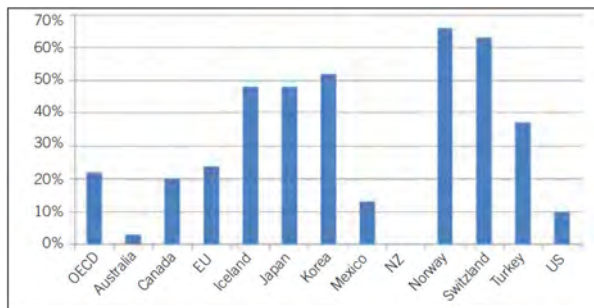
As discussed above, nutrients enter waterways through two means: point source pollution, and diffuse pollution. Point source pollution is caused by nutrients entering the water through one easily identifiable source such as a drain; whereas diffuse pollution is more difficult to identify as it enters waterways not through one source but from a vast area. The majority of the point source pollution has been identified and addressed so the focus has shifted to diffuse pollution. Agriculture has been identified as the main source of diffuse pollution in NZ. One of the major causes of is from the urine patches deposited by stock grazing on pastures. This is unique to NZ, as most other developed countries tend to house their animals and therefore, capture the majority of the urine and effluent. The main issues for other developed countries are around the disposal of effluent and application of fertilizers.

Therefore, with pressure coming from the general public, the export sector, the tourism sector and the local Iwi to improve water quality in the rivers throughout NZ the government has agreed that action is required. This has consequently been incorporated into the 2011 National Policy Statement on Freshwater.

Accordingly, over the past five years, there have been many discussions around the best way to approach the water quality debate and who should be responsible for implementing and paying for the clean-up process. Should farmers be responsible for covering the costs after generations of obliviousness resulting in degradation? On the other hand, as the public could be seen to be the main beneficiaries should they be responsible for paying for the clean-up? Alternatively, should the cost be shared?

## NZ Policy Environment

The policy environment in which NZ agriculture operates is unique. In the 1980s the NZ government removed all forms of government intervention almost overnight. This meant the removal of all



**Figure 3: Percentage of income derived from government support of countries in the OECD (Federated Farmers, 2011).**

led to great success for the country. NZ currently has the lowest level of government support of all the OECD countries (Figure 3). The small level of government support that is provided is in the form of research and development.

In NZ, the Resource Management Act (RMA) is the main piece of legislation that sets out how the environment should be managed. The National Policy Statement (NPS) sets out a national guideline to identify how competing national benefits and local costs should be balanced. The Regional Councils are then responsible for developing a Regional Policy Statement (RPS) that addresses all the issues under the NPS and provides a plan to address these at a local level (Figure 4) (Ministry for the Environment). It is the RPS that sets the specific legislature that is used in the

formation of the Regional Plans and these plans include information on the implementation process (Ministry for the Environment). Generally, the Regional councils have the most responsibility on rules around agriculture and the impact on the environment (Figure 4).

agricultural subsidies, government funded advice and market intervention. This was followed by a period of great change within the entire industry with a lot of fear around the impact that this would have on individual farmers and the number of farming businesses that would not be able to survive. However, it led to a period of great productivity gains and innovation within all sectors of the industry. Farmers were required to be productive and profitable to survive and adjustments were made, new technologies were developed and overall it has

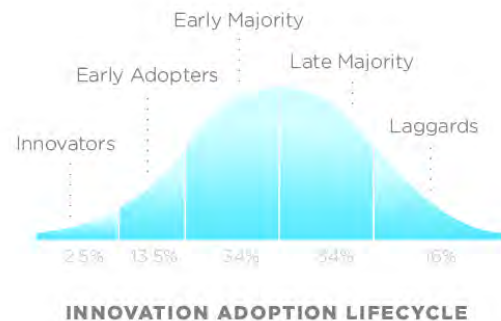


**Figure 4: Schematic diagram of the responsibilities under the Resource Management Act (Ministry for the Environment).**

## Science of Behaviour Change

In all sectors of society, there is a range of perceptions towards new ideas or opportunities. Rogers developed an ‘Innovation adoption lifecycle’ that categorises the population based on their attitudes to new technologies or practices (Figure 5) (Rogers, 1962).

The top 2.4% have been identified as **innovators** who are those people who are generally willing to act as 'guinea pigs'. They are willing to try a new practice or technology that may show potential in a scientific situation but has not yet been trialled in a commercial situation. After the innovators, there are the **early adopters** (13.5% of the population) who are a slightly more cautious than the innovators and tend to wait for more evidence; however, they are much quicker than the remainder of the population. They are often very involved in their communities and in activities such as discussion groups.



**Figure 5: Innovation adoption lifestyle as developed by Rogers, 1962.**

The **early majority** make up an estimated 34 % of the population. These people are more risk averse than the early adopters, they want to see the practice/technology successfully in place before they look to implement it themselves. They are often involved in activities such as discussion groups but tend to sit in the background.

The **late majority** will take up the technology later than the average. They are usually sceptical about new ideas or technology and often not as involved in the community as the previous groups. The last group to adopt any new technologies or practices are the **laggards**. These people are often averse to any change-agents and focused on traditions. These are generally not involved in the activities such as discussion groups (Rogers, 1962).

Another theory developed by Rogers in 1962 was around the factors that are considered prior to the adoption of a new technology or practice. He proposed there are five factors that can influence whether a technology is adopted or not. These are:

1. Relative Advantage – how improved is an innovation over current practices?
2. Compatibility – the level of compatibility of the innovation has to be assimilated into an individual's life.
3. Complexity/simplicity – if an innovation is too difficult to use an individual is not likely to adopt it.
4. Trialability – how easy is the innovation to be experimented with as it is being adopted?
5. Observability – the extent the innovation is visible to others. The adoption of a visible innovation will drive communication with their peers and networks that in turn will generate more positive or negative reactions.

The ranking of importance is likely to differ between individuals but these considerations are important in the decision of whether to adopt or to reject the innovation.

A potential flaw with both of Roger's models in this situation is that they have generally been used to explain new technologies or practices that are expected or perceived to have greater direct benefits to the adopter. However, in the situation of water quality there is often a perception that

practices that are being encouraged may have direct costs to the farmer. This perception is a difficult barrier to overcome, even if it is incorrect, and may lead to a greater timeframe between the innovators and the laggards. Most of the laggards and potentially a proportion of the late majority are also not likely to make these changes without some form of regulation in place.

There are various methods of initiating changes to practices on farm that fall into one of four categories. These are:

1. Provide financial **incentives** to encourage change (carrot)
2. **Regulate** farmers in an attempt to force them to change (stick)
3. **Voluntary change** at the farm level. This rarely occurs on a large scale unless driven by the threat of regulation. Even then, the response is still often slow
4. A combination of the three options above



## What has been learnt?

Farmers around the world act in a similar manner when it comes to changing farming practices to reduce their impact on the environment. Without significant financial benefits/penalties or imminent regulation there will be no on-farm changes to practices. There are some individual changes prior to the development of the regulation, but these farmers either have a passion in this area and would do it anyway or are the innovators that see the possibility of regulation or potential improvements from the technology and are being proactive. They enjoy the challenge of doing something new but these innovators only account for approximately 2.4% of the population.

Consequently, the development of regulation is required to drive change. In order to gain widespread changes the following are important:

- **Industry collaboration is key!** Input from all stakeholders is required in the development process. The industry needs to be working together in the policy development process. If there is industry and farmer buy-in, the process of change will be much smoother.
- **The development of desired outcomes needs to include all stakeholders.** These outcomes must satisfy<sup>2</sup> all parties.
- **The need for regulation needs to be based on sound fact and evidence not emotive ‘knee-jerk’ reactions to individual cases of negligence.** Often individual cases of negligence can lead to media ‘outcries’ which have in the past led to the rushing of developing regulation so as to appear to be doing something.
- **Tried and tested regulation.** The regulations need to be resulting in the outcomes required. This requires practical testing and not just modelling! A clear understanding of the impact of the proposed regulation on individual farms, and the industry is important
- **Industry capability and capacity.** A plan to ensure that the capability and capacity in the industry is available when the regulation is rolled out is important to ensure farmers have the support available to help during the change process.

Ensuring the regulatory process includes all stakeholders and that developing outcomes will satisfy all stakeholders and road testing proposed regulation, will take additional time to develop but this will help ensure the regulation achieves the desired outcomes with minimal impact to farming businesses and consequently the industry. Working under a collaborative framework can lead to greater understanding of the issues, a greater buy-in and empowerment by farmers and the

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<sup>2</sup>Satisfy is the key word in this process. According to the Collins Dictionary, satisfy is defined as: fulfilling the needs; to provide sufficiently; or to fulfil the requirements. The setting of industry targets and goals requires each of the stakeholder groups to identify their core needs, separated from their wants. The industry needs to find a win:win where the core needs of all parties are met as a minimum and the rest negotiated.

industry, which in the long-term this can reduce the resistance and disputes that always emerge following the release of a new regulation.

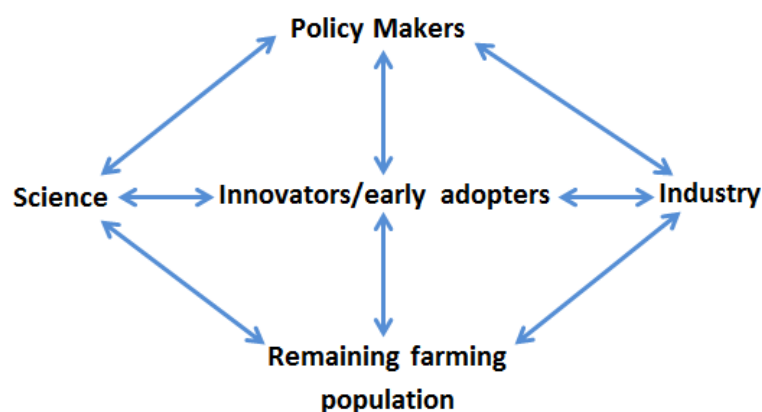
Highlighting this, in the USA, there was an article in one of the local papers discussing the complexity and intensity of the regulatory environment in California. It stated,

*“Most farmers just want all the regulators to get in the same room, agree on the result and issue straightforward rules (Rhee, 2011).”*

## ***Development of Initiatives***

From discussions throughout various parts of the wider agriculture industry, the conclusion has been that large scale change without the threat of imminent regulation or penalties will not occur even if there are significant incentives available. Schemes using incentives generally get uptake from the innovators, early adopters and sometimes some of the early majority, but the most of the early majority, late majority and in particular, laggards require enforced regulation to make any changes. Incentives also tend to only lead to short-term changes and once the incentives are removed, most

farmers will return to their initial behaviour.



**Figure 6: Proposed flow of information.**

Consequently, any funding or incentives should be targeted at education and harnessing the entrepreneurial attitudes and minds of the innovators and early adopters and helping provide the science and support to implement suggested changes that result in the proposed targets set by policy. There should be a two-way

feeding of information between policy makers and these programs to develop a clear understanding of the impacts of reaching these targets on all aspects of the business including costs, benefits and practicalities. This two-way feedback system can also provide information to the industry around knowledge gaps in the science and within the support sectors of the industry. The information surrounding the implementation of the initiatives can then also be extended out to the general farming public to provide transparency on what the proposed policies may mean for other farmers businesses (Figure 6).

This proposal would require policy makers to become more involved in programs at the farm level or to develop feedback systems back to the policy team.

**It is important that farmers, other stakeholders and the community are involved in the development process that will develop ownership of the program. This is likely to improve significantly the uptake and success of such a program.**

The innovators and early adopters need support and encouragement to get involved. They can help with the development and testing of the actual technologies or practices and with practical case studies.

The early majority need to be able to see the imminent regulation for them to consider changing. Incentives can help but they do need to know that the requirement to change is coming. These farmers also generally learn better from farmers so utilising the experiences of the innovators and early adopters in case studies and field days will help with this uptake. They can benefit from using both the carrot and the stick approach to facilitate change.

The late adopters and laggards need regulations to be enforced before they are likely to make any significant changes.

**A different strategy is required to engage each of these groups. Being able to develop a program to achieve this will increase the likelihood of success.**

For each group Rogers (1962) five factors of adoption need to be considered:

1. **Relative advantage** – what is the relative advantage of change in behaviour/uptake of technology?
2. **Compatibility** – how compatible are the proposed changes with the current system?
3. **Complexity/simplicity** - how complex/simple is the change/new technology?
4. **Trialability** – if the proposed changes are implemented and it doesn't work how easy is to reverse the change and what is the cost?
5. **Observability** – what changes can be seen by the farmers implementing (and by their neighbour!)?

Another factor significantly affecting the success rate of programs is having the right people on the ground interfacing with the farmers. They need to have the right knowledge and ability to build rapport and trust of farmers. People will only follow the advice of trusted advisors, which means these people providing the advice need time to build the trust and rapport and develop commitment to the process. NZ currently does not have the capacity or the capability within the industry at this stage to be able to provide enough of these people.

## Proposed Method of Change in the Waikato

There is a wide range of knowledge and understanding by farmers around the water quality issues in the Waikato. Over the past decade, there has been increased pressure around the water quality in the Waikato River. In response to this, the Waikato Regional Council (WRC) has been doing a lot of work around the region in the area of water quality. There has been particular attention to the sensitive catchments in the Upper Waikato region, which runs from the Huka Falls, just north of Taupo, to the Karapiro Dam. This work ranges from general measurements in the area to specific projects such as the Integrated Catchment Management (ICM) (Waikato Regional Council) project and the Upper Waikato Nutrient Efficiency Study (Waikato Regional Council) that were designed as information gathering and learning exercises. The WRC has also been instrumental in supporting other initiatives in this part of the region that range from individual Nutrient Management Plans to various educational based programs such as DairyPush (South Waikato District Council, 2009) and Tomorrow's farm Today (Waikato Regional Council, 2011).

The presence of all of the projects over the past five years has increased the awareness and understanding of the issues and potential solutions to farmers in this region. This part of the region has a much better understanding of the issues, and the contribution of agriculture than farmers and the industry in other parts of the region. Within the industry, a culture of collaboration has been built where organisations are working together within the programs to ensure that the messages are aligned. This is a great start to initiating change in the industry.

In order to get large-scale changes, the next step in the process is vitally important. Continuing and strengthening this industry collaboration is vital!

The Upper Waikato Nutrient Efficiency study was a collaborative study funded by WRC, DairyNZ, Fonterra, and Ballance Agri-nutrients. This project was commissioned to AgFirst Waikato and involved a modeling exercise looking at the actions which would be required on various case study farms if they were required to reduce their N leaching to 26kg N/ha (ref upper Waikato study). This was a good start to get an overview of what the implications of such a regulation may be on individual farms. It was also a great step forward in terms of organisations and independent companies working collaboratively around this issue. However, this was a desktop modeling exercise and it is important that this be verified before it is used in any policy development.

The next step is to develop these 'desktop' case studies (and others) into practical on-farm case studies where the modeling exercise can be verified. The implementation of these case studies should involve innovators and early adopters in the area, policy makers, regional council, and other industry personal. Innovators and early adopters from within the community will not only provide valuable contribution to the project but their involvement will also help their understanding and may lead to their buy-in. This has benefits to the wider industry as these farmers are often respected by their peers and can influence attitudes in their direct networks and farming community. Policy makers need to be involved directly in this project to monitor the success of their policy proposals in achieving the environmental outcomes desired and the effects of the proposals on all aspects of the business, and any unexpected outcomes.

These case studies need to be addressing the following:

- What changes are required to meet the potential policy?
- What impacts do these changes have on every other aspect of the business?
- Do these changes result in the environmental outcomes that the draft policy was initially designed for?
- How would this policy be introduced? What resources would be required by the industry?
- What would the cost of implementation be to the farmers? To the Regional Council? To the industry? To the community?

They can be used as a further learning platform not only for farmers but also regional councils and policy makers about how effective the proposed policy could be. Having farmer involvement at this level of development is critical to developing a regulation that is workable, practical and achieves the desired outcomes. It is likely that this approach will take a few years longer than alternative methods but in the long run it would achieve better outcomes and in a shorter overall timeframe.

In order for this to be successful, there needs to be a stronger link between the policy makers within WRC, the WRC staff on the ground, the industry, and the innovators and early adopters.

Alongside these case studies there also needs to be work investigating the capability of the industry to cope with the changes required. Is there the level of support available to help during this time of change? Are there the skills in the industry to support this change? If not, where are they going to come from? The lead in period with the case studies would be a good chance to identify the gaps, develop a plan, and start the implementation to ensure that the industry is able to provide the required support to ensure the changes can occur. It is also important that the right people are involved; people that can relate and build rapport with farmers.

## Who Pays?

Throughout the world, and within NZ, there are a number of views on who should be paying for the costs associated with reducing the environmental footprint of agriculture. These views are generally dependant on what part of the industry or community the person is involved in.

The general community tend to believe that the cost should be the responsibility of the farmer, as they do not have the right to damage the environment or pollute the waterways. On the other hand the farmers argument is two-fold: firstly that the damage done to the environment is a result of generations of human activities including clearing the land, depositing industrial waste directly into the streams as well as the intensification of agriculture. Therefore, why should farmers have to pay for the entire cost of cleaning up these waterways when the damage has not been done by them alone? Additionally, why should the community set the level of water quality which could be much higher than what is necessary under international rules. Are the levels discussed unrealistic, is there a compromise?

Following these arguments, this report concludes that the costs should be shared by the farmers and the general community. This is a problem which all of our forefathers' activities and recent farming and community activities have contributed to. Therefore, NZ needs to be working together as a community to address this problem. Funds to address this issue should not be allocated as direct incentives to farmers but towards science, research and providing the support networks to initiate and encourage changes.

Some of the issues that have developed in various countries where subsidies and incentives have been utilised as a method to initiate change include:

- Incentives have become expected by farmers and both industry and farmers believe that any significant scale change will not occur without financial incentives being offered.
- Personal grants are given for infrastructure that is predominantly bringing the individual farmer up to compliance level.

### ***Keys to success of creating change***

In order to get farmer involvement around any regulatory issues the following factors are important:

- Having agreement from all parts of the industry in terms of direction with goals and targets that **satisfy** all parties and that are based on science
- Involving the farmers in the process of development
- Transparency within the regulation process and targets set!
- Having the right people on the ground to get the buy-in from farmers at the implementation stage

- Having flexibility to let farmers have a choice so they do not feel like they are being dictated too
- Minimising the paperwork and particularly duplication in paperwork as this introduces significant cost and frustration at all levels of the business
- Being able to monitor the progress and success of any program to ensure it is achieving the outcomes

## Conclusions

This issue is vitally important to both our agriculture and tourism industries. It is a difficult and emotive problem to address for all stakeholders.

Collaboration between all stakeholders to this issue is vital. This collaborative process needs to develop objectives and goals that satisfy all stakeholders and that are based on science.

Programs need to be developed to help farmers adapt to achieve these objectives. These programs need to provide support and encourage innovation within the industry. They need to cater for the different approaches required for the innovator/early adopters; early majority and late majority/laggards in order to get large scale change.

The costs should be shared by all beneficiaries. Funds should be used in the development of programs and education while incentives should be used with caution and only during the start-up process to encourage engagement and initial involvement. There should be an emphasis on developing programs and education, which can show clear benefits to the farmer.

Water quality is a big issue that is not going to go away. If nothing is done, regulation will be developed. The industry can either, bury their heads in the sand and wait for the regulation to hit, or it can take the bulls by the horns and get involved in the process to ensure that the industry works together to achieve the best outcomes for all parties.



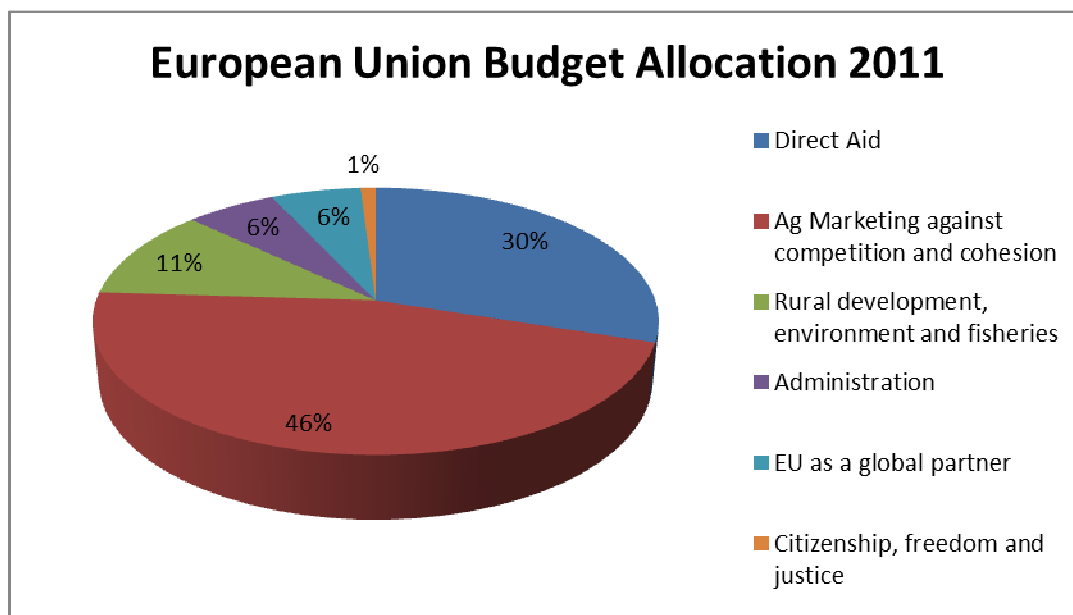
## Recommendations

1. New Zealand needs to continue emphasise the importance of collaboration between policy makers, industry and farmers throughout the policy development process
2. When selling the concept to farmers it is important to use a multi-faceted approach. The benefits are not just improving water quality but also strengthening NZ's reputation for sustainable production of food, in order to maintain current markets.
3. A combination of the carrot (incentives) and the stick (regulation) approach should be used. The carrot should be used to encourage and help support the innovators and early adopters to get involved in initiatives such as that suggested in recommendation 5. The stick is required to create change amongst the early majority, late majority and laggards.
4. Policy makers need to collaborate with farmers and the industry throughout the policy development process in order to develop policy that is practical, achieves the desired objectives and has buy-in at the industry and farm level.
5. Farmers need to be prepared to get involved and have open conversations around regulation with the regulators and policy makers. They need to get involved in this process in a constructive manner and encourage their peers to do so also. If farmers continue to ignore this issue, they will have no hope influencing the policy development process.
6. Programs that are developed need to cater for the five sections of the farming population: innovators and early adapters, early majority, then the late majority and laggards. These groups need different approaches to achieve engagement.
7. There needs to be a focus on increasing the education and understanding of the issues at the farm level now. The industry will be in a better position if farmers and the industry understand the issues and the contribution of agriculture. The next step is educating farmers around the environmental impact of their individual farm.
8. The cost needs to be shared among the agriculture industry and the community, as historical and recent practices from a range of sources has contributed to the problem and the wider community as well as farmers will benefit.
9. Funding should be utilised to develop initiatives where proposed policy is implemented on commercial farms as a 'case study'. From here, the impacts of compliance on all aspects of the business can be monitored. The required changes and impacts from these changes on other aspects of the business then need to be fed back to policy makers.
10. The gaps in the capability and capacity within the industry need to be identified and addressed.

# APPENDIX I

## European Union

There are 27 member countries of the European Union (EU) and was formed under its current name in 1993 (Prior to this it was called the European Economic Community, EEC). The EU holds a number of roles including maintaining a common policy on trade, agriculture, fisheries and regional development. The EU currently has an allocation of €864.3 million for the period of 2007-2013 (European Commission, 2011). In 2011, a total budget of €126.5 million was allocated as shown in Figure 7.



**Figure 7: Allocation of the €126.5 million EU budget for 2011 (Euroean Commission, 2011).**

Agriculture has always been allocated a large proportion of the budget with a peak of nearly 70% of the budget allocated to agriculture in the 1970s when the EU was termed the EEC (European Commission<sup>2</sup>, 2011). This has however dropped to just over 30% of the budget allocated to agriculture in the period of 2007-2013. The EU has the objectives in agriculture to increase agricultural production, provide certainty in food supplies, ensure high quality of life for farmers, stabilise markets and ensure reasonable prices for consumers (Consolidated Version of the Treaty on the Functioning of the European Union, 2010). The drop in percentage of budget has come as a response to an increase in responsibilities of the EU and an increase in income from additional countries entering the EU and no increase in agriculture spend (European Commission<sup>2</sup>, 2011).

The EU has various levels of responsibility. In some areas, they have the power to set specific regulation that states how countries must implement or obey this legislation. However, in most areas of agriculture they provide a framework in which the member countries must abide by. How each country develops the legislation to ensure compliance is left up to the individual countries. This system is similar to NZ's national level guidelines, with overarching guidelines set at the national level but specific legislation set at the regional level.

In the 15 most developed countries in the EU, the average percentage of the population employed in agriculture was only 2.8% in 2009 and dropping (European Commission, 2010). In conjunction with the decrease in population directly involved in agriculture has been the increase in number of people involved in environmental protection groups. In the UK alone there are great numbers of these groups including Natural England, FWAG (Farming and Wildlife Advisory Group), LEAF (Linking Environment and Farming), Campaign to Protect Rural England and various wildlife trusts just to name a few. These groups have huge levels of urban following and political power. The first environmental policy was introduced by the EU in 1972 and since then the EU has set policy to deal with a number of environmental issues including acid rain, air pollution, noise pollution, thinning of the ozone layer, waste and water pollution (Dimas, 2007).

### ***Policy Environment***

The policy environment is very complex. Subsidies are a prominent factor in the agriculture industry throughout Europe. The extent and methods of distributing this subsidy varies depending on individual countries with an average of just under 25% producer support levels in the EU in 2009.

The EU has developed a Common Agricultural Policy (CAP) that provides guidelines around trade barriers and the delegation of funds to the agricultural industry. This is made up of two parts: the direct subsidy payment, which is paid out to farmers based on the land stewardship (this was historically a production based payment); while the second part of the payment is based on price mechanisms such as minimum prices, import tariffs, and quotas on certain goods from outside the EU. Implementation of the scheme varies in different member countries. There is controversy within the EU around the CAP payments and the proportion of the EU budget that is allocated to these. Countries that have a relatively small agriculture industry in relation to their population such as the Netherlands and the UK receive a relatively small benefit from these subsidies. Whereas countries that have a high proportion of agriculture in their economy tend to obtain a greater share of this funding. In effect, the more developed countries are subsidising the less developed countries within Europe.

The direct payment section of the CAP has historically been quite market distorting. Some crops had greater payments than others based on food security and the crops the EU felt were important. In 2003, the Single Farm Payment (SFP) system was introduced to take over the subsidies that were historically issued. This SFP took the emphasis off producing specific crops or products and put more emphasis on using good agricultural and environmental practice; termed cross compliance. There are two pillars of SFP; pillar one requires farmers to demonstrate respect for the environment, phytosanitary animal welfare and food safety (essentially implementation of best practice) (European Commission 2, 2011). If farmers are proven non-compliant under these areas they will have part or all of their SFP removed.

The second pillar of the SFP is termed the Rural Development section. This receives approximately 11% of the EU budget (European Commission, 2011). This section has various programs in forestry, the environment and improving the quality of rural life. Under the environment section, there are subsidies and grants available for projects with the objectives of improving the environment, countryside or climate change.

The majority of farmers have opted into the pillar one SFP scheme. A much smaller proportion of farmers have opted into pillar two due to the additional requirements to be eligible for funding. This is particularly noticeable in the dairy industry where the requirements require reasonably significant changes to farm practices.

The SFP system is currently undergoing a reform and it has been suggested that there will be a 'greening' of the SFP. Specifically it has been suggested that the requirements to be eligible will become more difficult and a number of the requirements that are currently in the pillar two SFP will be shifted into the pillar one.

## ***EU Regulation***

In terms of regulations within the EU, there are certain agricultural policies at the EU level that significantly affect agriculture such as the Water Framework Directive (WFD). This is a document that discusses the need to manage water quality and quantity particularly for those waterways that travel between different countries. This document acts as a framework which all countries are required to work under, but how the outcomes are achieved is ultimately up to the individual countries to decide (European Commission, 2000). This provides flexibility to address individual issues and to implement in ways that is suitable for their individual country. The EU also provides some funding for each of the countries to utilise to achieve these outcomes (European Commission, 2000). Again, it is up to the individual countries to decide how these are utilised and distributed. However, there is a belief that there are discrepancies in the interpretation and contribution between countries.

The regulations around nitrogen application also varies between countries with a range of 170-250 kg N/ha organic nitrogen. There are no limits on the amount of chemical nitrogen fertiliser applied. However, the water quality throughout Europe varies significantly. In some water bodies in the UK, the groundwater and surface water have nitrogen levels of 50 ppm (European Commission, 2000), which are well above the international drinking water standards of 11.4 ppm. This has become a significant issue throughout the UK and has led to water treatment required prior to household use, which incurs significant cost. This led to the categorisation of all of these water bodies with high nitrogen levels as Nitrate Vulnerable Zones (NVZs). Over 68% of the farmland in England falls into NVZs.

Farms that fall into a NVZ have stricter regulations in a variety of areas including, the allowance for the application of organic nitrogen from 250kg N/ha to 170kg N/ha. They are also limited in the timing of these applications based on soil type and vegetation grown. This nitrogen limitation tends to result in a limit on stocking rate as the land area held needs to be large enough for the manure and slurry to be applied at a rate that does not exceed these limits. It is a particular issue in the Netherlands, where business growth is limited due to the high population and limited undeveloped agricultural land available. In some parts of the Netherlands, they export the farmyard waste across the border to the croplands in Germany as there is more organic nitrogen being produced than is able to be applied to land whilst maintaining under the regulated level of N.

### ***Methods of influencing behaviour***

The subsidisation of agriculture in Europe in addition to low or volatile commodity markets has had a significant impact on the productivity of some sectors. Farmers in some sectors are able to maximise profitability of their business through involvement in various agri-environmental schemes and ensuring qualification for the full quota of subsidies on offer as opposed to focusing on productivity.

The SFP has also provided a method in which the EU and national governments can in effect control on-farm practices. In essence, the SFP system is a system of incentivising farmers to abide by the requirements that EU and national governments set. The majority of farmers in the EU receive the SFP at least at the pillar one stage. The majority of the requirements of the pillar one section of the SFP are termed 'good agricultural practices.' Most farmers interviewed in the UK have admitted that they would be implementing these practices regardless of the SFP. This is one of the reasons for the proposed further 'greening' of the SFP. It has been suggested that a number of the agri-environmental requirements of pillar two may be shifted into the pillar one section resulting in farmers being required to implement additional measures towards improving the environment in order to be eligible for this subsidy payment. The impact of this 'greening' is likely to vary between countries.

There are a large number of different agri-environmental schemes running throughout Europe and in particular in the UK. A case study of one of the common schemes has been included below.

## Entry Level Stewardship Scheme

**Location:** England

**Approach:** Voluntary/incentivised program

### Background

The Entry Level Stewardship (ELS) program is available to all farmers in the UK. The program is designed to encourage management practices that improve various aspects of the environment and biodiversity including cleaner water, healthier soils, farmland birds, farm wildlife and to improve the historic environment.

ELS Code	Options	ELS/OELS Points	CFE Code
<b>Cleaner Water and Healthier Soil</b>			
<b>Tackle the Source</b>			
EG1/OG1	Undersown spring cereals	200/150 per ha	
EJ2 / OJ2	Management of maize crops to reduce soil erosion	18 per ha	
EJ10	Enhanced management of maize crops to reduce soil erosion and runoff	94 per ha	
EJ13 / OJ13	Winter cover crops	65 per ha	◆ C7b
<b>Slow the Pathway</b>			
EF1/OF1	Management of field corners	400/500 per ha	◆
EF7 / OF7	Beetle banks	580/750 per ha	◆
EJ5/OJ5	In field grass areas to prevent soil erosion and runoff	350 per ha	◆ C2
EK1/OK1	Take field corners out of management	400/500 per ha	
EK2/OK2	Permanent grassland with low inputs	85/115 per ha	
EK3/OK3	Permanent grassland with very low inputs	150/180 per ha	
EK4/OK4	Management of rush pastures	150/180 per ha	
	Reverted arable areas/optional scrub management	-	◆ C3a/b
<b>Protect the Receptor</b>			
EE9/OE9	6m buffer strip on cultivated land next to a watercourse	400/500 per ha	◆ C1
EE10/OE10	6m buffer strip on intensive grassland next to a watercourse	400/500 per ha	◆ C1
EJ9/OJ9	12m buffer strips for watercourses on cultivated land	400/500 per ha	◆ C1
EJ11/OJ11	Maintenance of watercourse fencing	4 per 100m	
	Sown wildflower headlands		◆ C13
<b>Farmland Birds</b>			
<b>In-field nesting habitat</b>			
EF8/OF8	Skylark plots	5 per plot	◆ C4
EF13/OF13	Un-cropped cultivated areas for ground nesting birds on arable land	360 per ha	◆ C5
EF22	Extended overwintered stubbles	410 per ha	◆
	Overwintered stubbles followed by spring/summer fallow		◆ C6
<b>Overwinter seed food</b>			
EF2/OF2	Wild bird seed mixture	450/550 per ha	◆ C9
EF6/OF6	Overwintered stubbles	120/150 per ha	
EG4/OG4	Cereals for whole crop silage followed by overwintered stubbles	230/250 per ha	◆
	Game strips	-	◆ C10
	Overwintered stubbles	-	◆ C7a

**Figure 8: Some of the management options available for farmers to pick and choose from to fulfil the criteria of the Entry Level Scheme (ELS). The CFE code indicates the options that are also eligible to put towards the Campaign for the Farmed Environment (Natural England, 2011).**

The method that is used in this scheme is interesting. It is a 'menu-based' approach with a points based system. In order to be eligible for the financial incentive associated with the scheme farmers need to obtain an average of 30 points/ha over their whole farm and the financial incentive paid out

equates to €30/ha. So for instance if the farm is 100 ha a total of 3,000 points is required to be eligible for the €3,000 ELS payment. These points are achieved through the implementation of specific practices. Various practices are worth various levels of points as seen in Figure 8.

So for instance if this farmer was to decide to

1. Grow winter cover crops on 17ha of his cropland	1105 points
2. On the 5 ha of summer wheat he grows he can undersow into the stubble. He receives 120/ha for the stubble + 200/ha for the undersowing	1600 points
3. Using the 1 ha at the corners of his crop paddocks to plant birdseed mix	450 points

This equates to a total of 3155 points that makes him eligible for the €3,000 subsidy. Some of these actions are also eligible to be counted towards another agri-environmental scheme called a Campaign for the Farmed Environment. For more information about this scheme, please visit <http://www.cfeonline.org.uk/>.

The industry is under pressure for schemes such as the ELS and the Campaign for the Farmed Environment to get farmers on board in order to avoid regulation. They seem to be reasonably successful so far where farmers acknowledge that currently it is not too difficult to fit under the ELS without making too many changes to their farm system.

However, there is pressure on increasing the requirements to qualify and it is likely that these are going to increase continually, making it progressively more difficult for farmers to achieve the required standards. Many farmers interviewed suggested that when it becomes too difficult to comply with the requirements of the scheme they will withdraw from the scheme.

Therefore, are the outcomes initially intended being met? Or, are they a short-term method of illustrating that something is being done but essentially providing subsidies for very little changes?

#### What can we learn from this?

- A menu type approach can lead to greater uptake due to the flexibility that it offers.
- The suggested actions from the menu need to be challenging enough that changes are required. Otherwise, it is funding farmers to continue farming the way they currently are.
- Updates and tightening of options are almost inevitable. However, it is essential that the timeframe of validity of the options are transparent. If it is based reaching a target number of farmers involved before the next step is introduced, farmers may purposely delay in taking up the options in order to delay the introduction of the second target. Transparency is key.



Figure 9: Birdseed crop to encourage biodiversity



-On-going subsidies can alter the focus of farming away from the primary purpose of producing food.

One of the issues with an industry heavily based on subsidies and incentives is that it develops a culture of resistance to change without financial incentives. When asked, most people in various sectors of the agriculture industry (both farmers and rural professionals) in the UK believed the agri-environment schemes would have very limited uptake without financial incentives. The general conclusion was that without financial incentives, large-scale behaviour changes, particularly around environmental issues would be unlikely to succeed.

In addition to agri-environment schemes, farmers in Ireland and the Netherlands are incentivised to attend training days, such as discussion groups, workshops or field days. This is to encourage up-skilling within the industry. Farmers that register and sign into a training day are paid approximately €100 for the day (there is a maximum subsidy in place that varies in each country). Although this is relatively successful in increasing attendance to these days, the real value to the industry is questionable. Some of the progressive farmers find it frustrating if the farmers in attendance are not there to contribute but to receive their subsidy instead. It is seen by some as more of a social gathering in which they are being paid for, which can be disrupting.

The EU has also introduced incentive schemes as a method of trying to drive the uptake and further development of particular technologies. For instance, the EU has a focus on reducing its reliance on non-renewable fuels such as coal. In response, Germany (with input from the EU) has developed a highly subsidised scheme in order to encourage investment in this area. The case study below shows how this can be very successful in creating change but if not carefully managed can result in unexpected effects on the wider industry.

## How Policy can Distort the Industry – Bio-digesters

**Location:** Germany

**Approach:** Voluntary incentivised scheme

### Background

For the past 20 years, the EU has had an increasing desire to produce a proportion of their fuel through renewable sources to reduce their reliance on non-renewable fuel sources. They have introduced a target of producing 20% of gross energy generated from renewable energy sources by 2020 (EurObserv'ER, 2010). In response, Germany has taken the lead on renewable energy, using incentives and subsidies to encourage the development of the technology. Germany now leads the EU in biogas technology with approximately 5,000 biogas plants throughout the country (EurObserv'ER, 2010).

In addition to the production of renewable energy, biogas production also provides a method of processing waste products including livestock manures, which have been becoming an increasing problem in some livestock dense regions (EurObserv'ER, 2010). However, the use of bio-digesters to process livestock manure alone is not viable due to the low yield of energy. The process of digestion by livestock utilises the majority of the energy rich substances resulting in manure with a low organic dry matter content and consequently a low yield of energy produced from the fermentation of the substance. Consequently, the use of other waste products, such as vegetable waste, and high energy crops, such as maize, was introduced to increase the efficiency of the bio-digesters (Weiland, 2003).

In order to encourage investment in this technology and to improve the financial viability, a subsidy has been offered in the form of a 'feed-in tariff.' This is designed to increase the demand for the technology, thereby reducing the production costs of the infrastructure and installation of bio-digesters. It also provides additional security to those early-adopters who take on the risk of taking up the technology first. These feed-in tariffs vary depending on the size of the bio-digester installed with a tariff of €0.1167/KWH for plants below 150KW capacity (EurObserv'ER, 2010) and a smaller tariff of €0.0779/KWH for plants with a capacity of up to 20MW. In addition to this, there are bonus tariffs available depending on the materials fed to the bio-digester as an encouragement to utilise various products (EurObserv'ER, 2010). The tariffs are payable for 20 years from the time of instalment but are due to decrease by 1% each year (EurObserv'ER, 2010). This 20-year contract and the requirement of electricity companies to give priority to purchasing electricity from renewable sources over non-renewable sources give investors the necessary confidence to invest in the new technology (Rank).

Producers who have taken advantage of these tariffs and installed biogas digesters are able to maximise the returns from the feed-in tariff by selling their electricity back to the main grid and purchasing back the electricity to run their operations.

### Kloster Sankt Ottilien Monastery

One of the goals of the Kloster Sankt Ottilien Monastery is to be self-sufficient but in a way that preserves the resources and environment for future generations. Therefore, when the technology to sustainably produce their own electricity was developed they took advantage of this. The Monastery is home to 180 monks and various families employed to help the running of various parts of the Monastery.



Figure 10: Kloster Sankt Ottilien Monastery dairy unit

The Ottilien Monastery is a modern diverse business that covers 80ha of agriculture land and is located 40km west of Munich, Germany. The business runs various units including dairy (Figure 10), beef, poultry and pigs. All animals are housed and the products are used to feed the people within the Monastery, with the excess sold in a farm shop also situated on the property. Some of the products are further processed into cheese and various meat products which are processed at their resident cheese-making unit and butchery. There is also an area planted in an orchard and vegetable gardens providing both the Monastery residents and the farm shop with fresh produce.

In 2009 a 250kW bio-digester was installed (Figure 11) as a method of generating electricity and disposing of the animal waste. The agricultural land is used to grow a range of crops to feed the various animals and the bio-digester. Some maize silage is required to be purchased to supplement that grown on farm. There is a stand of trees planted to provide additional income and the waste materials are used as wood chips which are also fed to the bio-digester.

Enough electricity is produced from this bio-digester to run the entire Monastery including the agricultural enterprises, the living quarters of the 180 brothers, the school, the church and the housing for the families that work in various parts of the Monastery. However, under the current tariff system it is more profitable to sell this electricity back to the main grid for a total of €0.26/KWh. The electricity required to run the Monastery can then be purchased for €0.12/KWh.

There are two by-products that are produced in the bio-digestion process: digestate and heat. These are both utilised under the current system. The digestate is used as a fertiliser product and spread over the crops grown. Approximately 50% of the heat produced can be captured and utilised. In this case some of the heat is reused for the fermentation process whilst the remainder is captured and used to provide heating to all of the buildings within the Monastery village. During the summer months enough heat is produced to cover all the needs of the Monastery without supplementation. However, in the winter months this is supplemented with oil and fossil fuels. Often the additional heat produced by a bio-digester cannot be utilised to its potential due to the location of the bio-digester and the losses that are experienced when transporting it to the nearest destination where it can be used.



**Figure 11: The bio-digester installed on the Ottilien Monastery.**

In 2011 the Ottilien Monastery received the Managenergy Local Energy Action Award. The new power supply to the Archabbey St. Ottilien has also had the Monastery nominated and reached the top three in a European Commission competition that had 300 nominations. The Monastery has been commended on the model of supplying an entire village will locally available resources.

This Monastery has shown noteworthy innovation in their quest to become completely self-sufficient in terms of food,

electricity, and heat. However, they did comment that the capital cost of the set-up would not have been viable without the presence of the feed-in tariffs. For more information on this Monastery, visit their website on <http://www.erzabtei.de/energiekonzept> .

There have been a number of situations where the introduction of bio-digesters has not been so well integrated into the community. In some areas, such as Bavaria and Lower Saxony there have been a large number of bio-digesters introduced with some of these being of significant size. These appear to be predominantly fed high-energy crops such as maize silage to produce the electricity. This has consequently resulted in a significant increase in the competition for maize silage crops and farmland that is suitable for growing maize silage (Warnecke, Braukmann, & Broll, 2008). This has led to an increase in the price of maize silage and other crops and has resulted in an increase in land value of land suitable for growing these crops. A downstream effect of this has been increasing the cost of production for all livestock producing businesses.

The financial viability of these operations without the feed-in tariff is debatable. This is of great concern to livestock farmers in the area who are currently competing with this industry.

#### **What can we learn from this?**

- Start-up incentives can be a useful method of helping the development, initial stages and demand for a new technology, but it can also have a distorting effect on surrounding industries
- When looking at influencing change it is important to have a good understanding of how this may impact, physically and financially, at a farm, catchment, and industry level. Potential flow-on effects also need to be identified

## United States of America (USA)

### ***Policy Environment***

The political environment in the USA is very complex. The federal government utilise the Farm Bill (USA policy tool) as the primary agricultural and food policy tool. The Farm Bill has been the method of developing subsidy payments dating back to the 1920s. It includes a range of intervention mechanisms such as direct payments based on crops historically grown, minimum prices and crop insurance schemes. The majority of the funding (74%) under the Farm Bill is allocated to the National Food Stamps program and food benefit systems for the poor. These have been strategically included under the Farm Bill as a political method of helping maintain votes for these subsidies. The subsidy level of farm income is variable depending on the industry and the state. The average level of support payments in the agricultural industry is just over 10% of farm income. This is shown in Figure 3 found in the NZ Policy Environment section of this report. Most of the farmers and industry people interviewed do not believe farming businesses would survive without the support from these subsidies.

At the time of writing, there was a reform of the federal budget with 1.2 trillion dollars needing to be removed from the budget over a 10 year period. How this is removed was to be decided by a super-committee of 12 people. This failed which is likely to result in across the board (equal percentage) cuts to the budget. This is not ideal for agriculture as 74% of the Farm Bill covers Food stamps and food benefit systems for the poor that are not likely to be reduced; therefore, the total proportion of the Farm Bill cut will come from the payments to farmers. This is creating a great deal of uncertainty and angst throughout the industry.

Similar to the EU there are multiple layers of regulatory agencies; federal, state and county. The federal government sets some agricultural laws and some guidelines in which the individual state governments are then required to legislate. In addition, there are some laws that are set at the county level. As a result, there are significant differences in laws and regulations between states and in some cases between counties.

### ***USA Regulations***

One significant difference to both the EU and NZ is that farming in the USA requires multiple permits. California is the most regulated state in the USA. In order to remain compliant in agriculture in California the following are just some of the organisations which set rules and regulations in which farmers are required to comply with:

- State Water Resources Control Board
- Department of Pesticide Regulation
- San Joaquin Valley Air Pollution Control District
- Federal Occupational Safety and Health
- State Employment Development Department

- Californian Air Resources Board
- Department of Water Resources

Any one of these organisations can audit farmers at any stage. They all have different reporting requirements and various plans that generally include similar base information (Farmers Faced Many Challenges in 2011, 2011). For instance, the Department of Water Resources require farmers to have a nutrient management plan, a manure management plan, a wastewater development plan, a pesticide disposal plan and a pollution contingency plan (Oosterman, 2011). Each of these plans contains similar base information, which must be replicated in these plans.

In addition, a number of these different agencies do not communicate well between each other and there is endless repetition and confusion for farmers. There has been some major concern around the complexity in remaining up-to-date and compliant at the paperwork level. This is adding significant stress and time requirements on a number of the smaller farms in the region. It is not uncommon for farmers that have sold or changed land use to identify the increasing regulatory requirements, paperwork and additional costs as one of the factors that influenced their decision to sell or change land use change (Oosterman, 2011). The case study below explains how this complexity led to a certification scheme being developed at the farm level as a response to the increasing complexity of compliance.

## **Californian Dairy Quality Assurance Program (CDQAP)**

**Location:** California

**Approach:** Voluntary

### **Background**

The Californian Dairy Quality Assurance Program (CDQAP) has been developed as a method of simplifying the permit process for dairy farmer in California. It was developed 10-12 years ago due to the increasing complexity of running a dairy farm under the political climate. California has become the most regulated state in the USA. There are permits required to cover water use, waste management, air quality and nutrient management among others. These permits are all administered and audited by different state bodies, and consequently, farmers can have each of these permits audited each year.

A number of these bodies do not communicate well between each other and some of the permits have some contradictory requirements. The amount of paperwork that these permits generate is a significant issue particularly for the smaller farms. The majority of the bigger farms are able to employ professionals to complete the paperwork due to the time requirement; but the small farms cannot afford to employ someone. Consequently, this becomes an additional task which has been a huge burden and takes a great deal of time away from farming the land.

There have been 300 dairy farms leave the dairy industry in California the past three years. Some suggest that the increasing regulations and the cost of compliance is a significant motive to leave. Many have converted to growing almonds, gone into heifer grazing whilst others have sold and purchased agricultural land (dairy or other), in one of the less regulated states such as Texas.

### **Initiative**

The CDQAP is a third party environmental certification scheme. It involves collaboration between fifteen organisations including government agencies (both federal and state), educators and various dairy industry organisations working towards the common goal of having an environmentally friendly and productive dairy industry (Californian Dairy Research Foundation, 2009).

CDQAP was initiated in 1999 as a method of simplifying the education and compliance process. In the development stages, the founders of CDQAP were required to take the proposed audit to the various government and industry organisations to obtain agreement that the proposed process and data collected would meet all their requirements and gain their confidence.

It is a completely voluntary program whereby farmers apply to become certified under the CDQAP. In order to become certified farmers are required to complete the three step process below:

- 1. Education** – Farmers are required to complete water quality and air quality courses to prove that they understand the regulatory requirements, facility evaluation, and best management practices relating to the dairy industry, and management plan creation.

**2. Environmental Stewardship Farm Management Plans (ESFMP)** – A management plan specific to their farm needs to be developed. CDQAP agents can assist in this process.

**3. On-site Independent Evaluations** – A third party is required to evaluate the facility for compliance and implementation of the ESFMP. This cannot be completed prior to either of the first two steps. Once this is completed, the farm gains certification under the CDQAP.

This process has been developed to ensure that farmers who succeed in obtaining this certification therefore fulfil all the requirements of the organisations in the partnership. This reduces the complexity of the permit process significantly for the farmer. In addition, these organisations have agreed to a reduction in the frequency of auditing due to the trust that they have in the CDQAP process.

Certification is required to be renewed every five years or if there is a change in ownership or significant changes to the system, such as an expansion.

The CDQAP also provide workshops for farmers around various aspects of the compliance process including: understanding environmental regulations, identifying best management practices and providing detailed record keeping tools to help meet compliance requirements.

More recently, CDQAP have been able to negotiate a reduction in the cost of farm permits by \$500/year for CDQAP certified farms due to the lower frequency of auditing required.

This is a program that has been developed from the industry due to the increase in the regulatory demands on businesses. It has had increasing uptake particularly in the past four years as the reputation of the organisation has increased and more recently as the \$500 reduction in permit costs has been included. For more information, please visit [www.cdqa.org](http://www.cdqa.org).

#### **What can we learn from this?**

- Complexity of compliance can increase costs and frustrations hugely in businesses and can lead to people prematurely leaving the industry. It also becomes increasingly difficult to attract intelligent young people into the industry.
- It is incredibly important for industry boards and organisations to communicate throughout the process of developing regulation. There are benefits of working together both on the developing and the auditing aspect. Huge costs have been added to the dairy industry in California due to duplication.
- The industry can work together to develop a certification type approach which really does have benefits to all parties.
- The three step process in the certification attempts to provide an understanding of the regulations, as well as the education to ensure compliance.



In addition to the complexity of compliance and regulatory environment in California, there are some cases where fragmentation of the regulatory bodies within the industry is leading to a stifling of innovation and increasing frustration levels. This has resulted in some of the best farmers considering leaving the state or even the country. This next case study illustrates a key innovator, John Fiscalini, struggling with regulatory restrictions and lack of support for trying new innovations. Over the past five to eight years these difficulties have left John frustrated, disheartened and seriously questioning his farming career not only in California, but also in the USA altogether.

## Fiscalini Cheese

**Location:** Modesto, California

**Approach:** Proactive voluntary

### Background

John Fiscalini is a dairy farmer currently milking 1500 cows (Figure 12) in an indoor total mix ration (TMR) diet in Modesto, located in the San Joaquin Valley, California, USA. Not only does he produce milk but he also has cheese-making facilities attached to the plant that utilise 20% of the farms' milk to produce Fiscalini chesses. One of the goals of the business is to become the nation's most environmentally responsible cheese producer. He is a well-established, well-respected, innovative farmer in the area.



**Figure 12: John Fiscalini's dairy cows.**

Approximately five years ago, there was increasing concern in the industry around the level of greenhouse gases emitted from dairy farms and the effect this was having on the environment. One of the major culprits in agriculture was identified to be the dairy cow and in particular the methane from the effluent produced by the dairy cow. One area of the dairy system, which was initially focused on, was the methane losses from effluent during storage. As a result of this concern, there were suggestions from the San Joaquin Valley Air Quality Control Board that in the future there may be a requirement for all livestock farms to install and use a methane bio-digester.

This prompted John to research some of the mitigation options available. As a response to what he found he decided to invest in a bio-digester after seeing the benefits of these in Germany and how they could translate to his system. This included a method of disposing of the large volumes of effluent produced daily and being able to utilise the waste product of the digester for bedding for his cows (effectively recycling the effluent), thereby reducing the cost of housing. Additionally the process of bio-digestion produces a significant amount of heat that could then be harnessed and utilised to help heat water and the processing facilities in the cheese factory. In addition to this, the bio-digester would also produce electricity and result in a reduction in the carbon emissions thereby helping towards his goal of becoming the nation's most environmentally responsible cheese producer.

Therefore, in 2006 he began the process of building a bio-digester. Some of the significant challenges along the way included gaining permission to build the digester. Some of the regulatory bodies would not provide permission without having research results that investigate the impacts of the digester on other aspects of the environment such as different emissions and the utilisation or discarding of the waste product. This information was available from research carried out in Germany, however, this was not accepted as it was not carried out in the USA. John was one of the first in the USA to build a digester so there was no information or data available from California. Following months of discussion, he finally obtained a temporary permit of allowing operation for 18 months on condition that a data collection system was included to enable the on-going collection of

various measures. The construction finally continued, behind schedule, and consequently significantly over budget (due to changes in exchange rate during this process), but progress was finally being made.

The digester comprises of two circular above ground insulated concrete tanks. The dimensions are 25 metres in diameter, 8.5 meters in height, 35cm thick reinforced concrete walls and 46cm thick floors. The walls and floors contain one-inch heating tubes spaced every six inches, which are used to help evenly heat the contents to approximately 37 °C.

The outputs from the process of digestion is dried and then utilised as bedding for the cows or alternatively can be used as a source of fertiliser on the crops.

One area of great interest from the regulatory perspective is the noxious gases (NOX) emitted from the digester. It has been suggested that these may be above the limit of 50ppm that has been set by the regulatory bodies. The digester finally got up and running in 2009 and



**Figure 13: Fiscalini Farms**

data has been collected every 15 seconds since. The results show that during certain times in the day (tends to be as the air temperatures are at their hottest) NOX emissions exceed 50ppm (higher risk between 1-3pm; during the hotter hours of the day), however on average during a 24hr period the emissions are between 25-30ppm. The regulators have indicated that the daily breach of the NOX limits deems the system non-compliant even though the average is well below the limit.

Consequently, John is not sure whether the permit will be renewed for the digesters as they are currently due to this spike in NOX emissions during the warmer hours of the day. The regulators are now aware of the pattern of NOX emissions therefore are aware of when it is most likely to exceed the limits set.

John has found the process of dealing with the regulators in this situation very difficult. They appear to ignore the overall benefits and focus on this one period of the day in which the emissions are slightly above the set limits. The regulators have been unable to explain to John why this is such an issue when the overall emissions are well below the limits. In addition, they have not been supportive in the trialling of new technology even though John was taking all the financial risk with potentially significant benefits to the wider industry.

John is completely frustrated. He has been considering leaving the state of California, dairying in California or even looking at getting out of the USA due to the stresses and huge additional cost that the project has incurred. It would be a great loss to California dairying if they do lose him, as he is one of these key 2.4% of innovators who try new things for the benefit of the industry. For more information on John Fiscalini's farm and cheese factory visit <http://fiscalinicheese.com/>.

#### **What can we learn from this?**

-We need to be identifying and encouraging the farmers who are the first ones to uptake new technology or have new ideas, and not stifle innovation. They are prepared to take

calculated risks to integrate these technologies on a commercial basis and these people should be embraced and supported throughout these trials.

-Regulatory bodies and industry needs to be ensuring that the broader benefits are considered and if issues arise that these are clearly explained.

The combination of regulatory bodies becoming removed from the practicalities of agriculture and increasing complexities within the dairy industry in California have also led to collaboration within the industry at a farm level to fight regulation. Farmers make up less than 0.1% of the population in the USA so the challenge of lobby against political power and government agencies has become greater in recent years. However, collaboration within the industry can result in positive outcomes. In the case study below, regulatory bodies were seriously considering the path of an unrealistic regulation that would add significant costs to all dairy farmers in the San Joaquin Valley. Therefore, in response to this, the Western United Dairymen, who are a dairy lobby group, got together with a number of farmers and developed an alternative proposal that was taken to the regulatory bodies, with farmer support, to fight the proposed regulation.

## Groundwater Monitoring Coalition

**Location:** San Joaquin Valley, California, USA

**Approach:** Voluntary

### Background

The San Joaquin Valley is part of the Central Valley in the heart of California and is the largest agriculture producing state in the USA. California produces 11% of the total USA agricultural value<sup>3</sup>. The Central Valley has been called the food basket of the USA, due to the large variety of products grown and the productivity of the area. The total land area of the valley covers approximately only 1% of the country's farmland but produces 25% of the nation's table food<sup>3</sup>.

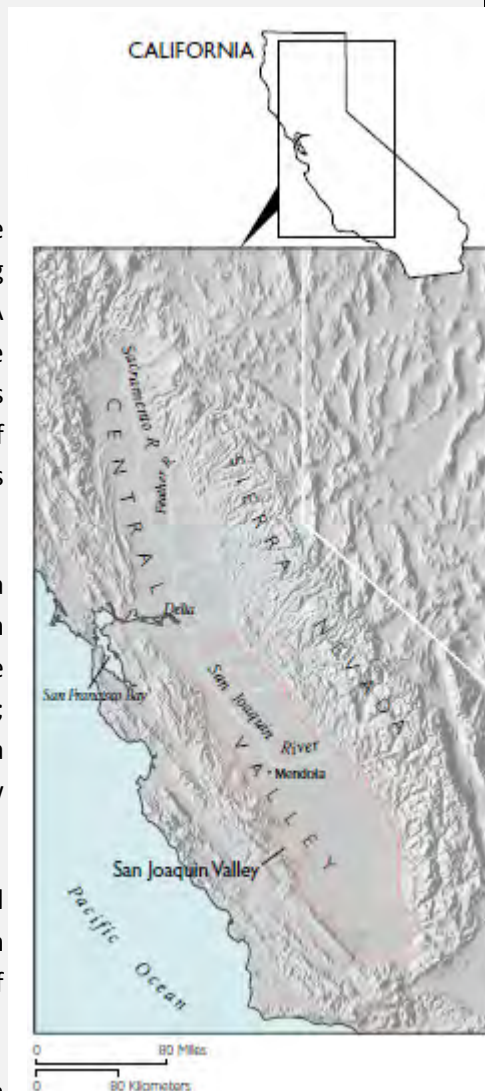
The Central Valley is contained by the Sierra Nevada Mountains on the East, the Diablo and Temblor Ranges on the West and the Tehachapi Mountains on the South (Figure 14). Rainfall in the basin area ranges from 130-400mm/yr; surface waterways are mainly fed from the Sierra Nevada Mountains on the East where much of the source is snow fall<sup>3</sup>.

There has been great concern around the quality and quantity of water in this valley for a number of years with some of the major issues including the unsustainable use of irrigation and the quality of both surface and groundwater<sup>3</sup>.

In the San Joaquin Valley, there has been growing concern about the quality of the groundwater throughout the region. In response to this concern, the California Regional Water

Quality Control Board for the Central Valley Region (hereafter the Central Valley Water Board) has been developing various regulatory measures to address the issue. These have been largely unsuccessful and the quality of groundwater has continued to decline. Consequently, in 2005 the Central Valley Water Board proposed a regulation that would require all 1600 dairy farms in this valley to install groundwater-monitoring wells to monitor the impact of their operations on the groundwater quality. To become compliant farmers would be required to meet specified targets around nutrient and salt losses to groundwater.

*"No set of waste management practices has been demonstrated to be protective of groundwater quality in all circumstances. Since groundwater monitoring is the most direct way to determine if*



**Figure 14: Location of the San Joaquin Valley in California**

<sup>3</sup> (San Joaquin Valley, California: Largest Human Alteration of the Earth's Surface)

*management practices at a dairy are protective of groundwater...groundwater monitoring is required to determine if a dairy is in compliance with the groundwater limitations of this order.” (California Regional Water Quality Control Board, Central Valley Region, 2007)*

The Central Valley Water Board were requesting a minimum of three wells per farm; one to be located downwater from the effluent storage pond, one downwater from the coral (livestock housing) and one in the paddocks where manure is spread. At an estimated cost of up to \$40,000 USD per well to be paid by the farmers this adds a significant compliance cost to all dairy business in the valley.

### **Initiative**

There was significant opposition to this proposal from those in the dairy industry. In response, the Western United Dairymen (dairy advocacy organisation), in collaboration with a number of farmers and other groups, initiated the Central Valley Dairy Representative Monitoring Program (CVDRMP) board to develop a proposal to put back to the Central Valley Water Board with the aim of achieving the same results but at significantly lower cost to the industry. The resulting proposal suggested that instead of all dairy farms requiring the installation of the monitoring wells, 12 farms that represent the general dairy farm types, soil types and various climate variances. Monitoring wells could be installed on these farms and monitored on an on-going basis. These would identify the main causes of water degradation and enable strategies to be developed which could then be duplicated on other farms in the area. The cost of the monitoring wells on these farms would be split between the dairy farmers involved in the program. Any farmers not involved in the program would be required to install their own monitoring wells.

This proposal was accepted by the Central Valley Water Board on the condition that they were able to gain the support and commitment of over 75% of the dairy farmers in the valley to join the CVDRMP. One of the main reasons for the Central Valley Water Board accepting the proposal is that they do not have the resources required to monitor, record and analyse results from 1600 dairy properties with three wells per property. After a period of promoting the coalition to dairy farmers in the valley, Western United Dairymen were able to obtain over 90% support. Consequently, the cost of the program to the dairy farms is approximately \$960 USD/farm/year (Oosterman, 2011).

The CVDRMP is currently in its early stages with the 12 farms having been identified and the groundwater monitoring wells in the processes of being installed.

### **What can we learn from this?**

- This is an example of how an industry can come together and have an influence on the development of the policy, which has saved the farmers significant costs. It has required commitment from farmers in the valley.
- It took an unrealistic regulatory proposal to provide the reason for the industry to work together.

The case studies so far have looked predominantly at situations in the USA that have been driven strongly by regulation or the threat of regulation. Below is an example that is driven strongly by an

incentive system that seems to have been reasonably successful in increasing the uptake of technology. It is driven by an environmental concern, but also provides financial benefits to the farm business, even after the removal of the subsidies.

## Direct Drilling

**Location:** Palouse Country, Washington State, USA

**Approach:** Incentivised voluntary

### Background

The Palouse country covers 810,000 ha (Hall, Young, & Walker, 1999) in the south western corner of Washington State (Figure 15). Of this area 485,000 ha is cropland with the predominant crop being winter wheat (Hall, Young, & Walker, 1999). Winter wheat crops are often followed by summer wheat then back to winter wheat again. Some farmers use summer barley one summer in two to break up the wheat crop and others will leave the land fallow over the summer period.

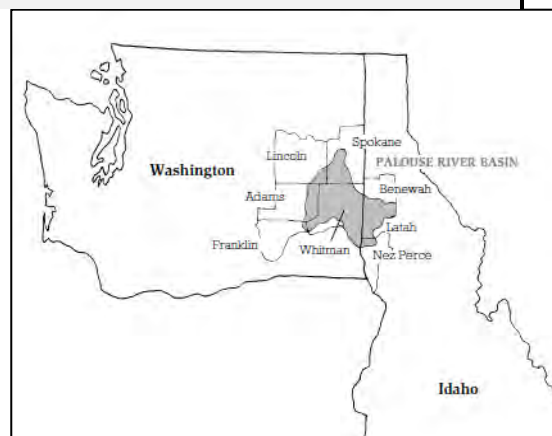
The Palouse country is characterised by the depth of topsoil, productivity and topography. The topsoil depth ranges from 5-130cm deep (Williams, 1991); over 400,000 ha has a slope ranging from 8-30% (Hall, Young, & Walker, 1999) with some slopes reaching 50% (Williams, 1991) (Figure 16). Rainfall ranges from 280mm/yr in the east to 660mm/yr on the west side of the region (Hall, Young, & Walker, 1999). Approximately 81% of this rainfall falls between the winter months of October to May (Hall, Young, & Walker, 1999). The steepness of the land and the relatively high rainfall during the winter months results in erosion being a major issue for the region with an estimated loss of

almost 25 t/ha of topsoil per year. In a year of high rainfall events or on the steeper slopes this rises to an estimated loss of 250 t/ha (Hall, Young, & Walker, 1999).

Yields of 5.3-6.7 t/ha is the average for winter wheat with the top farmers achieving yields of 6-8.7 t/ha (Aeschiliman, 2011). Summer wheat yields are lower with average yields of 2.7-5.3 t/ha (Aeschiliman, 2011).

The topography of the land is challenging in terms of physically being able to plant and harvest the crops as well as the extremely high risk of erosion. To address the issue of planting and harvesting crops on this land,

self-levelling tractors and harvesters have been developed.



**Figure 15: Location of the Palouse country in Washington State, USA.**



**Figure 16: Picture of a photo demonstrating the degree of slope which farmers in the Palouse country are required to deal with.**

### **Initiative**

To address the issue of erosion there has been a push for direct drilling as opposed to full cultivation. Direct drilling allows stubble to be left in the ground following harvest, which helps to stabilise the topsoil during the high-risk months. The next crop is then drilled directly into the stubble. This also reduces the risk of continuous ploughing causing a 'pan' or layer of compaction. The concept of direct drilling into the wheat stubble was started in the area in the 1970s by the Aeschiliman family (one of the large farming families in the area), who have been using this practice ever since. However, the uptake of this technology has been very slow.

One initiative that was introduced six years ago to encourage the uptake of this technology was a 'crop insurance' type scheme. This was carried out over a five year period in which farmers were invited to be involved for three years. Over this three year period the farmers were to plant a section of their farm using direct drilling (maximum of 83 ha) and the remainder in the conventional method. The farmers involved were appointed a 'mentor' (farmers that currently direct drill and have the machinery) who was paid by the Environment Protection Agency (EPA) to use their machinery for planting and share their expertise around the growing process to increase the likelihood of success.

During the growing period, farmers were required to keep records on both the direct drilled and conventional crops and at the end of the season if the crop that was grown using direct drilling yielded lower than that of the conventional crop the EPA would compensate the farmer for the difference in the crop yield at market rates.

However, the uptake of this program was relatively low. The reasons for which are not fully understood. The crop yields within the program were the same or better in all of the direct drilled crops compared to the conventionally planted crops. The majority of the farmers involved have continued the practice of direct drilling following the completion of their three year involvement (Aeschiliman, 2011). It appears that it is predominantly the innovators and early adopters that have taken advantage of this opportunity.

### **What can we learn from this?**

- Programs that spread the risk of uptake of new technology can help to encourage the uptake of new technology by farmers. However, it is generally the innovators and early adopters that take advantage of this opportunity.
- These programs can be relatively low cost if they are carried out correctly. This program did pay for the planting of the crop but only paid the yield compensation if there was a reduction in crop yield due to the practice of direct drilling. This is a different approach to the more common flat incentive payment.
- These programs need to have a set lifetime; i.e. this program lasted for five years, with a maximum involvement of three years per farm. This enables the leader farmers to benefit from taking the greater risk of being the 'guinea pigs' but does not act as an on-going subsidy.



The salmon industry in the USA has been impacted significantly by declining water quality and physical disturbances to the path of the rivers and streams. The presence of man-made dams for hydro electricity generation have had significant impacts on salmon populations as the obstacle, if not properly designed, can prevent salmon from reaching the section of the river in which they spawn. This can quickly begin to have drastic effects on the population numbers of species within these individual river catchments. The case study below illustrates how the federal and state governments have developed a program to address the issues affecting salmon populations and consequently achieved community involvement to create change.

## Salmon Recovery Project

**Location:** Dayton, Washington State, USA

**Approach:** Voluntary/incentivised scheme

### Background

Throughout the western states of the USA (Figure 17), in particular, there has been a noticeable decline in the number of salmon in the rivers over the last 50 years. Salmon are considered important to the USA due to the significance of the species to the Native American tribes who have historically relied on salmon (among other species) for their survival. They are also still used as a food source although only farmed fish are now allowed to be captured.



Figure 17: Location of the Snake River within Washington State

The significant drop in salmon populations has been put down to a number of reasons. These include: the building of multiple dams during the period of 1960-1975 impeding the physical ability of the salmon's spawning migration up river. As well as altering the rivers water flows; an increase in water temperature due to clearing of trees on the river banks; an increase in nutrient loadings of waterways; and a decrease in ponds along the water which the salmon use to rest during their migration and to lay their eggs. Consequently by the mid-1990s the population had dropped so low that all species of salmon in the Snake River were classified as endangered under the Endangered Species Act (ESA). This led to the federal government taking action, they set national criteria that must be met, and Salmon Recovery Boards were introduced around the country to set the catchment-specific strategies to achieve these targets.

### Initiative

There are a number of approaches to obtaining the desired outcomes outlined by the federal government. This report focuses mainly on the approach used in the Snake River catchment in particular.

The Snake River Salmon Recovery Board was founded in 2001 to deal with this issue of declining salmon numbers. The board is made up of 21 people that represent a range of industries including

timber, agriculture, fisheries and hydropower as well as Native American tribes, local and state agencies and people from local cities and townships. This board is responsible for developing priorities for that area and an implementation plan.

There has been comprehensive input from these various industries and the general public and the board has been successful in gaining support and agreement from a strong majority of the stakeholders. One of the changes that has been made in this river was to ensure all major dams have 'salmon ladders' which are positioned at the edge of the dams and act like rapids where the salmon are able to swim up the ladders to successfully get upstream from the dam.

Additionally, there has been a lot of work done with farmers along the riverbank to develop riparian areas to provide a buffer for nutrients coming off farmland in addition to providing shade to the waterways and biodiversity on the riverbanks. This has been achieved by approaching these farmers first as a group then individually. Financial compensation is also available for the land requested to be placed in a conservation easement. These agreements allow the ownership of the land to remain with the farmer but restrictions on the practices allowed are placed on this area of land. These farmers are then paid an annual lease from the salmon recovery board, which will often provide the labour and plants for the riparian planting. A large proportion of this land in this area is arable land and consequently fencing off of the land placed in an easement is not necessary.

This program has one main contact person for the farmers who is a local man, Steve Martin. He is well known in the area, has spent time building rapport with farmers in the catchment. He has a farming background so understands the impact that these changes can have on the farm business, but is also able to discuss the implications of the current situation on the salmon numbers and other fish species. Steve believes that one of the main successes of the program is the rapport and trust he has built with these farmers.

Steve also suggests that having a combination of one-to-one and group sessions helps encourage changes as it introduces an element of peer pressure for farmers to play their part in the solution. This peer pressure is valuable in initiating change.

### **Funding**

This project is predicted to cost \$220 million USD over a 15 year period. This funding comes from a variety of sources including the United States Department of Agriculture (USDA), Bonneville Power Administration, State Salmon Recover Funding Board, Congressional allocations, non-profit organisations and state legislature.

### **Outcomes**

This Snake River Salmon Recover Project has been deemed successful to date, with the number of salmon in the past year increasing significantly. Some of the achievements of the scheme have been outlined below (Martin, 2011):

- Installed 600+ miles of riparian buffer strips
- Installed 1000+ fish screens to stop juvenile salmon entering irrigation channels

- Removed 30 fish passage barriers

- Conservation easements on 300+ acres

- Increased stream flow by 50 CFS

- Installed more than 600 in-stream habitat units

- Converted more than 200,000 acres from conventional tillage to direct drilling

#### **What can we learn from this?**

It has been suggested that some of the key successes to improving farmer uptake and achieving the riparian changes to practices on farm include:

- Having a local person organising the program and talking to the farmers one-to-one. He has built a good rapport with the farmers and reputation in the area. He also understands the implications of the changes to farm businesses

- Landowners on the board influencing the process and priorities

- Having a financial incentive for giving up the land for riparian planting

- The changes are generally only influencing a small area of land next to the river

- Utilising peer pressure from farmers within the catchment. The farmers that have not got involved in the program and often questioned by their peers

Total funding which has been invested in the Snake River Recovery project so far is \$15million USD

Although the program is deemed a success, there is a fear amongst farmers that this is just the starting point and that once the riparian areas are established there will be pressure around water quality or there will be other issues introduced which will require further changes. Some farmers in the catchment do not believe that the program is transparent enough and they are wary about being too forward and flexible.

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