



Beyond Overseer: Exploring a landscape approach to freshwater, climate and biodiversity policy

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Introduction

- Thank you for inviting me to speak here today.
- Two and a half years ago I released a review of the Overseer model. It's entitled *Overseer and regulatory oversight* and you can find it on my website. Given the complexity of the model and the deficiencies surrounding its documentation, I recommended that the Government commission a comprehensive evaluation of the model by independent experts. I called for greater transparency about how the model works, and an alignment of Overseer's ownership, governance and funding arrangements given its increasing use in a regulatory setting.
- Two and a half years on, the Government has finally released the findings of that review together with its own response.¹

What did the Science Advisory Panel find?

- The findings of the Science Advisory Panel were devastating. The panel concluded that it did "not have confidence that Overseer's modelled outputs tell us whether changes in farm management reduce or increase the losses of nutrients, or what the magnitude or error of these losses might be." The panel considered that "Overseer's structure is not adequate to provide more than a coarse understanding of a farm's nutrient losses ... It cannot reliably estimate how changes in farm management would affect those losses."
- The review panel found Overseer as it stands cannot provide a robust numerical account of farm-scale nitrogen loss because:
 - Overseer focuses on nitrate-nitrogen – only one of the chemical forms of nitrogen. This means that Overseer does not provide a robust estimate of total nitrogen loss.
 - Overseer focuses on nitrate-nitrogen leaching through subsurface flows and does not adequately capture overland flow – which can be a significant pathway of nutrient losses as a result of high rainfall, flood events or the physical characteristics of the land.
 - Overseer relies on average climate data, but there is no such thing as an 'average year', as each year is different. As Overseer does not use actual climate data, it is not able to capture discrete events, and resulting nutrient losses.

¹ See <https://www.mpi.govt.nz/dmsdocument/46360-Overseer-whole-model-review-Assessment-of-the-model-approach>.

- Overseer relies on a highly simplistic hydrology sub-model, which uses a single soil layer and assumes uniform water movement.
- Overseer does not balance the inputs and outputs of nitrogen. This means that the model is not constrained by the fundamental laws of mass conservation.

How did we end up where we are today?

- I acknowledge that the Government is in a very difficult situation because one way or another Overseer has been hardwired or soft-wired into many regional plans as, over time, regional councils have used it to inform and implement regulations around water quality.
- It is important to understand why we've reached this point. In my view, different parties with completely different motivations have made common cause in wanting Overseer to 'work'.
- Farmers have tenaciously opposed input controls – they don't want bureaucrats coming and telling them what to do. Overseer offered the tantalising hope of an 'output' number they could target. If they could stay below it, they could claim they had managed the externality leaving their properties and tell regulators to back off. You can understand why that appeals.
- On the other hand, central government, under pressure to demonstrate measurable progress on tackling an issue of major environmental public concern, wanted a number for a completely different reason. Overseer offered a hard number that could be the target measure for reduced nutrient losses.
- Finally, regional councils who were having to implement government policies, found Overseer to be a very useful tool because it provided numbers and a vast amount of information on key inputs such as fertiliser, imported feed and stocking rates to name a few. Regional councils have been the meat in the sandwich and I sympathise with their plight.
- In fairness to the people running Overseer, they never made any secret of the fact that they didn't believe it should be used in a regulatory setting – probably because it might have made farmers more wary of it!
- In short, almost everybody, for completely different reasons, wanted Overseer to provide them with an output that we have now discovered it cannot provide. This problem cannot be wished away. My strong feeling is that whether you are an environmental regulator, a farmer or an environmental NGO, you are entitled to know that a model being used in a regulatory setting is accurate, or at the very least, that we understand the uncertainty around what it is saying. But we can't even say that.

What options has the Government proposed for the way forward?

- In the next 12 months, the Government has committed to investigate, and put in place, one or more of four options. It is clear that no single tool on its own will be the solution to improving freshwater quality in all regions of the country – a combination of tools and approaches will be needed. It is encouraging to see the Government acknowledging the serious concerns raised by the Science Advisory Panel and exploring multiple options going forward.

Option 1: New risk index tool

- The first option is to create a new risk index tool. This could potentially use elements of Overseer such as the user interface.

- In my view, a nutrient risk assessment approach as proposed by the Government could be a pragmatic way forward for addressing the risks associated with the loss of a wide range of diffuse contaminants, not just nitrogen. Such a tool could become a component of farm plans.
- While a specific contaminant risk assessment framework has not been developed yet (and several options are being discussed), I am encouraging officials to develop an approach that captures both the risks associated with management practices and the inherent vulnerability of the land (driven mainly by variability in climate and other biophysical data). Any such tool should be subject to rigorous scrutiny and completely transparent. If there is one thing we have learnt from the Overseer experience, it's the need for regular review and transparency.

Option 2: Next generation Overseer

- The second option is to develop a next generation Overseer to address the issues raised by the Science Advisory Panel and ensure that it is fit for purpose as a tool to use in appropriate regulatory settings. I am more sceptical about this plan.
- In particular, I am concerned that talking about developing a 'next generation Overseer' could raise the expectation that Overseer remains central to a comprehensive solution on water quality. It may be a useful part of the toolbox in the hands of farmers, but no one should overestimate what 'next generation' Overseer means.
- A careful reading of the Government's proposal suggests something much more modest. Tackling two of the shortcomings identified by the Science Advisory Panel (adding daily actual climate data and improving Overseer's simplistic hydrology sub-model) is only likely to make Overseer's use more credible in a small number of settings. While everyone agrees that Overseer provides a useful means to collate information about farm management practices, that doesn't extend to estimating nitrogen loss and exploring farm management changes.
- A common belief has emerged that the accuracy of the Overseer's nitrogen output does not matter because the relative magnitude of nutrient loss is just as useful. However, the Science Advisory Panel is quite clear that Overseer is "unlikely to be a reliable tool for predicting either relative or absolute nutrient loss estimates."
- Further, the Science Advisory Panel concluded that "the model structure only supports a limited output use: prediction of nutrient loss based on past measurements and records. It cannot compare scenarios or optimise a farm system". Further, "Overseer should not be used to simulate what nitrogen excretion might look like under variations in management".
- Perhaps for the reasons I've given, many seem desperate to hang onto Overseer, despite these fundamental flaws.

Option 3: Controls on practices and inputs

- The third option is greater use of controls on practices and inputs to manage nitrogen loss.
- Some sort of controls and limits on practices and inputs as sketched out by the Government may also be fairer and more transparent than continued reliance on a model that has been shown to be seriously flawed. If management practices cannot yield sufficient improvements, the only way to significantly reduce excess nutrients from livestock farming is to limit some of the inputs. The problem for regulators is, of course, that the extent of reduced inputs will depend on the infinitely variable mix of topography, climate, soils and the uses to which the land is being put.

Option 4: New approach to managing diffuse nutrient loss risk

- The fourth option is a new approach to understanding and managing diffuse nutrient loss risk. This could include:
 - near real-time monitoring of water quality at the local scale
 - a tool that provides detailed understanding of nutrient loss risk based on the characteristics of land
 - a new nutrient loss model.
- I certainly encourage the Government to invest in near real-time monitoring of freshwater quality (and ideally also flow rates) as part of its programme to strengthen the environmental reporting framework.
- As for a risk tool based on the biophysical characteristics of the land, this too sounds promising. Getting a more fine-grained understanding of how landscape attributes can influence spatial variation in environmental outcomes is a key component of an investigation I'm currently undertaking. I'd like to share some of the details of that work with you.

Concerns with the current approach

- My investigation stems from two concerns I have about the current approach to environmental policies that are aimed at changing the way people manage land and water.
- My first concern is that most of the focus to date has been on farms and farm-level management, particularly in the case of freshwater policy. Each landowner is responsible for the flows of contaminants lost from their land, regardless of the fate of these pollutants once they cross the property boundary or seep beneath the root zone.
- This farm-level approach has been supported by farm system management tools such as Overseer, and often coupled with national regulations containing uniform rules for how landowners are to manage their land. The national cap on nitrogen fertiliser application rates for pastoral land of 190 kilograms per hectare per year in the National Environmental Standards for Freshwater is one example.
- But treating all farms equally doesn't make sense because freshwater contaminants flow across and through property boundaries, and property boundaries are rarely aligned with the biophysical attributes of the landscape. We need to consider the catchment and the land and water within it as an interconnected system. Freshwater contaminants are very unlikely to likely to have uniform sources. The greatest gains could be made by focusing scarce resources on the most vulnerable areas – if we can identify them accurately.
- My second concern is that the policy framework that has been assembled to deal with freshwater quality, climate change and biodiversity is complicated and fragmented. We now have an amended Climate Change Response Act, an Essential Freshwater package, National Environment Standards for Plantation Forestry, Te Mana o te Taiao and a forthcoming National Policy Statement for Indigenous Biodiversity, to name a few.
- We have also developed a very complicated funding landscape. There are currently at least 20 distinct environmental funds and programmes relating to agriculture and forestry, totalling

several hundred million dollars annually (excluding Jobs for Nature).² Finding your way around this jungle can be challenging for landowners and catchment group members who have businesses to run.

- Worse, dealing with different pressures in isolation can lead to unintended consequences and perverse outcomes. For example, relocating high nitrogen loss activities such as dairying onto less well-draining soil can reduce nitrate leaching to an aquifer but increase nitrous oxide emissions, as well as surface runoff and all the attendant issues with sediment, *E. coli*, phosphorus and ammonia.
- I was intrigued by a paper I read a few years ago about the consequences of taking land out of pasture and putting it into forest in the Wairarapa: for some years, nitrogen loss was modelled to *increase* as a result of gorse and broom invading the land. As a landowner myself I'm acutely aware of the way in which land use change can allow weed invasion which is not always environmentally benign.
- I'm also concerned about the unintended consequences of the climate policy debate that commenced with the goal of reaching 'net zero by 2050'. There seemed to be an unchallenged assumption that planting trees was a legitimate, low cost means of reaching such a target.
- You are probably aware of the strong concerns I voiced in my *Farms, forests and fossil fuels* report. I concluded that trying to meet climate goals through tree planting was a strategy that treated the landscape as a place to dump carbon emissions from transport and industry while leaving gross emissions unchecked. It would also be risky because we have no way of guaranteeing that the carbon sequestered by trees will remain safely locked up for centuries. Forests are vulnerable to storms, fires, pests and disease – which climate change itself will intensify.
- I note that the Climate Change Commission's first package of advice to the Government proposed that carbon removals by forests should only be used to offset emissions from hard-to-abate sectors. Let's see how the Government responds to this recommendation later this year.
- In the last chapter of *Farms, forests and fossil fuels*, I called for a "landscape approach" that would "focus on the landscape as a place in which a wide range of interrelated environmental, social and economic services are provided", and "integrate all that we know about environmental processes at the landscape scale with bottom-up, grass-roots knowledge".³ I also suggested putting a levy on biological greenhouse gas emissions, then recycling the revenue back to the landscapes and communities it came from and using it to improve climate and other environmental outcomes. This was the genesis of my current enquiry.

² At-risk catchments project, DOC Community Fund, Drought Recovery Advice Fund, Erosion Control Funding Programme, Freshwater Improvement Fund, Global Research Alliance, Greenhouse Gas Inventory Research Fund, Hill Country Erosion Programme, Jobs for Nature, Mātauranga Kura Taiao Fund, MfE Community Environment Fund, Nature Heritage Fund, New Zealand Agricultural Greenhouse Gas Research Centre, Ngā Whenua Rāhui Fund, One Billion Trees, Our Land and Water, Pastoral Greenhouse Gas Research Consortium, Productive and Sustainable Land Use, Smarter Targeting of Erosion Control, Sustainable Food and Fibre Futures, Sustainable Land Management and Climate Change projects.

³ See <https://www.pce.parliament.nz/publications/farms-forests-and-fossil-fuels-the-next-great-landscape-transformation>.

Investigation on integrated landscape management

- My follow-up investigation will test the hypothesis that a fine-grained, integrated landscape approach to freshwater, climate and biodiversity policy will result in better environmental outcomes than a coarse, fragmented approach that treats all land the same way.
- The new investigation will be based around two case studies – one in Northland, one in Southland. The Northland case study is the Wairoa catchment. This includes the Wairua, Mangakāhia and Wairoa rivers (including the Hikurangi swamp), all of which drain into the Kaipara Moana.
- The boundary of the Southland case study is still being finalised. At a minimum, it will cover the area associated with the Wendonside catchment group bounded by the Waikaia River to the east and the Maitai River to the west. If we can find the money we'd like to expand it to cover the whole of the Maitai catchment.
- These catchments were chosen because they represent two very different settings, landscape attributes and climates. Data availability was also an important factor.
- The multiple environmental pressures I'm focusing on are:
 - Greenhouse gas emissions – methane from livestock, nitrous oxide from (i) urine and dung and (ii) use of synthetic nitrogen fertilisers.
 - Freshwater quality – nitrogen, phosphorus, sediment and microbes. I'm aware that there are also links with freshwater quantity – for example, planting forests can alter water yields within the catchment. My initial focus will be on freshwater quality because this is the policy area in which significant new government policy has recently been advanced.
 - Soil erosion – this is a big issue in the Wairoa catchment, and the main driver behind the Kaipara Moana Remediation project.
 - Indigenous biodiversity.
 - Resilience to a warming climate – we need to build climate resilience into every land use decision we make. Climate change is already having real impacts on the agricultural sector and this will only intensify with further shifts in temperature, rainfall and extreme weather events over the coming decades. We need to consider which land uses will be best suited to the coming changes in local climates.
- Some progress can be achieved through changes to land management practices. But there are limits to how far that can get you and, in some places, fewer livestock and/or changes to less emissions-intensive land uses are also likely to be part of the solution. This may require investment in trialling and scaling up alternative land uses and the supply chains needed to support these land use opportunities.
- Solutions that run *with* the grain of the land, such as rehabilitating native bush and restoring wetlands, can be particularly well suited to addressing multiple environmental outcomes and enhancing resilience.
- For a landscape approach to work, communities need to be able to access and use different sources of information. I'm particularly interested in how communities can use physiographic science to better understand the relationships between landscape attributes and freshwater quality and nitrous oxide outcomes with great precision. This is helpful for identifying and prioritising the best locations for on-farm interventions or land use change.

- Alongside this science lens, options for changing the landscape will also need to be evaluated from a kaupapa Māori perspective. The interconnected nature of land, water and people is at the heart of te ao Māori, and some Māori collectives are at the forefront of exploring alternative land use opportunities that they see as being consistent with being kaitiaki of the land.
- It's easy to talk about land use change. But it comes with an economic cost attached and we shouldn't run from this. To that end, I'm also planning to use economic land use modelling to explore the extent to which recycling the revenue from a levy on biogenic greenhouse gas emissions could enable rural communities to implement these changes.
- I'm basing this exercise on a levy because (1) it has been a live proposal for some time now and (2) a levy is a fairly sensible tool to use when it doesn't matter where you conduct an activity. Emitting a kilogram of methane in Northland has the same effect on the climate as emitting a kilogram of methane in Southland. Therefore a national-level levy on these emissions makes sense.
- There are different ways a levy could be designed. The He Waka Eke Noa partnership is currently exploring options for a farm-level levy. If farm-level proves too difficult, a processor-level levy could be explored.
- The revenue from a biological emissions levy could then be directed back to the landscapes and communities it came from. That revenue could be used to support tree planting, wetland restoration, shifts to less intensive land uses and other activities that reduce the impact of intersecting environmental pressures.
- The Government has already announced that the revenue from the New Zealand Emissions Trading Scheme will be recycled. The same has to apply to any levy on biological emissions.
- The key question is: who would get to spend that levy money? A key aspect of a landscape approach is greater community participation and responsibility in decision making. I am interested in governance models that encourage coordinated action by landowners and support solutions that are tailored to local circumstances and reduce costs.
- In Southland, a network of over 20 farmer-led catchment groups has been established to manage freshwater quality. This network is being supported and coordinated by the Thriving Southland initiative. These are the sorts of initiatives that will need to be built on if landscape-level initiatives are to be made to work.

Conclusion

- Let me finish by saying that at a time of challenging environmental catch-up and change, we must be wary of isolated policies that generate unintended consequences. The sum total of climate and other environmental pressures raise the prospect of potentially significant land use change. That will be unsettling for many landowners and many people will be asking just how much assistance there will be available to make the necessary changes.
- From my point of view, we should be investing in farming businesses or production forests because they are commercially robust. Internalising some or all of the environmental costs of these activities changes the parameters of what is "commercially robust". This will, in future, mean planting the right trees and grazing the right animals on the right land. This is something that has to involve landowners and land managers in a way that leverages their very considerable, place-based expertise. What we must avoid is seeing the landscape as a place where we can park the problems of other sectors.

- In short, we need to ensure that freshwater, climate and biodiversity policies have a long-term focus and do not lose connection with landowners and kaitiaki. There are no quick fixes to problems that have been many decades in the making.

For more information visit pce.parliament.nz