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Going with the Grain of the Landscape rethinking our approach to environmental policy

Abstract

There are doubts about whether the current approach to regulating the impacts of land use in rural Aotearoa is making a difference. This article starts by outlining four challenges policymakers face when designing policies to protect the environment while balancing social, cultural and economic interests. We then discuss some of the barriers landowners encounter when contemplating land use change to address environmental degradation. Finally, we sketch out an adaptive approach to rethinking how we do environmental policy, including by devolving some decision making to communities, providing better environmental information, being explicit about the costs and trade-offs, and reforming the New Zealand Emissions Trading Scheme.

Keywords land use change, water quality, biodiversity, catchment groups, agriculture, forestry

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Concerns about the degraded state of the rural environment have increased over the last 15 years, alongside the growth of an increasingly complex web of regulatory interventions and subsidies by successive governments designed to improve environmental outcomes. The evidence we have about the current state of our waterways, biodiversity and emissions reductions suggests that policy initiatives over the last 30 years have largely failed to shift the dial in the right direction. This conclusion has emerged over six years of research into land use change by the Parliamentary Commissioner for the Environment (PCE), which is, in turn, based on substantial investigations by previous commissioners.

This research culminated in a major report entitled *Going with the Grain: changing land uses to fit a changing landscape* (Parliamentary Commissioner for the Environment, 2024b), which was released earlier this year. Alongside this report, case studies were published which

detailed how current, proposed and alternative approaches to environmental policy could affect land use in two catchments, the Mataura in Murihiku Southland and the Wairoa in Te Tai Tokerau Northland (Parliamentary Commissioner for the Environment, 2024a). This article aims to expand on some of the key findings and recommendations from *Going with the Grain* that may be of particular interest to policymakers. The full report, a summary and the case studies are available on the PCE website.

It is important to emphasise at this point that *Going with the Grain* is not a list of definitive solutions to complex issues. Instead, it suggests that we open ourselves to an experimental approach going forward, one that draws on the knowledge of land users, mana whenua and rural communities, combines high-quality, openly accessible environmental information, and explores alternative tactics in catchments facing the greatest challenges.

The report starts from the premise that policy aims to balance the social, cultural and economic advantages derived from our natural resources, while simultaneously ensuring their protection for future generations. Research indicates that policymakers encounter four primary challenges in pursuing this complex objective.

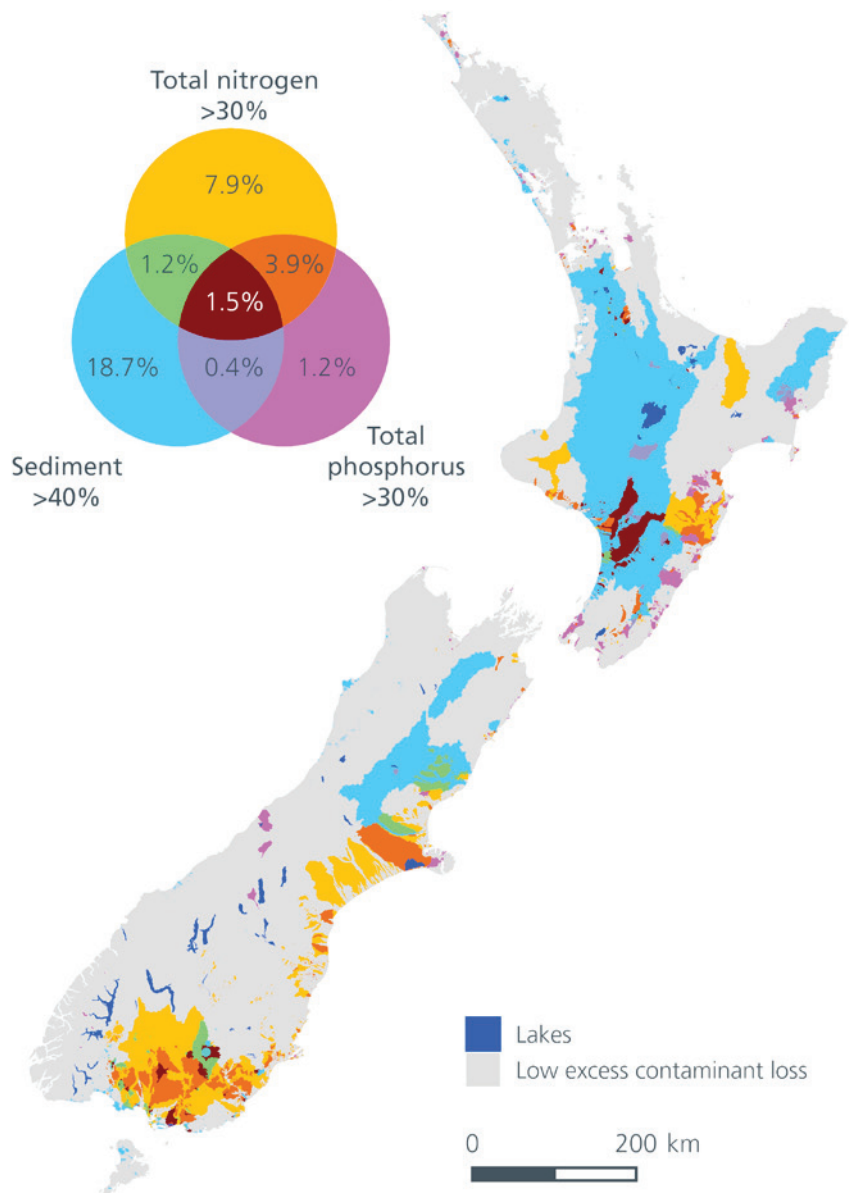
Four challenges facing policymakers

The magnitude of environmental degradation in some parts of the country means that change in land use – not just change in management practices – is needed

Work from the Our Land and Water National Science Challenge suggests that in roughly one third of catchments, environmental bottom lines for one of three key contaminants in fresh water (nitrogen, phosphorus and sediment) are being exceeded beyond levels that can be mitigated by changes to management practice. In 1.5% of catchments, the exceedances apply to all three contaminants (see Figure 1) (McDowell et al., 2021; Snelder et al., 2023).

Furthermore, 75% of indigenous species, including birds, freshwater fish, reptiles and bats, are classified as threatened or at risk of being threatened, and just

Figure 1: Catchments with high excess contaminants that will likely require land use change



Source: adapted from McDowell et al., 2021 and Snelder et al., 2023

under 1,800 plant species have been introduced and naturalised since human arrival, further threatening endemic ecosystems (Brandt et al., 2021; Statistics New Zealand, 2023). Large areas require biodiversity restoration (see Figure 2). On top of that, urgent greenhouse gas emissions reductions are needed.

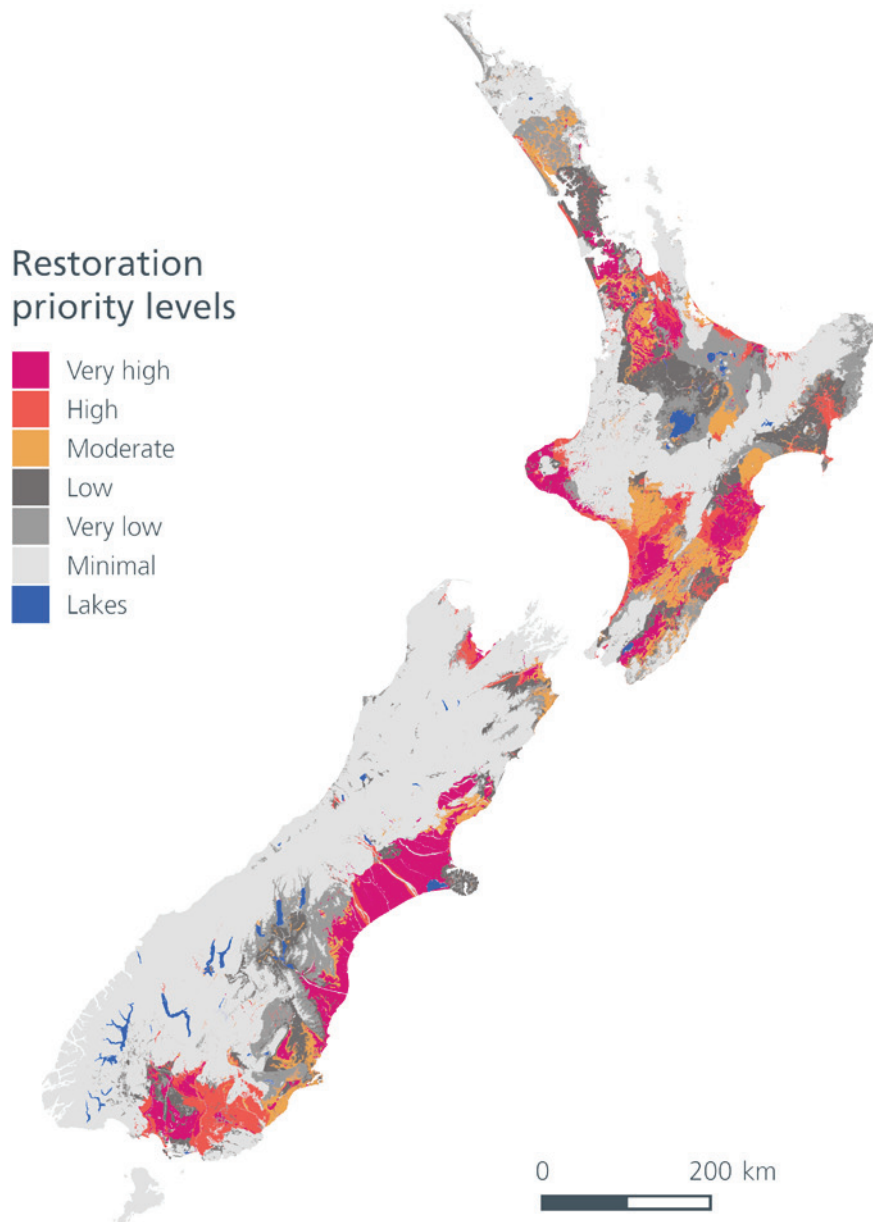
This catalogue of ongoing environmental degradation is a direct result of the way we have used the land in the past and the way we continue to use it. Present day pressures are added to the legacy of past land use choices. In short, further changes are needed if we are to halt any further decline. This will mean embracing a spectrum of land use changes, ranging from applying mitigation

techniques to existing land uses to wholesale land use change in some places.

The changing climate will increasingly drive land use change as landowners adapt to shifting temperatures and seasonal patterns

While we have some idea of the impact average warming trends will have on land use, one of the big unknowns is the impact of extreme weather events. In terms of average trends, Aotearoa is getting warmer, leading to more frequent droughts and fewer frosts. This temperature shift may facilitate the spread of new and existing pests and diseases. While warming could create new land use opportunities and potentially boost primary productivity by

Figure 2: Areas in New Zealand requiring urgent biodiversity restoration



Source: adapted from Eco-index¹

up to 10%, it might also encourage more intensive land use (Rutledge et al., 2017; Our Land and Water, 2023).

Extreme weather events are expected to intensify, with more severe droughts, floods and fires, possibly occurring more often. The unpredictability of these events may force landowners to confront new challenges while recovering from previous ones. Additionally, erratic weather patterns could affect production and yield, leading to volatile commodity prices both here and overseas.

In some areas, extreme events may render certain land uses unfeasible, while new possibilities may emerge elsewhere. Land values will likely be affected, sometimes significantly. Currently, it is

uncertain who will bear the financial burden of these changes, but without government intervention, it will likely fall on landowners.

The sheer scale and complexity of environmental regulation either in existence or under development

This challenge is worth elaborating, given its relevance to readers of this publication. The regulation of environmental impacts from land and water use is inherently complex, mirroring the intricacy of our diverse landscapes. However, over the past two decades this complexity has been exacerbated by a fragmented regulatory approach. Multiple policy initiatives directly affecting land and water use

decisions have converged, seemingly all at once, from the perspective of farmers. This simultaneous influx of policies is a significant source of uncertainty for landowners. There is ambiguity around the scale and timelines of required changes, and lack of clarity around the interplay between various regulations. This uncertainty poses a fundamental question: why would farmers invest in land use changes when the regulatory ‘goalposts’ are constantly shifting?

One key issue is that we have struggled to find an effective balance between national and local regulation. This situation can be traced back to the early implementation of the Resource Management Act 1991 (RMA), when, to better address the uniqueness of our regions, environmental management was devolved to regional and local government and communities. The RMA allowed for national direction, but policymakers chose to largely avoid this set of tools for over a decade after the passage of the Act.

The principle of environmental ‘subsidiarity’ was good in theory, but local government was not provided with sufficient practical frameworks, financial mechanisms, or the tools needed to properly implement its new mandates. As a result, we had 16 regional entities working in isolation, struggling to solve the same complex issues from scratch.

Additionally, local decision making has been at risk of being captured by vested interests, be that industry or farming wanting looser environmental standards, or residents using claims of amenity to protect their views and property values.

The resulting decline in rural environmental quality led to increasingly insistent calls for firmer national direction and policy. From the late 2000s through to 2023 both National and Labour-led governments promulgated a plethora of national policy statements and national environmental standards alongside multiple amendments to the RMA. The New Zealand Emissions Trading Scheme (NZ ETS) also entered the frame.

Today, it all adds up to a complicated web of top-down policies. All are well-intentioned. But some are duplicative and some even contradictory, with little thought having been given to how they

interact with one another. A tangle of funding mechanisms (see Figure 3) has also sprung up, designed to help implement the myriad policies but in some cases simply causing further confusion for land users considering land use change.

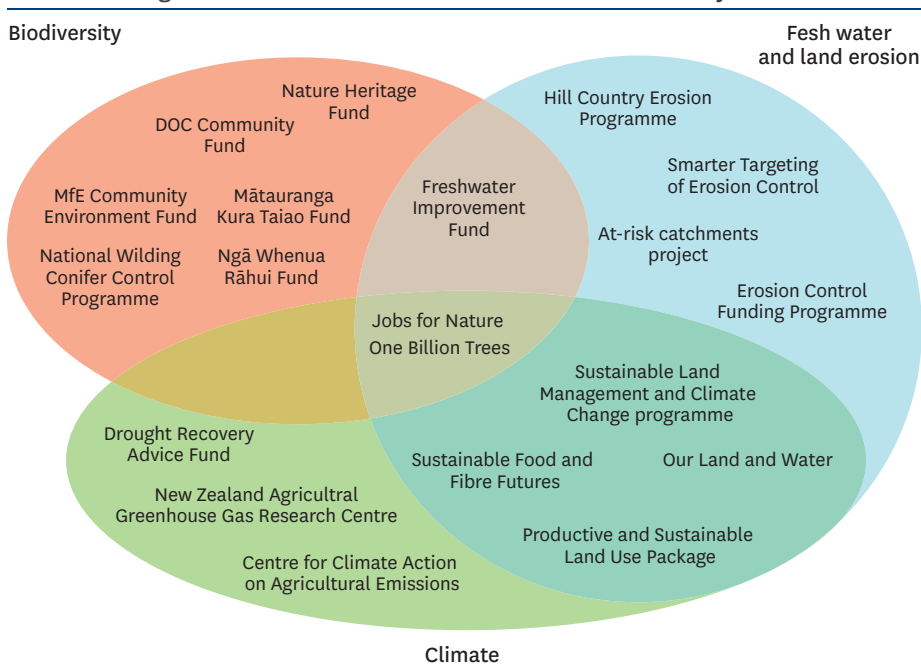
Implementing regulation effectively can take a decade before a system beds down, but the rapidly changing regulatory landscape has meant that some national direction has never been given time to work. A recent example is the National Policy Statement for Freshwater Management, which was introduced in 2011 and then amended in 2014, 2017 and 2020, and is again under review.

Long-term regulatory success requires buy-in from stakeholders and needs to be practical to implement. Key groups, mainly farmers and businesses, responsible for acting to improve environmental outcomes have viewed the increase in national direction and regulation as onerous, complicated and impractical. There is some truth to that view.

Regional councils have struggled to implement national policy statements provided by central government. Ratepayer money that has been spent on plan changes and the associated deluge of reviews and court cases would probably have been better spent on actual solutions. In part, this situation can also be traced back to regional councils' lack of capacity and risk aversion, but policies must be held up to scrutiny. If regional councils are struggling to successfully implement regulation, then the practicality and effectiveness of this regulation needs to be questioned. Upon receiving national guidance, regional councils would be well within their rights to ask central government to provide several things, including:

- consistency across different policy domains (or at least consistent use of definitions);
- funding to help implement the regulations;
- guidance on how to prioritise the actions derived from different national direction across different domains and within the limited resources of regional councils;
- legislation that enables the sorts of regulation and enforcement required to implement national direction;

Figure 3: Examples of past and present funding programmes related to climate change, fresh water and land erosion as well as biodiversity



Source: Parliamentary Commissioner for the Environment, 2024a, p.24

- guidance on how to resolve iwi rights and interests over fresh water to expedite land use change affordably;
- where it is unaffordable, finance to compensate landowners for land use change (or at least clarity from central government that they are comfortable bankrupting landowners and asking regional councils to do that on their behalf);
- the necessary information, monitoring and modelling base to inform all of the above.

In particular, central government has not provided tools or funding sufficient to shift the dial in environmentally constrained catchments. Land use change will be required in these catchments to achieve our environmental goals. Some of this might be done profitably; although even then it is not easy for landowners to make such large and possibly risky shifts. Where land use change cannot be undertaken profitably, central government has not provided regional councils with any tools to facilitate land use change where it is needed, and none are on the horizon.

The focus on farm-level or individual-level responsibility has led to solutions based on property boundaries

The RMA has further constrained environmental management by placing

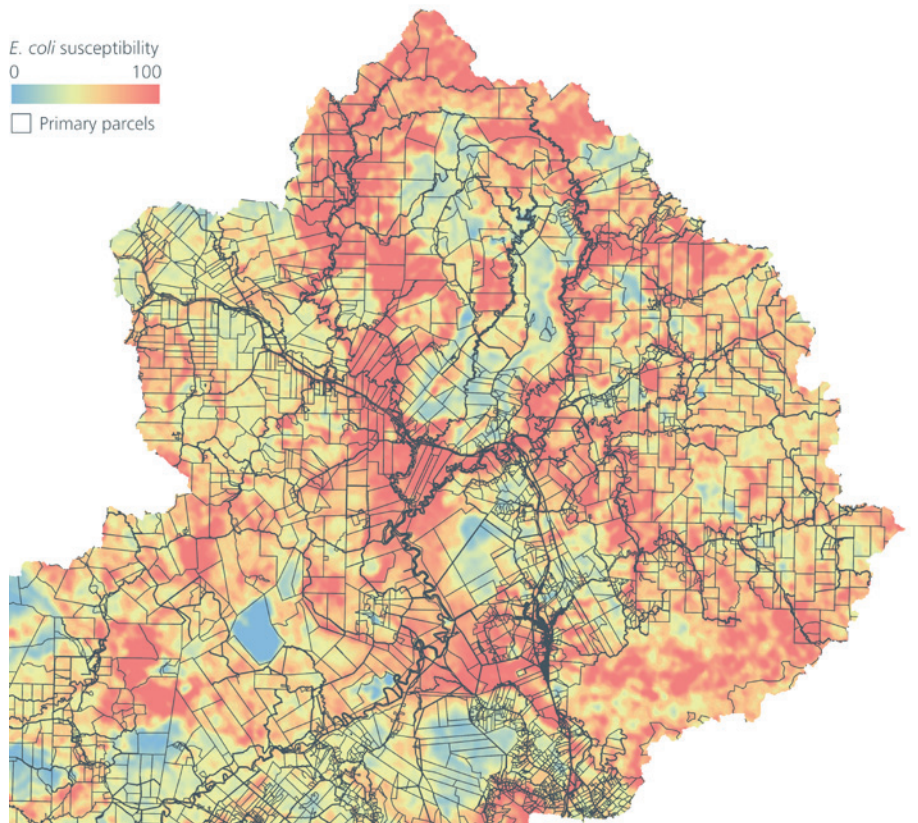
land use decisions largely in the hands of landowners. This approach ignores the fact that many of the environmental impacts of land use do not respect property boundaries.

For example, fresh water on the surface or underground runs through multiple properties. It can also be difficult to pinpoint the origin of and responsibility for environmental problems within a catchment. A property-based management approach also makes it difficult to incentivise land use change when the benefits from such change rarely map neatly onto cadastral boundaries.

Figure 4 demonstrates the mismatch between property boundaries in a part of the Northern Wairoa catchment in Northland and the land's susceptibility to *E. coli* contamination. This figure shows clearly that without cooperation between neighbours and others sharing the same catchment, individuals can have only a limited impact on improving freshwater quality. The same is true for biodiversity and many other environmental attributes.

This important insight has big implications for how policymakers think about implementing regulation and market-based mechanisms. New Zealand's predominant approach of *ex ante* RMA consents for activities with bespoke conditions does not deal well with either diffuse pollution or cumulative effects.

Figure 4: Susceptibility to *E. coli* pollution in the Northern Wairoa catchment, Northland, shown in red, overlaid with cadastral boundaries



Source: susceptibility map adapted from Rissmann et al., 2022; primary parcels retrieved from LINZ²

Top-down national direction was an attempt to standardise approaches and set limits. But those are difficult to apportion and attribute to individual consents and landowners.

Measurability and attribution are essential to conform to the concept of ‘innocent until proven guilty’. Enforcement on regulatory grounds relies on detection strategies, abatement mechanisms and prosecutions. For all three, the regulator must be able to objectively measure the impact on the environment and attribute that impact to the actions of a particular landowner. This is why the most effective regulations tend to concern things that are easily observable. Prosecutions of landowners, for example, tend to relate to things like dumping cowshed effluent directly into a stream, not fencing a riverbank, or redirecting a stream without consent. Waikato Regional Council estimates that about 7% of the farms in the region are not doing these basics day-to-day. These 300 farms (out of 3,666) are the focus of the council’s resources dedicated to investigations and prosecutions (Piddock, 2024).³ The resources required

mean that only the worst and most obvious offenders are investigated. As such, it only effectively deals with the laggards, rather than ‘moving the middle’. Successfully prosecuting large numbers of people for diffuse, non-point sources of contamination is nigh on impossible.

The nature of environmental issues, like freshwater quality, can also make it nearly impossible to attribute causes to individual land parcels. *Going with the Grain* argues that it is only possible to understand most of the environmental impacts of land use at a catchment scale. However, the deficiencies in our monitoring network mean we cannot always know where the issues *are* within a catchment, let alone know if particular actions are making a difference.

Water quality is probably the best example of this. The Overseer model attempts to estimate nitrogen losses with several land uses. But, as set out in a PCE report from 2018, Overseer should never have been used for regulatory purposes (Parliamentary Commissioner for the Environment, 2018). The Overseer model stops at the farm boundary and only

models a thin sliver of the land. Yet environmental impacts occur in distant waterbodies. Further, environmental impacts depend just as much on the susceptibility of different land parcels as they do on land use. Hence, the reality is far more complex than a model conceives.

Incidentally, the same issues apply to attempts to create market-based mechanisms (whether taxes or tradable permits) to incentivise landowners to change their behaviour to reduce environmental impacts. Long before we start talking about what is politically palatable, we should be talking about what impacts are measurable and attributable to individual property owners. Too often there have been proposals for market-based mechanisms that do not meet these conditions. Nitrogen trading is a good example: despite nitrogen being a pervasive issue, trading rights has only been successfully implemented in Taupō, and that was with considerable public subsidy.

One way to effectively regulate diffuse, non-point source contaminants using this paradigm is through input regulation (or input controls). This approach is used – to an extent – by the European Union.⁴ An example of an input control would be a limit on the number of stock units allowed in a particular catchment. Input controls are very unpopular with farmers and have been studiously avoided by New Zealand regulators. There are good reasons for this. By regulating inputs rather than outcomes, it can make it impossible for farmers to find innovative ways to reduce their environmental impacts.

Going with the Grain recommends that input controls should be retained within the toolkit of regulators as a last resort. They would be very unsatisfactory to all concerned, but they remain one of the few effective tools within the existing paradigm. Having the threat of input controls hanging over people’s heads should be enough to focus the mind on the need to find a better way forward. Again, some ideas on a different way forward are set out in *Going with the Grain*. Farmers have to be prepared to work together collaboratively on environmental improvement through organisations like catchment groups.

The second issue is that the current approach to regulation only ever moves the

laggards (see Gunningham, 2012; Gunningham and Sinclair, 2017). The traditional process of enforcing regulation relies on the legal process. This can be slow and expensive, especially if challenged or it goes to court, making it impossible to apply to all farmers. It can only target the most egregious breaches. In this sense, regulation aims to speed up the Darwinian approach to economics by nipping at the heels of the slowest in the herd of landowners.

We think the aim of good environmental policy should be to ‘move the middle’ – to encourage the slow starters to catch up with the best of landowners (who tend to be both profitable and with a lower environmental footprint) (see Greenhalgh and Morgan, 2021). If we want to meet our environmental goals, we simply cannot afford to move at the pace of the slowest operator.

There are other regulatory approaches that might make more sense here. For some complex occupations (such as in the health sector) we license people to operate. This creates high barriers to entry, and then lets them get on with the job at hand. They are only prosecuted for the most egregious and obvious breaches of good practice. This could be an approach used for farming, though, like input controls, it is unlikely to be welcomed by farmers themselves. Risk-based regulation – such as farm plans – is also promising in theory, but a lot depends on the quality of implementation.

Some barriers to land use change

Before moving on to alternative approaches to land use change, it is worth briefly discussing examples of specific regulations that are acting as barriers to transitions.

Water rights

Securing freshwater resources is crucial for identifying profitable and environmentally friendly land use alternatives. However, water rights are typically bound to specific land parcels and not easily transferable. This arrangement grants advantages to the status quo and perpetuates current, frequently inefficient usage patterns. *Going with the Grain* recommends that the government tackle this – which means in turn addressing the long-parked issue of resolving Māori rights and interests over

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fresh water – something the Land and Water Forum recommended back in the days of the Key government (Land and Water Forum, 2012).

Zoning regulations

Zoning regulations that create ‘permitted uses’ or that prohibit alternative activities or subdivision of rural land can be a barrier to land use change and also deny landowners the means to release capital that could be used for environmental improvement. For example, mitigation activities that necessitate earthworks or alteration to a waterbody often require resource consent. While many councils have categorised mitigation techniques as permitted activities, this varies across regions, and landowners also often face a long list of conditions that can be difficult to meet.

Adopting innovative land use practices can be challenging when landowners bear the responsibility of proving reduced environmental impact, especially if the

criteria are overly stringent or expensive to meet. Subdivision is one contentious example of a potentially environmentally beneficial land use change that faces significant regulatory obstacles. Local government regulations frequently prevent landowners from subdividing and selling property for lifestyle blocks or other uses deemed non-productive. These rules were initially implemented due to farmers’ concerns about lifestyle properties encroaching on agricultural land. More recently, urban planners and developers have embraced these restrictions to discourage low-density development, as exemplified by Waikato Regional Council’s Future Proof Strategy (Future Proof Te Tau Tītoki, 2024). However, allowing subdivisions could provide landowners with the financial means to enhance environmental practices or transition to alternative land uses.

New Zealand Emissions Trading Scheme

The greatest current driver of land use change in New Zealand is the NZ ETS, which is both incentivising certain uses (pine forestry) and inhibiting others. Viewed through the lens of reducing net emissions, the NZ ETS has been successful. However, from the perspective of gross emissions reductions, it has been a failure. And from the perspective of land use, it is becoming a massive liability.

Carbon emissions stay in the atmosphere effectively forever, so any forest we plant as an offset must also remain forever. Can we make that promise as a country, given the risks of fire, disease, natural disasters and a changing climate? As emissions continue, we must plant more and more forests. We are altering rural communities and removing choices from future generations about how to use that land to delay the inevitable fact that we need to reduce gross emissions (see also Parliamentary Commissioner for the Environment, 2019). As a nation, are we happy to collectively carry that liability? The time for delay is long past. Technologies now exist that a rising carbon price should be able to incentivise.

Instead, money is pouring into our landscapes from fossil fuel users, changing them forever without consideration of what land uses best suit the landscape in

the long term. As pine sequesters carbon more quickly than other tree types, there is no consideration of the other environmental issues generated by planting a monoculture. We have seen the results of this already in Tairāwhiti and we can expect disasters like this to happen more frequently with climate change.

A way forward?

To change the current trajectory of rural environmental degradation, first there must be a broad acknowledgement by policymakers that our current approach to regulating the environmental impacts of land use is not working. Neither devolution nor centralisation have worked. How then do we find an appropriate middle ground that is practical, and where both communities prosper and the state of the environment improves? A new approach is needed to stop the policy pendulum swinging wildly as it is currently doing.

Going with the Grain advocates that we tackle environmental pressures imposed by rural land uses in a joined-up way – in what is often described as a landscape approach – and focus on catchments or sub-catchments as the practical unit at which land users need to be engaged.

There is limited time, money and expertise to do this well, so regulators should focus on the catchments or sub-catchments where the pressures are the greatest and where the biggest changes are likely to be required. We need to make progress where we are most at risk, rather than advance incrementally everywhere.

To have a chance of making progress in the more challenging catchments we need to do four things.

Bring decision making closer to the people who will have to make significant management changes or even change land uses

Central and regional levels of government have to agree on *what* the desired environmental goals and outcomes are, but *how* those are met should be led and driven by landowners, local communities and mana whenua. We are inspired by Ostrom's (1990) design principles on how to manage common-pool resources at a catchment or sub-catchment level. It makes sense to offer incentives only to those willing

Currently,
New Zealand's
environmental
data, monitored
within the
environmental
reporting
framework, is at
best fragmented
– lacking
geographical
coverage or
consistent time
series – or at
worst not even
accessible.

to work collectively, and focus regulatory attention on those unwilling to take part in collaborative processes. Tackling our environmental deficit cannot be optional but it does not all have to be driven by a central rule book. The *Going with the Grain* report does not go into detail about the structure and governance of catchment groups. This would require some careful thinking about where regulation ends and where collaboration begins; about power inequalities in small groups, as well as the risk of capture; and how to share costs.

Everyone – regulators and regulated alike – needs cheap, easy access to high-quality environmental information

This is an investment that needs to be made by the government as a freely available public good; it cannot be made by individuals acting alone. Farmers and regional councils should be able to access the same information free of charge.

Currently, New Zealand's environmental data, monitored within the environmental

reporting framework, is at best fragmented – lacking geographical coverage or consistent time series – or at worst not even accessible. This data and information are often only available behind a prohibitive paywall, presented in a complex format that cannot easily be used, or have simply been lost. Indeed, the funding of New Zealand's environmental monitoring system is inexcusably low and has been static for many years. There is also a wealth of non-government environmental data held by landowners and companies that is inaccessible. Without such information, regulators and land users are constrained in their ability to make decisions about land use change.

Water regulation provides a good case in point. For a country that depends on its bioeconomy for its comparative advantage, it is startling that we do not have consistent statistics on water use available at a national level. Nor is our water monitoring network sufficient to confidently detect whether thresholds are reached for key water quality measures, including visual clarity, and phosphorus, nitrogen and *E. coli* concentrations. To do that, a recent Our Land and Water paper estimated that investment in monitoring would have to increase by four to five times current levels (McDowell et al., 2024). Our water quality monitoring network is not up to monitoring the effectiveness of on-farm actions to reduce environmental impacts.

Until now, regulation has often been progressed where, based on the information available, it is impossible to accurately answer any of the following questions:

- Where does land use result in environmental problems?
- What are the sources of those problems?
- Which options might best improve those environmental problems?
- What are the social and economic impacts of those options?
- How can we monitor the impacts of any actions taken?

This lack of information should have been repeatedly raised with ministers at each stage of the development of the many different national policy statements. The ongoing information deficit is symptomatic of a broader problem in the New Zealand public service: a lack of monitoring and

evaluation to inform continuous improvement. Instead, we have a penchant for doing something half-heartedly and when we realise it has not worked, we chuck it out and start afresh.

High-quality, accessible data would allow catchment groups (and individual farmers) to model the impact of different actions and be able to easily identify areas where land use change will yield higher than average benefits. In return, landowners and catchment groups need to be prepared to share the details of their practices and resource use with councils.

Monitoring and auditing have to generate information that can tell us, collectively, if we are making a difference at the catchment level, rather than just become an inventory of farm-level box ticking. Farm plans could be a useful part of the toolkit under the proposed approach. However, as currently conceived, farm plans seem to require voluminous amounts of information that is costly to assemble and certify and may not really make a difference. Farm plans need high-quality information that can be linked up through something like catchment groups.

We must be upfront about the potential cost of making changes and who is going to have to pay

We need a coherent and equitable basis for deciding who will pay to make those changes. If no one will, the environment will continue to carry those costs. What costs should lie with landowners? When should public subsidy be available to facilitate land use change, and how should that public subsidy be funded?

Socialising the costs of land use change is always the easiest route politically, but it can be eye-wateringly expensive. It cost \$80 million of public money to purchase a 20% reduction in the flow of nutrients into Lake Taupō. The lake's iconic recreational status provided an urban constituency for such

largesse. It is unlikely to be repeated in anonymous reaches of rural Aotearoa devoid of tourist attractions. Other financing solutions need to be explored – *Going with the Grain* provides some that are worthy of further investigation, including integrated grant and loan schemes, demonstration grants for first movers, and market-based mechanisms like an intensity-adjusted land tax.

We must refocus climate policy and harness it for positive land use change

Finally, to repeat the call that the Parliamentary Commissioner for the Environment has made consistently for some years, the government is now exploring limiting the rights of different land types to enter the NZ ETS. This will be an administratively complex and arbitrary way of addressing the issue, instead of dealing with the underlying cause. In the spirit of 'one tool for one outcome', it would work a lot better if the NZ ETS were purely focused on reducing gross emissions. The country could then explore other tools to encourage afforestation in a way that is sensitive and appropriate to the landscape. Options could include grants to plant forests on erosion-prone land, and creating an NZ ETS for biogenic methane that allows for offsets with commercial forestry. An NZ ETS built around biogenic methane would put all land uses on a level playing field with respect to greenhouse gas emissions.

An adaptive approach

It is important to emphasise that environmental problems resulting from land use are an adaptive challenge. They are a set of complex and ambiguous problems that require a fundamental shift in mindset, values and behaviours. They are not siloed problems that can be addressed by technical solutions and expertise alone. They require iterative

approaches tailored to the needs of different environments. As policymakers, we currently lack the toolkit to diagnose and deal with such adaptive challenges. The closest we have come in New Zealand is the process of developing the emissions reduction plans (Parliamentary Commissioner for the Environment, 2023, 2024c). Given the difficulties encountered in the first and second iterations of this process, we still have a long way to go in developing the institutional frameworks to deal with adaptive challenges.

Collectively, as policymakers, we also need to admit that we do not have all the answers and open ourselves to an experimental approach. *Going with the Grain* only sketches the contours of what such an approach could look like. Much more in-depth thinking and experimenting needs to go into designing the flexible and responsive governance arrangements that can underpin this way forward.

We do not have to completely reinvent the wheel. There are many lessons we can draw on – yes, from overseas, but also from right here in Aotearoa New Zealand. Te ao Māori and mātauranga offer great insights into holistic environmental management and governance. The process of the Land and Water Forum provides a recent experience and model of how to bring opposing world views and contradictory perspectives together. We have a foundation; now we need to build on it.

1 Data for map sourced from <https://eco-index.nz/> and licensed for reuse under CC BY 4.0.

2 Sourced from the LINZ Data Service and licensed for reuse under CC BY 4.0.

3 That said, unusually, dairy farming is a permitted activity in Waikato.

4 Water quality in the European Union is governed by the Water Framework Directive (WFD), which is largely based on principles, procedures and processes, with few 'hard' measures. The exception to this is where the WFD refers to the Nitrate Directive (1991), which regulates nitrate pollution of groundwater and surface waters from agricultural use. The Nitrate Directive limits the timing of and conditions when nitrogen fertiliser (often livestock manure) can be applied in so-called nitrate-vulnerable zones (OECD, 2017). While these thresholds and standards can be understood as input control, research suggests that they are too loose to achieve the ecological ambitions of the WFD (Wiering, Kirschke and Akif, 2023).

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