Healthy Rivers
PLAN FOR CHANGE | Wai Ora
HE RAUTAKI WHAKAPAIPAI

Outline of Waikato Regional Council dairy farming research

Collaborative Stakeholder Group Healthy Rivers: Wai Ora Project

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Policy work stream report for discussion at CSG workshop 3

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1 Purpose

The purpose of this report is to assist in understanding the grazing management research commissioned to date by Waikato Regional Council (the council) on dairy farming in Waikato[1].

The research summarised here seeks to provide a structured approach for understanding farmer decision making about winter management practices. Having detailed information about how practice and technologies identified to achieve policy objectives align with the needs, or choices, of landholders enables an understanding of what practices are being undertaken and potentially by how many may change. This can inform the design of policy to increase the uptake of desired practices and technologies in order to achieve the policy objectives.

2 Overview

This summary report provides a brief outline of three reports into dairy grazing. For more detailed information on the qualitative interviews research, the quantitative telephone survey or the farm context analysis please see the full reports; Davies and Topperwien (2011), Versus Research Ltd and Davies (2012) and Kaine (2014 in press).

The introduction section outlines why research on winter grazing management practices and technologies was undertaken and describes the approach that was used. Next, Section 4 covers the two research phases, and then gives detail on the purpose of each phase, the methodology used, topics that were covered during data gathering and the sample achieved. Section 5 examines one grazing practice, standing off, and uses it to illustrate the findings from both phases of research by including excerpts from the qualitative interviews research and the quantitative telephone survey with farm context analysis. At the end of Section 5 two dairy farms are described, both the context and stand off practices, to illustrate the depth of information gathered in the research. Finally, the report is summarised in Section 6.

3 Introduction

The Healthy Rivers: Plan for Change/Wai Ora: He Rautaki Whakapaipai project will work with stakeholders to develop changes to the Waikato Regional Plan, to better manage the effects of discharges in the Waikato and Waipa river catchments. This plan change is likely to contain detailed methods which affect various enterprise management practices, as these practices have an impact on losses of nutrients, sediment or E.coli to waterways. It is crucial to have a robust understanding of farm context, management practices and landholder decision-making so this information can be incorporated into policy design.

To some extent the council gathers information about landholders' management practices from a range of sources such as implementation staff and from industry publications. In previous policy development processes information has been gathered from a small group of landholders[2]. This information is useful, but is not guaranteed to cover the range of practices

[1] The research outlined in this report focuses on a particular body of research commissions on dairy grazing management.
[2] For more information on how this approach was used in Variation 5 – Lake Taupo catchment see the 'Case Study: Lake Taupo catchment property-level nitrogen discharge limits' Policy Report for the CSG. WRC document number 3034258.

and farm contexts[3] that are present in the catchment, nor does it give a clear indication of the extent of practice occurring or range of reasons landholders have reached that decision.

The Kaine Framework (Kaine, 2004 and 2008) contains theory and methodology on how landholders make decisions about adopting new technologies or practices. It provides a robust way of understanding the reasons behind landholders' decision making. The foundation of this approach is identifying the set of farm contexts for which a practice or technology creates benefits.[4] This then gives an indication of the market, or likelihood of adoption.

Broadly speaking the research approach developed by Kaine involves two stages. The first stage is to identify the elements in the farm system that form the benefits from adopting a particular practice or technology and which thereby forms the farm context for the practice or technology. The second stage is to quantify the proportion of landholders in the population possessing the farm context for the practice or technology (Kaine 2008). This proportion is an estimate of the population of potential adopters of the practice or technology (Kaine 2011).

In line with this approach the council has undertaken and commissioned a series of qualitative and quantitative studies, with additional analysis, for both the dairy and sheep and beef industries. The work is focused on winter grazing management practices as winter has been identified as a risk period for contaminant loss. The studies build on the understanding and data gathered in previous phases, including informing survey design. There are a large range of potential practices or technologies that landholders may use. The specific area of focus for each stage or analysis was directed by the types of problems and associated questions this research informs.

The research enables an understanding of how many people are currently undertaking a practice or using a technology, the range of reasons why they are using that practice or technology, or why not, and the relationships between farm contexts, the adoption of and the benefits of the practice or technology.

This understanding of the influences on landholders' decision making can be used to consider:

1. Where intervening might influence landholders choice of practice or technology
2. Which choices can't be influenced (e.g. physical constraints of the farm context that constrain choice); and
3. Where choice can realistically be influenced what instruments can be used to influence choice.

4 Overview of research phases

Various elements of the farm system that are thought to form the set of farm context factors for the practice or technology are identified. The benefits the practice or technology generates are also identified. This reveals associations between the set of farm contexts for a practice or technology, the adoption of the practice or technology and the benefits of the practice or technology. These associations can then be tested by gathering quantitative data on the elements of the farm context and on the adoption of the practice or technology (Kaine 2008).

[3] Farm context is described as the set of factors in a farm system that influence the benefits to be had from adopting a particular management practice (Kaine, 2008).

[4] For more detail on the Kaine Framework see 'Understanding landholder adoption of technologies and practices using the Kaine Framework' Policy Report for the CSG. WRC document number 2981456.

Phase 1 – Qualitative interviews

- The purpose of the qualitative study was to understand farm context and the variety of winter management practices that can be undertaken on farm.
- Data was gathered in this stage through semi-structure interviews

Phase 2 – Quantitative surveys and farm context analysis

- The quantitative study builds on the key themes that emerged from the qualitative research on a statistically representative population.
- Two reports have been produced for this phase.
- Data was gathered through a large scale telephone survey and the overall results compiled into a report.
- This data was then re-analysed to statistically test the link between proneness to pugging and practices of wintering off or standing off. The relationship between proneness to pugging and soils, topography and location was also tested.

4.1 Phase 1

Qualitative interviews

Understanding landholder decision-making: What grazing practices dairy farmers are doing, why they choose certain practices over others and why they may or may not have made changes to their system.

The purpose of the qualitative research was to understand the grazing management decisions of dairy farmers' in the Waikato region, and relate that to nutrient management practices. The focus of the research was gaining an understanding of the farm contexts dairy farmers were making decisions in and how nutrient management practices are, or could be, incorporated into the various farm contexts (Davies and Topperwien, 2011).

Between March and December 2008 36 face to face interviews were conducted with dairy farmers. Interviews were undertaken in the main dairying areas of the region, giving a satisfactory coverage of soil, climate, rainfall and topography within the region. The farm attributes of the interviewees included a range of herd sizes from 70 to 3900 cows, farm effective area from 40 to 1275 effective hectares and annual stocking rate from 1.6 to 4 cows per hectare (Davies and Topperwien, 2011).

The Davies and Topperwien (2011) report covers the nutrient management practices available to farmers. The interview findings present the following management practices of respondents:

- grazing practices including pasture rotation and grass residuals
- wintering practices including:
    - wintering on and wintering off
    - wet soils management, including standing off practices
- nutrient management including:
    - nutrient budgets, nutrient management plans, fertiliser use and application and effluent
- feed systems including:
    - the use of grown feed supplements and purchased supplements
- riparian management.

Asking farmers why they choose certain practices over others, or why they may have made changes to their farm system, can provide insight into the likelihood of the adoption of practices. It can help identify areas of the farm system where farmers are already exercising recommended practices. It can also indicate potential barriers or obstacles associated with certain practices, which could impede the adoption of new practices.

4.2 Phase 2

Quantitative survey

Quantifying why dairy landholders choose certain grazing practices over others: how many farmers are undertaking different practices and what are the range of reasons of why or why not.

Waikato Regional Council commissioned Versus Research Ltd to conduct a telephone survey of a random sample of dairy farmers in the Waikato Region. Between 5th and 14th September 2011 401 dairy farmers were interviewed. Overall, the sample achieved was largely representative of the region's spread of dairy farms (Versus Research Ltd and Davies, 2012).

The quantitative study builds on the key themes that emerged from the qualitative research. The purpose of the quantitative work was to investigate on a representative sample the winter grazing practices and management decisions in order to better understand the impact these practices and decisions have on nutrient run off and leaching in the region (Versus Research Ltd and Davies, 2012).

The Versus Research Ltd and Davies report (2012) covers:

- farm location, main soil type and contour
- proneness to pasture damage and pugging
- wintering off including:
    - reasons why or why not
    - proportion of herd, months, and number of months wintered off
    - typical arrangement for wintering off cows
    - location of run-off block
- infrastructure on farm including:
    - the proportion of farmers who have sacrifice paddocks, feedpads, stand off pads, wintering barns and winter cropping areas
- standing off including:
    - reasons why or why not
    - proportion of herd, frequency and duration stood off
    - infrastructure used and their design specifications
    - utilisation of infrastructure

Versus Research Ltd and Davies (2012) quantified the use of winter grazing practices by dairy farmers in the Waikato Region including the wintering off and standing off of stock. They then identified differences in the use of practices across districts, farm and herd size, stocking rates, soil types and demographics.

Farm context analysis

Statistically test some of the identified relationships between the winter grazing practices of dairy farmers and key elements in their farm system:

Specifically wintering off and standing off, and factors in the farm context such as proneness and extent of pugging, soil type, location and typography.

Versus Research Ltd and Davies (2012) concluded that contextual factors such as the severity of pugging influenced the practice of standing off stock. However it was unclear how the various contextual factors combined together to influence the grazing practices of dairy farmers. This combination is important for policy makers as this information is crucial to:

- Assessing the flexibility, if any, farmers may have in their choice of winter grazing practices
- Assessing the likely costs to dairy farmers of changing winter grazing practices (Kaine, 2014 in press).

The data collected by Versus Research Ltd and Davies (2012) was therefore re-analysed to show more clearly the link between the winter grazing practices of dairy farmers, specifically wintering off and standing off, and factors in the farm context such as proneness and extent of pugging and soil types. The results reported complement those reported by Versus Research Ltd and Davies (2012).

The influence of farm context factors on management practices was analysed by:

1. classifying farmers into farm context segments for standing off stock based on farmer's assessments of the proneness of their farm to pugging, and the proportion of their farm that was pugged in a normal winter; and
2. classifying farmers into a second set of farm context segments for wintering off stock based on the size of their herd and their stocking rate.

This method segments farmers into groups depending on their farm context factors, and therefore if those factors create a need for the management practices of standing off and wintering off. Whether or not a farmer has a need for a practice or technology will determine if they will benefit from it.

This method helps identify the proportion of the farming population who are already undertaking the practice, who are likely potential adopters and those who do not have a need for the action desired to contribute to the policy objective and therefore are unlikely to voluntarily adopt the practice or technology.

5 Example of findings: standing off

The following section outlines in detail one grazing management practice[5] (standing off) and uses it to illustrate the findings from both phases of research by including excerpts from the qualitative research interviews and the quantitative telephone survey. Standing off involves moving stock to an off pasture facility for long periods during wet weather, such as a barn or a pad (Waikato Regional Council et. al., 2013). To give an example of the findings of the research two dairy farms are described; including the farm context, what standing off practices are undertaken, why or why not, how flexible the farmers might be in their choice of practice and what the likely cost implications would be if these farmers were required to make changes on practices or technology.

[5] Section 4 details all the practices studied in each phase of the research. Refer also to full reports for full results.

5.1 Qualitative findings

Excerpts from Davies and Topperwien, 2011[6] on wet soils management and standing off

The extent of pugging varied between farms, and there were a number of strategies employed to manage pugging. For those on the wettest soils, grazing management to prevent damage involved frequent monitoring of weather and pasture conditions and, for some, standing off cows for extended periods throughout the winter months.

Some farmers did not require stand off areas to manage their pasture in wet periods. Farms were on rolling, rolling to steep, or flat to rolling land, and on free draining soils. Farmers generally managed pugging through their grazing rotation and shortening the rotation in wet conditions. The condition of paddocks was monitored closely and cows were moved to other paddocks when needed.

"Soils are more porous here - haven't found need [for stand-off areas] - don't have pugging issues" (Hauraki, pumice soil)

"…free draining soils so don't need a stand off pad. Move cows around, get up early to move them. Experience tells me what I need to do" (Upper Waikato, pumice soil)

In general, for the farmers who stated pugging was a management issue for them, their key concern was protecting pasture growth from damage. A few expressed concerns about the damage to soil structure and long-term effects on pasture growth, explaining that pugging damage can reduce pasture productivity for many months or even years:

"I hate pugging, pasture won't return so going to be non productive land". Animal health as well, especially if calving, buggers up the soil structure, area doesn't drain well" (Hauraki, gley soil)

For those farmers that did stand off, there was variety in the frequency, duration and proportion of the herd that was stood off. This ranged from only 1-2 days per winter for around 20 hours, to around 10 days during winter but only for 16 hours per day, to every day in winter for 16 hours per day or in some cases up to 20 hours per day. The proportion of the herd that was stood off depended on how many stock needed to be accommodated and what infrastructure there was on farm.

Of the farmers that did stand off there was a range of infrastructure and stand off technologies. These included purpose built stand off pads, herd homes, feed pads, sacrifice paddocks, winter cropping areas, or utilising cow shed yards and races.

This study showed the winter management practice of standing off is influenced by a number of interconnected factors, such as pugging severity and extent, soil, climate and topography. The individual combination of these factors on farm influenced if farmers had a need to stand off. Some farmers felt their current practices were sufficient to manage wet soils and stand off infrastructure was considered unnecessary. Some farmers used their infrastructure extensively.

[6] 36 face to face interviews were conducted with dairy farmers

5.2 Quantitative findings

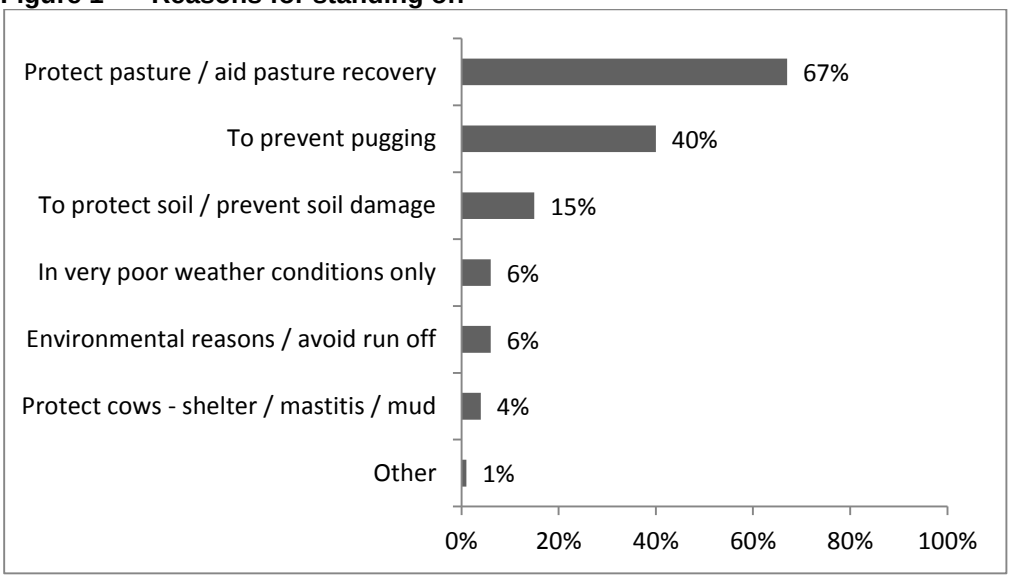
Excerpts from Versus Research Ltd and Davies, 2012[7] on standing off

Farmers were asked whether or not they stand off some, or all, of their herd in winter to manage wet soils and pasture damage. The majority of farmers (80%) stand off their herd in winter to manage wet soils, while 20% did not.

Farmers who stand off some, or all, of their herd to manage wet soils in winter were asked to give further detail as to why they stand off their herd.

Of farmers who stand off their herd in winter to manage wet soils, the highest proportion, 67% said they stand off to protect their pasture / aid pasture recovery. Some 40% said they stand off to prevent pugging; 15% said they stand off to prevent soil damage; 6% said they only stand off in very poor weather conditions; 6% noted environmental reasons for standing off; 4% said they stand off to protect cow condition; and 1% gave another reason for standing off (Figure 1).

Figure 1 Reasons for standing off[8]



Base: Farmers who stand off their herd in winter to manage wet soils or pasture damage, n=319

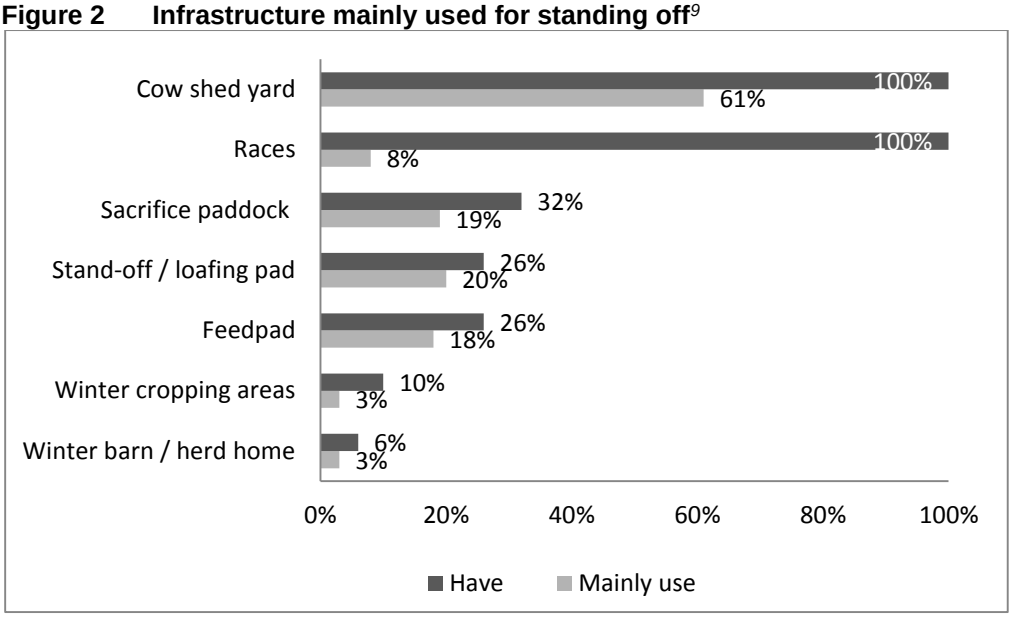
Of farmers who stand off their herd in winter to manage wet soils, 32% said that they had a sacrifice paddock; 26% a purpose build stand off pad; 26% a feedpad; 10% winter cropping areas; and, 6% a wintering barn / herd home (Figure 2).

Farmers who stand off their herd in winter to manage wet soils were asked to specify the infrastructure that they **mainly used** for standing off. Some 61% said they mainly used their cow shed yard; 20% a stand off pad; 19% a sacrifice paddock; 18% a feedpad; 8% races; 3% winter cropping areas; and, 3% a wintering barn / herd home (Figure 2).

[7] 401 dairy farmers were interviewed in a large scale telephone survey. Only high level results have been included, not significant findings between subgroups.

[8] Survey question: Can you please tell me why you stand off your cows? Please be as specific as you can and provide examples. (Q7)

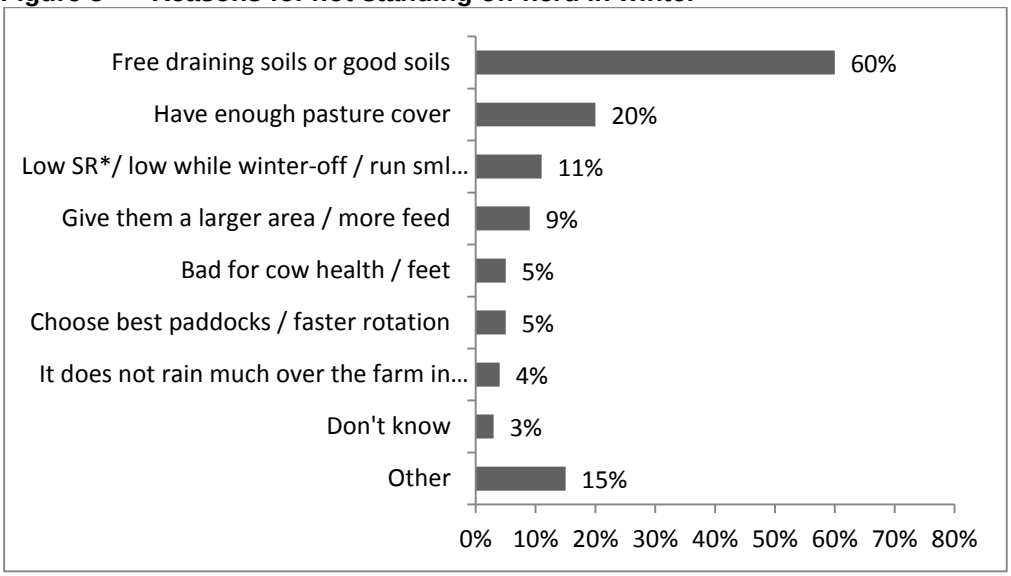
Figure 2 Infrastructure mainly used for standing off[9]



Base: Farmers who stand off their herd in winter to manage wet soils or pasture damage, n=319

Farmers who did **not** stand off their herd in winter were asked to specify why this was the case[10]. The highest proportion, 60% said they did not stand off their herd in winter as their farm had free draining soils or 'good' soils (Figure 3).

Figure 3 Reasons for *not* standing off herd in winter



Base: Farmers who did NOT stand off their herd in winter to manage wet soils or pasture damage, n=80

9 Survey question: Which of the following do you MAINLY use for standing-off your herd in winter to manage wet soils? (Q23)
10 Survey question: Why is it that you don't stand off your cows in winter? Is it because... (Q19)

5.3 Farm context findings

Excerpts from Kaine, 2014 in press on standing off

Respondents to the Versus Research Ltd and Davies (2012) survey were classified into farm context segments for standing off stock in winter based on their assessments of:

- the proneness of their farm to pugging, and
- the proportion of their farm that was pugged in a normal winter.

Six farm benefit segments for standing off were identified by Kaine (2014 in press) and are summarised in Table 1.

The analysis found that the main factors influencing standing off stock were proneness to pugging and the severity of pugging, together with stocking rate. This is consistent with the results reported earlier and confirms that farmers' decisions to stand off cattle are primarily influenced by the biophysical characteristics of their properties that relate to pugging and, to a lesser extent, the intensity with which they farm (Kaine, 2014 in press).

Put simply, dairy farmers who stand off stock in winter have farms that are prone to pugging, and pugging is relatively extensive. They also tend to have relatively high stocking rates. Farmers that do not stand off stock in winter have farms that are not prone to pugging and tend to have relatively low stocking rates (Kaine, 2014 in press).

The results presented in Kaine (2014 in press) confirmed that the practice of standing off dairy cattle in winter was driven by the frequency and extent of pugging that farmers experience over winter. The duration and frequency of pugging was primarily a function of biophysical characteristics of the farm that influence drainage (such as soil type, rainfall, and farm topography). Other management decisions and practices do not appear to have any influence on stand off practice, except for stocking rate, which appears to have some, small influence.

	Context 1 Prone to extensive pugging	**Context 2** Very prone to some pugging	**Context 3** Prone to some pugging	**Context 4** Prone to a little pugging	**Context 5** Some occasional pugging	**Context 6** Not prone to any pugging
Percentage of respondents	11%	17%	22%	14%	14%	22%
Proneness to pugging	Prone Very prone	Very prone	Prone	Prone	A little prone	Not prone
Extent of pugging	Extensive 25%	Small 5%	Small 7%	Small 2%	Small 7%	Small 2% a little prone
Topography	Flat	Flat Flat to rolling	Flat to rolling	Flat to rolling Rolling	Flat to rolling Rolling	Flat to rolling Rolling
Soil	Clay Loam	Clay Loam	Ash Loam	Ash Loam	Ash Peat Loam	Ash Pumice Loam
Drainage	Poor to moderate	Poor to moderate	Good	Good	Mixed to good	Good
Infrastructure on farm	Feed pads Stand off pads Wintering barns Sacrifice paddocks Low proportion only use sheds and laneways	Feed pads Stand off pads Wintering barns Sacrifice paddocks Low proportion only use sheds and laneways	Feed pads Stand off pads Sacrifice paddocks Low proportion only use sheds and laneways	Feed pads Stand off pads Wintering barns Sacrifice paddocks Low proportion only use sheds and laneways	High proportion only use shed and laneways	High proportion only use shed and laneways
Stand off	Up to a month or longer	Up to a month or longer	Less than a month	Less than a month	Less than 10 days	Not at all Less than 10 days
Stand off hours/day	More than 12 hours	More than 12 hours				
Stand off days/month	More than 10 days	More than 10 days				

Table 1 Summary of farm contexts for standing off
Source: Adapted from Kaine, 2014 in press

5.4 Example of standing off: two dairy farms

In this section findings from two dairy farmers[11], who completed the quantitative telephone survey in 2011 are described to give examples of the types of enterprises that fall in a particular context as described by Kaine (2014 in press)[12]. Below are details about the farm contexts, wet soils management and specifically any standing off practices.

John is the owner-operator of a 450 herd dairy farm in Matamata-Piako district. The farm is 87 effective hectares, overall the contour is flat and the main soil types are clay and loam. Overall the farm is very prone to pasture damage or pugging and about 15% of the farm is pugged in a normal winter (this includes prevention management, including standing off, and trough areas and gateways).

In winter John stands off all of his herd to manage wet soils. He does this "to avoid pasture damage and to allow us to have a milking platform". In a normal winter John stands off his stock for around 60-89 days, typically for around 8 hours a day.

John has the following infrastructure: a feedpad, a purpose built stand off or loafing pad, cow shed yard and races. He uses his feedpad and purpose built stand off or loafing pad to stand off stock on.

The feed pad is made from concrete, it has a nib to contain effluent, and he has a sump or holding facility that pumps to the dairy's effluent pond or holding tank. His loafing pad is constructed of post peel, has no flow underneath and has metal on top. It is sealed, it has a nib to contain effluent and he has a sump or holding facility that pumps to the dairy's effluent pond or holding tank.

In winter John typically reduces the herd rotation length, that is, speeds up cow movement around the farm to prevent pasture damage or pugging.

When the information that John supplied about his farm was analysed he was classified into farm context 1 for standing off. Eleven per cent of the survey respondents were also classified into this context (Kaine, 2014 in press).

Excerpt from Kaine, 2014 in press

Farm context one: Prone to extensive pugging
The farms with this context are prone or very prone to extensive pugging with approximately a quarter of the area of these farms being prone to pugging in winter, on average. Farms in this context have a flat topography and the soils are mainly clays or loams that have poor to moderate drainage. Farms with this context are concentrated in districts in the north of the region.

A relatively high proportion of the farms in this context have feed pads, purpose built loafing pads, wintering barns or a herd home, and have sacrifice paddocks over winter. A relatively low proportion of farms in this context only had sheds and laneways.

Most farmers with this context stand off stock for more than 12 hours a day for at least ten days in winter. Most have to stand off stock for up to a month, some for even longer.

(Kaine, 2014 in press, pg 6-7)

[11] Names changed.
[12] The benefit segments descriptors provide an overview of the range of farms that benefit (or not) from a particular practice.

Ben is the owner operator of a dairy farm in South Waikato district. The farm is 95 effective hectares, overall the contour is flat to rolling and the main soil type is ash. Overall the farm is not very prone to pugging and about 1% of the farm is pugged in a normal winter (this includes prevention management, including standing off, and trough areas and gateways).

In winter Ben does not stand off any of his herd. He doesn't need to as he has free draining soil.

Ben has the following infrastructure on farm: a feed pad, cow shed yard and races. He does not use any of these to stand off stock on. His feedpad is made of gravel, it is not sealed and it does not have a nib. Effluent is scraped or washed off directly into the dairy effluent pond or holding tank.

Ben typically prevents pasture damage or pugging by back fencing or strip grazing.

When the information that Ben supplied about his farm was analysed he was classified into farm context 6 for standing off. Twenty-two per cent of the survey respondents were also classified into this context (Kaine, 2014 in press).

Excerpt from Kaine, 2014 in press

Farm context six: Not prone to any pugging
The farms with this context are not prone to pugging at all, with approximately two per cent of the area of these farms being a little prone to pugging in winter, on average. The farms in this context have a flat to rolling or rolling topography and the soils are mainly ash, pumice and loam that have good drainage. Farms with this context, like those in context five, are spread throughout the region, although there is a relatively high proportion in the southern districts of the region.

Similar to the farms in context five, a relatively low proportion of the farms in context six have feed pads, purpose build loafing pads, and have sacrifice paddocks over winter. A relatively high proportion of farms in this context have only sheds and laneways.

Most farmers in context six either do not stand off stock or stand off stock for less than ten days in winter.

(Kaine, 2014 in press, pg 12)

Kaine (2014 in press) found that standing off was influenced by the frequency and extent of pugging that farmers experience over winter. The duration and frequency of pugging is primarily a function of biophysical characteristics of the farm that influence drainage (such as soil type, rainfall, and farm topography). This is consistent with what John and Ben are doing on their farms: John has soils that are prone to pugging, and a large area of his farm is usually pugged over winter. He needs to ensure that his ability to produce pasture is secure, so he does not want to damage his soils. Consequently, John has infrastructure on farm to enable him to stand stock off for an extended period of time.

Ben on the other hand does not experience severe pugging, and only a very small proportion of his farm gets pugged over winter. He does not stand off any stock. Ben manages his wet soils by reducing the time spent on each area of the farms pasture.

If changes were made which required the practice of standing off, or design specifications were required of any stand off infrastructure, both John and Ben may incur considerable

costs. The capital investment required to modify or install stand off infrastructure is very high, and in Ben's case may be viewed as not even necessary, as he feels he can effectively manage wet soils over winter without removing stock from the paddocks.

John and Ben highlight how different farm contexts result in management practice choice based on particular needs. It also shows how a requirement to implement a particular practice or specific technology standards would have varying impacts on different farms (e.g. investment in infrastructure when they do not have a "problem" to manage). Additionally, the objective for a practice or technology for nutrient management reasons may not align with the reasons why farmers currently do, or do not, undertake that practice.

6 Summary

The contribution that policy makes towards achieving policy objectives depends, in part, on the extent to which the policy target groups make changes in choices of practice and technologies. Consequently, the impact of policy initiatives involves identifying what practices and technologies are being undertaken, by how many, and identify how to increase the uptake of desired practices and technologies. All these depend, firstly, on a detailed understanding of how choices of practice and technologies identified to achieve policy objectives align with the needs, or choices, of landholders.

As Davies and Topperwien (2011) noted even though the environmental and economic benefits of a particular practice may appear to be well established, at the farm level there may still be sensible hesitation amongst farmers to adopt practices as the transition to a new practice may be of little or no benefit, involve significant costs, or present unwanted management issues. There are a number of factors that farmers must consider when assessing new practices. Benefits may not be present for those farmers who in their opinion have sufficient management methods. For some, farm contexts may make a change in practice or technology impractical (Davies and Topperwien, 2011).

The use of the Kaine Framework (2008) has enabled the council to understand the winter grazing management practices and decisions of dairy farmers in the Waikato Region. The Kaine Framework steps through a structured methodology which has guided the council to undertake two phases of research: qualitative interviews and a quantitative survey with farm context analysis.

The qualitative interviews elicit what practices and technologies farmers are currently undertaking, and why. The quantitative survey then tests the findings of the qualitative research by gathering data from a large sample of farmers that is representative of the population. Information on how many people are undertaking a practice or using a technology is known, as well as how many people share the same need for doing (or not doing) so. Finally, the farm context analysis looks at the relationships between farm context factors and the use of a certain practice or technology and statistically tests the relationships. This results in the population being divided into segments for which a practice or technology presents a benefit to the farmer, which is dependent upon the presence or absence of farm context factors that influence the need to undertake that practice or use that technology. The focus of the farm context analysis was on two practices dairy farmers use in winter: standing off and wintering off. This approach could be used to understand other winter grazing management practices.

The results of the research has revealed that farmer decision making is complex, highly involved and influenced by a range of factors such as fixed biophysical characteristics and associated management decisions, which can be hard to change (Kaine, 2014 in press).

For example the standing off results example highlighted that because farm context factors such as proneness and extent of pugging, soil type, rainfall, topography and location heavily influence farmers' choice of practices and technologies policy has limited capacity to influence the uptake of changes of these practices for some farmers. If policy prohibits current practices to manage these factors this creates substantial cost for farmers to find alternatives (Kaine, 2014 in press).

Undertaking this research enables policy decision makers to have a clear understanding of what winter grazing management practices are currently occurring in the dairy industry in the Waikato Region. Understanding what is currently being adopted by landholders is useful for a number of reasons:

- Firstly, understanding landholder choices can be used to target policy initiatives. There may be a proportion of the population for whom the desired practice or technology may be of benefit, but they have not yet adopted it. Changing to that practice or technology may fill a potential need so those individuals may more readily take up the practice as it could more easily be incorporated into their farm system.

- Secondly, understanding landholder decision making can assist in selecting instruments to accelerate uptake. If a policy objective requires action on the ground in a certain time period it is helpful to identify the proportion of the population who might be in the market to adopt a practice but needs additional assistance to meet the policy outcome or time frames.

- Thirdly, understanding landholder choices can be used to assist in selecting instruments to reduce the potential of counterproductive outcomes. There may be practices that are currently being undertaken on farm that align with a desired policy objective. However, if they are being undertaken for a different reason or purpose then there is potential for unintended consequences. As noted by Davies and Topperwien (2011), practices or technologies may not be adopted in a manner that achieves a policy objective.

The approach can be used to set priorities for, and design of, water resource management policies. This research approach forms part of a comprehensive, integrated approach to understanding behavioural responses of landholders to policy instruments.

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