A GLASS HALF FULL? – THE IMPACT OF EMERGING FRESH WATER QUALITY POLICY ON THE FUTURE OF NEW ZEALAND FARMING

Subtheme: The role of policy in defining future farming systems

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Abstract:

The last decade has seen a significant local and central government policy response to the issue of declining fresh water quality in New Zealand, much of it as a result of diffuse nutrient, sediment and bacterial contamination. The correlation between agriculture and diffuse contaminant loss is now well recognised by the scientific and agricultural sectors alike. The subsequent requirement that policy changes have for New Zealand farmers to take greater responsibility for their impact on fresh water quality certainly presents a significant challenge to farmers will necessitate substantial farm system change. The necessary extent of change appears achievable, but the associated costs of mitigation are going to have to be largely internalised by farm businesses. A renewed focus on productivity and innovation and the recognition of the wider benefits that such farm system changes will have on our own communities will need to underpin this necessary transition to how we farm into the future.

Keywords: *diffuse contaminants, fresh water policy, mitigations, pastoral farming, water quality*

Introduction

Agriculture in New Zealand, particularly pastoral farming, is no stranger to the impact that the policies of central and regional government can have on farm businesses. While New Zealand's climate, small domestic market, location relative to key markets and ultimately the market signals for our food and fibre products dominate the drivers for our export oriented low cost pastoral farming systems, government policy has had a significant role in shaping New Zealand's current agricultural sector.

The removal of direct subsidies from the sector by the fourth Labour government in 1985 was a key element for shaping the relatively efficient low cost production systems that New Zealand farmers are globally recognised for. The deregulation of financial markets that also commenced at this time has increased farmer access to capital, facilitating faster on-farm investment but also contributing to asset value inflation.

Marginal hill land has been exposed to numerous cycles of development and reversion as various governments sought to increase agricultural production through establishing pasture on this erodible and fragile landscape. Ironically almost in parallel with often questionable land development, the establishment of the Soil Conservation and Rivers Control Act in 1941 led to a significant increase of retirement fencing, riparian plantings and conservation forestry to reduce the risk of erosion.

New Zealand’s adoption of the Kyoto Protocol and the subsequent “ring-fencing” in 2008 of forests planted before 1990 in the Emissions Trading Scheme (ETS), established by the 2002 Climate Change Response Act, actually resulted in the acceleration of significant deforestation of exotic pine plantation in the central North Island for conversion to predominantly dairy farming.

Government policy has also been instrumental in the establishment of the irrigation schemes in Canterbury and Otago that have supported significant expansion of dairying in these regions. Initially this was through direct central government ownership, with government originally owning 43 schemes irrigating 86,500ha in these regions (Selwyn District Council 2000). These transferred to private ownership from 1988 and were subsequently followed by, via the passing of the 1991 Resource Management Act, the establishment of a number of new industry schemes (c. 153,000ha) subject to the oversight and policy of local, rather than central government.

While by no means a complete summary, government policy has had a direct impact on where the New Zealand agriculture sector finds itself today – which some could cynically describe as excessively geared, overly reliant on dairy, responsible for 1/3rd of New Zealand’s greenhouse gas emissions and ultimately responsible for the decline in the quality of fresh water throughout the country. While such a statement is not wholly correct and deliberatively provocative, it highlights some of the increasing challenges facing the sector today. It is the last issue – that of fresh water quality – that in our view is perhaps going to have the single greatest impact on the future direction of farm systems in New Zealand in the medium term.

Declining fresh water quality

The issue of declining fresh water quality in many of the inland water bodies of New Zealand as a result of diffuse or non-point source losses has been a developing issue for at least twenty years. However, it is only in the last decade that significant policy responses have been enacted by local and central government to address the issues that nitrogen, phosphorus, bacteria and sediment are having or appear to be having on water quality.

The data measuring fresh water quality in New Zealand is by no means unequivocal. Between 1989 and 2013, total nitrogen concentration increased in 60% of the 77 river sites monitored by the National Institute of Water and Atmospheric Research ("NIWA"), while dissolved phosphate levels also increased at 51% of the monitored sites (Ministry for the Environment & Statistics New Zealand, 2015). However, this same report noted that changes in total phosphorus levels demonstrated no clear trend in the same period and actually appeared to have improved over a more recent 2004-2013 survey period. Between 2009 and 2013, the trophic level index ("TLI") in 65 monitored lakes averaged 3.6, indicating moderate levels of nutrient enrichment; however it should be noted that monitored lakes consist of only about 4 percent of all New Zealand lakes, and [monitoring] programmes may focus on those that have poor water quality or are at risk due to the type of land use in their catchment. Data on ground water quality is similarly ambivalent. From 2004 to 2013, there were no overall trends for groundwater quality. Over this 10-year period, 86 groundwater sites were analysed for nitrate trends. Nitrate concentrations increased at 22 of the sites (26 percent), but decreased at 13 sites. There was also no overall trend for dissolved phosphorus.

There is a degree of uncertainty in the data that has been collected. This arises due to the variable hydrological lag between nutrients leaving the "farm gate" and ending up in a water course, an often poor understanding of attenuation, relatively limited data sources and non-representative monitoring sites. The use of such data as a basis for creating water policy has been raised as a cause for concern by farming communities and their advocacy groups.

However, the correlation between agriculture and diffuse nutrient loss is now well recognised by the scientific and agricultural sectors alike, particularly the significance of the urine patch as a major contributor to nitrogen leaching (Di & Cameron 2007). The

2013 report on water quality by the NZ Parliamentary Commissioner for the Environment concluded there was "*a clear link between expanding dairy farming and increasing stress on water quality*" and "*that without significantly more intervention, we will continue to see an on-going deterioration in water quality in many catchments across the country, particularly in Canterbury and Southland…the amount of nitrogen entering fresh water every year in virtually every region of the country will continue to rise. This is especially so in regions where dairy farming is expanding and is occurring despite concurrent increases in forestry*". This report also concluded that "*much, if not most, of the phosphorus that has accumulated, and continues to accumulate, in waterways is the result of the erosion that has followed many decades of forest clearance for sheep farming*".

There are a number of specific lakes and water bodies in New Zealand (e.g. Lake Rotorua, Waihora-Lake Ellesmere) that either do not meet minimum community expectations around water quality and/or have shown a significant decline in water quality standards over a period of obvious agricultural expansion and intensification, albeit in conjunction with other human influences that will have impacted negatively on water quality. Anecdotal reports, emotive media strategies (i.e. the so called 2002 "Dirty Dairying" campaign by the NZ Fish & Game Council) and, until recently, what we perceived to be the lack of the wider agricultural sector to demonstrate any real leadership in acknowledging its role in both contributing to and improving water quality, have helped create an environment where agriculture is, rightly or wrongly, deemed to be the primary source of diffuse pollution in NZ waterways. Communities have demanded a response and both central and local government are acting accordingly.

Policy response

Of New Zealand's eleven Regional Councils, seven currently have notified or enacted regulations placing limits on the diffuse loss of nutrients from land use activity (Arbuckle 2015), predominantly, but not always exclusively, targeting nitrogen. These rules vary between jurisdictions and individual catchments, dependent on contaminant type, load and often the relative influence of community stakeholders. These approaches include mandating the adoption of industry agreed good management practices (Canterbury Region), capping contaminant losses at historic levels (Lake Taupo &

largely Canterbury), restricting losses according to natural capital or land use capability (Wanganui-Manawatu), severely restricting land use change (Waikato Region) or requiring sector-based reductions of diffuse contaminants over time (Lake Rotorua). It is also important to note that while many Regional Councils are helping fund farm plans and access to professional support, no direct subsidies or grants are being paid to farmers to incentivise change or compensate for financial losses. The two exceptions to this are for the Lake Taupo and Rotorua catchments, where the iconic status of these water bodies (and early recognition of water quality issues) attracted community funds in order to purchase “nitrogen discharge allowances” from farmers prepared to sell.

Having initially lagged behind regional initiatives, central government released a National Policy Statement for Freshwater Management (“NPSFM”) in 2011, which was updated in 2014. Regional land and water plans must give effect to the objectives and policies specified in any operative National Policy Statement. The NPSFM requires regional councils to address the over allocation of water in catchments, both for water quality and water quantity, by setting freshwater objectives, limits or targets. Recent amendments to the NPSFM include the National Objectives Framework (NOF); a framework which contains compulsory water quality attributes and national bottom line standards for these attributes. The NPSFM allows regional councils until 2025 to complete implementation of all its freshwater policies including the “NOF”. This national directive means ignoring the issue of declining water quality is not an option and paves the way for the eventual implementation of water quality initiatives in all fresh water catchments within New Zealand. This month the Minister for the Environment announced new targets within this policy framework for 90% of all NZ lakes and rivers to meet a “swimmable” standard by 2040. It seems policy is going to require more change, not less.

Such policies and rules are often seen as unfair and economically destructive by the farmers and farming communities they impact upon, while environmental advocates, urban communities and recreational user groups tend to support such changes, if not advocating for additional measures. Opinion amongst farm management professionals tends to be equally varied; some offer strong and vocal opposition to such measures, while others, like the authors, endeavour to take a more constructive approach, working with farmers and regulators alike to ascertain, where possible, solutions within rules that deliver acceptable outcomes to all stakeholders.

While farming activities are by no means the sole source of these diffuse contaminants, they typically comprise a significant proportion of the potential contaminant load and tend to be considered one of the major "controllable" sources, particularly from the perspective of the public purse and limited, if any, government contribution. As mentioned above any costs (including losses in profitability associated with necessary farm system changes) associated with mitigation generally need to be internalised by the land owner

However, even where such public funds have been made available to assist with contaminant load reduction, policies on improving the quality of New Zealand's freshwater resource are invariably having or will have a significant bearing on the evolution of farming systems.

Impact on farm systems

Adapting farm systems to reduce the loss of diffuse contaminants to water has been an increasing focus of the research community in New Zealand for some time now. Findings have been both good and bad. The impact that critical source areas ("CSAs") within farming landscapes have on overland flow and its associated sediment and phosphorus losses (McDowell & Srinivasan 2009) are increasingly well understood and the ability for farmers to conceptually account for nutrients within their farm systems, the so called" nutrient budget", facilitated largely by AgResearch's OVERSEER® software, has highlighted the key loss areas within our predominantly pastoral farming systems. The Pastoral 21 Next Generation Dairy Systems ("P21") research project was a collaborative five-year, multi-regional farm programme led by DairyNZ that aimed to provide proven, profitable, simple, adoption-ready systems that lifted production and reduced nutrient loss. This has resulted in a significant quantum of research focussed on reducing Nitrogen (N) inputs (N fertiliser and supplements, capturing urine N) in late summer-winter, protecting wet soils in autumn and spring to decrease sediment and phosphorus runoff and reducing nutrient losses from forage cropping. There have been a number of farmer-led initiatives across New Zealand, largely at catchment or sub-catchment level, focussed on reducing contribution of N, P and sediment to water at the "farm-gate" (Birchall & Paterson 2011, Park et al 2014). Innovation in this space continues to develop, with initiatives such as water augmentation to improve water quality in lowland streams through dilution and increasing flow rates, through to the MAR (managed aquifer recharge) project which focusses on increasing water quantity and quality of aquifers through recharge with surplus alpine water (Golder Associates (NZ) Ltd, 2016).

In light of the current research and expected policy framework, it's apparent New Zealand farm systems will need to evolve from current or at least recently historic practice. Irrespective of sector, improvement in the efficacy of nitrogenous fertiliser usage (less quantity, targeted use), a reduction in soil cultivation, the adoption of deeper rooting crops, the use of more diverse pastures and managing overland flow will all be critical elements of farm system design. We expect we will also see a reduction in overall stocking rate, greater integration of both exotic and indigenous forestry into farm landscapes and actions to enhance biodiversity.

So if we know what the future needs to look like, then what does this cost?

There is a growing body of work in New Zealand, including contributions from the authors, which demonstrates that the financial impact on current farming systems from meeting various levels of reductions in diffuse contaminants can vary significantly between farms within sectors and between sectors. Analysis on the impact of proposed nutrient limits in the Lake Rotorua catchment (Perrin Ag Consultants, 2014) on ten dry stock and eight dairy farms found that the financial impact of meeting these limits, as measured by the change in operating profit per annum, ranged from -$1,032/ha to +$185/ha and -$305/ha to +$14/ha respectively. Given consistent geophysical parameters, this variation essentially arises from individual farm system design and/or operational efficacy, the given allocation method or a combination of these two factors. This situation suggests there is potential for many current NZ farm systems to adapt to current or looming regulation and offset some or all of the expected negative financial impact through improvements to farm systems, albeit with a potential loss in flexibility in land use or farm system to react to future changes in market prices or climatic events. However, irrespective of this, as the extent of nutrient reduction required increases, so does the "cost" of mitigation, conceptually demonstrated by the so called Neale or abatement curve (Doole 2016). Multiple analyses of both real and hypothetical farm systems in the Lake Rotorua catchment (Perrin Ag Consultants Ltd 2012, 2014, Parsons et al 2015) have demonstrated that meeting the nutrient loss targets proposed for that catchment will likely result in a net loss of operating profitability within the agricultural sector, before considering any impact on balance sheets and farmer equity levels. But, along with work by Dewes & Bolt (2012) and Perrin Ag Consultants Ltd (2013, 2015) in the Waikato region, these reports all identify the potential for some farmers (and farm systems) to deliver high profitability with relatively low environmental footprints, both on the basis of EBIT/kg N leached and at an aggregate farm level. The P21 farmlet trials in four regions of New Zealand all successfully demonstrated the potential to achieve significant reductions in diffuse contaminant losses, but three out of the four trials experienced a reduction in net profit (https://www.dairynz.co.nz/about-us/research/pastoral-21) and in the remaining trial the low-footprint system's relative profitability was highly dependent on milk price. In a multi-year study, research by Dodd et al (2014) on optimised land use on hill country at Whatawhata identified that while improved productivity was achieved on the residual farm area, the net impact on farm business profitability from land use change required to improve water quality was actually negative and required significant capital investment.

So what does this mean for farmers and farm systems moving into the future? If closing the productivity gap that exists in many, if not most, farm businesses as a result of sub-optimal on-farm decision making or poor farm system configuration is the primary solution to minimising the impact of water policy on farm businesses, then how do we get there? Is it realistic? And if we accept that policy and regulation in this area is likely to have negative financial impacts on the NZ farming sector, how can we suggest the "glass is half full", unless we're talking about it being full of dissolved N and P?

A glass half full?

In our opinion, the pastoral farming sector has little choice but to view these evolving changes in a positive light and embrace the need to change. The need for our farmers to modify their systems to not only prevent further water degradation but to help restore it is at the core of the changing social license to farm, not only here in New Zealand, but in a global context as well. It would seem that the often quoted mantra of farmers wanting to "leave the land in a better state than they found it" is going to be rigorously tested by the non-farming community more so than ever before.

It would be naïve to suggest that all farmers will be able to successfully modify their farm systems and improve their competency in decision making to meet the demands of these new policy frameworks without negative financial impact. However, in this new environmentally constrained environment, the sector's focus on [production-linked] capital appreciation as a means to wealth creation is likely to rapidly move towards achieving better cash returns driven by productivity and resource use efficiency.

In addition, many of the management and land use changes identified to address changes in water quality policy have co-benefits for farmers as regards addressing some of the other externalities associated with farming. Reducing carbon emissions, improving biodiversity and enhancing animal welfare have potential ecosystem and market benefits, and could potentially have direct financial benefit as regards offsetting future regulatory imposition in these areas (i.e. carbon tax). The benefits of improving water quality and other "ecosystem services" to other rural industries and sectors (i.e. tourism) as well as the improved cultural and social outcomes in rural communities from achieving fresh water quality targets also need to be recognised.

In saying this, the transitional or permanent costs to farm business in adjusting from the status quo shouldn't be discounted. There are likely to be significant challenges for those farming marginal land and/or businesses that are highly geared. If increasing production is no longer a pathway to diluting increasing costs, then lifting product value needs greater focus and investment. Will constraints on production result in higher prices to offset the environmental cost? Can the agricultural sector add value by marketing our products as more environmentally friendly and sustainable? And is this a key mechanism for supporting change and retaining economically viable businesses?

While we don't subscribe to suggestions that consumers will pay more for our grass-fed products on the basis that we improve our footprint regarding water quality (and other environmental externalities), the use of environmental footprint as a non-tariff barrier is certainly emerging in the global consciousness, as recent comments from John Comer, president of the Irish Creamery Milk Suppliers Association indicate ("Irish say suspend NZ trade talks", Farmers Weekly, February 21, 2017). Additionally, with the development of synthetic protein accelerating and increasing global pressure on food supplies, pastoral farmers will come under pressure to be able to justify not only their production systems but also the premiums that might potentially be required to maintain the economic viability of the sector.

Summary

The requirement that policy changes have for New Zealand farmers to take greater responsibility for their impact on fresh water quality certainly presents a significant challenge to the current and emerging generation of farmers. It is apparent that adaptation of our largely pastoral farm systems to reduce the loss of contaminants to water is achievable, but the associated costs of mitigation are going to have to be largely internalised by farm businesses. Despite this, we remain positive about the future of pastoral agriculture in New Zealand. History has shown the sector capable of withstanding significant disruption and we believe it will do so again. A renewed focus on productivity and innovation and the recognition of the wider benefits that such farm system changes will have on our own communities will underpin this necessary transition in how we farm into the future.

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