Notice is hereby given of the

Strategy and Policy Committee - Rautaki me Mahere

Wednesday 26 June 2024 at 10:00 am

Environment Southland Council chamber, 220 North Road, Invercargill
24/S&P/32

Committee Members

Cr Lundal Ludlow (Chair)
Cr Neville Cook
Cr Paul Evans
Cr Alastair Gibson
Cr Phil Morrison
Cr Robert Guyton
Cr Peter McDonald
Cr Jeremy McPhail
Cr Jon Pemberton
Cr Maurice Rodway *(Deputy)*
Cr Eric Roy
Chairman Nicol Horrell *(ex officio)*
Stewart Bull *(mana whenua appointee)*
Ann Wakefield *(mana whenua appointee)*

For **now**
& **our future**

Agenda

This meeting will be livestreamed through YouTube and will be available to view on our website. https://www.es.govt.nz/about-us/live-stream

Lucy Hicks

General Manager – Policy and Government Reform

Rachael Millar

General Manager – Strategy, Science and Engagement

RECOMMENDATIONS IN COUNCIL REPORTS ARE NOT TO BE CONSTRUED AS COUNCIL POLICY UNTIL ADOPTED BY COUNCIL

Terms of Reference
Strategy and Policy Committee

Council assigns to the Committee responsibilities from time-to-time, and the Committee provides advice and reports back to Council on:

1. the provision of governance oversight into the development and review of plans, policies, strategies and by-laws;

2. the recommendation to notify proposed changes or variations to proposed plans, policies, strategies and by-laws;

3. the governance oversight of consultation related to regional policies, plans and strategies;

4. the appointment of hearing committees or panels to hear submissions on regional policies, plans and strategies;

5. undertaking Water and Land Plan associated project work;

6. the receipt, and if necessary endorsement of, scientific studies/reports; receipt of SOE reports and/or score cards;

7. the compiling of submissions to Government as needed (if the Council timetable does not provide for same).

1 Welcome I Haere mai

2 Apologies I Ngā pa pouri

At the time of the agenda closing, no apologies had been received for this meeting.

3 Declarations of interest

At the time of the agenda closing. No declarations of interest had been received for this meeting.

4 Public forum, petitions and deputations I He huinga tuku korero

At the time of the agenda closing, no public forum, petitions or deputations were received for the meeting.

5 Confirmation of minutes I Whakau korero

Attached are the minutes from the meeting held 8 May 2024

Minutes of the Strategy and Policy Committee

Held at Environment Southland, 220 North Road Invercargill
Wednesday 8 May 2024 at 10.00 am

Present:

Cr Lyndal Ludlow (Chair)
Chairman N Horrell (ex officio)
Cr Neville Cook
Cr Paul Evans
Cr Alastair Gibson
Cr Robert Guyton
Cr Jeremy McPhail
Cr Phil Morrison
Cr Jon Pemberton – *From 10.17 am*
Cr Maurice Rodway
Cr Eric Roy
Ms Ann Wakefield (Mana whenua representative)

Also Present:

Ms Rachael Miller (GM Science Strategy and Engagement)
Ms Lucy Hicks (GM Policy and Government Reform)
Ms Bobbi Brown (Great South)
Mr Nick Talbot (Team Leader, Air and Terrestrial Science)
Mrs Liz Devery (Regional Planning Manager)
Mr Marcus Roy (Policy and Government Manager)
Mrs Mikayla Wass (Meeting Secretary)

1 Welcome I Haere mai

Cr Ludlow welcomed everyone to the Strategy and Policy committee meeting for Wednesday, 8 May 2024, and opened with a karakia.

2 Apologies

The Chairman advised he may have to leave the meeting early today, to attend the funeral of former Councillor, Derek Angus.

Resolved:

Moved Cr McPhail, Seconded Cr Gibson, that apologies be accepted on behalf of Mr Stewart Bull and apologies for lateness be accepted on behalf of Cr Pemberton.

Carried

3 Declarations of interest

There were no declarations of interest.

4 Public forum, petitions and deputations I He huiuga tuku korero

There were no public forum, petitions and deputations.

5 Confirmation of minutes

Resolved:

Moved Cr Morrison, Seconded Cr McPhail, that the minutes of the Strategy and Policy Committee meeting, held on 27 March 2024, be taken as read and confirmed as a true and correct record.

Carried

6 Notification of extraordinary and urgent business I He panui autaia hei totoia pakihi

Resolved:

Moved Cr Roy, Seconded Chairman Horrell, that the report titled '2024-2034, that pursuant to Section 46A(7) of the Local Government Official Information and Meetings Act 1987, the following items be dealt with under Notification of Urgent Business

Item 1 – 2024-2034 Long-term Plan Consultation Closing Date Extention

The reason that this item was not included on the agenda papers is because the proposal to extend the closing date for receiving submissions was not taken until after the agenda papers had been circulated.

The reason that this item cannot be delayed is because the extended closing date will already have passed by the time the next meeting of Council is held.

Carried

7 Questions I Patai

There were no questions asked by the membership.

8 Chairman and councillors reports

Cr McPhail reported on the Ballance Farm Environment Awards and the visit to the winner's property

Resolved:

Moved Cr Morrison, Seconded Cr Gibson that the Chairman and Councillor reports be received.

Carried

9 Staff reports

9.1 Update on the Beyond 2025 Long-term Plan

Bobbi Brown from Great South provided an update on the progress to implement the Beyond 2025 Long-Term Plan with particular focus on the unified Data Systems (data repository and dashboards) and housing. She also gave brief updates on water, aquaculture and energy. A copy of the presentation was retained for the file.

A short discussion took place on transport. It was noted that staff would prepare a report on transport priorities to bring to the next Strategy and Policy Committee meeting.

Resolved:

> **Moved Cr McPhail, Seconded Cr Gibson that the Strategy and Policy Committee receive the report 'Update on the Beyond 2025 Long Term Plan'.**

Carried

10:17 am - Cr Jon Pemberton arrived

9.2 Science update – Air quality monitoring

The purpose of this item was to update Council on the air quality monitoring programme with a focus on Particulate Matter of 2.5 microns ($PM_{2.5}$). Monitoring results from a recent Nitrogen Dioxide (NO_2) study were also provided. A copy of the presentation would be retained on file.

It was noted that going forward, quarterly science updates would be provided to a group of second tier managers from across Southland Councils and Te Ao Marama, to ensure the information was being shared.

Resolved:

> **Moved Chairman Horrell, Seconded Cr Cook, that the Strategy and Policy Committee:**
>
> 1. **receive the report 'Science update – Air quality monitoring'; and**
> 2. **receive results from the Waka Kotahi and NIWA Invercargill nitrogen dioxide investigation.**

Carried

9.3 Water and land portfolio update

This item was to provide an update on the water and land portfolio work that has advanced since the last update to this committee on 27 March 2023. It was noted that the outstanding appeals for the proposed Southland Water and Land Plan (pSWLP) were being progressed, and that an item was included in the upcoming extraordinary meeting of Council, seeking to make the pSWLP partially operative.

Resolved:

> **Moved Cr Roy, Seconded Cr Cook, that the Strategy and Policy Committee receive the report 'Water and land portfolio update'.**

Carried

9.4 Group Programme Update

This report gave an update on the work being carried out by the Strategy, Science and Engagement Group and the Policy and Government Reform Group. It was noted that government had indicated there would be two RMA amendment Bills proposed in 2024.

Resolved:

> **Moved Cr Cook, Seconded Cr McPhail, that the Strategy and Policy Committee receive the report 'Group Programme Update'.**

Carried

9.5 Update of Councillor Requests and Actions

This report captured Councillor requests and actions that had occurred during Strategy and Policy Committee meetings and provided an update on how the requests were being responded to.

Resolved:

Moved Cr Roy, Seconded Cr McPhail that the Strategy and Policy Committee receive the report 'Update of Councillor requests and actions'

Carried

10 Extraordinary/urgent business |He panui autaia hei totoia pakihi

10.1 2024-34 Long-term Plan Consultation Closing Date Extension

This item was prepared for Council to formally adopt the extension of the 2024-34 Long-term Plan consultation closing date to 5:00 pm, 13 May 2024. It was clarified for the meeting that the finalised document was required to be adopted by 30 June 2024.

Resolved:

Moved Cr Cook, Seconded Cr Evans, that Council:

1. **Formally approve the extension of the closing date to 5.00 pm. 13 May 2024 for the following 2024-34 Long-term Plan consultation document, supporting information and concurrent consultations:**
    - **Consultation Document, Investing in Southland Whakangao ki Murihiku;**
    - **Draft Financial Strategy;**
    - **Draft Infrastructure Strategy 2024-2054;**
    - **Draft Groups of Activities/Performance Framework (including links to strategic direction and levels of service);**
    - **Draft Financial Information (including Prospective Financial Statements, Disclosure Statement and Funding Impact Statement);**
    - **Proposed Financial Reserves Policy;**
    - **Draft Statement of Accounting Policies;**
    - **Draft Statement of Investment Policy and Objectives (SIPO);**
    - **Proposed Treasury Policy;**
    - **Proposed Marine Fee Reserve Allocation Policy;**
    - **Significant Forecasting Assumptions;**
    - **Draft Revenue and Financing Policy;**
    - **Draft Funding Needs Analysis;**
    - **Revenue and Financing Policy update and rating review 2024 Statement of Proposal;**
    - **Fees and Charges Schedule 2024-2025 and associated Statement of Proposal;**
    - **Proposed Rates Remission and Postponement Policy (including for Maori Freehold Land) and associated Statement of Proposal;**
    - **Proposed Significance and Engagement Policy and associated Statement of Proposal.**

Carried

11 Public excluded business I He hui pakihi e hara mo te iwi

There was no public excluded business.

Termination

There being no further business, Cr Ludlow closed the meeting with a karakia at 12:10 pm.

8 Chairman and councillors reports I Ngā purongo-a-tumuaki me ngā kaunihera

At the time of the agenda closing, no Councillor Reports were received for the meeting.

9 Reports

9.1 Options for Managing Commercial Forestry in Southland

Report by: Ali Meade, Biosecurity & Biodiversity Operations Manager
Approved by: Lucy Hicks, General Manager Policy & Government Reform
Paul Hulse, General Manager Integrated Catchment Management
Report Date: 19 June 2024

Purpose

To inform the Committee that the Southland Mayoral Forum has recommended that ES investigates three regulatory and non-regulatory options to manage the anticipated adverse impacts from commercial forestry in Southland and to seek further instructions.

Summary

The ongoing expansion of commercial forestry within Southland has caused a degree of concern in Southland in recent years, given its potential and realised adverse impacts on Southland's communities and its natural environment. They include the rise in wilding issues, which threatens the indigenous biota, as well as the potential decline of rural communities.

In March 2024, a report was presented to the Mayoral Forum to inform the members of the available options for managing commercial forestry and in particular non-regulatory measures such as a voluntary accord. That report outlined various workstreams occurring throughout the Southland councils to establish more stringent regulatory controls to protect regional matters of importance. This report reflects the content presented to the Mayoral Forum and seeks further instructions for the future.

Recommendation

It is recommended that the Strategy and Policy Committee resolve to:

1. note the recommendation from the Mayor Forum;
2. support the initiation of the preliminary investigation to review of the Regional Pest Management Plan to enhance measures for controlling wilding conifers and the possible development of the best practice guideline and the voluntary accord.

Background

Environment Southland and Southland District Council have recognised an increase in exotic forestry, including partial and full farm conversions over the last several years. This trend is also being observed in other rural areas throughout New Zealand.

One of the key drivers for increasing commercial forestry across New Zealand and Southland is the high market price of carbon credits and broader international signals seeking the mitigation and offset of carbon emissions. It is anticipated, despite the recent fluctuations in price, that carbon credits may continue to increase in price, which will in turn incentivise more landowners to invest in generating them through planting commercial forestry.

It is important for the Southland economy to have diverse economic opportunities and be able to manage emissions within the rural sector. However, local government must ensure that any adverse effects from land use change are appropriately managed through regulatory and non-regulatory methods as necessary.

National and regional regulations controlling commercial forestry are relatively permissive and forestry can be established in most locations throughout Southland. Several changes are currently underway which will improve regional regulatory measures and better manage the impacts of commercial forestry, these changes are outlined in Appendix A.

In addition to the changes currently underway, there are other regulatory and non-regulatory options which could be progressed such as, a voluntary accord, best practice guideline for Southland and amendments to the Regional Pest Management Plan (RPMP). These options are discussed in more detail below.

Options

1. Voluntary accord

A voluntary accord would be a mutual agreement between industry and agencies about how to manage the impacts and outcomes from commercial forestry.

Advantages:

- Working with industry to articulate and have a common understanding of issues and objectives;
- Could enable the industry to work closely with regulators to establish a common approach to managing forestry impacts;
- Quick to initiate due to lack of public consultation requirements.

Disadvantages:

- Not a regulatory control. A 'voluntary accord' could not be enforced if one party does not act in accordance with it;
- Likely to be difficult to find alignment or agreement due to industry and agency perspectives and positions.
- Staff are aware of a disparity of possible support for this approach via both informal conversations and formal proceedings such as Environment Court hearings on the proposed Southland and Water Plan.
- As forestry companies work nationally, this approached is more suitable as a national level resource

2. Best practice guideline

A best practice guideline is a document generated by the regulatory agency to inform and educate industry on best practice standards and processes.

Advantages:

- Quick to initiate due to lack of public consultation requirements.
- Could be generated by one agency without input from industry. However, would obtain better buy-in and achieve better outcomes if developed with industry involvement.

Disadvantages:

- No regulatory controls, a best practice guideline could not be enforced, it is only guidance.
- If not generated with input from industry it may not 'fix the problem'.
- As forestry companies work nationally, this approached is more suitable as a national level resource

3. Amend the Southland Regional Pest Management Plan 2019-2029

Created under the Biosecurity Act 1993, the Southland Regional Pest Management Plan 2019-2029 exists to prevent, reduce or eliminate adverse effects from harmful species that are present in the region. The plan could be strengthened to regulate the planting of specific species (such as Douglas Fir) in specific areas where it has the potential to cause adverse effects. The plan is operational until 2029 unless a decision is made to review it prior.

Advantages:

- Regulatory controls may be able to restrict commercial forestry species being planted in specific areas. The plan could potentially ssssify commercial forestry species (such as Douglas Fir) as a "pest", meaning that enforcement action could be undertaken if compliance with the plan is not achieved.
- It regulates species, so could prevent tree lanes and beautification/domestic planting from being established.
- Replanting of an existing commercial forestry that had previously been Douglas Fir would need to comply with any changed pest management plan requirements. Accordingly, an alternative species may need to be established.
- Regulations can be specific to locations or species meaning that at risk areas can have higher regulatory controls.
- Reviewing the Pest Management Plan could fill in gaps that District Plans are unable to regulate (e.g. areas prone to wilding pines that are outside of SNAs' and high value landscapes).

Disadvantages:

- A review of the Pest Management Plan occurring sooner than required, would impact budgets and work programmes.
- The review will take several months due to the regulatory process requirements (notification, public submissions, and hearing requirements).
- The review would involve a large amount of staff time to progress.
- Potential risk of industry strongly opposing new regulatory measures.

Notes:

- Prior to embarking on a review of the Regional Pest Management Plan, a robust risk and legal analysis assessment will need to be undertaken to ensure that the proposed work would be fit-for-purpose. Any significant shift in our regulatory measures carries risks, which need to be further articulated prior to commencing, and regularly tested during the review process.
- Environment Southland's Biosecurity team has a close working relationship with other biosecurity teams throughout New Zealand and the Ministry of Primary Industries who are also working on Pest Management Plan changes. Workshopping proposed changes with other regions would be an important step to ensure that the work aligns with the direction being considered by the wider sector.
- It should be noted regarding timing that the recommended review of the RPMP does not negate the need to undertake a full plan review in 2029. However, a partial review now could address some of the tasks required for the full plan review in advance.

Risks/Opportunities

The proposed changes aim to mitigate the risk associated with new afforestation and the re-planting, however, the wilding risk from existing plantations and shelterbelts will remain until the trees are harvested, which can be up to 100 years.

Banning or restricting the planting of new wilding conifers by giving them legal pest status is likely to result in economic costs. As such, further assessment would be needed if this option is supported. The Council will need to be satisfied that the benefit of reducing the risk of wilding conifers will exceed any costs to the region.

Views of affected parties

The forestry sector may have differing views of the issues and perceived issues regarding commercial and permanent forestry. In previous conversations and submissions, forestry companies have outlined that the standards in the NES-PF (now NES-CF) are sufficient to manage the effects of forestry within Southland.

The not-for-profit sector involved in the control of wilding conifer expressed many concerns, such as the continuing risk of reinvasion by wind-blown seeded wildings, and the lack of appropriate transitional arrangements. They actively support the introduction of measures to strengthen the control over the use of wilding conifers.

Fit with strategic framework

OUTCOME	CONTRIBUTES	DETRACTS	NOT APPLICABLE
Managed access to quality natural resources	X		
Diverse opportunities to make a living	X		
Communities empowered and resilient	X		
Communities expressing their diversity			X

Compliance with Significance and Engagement Policy

No implications at this stage

Considerations

Financial implications

While a detailed analysis would be necessary to calculate the benefits and costs associated with undertaking the recommended options, some preliminary estimates and initial thoughts have been provided below:

- The cost of not increasing investment for the control of wilding conifer can be substantial. For example, Otago Regional Council concluded that continuing with the current level of investment in the control of wilding pines would lead to losses of $2.1 billion over 50 years.
- A review of the RPMP as recommended, is estimated to cost approximately $200,000. It would also need to be preceded by a region-specific cost and benefit analysis to understand the financial and economic implications of reviewing RPMP. This can be carried out using the current budgets.
- The cost implementing any reviewed directions would have to be considered when assessing options.
- no budget has been assigned for the development of Best Practice Guides or a voluntary accord.

Legal implications

No legal implications at this stage

Additional Information

Southland District Council

The Southland District Plan currently does not map Outstanding Natural Areas (ONL), Outstanding Natural Character (ONC) or Significant Natural Areas (SNA) and accordingly the district plan has limited ability to prevent forestry from occurring in sensitive areas, particularly in the upper catchments and on slopes which are too steep to cultivate.

A review of the Landscapes chapter of the Southland District Plan is underway which will map and protect outstanding and natural landscapes by requiring resource consents to establish commercial forestry in these areas.

The District Plan chapter was likely to be notified in approximately May 2024 and it will have immediate effect, meaning once rules are notified resource consents will be triggered for new forestry in ONLs and ONCs.

Southland District Council have been engaging with the forestry sector and Environment Southland, about proposed changes. SDC received feedback from the sector and will continue to work with them and the Regional Council, on this plan change and its connection to other regional plan changes.

Gore District Council

The Draft Gore District Plan has recently been out for public consultation. The draft plan identifies outstanding landscapes and there is a plan to map SNAs moving forward. Rules are proposed, within the draft District Plan to manage the impacts of commercial forestry on the landscape values.

Other Central Government Changes

The coalition government promoted stronger regulations to prevent whole farm conversions to forestry. Additionally, campaign policies were proposed to prevent foreign owned land from being converted to commercial forestry.

In April 2023, changes were proposed to the Emissions Trading Scheme (ETS) to prevent carbon credits to be collected from permanent forestry, however the changes did not progress and carbon credits are still able to be collected from permanent forestry.

Ministry for Primary Industries has promoted “right tree in the right place” since the NES-PF came out in 2017. This work prompted the forestry sector to consider establishing indigenous forestry in certain areas where the impacts of short rotation exotic forestry are too high. Unfortunately, in a Southland context planting of indigenous forestry as an alternative to exotic forestry has not been widely used and the majority of forest being established are either Pinus Radiata or Douglas Fir.

9.2 Check Clean Dry advocacy messaging for 24/25 Freshwater invasive Clam inclusive / exclusive options

Report by: Ali Meade, Biosecurity and Biodiversity Manager
Approved by: Lucy Hicks, General Manager Policy & Government Reform
Paul Hulse, General Manager Integrated Catchment Management
Report Date: 20 May 2024

Purpose

To outline Environment Southland's preferred approach to Check, Clean, Dry messaging for the 2024/25 summer season.

Biosecurity New Zealand are seeking feedback from Environment Southland as a South Island stakeholder. Environment Southlands feedback was due 17 May 2024, however, MPI have been advised this needed to go to council for approval.

This decision will be shared with Biosecurity New Zealand (BNZ), Department of Conservation, Fish and Game and other South Island Councils. This will contribute to the design of a full South Island response to freshwater invasive species prevention work, considering the Freshwater Clam incursions in the North Island.

Summary

Two species of invasive clams have been found in Waikato. Check, Clean, Dry advocacy and cleaning protocols are one of the main defences that we can use to prevent freshwater invasive species spreading within New Zealand and Southland. Current guidelines are designed to prevent the spread of Didymo. These are not adequate to prevent the spread of Clams. Biosecurity New Zealand are seeking feedback on their proposed four options from South Island stakeholders including Department of Conservation, Fish and Game and other South Island Councils to proposed changes to Check, Clean, Dry (CCD).

The Environment Southland Biosecurity team are recommending the draft messaging be adopted for some but not all areas in Southland for the 24/25 season. In addition, staff believe a pathway management approach (proposed by Environment Southland) to be option 5) should also be considered by BNZ. This will support the protection of our significant areas from the spread of clams and is considered achievable for most people undertaking high risk activities.

Recommendation

It is recommended that the Strategy and Policy Committee **resolve to:**

1. Receive the report - Check Clean Dry advocacy messaging for 24/25 Freshwater invasive Clam inclusive / exclusive options.
2. Approve the messaging outlined in Option 2 - Environment Southland's preferred approach;
3. Approve a further request for Option 5 - A pathways management approach to be undertaken.

Background

Two species of exotic freshwater clams have been found in the Waikato region. *Corbicula fluminea* (discovered May 2023) is native to eastern Asia and is widely established in North and South America and Europe. It has now established in the Waikato River. *Corbicula australis* (discovered in recent months) is native to Australia, where it is common and widely distributed however in NZ it has established in one contained waterpark near Taupo. These are the two known sites and species of invasive clams in NZ.

Freshwater clams could have a significant impact on the Southland Region if they were to establish here (see Regional Services Paper National Incursion Response February 2024 at Appendix 1).

One of the tools being used to prevent further spread is advocating for Check, Clean, Dry (CCD) measures. This is tied into the long standing didymo (and other invasive aquatic species) advocacy to stop the spread throughout New Zealand. The programme has successfully kept the North Island didymo free and prevented its spread to parts of Fiordland and Rakiura. We currently contribute $10,000 annually towards a CCD advocate for Fiordland.

Clam management (based on overseas research and experience) requires updated and more comprehensive cleaning, as part of CCD protocols and incorporates

Check
- visible matter and remove debris.

Clean
- wash down gear, vehicle, watercraft and trailer with tap water in a bunded or sewage system to prevent debris entering storm water or the environment
- absorbent gear such as waders must be washed with hot 60^{o}C water for 1minute or 45^{o}C water for 20minutes, frozen or immersed in 10% bleach or isopropyl alcohol for an hour.

Dry
- to touch, inside and out, then leave to dry for at least 48 hours before using again.
- Drying inside watercraft can be done with towels, then leave the craft to dry for 48 hours.

Further research is being completed currently to establish if there are other cleaning methods in addition or that may be more practical than the current measures.

Biosecurity NZ have requested feedback from Environment Southland on preferred messaging options for the 24/25 season for Southland / South Island. They are:

Option 1: adopt clam-inclusive messaging for everyone and everywhere.
Option 2: adopt clam-inclusive messaging in high use/ high risk areas only (e.g. Fiordland, Rakiura and Waituna)
Option 3: adopt clam-inclusive messaging for trans-regional events only
Option 4: Continue normal clam exclusive messaging (status quo)

The following option has been proposed by Environment Southland:

Option 5: Environment Southland requests that Biosecurity NZ considers implementing a more formal Pathway management approach so that high risk pathways can be managed via regulation and without relying on behaviour change

Environment Southland staff recommend BNZ should consider a more formal Pathway management approach so that high risk pathways can be managed via regulation, without relying on behaviour change.
Staff have met with Fish and Game, DOC and other South Island Regional Councils to discuss the options. Staff assessment of the options is outlined below:

- Option 1 is not really feasible for the public or Environment Southland internally to meet currently. It may be possible in the future with significant investment in time and resources.
- Option 2 is potentially achievable within Environment Southland and the public, will need considerable investment.
- Option 3 and 5 is the bare minimum to prevent the most high-risk method of spread.
- Option 4 does not provide adequate risk reduction.

Risks/Opportunities

Risks

- Doing nothing increases the risk that Freshwater Clams will spread to Southland via preventable human means. Changing to a clam inclusive CCD programme will need significant time and resource investment including new signage and additional advocacy hours
- Compliance with the existing protocols is high for some user groups such as pack rafting, kayaking, and overseas fisherman. Whereas compliance is lower in other groups such as Jet boaters. The proposed clam protocols are less practical than the existing rule which could lead to the public becoming discouraged resulting in lower compliance;
- There will be a significant cost to Environment Southland and the public to implement these as any people or equipment movement between waterways will need to comply with the new guideline standards. The Environment Southland monitoring team have estimated Option 2 would cost $42,000 in equipment and Personal Protective Equipment to ensure that gear used in highly sensitive areas (Fiordland/ Te Anau) was not used in other areas of Southland. This does not factor in additional staff time to undertake the cleaning requirements. The Catchment Operations team and Biosecurity teams would also incur costs.
- Option 1 would cost significantly more and would dramatically impact the way field staff work.
- Clam inclusive CCD will not necessarily prevent clams from spreading. Currently the clam has not spread beyond the initial incursion points. However, if clams were to reach the South Island, Option 1 and movement restrictions would be the only option to prevent the spread.
- If we update messaging now and then the research develops a better way to clean, it could result in confusing messages.

Opportunity to raise awareness of the issue and influence behaviour change.

- Updated CCD messaging will refresh the brand and increase awareness of other invasive freshwater species;
- Prevention is the best biosecurity investment. The new protocol will prevent the spread of several other species and reduce the risk of a clam incursion;
- Will give more time for further research to be completed to investigate other CCD methods that may be more practical in all situations. Techniques, wash down facilities,
- Environment Southland biosecurity team recommend adopting Option 2 and Option 5.
    - Option 1 – adopt clam inclusive messaging for everyone and everywhere.
    - Option 5 – Environment Southland requests that Biosecurity NZ considers implementing a more formal Pathway management approach so that high risk pathways can be managed via regulation and without relying on behaviour change.

Views of affected parties

Some affected parties have been consulted to understand the best prevention steps.

Te ao Marama Ltd: Prefer Option 1 as it has the strongest messaging on risk and therefore prevention of Clams reaching Southland.

DOC (Department of Conservation): Prefer Option 1. If that is not possible then a combination of Option 2 and 3. Option 3 alone and Option 4 are not appropriate given the risks.

Fish and Game: Prefer a combination of Option 3 and 4. They support the continuation of current exclusive messaging and raising the awareness of clams through requiring clam cleaning through large events.

Other staff from the South Island Regional Councils have informally met and have come to consensus on Option 3 as a minimum, but their preference is for hybrids into Option 2 and 3. All councils are still to formally decide.

Fit with strategic framework

OUTCOME	CONTRIBUTES	DETRACTS	NOT APPLICABLE
Managed access to quality natural resources	y		
Diverse opportunities to make a living		y	
Communities empowered and resilient	y		
Communities expressing their diversity	y		

Compliance with Significance and Engagement Policy

Nothing in this report triggers this policy

Considerations

Financial implications

The budget implications of each option are yet to be finalised, but equipment to protect high risk sites could exceed $40,000.

All options are likely to require an increased investment in the CCD programme to increase communications and public support.

Option 3 requires at least 150 signs to be upgraded and additional infrastructure such as wash down bays or areas where boats / equipment can be cleaned would need to be investigated.

Legal implications

These are guidelines and are not enforceable.
Deliberate transference of an unwanted organism is an offence under the Biosecurity Act

Attachments

1. Biosecurity National Response Changes A10 [**9.2.1** - 4 pages]
2. CCD Protocol South Island paper April 202 [**9.2.2** - 5 pages]
3. BNZ Gold Clam Check Clean Dry Procedures [**9.2.3** - 2 pages]

Biosecurity national response changes

Objective ID: A1001995
Report by: Ali Meade – Biosecurity and Biodiversity Operations Manager
Approved by: Paul Hulse – General Manager – Integrated Catchment Management

Purpose

To provide an update to the Regional Services Committee on changes to regionally important biosecurity programmes that are led by Biosecurity New Zealand.

Summary

Velvetleaf, freshwater gold clams and plague skinks are unwanted organisms that pose an economic risk to New Zealand. Freshwater gold clams may also have a negative ecological impact. The management of these organisms currently sits with Biosecurity New Zealand (BNZ), however, BNZ are now changing their response (velvetleaf) or have specifically asked for Council assistance (freshwater gold clams).

Recommendation

It is recommended that the Regional Services Committee resolves to:

- Receive the report "biosecurity national response changes"
- Note the recommended operational approach

Background

In 2016, a national velvetleaf response was declared when contaminated fodder beet seeds were sown in 11 regions across New Zealand. Environment Southland was involved from 6 March 2016 and with the support of Emergency Management Southland (EMS) and BNZ, Environment Southland carried out the Southland part of the incursion response. Overall, a total of 4,443 ha was inspected and 199 velvetleaf plants found. The incursion response was completed at the end of April 2016, when the last 100 ha was inspected and only two plants were found. Overall, 46 people were employed in six teams (personnel supplied by Fonterra, the Southern Institute of Technology, Gore District Council, Invercargill City Council, South Roads, Fulton Hogan, Rural Support Trust, SSG Contracting, Southland District Council and Environment Southland).

Following the initial incursion, a long-term management plan was developed. This plan is managed by BNZ and Environment Southland worked with BNZ to develop farm management plans for contaminated properties. Since then, the Southland focus has been providing information to farmers to encourage self-surveillance, reporting, good farm hygiene and appropriate land management practices. Annual surveillance of high-risk sites with a biosecurity dog has also occurred. Environment Southland has provided staff time and funding to this programme over the years but involvement has declined, alongside the risk. No velvetleaf has been found in Southland since the 2020/21 growing season, however, the seedbank can last for 50 years so vigilance and management is still required (see appendix 1 for the BNZ report).

BNZ are now transferring the velvetleaf programme from their internal Pest Management Group to their On Farm Support Group. It is unclear if the transition will include ongoing surveillance.

Due to the status of the national response in 2019 when the Southland Regional Pest Management Plan (SRPMP) was being developed, velvetleaf is not included as a pest within Southland. However, velvetleaf is included in the Biosecurity Strategy as a case study that states 'Environment Southland will continue to investigate reports of velvetleaf in Southland'.

Implications/risks

The persistent seed bank of velvetleaf means it could still re-appear in Southland. High risk sites will therefore need ongoing surveillance. Wherever possible, infected land should not be cultivated and should remain in pasture. Landowners need to be skilled in the identification, reporting and control of any seedlings that occur.

Landowners that have been involved in the programme since the start, hold these skills, however, new owners may be unaware of the situation. In addition, as time passes, even engaged landowners are likely to reduce their vigilance.

Velvetleaf is still much more prevalent in Auckland and Waikato than it is in Southland, therefore, BNZ are likely to focus their resources in the North.

Next steps

Environment Southland staff will work with BNZ on the details of the new phase of the plan regarding velvetleaf management in Southland.

Environment Southland staff will:

- consider having a more active involvement in the ongoing surveillance and management of velvetleaf
- reassess the status of velvetleaf and consider inclusion in the SRPMP
- consider including cultivation restrictions in farm plans

Freshwater gold clams

Background

The freshwater gold clam (corbicula fluminea) is native to eastern Asia and is an invasive pest is many parts of the world, including the USA and Europe. It is known to be difficult to control and eradication has never been achieved. In May 2023, it was identified across a large section of the Waikato River[1]. BNZ are leading the incursion response as freshwater gold clams are a new to New Zealand organism.

The response is focusing on containing the spread of freshwater gold clams to the Waikato River, by installing wash stations, updating the national 'Check Clean Dry' campaign and increasing signage. Controlled Area Notices have been placed on 14 high-value lakes within the Bay of Plenty and catchment-wide delimitation surveillance via eDNA has been undertaken. On the 23 November 2023, an additional CAN was established to prevent Wakeboats moving from the Waikato to other waterways.

BNZ are now extending surveillance to determine if there are other populations elsewhere in New Zealand. BNZ have requested that councils support this work, by carrying out additional eDNA testing. BNZ have paid for the initial sampling of five sites within Southland. Initial sampling has been completed and no corbicula fluminea DNA was detected.

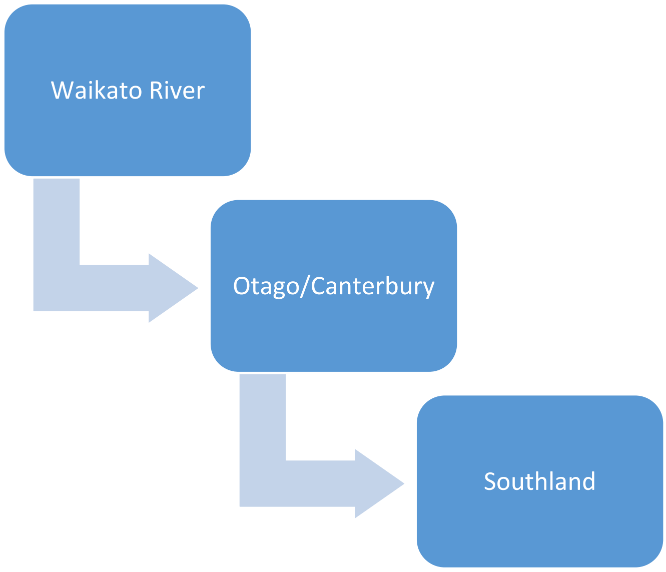
BNZ have requested that Environment Southland provide staff time and funding for all further testing. The exact cost to Environment Southland is unclear at this stage but it is estimated between $3,000 and $10,000 annually, plus staff time. This is currently unfunded in the Environment Southland budget but funding could be found by reprioritising part of the biosecurity strategy budget.

[1] https://www.BNZ.govt.nz/dmsdocument/59086-Technical-Advisory-Group-Report-Biosecurity-Response-to-Corbicula-fluminea-in-the-Waikato-River

Implications/risks

A complete regional assessment of the risk posed to Southland from freshwater gold clams has not been completed, however, a preliminary high-level analysis of publicly available information shows that the clams affect power stations, irrigation systems and drinking water intakes. Southland's nationally significant infrastructure, such as the Manapōuri Hydro Power Station, could be at risk if the clams establish. Costs reported in the USA to protect infrastructure is significant (>1 billion US$ annually[2]), however, it should be noted that these figures include the costs of shutting down nuclear power plants. Reported costs from Europe are generally lower, with Portugal reporting €200,000 annually[3] and Britain estimating a worst-case scenario of £2.5 Million cost to the power industry[4].

Thorough vector analysis has not been completed but there is thought to be only limited direct vector movement between Southland and the Waikato. However, there is movement between Otago/Canterbury with Waikato due to rowing and wakeboat events and movement between Southland and Otago/Canterbury (Figure 1). This may reduce the direct risk profile to Southland, however, if freshwater gold clams are identified in Otago or Canterbury, the risk profile for Southland will increase.



BNZ have negated the existing MOU for response management with the sector. The MOU covered the roles and responsibilities in a national incursion, including the rate BNZ would pay for Council staff engaged in a response. Te Uru Kahika, via biomanagers, is beginning to renegotiate the terms of the MOU, but without an agreement, councils could be left with very expensive staffing bills if a national response is supported.

Next Steps

Environment Southland staff will:

- support the national delimitation eDNA survey during 2023/24, utilising the Biosecurity Strategy budget as required

[2] https://nas.er.usgs.gov/queries/greatLakes/FactSheet.aspx?Species_ID=92&Potential=N&Type=0&HUCNumber=DGreatLakes
[3] https://invasivespeciesni.co.uk/wp-content/uploads/2017/08/RSS_RA_Corbicula_fluminea.pdf
[4] https://www.reabic.net/aquaticinvasions/2008/AI_2008_3_1_Elliott_Ermgassen.pdf

- keep a watching brief on freshwater gold clams and carry out more extensive risk analysis and vector analysis work if the clams are identified in Otago or Canterbury
- continue to work with Otago Regional Council and Environment Canterbury on joint biosecurity and pathways management programmes
- support Te uru Kahika's national negotiations on the biosecurity MOU and agreeing to a national response framework

Plague Skinks

Background

The plague/rainbow skinks (l*ampropholis* delicata) are native to Australia, they are abundant in some areas of the North Island and found at a few locations on the South Island. An incursion was reported in Environment Southland in June 2023. Environment Southland subsequently met with the Department of Conservation (DOC) and BNZ. It was determined that the skinks arrived in Southland when someone moved furniture down from Auckland, they were quickly identified and brought to the attention of DOC.
BNZ is the lead agency and they are working with DOC to monitor the situation. BNZ were reasonably confident they won't survive the weather in Southland. However, on the 13 November 2023, DOC reported that a small juvenile skink was been captured in October 2023. Control devices have been refreshed.

Implications/risks

If plague skinks are able to survive in Southland over the winter, it increases the risk they will establish in the region, leading to long term environmental impacts. This could be considered an early indication of the effects climate change will have on regions biosecurity risk profile.

Next steps

Environment Southland staff will:

- Continue to keep a watching brief on the situation and request regular updates from BNZ and DOC
- Include climate impact assessments of emerging pests when assessing species for the RPMP 2029

Considerations

Financial implications
Financial impacts are low at this stage and can be covered by existing budgets and staff time. However, changes to long term management could incur costs and additional cost benefit analysis would be required to add either species to the SRPMP.

Legal implications
None, all three species are currently the responsibility of BNZ.

Attachments

BNZ Velvetleaf Update (A1001208)

Request for decision on use of Check Clean Dry Protocol – South Island, 2024/25

Paper from the Check Clean Dry Working Group

April 2024

The purpose of this document is to guide a decision on whether the South Island regions will transition to clam-inclusive messaging for the 2024/25 summer.

This process is being overseen by the Check Clean Dry Working Group. (The Working Group consists of two representatives from the North Island and two from the South Island, and representatives from national organisations - Biosecurity New Zealand, LINZ, DOC, and Fish & Game NZ.)

We aim for a decision to be reached by the end of June 2024, if feasible, regarding use of the new clam-inclusive Check Clean Dry protocol, which was implemented across the North Island this past summer. This decision will aid in planning and designing campaigns and supporting resources for the 2024/25 summer, set to commence Labour weekend (28 Oct 2024).

Background
Shortly after the freshwater gold clam was discovered in the Waikato River in early May 2023, a revised version of the Check Clean Dry protocol was crafted, based on overseas research and experience. The protocol was designed to guide individuals who had visited the infested zone and to control every type of invasive freshwater species known to be here.

The other, clam-exclusive Check Clean Dry protocol, utilising dishwashing liquid, aimed to reduce the presence of weeds, algae, and pest fish. The new protocol differs in two significant ways: it omits the use of dishwashing liquid for absorbent materials as it doesn't kill shellfish, and it incorporates an initial blast of gear and craft with tap water to get rid of clams' mucous threads that can stick.

In the latter half of 2023 there was a requirement to clarify which regions would use the new, clam-inclusive Check Clean Dry as part of arranging activities for the coming 2023/24 summer. In particular, Biosecurity New Zealand needed to know for planning national digital campaigns and collateral such as flyers, both in the context of the clam incursion and also normal Check Clean Dry activity. Crucially, these needed to align with on-the-ground activities. Discussion was held with the Check Clean Dry regional ambassador contract managers (and contact people for the two regions where there is no ambassador contract operating) to work through the considerations for their region. This included contract managers themselves consulting as they considered appropriate – including with neighbouring regions in some cases. Across both islands, except for one region in each, the consensus leaned towards a unified approach: the North largely opted for a Check Clean Dry protocol inclusive of clams, while the South largely preferred to maintain a clam-exclusive protocol while raising awareness among freshwater users about the clam threat. The outlier in each case was engaged with, and they expressed willingness to align with the majority.

Consultation
During the Working Group meeting 21 February 2024, it was agreed to consult with the regional ambassador contract managers for each of the South Island regions, along with national partner organisations that operate regionally, that is: DOC, LINZ, and Fish & Game NZ.

The representatives being approached are:

Organisation	Contact	Role
DOC	Sarah McRae	Aquatic Delivery Manager, National Programmes Unit
LINZ	Julie Percival	Senior Advisor – Environmental (Natural Resources)
Fish & Game NZ	Maggie Tait	Principal Advisor Communications
Marlborough District Council	Jono Underwood	Biosecurity Manager & Check Clean Dry Contract Manager
Tasman Reginal Council	Guinevere Coleman	Team Leader Biosecurity and Biodiversity & Check Clean Dry Contract Manager
West Coast Regional Council	Emily Rutherford-Jones	Biosecurity Coordinator & Check Clean Dry Contract Manager
Environment Canterbury	Laurence Smith	Principal Biosecurity Advisor & Check Clean Dry Contract Manager
Otago Regional Council	Alfredo Paz	Community Coordinator Biosecurity & Check Clean Dry Contract Manager
Environment Southland	Jolie Hazley	Biosecurity Team Leader Pest Plants & Check Clean Dry Contract Manager

Check Clean Dry protocol – possible considerations for a region

	Advantages	Considerations/requirements
Option 1: Adopt clam-inclusive messaging for summer 2024/25.	• Proactive approach – as, based on overseas experience, the clam is considered biologically very able to spread and in New Zealand we have many "uncontrolled" pathways. • A cautionary approach that has a chance of minimising spread even if the clam does get to the South Island. • This is potentially less confusing for the high-risk water users who move across the Islands, as it aligns with the messaging in the North Island.	• The clam-inclusive protocol requires ability to soak in hot water or bleach solution or freezing, which are all typically more difficult to do than the clam-exclusive protocol. Also, the dry is more important, therefore extending the time period involved. • A signage and collateral upgrade would be required and this would likely take a couple of years. Some quick fixes and workarounds may be possible on some instances, eg sticker on relevant parts of existing signs. • Emphasis on soaking rather than spraying, so spray bottles become less useful. • Work closely with event permission givers and event organisers to ensure early adoption and understanding of new protocols. • Could possibly lead to more notifications that need to be followed up (requiring resourcing), including false positives, which means needing to provide good information on what they look like.

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Option 2: Adopt a hybrid approach. Require the clam-inclusive protocol in high-use/high-risk areas only, that is, areas that are likely to be connected to rivers and lakes in other regions via water users.	• The first 2 points above would apply – for high-use/high-risk areas (only). • It would highlight to users that they are entering an area that requires special care. • It introduces a cautionary approach to the areas that the clam is most likely to spread to first. • This could minimise the scale of the pivot required. • This could drive development of regional surveillance, including a more joined up approach across regional and district councils. • This could be a step towards a full transition in the following year (however there is danger of double handling - work would need to be done to bed this in for the one year before the transition).	• There are implications for aligned activities such as national digital campaigns and collateral. • It could be confusing for water users. (It would need to be supported by clear and effective local communications, eg signage, geo-targeted digital, talks with key audience groups, item in relevant water sports newsletters, info to i-site). • It would rely on an accurate assessment of high-use/high-risk areas, based on understanding the behaviours of a wide range of river and lake users. • This would rely on well-resourced regional surveillance - actively looking in a coordinated fashion, as finding it very early is key. • There would still be some level of risk for other areas.
Option 3: Adopt for trans-regional events only – that is, an event that attracts participants from other regions, particularly the North Island.	• This Option focuses on people – water users themselves, those who attend events. • All the Option 2 points apply here (though for people and events rather than areas). • It addresses potentially high-risk users, those that have recently used more than one river or lake or have come from an infested area. • During the past year, in the context of the clam incursion, the national Check Clean Dry network has worked with national organisations, permission givers and event organisers in relation to several events across a range of water sports, which has proved very influential, and this could be built on. • Events attract groups of water users who are ones who are likely to move and will do so in the context of the event, and they can be provided with good and timely information via the event organisers. • A good format for providing bespoke information to water user groups has been developed.	• All the Option 2 points apply here (for events rather than areas). • This requires reaching out to and working closely with event permission holders and organisers and having their cooperation.
Option 4: Continue clam-exclusive messaging for 2024/25 summer and talking about the clam threat.	• The regional would be able to continue using existing signage and collateral.	• This relies on being able to pivot quickly if the clam spreads, which is based on surveillance.

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Summary from a regional perspective for the coming year (only)

	Strategy - clam preventative (cautionary) & clam ready – if it moves	**Audience -clear for water users**	**Comms - uses existing signs**	**Comms - clear what collateral should be used, including which webpage to direct to**	**Comms - easy to align with national paid campaign**
Option 1: Adopt clam-inclusive messaging	Yes	Yes	No	Yes	Yes
Option 2: Clam-inclusive messaging in high-use/high-risk areas only	Some	No	Some	No	Less so
Option 3: Clam-inclusive messaging for trans-regional events only	Some	No	No	No	Less so
Option 4: Continue clam-exclusive messaging	No	Yes; less so if travelling across islands	Yes	Yes	Yes

Check Clean Dry protocol – national considerations

At the national level, work is done that needs to align with regional activity. This includes:

- National digital campaigns (funded by Biosecurity New Zealand)
- Provision of collateral, which includes features such as QR code links to webpages, and activity specific guides which are promoted through national water user organisations like kayakers, waka ama
- Annual ambassador training
- Development of the national surveillance activity.

Any time that a significant change would be made at the regional level this would also have significant implications for the national work and require a further pivot.

By definition, high-users move. Often this means across regions and it can mean across the islands. If there is to be a different protocol operating in different places, this needs to be communicated clearly and effectively.

It is recognised that there are uncertainties, which include:

- Lack of research internationally into biosecurity risk associated with the various life stages of the clam
- How the clam will behave in the New Zealand freshwater environments
- Whether, when and where the clam will spread.

Reflections on this past summer include:

- The clam threat and associated investment has provided a welcome impetus for the Check Clean Dry campaign, including more engagement from national water user organisations
- It showed the value of having a national Check Clean Dry network, that includes subject matter experts, experienced ambassadors and the Biosecurity NZ coordinator, who could lean in to support establishment of a new team in the Waikato
- There is remaining work to be done to pivot, even for the North Island, such as amending collateral.

Actions

- We would like an indication which of the 4 options you support for your region(s), or, if there is a different option you would prefer, or, if you would intend to transition from one to another in a given period of time. please let us know.
- We would appreciate a brief explanation of your rationale.
- We would like to hear back from you by **17 May (earlier if possible)**.

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Check Clean Dry Working Group Outputs/Timeline:

Action	Date
▪ Draft of CCD protocol 2024/25 paper	15 March
▪ Working Group sign off on paper	20 March
▪ Sent out request for input from identified key parties	2 April
▪ Due date for indication of regional protocol preference and rationale	**17 May (earlier if possible)**
▪ Working Group consideration and agreement for approach	22 May (we will shift the meeting of the Working Group to accommodate the above timeframes)

(End)

Gold Clam – Check, Clean, Dry Procedures

CHECK CLEAN DRY

When you move from the controlled stretch of the Waikato River (which is from Whakamaru Dam to the river mouth at Port Waikato) to another part of the river or its lakes, you must follow the Check Clean Dry procedures for the exotic freshwater clam for all watercraft, gear, or clothing that has come into contact with river water.

Some North Island regions are also requiring water users in their area to follow these Check Clean Dry procedures. Check with your local regional council for their specific requirements.

Note, Check Clean Dry procedures to prevent human spread of the exotic freshwater clam will also manage other freshwater pest species.

Check

- Remove any visible matter, including any clams you can see, along with plant material or mud. Drain all river or lake water.

Clean

- Wash down your gear, vehicle, watercraft, and trailer that has been in contact with river or lake water with tap water onto grass, beside the waterway or at home and not into a stormwater drain system. This will remove any remaining invisible material.
- For absorbent surfaces and materials that have been in contact with river or lake water (including carpet on trailers) use an appropriate treatment in the treatment options table on this page.
- Treat residual water that always occurs when on-board ballast bladders or tanks have been pumped.

Dry

- Allow gear to dry to touch, inside and out, then leave it to dry for at least 48 hours (2 days) before using again.
- Dry areas inside the watercraft where water has pooled, for example with an old towel, and then leave the craft to dry for at least 48 hours (2 days). The hull of a watercraft will dry when towed.

Treatment options for gear made of absorbent material

Type of treatment	Method
Hot water	Above 60°C for at least 1 minute, or Between 50 to 54°C (hot household tap-water) for at least 5 minutes, or Above 45°C for at least 20 minutes.
Freezing	Until solid (that is, freeze overnight).

Other treatment options

Type of treatment	Method
Bleach	Mix household bleach in a 10% (1 in 10) ratio with water and immerse for 1 hour.
Isopropyl alcohol	70% isopropyl alcohol, taking care as it is toxic and flammable, and there are requirements around storage and transport of isopropyl alcohol.

Note, the Check Clean Dry advice may be adjusted as further technical information becomes available or the need arises. Refer to the manufacturer's instructions for gear and any commercial treatments.

9.3 Clean Air Loans Scheme - Discontinuation

Report by: Claire Dooney, Principal Advisor - Strategy
Approved by: Rachael Millar, General Manager Strategy, Science & Engagement
Report Date: 19 June 2024

Purpose

This item provides the Strategy and Policy Committee with background and a recommendation regarding the discontinuation of the Clean Air Loans Scheme.

Summary

The Clean Air Loans Scheme (CALS) has been on hold since 2023 due to the low uptake of the loans and changes to the Credit Contracts and Consumer Finance Act (CCCFA). Following a review of CALS completed in June 2023 and Council and TAMI workshop in August 2023 it is recommended that the CALS is discontinued and a broader approach to improve air quality is explored, in addition to home heating impacts.

Recommendation

It is recommended that the Strategy and Policy Committee **resolve to:**

1 Receive the report - Clean Air Loans Scheme - Discontinuation.

2 Discontinue the current 'on-hold' Clean Air Loans Scheme.

Background

The National Environmental Standards for Air Quality (NES-AQ) set, among other things, a minimum level of health protection for all New Zealanders with respect to air quality. The NES-AQ includes a design standard for new wood burners in urban areas as well as ambient air quality standards for particulate matter less than 10 micrometres in diameter (PM_{10}). The NES-AQ allows for one air quality exceedance per year. There were 4 exceedances of the 50 $\mu g/m^3$ standard for PM_{10} in Invercargill during 2023 and Invercargill remains a polluted airshed. There were no exceedances in Gore, and this is the third year in a row there have been no exceedances at this site. The ES science team are currently undertaking a review of the air monitoring site in Gore to determine if its location enables the ambient air quality to be accurately reflected in readings.

The Clean Air Loans Scheme (CALS) was established in 2016 between Environment Southland and Invercargill City Council (ICC) and in 2017 between Environment Southland (ES) and Gore District Council (GDC) to provide 'Clean Air Loans' to ratepayers in both gazetted airsheds to assist them with the costs of moving to less polluting methods for home heating. The Clean Air Loans Scheme has been on hold since 2023 due to low uptake and changes to the Credit Contracts and Consumer Finance Act (CCCFA). The scheme had 201 loans issued from 2016-2022. The CCCFA changes were implemented to ensure new responsible lending criteria are adhered to. Individuals issuing these loans on behalf of council needed to be certified adding an increased level of complexity that wasn't feasible for ICC and GDC to implement.

A review of the CALS was completed in June 2023 along with a report exploring possible alternative options. These are attached and Council and TAMI were introduced to these reports at a workshop in August 2023. The Clean Air Loans Scheme effectiveness review (June 2023) concluded that given the low uptake of loans, the changes to the CCCFA, and many banks offering home heating loans, that the scheme should be put on hold. The CCCFA changes have since been repealed, exempting local authorities from CCCFA for voluntary targeted rates schemes including loans to install heat pumps or insulation. However, the recommendation to discontinue the scheme remains due to the remaining two reasons cited.

The Clean Air Loans Scheme alternative options report (June 2023) report outlines some initial alternative options to the CALS for consideration related to home heating and resultant air quality changes (note that this is not an exhaustive list and further work would need to be completed to determine the potential impact of these). Alongside these it is recommended that the overall Air Quality portfolio is reviewed to enable a broader approach to improving air quality to be explored, in addition to home heating impacts. This will enable further understanding of the likelihood and scale of impact of various approaches to improving air quality and an appropriate region wide strategy/plan to be developed.

Environment Southland communications and compliance work continues to contribute to improving air quality. Communications have focused on promoting best practice burning methods for home fires and outdoor burning through our Winter Air Quality campaign, promotion of the Good Wood Scheme, and maintaining the Breathe Easy Southland website. The following communication channels have been used:

- Southland Express & Gore Ensign:
  - winter warmth –tips for indoor burning (Southland Express only - 2 ads completed, 2 left to run);
  - outdoor burning (2 ads completed, 2 left to run);
  - a dry firewood feature ran on 14 March 2024 in Southland Express;
  - an enviroweek feature ran in December 2023 reminding people to get their firewood so it was dry for winter, and an outdoor burning enviroweek feature was run at the beginning of May 2024.
- Facebook:
  - weekly updates on the air quality measurements from the previous week will occur throughout winter;
  - Lumberjack Rob tips for winter video series posted on Facebook from February onwards.
- Radio:
  - Adverts playing throughout the winter period (The Hits, Radio Hauraki, ZM, Hokonui).
  - A Free Firewood Giveaway was run with The Hits and the winner received their wood on 10 June (councillors were invited to attend).
- Home Show
  - Shared booth at Southland Home Show (13/14 of July 2024) with Fire and Emergency NZ.

From a compliance perspective ES responds to complaints and a low number are received related to domestic burning. There have been five complaints relating to domestic burning since January this year and none have been confirmed (note that it is only the start of the domestic burning season for this year). Of note, there have been 52 complaints related to outdoor burning during the same period, of which 20 were confirmed as breaches.

ES also continues to financially support the Southland Warm Homes Trust subsidies which focus on improving insulation and heating for low-income households.

Risks/Opportunities

There is an opportunity to regroup and explore innovative alternative methods to meet the NES-AQ and Regional Air Plan Policy direction including Policy 3.2 (Phase Out), Policy 3.3 (Incentives programme), Policy 3.4 (Outdoor burning in the Invercargill and Gore Airsheds) and Policy 3.5 (Education) whilst retaining flexibility to adapt to future policy frameworks.

Views of affected parties

Invercargill City Council – scheme is currently on hold, no impact. ES will need to confirm CALS is ending. In their submission on the 2024-34 Long-term Plan Consultation Document, ICC requested that the scheme be discontinued.

Gore District Council – scheme currently on hold, no impact. ES will need to confirm CALS is ending.

Fit with strategic framework

OUTCOME	CONTRIBUTES	DETRACTS	NOT APPLICABLE
Managed access to quality natural resources			X
Diverse opportunities to make a living			X
Communities empowered and resilient	X		
Communities expressing their diversity			X

Compliance with Significance and Engagement Policy

This item and recommendations align with the Significance and Engagement Policy and consultation is not required.

Considerations

Financial implications

As at the end of March 2024, there was a $23,282 loan balance remaining to the councils (Invercargill City Council, Gore District Council and Environment Southland. This will gradually disappear over time.

Legal implications

There are no legal implications of discontinuing the CALS.

Attachments

1. CALS effectiveness review FINAL June 2023 [**9.3.1** - 13 pages]
2. CALS alternative options FINAL June 2023 [**9.3.2** - 28 pages]

DRAFT AND CONFIDENTIAL – NOT COUNCIL POLICY

CLEAN AIR LOANS SCHEME REVIEW

JUNE 2023

Document Quality Control

Prepared for:	Environment Southland: Strategy, Science & Engagement
Report reference:	Title: Clean Air Loans Scheme Review 2023
Prepared by:	Sonya Nicol, Southern Land and Water Planning Ltd Anke Habgood, Senior Strategy Advisor, Environment Southland
Supported and reviewed by:	Nick Talbot, Team Leader Air and Terrestrial Science, Environment Southland

EXECUTIVE SUMMARY

This report provides background to the existing Clean Air Loans Scheme (CALS) and an overview of how effective the scheme has been to date, setting out key recommendations for consideration regarding the continuation of the CALS in the Invercargill and Gore Airsheds.

The CALS was established to provide 'Clean Air Loans' to ratepayers in both Invercargill and Gore to assist them with the costs of moving to less polluting methods for home heating. Applicants must have no rates arrears and have an open fire, old wood burner or multi-fuel burner to replace. Two Memorandum of Understandings (MoUs) were developed to underpin the CALS. For the Invercargill Airshed, a MoU between Environment Southland (ES) and the Invercargill City Council (ICC) was established. ES agreed to provide ICC with a loan of up to $500,000 each year for the first three years and ICC agreed to match this. For the Gore Airshed, a MoU between ES and Gore District Council (GDC) was established. ES agreed to provide GDC with a loan of up to $140,000 each year for the first three years and GDC agreed to provide $50,000 each year over the same period. Awarua Synergy (AS) is the Service Provider for both schemes. Both ICC and GDC report back to ES quarterly regarding the number of loans made and their term, amount and type (heating assistance or installation of insulation), status of loan repayments and costs of administration. These reports are regularly presented to Council via the OPAC committee.

This report has found that since 2016, 171 loans have been issued by ICC (data as at 31 March 2023) of which the majority (75%) were approved for heating and twenty-five percent were for insulation. Since 2017, 30 loans have been issued by GDC (data as at 31 March 2023). Ninety-three per cent of these were approved for heating and seven percent were approved for insulation. For both schemes, uptake has tapered off since December 2021, with the key reason being changes to the Credit Contracts and Consumer Finance Act (CCCFA) that require ICC and GDC to put lender responsibility principles into practice to make sure the loan will be suitable and affordable for the borrower, meaning additional implications and effort is required in setting up and administering loans.

The term of both MoUs is 10 years from the commencement date. The ICC CALS therefore naturally terminates in 2026 and the GDC CALS in 2027.

Below is a high-level summary of the air quality context in Murihiku Southland, followed by key recommendations for consideration.

Air quality context:

1. Murihiku Southland has three airsheds[1], being Invercargill and Gore (both 'gazetted') and the wider Murihiku Southland region by default;
2. The Resource Management (National Environmental Standards for Air Quality) Regulations (NESAQ) required the ambient PM^{10} standard for the Gore Airshed to be met by September 2016 and that for the Invercargill Airshed to be met by September 2020. At present, both remain listed as polluted airsheds.

[1] A NESAQ airshed is a defined geographic area for air quality management, which extends upwards from ground level, with no upper limit.

3. The Southland Regional Policy Statement (SRPS) sets out a collaborative framework under which the existing CALS was established, to progressively upgrade older solid fuel heating appliances and requiring all new heating appliances to be compliant with national standards. However, with this came the expectation that air quality would steadily improve, particularly with regard to PM_{10} emissions.
4. Southland Regional Air Plan (RAP) Objective 2.3 Ambient Air Quality: Invercargill and Gore states to 'reduce adverse effects on human health and the environment by ensuring that the ambient air quality in the Invercargill and Gore airsheds is improved towards complying with the NESAQ'.
5. RAP policies set limits for new installations of small-scale solid fuel burners and boilers in the Invercargill and Gore Airsheds, with RAP rules phasing out the use of open fires and, where they do not met specified emissions criteria, existing small-scale solid fuel burning appliances.
6. The NESAQ allows for one exceedance of the ambient PM_{10} standards per year. In the Invercargill Airshed, there has been at least one exceedance per year, with three in 2021 and two in 2022.
7. In the Gore Airshed, ambient PM_{10} standards were met in 2014, 2019 and 2021 (no exceedances in 2021 or 2022).
8. There are many agencies involved with the administration of the scheme, with no single organisation driving it, although it is acknowledged that, AS is the actual Service Provider.
9. Many banks now offer home heating loans. Examples are, Westpac Warm up[2] (interest free for five years up to $40,000 (subject to criteria) and ANZ Good Energy Home Loan[3] (1.0% P.A. for three years up to $80,000).

Key recommendations for consideration:

A Discontinuing the existing CALS in light of low uptake (with a total of 201 loans issued to 31 March 2023), implications of CCCFA and with many banks now offering home heating loans; and

B Looking at new methods to meet the NESAQ and RAP Policy direction including Policy 3.2 (Phase Out), Policy 3.3 (Incentives programme), Policy 3.4 (Outdoor burning in the Invercargill and Gore Airsheds) and Policy 3.5 (Education) whilst retaining flexibility to adapt to a future policy framework that will likely, for example, monitor for $PM_{2.5}$ as well as PM_{10}.

[2] www.westpac.co.nz/home-loans-mortgages/options/warm-up/
[3] www.anz.co.nz/personal/home-loans-mortgages/loan-types/good-energy/

Contents

1. INTRODUCTION

The purpose of this report is to describe the background to, and subsequent effectiveness of, the existing Clean Air Loans Scheme (CALS) that was established for the benefit of ratepayers within the Invercargill and Gore gazetted airsheds. Furthermore, to set out key recommendations for consideration regarding the continuation of the CALS in these airsheds.

The Resource Management (National Environmental Standards for Air Quality) Regulations (NESAQ) sets, among other things, a minimum level of health protection for all New Zealanders with respect to air quality. The NESAQ included a design standard for new wood burners in urban areas as well as ambient air quality standards for particulate matter less than 10 micrometres in diameter (PM_{10}). For Murihiku Southland, this required the ambient PM_{10} standard for the Gore Airshed to be met by September 2016 and that for the Invercargill Airshed to be met by September 2020. The NESAQ allows for one air quality exceedance per year.

To implement the national regulations before they came into effect in 2016, Environment Southland (ES) undertook a review of the now previous air plan. The current RAP was adopted in 2016 and sets out the way in which ES will control and manage discharges to air, such as those that stem from domestic heating sources. The current RAP is aligned with the NESAQ as amended in 2011[4], noting that Murihiku Southland has three airsheds, with Invercargill and Gore being 'gazetted' and the wider region an airshed by default.

There are many agencies and groups involved in home heating and insulation in Murihiku Southland. Council's functions are set out in section 30 of the Resource Management Act 1991 (RMA) and include controlling discharges of contaminants to air (as well as to land and water) to give effect to the sustainable management purpose of the RMA and achieve integrated management. With regards the region's air quality, the focus to date has largely been in respect of management of PM_{10}. The policy context is complex, for example, the air pollution risk from particulate matter can affect human health, and however there are also health risks if people do not live in warm homes. In response to this, Council established a financial assistance package to assist people with home heating options and comply with the clean air requirements in respect of approved heating, but the uptake has been low. These issues are explored further in this report and options for ongoing airshed management in the Murihiku Southland region provided for further discussion.

[4] Government undertook consultation[4] in 2020 relating to proposed amendments to certain provisions within the NESAQ, including proposed amendments to the standards for ambient particulate matter and burner design as well as new standards for mercury emissions. The proposed changes to the NESAQ are designed to take into account improved scientific understanding and evidence about the health impacts of particulate matter and to better target controllable sources of air pollution. The change would introduce $PM_{2.5}$ as the primary regulatory tool to manage ambient particulate matter. Whilst this is not currently national regulation, it is highlighted to Councillors as a likely 'future direction of travel' for air quality that would have resultant changes to the requirements around air quality management within our airsheds.

2.0 Clean Air Loan Scheme (CALS)

2.1 Creation of the CALS

The first CALS was set up between ES and Invercargill City Council (ICC) after a high-level interagency working group was established to find common ground. ES and ICC signed a Memorandum of Understanding (MoU) in 2016 to provide a joint CALS in the Invercargill Airshed, with ES agreeing to provide ICC with a loan of up to $500,000 each year for the first three years and ICC agreeing to match this (totalling up to $3 million), for the purpose of providing financial assistance to all Invercargill City ratepayers within the airshed for home heating assistance and/or for the installation of approved insulation. It was agreed that ICC are responsible for the administration of the Scheme and that ICC would be responsible for the approval of financial assistance to a ratepayer's application. The parties also agreed Awarua Synergy (AS) as the Service Provider, on such terms as ICC agree with AS.

Similar discussions between ES and Gore District Council (GDC) took place, with a similar MoU between ES and GDC signed in 2017 to provide a joint CALS in the Gore Airshed. As part of this MoU agreement, ES agreed to provide GDC with a loan of up to $140,000 each year for the first three years and GDC agreed to provide $50,000 each year over the same period for insulation (totalling up to $570,000). In addition, GDC agreed to cover the administrative costs of the Scheme and ES and GDC agreed AS as the Service Provider, on such terms as GDC agree with AS.

Both ICC and GDC report back to ES quarterly regarding the number of loans made the term of the loans, loan amounts, types of loans (heating or insulation), status of loan repayments and costs of administration. These reports are regularly presented to Council via the OPAC committee.

The term of both MoUs is 10 years from the commencement date. The ICC CALS therefore naturally terminates in 2026 and the GDC CALS in 2027.

2.2 How the CALS works in practice

Awarua Synergy (AS) has two MoU with ICC and GDC, respectively as well as a contract as the only service provider of the CALS. This means that AS are usually the first line of enquiry for a consumer interested in applying for a loan under the CALS. However, AS are also the service provider for other schemes and the Southland Warm Homes Trust (SWHT), so they generally direct people towards the scheme that they assess best meets a customer's needs.

An applicant for a loan under the CALS needs to be a ratepayer within the relevant airshed and their rates must be up to date. A full credit check process is undertaken and, in doing so, both ICC and GDC assess debt ratio.

It is possible for a landlord to apply for a loan, however an applicant may only loan up to a maximum value of $5,000 at any one time, which usually limits a consumer to one loan at a time. There is an option of choosing the term, but the maximum is five years. In addition, if the house for which the loan applies to is sold, then the loan must be repaid at the time of sale.

ICC charge 3.95% interest, which is put towards the administration costs of the loan. This interest rate has not changed since the commencement of the Scheme. GDC do not charge interest as covering administration costs is part of their contribution to the Scheme. Neither ICC nor GDC charge any other credit fees or security interest.

ICC undertook some promotion of the Scheme when it first started but have not actively promoted it for a while. GDC only promote the Scheme by way of information on their website, but currently no active promotion takes place.

The administration component of the CALS for both ICC and GDC appears to be significant, both in terms of responsibilities and staff time processing and approving applications and, in some instances, following up to ensure that a consumer does not default on their loan repayments.

2.3 The uptake of the existing CALS

Both ICC and GDC provide ES figures on the uptake of the CALS on a quarterly basis, to enable ES to report to Councillors on the Scheme[5].

So far, $200,000 has been paid by ES into the Invercargill CALS and $62,000 into the Gore CALS (figures confirmed as of 31 May 2023). No further installments have been necessary due to lower than expected number of applications for loans.

Since 2016, 171 loans have been issued by ICC (data as at 31 March 2022). Seventy-five per cent of these were approved for heating and 25% for insulation. Initially there was an increasing uptake of applications. However, this has significantly tapered off in the past 3-4 years. In addition, it should be noted that 136 of the 171 loans have been fully repaid to date. As at 31 March 2023, $31,604 was on loan to recipients of the Invercargill CALS. The balance on the Invercargill CALS loan is the lowest since the Invercargill CALS began.

Since 2017, 30 loans have been issued by GDC (data as at 31 March 2023). Ninety-three per cent of these were approved for heating and 7% for insulation. Again, there was an initial increasing uptake of applications to GDC. However, this has also tapered off in the past two years. In addition, it should be noted that 18 of the 30 loans have been fully repaid to date. As at 31 March 2023, $23,705.52 was on loan to recipients of the Gore CALS. The balance on the GDC CALS loan is also the lowest it has been since the CALS began.

Overall, 201 loans, whilst a success in respect of air quality, is considered a low uptake. With the approximate number of dwellings[6] in the Invercargill Airshed 18, 339 and in the Gore Airshed 3,343 dwellings, this means only approximately 1% of households have taken up the CALS. As a comparison,

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[5] The reporting includes: the number of loans made, the term of the loans, loan amounts, types of loans (heating or insulation), status of loan repayments and costs of administration.
[6] Based on 2018 census data and adjusted for projected population increases of 0.4% for Invercargill and 0.1% per year for Gore (Statistics New Zealand, 2018). It is noted that Statistics New Zealand details that the total private dwellings in Invercargill City (2018 Census) is 23, 103 (Sourced at: www.stats.govt.nz/tools/2018-census-place-summaries/invercargill-city) but it is noted that not all of these are in the airshed, hence the difference.

The Warm Dunedin programme assisted more than 1600 households via a rates advance to assist with the upfront costs of installing insulation and/or approved heating[7], although it is noted that this scheme is on hold. Furthermore, another example, in 2019 the Otago Regional Council (ORC) made changes to the subsidy offered to mean eligible households could access additional subsidies towards installing ultra-low emission heating appliance, and was offered to qualifying homes in Arrowtown, Clyde, Cromwell, Alexandra and Milton, with a funding pool capped at $120, 000 and allocated on a first in, first-served basis.[8]

3.0 Credit Contracts and Consumer Finance Act (CCCFA)

3.1 Changes to the CCCFA

Changes to the CCCFA that came into effect on 1 December 2021 put in place stronger requirements for lenders to follow a robust process and ensure that lending is suitable and affordable for people seeking a loan. The purpose of these changes is to protect those most at risk from harmful lending practices. Lenders now need to be certified by the Commerce Commission, who needs to be satisfied that the directors or senior managers of an organisation are 'fit and proper' persons to hold their positions. Lenders are then registered on the Financial Services Providers Register to provide consumer lending services. In addition, lenders must make certain inquiries before any consumer loan is entered into to make sure the loan will be suitable and affordable for the borrower, and lenders must also comply with certain responsible lending principles. This has increased compliance in terms of setting up and administering loans.

3.2 Implications of the changes to the CCCFA

The recent changes to the CCCFA mean the onus is on ICC and GDC to take the new responsible lending criteria into account. Furthermore, those individuals within these two councils that are issuing the loans on behalf of the councils need to be certified to issue the loans.

Given ES's role in the CALS is to contribute financially to both ICC and GDC in order to enable these councils to administer the CALS, ES currently has no outstanding liability arising from the recent changes to the CCCFA.

ICC have put their CALS on hold as they work through their obligations and while GDC have not, they advise that there have been no recent applications.

3.3 Further changes to the CCCFA

The Government has undertaken to review the recent changes. A national working group of councils (led by Bay of Plenty Regional Council) is negotiating with MBIE to minimise the impacts on local authority loan schemes nationally. This is on the basis that local authority loan schemes were not specifically meant to be caught by the changes to the CCCFA. The national working group are seeking

[7] Sourced from www.dunedin.govt.nz/services/warm-dunedin
[8] Sourced from: www.orc.govt.nz/news-and-events/news-and-media-releases/2019/may/increases-to-the-clean-heat-clean-air-subsidy-help-make-environmentally-friendly-heating-more-accessible-in-otago-towns

exemptions from particular provisions of the CCCFA such as fit and proper person certification. Staff from ICC and GDC are members (ES staff are not) and important to enable the Murihiku Southland situation to be considered. The ICC CALS and GDC CALS differ from many other similar loans schemes in not being set up as a voluntary targeted rate scheme. Instead, loans are collected directly via direct debit.

At this stage, feedback from the national working group is optimistic that further changes to the CCCFA may potentially resolve at least some of the implications on council initiated loan schemes; however, no formal advice has been received at the time of writing this report.

4.0 Wrap up of CALS uptake - what are the implications of low uptake?

Overall, given the generally low uptake of loans (a total of 201 to 31 March 2023) and the obligations arising from the changes to the CCCFA, with many banks now offering home heating loans, it is recommended that alternatives to the CALS are considered to enable an improved scheme with different operating parameters for the Invercargill and Gore Airsheds.

The ability for Council to initiate change to the current CALS is considered below after which early feedback is presented.

4.1 Mandate/scope for change to the CALS

4.1.1 Memorandum of Understanding

Both Memorandum of Understanding contain the review clause that:

> ‘*The Scheme shall be reviewed on or before year nine and unless the Parties agree to extend the term beyond year ten shall terminate at the end of the Term unless terminated sooner as provided-in this agreement*’.

ICC and GDC were contacted respectively regarding ES initiating a review and conversations have been, and will continue to be, had with relevant staff as part of the reviews that have been initiated. It is noted that this is an ongoing process. However, no further loans have been issued, largely due to the CCCFA. The changes to how the CCCFA works provides an opportunity for change.

4.1.2 Long Term Plan target – June 2022

The need for a review was an aspect of the submission made by ICC on Council’s (ES) Long-term Plan (LTP). The review is in the current LTP and targets completion by 30 June 2022 that due to resourcing and changes to the CCCFA was delayed.

4.1.3 Feedback received to date from ICC and GDC

Various conversations have been had with key operational staff at ICC and GDC, firstly to advise that a review of each CALS is being undertaken and thereafter to understand how each territorial authority administers their CALS in practice and what improvements or changes could be made. While this is an ongoing process, it is appropriate to note that both ICC and GDC are open to improvements and new solutions.

4.1.4 Discussions with Te Ao Mārama Inc

Staff from Te Ao Mārama Inc have been invited to participate in the review of the CALS. However, due to resourcing constraints this has not been possible yet.

4.1.5 Other external discussions – Southland Warm Homes Trust (SWHT) and Awarua Synergy (AS)

SWHT meetings
In mid-June 2022, the opportunity arose to present to the SWHT regarding the review of the CALS. The meeting discussion highlighted that the CALS is not really on the radar of the SWHT, aside from being mentioned by AS in reports to them. However, the trustees of the SWHT did make it clear that due to the commonalities in terms of what SWHT and ES are trying to achieve, SWHT are very interested in improvements to the CALS or new solutions. One suggestion was that ES could provide SWHT with additional funding to enable SWHT to continue to grow their business with respect to the number of grants or subsidies they issue.

AS progress reports
These reports are presented at each SWHT meeting and include reference to the CALS as a point of interest. This is alongside information regarding the uptake of the Warmer Kiwi Homes Scheme, other subsidies and the Healthy Homes Initiative.

Discussions with AS indicate that from their perspective it is extremely important to ensure the 'insulation first' approach continues, as in their view there is little point putting clean heating into a cold, drafty, poorly insulated home. When this is considered from the core functions required of a Regional Council (i.e., air quality management) overall, an upgraded burner would result in greater reductions in air quality emissions due to putting the burner in before the insulation. This highlights the ongoing challenge of air quality management, home heating and resultant health effects. AS are also willing to be part of any improvements made to the CALS or alternative options considered.

The subsequent section of this report considers options from the perspective of 'where to from here?'

5.0 Where to from here?

5.1 Does the existing CALS achieve ES policy direction in practice (relevant RAP policies)

The requirements of RAP Policy 3.3 are to 'establish a targeted incentives programme with the Invercargill and Gore airsheds and encourage the use of cleaner heating options to reduce PM_{10} in high concentration areas and to promote incentives to assist and encourage people to install and/or convert to cleaner forms of heating within airsheds'. This must be considered alongside the following RAP policies:

RAP Policy Direction	Achieved?
Policy 3.1 *Emission limits* *Set emission limits for new installations of small scale solid fuel burners and boilers in the Invercargill and Gore airsheds.*	Yes, limits set. However it is noted that there are likely future changes to the NESAQ as it relates to $PM_{2.5}$
Policy 3.2 *Phase out* *Phase out the use of open fires from 1 January 2017 and small scale solid fuel burning appliances, excluding pellet burners and solid fuel cooking stoves, that do not meet specified emissions criteria no less than 20 years after installation in the Invercargill and Gore airsheds.*	The RAP was made operative in 2016, and thus the 20-year phase out period that applies to small scale solid fuel burning appliances runs until 2036.
Policy 3.4 *Outdoor burning in the Invercargill and Gore airsheds* *Restrict discharges to air from outdoor burning and burning green waste within Invercargill and Gore airsheds between May and August inclusive.*	Ongoing education and awareness raising required. Compliance monitoring is ongoing.
Policy 3.5 *Education* *Inform the community and business sectors of:* ▪ *the effects of discharges on ambient air quality,* • *how clean forms of heating and improved insulation are available to all households to mitigate adverse health effects, and* ▪ *best practice guidance to minimise the effects of discharges from domestic heating and outdoor burning sources.*	Ongoing education and awareness raising required. Note that this policy applies to the region (is not specific to the Invercargill and Gore Airshed as are RAP Policies 3.1, 3.2 and 3.4).

Consequently, RAP Policy 3.3 can be considered as being met in part, in so far as ES established a targeted incentives programme with the Invercargill and Gore Airsheds.

It is highlighted that the Invercargill and Gore Airsheds would not meet these criteria with the proposed (future) recommended PM_{10} standard of 45 mcg/m^3 (24-hr), or for $PM_{2.5}$ even at the higher recommended guidance level of 25µg/m^3. It is acknowledged that this would be subject to further consultation, but is highlighted as a likely future direction for air quality monitoring.

However, largely due to low uptake (201 loans) and the changes to the CCCFA (under which the ICC has placed the CALS for the Invercargill Airshed) on hold, it is considered that the existing CALS is not achieving all aspects of ES policy direction required and that alternatives need to be considered to meet policy direction at both the national and regional levels.

5.2 Is the existing CALS contributing to an improvement in air quality in Murihiku Southland?

This is difficult to determine conclusively. Part of the reason for this is that we cannot, for example, confirm how the 157 households that have upgraded their heating appliances previously used their fires (e.g., whether they used to burn coal or dry/wet wood, or indeed, or how they used their fires, if much at all). However, as outlined above, 75% of the loans issued by ICC (128) and 93% of the loans issued by GDC (29) were for heating. The positive is that this is 157 homes that may not have otherwise sought or had the means to upgrade their home heating. It is also acknowledged that there are a range of other providers, not only the CALS, and that people who have already changed heating

From a monitoring results perspective:

- In Invercargill, there is an overall downward trend but there has not yet been a year without exceedances of the ambient PM_{10} standards. In 2021, there were three exceedances and in 2022 there two exceedances.
- In Gore, the ambient PM_{10} standards were met in 2014, 2019 and 2021, and in 2021 and 2022, there were no exceedances of the ambient PM_{10} standards. It is acknowledged that the concentrations in Gore were lower to begin with, meaning that the reductions achieved have reduced the highest PM_{10} days to values now below 50 micrograms/m^3.

At a high-level, since the RAP became operative monitoring shows that the rate of decrease in PM_{10} year-on-year for the Invercargill Airshed nearly doubled compared to the previous 5 years. In Gore, the rate of decrease in PM_{10} halved between 2016-2022 compared to the previous 5 years. This success can likely be attributed to a number of factors such as all of the retrofits that meant a change to clean heating appliances and in part to the extensive promotion and education campaign with some examples of which include the Breathe Easy Southland website and associated Good Wood Approved Suppliers (moisture content of less than 25% dry weight). While these monitoring trends (general improvement in air quality within the two airsheds) cannot be directly linked to the CALS, each change to clean heating can bring an improvement to our air quality.

5.3 What improvements could be made to the existing CALS?

Whether potential changes to the CALS would result in a 'real difference' in respect of either uptake and/or improvements to air quality needs consideration. However, if you look at the Invercargill Airshed where loans up to $3 million dollars was available (noting that the applicant may only loan up to a maximum value of $5,000 at any one time), there has only been an uptake from 171 ratepayers, with the overall loans approved for heating being $521, 860.97 and loans approved for insulation being $178, 245.99, for a total uptake up to a value of $700, 106.96.

At a high level, it is acknowledged that there has been reduced uptake by the community than what had been budgeted for, along with implications due to the changes to the CCCFA and the role of banks.

Suggestions of changes that could be made include but are not limited to:

- Refocusing the CALS on clean heating only, in conjunction with removing the current requirement to install insulation to minimum standards prior to the installation of clean heating (though acknowledging the feedback received from AS that it is important to ensure the 'insulation first' approach continues);
- Increasing the number of contract service providers (not just AS), to enable customers to obtain more than one quote and choose their provider;

- Enabling a person to apply for one loan per property, for those people with more than one property (e.g., landlords), to increase access to the CALS;
- Developing metrics for the CALS to be able to assess the improvement in air quality, in terms of finding out about the heating appliances that are removed as part of the scheme versus what is being installed and recording that information;
- Re-launching and improving the overall promotion of the CALS, including reconsideration of target audiences, including confirmation on who is responsible for promotion and how it would be resourced;
- ES work with the banking sector in the two airshed areas (from an awareness raising perspective around Clean Air), to be able to capture data of loan uptake to contribute to a broader picture; and
- Continue to support SWHT.

5.4 Recommendations

Based on the above review, it is recommended that Council considers:

1. Discontinuing the existing CALS within the Gore and Invercargill Airsheds; and
2. Exploring alternative methods to the current CALS scheme to continue meeting, and to better meet, NESAQ and RAP Policy direction including Policy 3.2 (Phase Out), Policy 3.3 (Incentives programme), Policy 3.4 (Outdoor burning in the Invercargill and Gore Airsheds) and Policy 3.5 (Education) whilst retaining flexibility to allow it to adapt to a future policy framework that will likely, for example, monitor for $PM_{2.5}$ as well as PM_{10}.

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ALTERNATIVE OPTIONS TO THE CLEAN AIR LOANS SCHEME

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EXECUTIVE SUMMARY

This report builds on the review of the effectiveness of the existing Clean Air Loans Scheme (CALS) that recommended Council consider discontinuing with the existing CALS within the Gore and Invercargill airsheds and instead explore alternative methods to the current CALS scheme. To consider alternative options to the CALS scheme, this report brings together information on Southland's current national legislative requirements, air quality monitoring results, reports relating to air quality and Environment Southland (ES) policy direction.

The Clean Air Loans Scheme (CALS) was established to provide ratepayers "Clean Air Loans" in both Invercargill and Gore to assist with the costs of moving to less polluting methods for home heating. To be eligible, applicants must have no rates arrears; and have an open fire, old wood burner or multi-fuel burner to replace. Two Memorandum of Understandings (MoU) were developed to underpin the CALS in Invercargill and Gore. Loan uptake across Invercargill and Gore from 2017 to My 2023 has resulted in 201 loans being issued and is considered a low uptake. Additional lender responsibilities for ICC and GDC due to the requirements of the Credit Contracts and Consumer Finance Act (CCCFA) coming into effect on 1 December 2021, and many banks offering home heating loans is likely to have also contributed to the low uptake.

Below is the current air quality policy and science/monitoring context for Murihiku Southland.

Policy Context:

1. The management of air quality is a requirement under the National Environmental Standards for Air Quality (NESAQ) and sets a minimum level of health protection for all New Zealanders with respect to air quality;
2. Murihiku Southland has three airsheds[1], with Invercargill and Gore being 'gazetted' and the wider Southland region by default;
3. The ambient PM^{10} standard for the Gore airshed were required to be met by September 2016 and for the Invercargill airshed by September 2020. The NESAQ also allows for one air quality exceedance per year; at present, both are listed as polluted airsheds.
4. The Southland Regional Policy Statement (SRPS) sets out a collaborative framework under which the existing CALS was established, to progressively upgrade older solid fuel heating appliances and requiring all new heating appliances to be compliant with national standards.
5. Ngāi Tahu ki Murihiku Natural Resource and Environmental Iwi Management Plan 2008 (Te Tangi a Tauira) requires Māori cultural and traditional beliefs are recognised and provided for when dealing with discharges of contaminants to air;
6. Southland Regional Air Plan (RAP) Objective 2.3 Ambient Air Quality: Invercargill and Gore to 'reduce adverse effects on human health and the environment by ensuring that the ambient air quality in the Invercargill and Gore airsheds is improved towards complying with the NESAQ'.
7. Current RAP policies set limits for new installation of small-scale solid fuel burners and boilers in the Invercargill and Gore airsheds as well as rules that phase out the use of open fires and small-scale solid fuel burning appliances that do not meet specified emissions criteria no less than 20 years after installation.

[1] A NESAQ airshed is a defined geographic area for air quality management, which extends upwards from ground level, with no upper limit.

Science/Monitoring Context:

8. The focus of the monitoring is compliance within the current NESAQ for PM_{10} with an exceedance event being ambient concentrations of PM_{10} above 50 µg/m^3.
9. There has not yet been a year without exceedances of the ambient PM_{10} standards within the Invercargill airshed. In 2021, there were a total of three exceedances, in 2022 there were a total of two exceedances.
10. In the Gore airshed, there were no exceedances in 2021 or 2022.

Options for consideration

This report outlines some initial alternative options to the CALS for consideration related to home heating and resultant air quality changes (note that this is not an exhaustive list and further work would need to be completed to determine the potential impact of these). Alongside these it is recommended that the overall Air Quality portfolio is reviewed to enable a broader approach to improving air quality to be explored, in addition to home heating impacts. This will enable further understanding of the likelihood and scale of impact of various approaches to improving air quality and an appropriate region wide strategy/plan to be developed. A review will be dependent on the strategic direction of Environment Southland and where air quality sits within this as a priority. Once this is known appropriate decisions about resourcing and direction in regard to air quality can be made.

Council will need to ensure any alternative options implemented give effect to the current National NESAQ, whilst retaining flexibility to allow it to adapt to future policy frameworks and changes. For example the requirement to monitor PM2.5 in addition to PM10 that will likely for example monitor for PM2.5 as well as PM10.

Initial shorter term options recommended for further consideration by Council, alongside beginning an Air Quality Portfolio review, for Murihiku Southland include:

1. Continue raising and gathering awareness of air quality states and issues in the region, including by:
    a. Communications – continue to promote and raise awareness of the Breathe Easy website through targeted Facebook, newspaper and pamphlets.
    b. Continue to report and raise awareness on Air Quality monitoring results.
    c. Continue with GIS work programme to record where upgraded appliances have been issued.
2. Continue to support SWHT through the establishment of a short-term air enhancement incentive fund. The fund would:
    a. Be available for two years and capped at $50,000/yr;
    b. Provide a First-in-First-served one-off grant (once device has been replaced) for replacement of a non-compliant fire/heating source with a compliant heating device (wood burner, pellet burner or approved heat pump)[2];
    c. Grant could be set an any value desired by Council/SWHT for example $1,000 + GST per household;

[2] For Warmer Kiwi Homes (WKH) there are currently four providers being: Awarua Synergy (for insulation, heat pumps and wood burners), Premier Insulation (for insulation), Hotspot Installations (for wood burners), Southland Home Ventilation (for heat pumps)

   d. Consider widening the SWHT scheme providers, to ensure sufficient capacity to deliver clean heating solutions over a shorter time period;
   e. Any air enhancement fund would be an additional cost to the Council. The current CALS is cost neutral as it loans money. A grant scheme would not be repaid and therefore any grants paid out will directly cost the Council and likely its ratepayers (if covered by rates). There will also be administration costs of a grants scheme.
3. Encourage TA's to waive building consent fees for replacement and compliant wood burner.
4. Undertake a updated air plan protections analysis (as recommended within the Emission Inventory reports) to bring together an evaluation of how much of the reduction anticipated as a result of the air plan rules has occurred to assist with informing any future incentive fund.

CONTENTS

1.0 INTRODUCTION

The purpose of this report is to describe the air quality context in Murihiku Southland by outlining national legislative requirements, air quality monitoring results, highlight reports prepared relating to air quality and assess whether alternatives would meet Environment Southland (ES) policy direction to contributing to an improvement in air quality in Murihiku Southland. Furthermore, this report sets out some options for Council consideration to determine alternatives to the existing CALS.

The Resource Management (National Environmental Standards for Air Quality) (NESAQ) sets, among other things, a minimum level of health protection for all New Zealanders with respect to air quality. Part of the NESAQ included a design standard for new wood burners in urban areas as well as ambient air quality standards for particulate matter less than 10 micrometres in diameter (PM_{10}). For Murihiku Southland, this meant that the ambient PM_{10} standard for the Gore airshed was required to be met by September 2016 and for the Invercargill airshed by September 2020. The NESAQ also allows for one air quality exceedance per year per airshed. Murihiku Southland has three airsheds, with Invercargill and Gore being 'gazetted' and the wider Southland region by default.

To implement the NESAQ, ES undertook a Stage 1[3] review of the now previous Regional Air Quality Plan for Southland 1999 with the provisions being adopted in 2016. The Stage 1 review contains the updated policy framework for new rules, by which ES controls and manage discharges to air, such as those that stem from domestic heating sources. The current RAP is aligned with the NESAQ 2011[4].

The policy context is complex, for example, the risk from air pollution from particulate matter can affect human health, and however there are also health risks if people do not live in warm homes. In response to this, Council established a financial assistance package known as CALS, to assist people with home heating options to comply with the clean air requirements in respect of approved heating, but the uptake has been very low. These issues are explored further within this report.

2.0 REGULATORY OVERVIEW & THE ROLE OF COUNCIL

2.1 Resource Management Act 1991 (RMA)

Environment Southland's functions are set out in section 30 of the RMA. Of relevance to this paper, it includes a statutory obligation to give effect to the RMA to sustainably manage the control of discharges of contaminants into air.

Section 30(1)(fa) of the RMA requires (if appropriate) the establishment of rules in a regional plan to allocate the capacity of air to assimilate a discharge of a contaminant. Furthermore, under the RMA, a regional plan must give effect to (among other matters) a national planning standard[5], which for air

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3 Stage 2 encompasses the remaining framework from the Regional Air Quality Plan for Southland (1999).

4 Government undertook consultation[4] in 2020 relating to proposed amendments to certain provisions within the NESAQ, including proposed amendments to the standards for ambient particulate matter and burner design. The change would introduce $PM_{2.5}$ as the primary regulatory tool to manage ambient particulate matter. Whilst this is not currently national regulation, it is highlighted to Councillors as a likely 'future direction of travel' for air quality that would have resultant changes to the requirements around air quality management within our airsheds.

5 RMA section 67(3)(ba).

quality is the NESAQ, and any regional policy statement[6]. Within Murihiku Southland, this occurs within the provisions of the RAP. Section 7(f) and 7(g) of the RMA require decision makers to have particular regard to the maintenance and enhancement of the quality of the environment and any finite characteristics of natural and physical resources.

Overall, to meet these requirements, air quality must be managed appropriately to protect the quality of the environment in which we all live and breathe.

2.2 National Environmental Standards for Air Quality (NESAQ)

The NESAQ regulations initially came into force in 2004, setting a minimum level of health protection for all New Zealanders with respect to air quality and included a design standard for new wood burners in urban areas as well as ambient air quality standards for particulate matter less than 10 micrometres in diameter (PM_{10}).

In 2005, the definition of airshed was amended so that all regions in New Zealand are airsheds and the ambient standards apply everywhere. In addition, separate gazetted airsheds inside each region are areas that are known, or likely, to breach the ambient standards. As a result, there are three airsheds in Murihiku Southland being the wider Murihiku Southland region, and the two gazetted airsheds (being a defined geographic area for air quality management) that are known as the Invercargill airshed and the Gore airshed. The Invercargill airshed and the Gore airshed broadly follow urban boundaries.

The NESAQ regulations were amended again in 2011 and extended the target date for regional councils to meet ambient PM_{10} standards. For Murihiku Southland, this meant that the ambient PM_{10} standard for the Gore airshed was required to be met by September 2016 and for the Invercargill airshed by September 2020. The NESAQ also allows for one air quality exceedance per year for airsheds, which are deemed polluted.

Monitoring is also a requirement within an airshed, where people are most likely to be exposed and where the ambient standards are most likely to be breached by the greatest margin or with the most frequency. Accordingly, there is a monitoring station in the Invercargill airshed on Pomona Street; and there is a monitoring station in the Gore airshed on Main Street.

2.2 Southland Regional Policy Statement 2017 (RPS)

The RPS provides an overview of regional resource management issues in Murihiku Southland and presents the objectives, policies and methods to manage the region's natural resources such as air. The current RPS became operative in 2017. The RMA requires a regional plan to give effect to any regional policy statement.

Chapter 9: Air Quality of the RPS is the chapter that contains the objectives, policies and methods relevant to the management of the region's air. The introduction of Chapter 9: Air Quality states, "*The prevailing south-westerly wind, relatively low population and the agricultural, rather than industrial,*

[6] RMA section 67(3)(c)

*nature of the economy help to ensure that Southland generally enjoys good air quality, localised air quality problems do occur in Southland and these can have negative effects on health, wellbeing and amenit*y." As an overview, the RPS aims to address regionally significant issues by protecting human health and the environment from the adverse effects of air pollution, in particular smoke from domestic heating.

Issue AQ.2 - states that 'In Southland's airsheds, discharges to air from burning solid fuel for domestic heating can result in elevated levels of particulate matter and poor winter air quality, which has an adverse effect on human health and the environment'.

Policy AQ.1 - Adverse effects of discharges; requires 'Avoid, remedy or mitigate the adverse effects of discharges of contaminants to air on human health, cultural and amenity values and the environment' of which the explanation refers to activities such as 'burning coal and wet wood for domestic heating…'.

Policy AQ.3 - Areas with poor air quality; requires: 'Improve areas with poor air quality, focusing in particular on reducing the adverse effects of activities that discharge particulate matter' of which the explanation again refers to 'burning fuels such as wood or coal for domestic heating…', as the main source of particulate matter in the air in urban areas of Southland. The explanation to Policy AQ.3 states that where discharges from burning solid fuel for domestic heating occur in proximity and atmospheric conditions do not disperse PM_{10}, air quality management areas called 'airsheds' have been delineated.

Policy AQ.5 - Promote best practicable option; requires: 'Promote and facilitate the adoption of the best practicable option to improve air quality'. The explanation of this policy refers to 'improving building insulation, installing clean heating devices (e.g. heat pumps or wood burners that comply with the NESAQ) and using cleaner renewable energy are practices that reduce levels of particulate matter in the air from domestic heating. However, some of these measures can be expensive and/or require a significant change in behaviour. Therefore, to ensure the widespread uptake of these and other best practicable options by the community, encouragement, support and incentives are appropriate'.

Method AQ.1 - Regional Plans; requires: 'Environment Southland to establish and maintain provisions in the Regional Air Plan to control the discharge of contaminants to air; reduce PM_{10} emissions from domestic solid fuel heating as consistent with any NES that applies; and achieve compliance with any relevant NESAQ'.

Method AQ.3 - Information, education and public awareness; focuses on Environment Southland's role in providing information, education and public awareness on low or no-emission domestic heating alternatives to promote and improve awareness and encourage the adoption of domestic heating that is compliant with national standard to avoid or mitigate adverse effects of solid fuel heating on air quality.

In addition, Method AQ.5 - Financial Incentives; encourages Local authorities to consider providing support and financial incentives as necessary in airsheds to improve domestic home heating efficiency and adopt forms of domestic heating compliant with national standards to improve ambient air quality and meet any relevant national standards.

In summary, the RPS sets out a collaborative framework under which the existing CALS was established, to progressively upgrade older solid fuel heating appliances (phase out) and requiring all new heating appliances to be compliant with national environmental standards. With this came the expectation that air quality would steadily improve, particularly with regard to PM_{10} emissions.

2.3 Regional Air Plan 2016 (RAP)

The purpose of the RAP is to set out the way in which ES will control and manage discharges to air, such as those that stem from domestic heating sources. The RAP is currently aligned with the NESAQ 2011 and the relevant provisions of the RAP came into force in 2016[7]. A key focus of the RAP adopted in 2016, is addressing ongoing exceedances of the NESAQ for PM_{10} within the Gore and Invercargill airsheds.

Under the RAP Objective 2.3 Ambient Air Quality: Invercargill and Gore, directs to 'reduce adverse effects on human health and the environment by ensuring that the ambient air quality in the Invercargill and Gore airsheds is improved towards compliance with the NESAQ'.

Policy 3.1 and rules 4.3, 4.3, 4.4 and 4.5 set limits for new installation of small-scale solid fuel burners and boilers in the Invercargill and Gore airsheds. In addition, Policy 3.2 and rules 4.6 and 4.7 phase out the use of open fires and small-scale solid fuel burning appliances that do not meet specified emissions criteria no less than 20 years after installation. It therefore depends on when a non-compliant appliance was installed, as to what the deadline is for a particular appliance to be phased out. Overall, the phase-out timeline will not be complete until January 2034, when all non-compliant burners will no longer be permitted.

Lastly, Policy 3.3 states 'establish a targeted incentives programme with the Invercargill and Gore airsheds to:

(a) Encourage the use of cleaner heating options to reduce PM_{10} in high concentration areas; and
(b) Promote incentives to assist and encourage people to install and/or convert to cleaner forms of heating within airsheds.'

In summary, the RAP sets out the direction for managing air quality in the Invercargill and Gore airsheds. It is this policy direction that was instrumental in the creation of the existing CALS.

2.4 Ngāi Tahu ki Murihiku Natural Resource and Environmental Iwi Management Plan 2008 (Te Tangi a Tauira – The Cry of the People)

[7] The RAP is subject to a review in two parts, called Stage 1 and Stage 2. The purpose of the stages was to immediately address ongoing exceedances of the NESAQ of PM_{10} in the Gore and Invercargill airsheds and allow for a more thorough review of the remainder of the Air Plan subsequent to this process. As such, Stage 1 (in effect from 2016), contains the updated policy framework for domestic home heating, outdoor burning, the application of agrichemicals and fertilisers, and fire training. Stage 2 encompasses the remaining framework from the Regional Air Quality Plan for Southland (1999) such as industrial discharges. Stage 2 will be subject to review at a future date.

Ngāi Tahu ki Murihiku Natural Resource and Environmental Iwi Management Plan 2008 (Te Tangi a Tauira) is a culturally based framework developed by and for Ngāi Tahu Whānui to assist in achieving more meaningful rangatiratanga and kaitiakitanga in natural resource management. Within Chapter 3.2 of Te Tangi a Tauira, it refers to Air as O Te Pū hau - the surrounding air and atmosphere supporting all things and that such a life force should be respected due to its importance in protecting the survival of those and all things connected that will follow in generations to come.

As part of the vision for the region's ambient air, the Iwi Management Plan states that Ngāi Tahu ki Murihiku shall actively engage in and contribute to a co-ordinated response to the improvement of existing air quality in Southland; and that it is ensured that Māori cultural and traditional beliefs are recognised and provided for when dealing with discharges of contaminants to air.

In addition, there are a number of Nga Kaupapa (policies) regarding the management of discharges to air. Some of the key ones relevant to this review are:

3. Encourage existing activities that emit contaminants to air to evaluate and where practical implement new technologies to reduce adverse effects on air quality;
9. Discourage and prevent discharges to air that will have impacts on cultural well-being and community health; and
20. Advocate and support improved and clean forms of domestic home heating.

2.5 Proposed amendments to the National Environmental Standards for Air Quality - particulate matter and mercury emissions - Consultation document (Ministry for the Environment) (2020).

In February 2020, the Ministry for the Environment released a discussion document relating to proposed amendments to the NESAQ. The message from the Minister at the start of the document states:

> *"In Aotearoa New Zealand, we are lucky our air quality is generally good most of the time. However, in winter, some of us live in polluted environments where poor air quality is affecting our health. The numbers are not good. Research shows that exposure to $PM_{2.5}$ (fine airborne particles) can be associated with over 600 premature adult deaths per year and 1.6 million days where activities are restricted.*
>
> *It is important to treat clean air as a taonga. While we can continue to improve our practices and behaviours, we must collectively do more to restore and preserve its quality.*
>
> *In New Zealand, the National Environmental Standards (NES) for Air Quality are a key tool for managing air quality. The standards were introduced in 2004 to set a guaranteed minimum level of health protection for all New Zealanders. In the 16 years since then, we have seen improvements in air quality in many urban areas in New Zealand. We have gained a better understanding of air contaminants and their effects on human health. Wood burner technology has also become much more efficient.*

> *The focus of this consultation is threefold. First, to ensure the NES reflects up-to-date research on the health effects of particulate matter, specifically the role of $PM_{2.5}$. Second, to propose amendments to further reduce the impacts of household solid-fuel burners. Finally, to enable us to meet our international obligations in relation to mercury emissions to air."*

As an overview for matters relevant to this paper, the proposed changes relating to particulate matter propose introducing $PM_{2.5}$ as the primary regulatory tool to manage ambient particular matter. Specifically, the proposal seeks to introduce:

- For $PM_{2.5}$, establish an annual average limit of 10 µg/m^3 to manage long-term impacts from exposure; and
    - A daily (24-hour) average limit of 25 µg/m^3 (including no more than three exceedances per 12-month period) to manage the health effects from short-term exposure to fine particulate matter;
    - Require regional councils (and unitary authorities) to monitor $PM_{2.5}$ and publicly notify any breaches; and
    - $PM_{2.5}$ would replace PM_{10} as the 'trigger' for the current mitigation measures for example in resource consent applications.

The report details the relative size of particulate matter as shown below:

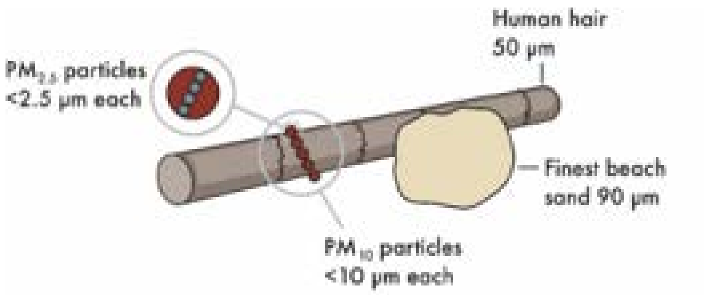

Figure 1: Relative sizes of particulate matter (Sourced from Proposed amendments to the National Environmental Standards for Air Quality - particulate matter and mercury emissions - Consultation document).

Submissions closed on 24 April 2020. Further updates are anticipated during this year. Whilst this summary is an overview of a discussion document, it is highlighted that this is a likely 'future direction of travel' if it came into effect.

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3.0 AIR QUALITY MONITORING RESULTS – WHAT DOES IT SHOW?

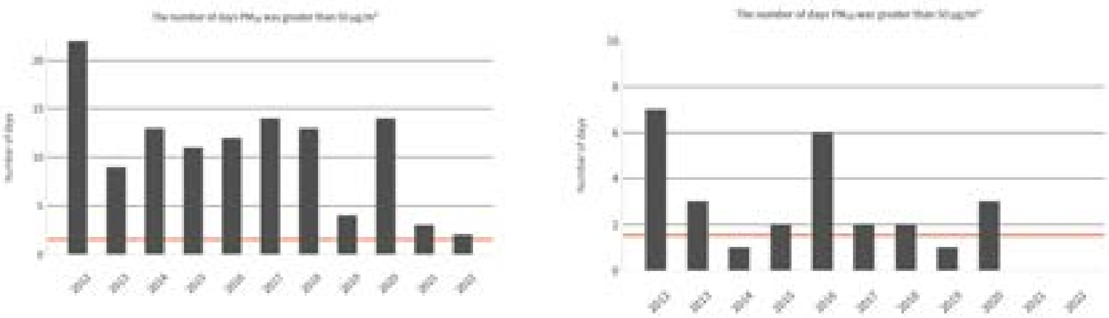
3.1 Monitoring of ambient PM_{10} standards

Air Quality monitoring of PM_{10} has been undertaken in Invercargill since 2003. From 2003-2008 monitoring was undertaken at Miller Street and since 2008 this has been collected at Pomona Street. Air Quality monitoring of PM_{10} has been undertaken in Gore since 2004, which is collected on Main Street, Gore. The focus of the monitoring is compliance with the current NESAQ for PM_{10}. The data collected is reported live on the 'Breathe Easy' website, which makes it accessible for anyone that is interested. In addition, monitoring results are also available on the Land Air Water Aotearoa website (Lawa.org.nz). The location of the air quality monitoring sites is detailed below.

Figures 2 and 3: *Location of air quality monitoring sites in Invercargill and Gore airsheds (maps sourced from www.lawa.org.nz/explore-data/southland-region/air-quality)*

The graphs below illustrate the exceedance data being the number of days per year that concentrations of PM_{10} went above 50 µg/m^3 in the both the Invercargill and Gore airsheds since 2012. In Invercargill, there has not yet been a year without exceedances of the ambient PM_{10} standards within the Invercargill airshed, with three exceedances in 2021 and in 2022, there were a total of two exceedances. At the time of writing, this report there had been four exceedances within the Invercargill airshed (as at 13 July 2023).

CONFIDENTIAL – NOT COUNCIL POLICY



Figures 4 and 5: *Graph showing annual exceedances for the Invercargill (left) and Gore (right) airsheds - sourced from https://www.lawa.org.nz/ 23 June 2023*

The ambient PM_{10} standards in the Gore airshed were met in 2014, 2019 and 2021. In fact, in 2021 and 2022 there were no exceedances of the ambient PM_{10} standards within the Gore airshed. Note that an airshed has to be without an exceedance to the NESAQ over five consecutive years to be deemed clean.

3.2 Updated emission inventory for Invercargill and Gore Airsheds

ES has commissioned emission inventory reports in 2004, 2011 and 2015, with the most recent one being a 2022 update of the 2015 report. The purpose (of the reports) is to determine the sources of emissions to air in Invercargill and Gore and its focus is on PM_{10}. To undertake the emission inventories, a household survey, which integrated questions on heating methods, was combined with census data to quantify the prevalence of heating methods and fuels.

The Invercargill Emission Inventory 2022, prepared by Environet Limited reported the following:

An emission inventory was carried out in 2022 to assess quantities and sources of discharges to air and changes in emissions. The sourced included were domestic heating, motor vehicles, outdoor burning and industrial and commercial activities. The evolution focuses on particles in the air less than 10 microns (PM_{10}), particles in the air less than 2.5 microns ($PM_{2.5}$), sulphur oxides, nitrogen oxides and carbon monoxide. The inventory updates a previous assessment (Wilton, 2011, 2015) which found domestic home heating contributed around 95% of the daily winter PM_{10}.

Electricity was found to be the most common method of heating the main living area where 81% of households using this source… Wood burners were used by 35% of households and around 144 tonnes of wood and five tonnes of coal was burnt on an average winter's night.

Across all sources, a total of 981 kilograms of PM_{10} per year was estimated to be discharged in Invercargill on a typical winter's day with 940 kilograms of this in the $PM_{2.5}$ size fraction. Domestic heating was the most significant contributor to annual and daily winter PM_{10} in Invercargill contributing 78% and 89% respectively. Annual and daily $PM_{2.5}$ emissions were also dominated by domestic heating (83% annual and 92% daily).

A comparison to the previous Invercargill air emission inventory, after adjusting for methodological differences suggests a reduction in PM_{10} emissions of around 70% since around 2011.

The Gore Emission Inventory 2022, prepared by Environet Limited reported the following:

The inventory updates a previous assessment in 2015) which found domestic home heating contributed around 97% of the daily winter PM_{10}.

Electricity was found to be the most common method of heating the main living area with 68% of households using this source. Wood burners were used by 45% of households and multifuels by 9%. Diesel fired boilers or burners were also common in Gore with 6% of households using this fuel. Around 30 tonnes of wood and 6 tonnes of coal was burnt on an average winter's night.

Across all sources, a total of 46 kilograms of PM_{10} per year was estimated to be discharged in Gore, with 42 tonnes of this in the $PM_{2.5}$ size fraction. Around 285 kilograms of PM10 is emitted on an average winter's day. Domestic heating was the most significant contributor to annual and daily winter PM_{10} in Gore contributing 88% and 95% respectively. Domestic heating is also the main source of annual and winter $PM_{2.5}$.

A comparison to the previous Gore air emission inventory, suggests a reduction in daily winter PM_{10} emissions of around 64% since around 2011.

3.3 Further Reports commissioned by ES relating to air quality management

Following the RAP process, further science work undertaken included the following reports:

3.3.1 Assessment of the impacts of regulatory measure targeting domestic home heating on annual average $PM_{2.5}$ in Invercargill and Gore (Environet Ltd) May 2017

As outlined above, there was an expectation that there would be a revision of the NESAQ that would be based on tighter World Health Organisation guidelines. The new RAP rules were aiming to achieve a reduction in daily winter PM_{10} levels to meet the current NESAQ. However, it was expected that any revision of the NESAQ would focus on $PM_{2.5}$ levels.

The objective of this report was to evaluate the potential implications of the possible introduction of $PM_{2.5}$ as a new national environmental standard. The RAP rules targeting domestic heating aimed to reduce 24 hour-average PM_{10} concentrations in Invercargill by 56% by 2030; and for Gore by 35% by 2022. If these reductions in PM_{10} concentrations eventuate, it may mean that enough of a reduction in $PM_{2.5}$ would also be achieved. The report outlines that if the reduction in PM_{10} is not achieved, nor would the reduction in $PM_{2.5}$.

This study included a number of limitations but stated that overall, the annual average $PM_{2.5}$ concentrations for Invercargill is likely to be 12-14 μg/m^3 and for Gore 12-12.5 μg/m^3. Therefore, the annual average $PM_{2.5}$ concentrations in Invercargill and Gore would be unlikely to comply with a concentration limit of 10µg/m^3 or less, but that further monitoring would be required to determine the certainty of this assessment.

3.3.2 Achieving healthy air quality in South Invercargill: Inter-agency programme (ESR) 2019

This report detailed a collaborative approach that was piloted in the South Invercargill community. It involved community workshops to scope the complexity of the issue of improving air quality in Murihiku Southland.

An initial co-design workshop was held involving stakeholder agencies and proposed next steps. These included holding a follow up inter-agency workshop, confirming levels of commitment from participating agencies and establishing a basic structure to support the integration of activities across agencies through to 2025. Due to resourcing issues, the proposed next steps recommended in this report were not followed through.

3.3.3 Air Quality Reporting – Report investigation the type of heating and practices residents have implemented to improve air quality within the Gore and Invercargill airsheds (Research First, September 2022

This telephone survey was undertaken in June 2022 within both the Invercargill and Gore airsheds, to better understand behavior regarding home heating choices and establish some baselines. The sample size was 400 with 200-survey response in Gore and 200 in Invercargill via telephone and an additional 62 online responses, meaning a total of 272 responses from Invercargill and 213 responses from Gore.

Results indicate that 74% of respondents think that the air that they breathe is ‘good’. Air pollution is reported as most noticed in the evenings (55%), and due to increased home heating operating at this time. The report notes that 86% of respondents said that everyone has a part to play in improving air quality, and that 51% of respondents felt they were educated about air quality in the area. The report highlighted that those from Invercargill are less likely to feel educated about air quality and outlines that there is a gap in education for residents within the Invercargill airshed that needs to be addressed.

Sixty five per cent of respondents agree that they feel educated about the possible actions their household can take to improve air quality. The 35% of respondents who had adopted new practices to improve air quality highlighted the new practices adopted included starting to use electric heating (31%) and wood burner (25%). The practices stopped included the use of a wood burner (25%) and coal (17%). The report highlights that respondents noted the use of a wood burner as a practice that had been both stopped (likely replaced) and started (again likely replaced with a cleaner burner), and highlights that there is a need for further education on this to improve air quality.

When asked what the main barrier would be preventing them from changing to a cleaner heating appliance, 31% of respondents indicated they already had a heat pump or other heating; 25% said ‘nothing’ and 26% said ‘cost’.

Only 18% of respondents were aware of the Breathe Easy website. The respondents also reported that the preferred way to receive information about air quality are Facebook (21%), mail drop (17%) and newspapers (14%). People with six members in their household reported they prefer to be provided with information about air quality through school or university. Those that noted they trust information and advice provided by Environment Southland prefer to receive information on Facebook.

3.3.4 The impact of retrofitted insulation and new heaters on health services utilisation and costs, pharmaceutical costs and mortality (Motu report) 2011

This report was to the Ministry of Economic Development and evaluated the changes in the incidence and costs of health services, pharmaceutical usage and mortality resulting from a previous version of the EECA WKH scheme, called 'Warm Up NZ: Heat Smart Programme'.

This study concluded that retrofitted insulation had a significant impact on reducing hospitalization and pharmaceutical costs for the occupants of house compared to a control group who had not received retrofitted insulation; and that the insulation also contributed to reduced mortality per household.

In addition, the installation of heaters did not significantly reduce hospitalizations and that it was not clear whether this solution was cost-beneficial. However, the report does not cover whether or how these heaters were used, or if ongoing electricity costs were too high leading to lower, or no use.

3.3.5 Acute respiratory infection risk associated with exposure to outdoor PM_{10} emissions from domestic heating (Hammond & Alef-Defoe; NZ Medical Journal) 2022

This was a recent study researching a mid-sized town in the Otago region that had known wood-smoke pollution issues. PM_{10} monitoring information was evaluated alongside information from GP visits for acute respiratory infections during the winters of 2014-18. The key result was that an increase in PM_{10} concentration was associated with increases in the odds of a GP visit for an acute respiratory infection for certain population groups. This study recommended integrating air quality and housing policies to improve community health.

3.3.6 Health and air pollution in New Zealand 2016 (HAPINZ 3.0) (Emission Impossible) 2022

This is a major national study that focused on understanding how much air pollution people are experiencing (exposure) and the relationship to potential health impacts and overall health burden for New Zealand; based on population, health and air quality data for 2016 and accounting for variability in meteorological conditions.

Both $PM_{2.5}$ as well as NO_2 was assessed by census area unit across New Zealand. This study found that Invercargill City has the highest death rate due to anthropogenic air pollution overall (219 per 100K population), but a low actual number of deaths (74). In addition, Invercargill City has the second highest $PM_{2.5}$ death rate, with Gore District being 6^{th}.

The message from this report was that the results are likely in part due to a high proportion of wood and coal use for domestic heating in winter, with 49% of Invercargill households using wood in 2013 compared to 37% nationally; and 31% of Invercargill households using coal in 2013 with 4% nationally.

4.0 WHAT OTHER FINANCIAL OPTIONS ARE AVAILABLE IF THE CALS SCHEME IS DISCOUNTINUED?

4.1 The Southland Warm Homes Trust (SWHT)[8]

The SWHT was established in June 2008 by Electricity Invercargill Limited (EIL) and the Southland Electric Power Supply Consumer Trust to provide an umbrella organsiation to facilitate a Murihiku Southland wide warmer homes initiative. Its vision is to ensure Southlanders have a more energy-efficient home, an improved living environment, improved well-being, better health and greater energy efficient awareness.

ES is one of many funding partners of the SWHT and currently provides an annual $50,000 donation to assist the Trust to achieve its goals. The $50,000 donation has been provided annually since 2017.

Other funding partners include the ICC $50,000 annually, GDC $15,000 annually and Southland District Council $35,000 annually. There are other funding partners, for example Powernet which provides administration and financial reporting services. Essentially SWHT raises this money to input into a variety of schemes focused on achieving their aims. The main part of their business is topping up the Warmer Kiwi Homes Programme in Southland for both insulation and/or heating (insulation must be completed first); however other subsidy options are also available on a case-by-case basis. SWHT has a close relationship with AS, who have been the main providers for installing insulation and/or heating on behalf of SWHT.

4.2 Energy Efficiency & Conservation Authority (EECA) Warmer Kiwi Homes Programme, topped up by SWHT

The EECA Warmer Kiwi Homes Programme is a government led initiative. The focus of the programme and eligibility criteria have changed at various times, depending on which party is in government. In earlier years, the programme was focused on landlords to improve their rental accommodation with regard to insulation and heating. However, the focus of the current programme is on enabling low-income homeowners to access a grant for either insulation or heating.

The current criteria to be able to access these grants is that the consumer must be a home owner and must either have a community services card, or alternatively their house must be in an area with a deprivation index of either 8, 9 or 10. If approved, this grant would cover 80% of the cost of ceiling and underfloor insulation and/or 80% of the cost of a heat pump of efficient wood or pellet burner (grants for heaters are capped at $3,000 incl GST).

[8] The SWHT area only relates to the Southland electricity network, therefore Stewart Island/Rakiura is not included in the Trust's area.

The SWHT then tops up approved applications, by providing an additional grant of 15% (capped at $900 incl GST for heating). This means that effectively the consumers, who qualify, only pay 5% towards the insulation or heating project being approved.

The programme requires that insulation must be installed (to EECA standards) prior to the consideration of a grant for heating. Awarua Synergy is currently the service provider for the programme in Murihiku Southland and can provide insulation, heat pumps and wood burners (but not pellet burners). There may be times that people meet the criteria of the WKH scheme but find it difficult to pay the 5%. In these cases, AS either recommends them for other SWHT subsidies or alternatively anecdotally they have accessed the CALS scheme for assistance to pay the remaining 5%.

4.3 Other SWHT subsidies:

Other funding options available through the SWHT, include the general income subsidy, the health subsidy and the hardship subsidy. These all serve a slightly different purpose. There are no specific criteria for the assessment of any of these subsidies and none of these subsidy options are advertised or widely known. These subsidy options are only suggested to property owners by AS on a case-by-case basis, if by way of their assessment it is considered that it may be what is required to 'get someone across the line'. As examples:

- during the summertime, when business is traditionally quieter for AS they may put forward someone for the summertime subsidy to help keep the AS workload up; or
- if the assessment process reveals that while someone may qualify for the Warmer Kiwi Homes programme however, they may not be able to afford to pay the remaining 5% then AS may put this applicant forward for a hardship subsidy; or
- if someone's income is just above the Warmer Kiwi Homes programme thresholds, but the assessment process reveals they are unlikely to be able to afford the options, AS may put this applicant forward for a general income subsidy; or
- if a referral is received from WellSouth or if the assessment process reveals health issues, then AS may put this applicant forward for a health subsidy (this subsidy required medical information to be provided as part of the process).

These subsidies seem to provide some flexibility in the system, to enable individual circumstances to be considered on a case-by-case basis. There are very low numbers of these subsidies issued each year and these are primarily used for insulation, as this is the priority for SWHT and AS ahead of clean heating.

4.4 Banks

Some banks have tailored their own loan packages towards encouraging consumers to either access new loans or top up existing mortgages, specifically for the purpose of insulating or improving their home heating. For example, Westpac Warm up[9] is an interest free loan of up to $40, 000 for five

[9] www.westpac.co.nz/home-loans-mortgages/options/warm-up/

years (subject to criteria) and ANZ Good Energy Home Loan[10] (1.0% P.A. for 3 years top up to $80,000). Other banks also enable mortgages to be topped up, however not all banks target their marketing in the same way as Westpac and ANZ have done.

4.5 Healthy Homes Initiative

This scheme is led by the Ministry of Health and has been running in other parts of New Zealand since 2013-2015. Initially it focused on those district health boards that have a high incidence of rheumatic fever and targeting low-income families most at risk. In 2016, the breadth of the scheme expanded to include targeting pregnant people; low-income families with young children (0-5) that have been hospitalized due to a housing related condition; and families with young children (0-5) for whom at least two social investment[11] risk factors apply. To access the scheme a medical referral is required, and funding is then provided for a home assessment to take place.

If any interventions are recommended (e.g., insulation), people are generally then referred to the Warmer Kiwi Homes programme for example, if they are eligible to access these grants. This scheme was recently expanded to the whole country as of 1 July 2022. The contract for Murihiku Southland was awarded to the Aukaha Trust (based in Dunedin), who is in the early stages of setting up the scheme in Murihiku Southland. This will therefore become another avenue in terms of improving housing quality available to some people in the near future.

5.0 ES INITIATIVES, ACTION AND DISCUSSIONS AT STAFF LEVEL

Since the RAP became operative in 2016, ES has largely taken an 'education first' approach with regard to air quality issues. This has meant resourcing has been put into ensuring key messages around adopting clean heating practices and upgrading heating appliances are widely available in our communities. A summary of this work is highlighted below.

Key initiative – Breathe Easy brochures	Developing a series of Breathe Easy brochures – these outline proposed rules about the use of approved burners, the phase-out of open fires and non-approved burners and what people cannot burn.
Key initiative – Breathe Easy website	Establishing the Breathe Easy website as a one-stop shop for information regarding air quality. It contains links to key resources (websites and brochures), live monitoring data of Invercargill and Gore air quality, as well as information on past trends by linking to the Land Air Water Aotearoa (LAWA) website.
Key initiative – Good Wood scheme	Developing the Good Wood scheme – which promotes wood suppliers who commit to supplying either dry seasoned firewood suitable for immediate use.

[10] www.anz.co.nz/personal/home-loans-mortgages/loan-types/good-energy/
[11] Child Youth and Family finding of abuse or neglect; caregiver with a Corrections history; mother has no formal qualifications; long term benefit receipt. Definition sourced from: healthy-homes-initiative-evaluation-apr-2018.pdf

Key initiative – promotions	Holding annual free dry firewood promotions since 2016 – in conjunction with The Hits radio station, as an opportunity to promote the importance of burning dry wood.
Key initiative – promotion on good practice	Attendance at the local Home Show in 2016, 2017, 2018 and 2023 – to promote the importance of clean burning practices and the usefulness of a moisture meter to measure the moisture content of a piece of firewood.
Key initiative – attend events	Various opportunities to provide key players with relevant information – for example, meetings with the Property Owners Association; some real estate agents; and events run by the Southland Chamber of Commerce aimed at investors/landlords.
Internal staff discussions (including finance, science, policy, consents and compliance staff)	General consensus that the existing CALS has so far not been as effective as it was envisaged at the time it was created. This is based on the number of loans approved to date (201), as well as the declining number of loans being approved over time. A frequent comment is querying whether the money set aside for the CALS could be better allocated, although it is acknowledged that this money is 'cost neutral' due to the loan being repaid by the end user. Key suggestions for changes have included the following: • Reconsidering a subsidy option for low income households; • Refocusing the CALS on clean heating only and removing the need for insulation to be installed first; • Increase the number of service providers for the CALS; • Improving marketing of the Breathe Easy website. • Encouraging all territorial authorities in Murihiku Southland to waive building consent fees for applications involving the installation of clean heating appliances; and • Establish an independent eco advisor position which could work directly with homeowners to advise on the best solution for their need. •

These initiatives may have had some success. For example, after the promotion of the moisture meter at the first local Home Show, retailers were depleted of moisture meter stocks within a short time after the event. This illustrated that moisture meters are a tangible tool that people were able to understand and put to use as a way of ensuring their firewood was dry enough for burning.

Conversely, a recent study by Research First directly asked respondents about their awareness of the awareness of the Breathe Easy website, with only 18% replying yes. This data may suggest that the website has not reached as many people as was hoped, and some of those that were aware of the website did not necessarily know about the information on it. This may mean that future marketing of the Breathe Easy website needs consideration.

Greypower Southland
Following a recommendation from Cr Ludlow in 2022 feedback was sought from Greypower Southland. The key feedback was that while older people may often qualify for financial assistance, there are many perceived barriers that can prevent this group accessing grants or the CALS initiative. Reported difficulties included being too difficult to access due to the steps involved, the terminology used, and the need to access information online. Feedback also highlighted that older people often live day-to-day financially and the 5% payment can be unaffordable, even if they qualify for the WKH scheme..

The strong message from Greypower was that it is important to tailor information directly to their audience i.e. provide a brochure that explains what is available and who they can contact for assistance, including step by step instructions. Greypower representatives currently guide people through the process as best as they can and suggested that if there was one person from Council that could facilitate this it could be beneficial.

6.0 WHERE TO FROM HERE?

The Clean Air Loans Scheme review report provided an assessment on the background to the existing Clean Air Loans Scheme (CALS) and an overview of how effective the scheme has been to date.
The recommendations from this report are to:

- Discontinue the existing CALS in light of low uptake (with a total of 201 loans issued to 31 March 2023), implications of CCCFA, and many banks offering home heating loans.
- Explore alternative methods to meet the NESAQ and RAP Policy direction including Policy 3.2 (Phase Out), Policy 3.3 (Incentives programme), Policy 3.4 (Outdoor burning in the Invercargill and Gore Airsheds) and Policy 3.5 (Education) whilst retaining flexibility to adapt to future policy frameworks.

Below are some initial alternative options to the CALS considered and related to home heating and resultant air quality changes (note that this is not an exhaustive list and further work would need to be completed to determine the potential impact of these). Alongside these it is recommended that the overall Air Quality portfolio is reviewed to enable a broader approach to improving air quality to be explored, in addition to home heating impacts. This will enable further understanding of the likelihood and scale of impact of various approaches to improving air quality and an appropriate region wide strategy/plan to be developed. A review will be dependent on the strategic direction of Environment Southland and where air quality sits within this as a priority. Once this is known appropriate decisions about resourcing and direction can be made.

6.1 Initial alternatives to existing CALS

The following are some initial alternative options that have been considered that would align and achieve ES policy direction.

Alternative options	Benefits	Drawbacks and/or issues
Increasing the number of contract service providers (not just AS) to enable customers to	Would enable consumers to shop around to suit their individual needs, and likely would increase	This will likely require upskilling other providers to carry out an

obtain more than one quote and choose their provider. Currently capacity of scheme is dependent on AS capacity and the lag time varies. Approximate AS wait time during winter 2022 for new applications were insulation two weeks, heatpumps four-six weeks and woodburners take longer due to building consent process.	overall capacity to process applications and install insulation and clean heating.	assessment role that AS provide, and consideration of if the Murihiku Southland market may not be big enough to sustain additional providers. Would have implications for AS as current skilled service provider and business.
Ensuring a method is developed to establish metrics for the CALS in terms of finding out about the heating appliances that are removed as part of the scheme, versus what is being installed.	From a monitoring perspective, being able to measure the reduction in annual PM_{10} for each successful CALS application would be useful.	Would require coordination with TAs, information sharing agreements most likely required, upkeep of information. Further resourcing, investment in a database or app, upkeep of information.
Create a bylaw that includes a 'point of sale rule' requiring the removal of non-compliant burners at the time a property is sold;	Creates a solid enforcement tool, ES could continue its 'education first' approach but be seen to balancing out education and enforcement as necessary.	This would involve either TAs being willing to take ownership of the bylaw or alternatively that a transfer of powers occurs under the RMA to enable ES to administer it.
Establishing an 'air quality sub team' within the compliance team to undertake proactive as well as reactive compliance activities with regard to improving air quality;	Role could be as an urban "on the ground air quality awareness and improvement" role and focused on winter months.	Further resourcing would be required.
Establishing an independent interagency 'home eco advisor' that can work with property owners of existing homes;	Potential to reduce the reliance on AS to carry out an assessment process, thereby enabling additional businesses becoming contracted service providers, noting further training would likely be required.	Further resourcing would be required and notes that this would require a person going into people's homes.
A free home energy inspection could be offered if certain criteria are met, to the value of the equivalent of up to two hours of staff time;	Promotional opportunity for new 'home eco advisor role', and could be an alternative method to incentivise behaviour change.	Further resourcing would be required.

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Reconsidering a new partial subsidy option for low-income households that are not able to access the Warmer Kiwi Homes EECA grants.	This would likely be much more clearly a ‘targeted incentives scheme’ as per ES policy direction, compared to the existing CALS with ICC and GDC.	Any air enhancement fund would be an additional cost to the Council. The current CALS is cost neutral as it loans money. A grant scheme would not be repaid and therefore any grants paid out will directly cost the Council and likely its ratepayers (if covered by rates). There will also be administration costs of a grants scheme.
Improving marketing of the Breathe Easy website.	Investing in order to obtain more value out of this existing resource.	Costs in respect of resourcing and coordination.
Encouraging TAs in Murihiku Southland to waive building consent fees for applications involving the installation of clean heating appliances.	Already a successful scheme in Winton being run by SDC and it is possible that this scheme has avoided air quality becoming an issue within the Winton area.	Direct cost for TA’s.
OTHER RELATED ACTIONS		
Redo the emissions inventory	Has been completed in 2022.	
Undertake an updated air plan protections analysis.	Would provide detailed information to inform all air quality policy and science work.	Ongoing procurement process.
Repeat the Research First survey, which established a baseline for the ‘percentage of surveyed residents who have adopted practices that improve air quality in the region’ annually (early winter each year). Take survey improvements into account	Relates to baseline information regarding burner behavior only (part of ongoing work programme).	
Form an interagency Air Quality management group, to work through and tackle relevant actions together. Task this group with the following: • Taking on relevant report recommendations • Interagency information sharing Raising awareness of the need to manage air quality	Group would have representation from ES, ICC, GDC, SDC as well as other relevant agencies as required such as SWHT, South Alive, contracted service providers such as AS.	Who would manage and ongoing resourcing and uptake.

Set up an inter-agency information-sharing Air Quality database with TAs with respect to installation, removal, emissions information.	Potential to include census data, building consent data from TAs, point of sale data from bylaw, chimney/flue monitoring data from student surveys, infrared monitoring during winter months, domestic burning incident data etc.	Who would manage and ongoing resourcing and uptake.
Consideration of policy changes.	Ongoing as part of work programme.	Expected to take place when the next NESAQ is released.

A summary of other schemes run by other Councils nationally are contained in Appendix A, although it is noted that many are currently on hold.

6.2 CALS alternatives for Council consideration and discussion

Initial shorter term options recommended for further consideration by Council, alongside beginning an Air Quality Portfolio review, for Murihiku Southland include:

1. Continue raising and gathering awareness of air quality states and issues in the region, including by:
    d. Communications – continue to promote and raise awareness of the Breathe Easy website through targeted Facebook, newspaper and pamphlets.
    e. Continue to report and raise awareness on Air Quality monitoring results.
    f. Continue with GIS work programme to record where upgraded appliances have been issued.
2. Continue to support SWHT through the establishment of a short-term air enhancement incentive fund. The fund would:
    a. Be available for two years and capped at $50,000/yr;
    b. Provide a First-in-First-served one-off grant (once device has been replaced) for replacement of a non-compliant fire/heating source with a compliant heating device (wood burner, pellet burner or approved heat pump)[12];
    c. Grant could be set an any value desired by Council/SWHT for example $1,000 + GST per household;
    d. Consider widening the SWHT scheme providers, to ensure sufficient capacity to deliver clean heating solutions over a shorter time period;
    e. Any air enhancement fund would be an additional cost to the Council. The current CALS is cost neutral as it loans money. A grant scheme would not be repaid and therefore any grants paid out will directly cost the Council and likely its ratepayers (if covered by rates). There will also be administration costs of a grants scheme.
3. Encourage TA's to waive building consent fees for replacement and compliant wood burner.

[12] For Warmer Kiwi Homes (WKH) there are currently four providers being: Awarua Synergy (for insulation, heat pumps and wood burners), Premier Insulation (for insulation), Hotspot Installations (for wood burners), Southland Home Ventilation (for heat pumps)

4. Undertake a updated air plan protections analysis (as recommended within the Emission Inventory reports) to bring together an evaluation of how much of the reduction anticipated as a result of the air plan rules has occurred to assist with informing any future incentive fund.

6.3 Do the alternatives achieve ES policy direction in practice (relevant RPS, Te Tangi a Tauira and Air plan policies);

The requirements of RAP Policy 3.3 are to 'establish a targeted incentives programme with the Invercargill and Gore airsheds and encourage the use of cleaner heating options to reduce PM_{10} in high concentration areas and to promote incentives to assist and encourage people to install and/or convert to cleaner forms of heating within airsheds'.

Consequently, RAP Policy 3.3 can be considered as being met in part, in so far as ES established a targeted incentives programme with the Invercargill and Gore Airsheds. It is highlighted that the Invercargill and Gore Airsheds would not meet these criteria with the proposed (future) recommended PM_{10} standard of 45 mcg/m^3 (24-hr), or for $PM_{2.5}$ even at the higher recommended guidance level of 25µg/m^3.

It is important that the requirements of RAP Policy 3.3 are considered alongside the following RAP policies:

RAP Policy Direction	Achieved?
Policy 3.1 *Emission limits* *Set emission limits for new installations of small scale solid fuel burners and boilers in the Invercargill and Gore airsheds.*	Yes, limits set. However it is noted that there are likely future changes to the NESAQ as it relates to $PM_{2.5}$
Policy 3.2 *Phase out* *Phase out the use of open fires from 1 January 2017 and small scale solid fuel burning appliances, excluding pellet burners and solid fuel cooking stoves, that do not meet specified emissions criteria no less than 20 years after installation in the Invercargill and Gore airsheds.*	The RAP was made operative in 2016, and thus the 20-year phase out period that applies to small scale solid fuel burning appliances runs until 2036.
Policy 3.4 *Outdoor burning in the Invercargill and Gore airsheds* *Restrict discharges to air from outdoor burning and burning green waste within Invercargill and Gore airsheds between May and August inclusive.*	Ongoing education and awareness raising required. Compliance monitoring may also be required given the policy direction to 'restrict'.
Policy 3.5 *Education* *Inform the community and business sectors of:* ▪ *the effects of discharges on ambient air quality,* • *how clean forms of heating and improved insulation are available to all households to mitigate adverse health effects, and* ▪ *best practice guidance to minimise the effects of discharges from domestic heating and outdoor burning sources.*	Ongoing education and awareness raising required. Note that this policy applies to the region (is not specific to the Invercargill and Gore Airshed as are RAP Policies 3.1, 3.2 and 3.4).

As previously reported the existing CALS is not achieving all aspects of ES policy direction required and that alternatives need to be considered to meet policy direction at both the national and regional levels.

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APPENDIX A - Schemes run by other Councils nationally

Below is a summary of schemes run by other Councils nationally, although it is noted that many are currently on hold:

Council	Status	Facilities	Funding limit	Interest or fees
Auckland Council (unitary authority)	Closed	Heating, insulation, water conservation, mechanical extraction, fireplace decommissioning	$5,ooo	Yes
Waikato	In development	Water tanks, insulation, double-glazing, heating, ventilation, solar power, septic tank upgrades	$15,000	??
South Waikato District Council	Open since 2011	Heating, insulation if with heating	No limit	Yes
BOP Regional Council	Rotorua Hotswap scheme closed in 2021 after 10 years but a new region wide Sustainable Homes scheme is in development	Heating, insulation, solar power	$12,000	Yes (though some loans were interest free)
Hawke's Bay Regional Council	Open	Fires, heat pumps (incl. hot water), pellet burners, gas fires, insulation, ventilation. Also, offer Clean Heat Grants, being a one off grant one-off grant for replacing a non-compliant fire with a compliant wood burner, gas fire or heater or heatpump. Grants are claimed when the fire has been replaced. The grant is either: • $700 (incl GST) if invoiced by a supplier, who can pass it on to you as a discount or, • $608 (GST exclusive) if paid directly.	$4,500.	Yes
South Taranaki District council	Open	Heating, insulation	$5,200	Yes
New Plymouth District Council	On hold	Insulation, double glazing, draught sealing, water conservation, heating, ventilation, energy conservation/generation, lighting efficient, re-	$10,000	Yes

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		roofing/cladding, food resilience, EV charges, replacing gas appliances etc.		
Greater Wellington Regional Council	On hold	Heating, insulation	$5,000	Yes
Nelson City Council (unitary authority)	Closed	Solar hot water heating, heating and insulation	$10,000	Yes (though some were interest free)
Marlborough District Council (unitary authority)	Open	Clean heating, insulation, solar power, solar hot water	$15,000 ($20,000 in exceptional circumstances)	Yes
Environment Canterbury	On hold	Heating, insulation, solar power, solar hot water	$6,000 (incl GST)	Yes
Dunedin City Council	Closed/On hold	Heating, insulation	S5,000	Yes.
Clutha District Council	On hold	Dust suppression, sewage connections	$varies	Yes
Gore District Council	On hold	Heating, insulation	$5,000	No
Invercargill City Council	On hold	Heating, insulation	$5,000	Yes

The table above illustrates the variety of facilities that some other council's offer with regard to loans schemes. The majority of these all include heating and insulation; however, some of these schemes are more broadly focused. A number of these schemes are also currently on hold due to the recent changes to the CCCFA legislation. However, pending either getting an exemption from the CCCFA legislation or further amendments to this legislation being made, generally the intent is for these schemes to continue in some shape or form.

The success of these schemes also varies, but a number of these schemes have had a much larger uptake than what ICC and GDC have had with our local CALS schemes. For example, the Rotorua Hot Swap scheme that was open for 10 years (from 2011-2021) issued approximately 2,500 loans during this time. The Bay of Plenty Regional Council are now looking at extending this scheme to the wider region. Another example is the Hawke's Bay Regional Council, whose scheme has been open since 2009 (11 years in operation) and during this time has issued 17,000 loans.

As another example, in 2019 the Otago Regional Council (ORC) made changes to the subsidy offered to made changes to the subsidy offered to qualifying homes in Arrowtown, Clyde, Cromwell, Alexandra and Milton, with a funding pool capped at $120, 000 and allocated on a first in, first-served basis.[13]

[13] Sourced from: www.orc.govt.nz/news-and-events/news-and-media-releases/2019/may/increases-to-the-clean-heat-clean-air-subsidy-help-make-environmentally-friendly-heating-more-accessible-in-otago-towns

9.4 Submission on Resource Management (Freshwater and other matters) Amendment Bill

Report by: Marcus Roy, Policy and Government Manager
Approved by: Lucy Hicks, General Manager Policy & Government Reform
Report Date: 26 June 2024

Purpose

To gain approval on the submission on Resource Management (Freshwater and Other Matters) Amendment Bill.

Summary

The Primary Production Committee is receiving submissions on the Resource Management (Freshwater and Other Matters) Amendment Bill. The Government has announced that it intends to progress reforms of the RMA in three phases. This bill is part of the second phase, focusing on addressing particular issues the Government considers time-sensitive. The Government has signalled it intention to propose a more comprehensive reform of the RMA to Parliament in due course. Submissions close on 30 June 2024. The Primary Production Committee intends to focus its work on this bill on the particular issues in the bill listed below:

- Amendments to exclude the hierarchy of obligations under the NPSFM 2020 from consideration in a resource consent context;
- Amendments to the NES-F and Stock Exclusion Regulations (including regarding intensive winter grazing);
- Amendments to the timeframes for implementing part of the NPSIB 2023;
- Amendments to the process for making national direction including below; and
    - removal of the Board of Inquiry process
    - new process for evaluating national directions
    - expansion of the list of exemptions
- Amendments to provide a consenting pathway for coal mines.

Key submission points from Environment Southland are:

- Support for the decision-making power going back to regional councils on winter grazing and stock exclusion.
- Concern regarding the suspension of SNA identification given the continuing loss of areas of indigenous biodiversity within Southland.
- The process for creating or amending national direction could be improved by considering broader factors such as informed feedback from the public and stakeholders.
- Does not support the proposal the expansion of consenting pathways for coal mining, as it is unlikely to provide a sustainable long-term solution to the issue of national energy security and conflicts with international, national and regional commitments to address the issue of climate change.

Recommendation

It is recommended that the Strategy and Policy Committee **resolve to:**

1 Approve the submission on Submission on Resource Management (Freshwater and other matters) Amendment Bill.

Background

The current Bill is part of the second phase of the RMA reform. The remainder of RMA reform will bring further changes. These will include a review of the National Policy Statement for Freshwater Management (NPSFM), a review of the National Policy Statement for Indigenous Biodiversity (NPSIB), and an overhaul of the RMA itself. Despite this context, our submission is focused on the specific details of the current phase.

The bill is likely to have a limited impact on our operations. The hierarchy of obligations of Te Mana o Te Wai is embedded in our proposed Southland and Water Land plan (pSWLP)[1]. The pSWLP has existing rules on intensive winter grazing and stock exclusion, which pre-dates the central government's rules. This demonstrates the regional decision-making process to develop policies that protect environmental values while meeting community needs, even in the absence of national directives.

However, there is concern about the suspension of the SNA identification requirements in the NPSIB. This may lead to negative results and/or a halting of community action, for the protection of indigenous biodiversity within Southland. Therefore, we suggest the Government reconsider this aspect of the proposal. Southland currently does not have many mapped SNAs and the current regulatory rules in the region struggle to prevent ongoing loss of significant indigenous vegetation. Currently, only a few SNAs have been identified within Invercargill City, the Southland District plan does not identify SNAs and relies on general rules for protecting indigenous biodiversity. Gore District Council's draft District Plan included provision to identify SNAs, but these have been suspended following announcements from central government.

Concerning the proposals around simplifying the process for national policy development, we agree that there is a need to enhance the efficiency of government policy-making. However, there is a risk that this could lead to limited input from citizens, relevant institutions, and especially local government that are directly involved in policy implementation. This could potentially compromise the quality of policies and reduce the essential trust and participation of the public in democracy. Therefore, we are proposing that the government consider making some adjustments to the relevant proposals.

Lastly, the submission addresses the proposal to reauthorise the establishment and operation of coal mines. The current economic impacts of such a policy changes on our region are uncertain. Enabling the expansion of coal mining contradicts international agreements and national direction, to reduce fossil fuel use and promote environmentally friendly energy sources in response to climate change. Regionally, it could weaken or possibly undermine the efforts and progress Southland have been making to establish joint regional action on climate change-related programmes.

Risks/Opportunities

Relevant risks and opportunities have already been discussed in the Background section.

Views of affected parties

No other parties have been consulted as part of this submission.

Fit with strategic framework

OUTCOME	CONTRIBUTES	DETRACTS	NOT APPLICABLE
Managed access to quality natural resources		x	
Diverse opportunities to make a living			x
Communities empowered and resilient		x	

[1] The plan's capacity to safeguard water health was enhanced through court proceedings, resulting in the incorporation of Te Mana o te Wai principles into its objectives, policies, and associated rules.

Communities expressing their diversity			x

Compliance with Significance and Engagement Policy

There are no matters in this item that trigger this policy.

Considerations

Financial implications

There are no financial implications associated directly with the submission. However, if the Proposal is passed in its current form there will be increased costs to landowners, community and council over the long-term.

Legal implications

There are no legal implications associated directly with the submission.

Attachments

1. Resource Management Freshwater and Other Matters Amendment Bill (4) [**9.4.1** - 23 pages]
2. 2024 06 12 Submission on Resource Management (Freshwater and other matters) Amendment Bill [**9.4.2** - 4 pages]

Resource Management (Freshwater and Other Matters) Amendment Bill

Government Bill

Explanatory note

General policy statement

The objective of the Resource Management (Freshwater and Other Matters) Amendment Bill (the **Bill**) is to reduce regulatory burden by making targeted amendments to the Resource Management Act 1991 (**RMA**) and national direction.

The Bill—

- excludes the hierarchy of obligations contained in the National Policy Statement for Freshwater Management 2020 (the **NPSFM 2020**) from resource consent application and decision-making processes until the NPSFM 2020 is replaced:
- aligns the consenting pathway for coal mining with other mineral extraction activities across the NPSFM 2020, National Policy Statement for Indigenous Biodiversity 2023 (the **NPSIB 2023**) and Resource Management (National Environmental Standards for Freshwater) Regulations 2020 (the **NES-F**):
- modifies local authority obligations under the NPSIB 2023 to identify and include in district plans new significant natural areas (**SNAs**) for 3 years:
- amends the Resource Management (Stock Exclusion) Regulations 2020 in relation to sloped land:
- repeals the permitted and restricted discretionary activity regulations and associated conditions for intensive winter grazing from the NES-F:
- makes amendments to speed up the process to prepare or amend national direction under the RMA.

The Bill principally amends the RMA. It also amends the following legislation:

- the National Policy Statement for Freshwater Management 2020:

- the National Policy Statement for Indigenous Biodiversity 2023:
- the Resource Management (National Environmental Standards for Freshwater) Regulations 2020:
- the Resource Management (Stock Exclusion) Regulations 2020.

The Bill includes consequential amendments to the Resource Management (Freshwater Farm Plans) Regulations 2023 and the Resource Management (Infringement Offences) Regulations 1999.

Proposals

Excluding the hierarchy of obligations within the NPSFM 2020 from resource consent application and resource consent decision-making processes

Under the RMA, the NPSFM 2020 primarily takes effect through objectives, policies, and rules in regional policy statements and plans, and is also relevant to resource consenting. Resource consent applicants must assess (in applications for resource consent), and consent authorities must have regard to (when considering an application for resource consent), any relevant provisions of a national policy statement.

The NPSFM 2020 includes the concept of Te Mana o te Wai, which refers to the fundamental importance of freshwater and recognises that protecting the health of freshwater protects the health and well-being of the wider environment. Te Mana o te Wai includes a hierarchy of obligations that prioritises—

- first, the health and well-being of water bodies and freshwater ecosystems:
- second, the health needs of people (such as drinking water):
- third, the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future.

Managing freshwater in a way that prioritises the hierarchy of obligations is the stated (single) objective of the NPSFM 2020.

The Bill excludes the hierarchy of obligations within the NPSFM 2020 from resource consent application and decision-making processes by precluding—

- resource consent applicants from including an assessment against clause 1.3(5) or 2.1 of the NPSFM 2020 in applications for resource consent:
- consent authorities from requesting information from consent applicants or commissioning reports on clause 1.3(5) or 2.1 of the NPSFM 2020:
- consent authorities from having regard to clause 1.3(5) or 2.1 of the NPSFM 2020 when considering resource consent applications.

The Bill limits the application of this proposal to resource consent applications lodged with a consent authority after commencement.

The Bill requires the Minister for the Environment to make a recommendation to the Governor-General to repeal this proposal by Order in Council when recommending the approval of a new national policy statement for freshwater management to replace the NPSFM 2020.

Regional councils will remain obligated to give effect to the NPSFM 2020 (including the hierarchy of obligations) through their policy statements and plans.

Aligning the consenting pathway for coal mining with other extractive activities across national direction

The NPSFM 2020, NES-F, and NPSIB 2023 contain strong protections for wetlands and SNAs, but also provide specific consent pathways for mineral extraction activities that have adverse effects on wetlands or SNAs. The current pathway for coal mining has additional controls compared to other mineral extraction activities. The consent pathway is limited to the operation and expansion of existing coal mines and for thermal coal extraction, this consent pathway ceases on 31 December 2030.

The Bill therefore provides for measures to align the resource consent pathway for coal mining with other mineral extraction activities under the NPSIB 2023, NPSFM 2020, and NES-F. The Bill extends the consenting pathway for coal mines to new coal mines and removes the sunset clause on consent pathways for thermal coal.

Modifying local authority obligations under NPSIB 2023 to identify new SNAs and include them in district plans for 3 years

The NPSIB 2023 directs local authorities on how to discharge RMA requirements regarding indigenous biodiversity. It provides a consistent framework and assessment criteria for councils to identify and include SNAs within their policy statements and plans, and to manage the effects of development on SNAs. It also specifies time frames for those actions.

The Bill suspends NPSIB 2023 requirements for councils to identify and notify new SNAs using the NPSIB 2023 assessment criteria and principles for 3 years. This suspension does not affect NPSIB 2023 obligations on councils for SNAs already existing in policy statements, proposed policy statements, plans, proposed plans, or plan changes before the commencement of this Bill. The 3-year suspension period for the implementation of new SNAs will allow time for a review of the operation of SNAs more broadly.

The Bill also amends timing provisions within the NPSIB 2023 for when local authorities must publicly notify any policy statement or plan or changes necessary to give effect to NPSIB 2023 provisions about SNAs (subpart 2 of Part 3 of the NPSIB), except indigenous biodiversity outside an SNA (see clause 3.16 of the NPSIB 2023). The date is extended to 31 December 2030.

The Bill clarifies that it does not affect councils' existing obligations under the RMA for indigenous biodiversity which includes the requirement to recognise and provide for the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna.

The changes in the Bill do not affect or prevent identification or notification of new SNAs in policy statements, proposed policy statements, plans, proposed plans or plan changes during the 3-year suspension period if required by a court order or other outcome as a result of existing proceedings or processes, which are preserved by sections 32 to 33 of the Legislation Act 2019.

Amending stock exclusion regulations in relation to sloped land

The Resource Management (Stock Exclusion) 2020 regulate the access of cattle, pigs, and deer to water bodies.

A map of low slope land is currently incorporated by reference in the regulations and acts as a land-based trigger for requirements to exclude non-intensively grazed beef cattle and deer from water bodies (and all stock in relation to wetlands greater than 500 square metres).

The Bill repeals the map of low slope land and associated requirements, meaning that exclusion of affected stock types will instead be managed by freshwater farm plans and/or regional plan rules.

Repealing intensive winter grazing regulations in the NES-F

The NES-F includes regulations that allow intensive winter grazing to occur as a permitted activity, provided certain conditions are met or where a farm has a certified freshwater farm plan. Otherwise, a restricted discretionary resource consent is required to undertake intensive winter grazing.

The NES-F also includes stand-alone regulations to minimise adverse effects on freshwater from any pugging and to ensure a vegetated ground cover is established after livestock have finished grazing.

The Bill repeals the permitted and restricted discretionary activity regulations and associated conditions from the NES-F. However, the stand-alone regulations will be retained.

Amendments to speed up process to prepare or amend national direction

The process for preparing or amending a national direction is set out in subpart 1 of Part 5 of the RMA.

The Bill—

- removes the now redundant board of inquiry process to provide a clear default process for preparing a national direction:
- makes it easier to make simple updates to national direction:
- removes unnecessary prescription from the process to make or amend a national direction:
- amends evaluation report requirements as they relate to a national direction to make them more flexible and less onerous.

This proposal applies to preparing or amending a national environmental standard, national planning standard, national policy statement, or a New Zealand coastal policy statement.

Departmental disclosure statement

The Ministry for the Environment is required to prepare a disclosure statement to assist with the scrutiny of this Bill. The disclosure statement provides access to information about the policy development of the Bill and identifies any significant or unusual legislative features of the Bill.

A copy of the statement can be found at http://legislation.govt.nz/disclosure.aspx?type=bill&subtype=government&year=2024&no=47

Supplementary Analysis Reports

The Ministry for the Environment produced 2 Supplementary Analysis Reports on 13 and 14 May 2024 to help inform the main policy decisions taken by the Government relating to the contents of this Bill.

A copy of these Supplementary Analysis Reports can be found at—

- Supplementary Analysis Report: amending the consenting pathway for coal mining in or around wetlands and significant natural areas https://www.mbie.govt.nz/dmsdocument/28364-supplementary-analysis-report-amending-the-consenting-pathway-for-coal-mining-in-or-around-wetlands-and-significant-natural-areas
- Supplementary Analysis Report: Supplementary Analysis Report Streamlining National Direction Processes https://environment.govt.nz/what-government-is-doing/cabinet-papers-and-regulatory-impact-statements/streamlining-national-direction-processes

Clause by clause analysis

Clause 1 is the Title clause.

Clause 2 provides that this Bill comes into force on the day after Royal assent.

Clause 3 provides that this Bill amends the Resource Management Act 1991 (the **principal Act**).

Part 1
Amendments to Resource Management Act 1991

Clause 4 amends section 2 to insert definitions of the National Policy Statement for Freshwater Management 2020 and the National Policy Statement for Indigenous Biodiversity 2023.

Clause 4 also inserts a definition of national direction, which means a national environmental standard, a national planning standard, a national policy statement, or a New Zealand coastal policy statement.

Clauses 5 and 6 amend sections 32 and 32AA so that the evaluation requirements in those sections do not apply to national direction proposals.

Clause 7 inserts *new section 32AB* to provide requirements for evaluation of national direction proposals. An evaluation of a national direction proposal must consider—

- the effectiveness of the proposal; and
- the impact on the environment and the economy; and
- reasonably practicable alternative options.

Clause 8 consequentially amends section 32A, which provides for consequences for failure to carry out an evaluation.

Clause 9 consequentially amends section 42, which relates to protection of sensitive information.

Clause 10 replaces section 44(3) with a new provision enabling the Minister to recommend a change to a national environmental standard without undergoing the full process if the reason for the change is—

- to align with a New Zealand standard:
- to implement New Zealand's obligations under international conventions, agreements, or protocols:
- to give effect to provisions in an emissions reduction plan or national adaptation plan:
- to change the time frame for implementation of any part of a national environmental standard:
- to remove provisions in a national environment standard that are no longer required as a consequence of changes to legislation:
- to make changes that are no more than minor in effect, to correct errors, or to make similar technical alterations.

Clause 11 amends section 46A, which relates to the process for preparing national environmental standards and national policy statements.

Section 46A(4)(b) currently requires the process to include a requirement that those notified be given adequate time and opportunity make submissions. Section 46A(4)(b) is replaced with a new provision that requires that those notified must be given what the Minister considers to be adequate time and opportunity to make submissions.

Clause 12 consequentially amends section 46B, which relates to incorporation of material.

Clause 13 repeals sections 47 to 51, which requires a board of inquiry process for making national environmental standards or national policy statements.

Clauses 14 and 15 make minor and consequential amendments to sections 51A(3) and 52.

Clause 16 replaces section 53(2)(a) with a new provision enabling the Minister to amend a national policy statement without undergoing the full process if the amendment is for a reason specified in *new section 44(3)*.

Clauses 17 and 18 consequentially amend sections 57 and 58D.

Clause 19 amends section 58E to reflect that the process of making a national planning standard does not include any further evaluation in accordance with section 32AA.

Clause 20 replaces section 58H(2) with a new provision enabling the Minister to change a national planning standard without undergoing the full process if the change is for a reason specified in *new section 44(3)*.

Clause 21 inserts *new section 78*, which modifies local authority obligations under the NPSIB 2023 to—

- assess and identify areas of significant indigenous vegetation or significant habitats of indigenous fauna that qualify as a SNAs:
- include those SNAs in a proposed plan, plan, or plan change.

New section 78(2) provides that the following provisions of the NPSIB 2023 do not apply for 3 years after the commencement of this Bill:

- clause 2.2, Policy 6 (which requires a consistent approach in identifying significant indigenous vegetation and significant habitats of indigenous fauna as SNAs):
- clause 3.8(1), (6), and (8) (which require a territorial authority to conduct assessments to identify areas of significant indigenous vegetation and significant habitats of indigenous fauna that qualify as SNAs):
- clause 3.9(1) (which requires a territorial authority to notify a plan or plan change to include areas identified as qualifying as SNAs):
- clause 3.9(3) (which requires that when a local authority does its 10-yearly plan review, that it assess its district in accordance with clause 3.8(1) and (2) to determine whether changes are needed).

New section 78(3) provides that the obligation of a local authority to give effect to the NPSIB 2023 as soon as reasonably practicable excludes the provisions of the NPSIB 2023 described above during that 3-year period.

New section 78(6) provides that section 78 does not affect any SNA that is included in a policy statement, proposed policy statement, plan, proposed plan, or plan change, before the commencement of this Bill.

Clause 22 amends section 92 by inserting a new subsection that prohibits a consent authority from requesting information or commissioning reports on clause 1.3(5) or 2.1 of the NPSFM 2020. Those clauses establish a hierarchy of obligations that prioritises (in descending order of importance) the health and well-being of water bodies and freshwater ecosystems, the health needs of people, and the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future.

Clause 23 amends section 104 to require that a consent authority must not have regard to clause 1.3(5) or 2.1 of the NPSFM 2020 when considering an application for resource consent and any submissions received.

Clause 24 consequentially amends section 360B.

Clause 25 consequentially amends clause 47 of Schedule 1.

Clause 26 amends Schedule 4, which sets out the information required in an application for resource consent. Clause 2 of Schedule 4 is amended to provide that an assessment required by clause 2(1)(g) and (2) must not include an assessment of the activity against clause 1.3(5) or 2.1 of the NPSFM 2020.

Clause 27 and Schedule 1 amend Schedule 12 to provide for transitional provisions.

New Part 7 of Schedule 12—

- provides for the application of the NPSIB 2023 in respect of SNAs that are included in a policy statement, proposed policy statement, plan, proposed plan, or change before the commencement of this Bill; and
- requires that specified provisions of the RMA that limit the effect of clauses 1.3(5) and 2.1 of the NPSFM 2020 only affect resource applications lodged on and from the commencement of this Bill; and
- provides for the repeal of those specified provisions when the NPSFM 2020 is replaced; and
- provides that specified amendments to the NPSFM 2020, NES-F, and NPSIB 2023 that affect coal mining do not apply to resource consent applications lodged before the commencement of this Bill (regardless of any provision to the contrary in the RMA).

Part 2
Other matters

Clause 28 and Schedule 2 provide for amendments to secondary legislation made under the principal Act.

The Resource Management (Freshwater Farm Plans) Regulations 2023 are amended by replacing the definition of critical source area.

The Resource Management (National Environment Standards for Freshwater) Regulations 2020 are amended by—

- revoking the provisions regulating intensive winter grazing as a permitted activity (regulations 26 and 27 to 31); and
- revoking regulation 45D(7) (which restricts resource consent applications for discretionary activities involving coal extraction where certain activities affect natural inland wetlands); and
- revoking regulation 45D(8) (which, after 31 December 2030, would restrict resource consent applications involving the operation or expansion of existing

coal mines (other than for coking coal) where certain activities affect natural inland wetlands).

The Resource Management (Stock Exclusion) Regulations 2020 are amended by—

- revoking the provisions regulating the grazing of beef cattle and deer on low slope land:
- revoking the provisions requiring stock on low slope land to be excluded from natural wetlands of 0.05 hectares or more.

The Resource Management (Infringement Offences) Regulations 1999 are amended by removing references to provisions of regulations that have been revoked.

The National Policy Statement for Freshwater Management 2020 is amended by replacing clause 3.22(1)(e)(i) to remove restrictions on coal mining activities.

The National Policy Statement for Indigenous Biodiversity 2023 is amended by modifying the exceptions in clause 3.11 to the requirement that adverse effects specified in clause 3.10(2) on an SNA of a new subdivision, use, or development must be avoided. The amendments—

- remove the restriction in clause 3.11(1)(a)(ii) that prevents coal mining from being a mineral extraction to which that provision applies; and
- revoke clause 3.11(1)(a)(iv), which provides an exception for pre-established coal mines that, after 31 December 2030, would apply only to coal mines that extract coking coal.

The NPSIB 2023 is also amended by extending the time frame in clause 4.2 by which local authorities must publicly notify any policy statement, plan, or changes necessary to give effect to subpart 2 of Part 3 of the NPSIB 2023 (which relates to SNAs). However, the extended time frame does not apply to clause 3.16 of the NPSIB 2023 (which relates to indigenous biodiversity outside of SNAs).

Hon Chris Bishop

Resource Management (Freshwater and Other Matters) Amendment Bill

Government Bill

Contents

The Parliament of New Zealand enacts as follows:

1 Title

This Act is the Resource Management (Freshwater and Other Matters) Amendment Act **2024**.

2 Commencement

This Act comes into force on the day after it receives the Royal assent.

3 Principal Act

This Act amends the Resource Management Act 1991.

Part 1
Amendments to Resource Management Act 1991

4 Section 2 amended (Interpretation)

In section 2(1), insert in their appropriate alphabetical order:

national direction means, except as provided in section 80B(3),—

(a) a national environmental standard; or

(b) a national planning standard; or

(c) a national policy statement; or

(d) a New Zealand coastal policy statement

National Policy Statement for Freshwater Management 2020 or **NPSFM 2020** means the National Policy Statement for Freshwater Management 2020 that was approved by the Governor-General under section 52(2) on 3 August 2020 and that came into effect on 3 September 2020

National Policy Statement for Indigenous Biodiversity 2023 or **NPSIB 2023** means the National Policy Statement for Indigenous Biodiversity 2023 that was approved by the Governor-General under section 52(2) on 31 May 2023 and that came into effect on 4 August 2023

5 Section 32 amended (Requirements for preparing and publishing evaluation reports)

(1) Replace the heading to section 32 with "**Evaluation of proposal (other than national direction)**".

(2) In section 32(1), after "under this Act", insert "for a proposal other than a national direction".

(3) In section 32(3), delete "national planning standard, regulation".

(4) Replace section 32(5) with:

(5) The person who must have particular regard to the evaluation report must make the report available for public inspection at the same time as the proposal is notified.

(5) In section 32(6), definition of **proposal**, delete "national planning standard, regulation, regulation".

6 Section 32AA amended (Requirements for undertaking and publishing further evaluations)

(1) Replace the heading to section 32AA with "**Further evaluation of proposal (other than national direction)**".

(2) In section 32AA(1), after "Act", insert "of a proposal other than a national direction".

(3) Replace section 32AA(1)(d)(i) with:

(i) be published in an evaluation report that is made available for public inspection at the same time as the decision on the proposal is notified; or

(4) In section 32AA(3), definition of **proposal**, replace "statement, national planning standard," with "regional policy statement,".

7 New section 32AB inserted (Evaluation of national direction)

After section 32AA, insert:

32AB Evaluation of national direction

(1) An evaluation report required under this Act of a proposal that is a national direction must include consideration of—

(a) the effectiveness of the proposal; and

(b) the impact on the environment and on the economy (whether adverse or beneficial) when proposing whether to regulate; and

(c) reasonably practicable alternative options in the proposal.

(2) The analysis for the report must begin early in the process of developing the proposal.

(3) The report must be prepared and presented in a way that—

(a) is cost-effective; and

(b) provides a level of detail that is proportionate to the scale and significance of the proposal; and

(c) is succinct and plainly expressed; and

(d) is useful for decision makers and the public.

8 Section 32A amended (Failure to carry out evaluation)

(1) In section 32A(1), replace "or 32AA" with ", 32AA, or **32AB**".

(2) In section 32A(1), delete "49,".

(3) In Section 32A(2), after "32", insert "or **32AB** as applicable".

(4) In section 32A(3), replace "statement, national planning standard" with "national direction, regional policy statement, standard".

9 Section 42 amended (Protection of sensitive information)

In section 42(6)(b)(i), replace "section 47 or 149J" with "section 149J".

10 Section 44 amended (Restriction on power to make national environmental standards)

(1) In section 44(1)(b), replace "section 32" with "**section 32AB**".

(2) In section 44(1)(d), replace "section 46A(4)(c) or 51(2), as the case requires" with "section 46A(4)(c)".

(3) In section 44(2)(a), replace "section 46A(4)(c) or 51, as the case requires" with "section 46A(4)(c)".

(4) Replace section 44(3) with:

(3) The Minister need not follow the process referred to in section 46A if the Minister is recommending the making of an amendment for 1 of the following reasons:

(a) to align with a New Zealand Standard within the meaning of section 4 of the Standards and Accreditation Act 2015:

(b) to implement New Zealand's obligations under any international convention, protocol, or agreement to which New Zealand is a party:

(c) to give effect to provisions in an emissions reduction plan or national adaptation plan:

(d) to change the time frame for implementation of any part of a national environmental standard:

(e) to remove provisions in a national environmental standard that are no longer required as a consequence of changes to legislation:

(f) to make changes that are no more than minor in effect, to correct errors, or to make similar technical alterations.

(4) An amendment under this section is secondary legislation (*see* Part 3 of the Legislation Act 2019 for publication requirements).

11 Section 46A amended (Single process for preparing national directions)

(1) Replace the heading to section 46A with "**Process for preparing national environmental standards and national policy statements**".

(2) Repeal section 46A(1).

(3) Replace section 46A(2) and (3) with:

(2) This section sets out the requirements for preparing—

(a) a national environmental standard; or

(b) a national policy statement.

(3) If the Minister proposes to issue a national environmental standard or national policy statement, the Minister must establish and follow a process that includes the steps described in subsection (4).

(4) In section 46A(4), replace "subsection (3)(b)" with "**subsection (3)**".

(5) Replace section 46A(4)(a)(i) with:

(i) the proposed national environmental standard or national policy statement (the **proposal**); and

(6) In section 46A(4)(a)(ii), replace "proposed national direction" with "proposal".

(7) Replace section 46A(4)(b) with:

(b) those notified must be given what the Minister considers to be adequate time and opportunity to make a submission on the subject matter of the proposal; and

(8) In section 46A(4)(c), replace “national direction; and” with “proposal.”.

(9) Repeal section 46A(4)(d).

(10) Replace section 46A(5) with:

(5) In preparing a national environmental standard or national policy statement, the Minister may, at any time, consult on a draft of that document.

(11) Repeal section 46A(6).

12 Section 46B amended (Incorporation of material by reference in national direction)

(1) In the heading to section 46B, replace “**national direction**” with “**national environmental standard or national policy statement**”.

(2) In section 46B, replace “national direction” with “national environmental standard or national policy statement”.

13 Sections 47 to 51 repealed

Repeal sections 47 to 51.

14 Section 51A amended (Withdrawal of proposed national policy statement)

Repeal section 51A(3).

15 Section 52 amended (Consideration of recommendations and approval or withdrawal of statement)

(1) Replace section 52(1)(a) with:

(a) first, must consider a report and any recommendations made under section 46A(4)(c); and

(2) In section 52(1)(c), replace “section 32” with “**section 32AB**”.

16 Section 53 amended (Changes to or review or revocation of national policy statements)

(1) Replace section 53(1) with:

(1) The Minister may review, change, or revoke a national policy statement after following the process referred to in section 46A.

(2) In section 53(2), replace “without using a process referred to in subsection (1)” with “without following the process referred to in section 46A”.

(3) Replace section 53(2)(a) with:

(a) amend a national policy statement if the Minister is recommending the amendment for a reason specified in **section 44(3)**, which applies as if a reference in that section to a national environmental standard were a reference to a national policy statement; or

17 Section 57 amended (Preparation of New Zealand coastal policy statements)

In section 57(1), replace "using one of the processes referred to in section 46A(3), as if references in sections 46 to 52" with "after following the process referred to in section 46A as if references in that section".

18 Section 58D amended (Preparation of national planning standards)

In section 58D(3)(b), replace "section 32" with "**section 32AB**".

19 Section 58E amended (Approval of national planning standard)

Replace regulation 58E(1) with:

(1) Before approving a national planning standard, the Minister must consider the report and recommendations made under section 58D(3)(d)(ii).

20 Section 58H amended (Changing, replacing, or revoking national planning standards)

Replace section 58H(2) with:

(2) The Minister need not follow the process set out in sections 58D and 58E if the Minister is recommending a change to a national planning standard for a reason specified in **section 44(3)**.

21 New section 78 inserted (Time-limited modifications to NPSIB 2023)

After section 77T, insert:

78 Time-limited modifications to NPSIB 2023

(1) For the purposes of this section, the **3-year period** means the period that—

(a) commences on the date of commencement of the Resource Management (Freshwater and Other Matters) Amendment Act **2024**; and

(b) expires on the date that is 3 years after commencement.

(2) The following provisions of the NPSIB 2023 do not apply during the 3-year period:

(a) clause 2.2, Policy 6 (which requires a consistent approach in identifying significant indigenous vegetation and significant habitats of indigenous fauna as SNAs):

(b) clause 3.8(1), (6), and (8) (which requires a territorial authority to conduct assessments to identify areas of significant indigenous vegetation and significant habitats of indigenous fauna that qualify as SNAs):

(c) clause 3.9(1) (which requires a territorial authority to notify a plan or plan change to include areas identified as qualifying as SNAs):

(d) clause 3.9(3) (which requires that a local authority must, when doing its 10-yearly plan review, assess its district in accordance with clause 3.8(1) and (2) to determine whether changes are needed).

(3) Clause 4.1 of the NPSIB 2023 (which requires a local authority to give effect to the NPSIB 2023 as soon as reasonably practicable)—

(a) does not apply during the 3-year period in relation to the provisions of the NPSIB 2023 specified in **subsection (2)**; but

(b) continues to apply in relation to the other provisions of the NPSIB 2023.

(4) This section does not affect any function or requirement under other provisions of this Act relating to indigenous biological diversity, including in relation to areas of significant indigenous vegetation or significant habitats of indigenous fauna.

(5) However, an area of significant indigenous vegetation or significant habitat of indigenous fauna that, after commencement, is included in a policy statement, proposed policy statement, plan, proposed plan, or change is not to be treated as an SNA regardless of how it is described in that document.

(6) This section does not affect any SNAs that are included in a policy statement, proposed policy statement, plan, proposed plan, or change before commencement (*see also* **clause 40 of Schedule 12**).

(7) The Minister for the Environment may amend the NPSIB 2023 to make any changes that the Minister is satisfied are required as a result of the enactment of the Resource Management (Freshwater and Other Matters) Amendment Act **2024** to—

(a) remove an inconsistency or a potential inconsistency between the NPSIB 2023 and that Act; or

(b) clarify the relationship between the NPSIB 2023 and that Act.

(8) In this section,—

commencement means the commencement of the Resource Management (Freshwater and Other Matters) Amendment Act **2024**

SNA means a significant natural area as defined in clause 1.6 of the NPSIB 2023.

(9) An amendment under this section is secondary legislation (*see* Part 3 of the Legislation Act 2019 for publication requirements).

(10) This section is repealed on the close of the date of expiry of the 3-year period.

22 Section 92 amended (Further information, or agreement may be requested)

After section 92(2), insert:

(2A) However, a consent authority must not request further information nor commission a report on clause 1.3(5) or 2.1 of the NPSFM 2020 (which relates to the hierarchy of obligations in the NPSFM 2020).

23 Section 104 amended (Consideration of applications)

After section 104(2E), insert:

(2F) When considering an application and any submissions received, a consent authority must not have regard to clause 1.3(5) or 2.1 of the NPSFM 2020 (which relates to the hierarchy of obligations in the NPSFM 2020).

(2G) **Subsection (2F)** applies despite subsection (1)(b)(iii) and any other provision of this Act.

24 Section 360B amended (Conditions to be satisfied before regulations made under section 360A)

In section 360B(2)(d), replace "32" with "**32AB**".

25 Schedule 1 amended

In Schedule 1, clause 47(1), delete "51,".

26 Schedule 4 amended

In Schedule 4, after clause 2(2), insert:

(2A) An assessment required by subclauses (1)(g) and (2) must not include an assessment of the activity against clause 1.3(5) or 2.1 of the NPSFM 2020 (which relates to the hierarchy of obligations in the NPSFM 2020).

(2B) **Subclause (2A)** applies despite subclauses (1)(g) and (2) and any other provision of this Act.

27 Schedule 12 amended

In Schedule 12,—

(a) insert the Part set out in **Schedule 1** of this Act as the last Part; and

(b) make all necessary consequential amendments.

Part 2
Other matters

28 Amendments to secondary legislation made under Resource Management Act 1991

Amend the secondary legislation specified in **Schedule 2** as set out in that schedule.

Schedule 1
New Part 7 inserted into Schedule 12

s 27

Part 7
Provisions relating to Resource Management (Freshwater and Other Matters) Amendment Act **2024**

39 Interpretation

In this Part, unless the context otherwise requires,—

amendment Act means the Resource Management (Freshwater and Other Matters) Amendment Act **2024**

commencement means the date that the amendment Act comes into force

specified provisions relating to the NPSFM 2020 means—

(a) **section 92(2A)**; and

(b) **section 104(2F) and (2G)**; and

(c) **clause 2(2A) and (2B) of Schedule 4**.

40 Effect of certain amendments on significant natural areas before commencement

(1) The NPSIB 2023, as it was immediately before commencement but subject to the specified amendments, continues to apply in respect of an SNA described in **section 78(6)**.

(2) In this clause, **specified amendments** means the amendments made by section 28 and Schedule 2 of the amendment Act to—

(a) clause 3.11(1)(a)(ii) and (iv) of the NPSIB 2023:

(b) clause 4.2 of the NPSIB 2023.

41 Specified provisions relating to NPSFM 2020

(1) The specified provisions relating to the NPSFM 2020 apply only in relation to an application for a resource consent that is lodged with a consent authority in accordance with section 88 on and from commencement.

(2) To avoid doubt, an application referred to in **subclause (1)** includes any application that is treated as a new application under section 88(4) and lodged with a consent authority on and from commencement.

42 Repeal of specified provisions relating to NPSFM 2020 by Order in Council

(1) The Governor-General in Council may, on the recommendation of the Minister, repeal the specified provisions relating to the NPSFM 2020.

(2) The Minister must make a recommendation under this clause when recommending the approval of a new national policy statement under section 52 to replace the NPSFM 2020.

(3) An Order in Council under this clause is secondary legislation (*see* Part 3 of the Legislation Act 2019 for publication requirements).

43 Effect of certain amendments on existing applications for resource consents

(1) The amendments affecting coal mining do not apply to an application for a resource consent that is lodged with a consent authority before commencement regardless of any provision to the contrary in this Act.

(2) In this clause, the **amendments affecting coal mining** mean the amendments made by section 28 and Schedule 2 of the amendment Act to—

(a) regulation 45D(7) and (8) of the Resource Management (National Environment Standards for Freshwater) Regulations 2020:

(b) clause 3.22(1)(e)(i) of the NPSFM 2020:

(c) clause 3.11(1)(a)(ii) and (iv) of the NPSIB 2023.

Schedule 2
Amendments to secondary legislation made under Resource Management Act 1991

s 28

Resource Management (Freshwater Farm Plans) Regulations 2023 (SL 2023/113)

In regulation 3, replace the definition of **critical source area** with:

> **critical source area** means a landscape feature such as a gully, swale, or depression that—
>
> (a) accumulates runoff from adjacent land; and
>
> (b) delivers, or has the potential to deliver, 1 or more contaminants to 1 or more rivers, lakes, wetlands, or drains, or their beds (regardless of whether there is any water in them at the time)

Resource Management (National Environment Standards for Freshwater) Regulations 2020 (LI 2020/174)

In regulation 3, revoke the definition of **critical source area**.

Revoke regulation 26.

In regulation 26A(1), delete “in accordance with regulation 26”.

In regulation 26B(1), delete “in accordance with regulation 26”.

Revoke regulations 27 to 31.

Revoke regulation 45D(7) and (8).

Resource Management (Stock Exclusion) Regulations 2020 (LI 2020/175)

Revoke regulation 3(4) and (7).

In regulation 3A, replace “14 to 18” with “16 and 17”.

In regulation 4, revoke the definition of **low slope land**.

In regulation 7, replace “12(b), or 14(b)” with “or 12(b)”.

Revoke regulations 14, 15, and 18.

Resource Management (Infringement Offences) Regulations 1999 (SR 1999/359)

In Schedule 1A, table, revoke the items relating to regulations 14(a), 14(b), 15, and 18.

National Policy Statement for Freshwater Management 2020

Replace clause 3.22(1)(e)(i) with:

> (i) the activity is necessary for the purpose of the extraction of minerals and ancillary activities; and

National Policy Statement for Indigenous Biodiversity 2023

In clause 3.11(1)(a)(ii), delete "; but this subparagraph does not apply to any mineral extraction that is coal mining, and subparagraph (iv) applies instead".

In clause 3.11(1)(a)(iii), replace "New Zealand:" with "New Zealand; and".

Revoke clause 3.11(1)(a)(iv).

In clause 4.2(1), replace "subpart 2 of Part 3 (significant natural areas)" with "clause 3.16 (indigenous biodiversity outside SNAs)".

After clause 4.2(1), insert:

(2) Local authorities must publicly notify any policy statement or plan or changes to these necessary to give effect to subpart 2 of Part 3 (except clause 3.16) by 31 December 2030.

Wellington, New Zealand:

Published under the authority of the New Zealand Government—2024

Submission on Resource Management (Freshwater and other Matters) Amendment bill

Environment Southland thanks the Committee for the opportunity to participate in the submission process for the abovementioned bill. As the regional council, we have drawn on our extensive knowledge and insights to provide our perspective of the region and its communities, as well as our experience obtained from implementing national directions. We have been proactively participating in the resource management reform processes for a number of years. We intend to continue to collaborate with officials and support relevant ministers during the upcoming legislative changes.

The Bill introduces a number of amendments, the most relevant to Environment Southland being:

- Amendments to exclude the hierarchy of obligations under the NPSFM 2020 from consideration in a resource consent context;
- Amendments to NES-F and Stock Exclusion Regulations (including intensive winter grazing);
- Amendments to the timeframes for implementing part of the NPSIB 2023;
- Amendments to the process for making national direction including below; and
    - removal of the Board of Inquiry process
    - new process for evaluating national directions
    - expansion of the list of exemptions
- Amendments to provide a consenting pathway for coal mines.

Executive summary

1 Environment Southland supports some the changes to the RMA to remove unnecessary regulatory barriers. Regional councils are well placed, to make local decisions for winter grazing and stock exclusion, as demonstrated by those we have in place in, in our Southland Water and Land Plan. There are further opportunities to improve outcomes by retaining the ability of councils to develop regulations more stringent than national regulations, as needed by the local conditions.

2 Given the continuing loss of areas of indigenous biodiversity in Southland, Environment Southland does not support the delay of SNA identification.

3 Environment Southland request that the parts of the Bill relating to developing national direction would benefit from broader consideration of a process for informed feedback from the public, to ensure outcomes are holistic and that national direction has enduring impacts.

4 Despite acknowledging the benefits of achieving energy self-sufficiency within New Zealand, Environment Southland considers that approving coal mines within New Zealand would not provide a sustainable long-term solution. Therefore, we do not support the proposal to expand consenting pathways for coal mining.

Exclusion of the hierarchy of Te Mana o Te Wai & Intensive winter grazing and stock exclusion regulations

The Bill proposes to exclude the hierarchy of Te Mana o Te Wai from consideration when processing resource consents. The bill also seeks to change regulations including the repealing of the permitted and restricted discretionary activity rules for intensive winter grazing and removing the low slope map.

There are rules that manage the impacts of these activities, in Southland, through our provisions in the Southland Water and Land plan. These rules are the result of how regions develop regulations that effectively address environmental issues, while meeting the needs of the community.

Recommendation
Retain local government's ability of local government to enact regulations more stringent and locally defined.
Support on-going effective regional policy development by providing robust national guidance and other resources.

Amendments to the timeframes for implementing part of the NPSIB 2023

Environment Southland has been working with our community to understand and protect the broader benefits that indigenous biodiversity brings to the region. Halting the decline of biodiversity is a high priority to prevent ongoing loss of significant indigenous vegetation.

Environment Southland is concerned that delays to the SNA mapping may cause further irreversible loss of indigenous ecosystems.

additionally, we also note that the wording of s78(5) needs to be improved. As proposed, the provision prevents any new SNAs identified by councils within the next three years, from being recognised. The clarity needed is would those areas receive protection under existing regional rules despite not being recognised under the NPSIB.

Recommendation
Reconsider the SNA mapping requirements and amend the proposed s78(5) to improve clarity.

Amendments to the process for making national direction

Proposed new criteria for evaluation report

The Bill proposes to establish a new process for the evaluation of national direction in section 32AB to enhance process efficiency. Environment Southland request that the Bill sections relating to this process should include the consideration of broader factors such as informed feedback from the public to ensure outcomes are more holistic and the national direction has an enduring positive impact.

The proposed process for preparing evaluation reports requires consideration of 'the impact on the environment and the economy (whether adverse or beneficial) when proposing whether to regulate'. We suggest the ministry consider broadening the list by adding social and cultural effects to achieve consistency with the purpose of the RMA, which relates to all four well-beings. Additionally, we believe that such impact should also be considered regarding amendments to national directions as well as creation of new directions since amendments to national policies can have a substantial impact depending on the scale and nature of the proposal. Addition of a requirement for publishing evaluation reports would ensure that the general public and relevant stakeholders have access to crucial information to support making submissions.

Recommendation
Consider amending the wording of s32AB(1)(b) to

- Require consideration of the impacts on social and cultural aspects as well as environmental and economic impacts;
- Require consideration of the environmental, economic, social, and cultural impacts for all changes to the national direction including reviews;
- Require publication of an evaluation report at the same time as the relevant decision is notified;

'What the Minister considers to be adequate time and opportunity to make a submission'

The Bill provides that ministers can determine what would be 'adequate time and opportunity to make a submission on the subject matter of the proposal'. While we understand the desire to enhance efficiency through introducing more flexibility, enabling ministers to reduce the relevant submission timeframes further risks a reduction in the quality of submissions being received, whereby limiting the potential improvement brought about by public consultation.

In particular, advice from councils can be compromised by shorter timeframes due to the strict constraints they operate under. As a result, the national policies may not benefit from the feedback provided to ensure that the proposed policies are practical and effective in achieving their intended objectives on the ground.

Recommendation
Retain the existing wording of s46A(4)(b) which requires ministers to give 'adequate time and opportunity to make a submission'.

Exemptions to going through the process

Environment Southland considers that the proposed provision to the process of national direction development could be strengthened by defining certain exemptions. While the current framework allows ministers to bypass the usual process only for amendments of minor effects, the Bill adds more to the list, including giving effect to international obligations, provisions in an emissions reduction plan, or a national adaptation plan. Disputes can arise regarding whether and how certain national proposals give effect to such directions. We suggest defining the scope of exemptions more narrowly to minimise the risk of disputes and the associated costs.

Recommendation

Amend the section to narrow the scope of exemptions by adding criteria related to the scale of potential impact of the proposed national direction, thereby ensuring that exemptions are granted only when the anticipated impact is minor or negligible.

Consenting pathway for coal mines

Environment Southland does not support the proposed changes intended to provide broader consenting pathways for coal mines. Despite acknowledging the benefits of achieving energy self-sufficiency within New Zealand, approving future coalmines may stymy other industries appetite to innovate and they are unlikely to provide a viable, sustainable long-term solution.

The proposed policy changes need to align with the array of climate change-focused policies at international, national and regional levels. These policies are the result of extensive public consultation. They include policies within the NPSFM, NPSIB, National Policy Statement for Greenhouse Gas Emissions from Industrial Process Heat 2023, and the Emissions Reductions Plan, as well as international commitments arising from the Paris Agreement.

Conflicting national objectives are detrimental to effective regional policy-making, the efficient processing of resource consents and have the potential to confuse the public, which can cause uncertainty and prevents action. This can slow regional efforts towards establishing climate change actions on the ground.

Recommendation

Reconsider the proposed changes for expanding consenting pathways for coal and retain alignment with national climate change commitments.

9.5 PCE Report Update - Land use change investigation

Report by: Ewen Rodway, Team Leader-Science Strategy & Integration
Approved by: Rachael Millar, General Manager Strategy, Science & Engagement
Report Date: 19 June 2024

Purpose

To provide an update on the recent reports from the Parliamentary Commissioner for the Environment (PCE) that aim to clarify the multiple environmental challenges rural New Zealand faces and the trade-off of meeting them, with a particular focus on land use changes.

Summary

The reports document six years of work on this topic of addressing multiple environmental challenges in New Zealand. The first report outlines a process and sense of direction for addressing these challenges. It describes the need to accept the inevitability of land use changes, adopt an integrated and region/catchment specific approach, the utilisation of the best environmental information, and the possibility of alternative mechanisms to fund land use change. The second report explores various aspects of a catchment-based management approach and explores the progression of land use changes under different policy settings. The Mataura is one of two catchments used as a case study in this scenario modelling exercise.

Recommendation

It is recommended that the Strategy and Policy Committee **resolve to:**

1 receive this update and note the implications.

Background

In the first report, *Going with the grain: changing land uses to fit a changing landscap*e, the PCE identified the key barriers to effectively addressing the multiple environmental challenges impacting land uses. It aims to provide a sense of direction for addressing climate change, biodiversity loss, and water quality while considering the economic, social, and cultural aspects of our regions. Rather than prescribing specific actions, it outlines a process while encouraging urgent action.

The six key issues and potential solutions (in italics) have been summarised below:

- **The way we use land needs to change under the changing climate.** How it progresses will be influenced by various factors, including regulations, our trading relationships, and changing consumer preferences abroad. *To address this issue, New Zealanders must acknowledge that land use change is unavoidable and initiate discussions about how we manage that change and the impacts it will have on our people.*

- **The policy landscape is fragmented,** reflecting the perception that environmental impacts of land use are a series of technical problems (climate mitigation, climate adaptation, freshwater quality, and biodiversity) with discrete solutions. Such an approach is particularly at odds with the holistic approach of tangata whenua. *Policy makers should adopt an integrated approach that looks at the collective impacts of land uses, and changes to those land uses, at the same time.*

- **One-size-fits all approach in national regulations.** National regulations currently overlook the unique characteristics of different catchments, resulting in policies that have varied effects based on existing land uses and geography, as demonstrated by case studies in Wairoa and Mataura. *There should be a rebalance of decision making so that central government and regional councils determine the general direction in consultation with the community and communities and mana whenua at the catchment or sub catchment level make decisions on the implementation.*

- **Property-scale responsibility for environmental management.** Decisions on land use are primarily in the hands of landowners under current regulations, limiting their ability to address environmental impacts beyond their properties. *Catchment groups should be incentivised to play a larger and more proactive role in environmental management. Incentivisation could happen through increased resourcing or devolution of greater power to these groups.*
- **Incomplete and inaccessible environmental data.** The quality of environmental information in New Zealand often falls short of its intended purpose, with fragmented and inaccessible data within the reporting framework, compounded by inadequate funding leading to database cuts and stagnation. *Central government should ensure that high-quality environmental information is accessible and treated as a public good, available to land users and regional councils at no cost to avoid disputes over facts. This information is crucial for modelling the impacts of potential actions, identifying hotspots for effective land use changes.*
- **Several commercial obstacles hinder land use change**, especially for small farming businesses facing high capital requirements and long payback periods, compounded by difficulties in obtaining loans from risk-averse banks. Consequently, landowners tend to favour the status quo due to risk aversion, and the lack of tools to address environmental issues. *We need to find alternative ways to fund land use change. There are several options, including integrated grant and loan schemes, demonstration grants, market-based mechanisms, an intensity-adjusted land tax or a price on biogenic methane emissions.*

In the second report, *Exploring land use change under different policy settings in two case study catchments,* the PCE applies a catchment-based modelling approach to explore the interactions of various policy settings for addressing climate change, freshwater quality and biodiversity issues, considering specific local contexts. Two case-study catchments were used in this work, the Mataura catchment and the Wairoa catchment (Northland).

The work explores the progression of land use changes under different policy settings. Since the Mataura catchment was one of these case study areas, Environment Southland staff contributed insights to this process.

The point of this exercise was to test whether the concept of integrating spatial susceptibility mapping, land use and economic modelling with input from local people could deliver useful insights into the potential alternative futures arising from different mixes of policy.

Scenarios explored included below:

Scenario 1. Low levy, no revenue recycling back to catchment
- A low farm-level levy on agricultural emissions that increases gradually over time.
- Biogenic methane and nitrous oxide treated separately.
- Levy revenue spent on national-level research.
- Farms comply with freshwater quality regulations as at 2022.

Scenario 2. Higher levy, untargeted revenue recycling back to catchment

- Higher farm-level levy on agricultural emissions that rises more rapidly over time.
- Biogenic methane and nitrous oxide treated separately.
- Levy spent on national level research, riparian planting, and untargeted subsidies to reduce stocking rates (Mataura).
- Farms comply with freshwater quality regulations as at 2022.

Scenario 3. Low levy, tailored freshwater regulations

- Low levy same as scenario 1.
- Levy revenue spent on national-level research.
- Tailored freshwater regulations

Scenario 4. Higher levy, targeted revenue recycling back to catchment

- High levy same as scenario 2.
- Levy spent on national research and recycled back into targeted catchment actions.
- Farms comply with freshwater quality regulations as at 2022.

Scenario 5. Higher levy, targeted revenue recycling back to catchment, forestry phased out of NZ ETS

- High levy same as scenario 2.
- Levy spent on national research and recycled back into targeted catchment actions.
- Farms comply with freshwater quality regulations as at 2022.
- No new forest allowed in the NZ ETS after 2030.
- Subsidies for planting alternative forestry types.

Scenario 6. Low levy, no revenue recycling back to catchment, trees integrated into farms (farm– forestry)

- Low levy same as scenario 1.
- Levy spent on national research.
- Farms comply with freshwater quality regulations as at 2022.
- Livestock farming on marginal land is converted to pine forestry. Livestock farming on high-sediment-risk land converted to permanent native forest.

Below graphs show land use changes in Mataura under the different scenarios:

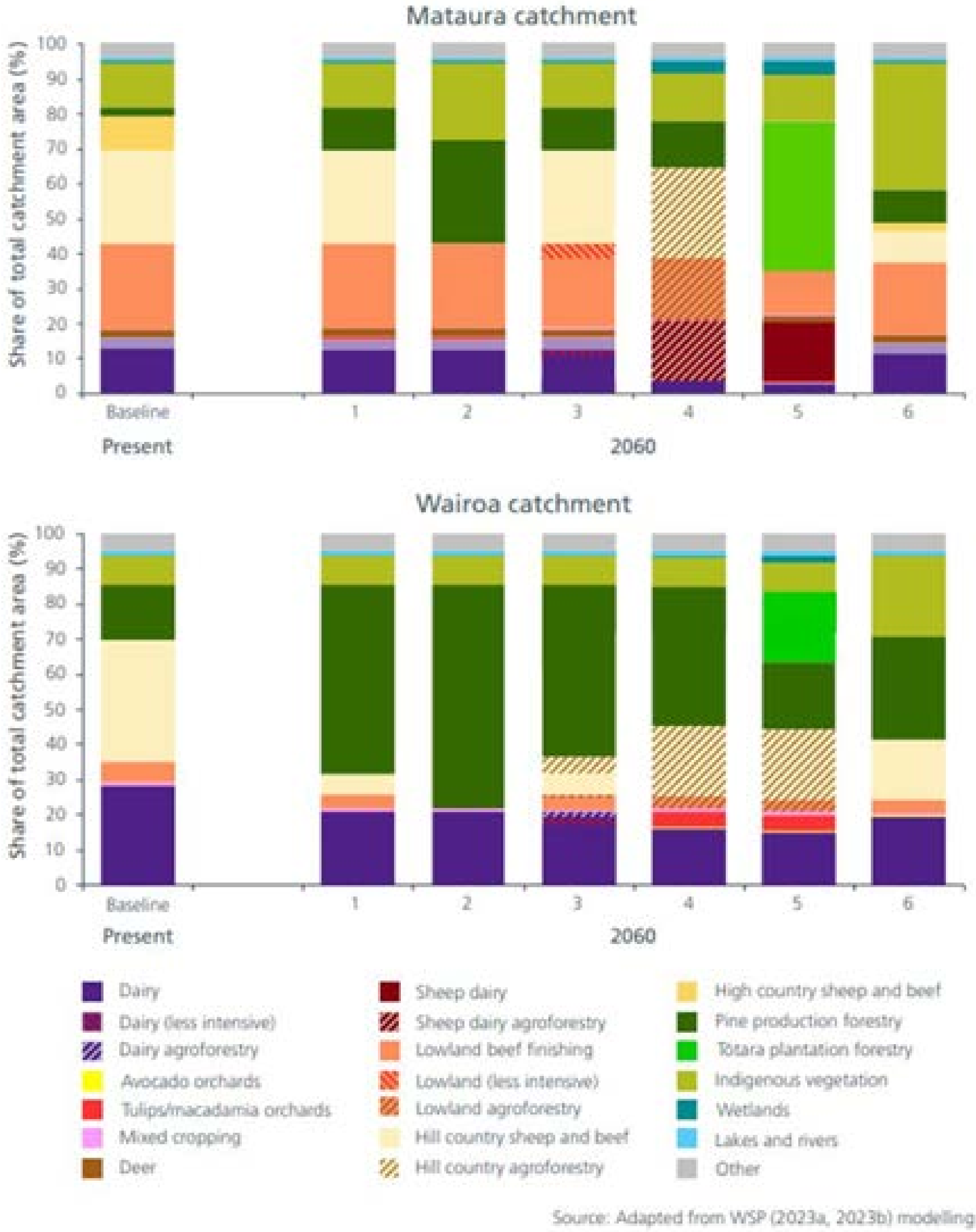


Figure 6.1: Land uses in Mataura and Wairoa under the six policy scenarios. 'Indigenous vegetation' includes riparian planting. 'Other' includes all other land uses.

Some key assumptions and observations of the modelling

The analysis assumed fixed commodity prices and no new technologies to reduce ruminant methane emissions.

The impact of climate change on the catchments was not modelled.

For farms that were no longer profitable, the modelling assumed the land use would change to the most profitable alternative.

Climate and soil limitations were considered, but other barriers to scaling up alternative land uses – such as supporting infrastructure needs and labour market constraints – were not modelled.

In most cases, land use changes in the model were triggered by decreases in profitability due to the agricultural emissions levy.

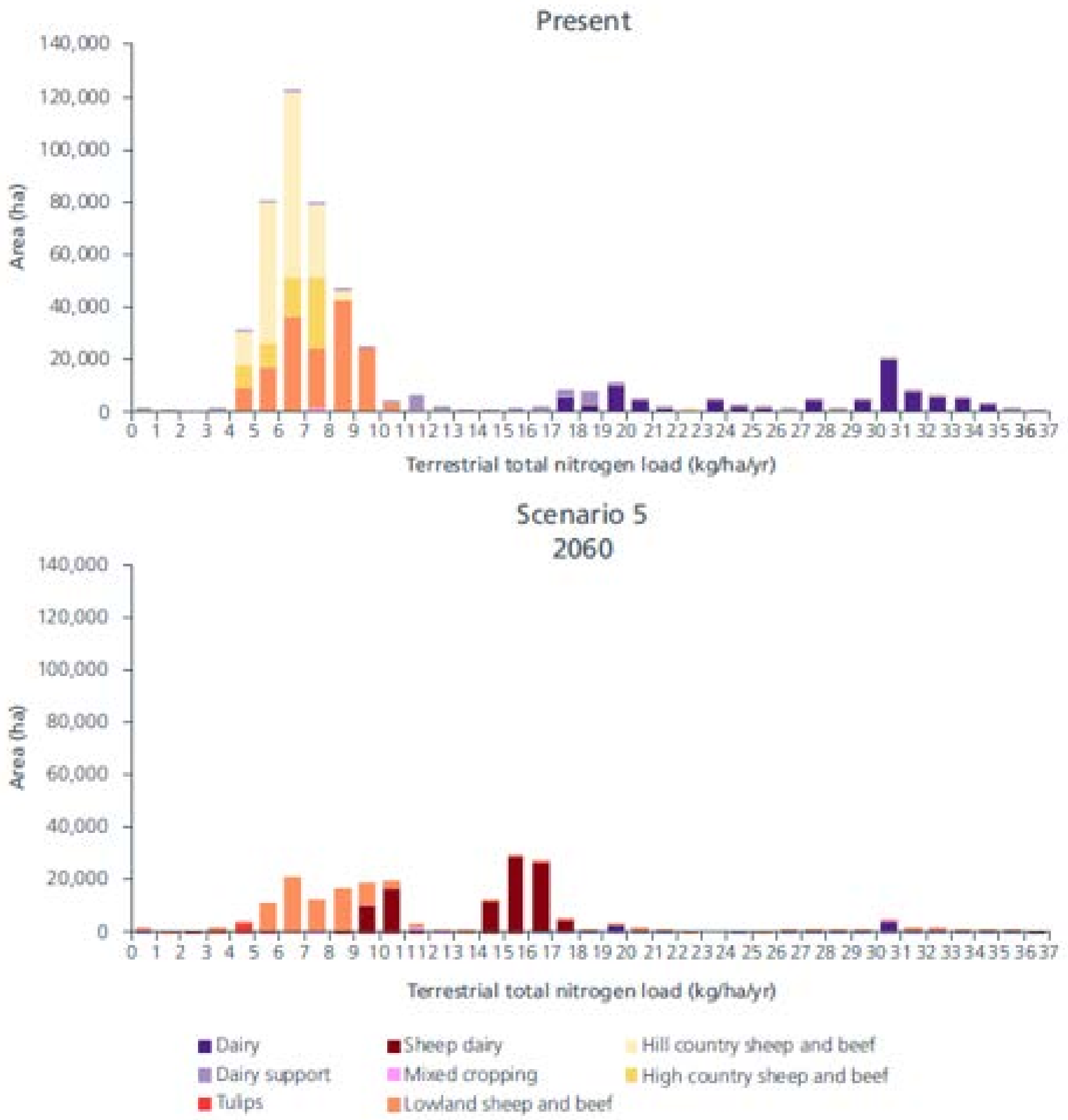
In some cases, changes in land uses and/or land management practices in the model were driven by freshwater regulations.

Further changes to farm systems and land use were also initiated in some scenarios through the recycling of the agricultural emissions levy revenue. Actions funded via the levy included riparian planting, loans or subsidies.

More rigorous testing of the robustness of the assumptions and other choices used for this exercise would have been necessary if the point of this exercise had been to feed into the formal decision-making processes of government, businesses, land managers, communities and tangata whenua. If the approach is determined to be useful, the tools would need to be developed further so they are fit to be used to inform decision making.

Specific points related to water quality

The modelling highlighted how changing land use under different policy scenarios can impact freshwater environmental outcomes. The graphs below indicate a modelled change in the distribution of terrestrial total nitrogen load under one particular scenario (scenario 5).



Source: Adapted from WSP (2023a) modelling

Figure 6.5: Change in total nitrogen load by land use in Mataura catchment between the present and 2060 under scenario 5 (estimates from the Nature Braid model).

Implications for Southland

The reports also provide valuable observations and data that can be used to aid future research and policy development in Southland. In particular, the findings of the case study affirm the desirability of the catchment-based approach by highlighting the benefits of an integrated approach that goes beyond the property boundaries and separate environmental issues.

Of particular interest is the commissioner's attention to alternative forestry, examples of which include continuous cover forests, native production forests, and agroforestry systems. The PCE is currently undertaking further work on the topic of alternative forestry options to better understand the potential trade-offs they imply.

The reports highlight how broad-brush national policies can significantly impact catchments – and the consequences may be exacerbated by not joining up environmental policies. Trade-offs (intended or otherwise) between environmental, economic, social and cultural outcomes need to be considered together to avoid changes that may later be regretted but are locked in for decades to come. The outcome of not doing so will be suboptimal in many regards.

Fit with strategic framework

OUTCOME	CONTRIBUTES	DETRACTS	NOT APPLICABLE
Managed access to quality natural resources			X
Diverse opportunities to make a living			X
Communities empowered and resilient	X		
Communities expressing their diversity			X

Attachments

1. Going with the grain - changing land uses to fit a changing landscape report [**9.5.1** - 84 pages]
2. Exploring land use change under different policy settings in two case study catchments - Report [**9.5.2** - 103 pages]

C.12

Going with the grain

Changing land uses to fit a changing landscape

May 2024

Parliamentary Commissioner for the Environment
Te Kaitiaki Taiao a Te Whare Pāremata

This report has been produced pursuant to subsections 16(1)(a) to (c) of the Environment Act 1986. The Parliamentary Commissioner for the Environment is an independent Officer of Parliament, with functions and powers set out in the Environment Act 1986. His role allows an opportunity to provide Members of Parliament with independent advice in their consideration of matters that may have impacts on the environment.

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Going with the grain

Changing land uses to fit a changing landscape

May 2024

Parliamentary Commissioner for the Environment
Te Kaitiaki Taiao a Te Whare Pāremata

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- Dr David Hall, Toha Network
- Alison Dewes, Tipu Whenua.

While he has benefited hugely from their insights, any errors, omissions or opinions are entirely his own.

Contents

2

A personal reflection

This is a report about land use change – what drives it and what stands in its way. It is not a matter of academic interest. My family arrived in the Raglan hill country in the 1850s. Ignorant of the land into which they stumbled, my forebears turned their backs on the Waikato floodplain and went into the hills. They appeared to be more productive – after all, they could support dense forest. And where the soil under the trees they cleared was well-drained ash, amidst limestone outcrops, it was good stock country. But where there was only a fragile veneer of soil over hard clay, it was a struggle.

In the 1940s, my great uncle left the hill country and purchased a smaller block on the western side of the central Waikato plain. It too had seen continuous land use change. Before European settlement, the well-drained sandy loams were good sites for kūmara. The deeply incised gullies cut through the volcanic outwash were wetlands filled with eels. The first European farming was surprisingly varied. There was dairying early on and there was also wheat being grown.

But the farm I grew up on was a sheep farm. My father bought it from his uncle shortly after the Korean wool boom. It was downhill all the way after that. When I was ten it became a beef unit. We didn't convert to dairying as many did. But no matter, it has effectively become a dairy support unit with some beef on the side and a small market garden.

The changes to my farm over the last 80 years have mapped the changing economics of livestock farming. And over the last decade they have started to chart the rising tide of concern about the state of our environment. About ten per cent of the property has been taken out of production to recreate the wetlands that filter down to the Waipā River.

How I came to live on the land that I call my home is a very ordinary tale of no special interest. I recount it to be upfront about the fact that I am not a disinterested party and not indifferent to the pressures that are bearing down on farming. But I am equally aware that landowners cannot disown the environmental harm they cause just as they can't ignore the costs that a changing climate will impose whether we like it or not. Environmental clean-up is not optional.

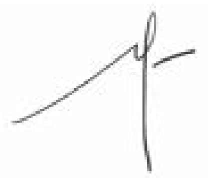
When markets move, land uses change. That has been the history of the last 170 years. Profitable new activities – or new ways of doing old things – can support land use change. If they entail a lower environmental footprint, we all win. Even then, the social costs may be controversial. Carbon farming is a case in point. Businesses wanting to earn carbon credits offer an exit strategy for a landowner wanting out, but pose a headache for the local school or livestock carrier.

But where the case for environmental clean-up comes without a market-driven solution, regulation is needed to provide the incentive to do better. But that raises an even more intractable problem: where's the money going to come from? At any one time, some land uses will be on the winning side while others are up against the wall. Right now, we have a profitable dairy sector with a large endowment of skills and technologies both on and off-farm, with some very large, corporate-scale operators. For the sheep and beef sector, the boot is on the other foot. Its profitability is marginal so its ability to invest in change is much more fragile.

The political economy of steering land use change in a consistently sustainable direction is not for the faint-hearted. The easy way forward will always be to spend public money. But the scale of the problem far outstrips the public purse. And in any case, if food and fibre are to continue to be internationally competitive industries, they can't rely on subsidies whether they are financial or environmental.

Plans to reduce the environmental impact of farming can't ignore the question of who pays. Neither can they be imposed uniformly from a distance. While some national direction and support is needed, different land uses in different catchments pose different risks. We need to couple the detailed local expertise and knowledge of farmers, mana whenua and communities with fine-grained land information to channel investments to the parts of the landscape that will deliver the biggest environmental gains. In short, we need solutions that run *with* the grain of the land.

Coming from rural New Zealand, I find it easy – perhaps too easy – to sympathise with farmers confronting what seem to be ever mounting environmental challenges. But farmers don't need sympathy. They need really good environmental information, excellent market intelligence and access to finance. And they need regulations that will make environmental indicators trend in the right direction in the least costly way possible. This report offers some ideas on how that might be achieved.



Simon Upton

Parliamentary Commissioner for the Environment
Te Kaitiaki Taiao a Te Whare Pāremata

1

Rumohra adiantiformis

How this report came to be written

We need to change the way we use the land if we are to hold the line on environmental quality, let alone improve it.

But it has to be said that land use is, in any case, in a constant state of change. What future landscapes of Aotearoa will look like, and the state of their environmental health, will depend on at least two things. A changing climate will force changes to what we do where on the land – and how we do it. And then there will be the changes that flow from the decisions that people make. These are driven by everything from local environmental and planning regulations to who we trade with and evolving consumer preferences abroad.[1]

Some of these changes will be incremental and take decades. Others will be more abrupt and involve switches to new land uses. All of them will affect our attempts to deal with freshwater, biodiversity and our contribution to mitigating climate change.

Changing land use to achieve environmental objectives involves a spectrum. At one end of the spectrum there is change to management practices within the same farm system, where the effects of existing land uses are mitigated through specific interventions. This could range from planting trees in low-productivity areas and restoring wetlands, to changing the mix of crops or grazing animals, or intensifying the use of other land parcels. At the other end of the spectrum, there is wholesale land use change from one specific use to another.

How much environmental degradation can be mitigated through changes of practice and how much requires wholesale land use change will depend on each farm. One thing is clear: our landscapes today look very different to how they looked a century ago, and by the end of this century they will look very different again.

[1] Since 2004, our trade with China has grown more than eightfold from ca. $4.7 billion to ca. $39.5 billion (Stats NZ, 2024a, b). Meanwhile, consumer preferences in other markets may be having more impact on how we use land than attempts to regulate it. Nestlé and Tesco UK both have stringent net zero 2050 targets that include their scope 3 emissions from farming, and they are piloting Science-Based Targets initiatives, which aim to improve biodiversity (Nestlé, 2023; Tesco UK, 2023). Both are big buyers of New Zealand dairy and meat and so this has direct impacts on New Zealand producers and the way they farm (Rennie, 2023; Uys, 2023). It has led Fonterra to announce stricter climate targets as well, although these remain based on 'intensity' rather than absolute reductions (Wannan, 2023). The power of consumers and markets is further compounded not only by the increasing prevalence of climate-related disclosure regimes (now mandatory in New Zealand, see MBIE, 2023) but also by the introduction of the much broader nature-related disclosure regimes (see, for example, TNFD, 2023).

My predecessor Dr Morgan Williams, in his 2004 report *Growing for good: Intensive farming, sustainability and New Zealand's environment*,[2] started a national conversation about the effects of intensive farming on the environment. He also laid out a possible way forward, which included a call for 'integrated catchment management'. Dr Jan Wright continued this line of inquiry with her 2013 report *Water quality in New Zealand: Land use and nutrient pollution* and its 2015 update.[3] This present report continues these conversations.

In the 20 years since Dr Williams' report, we have seen continuing intensification of some land uses, wholesale changes in others, and a raft of attempts (with variable success) to use environmental regulation to manage the consequences. Concerns about the effects of livestock farming, particularly dairying, on water quality has led to five iterations of a National Policy Statement for Freshwater Management.[4] There have also been stop–start attempts to preserve biodiversity on privately owned land.

Running a farm has become a much more complex business, with significant recent changes in banking, processing, and environmental regulation. A widely repeated view among farmers is that there is too much disjointed regulation of on-farm activities that does not consider their cumulative impacts. In the winter of 2023, Beef + Lamb New Zealand's chief executive Sam McIvor had this to say:

> "The Government needs to pause, review, reassess and simplify its approach to policies. Policies are all too often fragmented and impractical. A more holistic view is needed to develop sensible and pragmatic regulations that enable farmers' ongoing stewardship of the land."[5]

Ironically, it is not on-farm regulation that is currently forcing the most substantial changes in the way we use land, but attempts, far from the farm gate, to mitigate our fossil fuel emissions. For as long as New Zealand has been debating doing something about climate change, storing our carbon dioxide emissions in trees on the landscape has been our preferred get-out-of-jail (almost) free card. However, I have had growing concerns about the sustainability of this approach to climate mitigation.[6]

In my *Farms, forests and fossil fuels* report, released in March 2019, I explored what the implications of the Government's climate change targets and policies might be for New Zealand's landscapes.[7] I commissioned modelling of the scale of land use change that would be expected to occur at the national level if all emissions were priced the same, including those from agriculture,[8] and all emitters were allowed unlimited access to forestry offsets through the New Zealand Emissions Trading Scheme (NZ ETS). The short answer was that a lot of land would be converted to forestry – up to 5.4 million hectares (or 54%) of current farmland by 2075,[9] most of it in Canterbury, Otago and Manawatū-Whanganui.

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[2] PCE, 2004.

[3] PCE, 2013, 2015.

[4] NPS-FM 2011; NPS-FM 2014; NPS-FM 2014 as amended in 2017; NPS-FM 2020; and the NPS-FM 2020 as amended in 2024. The new government has also signalled that it will start work to replace the current NPS-FM 2020.

[5] B+LNZ, 2023.

[6] PCE, 2023a.

[7] PCE, 2019a.

[8] Emissions from the agricultural industries are currently not being priced. The current coalition government has signalled it will introduce agricultural emissions pricing by 2030.

[9] Based on roughly 10 million hectares of agricultural and horticultural land use (excluding forestry) in 2019 (Stats NZ, 2021a).

The modelling for that report also tested an alternative approach in which a separate target was set for gross carbon dioxide emissions from the transport, energy and industrial sectors, while access to forestry offsets was reserved exclusively for biological emitters. Under this alternative approach, a 'mere' 3.9 million hectares of farmland would be converted to forestry by 2075.

To get a better understanding of the problem, I commissioned some follow-up work to calculate the area of forest that would be required to achieve roughly the same change in temperature as reducing a herd of livestock by one animal. The answer – 0.6 hectares for a single dairy cow – confirmed that while forests could theoretically be used to offset warming from livestock methane emissions, very large tracts of forest would still be needed to make any significant dent in the warming effect of New Zealand's livestock methane emissions.

Farms, forests and fossil fuels also attempted to downscale the national-level modelling to a specific catchment to see what offsetting emissions with trees could mean for a particular community. I chose the Hurunui in Canterbury. But the modelling was relatively crude and suffered from several limitations: the resolution was coarse, land uses were represented using national averages rather than being catchment-specific, and the only environmental indicator assessed was greenhouse gas emissions.

Furthermore, the report's scope was restricted to modelling the impact of emissions pricing on land uses. The impacts of other environmental policies, such as freshwater quality regulations, were not considered. Neither was any input sought from mana whenua or the local community.

I concluded the report by calling for a landscape-based approach to managing climate and other environmental challenges. The idea was to integrate "all that we know about environmental processes at the landscape scale with bottom-up, grass roots knowledge".[10] Rather than wait for the recommendation to be politely shelved, I decided to test the idea by using more fine-grained, catchment-specific modelling tools and engaging with the mana whenua and communities directly concerned.

It just so happened that during my review of the Overseer model in 2018,[11] I came across the work of Land and Water Science in Invercargill on physiographics. Physiographics uses high resolution spatial datasets to gain a deeper understanding of the role physical landscape characteristics, such as geology, soils, climate and hydrology, can play (in addition to land use) in driving spatial variation in freshwater quality outcomes. I was intrigued by the potential such tools could play in enabling more targeted policies to be developed for managing freshwater quality and soil greenhouse gas emissions. I therefore commissioned Land and Water Science to develop landscape susceptibility maps for two case study catchments: the Mataura catchment in Southland and the Northern Wairoa catchment in Northland.

[10] PCE, 2019a, p.156.

[11] PCE, 2018.

The next step was to consider the effects of different environmental policy settings in these catchments. I commissioned WSP and Nature Braid to model changes in land uses and land management practices in the Mataura and Wairoa catchments under six hypothetical policy scenarios, and to estimate the resulting environmental and economic outcomes. As part of the process, a series of hui and workshops were held in each catchment to discuss the policy scenarios and modelling assumptions, and to better understand the social and cultural considerations that could not be modelled. Additional work was also commissioned to highlight the perspectives of iwi and hapū from each catchment on these issues. The results of this exercise are published alongside this report.

The two case studies were designed to illustrate how a more integrated landscape approach could shed light on what different policy mixes might mean for the direction and scale of land use change. What the modelling delivered was striking.[12]

Based on current and forthcoming environmental and climate policy settings, our modelling projected that the Northern Wairoa catchment would – as a simple function of relative profitability – see a wholesale switch from sheep and beef farming to pine production forestry.[13] The scale of change was stark and came as a shock both to me and the local people who participated in the exercise. They expressed concern for their community about the loss of jobs and people that might result. They were also concerned about the impact of pine production of that scale on the landscape and environment. That said, they were also concerned about the costs of the status quo, particularly the destructive effect of sediment on water quality and mahinga kai – and ultimately the health of the entire Kaipara Harbour.

In the Mataura catchment, the same policy settings would also drive significant land use change – particularly the transition of hill country sheep and beef farming to pine production forestry. However, in contrast to Northern Wairoa, most dairy and lowland sheep and beef operations in the Mataura remained viable, albeit much less profitable. This highlights that the current national policy trajectory is likely to have significantly different outcomes depending on the context of the catchment and the farm systems located there.

The scenarios based on alternative policy mixes generated outcomes that were less extreme but still very challenging. From an environmental perspective, these alternative approaches showed that by sacrificing some carbon sequestration in the short term – pine is very fast growing – it is possible to generate better environmental outcomes for water quality and biodiversity. It is fair to say that the locals were still struck by the scale of land use change that was presented in these scenarios. However, they provided some assurance that a greater diversity of land uses could provide a more resilient local community, economy and environment. Unsurprisingly, communities reported that they were attracted by a process that gave them a greater say in the pace and direction of change.

[12] See PCE (2024) for detailed modelling methodology and results.

[13] In this report, 'pine' refers to radiata pine, which is the dominant pine species planted in New Zealand and makes up about 90% of our exotic plantation forests.

The case studies are not a forecast of the future for these regions and certainly not ones that can be extrapolated across the country. But in the process of developing them, it became clear that:

- the future will not look like the past
- the way we use the land is changing inevitably for a wide variety of reasons
- responding to environmental challenges will be one of the most important of those reasons.

Rather than draw conclusions from two case studies undertaken in very different regions, I decided to synthesise some key conclusions from the wider body of work I have undertaken. Modelling exercises can give a feel for the direction and scale of what may happen under different scenarios. But they omit as much as they include and cannot begin to sketch the ways people respond and adapt to change, new information and new technologies.

This document does not follow my usual investigative approach, which is to examine the evidence in detail to enable me to make reasonably granular recommendations. While the so-called 'wicked' problems it aims to tackle are well documented, the way forward remains mired in the political economy of conflicting interests that cannot be resolved from a purely environmental point of view. This report is as much about those conflicting interests as it is about the environment.

While attempting to tackle these problems we also must consider the position of whānau, hapū and iwi as kaitiaki and as landowners. Māori have a more holistic way of thinking about the environment. They assert that there is a lot to be learnt from a philosophy that protects the environment as a family member, not just a resource that can be traded at a price.

Some may be tempted to treat that as an unworldly view. It is not. Māori ag-related businesses we talked to are as pragmatic as any other players in the rural economy. But they start from a multigenerational standpoint. And they expect to be listened to by governments and regulators. Whatever lawyers may have to say about the reach of Te Tiriti in respect of whenua, wai and taonga, Māori represent by far the longest human link with many localities in rural Aotearoa. Māori knowledge must be part of all future landscape decision making.

This report tries to clarify the nature of the environmental challenges that rural New Zealand faces and ensure that those who determine public policy cannot claim they are unaware of the trade-offs they are confronting. Changing the way we use land cannot be avoided if only because current policies (particularly those governing climate mitigation) are actively encouraging it. My hope is that this report will give a sense of the possible direction of travel if New Zealand is serious about responding to the triple challenge of climate change, biodiversity loss and water quality in a way that maintains the economic, social and cultural viability of rural Aotearoa.

2

Cheilanthes sieberi ssp. *Sieberi*

Four critical problems confronting policymakers

This document starts from the assumption that we want to maximise the social, cultural and economic benefit of our natural resources while making sure that we look after them for future generations. My investigations suggest that policymakers confront four key problems that make this task a difficult one. They can choose to ignore them, but they will not go away.

Firstly, the way we use the land needs to change. The magnitude of environmental degradation in some parts of the country means that change in land use – not just management practices – is needed. Secondly, this situation is compounded by the reality that climate change itself is already and will increasingly become a driver of land use change as adaptation to a shifting climate becomes unavoidable. The third key problem is a fragmented policy landscape, where multiple streams of policy impact both directly and indirectly on decisions about land and water use. This fragmentation increases complexity and creates more uncertainty for landowners and kaitiaki. The final key problem is rooted in the fact that responsibility for environmental management is currently delegated to the owners of individual property while the consequences of many activities are variable, diffuse and catchment-wide. I will discuss each of these key problem areas below.

The way we use land needs to change

Past and present land use has had and will continue to have large and sustained environmental impacts, particularly in the form of greenhouse gas emissions, impacts on water quality and quantity, and on biodiversity. The impacts of land use activities on the environment of Aotearoa have been well documented in research and I shall only touch on some of the main concerns.

Greenhouse gas emissions from land use activities

New Zealand's contribution to global climate change is small on an absolute basis, but much larger on a per capita basis. The ongoing warming from the carbon dioxide released by historical deforestation is New Zealand's largest contribution to global warming, accounting for roughly three-quarters of New Zealand's current total warming contribution.[1] Today, fossil carbon dioxide emissions from transport, energy and industry are New Zealand's fastest-growing source of warming. But methane from agriculture, though plateauing over the last decade or so, causes more warming overall, accounting for twice as much of New Zealand's total contribution to warming as fossil fuels.[2] I have explored the warming contribution caused by methane and nitrous oxide emissions from livestock in New Zealand in a previous report – and it is considerable.[3] Reducing agricultural methane emissions, therefore, represents the greatest immediate opportunity to reduce New Zealand's contribution to warming.[4]

Degraded water quality

The quality of our rivers can be measured using five main indicators: phosphorus; nitrogen; clarity and turbidity; a macroinvertebrate community index; and *Escherichia coli* (*E. coli*). Data from Stats NZ show that the water in many of our rivers is in a degraded state, although some indicators are starting to show an improving trend.[5] Most of this degradation is a result of the way we use our land. That said, existing monitoring sites are unevenly distributed across the country and are not representative of all waterways.[6] Similarly, the quality of our groundwater is mixed. Existing monitoring of a limited number of sites suggests groundwater quality may be improving.[7] However, there is such a paucity of data on groundwater quality that it is difficult to make any definitive claims. What is clear, is that many of our catchments are not meeting the environmental bottom lines set out in the National Policy Statement for Freshwater Management.[8]

The Our Land and Water National Science Challenge has created maps estimating the catchments where the country's environmental bottom lines (set by successive governments) are being exceeded. They used results from the current monitoring network to model results for the whole country.

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1 Reisinger and Leahy, 2019, p.5. Land use change since human arrival to New Zealand has released around 12 billion tonnes of CO_2. This CO_2 continues to cause warming today (PCE, 2019a, p.66).

2 PCE, 2019a, p.80. This excludes the contribution to warming from historical deforestation, which dwarfs everything else.

3 PCE, 2019a, pp.79–80.

4 Barth et al., 2023, p.29.

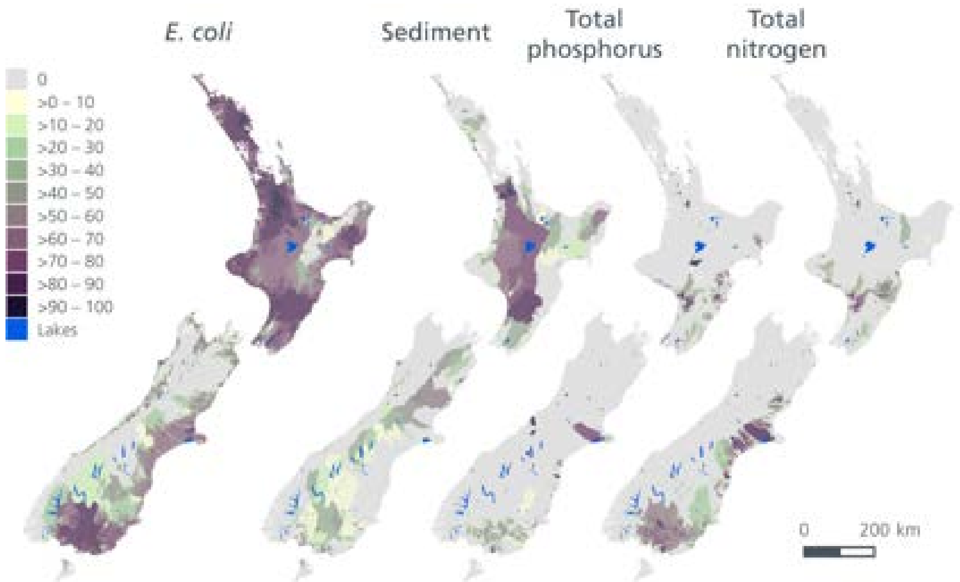
5 Stats NZ, 2022a, b, c, d, e.

6 For details, see PCE (2019b, pp.33–35).

7 Stats NZ, 2020.

8 MfE, 2024.

As Figure 2.1 shows, several catchments across the country exceed environmental bottom lines for one if not several contaminants. Some of these contaminants may be able to be reduced to stay within bottom lines by implementing on-farm mitigation measures, while in other places wholesale land use change will be needed.

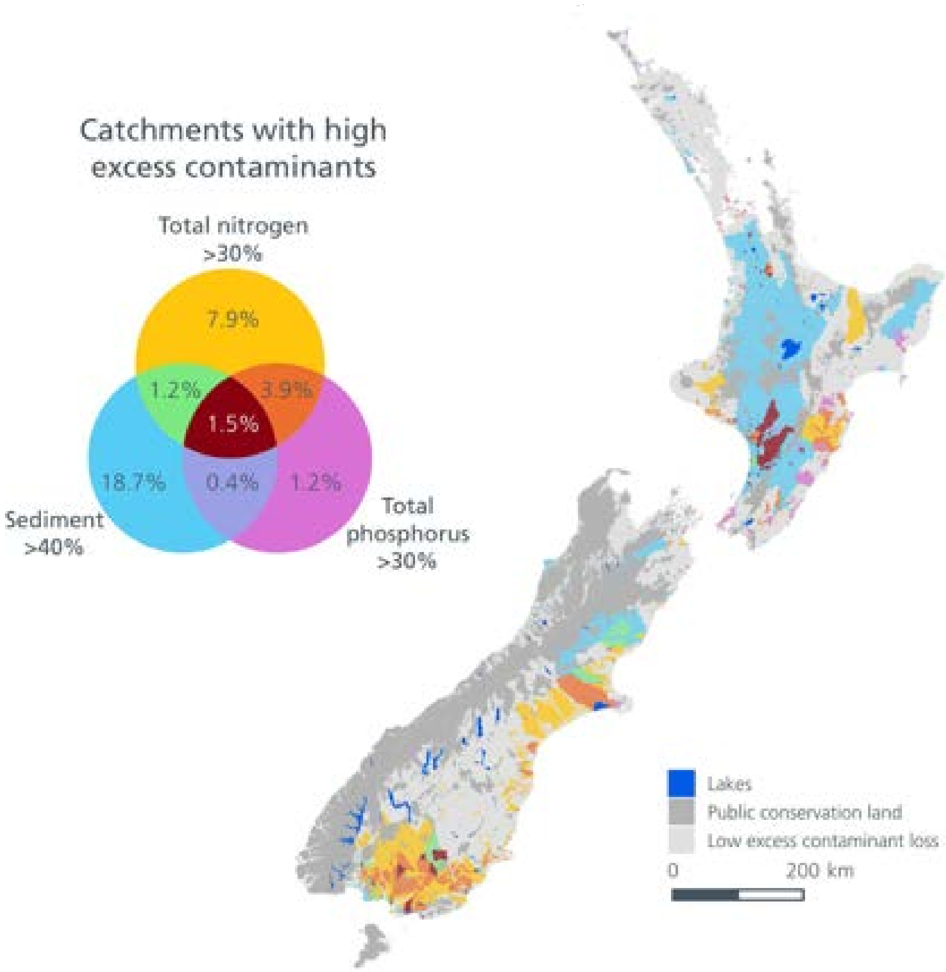


Source: Adapted from McDowell et al. (2021) and Snelder, Smith et al. (2023)

Figure 2.1: Map of catchments across the country showing the level of exceedance of current environmental bottom lines for *E. coli*, sediment, total phosphorus and total nitrogen.

Figure 2.2 presents a consolidated map that shows catchments with high excess contaminants that are beyond the levels that can be mitigated. Based on the available data, these catchments are likely to require land use change to achieve their environmental bottom lines.[9] This would affect about a third (34.8%) of catchments in New Zealand. In 1.5% of these catchments, all three contaminants mapped are in excess of these percentages. They are in parts of the Manawatū and Whangaehu catchments managed by Horizons Regional Council, parts of Waituna and Otapiri catchments managed by Environment Southland, and Otapiri catchment managed by Otago Regional Council.

[9] Using all established and developing mitigations available as of 2020, it would be possible to mitigate the impacts of existing land use in catchments where nitrogen and/or phosphorus is up to 30% above environmental bottom lines. In the case of sediment, the estimated figure is slightly higher at 40%. Where required reductions exceed these numbers, land use change is likely to be required. See McDowell et al. (2021) and Snelder, Smith et al. (2023).



Source: Adapted from McDowell et al. (2021) and Snelder, Smith et al. (2023)[10]

Figure 2.2: Map of catchments that will likely require land use change to meet environmental goals.

[10] The minimum acceptable states are determined by the national bottom lines for attributes as defined by Appendix 2A of the NPS-FM 2020 (MfE, 2024) that can be modelled in a consistent and comprehensive manner across New Zealand. This includes the nitrate toxicity, periphyton, *E. coli* and suspended sediment attributes for rivers, and the total nitrogen and total phosphorus attributes for lakes (Snelder, Smith et al., 2023). The thresholds for nitrogen, phosphorus and sediment are derived from McDowell et al. (2021).

E. coli was excluded from the consolidated map in Figure 2.2 because of the following issues with its monitoring:

- *E. coli* has a high natural background level in some catchments.[11] This can make it difficult to distinguish the impact of agricultural land use from urban land use. Consequently, it is difficult to attribute and determine the reductions required from different uses.
- Accurately understanding the concentrations of *E. coli* is difficult due to a combination of our relatively infrequent (monthly) monitoring and the fact that most *E. coli* is washed down rivers in times of heavy rainfall. Sampling frequency would have to at least double in most sites to detect changes in *E. coli* from any intervention.[12]
- There is limited understanding of the effectiveness of further mitigations to reduce *E. coli* losses.

Enhanced concentrations of *E. coli* are so pervasive across most of New Zealand that, in the absence of much better information on the sources of *E. coli* (e.g. sheep, cattle, deer, avian or human), it may not be a useful measure to use to prioritise areas for action. This is *not* a reason to stop regulating and managing *E. coli*. Instead, it is an argument for investment in more monitoring and research so that management can be effectively prioritised.

Freshwater currently needs to be maintained or improved to give effect to a hierarchy of objectives in Te Mana o te Wai designed to protect the mauri of the water (the new Government has signalled this hierarchy may change).[13] Giving effect to Te Mana o Te Wai and the required monitoring for this is new. However, monitoring programmes already developed by Māori to measure mauri show a degrading trend of water quality (e.g. Mauri Compass or Waikato River Authority taura).[14]

Reduction in water quantity

All human uses of freshwater have *some* environmental effects, including reducing or slowing flow, changing water temperature, reducing transportation of gravel or increasing pollution levels. Where these changes in water quantity impact on water quality they are implicitly picked up in the previous section. For our purposes here it is simply worth noting the interaction.

The main environmental impact of water use is where it results in a flow below the minimum needed for environmental functioning. Prominent examples are catchments in Canterbury where the use of freshwater has reduced the minimum flow to a level below that required for healthy ecosystem functioning, at least seasonally.[15] Data on water use has historically been poor, relying on consented takes, which often bear little resemblance to actual use.[16] Consents of consumptive water use (not including hydroelectricity use) total around 13 billion tonnes. Actual water use is likely to be less than this total. Recent legislative changes require regional councils to improve reporting of actual usage.[17]

[11] McDowell et al., 2013.
[12] McDowell et al., 2024.
[13] See MfE and MPI (2020a).
[14] Benson et al., 2020; Waikato River Authority, 2016. For more examples of Māori monitoring tools, see Rainforth and Harmsworth (2019) and Stats NZ (2017).
[15] Note that this problem occurs to varying degrees in other parts of the country – for example, in parts of Central Otago. For more details on how overallocation is conceptualised and calculated, see Booker (2016).
[16] PCE, 2019b.
[17] MfE and MPI, 2020b.

Loss of biodiversity

Owing to its geographic isolation, Aotearoa is home to a high number of endemic species.[18] These species (and others) are threatened by loss of habitat and competition from over 80 exotic animal species and, as of 2020, just under 1,800 plant species that have been introduced and naturalised since human arrival.[19] This has resulted in the extinction of at least 81 animal and plant species, including 62 bird species. More than 75% of indigenous species are threatened with extinction or are at risk of becoming threatened. They include 94% of reptiles, 82% of birds, 80% of bats and 76% of freshwater fish.[20]

Before human arrival, 80% of the land was covered with native forest.[21] By 2018, this was down to 27%. This loss continues. Between 2012 and 2018, indigenous land cover area decreased by 12,869 hectares.[22]

Wetlands provide enormous ecological, economic and wellbeing benefits. They are seen by some hapū as the lungs of Papatūānuku.[23] In pre-human times, wetlands covered almost 2.5 million hectares of Aotearoa.[24] By 2008 this area had been reduced to 250,000 hectares or roughly 10% of their original extent.[25] Wetland loss has continued since then, with the area of freshwater wetland decreasing by 1,498 hectares (0.6%) between 2012 and 2018, and saline wetland decreasing by 69 hectares (0.1%) over the same period.[26] The previous Government introduced a "no further loss of extent of natural inland wetlands" policy, but it is too soon to see if this was effective in halting the decline.[27] It would be helpful if the tax system were aligned with this policy; currently, it is still possible for farmers to write off the earthworks associated with draining wetlands.[28] It is not only the losses in extent that matter, but also the health of any remaining wetlands.

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[18] Endemic species are those found only in Aotearoa.
[19] Brandt et al., 2021
[20] Stats NZ, 2023b.
[21] Stats NZ, 2015.
[22] Stats NZ, 2021b.
[23] Sustainable Kaipara, 2022.
[24] Stats NZ, 2018.
[25] Stats NZ, 2018.
[26] Stats NZ, 2021c.
[27] Policy 6 of the NPS-FM 2020 (MfE, 2024).
[28] Farmers can claim an amortisation of 5% per annum on a range of farm development expenditures, including the draining of swamps and low-lying land. See Brenton-Rule et al. (2019, p. 23).

Summary

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. We will need to make further changes to the way we use the land if we are to halt any further decline.

This is not only important to achieve our environmental goals. It has a large economic component. Most environmental impacts of land use activities do not currently appear as costs in the production process, yet they should. Conversely, the activities landowners undertake to improve the environment should be rewarded economically, yet generally they are not. In a recent report, the Food and Agriculture Organization of the United Nations used a true cost accounting approach to estimate the cost of the hidden environmental impacts of New Zealand's food production. It put the total at over $14 billion.[29] Eventually we all bear these costs as a degraded environment impacts on our quality of life and the productive capacity of the land.

Large numbers like $14 billion can be dismissed as an artefact of the methodology that generated them. But measures like these are increasingly informing the decisions of consumers and food processors on whom we rely for a significant chunk of our national income.[30] The future will be one in which more questions are asked about the way we produce food and fibre, and more accountability demanded from producers.

The empirical record of how we use the land and what that means for environmental quality will not be able to be as easily sidelined as it once was. Getting land use onto a more sustainable basis will mean embracing a spectrum of land use changes. In some cases, applying mitigation techniques to existing land uses may be enough to achieve our environmental goals. In other cases, wholesale land use change will be necessary.

A changing climate is re-dealing the cards

Climate change itself will increasingly be a driver of land use change as landowners adapt to shifting climatic conditions. We have some idea of how average warming trends will impact on land use.[31] But the big unknown is the impact of extreme events.

In terms of average trends, Aotearoa is getting warmer.[32] As a result of this trend, droughts have become more frequent while frosts are rarer.[33] Changing temperatures are likely to favour incursions by new pests and diseases and the rapid spreading of existing ones.[34]

[29] New Zealand dollars (converted from 2020 purchasing power parity (PPP) dollars). FAO, 2023, p.100, see environmental hidden costs.

[30] See SBTN Freshwater Hub (2024).

[31] See, for example, the Data Supermarket website (https://landuseopportunities.nz/).

[32] MfE and Stats NZ, 2023, p.23.

[33] Stats NZ, 2023a, c.

[34] Phillips et al., 2023.

Notwithstanding these average trends, the forecasts for New Zealand agriculture are *relatively* positive in economic terms. A changing climate is likely to open new opportunities for land use.[35] Studies predict improvements in primary productivity of between 1% and 10%. Our international competitors are likely to be impacted more negatively, leading to higher international commodity prices.[36] Depending on which sectors are most affected, this is likely to create an incentive for even more intensive land use.[37] Without mitigating measures in place, more intensive land uses could have further negative impacts on the environment.

It is more difficult to predict the impact of extreme weather events on the way we use the land. There is a clear upward trend in both the declarations of states of emergency and insurance payouts for weather-related events.[38] This trend is likely to continue with droughts, fires and floods all becoming more extreme when they happen and possibly more common. There will be some unpredictability in how and when such extreme events manifest. As a result, landowners will likely have to face new extreme events while still recovering from previous ones. A possible consequence will be commodity price volatility as landowners, and particularly farmers, are confronted with increasingly extreme weather patterns that unpredictably affect production and yield.

Understanding the risk of these extremes is a relatively new area of research and requires modelling of the potential impacts of extreme events at very local levels. Models such as RiskScape are an example of this.[39] The next step in research will be to understand the costs and benefits of potential investments in disaster mitigation.

Research is currently being undertaken to examine the implications that climate change holds for land use change.[40] It explores where in regions climate change will drive land use change, identifies the land use options in those areas, and models the regional and national economic effects of those shifts. The research will use downscaled climate projections for New Zealand, which will include a range of weather patterns. It will not explicitly examine extreme events. This research will be complete in 2025.

A separate recent study has investigated the impact of extreme sea level events and relative sea level rise on the viability of dairy operations and their exposure to coastal inundation. It shows that even with a conservative estimate of 0.5 metres of relative sea level rise over the next century, 4–7% of dairy farms are likely to need to change their land use in some shape or form. In some areas that figure is higher – for the Waikato it is 8–10%, with significant areas of the Hauraki Plains likely to be at risk.[41]

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[35] OLW, 2023.
[36] See Jägermeyr et al. (2021).
[37] Rutledge et al., 2017.
[38] Carbon News, 2023.
[39] Jointly funded by NIWA, GNS Science and Toka Tū Ake EQC. See https://riskscape.org.nz.
[40] The research is being undertaken by Manaaki Whenua – Landcare Research, Plant and Food Research, Scion and NZIER.
[41] Craig et al., 2023 (see supplementary data). Note that the modelling does not account for potential flood mitigation.

The previous Government developed a national adaptation plan,[42] but we have little detail on its implementation. Government responses to the storms in Auckland, Hawke's Bay and Tairāwhiti over the summer of 2023 and Nelson in 2022 have potentially set precedents for how we respond to such events. These precedents include compensation for home and landowners in high-risk flood areas. The Ministerial Inquiry into land use causing woody debris and sediment-related damage in Tairāwhiti and Wairoa during Cyclone Gabrielle also includes the proposal for a new category for land with 'extreme erosion susceptibility' within the Erosion Susceptibility Classification and investigating an appropriate management response (such as permanent canopy cover).[43] The Government's response to the Ministerial Inquiry agreed in principle with this recommendation, noting that Gisborne District Council is already intending to address this issue through a plan review.[44]

Also relevant for farming is the recommendation of the Expert Working Group on Managed Retreat that compensation for commercial buildings be means tested and capped at a lower proportion of the value than the compensation for homeowners.[45] It is worth noting that the Government is developing a National Policy Statement for Natural Hazard Decision-making to respond to the increasing risk of climate-related disasters.[46]

In sum, climate change will force some changes in the way we use the land as temperature and seasonality shift, and in some regions extreme events will make some land uses untenable. Some new land uses may become possible; some will be made inevitable. Land values will be affected, in some cases seriously. At this point, it is unclear who will bear this burden, but in the absence of any public intervention it will be the landowner.

The policy landscape is fragmented

A further challenge is the sheer scale and complexity of environmental regulation either in existence or under development. Regulation of the environmental impacts of land and water use will always be complex to some degree. This is probably unavoidable. However, this complexity is increased by the fragmented nature of the current regulatory approach. There are multiple streams of policy work that directly impact decisions about the use of land and water. From the perspective of farmers, these policies appear to have all landed on their kitchen table at the same time.

This situation is unquestionably a source of uncertainty and becomes, in turn, an additional barrier to land use change. Uncertainty about the scale and timeframes of the required changes and the ways different regulations interact with one another makes it more difficult for landowners to make the large investments required to change land uses. After all, why would a farmer make an investment when it is unclear whether it will help them comply with regulations?

42 See MfE (2022).
43 See MILU (2023).
44 See Office of the Minister for the Environment and Office of the Minister of Forestry (2023).
45 EWGMR, 2023.
46 MfE, 2023b.

For landowners, mana whenua and communities on the ground, this fragmentation increases the complexity of responding to regulation. It can be unclear how these policies fit together; and there is a risk that sometimes they will pull in different directions.[47]

Beyond being complex, these policies tend to have lag times – sometimes several years – between development, implementation and response. While these policies need to be customised to local circumstances, different approaches to implementation by regional councils can add another layer of complexity. To that complexity is added the need to ensure that Māori can engage both in terms of developing regulations and implementing them. As a Treaty partner (under Article 2 of Te Tiriti o Waitangi), Māori assert a right to practise kaitiakitanga in the protection of their taonga like freshwater within their rohe. Māori are also landowners who will have the same responsibilities as other landowners to protect taonga as well. While the way this is done varies around the country, there is a need to support this participation across the board.

Regulation of the environmental effects of land and water use has been a dynamic space in recent years. Different issues (such as carbon, fencing rivers or nitrogen leaching) have become the myopic focus of central government at different times. Every time a policy is reviewed or updated, or a potential change of government signals change, uncertainty reverberates through communities of land and water users, affecting their decisions. In a recent Survey of Rural Decision Makers, four in ten respondents said they struggled with constantly shifting goalposts.[48] The complexity of environmental regulation is described in further detail below.

Policies that influence land use

Central government has developed separate policies for climate change, freshwater quality and biodiversity. All these policies have the potential to significantly influence decisions related to land use and land management practices. From a landowner or kaitiaki perspective, it is difficult to see how these policies fit together cumulatively at a catchment or landscape scale. Table 2.1 provides some examples of the different policies and how they influence land use.

[47] Research is being undertaken to investigate tensions that arise between water quality and greenhouse gas regulations, in relation to housing livestock within off-paddock herd homes during wetter winter periods. The practice of housing livestock improves water quality but potentially increases greenhouse gas emissions. See Morris and Lowe (2024).

[48] Stahlmann-Brown, 2023.

Table 2.1: Some examples of climate change, freshwater and biodiversity policies that influence land use

Theme	Policy	How the policy influences land use
Climate change	New Zealand Emissions Trading Scheme (NZ ETS)	Provides financial rewards for planting forests that are based on annual carbon sequestration rates. People have predominantly planted fast-growing, exotic tree species to accumulate more sequestration units quickly, and there are proposals to recognise smaller on-farm plantings.
	Levy on agricultural greenhouse gas emissions (delayed to 2030)	Puts a price on biogenic methane and nitrous oxide emissions from farms. This could encourage farmers to reduce their emissions by decreasing stock numbers, changing management practices, diversifying their farm system, and/or adopting new technologies.
	Support for research, development and commercialisation of tools and technologies to reduce emissions	Accelerates progress on tools and technologies that enable landowners and kaitiaki to reduce their greenhouse gas emissions. This could reduce the amount of land use change required to meet emissions reduction targets.
Freshwater quality	National Policy Statement for Freshwater Management*	Requires freshwater to be managed in a way that gives effect to Te Mana o te Wai and protect its mauri. Establishes national bottom lines for water quality in rivers and lakes and requires regional councils to engage with tangata whenua and communities. It also requires regional councils to set visions, objectives and targets for specific freshwater attributes and contaminants, and to set rules, limits and methods for achieving these visions, objectives and targets.
	National Environmental Standards for Freshwater*	Sets national requirements for carrying out certain activities that pose significant risks to freshwater quality and freshwater ecosystems. These include rules relating to: • conversions of pine production forestry to pasture • conversions of farmland to dairying • irrigation of dairy land • intensive winter grazing • application of synthetic nitrogen fertiliser to pastoral land • natural inland wetlands • fish passage.
	Stock exlusion regulations*	Prohibit the access of cattle, pigs and deer to wetlands, lakes and rivers.
	Freshwater farm plans*	Requires most farms to have a freshwater farm plan that identifies risks to freshwater quality and actions that will be taken on farm to mitigate these risks, in the context of the catchment in which each farm sits.

Biodiversity	Te Mana o te Taiao – Aotearoa New Zealand Biodiversity Strategy and its implementation plan	Sets the strategic direction for the protection, restoration and sustainable use of biodiversity over the next 30 years. The implementation plan is a 'living' document and allows for five-yearly reviews.
	National Policy Statement for Indigenous Biodiversity*	Recognises the role of landowners and tangata whenua as stewards and kaitiaki of indigenous biodiversity. The Resource Management Act 1991 requires councils to identify significant natural areas and make plans to manage them. The national policy statement provides a consistent method of identifying and protecting significant natural areas across regions. Crucially, these areas can be on private land. Separately, the Government is also exploring a biodiversity credit system.
Cross-cutting	National Policy Statement for Highly Productive Land	Requires that highly productive land is protected for use in land-based primary production, both now and for future generations. It requires regional councils to identify (map) highly productive land in their regions and manage that land in an integrated way that considers the interactions with freshwater management and urban development. Specifically, it requires highly productive land to be protected from inappropriate use and development, and to be prioritised for land-based primary production.
	The National Policy Direction for Pest Management	Sets out the responsibilities and requirements for central and local governments to manage unwanted organisms, including pests and weeds already in the country. It also sets up a framework for preparation of various management plans.
	National Environmental Standards for Commercial Forestry	Sets nationally consistent standards to manage the environmental effects of eight core forestry activities for both pine production and carbon forests (afforestation, pruning and thinning, earthworks, river crossings, forestry quarrying, harvesting, mechanical land preparation and replanting), sets out clear rules for any harvests that happen in carbon forests, and sets a new permitted activity standard for managing forestry slash on the cutover.

* Denotes policies that have recently been identified for further review.

As noted above, climate adaptation will inevitably (over time) form another layer of policy that impacts on land use.

The Government also has responsibilities to all Māori under Te Tiriti o Waitangi as well as those set out in individual Treaty settlements relating to tino rangatiratanga and kaitiakitanga, and how to include tangata whenua in local policy and regulatory processes. Operationalising these responsibilities is always likely to be challenging given the differences in worldview between te ao Māori and a mixed market economy based on the paradigm of individual property rights.

Fragmentation extends to funding land-based activities

In addition to their policy and regulatory settings, successive governments have presided over the emergence of a thicket of funding programmes for landowners and kaitiaki. New Zealand's agribusiness sector likes to think of itself as sturdy and subsidy free. The truth is a little more nuanced. Taxpayers have in fact spent an average of just under $700 million per year supporting the sector (as set out in Table 2.2). In addition to this figure, on average, around $170 million is spent every year on generic biosecurity; an investment that benefits agriculture.

Table 2.2: Expenditure for the land-based food and fibre sector over the last four budget cycles.[49]

Category	2020/21 $(000)	2021/22 $(000)	2022/23 $(000)	2023/24 $(000)
Administration, supervision, regulation, and policy advice	140,345	166,494	229,230	261,390
Research	62,586	60,917	83,341	72,815
Trade promotion and industry development	21,525	22,804	21,630	20,398
Knowledge transfer and farm advice	800	800	9,102	6,857
Grants, loans, subsidies, and co-funding	133,458	135,852	227,270	277,942
Assistance for exceptional events (COVID-19, extreme/ adverse weather events, etc)	12,115	7,798	93,234	16,267
Biosecurity	124,816	92,946	178,298	49,998
Animal welfare	18,560	19,713	17,268	24,177
Support for whenua Māori	7,979	9,309	6,303	7,438
Total	**522,184**	**516,633**	**865,676**	**737,282**

Note: Individual figures may not sum to stated totals due to rounding.

[49] The Treasury, 2023; MPI, pers. comm., March 2024; Te Puni Kōkiri, pers. comm., March 2024.

There is nothing in principle wrong with public funding for the land-based sector. There are types of expenditure that are hard for individuals to undertake because they cannot capture the benefits – the goods produced are 'non-excludable'. Funding for research and development to facilitate the innovation and diffusion of technologies that may not yet have a foothold in the market falls into a similar category. It makes sense to fund these public goods and services provided the benefits are sufficient to justify the outlays. In making the case for continued taxpayer provision of these goods and services, agribusiness needs to ensure that its social licence to operate aligns with ongoing taxpayer support. In blunt terms, agribusiness cannot decide to socialise the environmental cost of its operations but seek support for the provision of public goods that will increase private profits.

Many of these taxpayer-funded schemes are related to reducing emissions, improving freshwater quality and protecting or enhancing biodiversity. A selection of these is illustrated in Figure 2.3. Like the national policies outlined above, these funding programmes are often fragmented in the sense that they target a specific policy outcome even though they have co-benefits across domains.

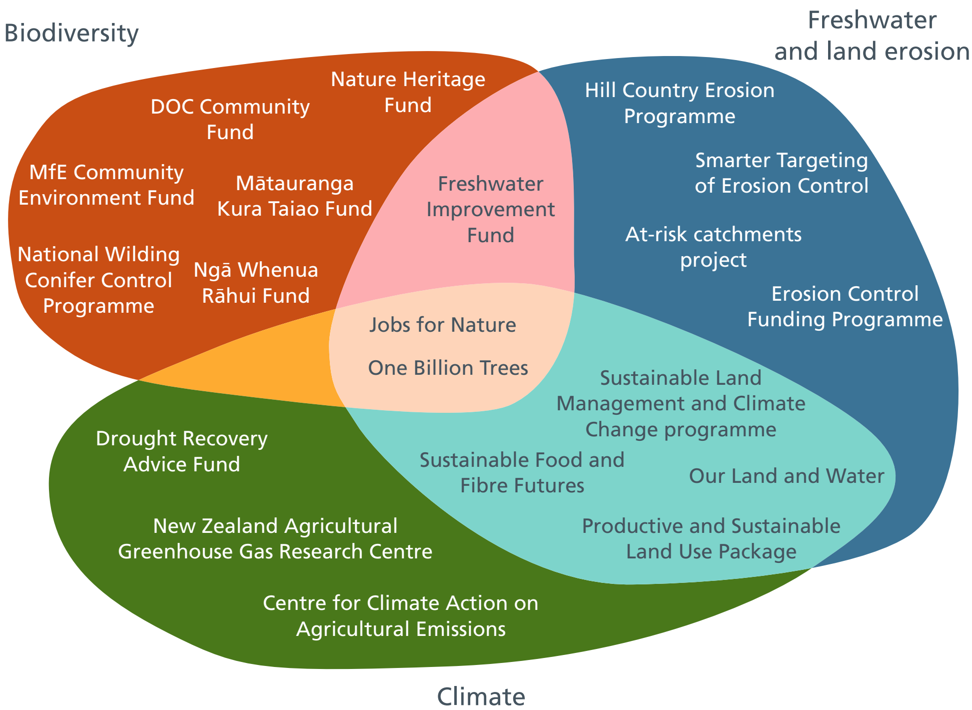

Figure 2.3: Examples of past and present funding programmes related to climate change, freshwater and land erosion as well as biodiversity.

In addition to the climate, freshwater and biodiversity policies and funding outlined above, the Government has separate policies aimed at enabling Māori to unlock the potential of their whenua. For example, the Whenua Māori Service provides access to a network of regional whenua advisors, and the Whenua Māori Fund provides financial support for activities to develop whenua Māori. The focus of these policies is generally on improving the productivity of Māori land.[50]

As the patchwork of policies and funding outlined above expands, it is becoming increasingly difficult for landowners, catchment groups and kaitiaki to navigate them. It is also increasingly challenging for officials from different ministries to coordinate and align the many moving parts. Further, it is difficult for parliamentarians to hold ministers and agencies to account for whether they are making a difference. Finally, there is a risk of imbalances between different policy areas, which can lead to negative unintended consequences for the environment. For example, the current strong focus on offsetting carbon emissions with forests increases the risk of land use decisions being made that are suboptimal for freshwater quality, indigenous biodiversity and climate change adaptation.

The limitations of property-based management

Many of the environmental impacts of land use are difficult to measure, do not respect property boundaries, and make attribution challenging. A focus on farm-level or individual-level responsibility leads to solutions based on property boundaries. Some property boundaries are aligned with geographic features of the landscape such as waterways or ridge lines, but many bear no relation to the grain of the land. As a result, in the absence of cooperation with neighbours and others sharing the same catchment, any individual can only have a limited impact on improving freshwater quality or biodiversity.

Under our current system, decisions about land use are largely in the hands of landowners, within regulatory constraints originating from the Resource Management Act. The domain of landowners is denominated by property boundaries. In theory, positive and negative externalities should be internalised in the costs of business operation via market-based mechanisms (including prices, taxes and subsidies). Or, in more colloquial terms, polluters should pay for the impact of their activity on the environment, and that money should be used to clean up the mess. Pollution is not always easy to measure. But in those cases where impacts can be accurately measured and attributed, market-based mechanisms can be adopted. This will be discussed in the next chapter.

However, in many cases the sheer complexity of environmental impacts can make it difficult to pinpoint the origin of and responsibility for environmental problems at a property level. It also makes it difficult to incentivise land use change when the benefits from such change generally do not map neatly onto property boundaries.

[50] TPK, 2023a, b.

For example, climate emissions are difficult to apply accurately on an individual farm basis unless the animals are kept inside. In the case of the levy on agricultural emissions, as proposed by the previous Government (the current Government has delayed implementation to 2030), the primary point of obligation lies at the farm level, though levy payers might be permitted to fulfil their reporting and payment obligations as a collective.[51]

Biodiversity (both flora and fauna, native and introduced) is also capable of moving around, often crossing property boundaries.

And of course, the impacts on water quality downstream of a certain land use depend very much on the soil type and hydrology of the area. Some activities, such as intensive winter grazing or cropping on vulnerable land classes, pose a high risk to receiving environments yet they have become normalised. Impacts also vary strongly because of climate and weather patterns, making it difficult to discern trends. While the environmental impacts of land use on water quality become more obvious as catchments get closer to the sea, accurately attributing those impacts to individual landowners is very complex.

These challenges are only likely to grow with the impact of climate change introducing increasing uncertainty into environmental flows and management decisions. Extreme weather events are likely to make the interdependencies between the actions of different landowners in a catchment even more stark. This will only heighten the positive and negative externalities of different land uses.

As a result, it is difficult to accurately measure and attribute environmental damage (or benefits) to land use choices made by individual landowners, except in the most extreme circumstances (such as discharging effluent into rivers, or winter cropping on steep slopes). This in turn makes it difficult to either incentivise or compel landowners to reduce their damage in an enforceable way. Instead, models are used to attribute environmental damage to individual farms.

In freshwater management, for example, the focus is on farms and farm-level measurement and management. Each landowner is technically responsible for the flows of contaminants lost from their land, often regardless of the fate and cumulative effects of these pollutants once they cross the property boundary or seep beneath the root zone. The Ōtūwharekai Ashburton Lakes provide a troubling example of what can happen if insufficient attention is paid to these cumulative effects. In this case, nitrogen-loss limits were set based on the past practices of individual farms (i.e. they were grandparented) rather than the ecological requirements of the lakes themselves. This resulted in nitrogen-loss discharges above what the lakes could tolerate, leading to a significant decline in water quality.[52]

[51] MfE and MPI, 2022.

[52] MfE, 2023a.

The difficulties of attributing environmental outcomes from land use at the property level have contributed to the creation of freshwater farm plans. In general, regulation is costly to implement and enforce and therefore tends to be focused on the laggards in any industry. When attribution is difficult, regulatory enforcement is even more complex. Farm plans are a risk-based regulatory tool that focus on actions to reduce each farm's potential impact on freshwater, in the context of the catchment in which each farm sits. This could be a promising way forward, provided that (1) there is sufficient capacity for implementation, (2) the plans focus on material issues (rather than resorting to box ticking), and (3) there is a basis of good information to underpin the exercise (which will be discussed in the next chapter).

Māori land presents additional unique issues

Māori have strong connection to the whenua through whakapapa and their collective responsibility to the land. Despite the Treaty of Waitangi, forced land sales and confiscations diminished the ability of Māori to exercise tino rangatiratanga and kaitiakitanga over their land and waters. Settlement agreements and Te Ture Whenua Māori Act 1993 are attempts, with variable success, to redress these losses (but see Box 2.1 for two examples of Māori businesses attempting to do so). These unique circumstances mean Crown policies that – directly or indirectly – influence land use change need to be carefully managed to ensure they do not further disadvantage or alienate Māori and Māori land. Targeted policies and funding mechanisms are needed to ensure Māori can manage their land on an equal footing with other landowners.

Settlement agreements

Through settlement agreements, iwi have been given a small fraction of their land back, either through gifting or purchases from the Crown. Many of these parcels included former Crown forestry licensed land, including pre-1990 exotic forests. Due to these parcels being excluded from gaining carbon credits in the NZ ETS, investments back into the land, including for environmental purposes, have been difficult. Other parcels included land that was already established in agriculture or horticulture. Many iwi are reclaiming their rangatiratanga and kaitiakitanga by changing land use to more environmentally friendly purposes and through the use of te ao Māori business frameworks. Two examples are the Māori-owned businesses Parininihi ki Waitōtara and Miraka (see Box 2.1).

Box 2.1: Attempting to improve Māori land use

Parininihi ki Waitōtara Inc

Parininihi ki Waitōtara is a Māori incorporation that administers approximately 21,000 hectares of diverse land use, predominantly ahuwhenua, in Taranaki. It has circa 11,000 shareholders who whakapapa to the land.

The land is looked after for the collective benefit of its people, and the Committee of Management's business strategy has a multigenerational outlook. Its vision – He Tangata, He Whenua, He Oranga – is measured through its bottom line and its enterprise operations, utilising Te Ara Putanga, its kaupapa evaluation tool. This tool helps them to assess whether they are achieving their core values of manaakitanga, kaitiakitanga, whakapono and whanaungatanga/kotahitanga.

Parininihi ki Waitōtara invests in the restoration and care of the whenua through supporting the development of hapū-led water monitoring programmes, species protection and capability building.[53]

Miraka

Miraka was established in 2010 by a group of Māori trusts and organisations with significant land assets and farming operations in the Central North Island. It is the first Māori-owned dairy processing company in Aotearoa and is powered by geothermal energy.

Establishing a dairy processing operation on their own land corresponds to a long-term intergenerational view of 100 farms for 100 years, with a prosperous outcome for their communities and shareholders. Miraka is founded on te ao Māori values, and kaitiakitanga is at the core of the business. Values of tikanga (protocols), whanaungatanga (relationships), and kotahitanga (collaboration) are part of the company's business strategy. The intention is to support their suppliers in achieving these values as well. Being a processing plant, Miraka can only encourage its suppliers to uphold these fundamental values. It is ultimately up to the suppliers to balance these values against the sustainability of their business.

To support the implementation of its core values, Miraka has developed its Te Ara Miraka farming excellence programme, which incentivises best practice on farm. The programme incentivises suppliers to achieve certain standards, including environmental stewardship. The Farm Sustainability manager at Miraka helps suppliers to stay ahead of environmental regulations as well as supporting a kaitiakitanga focus covering, for example, support on effluent management, riparian planting and reducing nutrient losses.

Many of Miraka's suppliers have diversified land portfolios outside of their dairy farming businesses (predominantly the Māori trust suppliers) while across their supplier base some of their farmers have explored other farm systems, including regenerative farming. This is not an easy task for landowners who need to find profitable uses for land that may originally have been used for unsustainable purposes such as dairying on high-leaching soils.[54]

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[53] Parininihi ki Waitōtara, 2016.

[54] Miraka 2021; Miraka, pers. comm., November 2023.

Much of the settlement land is marginal in terms of economic productivity because of poor soil quality or steep slopes. Furthermore, many pockets of Māori land today are landlocked, or have been identified as important native bush. Where that marginal land is running sheep and beef, policies that add additional costs, such as an emissions levy, may disproportionately affect Māori owners. For Māori landowners, options to make an economic return on that land are mostly limited to forestry. Policies that then limit forestry's potential on that land risk further disadvantaging its Māori owners. Even retiring 'marginal' land can be difficult. For example, converting land to native forest as an exercise of kaitiakitanga would provide cultural and environmental benefits but requires funding to do it.

Māori land

Māori freehold land governed by Te Ture Whenua Māori Act 1993 is collectively owned through whakapapa and succession. The Act sets up collective ownership, where many people 'own' the land. To manage those multiple owners many iwi and hapū have set up management structures like a trust or an incorporated society.[55] By area, 83% of Māori land blocks are now under whānau management. Many of these trusts or organisations are working towards self-determination of their lands and trying to implement te ao Māori frameworks to manage them, but they face challenges.

While the provisions of the Act protect descendants from further alienation, they reduce the options Māori have to manage the land economically and restrict options for land use change. Decisions to develop, use or change the land with multiple 'owners' require collective agreement, which is often hard to win even with a trust or incorporated society structure. Land cannot be used as an asset to borrow against, thereby restricting Māori from easily developing their land or making the transition to more environmentally sustainable uses. Restrictions in place reduce the ability to transfer ownership outside of the owners' whānau, hapū or descendants.[56] While Māori land can legally be sold, many Māori object to sale of land they are connected with through whakapapa, even if the land generates poor returns. As a result, these administrative challenges make transitioning to alternative land-use approaches difficult. Public policy initiatives that provide support for administering whenua Māori and targeted initiatives for supporting Māori agribusiness are essential.

[55] Community Law, 2024.
[56] Community Law, 2024.

Cranfillia deltoides

3 What would be needed to do a better job?

How – or even if – we go about tackling the environmental challenges outlined in chapter two is a matter of political judgement, as is the question of who pays. None of this happened yesterday and it will only be addressed over a time frame better measured in decades rather than parliamentary terms.

From the protestations of all politicians, I have to assume that people want to halt the decline in environmental quality and, if possible, improve it. Regardless of who pays for the transition to a more resilient landscape, we need to change the way we are approaching the problem. It is important that we view the environmental impacts of land use not as a series of technical problems (climate mitigation, climate adaptation, freshwater quality and biodiversity) with discrete solutions – as has often happened in the past. In academic jargon this is called an *adaptive challenge*.[1] In practical terms it means facing the fact that natural and rural environments are complex systems (with all sorts of feedback loops) and so are the rural communities who live there. So, any policies should be written in the full knowledge that there will be a need for constant adjustments as we learn more about the way those complex systems are responding – or are not. Simply put, we must *continually adapt our land management and land use choices in ways that are appropriate to the landscape and local communities*.

For some years I have been calling for an **integrated approach** to thinking about the environmental impacts of land use. I have not been alone in this.[2] By integrated, I mean considering the impact of land uses and changes to those land uses all at once rather than treating 'integration' as the sum of a whole series of separate exercises.

1 "Adaptive problems are often systemic problems with no ready answers" (Heifetz and Laurie, 1997, p.124).

2 See MILU (2023).

Part of the reason I undertook case studies in two catchments was to test this proposition (see Box 3.1). The experience convinces me that the approach is worth pursuing. For instance, I found that by sacrificing some of the short-term benefits of carbon sequestration, it was possible to create a more diverse landscape with environmental benefits that reinforce one another.

Another benefit of this approach is that it creates multiple income streams from a range of land uses, as integrated approaches are more likely to produce diverse land use mosaics.[3] Such an approach could help the people who live in our landscapes to be more resilient to external shocks. By contrast, I found that the current approach is likely to result in less diverse landscapes (mainly dairy farms and pine production forests).

Most people I have talked to agree that an integrated approach would be an appropriate way forward. In fact, nobody has seriously challenged this proposition. But 'integration' is one of those words that is easily trotted out to give the appearance of holism while practical day-to-day matters remain siloed. The question is, how in practice could that work?

The answers to that question lie, in part, beyond my remit and raise questions about the structure of government and the levels at which initiatives can be taken. However, four issues are worth exploring here:

- the appropriate scale for integration
- the availability of reasonably granular, high-quality information that can make links between the ambition of proposed changes to land management and land use, and environmental outcomes
- the way communities are engaged and the extent to which decision making is devolved
- the financial resourcing needed to fund all of the above.

Each of these is explored in turn below.

[3] MILU, 2023.

Box 3.1: Findings from two case studies[4]

The integrated exercise undertaken for the Mataura catchment in Southland and the Wairoa catchment in Northland illustrated how the impacts of environmental policies are likely to vary considerably from place to place. For example, modelling a low levy on agricultural emissions indicated a minimal impact on land use in the Mataura catchment between now and 2060. By contrast, in the Wairoa catchment, it would be likely to trigger a significant amount of land use change, with most hill country sheep and beef farms and even some dairy farms converting to forestry.

The modelling also illustrated how in the absence of changes to the role of forestry in the NZ ETS, the combination of a medium levy on agricultural emissions and a rising NZ ETS price would be likely to result in less diverse landscapes by 2060, with most of the land in these two catchments used for pine production forestry, dairy farming or (in the case of Mataura) lowland sheep and beef farming. Fast-growing pine forests can remove significant quantities of carbon from the atmosphere, and soil losses from forests are generally lower than losses from pasture. However, if clear-felled, the exposed land is left particularly vulnerable to erosion during the period following harvest. Discussions with people living in these catchments also highlighted that converting large areas of land to pine production forests to earn carbon credits could have negative local social and cultural impacts.

The exercise also considered what might happen if a more nuanced, place-based mix of policies were implemented. Alternative policy scenarios were developed in a series of hui and workshops with local people in the catchments. In these alternative scenarios, the revenue from a levy on agricultural emissions was recycled back to the catchment it came from and spent on actions to address multiple environmental pressures.

The modelling highlighted the importance of identifying 'hotspots' – areas in the landscape that are responsible for a disproportionate impact on the environment. These hotspots are a result of the characteristics of that land and the way it is being used. Farmers and advisors will be familiar with the term 'critical source areas' (areas of a field, farm or catchment that account for the majority of contaminant loss to waterways), which are an example of a hotspot. Targeting and taking action on hotspots will have disproportionate benefits for the environment. In the modelling, examples included fencing off waterways and riparian planting, gully planting, scaling up alternative land uses on hotspots, and restoring and constructing wetlands.

The case studies also highlighted the importance of engaging mana whenua early in any process to better understand landscapes and land use from a Māori perspective. Not surprisingly, both mana whenua groups decided to represent their intergenerational connections and the application of their mātauranga in very different ways. It was communicated by both that this relationship cannot be severed or reduced. Any exploration on changing land uses to implement multiple environmental policies needs to ensure Māori ways of knowing and understanding catchments are integrated into the purpose, outcomes, methodology, etc of the approach. This is much more easily achieved at the local level.

[4] PCE, 2024.

Appropriate scale for an integrated approach

The manifestation of many environmental stresses is very often place-specific. This means they cannot easily be handled effectively by national-level regulation. Decisions need to be taken much closer to the land uses that are generating them. This makes actions like the implementation of strategies to mitigate contaminant loss from land to water much more cost-effective than relying on cleaning up contaminants downstream.[5] Any attempt to **integrate** a response to the impacts of land use change on the environment in a holistic way will run up against individual property rights. The bundle of rights that attach to land ownership are likely to remain a cornerstone of our society. Those rights are not immutable, but attempts to regulate that cut across them need to be compatible with them.

Input regulations are a good example; they are blunt and much derided by farmers as telling them what to do on their own land. But if farmers cannot control the impact of activities beyond their property boundaries and monitoring those impacts at a micro level is impractical, input controls will have a place in the policy toolkit. The trick is to implement them in the right place and time so that they are effective.

In my view, the catchment is the appropriate scale for an integrated approach. This has been the bedrock of land and water management in New Zealand for almost a century and is one of the things we have managed better than some other countries. Most environmental issues that relate to how we use the land – climate adaptation, water quality, water quantity, biodiversity, pests and weeds – are best managed at a catchment level. Emissions reductions are an exception; it would be best to manage them at a global scale, but due to the political reality of our geopolitical system, they are, in fact, most effectively managed at a national level.[6]

This point does not negate the need for coordination, prioritisation and oversight at a national level. But if central government issues a 'paint-by-numbers' template it will almost certainly lack the information to do this in a way that really makes sense of the environment, and will certainly lack the knowledge of the people who live there. This is particularly important (but by no means uniquely so) for Māori whose assertion of kaitiakitanga is rooted in hapū who whakapapa to particular places with particular valued resources (such as kanakana/lamprey).

Rather than breaking up the environment into different silos, a te ao Māori perspective prefers engagement in an integrated, holistic fashion at a local level. But I suspect most New Zealanders, including individual landowners, feel much the same way. Everyone knows that water, birds, insects and sediment move around.

Taking a catchment-based approach must start by recognising that there is no single 'right' land use for each piece of land. These choices are subjective and depend on how individuals weigh environmental, social, economic and cultural values.[7] The question is, how do we then input the values of local people and engage them in decision making?

[5] See Macintosh et al. (2018).
[6] See McDowell and Kaye-Blake (2023).
[7] Snelder, Lilburne et al., 2023.

The natural starting point for governance at a catchment level would be regional councils and mana whenua. This raises legitimate questions about the past performance of regional councils in undertaking this role. It would be fair to say that regional councils have struggled to effectively implement central government direction, let alone do so in an integrated way. Without attempting a diagnosis as to why this should be the case, the turnout in regional council elections is mediocre at best and the sector has frequently lacked commanding elected leaders. As is the case at any level of elective democracy, poor turnout can enable the capture of the governance process by vested interests.

There is also a challenge of scale for some regional councils when it comes to attracting skills. Problems of this nature can be alleviated by assistance from the centre, and in some cases this has been provided. But central government can also be the source of other problems.

1. As a result of elections, central government direction can change relatively frequently compared to the time spans that apply to environmental issues and impacts.
2. Central government direction itself tends to be fragmented.
3. Central government direction often comes without the resources and tools required to effectively implement and sustain it (while debt limits constrain council borrowing).[8]

Indeed, the power of central government to direct regional councils may be a driver of low voter turnout. If the public senses that regional councils lack the ability to truly make a difference to their lives, they will be less inclined to engage.

Regardless of the cause, the past performance of regional councils must not prevent catchments or sub-catchments being used as the unit of analysis when it comes to operationalising an integrated approach.[9] In my view, local governance of an integrated approach could be bolstered by investing in the human and financial resources of catchment groups that work in partnership with elected councils. There must be clear lines of responsibility of who does what, something I discuss in more detail in chapter five. Where catchment groups are operating successfully, I would encourage delegating as much decision making to them as possible, but reserve to local authorities the power to intervene to overcome impasses.

Delegation of this nature would require arriving at a practical way of satisfying Māori claims to the management of resources that they value.[10] Māori will of course be landowners and economic players in their own right, but their relationship with the land and the water is wider than that.

[8] Dickie and Keenan, 2023.

[9] Under current regulation, regional councils are supposed to define freshwater management units in conjunction with community input. In practice, the level of community engagement has varied.

[10] Dickie and Keenan, 2023.

Adequate information

Any enduring solution to this adaptive challenge must start by getting the local community on board with a shared understanding of the scale of the challenge. This requires adequate information, pulling together research outputs, mātauranga Māori and local knowledge to help identify the problems and potential solutions that fit the local context and circumstances. Figure 3.1 illustrates the potential local catchment processes required, as well as the investments needed at different stages of that process.

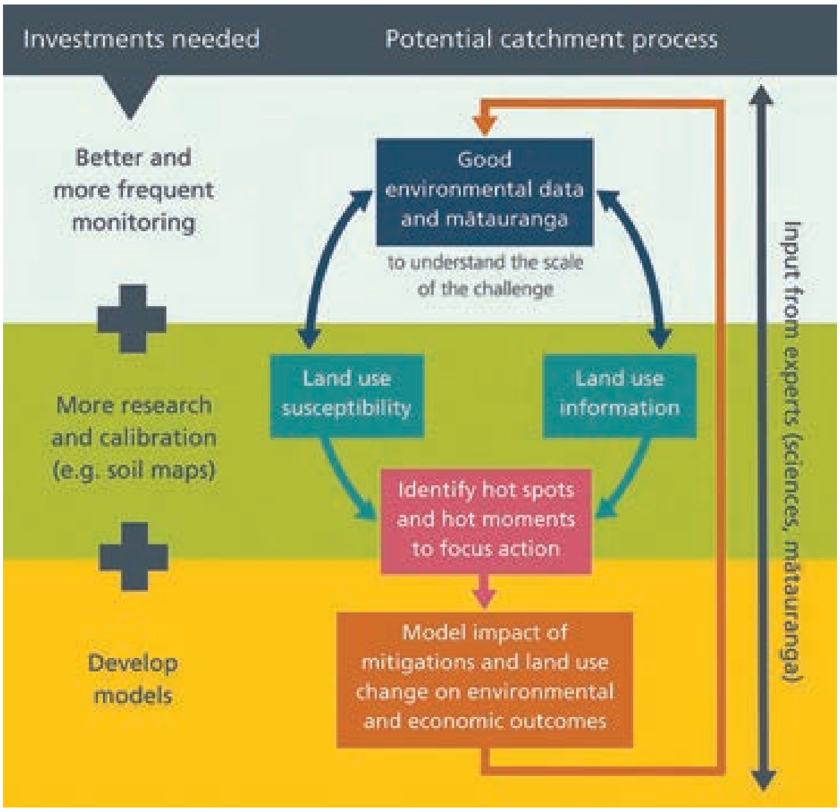

Figure 3.1: Potential catchment processes and investments needed to support them.

Catchment processes need to have clear national guidance with regard to environmental bottom lines and limits as well as other environmental goals. Communities also need guidance on how to prioritise and manage trade-offs across different environmental domains. Even where national guidance is well-established through national policy statements, for example, implementing these can take time. To do so effectively, communities and regional councils need a degree of stability in these expectations, which in turn requires a level of political consensus. I note that the current Government plans to overturn some of the existing policies, particularly with regard to freshwater management, which may in turn cause catchment groups to pause any progress, perhaps for years.

Our ability to assess the scale of the environmental challenge that catchments face relies on the availability of good environmental data, mātauranga Māori and the suitability of models at hand – whether biophysical or conceptual. This information is really needed now for the successful implementation of farm plans. Farmers need this information to truly understand the catchment context and the risks that their farm poses. Good information would make completing farm plans a relatively straightforward exercise for most farmers, and for the rest it would become obvious who needs some targeted support.

I have commented before that the quality of our environmental information is not fit for purpose in New Zealand.[11] The environmental data that are monitored within the environmental reporting framework are at best fragmented – lacking geographical coverage or consistent time series – or at worst not accessible. By not accessible, I mean the data and information are either only available behind a prohibitive paywall, presented in a complex format that cannot be used easily, 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. This has resulted in cuts and the atrophy of many databases.

In 1992, 26 Nationally Significant Collections and Databases were selected and backed by funding. The list has not been revised in over three decades. While the 26 still benefit from *some* funding today, in real terms they command a much smaller budget. Being on the list at least provides some protection from being forgotten. But there is a plethora of other environmental databases and collections that are not on this list and lack even that status when it comes to arguing for the technical and financial means needed to support an acceptable level of usability. These environmental databases can be classified into five domains:[12]

- **Land environment**, including the S-map Online data and Land Cover Database held by Manaaki Whenua – Landcare Research; the NZ Aerial Imagery Set, NZ Property Titles and NZ River Centrelines held by Land Information New Zealand; and several herbarium and plant repositories.
- **Biodiversity and ecosystem functioning**, including the vast Te Papa entomology collection, the internationally acclaimed iNaturalist database, AgResearch's Margot Forde Forage Germplasm Centre, the Lincoln University Entomology Research Collection and the New Zealand Plant Conservation Network.

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[11] PCE, 2022a.

[12] See PCE (2020) for a more comprehensive list of selected databases and collections that contribute to New Zealand's understanding of the natural environment.

- **Freshwater and marine environment**, including Land, Air, Water Aotearoa (LAWA), and the New Zealand Freshwater Fish Database, National River Water Quality Network and Freshwater Biodata Information System held by the National Institute of Water and Atmospheric Research (NIWA).
- **Pollution and waste**, including the Chemical Classification and Information Database and the hazardous substance and new organism application register held by the Environmental Protection Authority.
- **Climate change and variability**, including databases of atmospheric observations (aerosols, carbon dioxide, ozone, water vapour) and the New Zealand rainfall intensity statistics held by NIWA.

It is truly remarkable that a land and resource-based economy like New Zealand lacks a comprehensive database of land use updated in real time. The information exists, but it is not public due to privacy concerns. When it comes to water quality monitoring, without good baseline information on land use and management our existing network cannot tell us if mitigations would be effective at the catchment level. Similarly, data on the health of our soils are insufficient to shed light on trends. These are just three examples of subpar data – all of them seemingly crucial for a biological economy. We are living through a revolution in data collection, interpretation and application technologies. It is possible to collect comprehensive environmental data in time and space in ways that have never previously been imaginable – or even if they were, affordable. Investment in data is as much about infrastructure as building motorways or water treatment plants. It is time governments took a long hard look at their woeful record over the last 30 years.

There is a strong case for this investment to be a public one so that the information can be freely and easily accessible to all land users and form a trusted foundation for any modelling undertaken. Models are an essential tool to help landowners and decision makers understand the potential direction of environmental change under different assumptions. Modelling can usefully combine information on land use susceptibility with information on land use itself,[13] so that environmental hotspots can be identified. There is also a temporal element to this – so-called 'hot moments' or particular times when hotspots can be at an even bigger risk.

But models rely on good data, and without them it is a case of 'garbage in, garbage out'. I have now spent six years making the case for a concerted effort to lift our game on environmental data. Land use change undertaken to improve environmental outcomes or forced on us by natural disasters will be costly. It will be even more costly if we do not have good information to rely on.

[13] In the case study report (PCE, 2024), I experiment with a relatively novel approach known as physiographics (see https://landscapedna.org/). There are other approaches that attempt to do similar things, such as the APSIM model (see https://www.apsim.info/), funded by MfE, or Nature Braid (see https://naturebraid.org/). These tools are immature and still need further development and calibration, and as yet there is no scientific consensus about the best way forward.

Devolved decision making

One issue for devolving decision making is a lack of institutions to devolve it to. I have already discussed the situation of regional councils above.

Where they work well, **catchment groups** can provide a local institution. Unlike research or infrastructure for which central government has long accepted and played a role, the development of local institutions has been left to communities. Catchment groups have been a prominent, if uneven, response to recent central government demands. Their success often depends not only on the quality and skills of the people in them (particularly their leadership) but also on the support and resourcing available, as well as the incentive to collaborate.

The case studies I undertook underlined that the scale of land use change needed to reduce environmental pressures is as much (if not more of) a social challenge as an environmental or economic one. Catchment groups, if empowered with high-quality information, should be a place where mana whenua, landowners, communities and other local stakeholders can confront, face to face, the trade-offs that changing the way we use land lead to.

Our current approach is to hand down generic, high-level requirements, say little about the cost of implementing them, and then leave it to councils and communities to dig out whatever information they can to find a way forward. If sorting out the environmental consequences of land use is really a national priority, then a serious investment into financial and human resources is needed to facilitate the knowledge and community engagement required to make it a reality.

Catchment groups can facilitate many different roles that span information and decision making.[14] They can:

- improve community understanding of the problem
- build a common understanding of and buy-in to the potential solutions (which will often require collective action)
- share good practice across peer groups
- engage with hapū and support them to act as empowered kaitiaki
- help balance cultural, social, environmental and economic impacts to prioritise the most effective actions in the catchment
- inspire action.

[14] Just Transitions Aotearoa Group, 2023.

There are several examples of catchment groups and catchment collectives around the country. In Southland, a network of over 30 farmer-led catchment groups has been established to manage freshwater quality. They cover over 90% of the region. This network is being supported and coordinated by the Thriving Southland initiative (a partnership funded by the Ministry for Primary Industries and private sponsorship, set up with support from the NZ Landcare Trust).[15] Where they exist, catchment groups are already helping farmers prepare their farm plans by building an understanding of the catchment context and potential effective on-farm mitigations. In the future, catchment groups could support integrated farm planning and help show farmers the collective impact of the actions in their farm plans on the health of the local environment.

It is crucial that catchment groups receive high-quality, timely information that is adapted to the specific context they work in. They also need access to expertise to understand and interpret that information to make good decisions. I am interested in ways the Government can support and further build the capacity of these existing groups to explore locally appropriate ways to tackle greenhouse gas emissions, soil erosion, freshwater quality and biodiversity loss, while enhancing resilience.

I am not the first to suggest a greater role for collaborative processes as a solution to common pool resource problems. It has been tried in many guises and is heavily researched.[16] Catchment groups are not a panacea. In cases where resources are overallocated it can be difficult to reach collective agreement on who will lose out. However, when they are successful, they can be a valuable tool. The real question is, what makes them successful?

Nobel Prize-winning economist Elinor Ostrom developed eight design principles to manage common pool resources such as freshwater.[17] These principles resonate with the way Māori exercise kaitiakitanga (as shown in Box 3.2).

[15] See https://www.thrivingsouthland.co.nz/catchment-groups/ for details.
[16] See Just Transitions Aotearoa Group (2023).
[17] Ostrom, 1990.

Box 3.2: Ostrom's design principles on common pool resources and te ao Māori

Elinor Ostrom developed her eight design principles by observing how societies across the globe built up customs – often over generations – to successfully manage common pool resources. The principles include having:

1. clearly defined boundaries of the common pool resources
2. rules that fit local circumstances and conditions
3. participation in the rulemaking of those affected by those rules
4. effective monitoring to create accountability
5. graduated sanctions when community rules are violated
6. low cost and accessible conflict resolution mechanisms
7. higher authorities respect and value the community's rules and self-determination
8. a nested system with multiple tiers to manage large and complex common pool resources.

Given Ostrom's methods, it is no surprise there is resonance in te ao Māori. Kahui and Richards (2014) have provided a detailed account of concepts, definitions and practices applied by Ngāi Tahu, which in many ways echo Ostrom's principles. In te ao Māori, resources are managed by kaitiaki (often chiefs, elders or resource/ritual specialists), who are accountable to and kept in check by their wider hapū and/or iwi to manage resources effectively for the collective benefit. Discussions around resource management are often carried out on the marae.

Resource governance and management is based on kaitiakitanga (the ethic of intergenerational sustainability), which uniquely adapts to local conditions. Spatial and temporal access are regulated by rāhui (a temporary restriction) and owheo (permanent conservation); maintenance of ecosystems is achieved through ohu (communal working bees); and there are rules around the quantity and method of harvesting certain resources. In that sense,

> "conservation was always utilitarian and anthropocentric in nature. Resource controls such as *rahui*, *tapu* and *owheo* … were implemented to ensure the long-term availability of resources. 'It is a pragmatic kind of conservation, though perhaps an ethnocentric one, yet it has worked longer than many modern conservation programs.' (Ehrenfeld, 1989, quoted in Williams, 2004: 230)."[18]

It is worth making a few observations on what might work for New Zealand catchment groups. We are at an advantage in that common pool resource management principles are in close alignment with te ao Māori principles. The next step would be to ensure that equal weight and opportunity is given to applying non-Māori and Māori principles.

An important observation is that collaboration is not easy, and sometimes people need an incentive to take part. There are two important ways to incentivise collaboration: financial resources and devolution of power.

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[18] Kahui and Richards, 2014, p.6.

The first way is simple: catchment groups need to be resourced. Currently, funding streams to support catchment groups are patchy and time limited.[19] For catchment groups to be successful, however, they need to be resourced consistently over the medium to long term, particularly the roles of group coordinator and mana whenua.[20] Enquiries suggest that it is possible for one full-time coordinator to manage a few groups at once. The Government could reprioritise money from its many funds (see chapter two) and give priority to groups in environmentally constrained catchments.

A more controversial way to incentivise collaboration is through the devolution of power. A serious devolution of power means not only handing over funding but also decision making. This could include allowing catchment groups to depart from national and regional regulations where the catchment group has developed a credible plan to meet local environmental objectives.

The risk of devolution is that catchment groups sometimes prioritise their own issues rather than the ones identified by regulators.[21] The terms of any devolution would need to be very clear. Beyond that, devolved decision making can be more easily captured by vested interests and biased in favour of the status quo. The charge has been made that regional councils themselves have not been immune to this. How do you stop progress being watered down to reflect the interests of a subset of the community? This is where the first design principle becomes important: the need for clearly defined boundaries, or in other words, defining an appropriate scale at which catchment groups should operate. Crucially, there needs to be a regulatory backstop for those that don't participate to prevent them 'free-riding' on the rest of the community's hard work.

Many people have been experimenting with catchment groups around the country. Where they are working, we should experiment by giving them greater powers and resources with clear links to environmental outcomes. The corollary of that is there would not be complete coverage across the country. This could prove to be an advantage. Localism allows for more experimentation and a greater diversity of approaches and land uses across the country.[22] Some will, quite reasonably, resist a retreat from the idea of a uniform national approach. But on balance, given that there is no one-size-fits-all solution to managing very different places, a diversity of approaches seems to me desirable *provided that* catchment groups are transparently accountable for the outcomes they deliver.

[19] Recent government investments in this area by MfE and MPI are encouraging, including the development of resources to help catchment groups understand their role, such as the Catchment Toolkit (https://www.catchmenttoolkit.co.nz/resources/).

[20] Sinner et al., 2023.

[21] Sinner et al., 2023.

[22] Craven et al., 2019.

Mobilising financial resources to effect change

Access to financial resources is a key barrier for landowners, regional councils and catchment groups trying to effect land use change. Mobilising adequate financial resources to change how we use our land is therefore critical. Below, I discuss some options, from the tried and tested approach of grants and loans funded by taxpayers, through to more innovative market mechanisms.

Publicly funded grants and loans

Historically, central and local government have used grants and loans (funded by taxpayers and ratepayers) to encourage changes to how we use the land. Grants are particularly important for entities without income sources, such as some Māori landowners and catchment groups. The advantage of grants and loans is that specific criteria can be attached to ensure public money is spent appropriately. The downsides include increased administration for all involved (especially given the proliferation of schemes) and uncertainty around future funding.

Central and regional government could design an integrated grant and loan scheme with broad criteria customisable to local circumstances. The need for local customisation suggests that regional councils, mana whenua and catchment groups could ideally lead the grant-making process. New funding may not be needed; many existing schemes could be integrated into this approach.

An integrated grant and loan system should target the most environmentally constrained catchments, particularly the hotspots within them. They could fund catchment groups and help meet the costs of implementing nature-based solutions that deliver the greatest improvement in local ecosystem services. Nature-based solutions might include restoring wetlands or afforestation to improve biodiversity, sequester carbon, reduce erosion and regulate water flows.

Reducing erosion and regulating water flow will be especially important in areas that are increasingly susceptible to extreme weather events. Retiring peat lands is also a possibility, although the high value of this land suggests that it might be ideal to start in areas most at risk from climate change (sea level rise and extreme events). How the cost of implementation is shared depends on what we want from our catchments, and how much of that we expect landowners and communities to do themselves. Targeting hotspots means that some landowners will need to do disproportionately more than others, and grants are a way to make that action more equitable.

Where new land uses are trialled and likely to be economic, demonstration grants (for first movers) and underwritten loans can be valuable tools to encourage land use change. Loans can also be helpful where investments in infrastructure are needed to support new land uses (e.g. processing capacity to support new land uses). Loans were used heavily in the transition following the removal of agricultural subsidies in the 1980s. Where land uses are not economic or land is under Te Ture Whenua Act, grants may be necessary. For uneconomic land, land buybacks might also need to be considered.

One potentially controversial form of infrastructure to facilitate land use change is water storage. In the past, water storage has been touted as having benefits for the environment that have not always materialised in practice as land use has intensified (usually to dairying) to pay for the water storage.[23] I am not opposed to water storage infrastructure in principle, but there need to be strong environmental limits in place within a catchment before investment in water infrastructure occurs. Ideally, water storage should be used to provide security of supply to high-value uses, rather than to increase water use *per se*. As discussed above, we lack the tools to enforce such limits effectively at the farm scale, and therefore great caution is needed when considering the use of public money for water storage schemes.

Uncertainty around future funding is more challenging to resolve. Changing how we use the land is a challenge with long time frames, and catchment groups tend to struggle finding commensurately long-term funding. Grants and loans can be accompanied by contracts promising future funding if certain conditions are met. However, any solution that is dependent on taxpayer or ratepayer funding will always be vulnerable to reprioritisation. Market-based mechanisms could – if successfully introduced – provide more stable funding streams.

Market-based mechanisms

Where outcomes can be accurately measured and attributed, market-based mechanisms can be used to place a price on resource uses that impose environmental costs. These mechanisms effectively include the cost of environmental damage and/or the value of environmental improvement in a farmer's bottom line. Another benefit of these tools is that prices do not mandate specific actions. Instead, they provide incentives to change behaviour. People can choose *how* they change their land management or use – or can even decide not to change behaviour and pay the price instead.

In some cases, market mechanisms are being put in place by private companies to encourage environmental best practice. These tend to reward good performers with a premium and/or exclude poor performers. However, the robustness of the incentive ultimately depends on consumer demand. In my view, this makes private sector schemes vulnerable to trends, and as such they are no substitute for government-mandated schemes.

Compared with other developed countries, the use of environmental market-based mechanisms in New Zealand is relatively low.[24] While not their intended purpose, government-led market mechanisms can also raise revenue that can be used to either offset other taxes or meet other spending priorities.

The chief concern with market-based mechanisms is that if incorrectly specified, their outcomes can lead to gaming or unintended consequences. The best current example of this is the NZ ETS. My two catchment case studies indicated that under current policy settings the NZ ETS is the main driver of land use change, mostly from sheep and beef to pine production forestry. This is confirmed by the most recent Survey of Rural Decision Makers, which found that the main driver of land use change currently is carbon.[25] That was not the intended purpose of the NZ ETS. It is, rather, its foreseeable but unintended consequence. The role of the NZ ETS as a barrier to effective land use change is discussed in the next chapter.

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23 See Thomas et al. (2020).
24 See OECD (2024).
25 See Manaaki Whenua – Landcare Research (2023).

Very recently there has been discussion about biodiversity credits as a potential market-based mechanism.[26] However, biodiversity is so localised that it would make trading across different species and jurisdictions difficult. It is also not yet clear what the scale of private sector demand for these credits would be. If biodiversity credits are an attempt to bid for public funding, then we should take an integrated approach that targets the most environmentally constrained catchments and hotspots within them, as discussed previously.

Pricing water

A price could be placed on the commercial use of water – either for consumptive (e.g. irrigation), non-consumptive (e.g. most hydroelectricity) or absorptive capacity (e.g. nitrogen leaching) purposes. To implement any of these, rights to use freshwater need to be clarified and actual use measured.

Any durable set of rights around the use of freshwater will require resolving Māori rights and interests (discussed below). Water use is measurable now that metering is required as part of resource consents. Conversely, nitrogen leaching has proved very difficult to measure accurately at a property level, with landowners instead relying on results modelled using Overseer, which with all its limitations creates a risk of gaming. As a result, nitrogen leaching is much more difficult to price accurately.

A price on water would act as a resource rental, recognising both the damage to the environment of taking water and its value as an input into a commercial undertaking (residential use could be exempt). This would provide an incentive to ensure that water is allocated to its highest value use. A charge could also provide revenue to safeguard the future of that resource.[27] In terms of Te Mana o te Wai, this is making sure that we look after the river first. Combined, these arguments for a resource rental would help achieve the goal of this paper – ensuring that as a nation, we maximise the social, cultural and economic benefit of our natural resources while making sure we look after them for future generations.

A resource rental would likely be a small charge per unit of water used, ideally adjusted for the scarcity of water in the particular catchment. This would have the greatest relative impact on the largest users of freshwater in New Zealand, particularly those using water for irrigation and hydroelectricity generation. A 2014 study by the New Zealand Institute of Economic Research (NZIER) and AgFirst estimated that irrigation increased the productive capacity of landowners (particularly in Canterbury) to the value of $2.17 billion per year.[28] Currently these businesses can use this valuable natural resource for free, so this value is capitalised in land prices.

Although most hydroelectricity generators are returning the water to the river immediately after it is used, dams prevent the migration of some species, significantly alter flow and temperature and contribute to water loss through increased evaporation. This impact on the mauri of our awa needs to be acknowledged appropriately. While non-consumptive water users could pay a lower per unit price than consumptive users, they should in fairness pay something.[29]

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[26] PCE, 2023b.

[27] Tax Working Group, 2019.

[28] Corong et al., 2014.

[29] In Scandinavia innovative policies have been enacted to manage hydropower. In Norway, resource rent taxes have been applied to ensure a share of the return on hydropower accrues to society (Ministry of Finance, 2022). In Sweden, a new national relicensing plan means many small hydropower plants are opting to be decommissioned, with the funding for this, and other environmental measures, coming from the largest hydropower companies (Borg, 2020).

The revenue from any such a rental could be channelled into investing in activities that reverse the decline in freshwater quality that we have seen in recent decades. The revenue could be retained within the catchment or region where it is collected. This would, however, disproportionately benefit Canterbury. Alternatively, it could be used to buy back water use rights in overallocated catchments and the remainder channelled into other restorative activities through grants and loans as per above.

Pricing biogenic methane

Currently there appears to be political consensus between the two largest parties in Parliament that a price should be levied on biogenic methane emissions. The main area of disagreement is the timing of implementation.

Again, the revenue from a price on biogenic methane could be retained within the catchment or region where it is collected. In this case there is likely to be a better match between revenue and the catchments facing the greatest environmental challenges.

Source: Angela Mulligan, Unsplash

Figure 3.2: Revenue from a price on biogenic methane could be retained within the catchment or region where it is collected to help fund environmental mitigation measures and land use change.

For biogenic methane, a cap-and-trade scheme would in my view be preferable to a tax or levy. While a tax or levy would provide greater price certainty and simplicity, there are two main advantages to a cap-and-trade scheme:

- Firstly, a cap-and-trade scheme is more appropriate for methane than long-lived gases such as carbon dioxide because emissions do not need to be reduced to zero. To reduce carbon dioxide emissions to zero under the NZ ETS will (in the absence of complementary measures) eventually require an exponentially high carbon price. For short-lived gases like methane, the goal is to reduce emissions to an acceptable flow rather than eliminate them altogether. Hence the importance of ensuring that the price incentivises the most efficient producers.
- Secondly, using rotational pine production forestry (or potentially other species) to offset some of the warming from biogenic methane is a more justifiable strategy than using it to offset fossil carbon dioxide since it does not involve the permanent loss of the land's option value. I have elaborated my reasoning for this conclusion in *How much forestry would be needed to offset warming from agricultural methane?*[30]

A new cap-and-trade scheme for biogenic methane should be investigated that allows for some forestry offsets.[31] For this to work, however, production forestry would need to be removed from the NZ ETS (see chapter four).

There seems to be little doubt that putting a price on biogenic methane would – all things being equal – reduce emissions. The question is, how would this happen and what would be the likely impact on other environmental outcomes?

A price on methane as proposed would enable farmers to choose between a menu of options, including on-farm mitigation, using afforestation as an offset, simply paying the price or destocking. Exactly how landowners would react depends on the costs and benefits of different options. Where techniques and technologies to reduce on-farm emissions exist, a price on agricultural emissions would incentivise their uptake. Even if no new technological options to reduce emissions emerge, a well-designed price would favour more efficient producers of meat and milk, allowing them to expand at the expense of less efficient producers. Improving efficiency has been shown to improve profitability and environmental outcomes at the same time and should be encouraged.[32]

More profitable landowners (e.g. dairy operating on more productive land) are likely to choose from the first three options where they exist. If they do not have sufficient unproductive land to afforest to offset their emissions, they may choose to purchase offsetting from other landowners. Marginally profitable farmers faced with a price may choose to exit livestock farming entirely, and productive farmers paying for land to be afforested could provide them with an exit strategy. As a result, a cap-and-trade scheme for methane would likely continue the conversion of sheep and beef farms to forestry.[33] This would certainly offset the warming effect of methane emissions, but it is the impact on other environmental and social outcomes that would continue to be the subject of considerable debate.

[30] PCE, 2022b.
[31] See Bognar et al. (2023).
[32] BERG, 2018.
[33] See also PCE (2024).

A combined intensity-adjusted land tax and natural capital enhancement subsidy

If the aim is to reverse the loss of biodiversity and degradation of water quality, and we accept that ongoing payments are needed in some form to achieve that, a logical funding source would be an intensity-adjusted land tax. That is, a tax based on a percentage of the value of the land, but adjusted for the degree of environmental impact that is being imposed. Land covered with roads, concrete or buildings, for example, would be subject to the full tax. Farmed land or buildings with green roofs, which still support biodiversity in some form, would be partially taxed. Land in a natural or restored state would receive a subsidy (in effect a recognition of the ecological services being provided).

A tax and subsidy system could be designed to be revenue neutral overall. Effectively, an intensity-adjusted land tax absorbs the concept of biodiversity credits and takes funding it to its logical conclusion. Such a tax and subsidy system would sensibly be administered by government. It could also be used to offset some environmentally based local government charges.

Due to the revenue-neutral nature of this tax, it would not be a direct source of revenue for catchment groups, unless they are landowners. However, farmers, mana whenua, and potentially also local authorities would receive payments for land they own that is maintained in or returned to its natural state.

This idea was initially pitched by the Tax Working Group in 2019 as a 'natural capital enhancement tax':

> "The tax aims to recognise that natural capital produces valuable ecosystem services. It provides incentives for the conservation, restoration and regeneration of high-value natural capital, going beyond more narrowly targeted negative externality taxes. Remote sensing technologies, combined with mapping and modelling tools, could potentially be used to assess both the level and change in the ecological value of a specific area of land or coastal zone."[34]

As always, a key challenge with such a system is having sufficiently granular, high-quality data to implement such a tax and subsidy system. Such data are increasingly feasible to collect with remote sensing technologies and artificial intelligence.

[34] Tax Working Group, 2019, p.54.

Another implementation challenge would be working through the relative tax rates between different land uses based on the best science available and ensuring that Māori-owned land is not disadvantaged. However, for land use, there have been numerous indicators that combine agricultural intensity into a single measure and relate this to environmental performance like water quality.[35] The relative contribution of different land uses would no doubt attract controversy and need to be grounded in good science.

This idea is speculative and may be dismissed by some as unrealistic. However, it is difficult to think of another tool that could provide the resourcing needed to achieve our environmental goals, and do so in a fair and transparent way. A tax and subsidy system would start low and could be progressively dialled up until the country's environmental goals are reached.

This idea does raise an important point. Landowners will look to be compensated by the taxpayer for environmental improvements. This, however, undermines the 'polluter pays' principle, especially in cases where landowners have contributed to – and benefitted from – environmental damage without paying for it. How much should they contribute to solve the problem? Or, looking at it another way, how much of their effort should they contribute for free? To be good stewards of the land, what baseline level of environmental management should simply be expected? These are all important questions to ask when considering an integrated approach to land use.

[35] Giri and Qiu, 2016.

3 What would be needed to do a better job?

4

Schizaea dichotoma

Some barriers that stand in the way of land use change

Doing a better job of caring for land and water is not just about adopting new practices or changing land uses. It may also be about removing barriers. Some of these barriers are highly local, others are structural.[1] While there may be quite strong incentives to change, landowners can face a complex array of barriers to consider when making their land use decisions. This creates uncertainty when making both the small and large investment decisions needed to change direction.

In 2017, the Ministry for Primary Industries (MPI) commissioned a useful literature review that summarised the drivers and barriers in play when land use change is under consideration.[2] It covered biophysical, economic, technological, societal, regulatory and individual factors. The review acknowledged that many of these factors interact in complex ways that will vary according to the specific case. The following discussion highlights some barriers that were apparent in conversations with both landowners and researchers undertaken in the course of the two case studies. It also draws on MPI's work and other research.

1 For example, see Biden (2023).
2 Journeaux et al., 2017.

Commercial imperatives

Farmers wryly note that 'you cannot be green if you're in the red'. Profitability is essential if landowners are going to invest in land use change. The capacity to borrow depends on profits or at least the promise of future profits.[3] In what is essentially a sector dominated by small businesses, there is often a strong culture of family ownership, and injections of equity funding are relatively rare.

Land use change often involves large capital outlays, and it can take years before the changes start to generate returns. The capital outlay is not restricted to on-farm changes. Before any land use change can happen, landowners need to invest in research and advice to understand their land and potential alternative uses. It can be challenging for landowners to receive land use agnostic advice. This is because not many farm advisors are trained to provide advice across different land uses while industry bodies must focus on their respective commodities under the Commodity Levies Act 1990. Advice on land use change is also complex. While land use change *per se* is relatively simple, the knock-on effects of bringing new products to the market require the development of new customers, new processing infrastructure and new distribution channels.

These challenges are daunting for any small business with limited resources operating in a global market. Farmers are no exception. New Zealand has a small domestic market and is a long way from international markets. In its work on frontier firms, the Productivity Commission catalogued the challenges facing small businesses trying to export in such circumstances.[4] These uncertainties are much smaller in the more established industries such as dairy, meat, apples, kiwifruit and pine production forestry because producers have been able to organise themselves collectively (in varying degrees) to research, process and market their commodities.

The reduced uncertainty that collective action provides naturally biases landowners towards established industries. This is not always positive for the environment. The Dairy Industry Restructuring Act 2001, which created Fonterra, was justified on the basis of creating a "national champion" that could diversify into high-value consumer products.[5] This strategy has failed to meet expectations and Fonterra has returned to a more traditional strategy of driving improved commodity returns for the benefit of suppliers. Unsurprisingly, this approach incentivised conversions to dairying and with them an intensification of land use up until around 2016.[6] As we know, intensive dairy farming has contributed to poorer environmental outcomes in some parts of the country.

Given these different factors to consider, and the complex and fragmented policy landscape, it is understandable that landowners are risk averse and biased towards the status quo in their decision making. This has huge implications for the speed of land use change for two reasons.

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[3] See Environment Southland (2022).
[4] NZPC, 2021.
[5] NZPC, 2020.
[6] NZPC, 2020.

Firstly, if investments have been made in the recent past, landowners will want to recoup the returns on their investment before making further changes. Secondly, as with any small business owner, a significant change to the business will often literally mean betting the house. For most farmers, the main source of capital for investment will be bank loans. Banks in New Zealand are risk-averse lenders that find home lending an easier and more profitable activity than farm lending. Landowners are naturally (and quite rightly) cautious about exposing themselves to commercial risk. Based on this analysis we might expect some of our larger corporate, iwi or publicly owned farming operations (such as Pāmu/Landcorp) to lead the charge on land use change in environmentally constrained catchments as they will be better placed to spread the risk of experimentation across their operations.

Unsurprisingly, the relative profitability of dairying makes a transition to lower-intensity practices more commercially achievable than is possible for sheep and beef, which has seen its average profitability decline to the point of being marginal. Where land is suitable for conversion to a more profitable use (for example, from sheep and beef farming to dairying or forestry), the sale and transfer of the land can draw a neat line under yesterday's unsustainable uses, as the purchaser starts with full knowledge of the need to meet higher standards. But where this convenient exit route is not available, the resources available for sustained environmental clean-up are meagre.

This highlights the point that as a country we have few tools for improving the environment where environmental goals impose a cost that landowners are unable to bear. The implementation of environmental policies is often pushed onto regional councils, which are left to confront landowners, who in some cases – but not all – lack the resources to deliver what is expected of them. In cases where landowners do lack resources, their precarious position might be further compromised by increased pressures from global food companies and banks that will increasingly require them to measure and reduce emissions as well as make biodiversity improvements. Regional councils have raised this issue with the Ministry for the Environment. For the current set of freshwater plans (for which the current Government has pushed back the implementation deadline) regional councils are focusing on what they can achieve within current tools. In the absence of profitable alternative land uses, the only large-scale example we have of a successful transition to less environmentally damaging land uses is Lake Taupō – and that was a mixture of de-intensifying land uses and preventing further intensification. Iwi buy-in and $80 million compensation from central and local government was crucial to the success of this initiative.

The New Zealand Emissions Trading Scheme

The NZ ETS is currently the main commercial driver of land use change. While afforestation is certainly needed in parts of Aotearoa and the NZ ETS provides a source of revenue for this, the scale of this change has the potential to create negative externalities and foreseeable unintended consequences (while reducing other pressures). In my view, using such a blunt tool as the main driver of land use change is becoming a barrier to the outcomes we are seeking.

My concerns with the use of forestry as an offset for fossil fuel emissions began with the work on *Farms, forests and fossil fuels*.[7] Carbon emissions stay in the atmosphere indefinitely. How can we ensure that the carbon sequestered in a forest stays locked up for similar time frames in the face of risks of fire, diseases and policy change? These risks are likely to grow as the climate itself changes and are higher for permanent forests, which will need management long after the income flow from carbon sequestration has ceased.

The environmental impacts of new forests will vary depending on local conditions, the type of forest and the management regime. The key point is that the NZ ETS drives land use decisions based on tree species that absorb carbon quickly (usually pine). This will not necessarily lead to forest management decisions that are optimal across all environmental outcomes (let alone social and economic ones).

More recently, questions have arisen about the durability of the NZ ETS given its current settings – particularly the use of forestry as a source of unlimited offsets. These issues are well covered by He Pou a Rangi Climate Change Commission's latest advice.[8]

Additionally, there have been concerns about the loss of productive land from widespread afforestation. Theoretically, this is unlikely to become a problem soon as Te Uru Rākau has estimated that there are close to 2.7 million hectares of low-productivity, privately owned pastureland suitable for afforestation.[9] However, it is difficult to know if current and projected afforestation is restricted to low-productivity pastureland. The Ministry for the Environment has estimated that at current carbon prices it is economic to convert more productive land in addition to that included in the estimates done by Te Uru Rākau. The type of forest can also make a difference – permanent carbon forestry can be on difficult-to-access marginal land, but production forestry needs to be accessible for cost-effective harvesting and transportation to market.

The feasibility and impacts of establishing different types of forests in different locations is a complex question I am addressing in a forthcoming review. The costs, revenues, risks and benefits associated with any newly established forests will depend on a number of things, including the type of forest, where it is located, and how it is managed.

The current unrestricted use of forestry as an offset is removing different land use options from future generations. Long-term predictions are purely speculative, but it is easy to foresee scenarios where this might become a problem. In the second half of this century there is a risk of running out of low-productivity pastureland for afforestation. If we do not reduce gross emissions, we will need to keep planting trees on more grassland in perpetuity. This risk is more likely to eventuate if we continue to allow unlimited forestry offsets in the NZ ETS as it depresses the carbon price and reduces action on gross emissions. The country also needs to consider the potential need to go carbon negative to restrict warming.

7 PCE, 2019a.

8 He Pou a Rangi Climate Change Commission, 2023.

9 Te Uru Rākau New Zealand Forest Service, Ministry for Primary Industries, pers. comm., November 2023. Note that this model was run in 2020, so there may have been changes since then.

A more immediately pressing issue than the loss of productive land is the social and economic impact of converting sheep and beef land to pine production or permanent carbon forestry. This is a hotly debated issue and both industries have published research to support their arguments.[10] The answer ultimately lies in the eye of the beholder; on a judgement of 'who matters', both on spatial and socio-economic (landowners versus workers) scales. What is clear, is that permanent carbon forestry reduces employment overall.

It is worth noting that in deciding the rating differentials for ratepayers, Wairoa District Council on the East Coast has determined that forestry activities are of minimal benefit to the Wairoa community and that forestry has a negative impact on employment in the district. The High Court did not dispute the council's reliance on the 'disbenefits' of forestry to community wellbeing when considering its rating decision.[11] Similar concerns were noted by local communities in the course of our case studies.

Pine production and permanent forestry are legitimate land uses and, as long as they are properly regulated, they should be free to compete with other land uses. But afforestation should not be incentivised by treating it as a cheap way to offset fossil fuel emissions. In my view, the NZ ETS should be retained as a tool for reducing gross emissions, but the right to use forestry as an offset should be progressively phased down over time.[12]

Removing forestry from the NZ ETS should allow the Government to auction more credits at a higher price. The augmented revenue could be applied to incentivise changing how we use the land (as per the 'Publicly funded grants and loans' section above). This should include paying for nature-based solutions that sequester carbon and generate other ecosystem services such as afforestation or restoring wetlands on private land and whenua Māori.

Using revenue from the NZ ETS to fund nature-based solutions on our land may seem oblique, but in many ways, it is more compelling. Firstly, New Zealand's greatest contribution to warming has been land use change through deforestation. This would be an opportunity to recapture some of the enormous carbon stock that was emitted to the atmosphere during the 'breaking in' of much of Aotearoa, together with the collateral environmental damage inflicted on biodiversity. It makes sense for modern day fossil fuel users to pay to repair the widespread damage that occurred during the formative stages of this contemporary capitalist economy. Secondly, these actions would (if well targeted) also prove to be valuable investments as the climate changes. Essentially, such a fund could be billed as funding nature-based solutions for climate adaptation.

[10] See, for example, Harnett (2019) and Harrison and Bruce (2019).

[11] *New Zealand Forest Owners Association Incorporated v Wairoa District Council* [2023] NZCA 398.

[12] I am not alone on this point; see, for example, Cullenward (2023) for a similar argument.

Source: Geoff McKay, Flickr

Figure 4.1: Native trees and pine production forestry are visible from Fern Walk in Tōtara Reserve Regional Park, Pohangina Valley.

Individual factors

It is often difficult for others to understand why people make the decisions they make. However, factors relating to the individual could be among the most important barriers to land use change, at least in the short to medium term. In the longer term – for example, when a property comes up for sale – it is more likely that a new owner will be willing to take a fresh look at land use to get the most value from their investment.

Research indicates that 'lifestyle' factors are a major barrier to land use change. Several studies show that many farmers accept below-average returns on their investment even when capital gains are included.[13] While there may be a number of reasons for this, including the farm being both the business and the home, the lifestyle benefits of farming are likely to be one of them.[14] A survey of rural decision makers found that farmers who had not changed land use, intensified it or increased the size of their farm gave reasons like 'lifestyle' (53.6%) and 'the imminent anticipation of retirement' (12.6%). Several other responses clearly also related to lifestyle, including 'age', 'already retired' and 'happy as I am'.[15]

[13] DairyNZ, 2022; Greig et al., 2018.
[14] Greig et al., 2018.
[15] Journeaux et al., 2017, p.15.

Cultural factors will also influence decisions on land use. A case study in the Waiapu catchment in Gisborne focused on the economic and cultural implications of changing land use under different climate change scenarios for Māori landowners.[16] The land in question had relatively large areas of land in Māori ownership and is prone to extreme erosion. The scenarios (all focused on afforestation) were also assessed using a kaupapa Māori tool.

Kaitiakitanga (Māori sustainable resource management), manaakitanga (the reciprocity of actions to the environment and people), and whakatipu rawa (the need to retain the resource and asset base for future generations) were the principles used in the tool alongside the economic modelling. The study found that these values, incorporating a long-term intergenerational view, were more important than economic ones when it comes to making decisions on changing land use.

This underlines the point that the scale of land use change needed to achieve our environmental goals is as much a social and cultural challenge as an economic one. Economic incentives will no doubt make a difference over the medium to long run, but in the short term, social considerations are also likely to impact on decision making. Understanding these social and psychological considerations is the motivation behind the *Moving the Middle* research programme being led by Manaaki Whenua – Landcare Research.[17] It is investigating the pressures landowners face and the types of interventions that can reduce these pressures to empower them to make land use and land management changes to achieve environmental goals.

Regulatory rigidity

Many of the sources of regulatory rigidity are an attempt to manage specific environmental problems. They tend to put up barriers to land use change on the assumption that it might negatively impact on the environment, but in practice these barriers might also prevent positive changes.

As noted above, our tendency as a nation is to use property rights as the unit of regulation, despite that not always being appropriate. Ensuring that land use is well matched to the capability of the land beneath it will always be difficult when taking this approach. Allocating new rights tied to property is an extension of this approach. Ultimately, there is no fair way to allocate resource rights, but ideally they should be tradable so that available resources are used for their highest possible value consistent with maintaining environmental quality.[18] If resources are not tradable, that can cut off the possibility of land use changes that might be better from both a holistic environmental perspective and an economic perspective.

We have already noted above that obligations under the NZ ETS reduce options for land use change. However, at least the carbon obligation is tradable.

[16] Awatere et al., 2018.
[17] Greenhalgh and Morgan, 2021.
[18] See McDowell et al. (2018).

Resource management

There has been no specific research into the extent to which the resource management legislative framework impedes changes to land uses with lower environmental impacts. However, there is research into regulatory barriers that prevent the uptake of techniques to reduce the environmental impacts of existing land uses.[19] An example of such a barrier is where mitigation requires earthworks or the alteration of a water body, which often requires resource consent.

While many regional councils have categorised mitigation techniques as permitted activities, this varies across regions and they are often accompanied by a long list of conditions that are difficult to meet. Many regional councils overcome this barrier by offering grant funding to support these activities. Research into best practice for the implementation of mitigation techniques that take a multidisciplinary perspective might help councils refine conditions to improve both the uptake of mitigations and the consistency in their quality.[20]

The same regulatory barriers may apply to land use changes with lower environmental impacts (particularly those involving subdivision of land). Embarking on novel land uses may be considered too difficult if the burden falls on the landowners to demonstrate that the environmental impacts are lower, and the threshold for proving this is set too high or is too costly. One particularly controversial example of a land use change that *could* have lower overall environmental impacts, but faces large regulatory barriers, is conversion to lifestyle blocks.

Territorial authority restrictions often prevent people from being able to subdivide and sell land for lifestyle blocks or other so-called non-productive uses. The rules were originally driven by farmers concerned about lifestyle blocks eating up agricultural land but have in recent times been adopted by urbanists and planners opposing low-density development (Waikato Regional Council's Future Proof Strategy is a good example). Yet subdivision can free up capital to enable landowners to upgrade environmental practices or change land uses.

The previously cited MPI document summarising barriers to land use change has this to say:

> "Broadly, Territorial Authorities have a relatively permissive attitude to land use (in the sense that land use is permitted relative to various standards; it does not infer a 'do as you like' approach), apart from rural subdivision. This is often tightly controlled, in an endeavour to maintain land parcels as 'economic units' and/or prevent the loss of high quality soils. Often, though, subdivision is a prerequisite for land use change, particularly for horticultural development, and there are strong economic drivers for this. Similarly, subdivision of rural land for urban development is driven by extremely high economic (and often political) factors."[21]

Some district councils allow farmers to subdivide and sell lifestyle blocks for them to free up capital to invest in environmental improvements (such as restoring native bush, wetlands or riparian areas).[22] In practice there are often many technicalities that make this process complex. One drawback of this approach is that subdivision often happens on the best quality land because it is the flattest. The concern is that fragmentation of farmland into lifestyle blocks can leave the remaining pockets of land unviable for farming, leading to more lifestyle blocks. In some areas the development right can be sold and transferred.

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[19] Milne and Luttrell, 2020.
[20] Milne and Luttrell, 2020.
[21] Journeaux et al., 2017, p.6.
[22] See, for example, KDC (no date).

It is worth noting that lifestyle blocks are used as a conservation tool by Trust for Nature in Australia.[23] They have a revolving fund that allows them to purchase properties, alter land use to ensure it is more sustainable, apply covenants where appropriate and resell the property. Often close to urban areas, they will convert the land to lifestyle blocks and sell them with the assurance that the new owners will act as caretakers of these important environmental areas.

Water rights tied to land parcels

Access to the right to use freshwater is essential to finding profitable land use options with a lower impact on the environment. Unfortunately, the rights to use water are usually tied to land parcels and difficult to trade.

Recent national policy statements deal with the thorny concept of freshwater allocation. Te Mana o te Wai imposes a hierarchy of obligations where the first priority emphasises the health and wellbeing of water bodies and freshwater ecosystems (e.g. ensuring minimum flows), followed by human health needs (such as drinking water), and finally water for social, cultural and commercial needs.[24] The discussion in this section only applies to the allocation of freshwater for commercial purposes.

Unfortunately, these principles of water allocation have only recently applied. As a result, there are three major environmental problems stemming from historical water allocation that took place in the absence of national direction:

- Firstly, consents to use freshwater (either from ground or surface water) have been dealt with on a first-come, first-served basis. This means that the water has not necessarily been allocated to the highest value use.
- Secondly, the consent to use water is linked to the land title. As a result, the right to use water is linked to land ownership and is therefore capitalised in the land value,[25] although a recent court decision restricts the ability to use consented water for different purposes.[26] While the Resource Management Act 1991 allows for a transfer of water rights between two landowners in a catchment, the process is painstaking and rarely used.
- Finally, some catchments have been overallocated. This means that when there is a dry spell the flow of water can fall below the level needed to sustain the environment. Clearly, this is not aligned with the goals of the national policy statement as set out above. However, it makes any attempt to transition from the status quo challenging. In these catchments the first two challenges are compounded.

It is unclear how these challenges around water allocation will be resolved. Following the repeal of the Natural and Built Environment Act 2023 and the Spatial Planning Act 2023, the Resource Management Act reform signalled by the new Government will need to comprehensively address the environmental challenges of water allocation. This is a major issue for reform, further complicated by commitments to 'rebalance' Te Mana o te Wai by replacing the National Policy Statement for Freshwater Management and the National Environmental Standards for Freshwater.[27]

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[23] Trust for Nature, 2017. It is worth noting once again that this would be more complex for some Māori land.

[24] MfE and MPI, 2020a.

[25] Garner, 2020; Grimes and Aitken, 2008.

[26] *Cloud Ocean Water Limited v Aotearoa Water Action Incorporated* [2023] NZSC 153.

[27] New Zealand National Party and ACT New Zealand, 2023; New Zealand National Party and New Zealand First, 2023.

Similar issues occur where councils have allocated rights to pollute freshwater. As noted in chapter three, this is very difficult to do accurately. To reduce nitrogen leaching, Environment Canterbury has allocated the right to leach nitrogen based on (modelled) historical levels.[28,29] These rights have been allocated to properties and are not tradable, thereby further impeding progress and allocating a valuable right to pollute to users who may not be the most efficient resource users.

There is never an ideal way to allocate the right to use or pollute water. Given that it can have a large impact on land values, it is first and foremost an issue of fairness. This is a matter of subjective judgement that lies in the realm of politics. The most important objective factor to consider is ensuring that the process of allocation does not create any perverse incentives (for example, inadvertently encouraging pollution by rewarding those who pollute more in a given period, i.e. grandparenting) or encourage hoarding.

From an economic perspective, the more important factor is to make sure that however rights are allocated, they are in some way tradable. The theory is much the same as for other forms of rights to access or use resources: that by making them tradable they are able to find their highest value use. This becomes even more important in a situation where we are trying to minimise the economic impact of applying environmental constraints.

Setting out a rational way to manage freshwater is relatively straightforward. The question is how to undertake a reform that can provide certainty to existing and future water users so they have the confidence to invest and at the same time resolve Māori rights and interests over freshwater. The Land and Water Forum's third report was optimistic that the issue could be resolved to mutual advantage:[30]

> "For a system which articulates general rights and interests to be stable and durable, however, iwi rights and interests also need to be resolved. We can see significant win-wins in this process, including the development of under-utilised land and resources, and the ability of iwi to partner with others [in] the growing of the water economy – including through the development of infrastructure."

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[28] MfE, 2023a.

[29] The region-wide nitrogen allocation framework essentially grandparents historical nitrogen losses, adjusted to reflect Good Management Practices. In catchments where limit-setting processes have been completed, there are further requirements to reduce nitrogen losses. These are usually expressed as a percentage reduction below historical (i.e. grandparented) rates. (Environment Canterbury, pers. comm., March 2024).

[30] LAWF, 2012, p.8.

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5 A way forward

The way we use the land has changed over time and will continue to do so. The environmental impacts of land use are just one driver of change, albeit a prominent one in recent years. Looking forward, difficult trade-offs will need to be made in some parts of the country between environmental, cultural, economic and social objectives. The key message of this report is that central and local government need to be upfront and transparent about these trade-offs and work with communities and mana whenua to agree and manage those trade-offs. Some tough conversations lie ahead, and the process will not be easy. But the quicker we press on with the job, the better.

Contaminants to water, biogenic greenhouse gases, and biodiversity loss (probably in that order) are the biggest pressures land-based industries currently place on the environment. They also pose risks to continued market access and consumer acceptance as international awareness of the true cost of food production grows. Even if we want to avoid addressing the environmental pressures that current uses place on the land, an increasingly disrupted climate will leave some landowners stranded.

The modelling we undertook for the Wairoa and Mataura case studies suggested that current policies could encourage the expansion of two dominant monocultures: dairying and pine production forestry.[1] It showed how economically precarious some current land uses are, suggesting that the status quo is neither environmentally nor economically viable beyond the short term.

My conclusions are based on the twin premises that governments do recognise (1) the importance of improving the environmental footprint of our land-based industries and (2) that climatic disruption poses significant risks to those industries. If either of those premises is not shared by those in power, then all bets are off, although some overseas consumers may have other ideas. But assuming them to be reasonable – and within the remit of governments to influence – what might we do, starting from where we are?

1 See the accompanying report (PCE, 2024) for details.

Taking an integrated approach

This report argues for taking an **integrated approach** to policies that impact land use. The idea of *integrating* policies is as old as the hills and risks being a piece of tired policy boilerplate.[2] So, what it means in this context needs to be expressed crisply and simply. This report does not hand down a masterplan to achieve better water quality, lower climate impacts and better habitat protection. What I have to say is more about the *process* by which people on the land and those who whakapapa to it can go about implementing changes for the better. It is also about how central and regional governments should both support them and provide a backstop if and when they fail.

Implementing an integrated approach will require growing the capacity of all involved. The environmental impacts of land use need to be treated as an adaptive problem, not a series of technical ones with discrete solutions. This means that the social, economic and cultural dimensions are as important as the environmental one and that multiple actions implemented iteratively will be required.

Dealing successfully with these environmental pressures is only likely to be achieved over a generation or longer. The long-term nature of the challenge has tended to favour aspirational outcomes – something New Zealand is rather good at: net zero emissions by 2050, 90% of rivers swimmable by 2040, a country free of pest predators by 2050. Where we are less successful is in constructing means of implementation that are practical, affordable, fair and capable of consistent monitoring so that we can know whether we are making progress – or not.

In many places, mitigations to existing land use will be sufficient to make progress. For some catchments, improved management as well as land use change targeted at specific hotspots (parcels of land) may be enough to move the environmental dial. Research has shown that implementing up to three mitigations for freshwater contaminants, such as phosphorus, could be achieved at a cost of less than 10% of farm profitability.[3]

But in a few places, wholesale land use change will be needed. We urgently need to develop a shared understanding of those catchments or sub-catchments that are environmentally constrained, and the likely scale of change needed. The communities in question need to buy in to this process.

Based on our case studies and research from Our Land and Water,[4] the majority of land use change should be possible without harming profits or exports. However, successful changes will still likely require public investment in research, monitoring, advice and potentially grants and loans for proof-of-concept projects and the infrastructure required to kickstart land use change (including, for example, processing or water storage).[5] A more diverse landscape could not only improve our environment but also improve the resilience of our communities and economy.

In some cases, land use change will not be economically viable for landowners to undertake. In these cases, landowners should ideally be paid for the ecosystem services that their land use provides (just as they should pay the true cost of the environmental impacts of their existing uses). There has been some talk of payments for biodiversity, but the scale of demand for these is not yet clear. Other unfunded ecosystem services will also become more important, including water regulation and erosion control in flood-prone catchments.

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[2] For other discussions on integrated approaches, see, for example, Hall (2018).

[3] McDowell, 2014.

[4] McDowell et al., 2024.

[5] Noting the earlier caveats about water storage often leading to intensification and worse environmental outcomes overall.

This brings us to this central point, which is often avoided: **someone has to pay**. And we need a coherent and equitable basis for deciding who that is. If no one will, the environment will continue to pay. 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? We have raised several options in this paper, but ultimately these are political questions.[6]

Socialising the costs of land use change is always the easiest route politically, but it can be eye-wateringly expensive. If it required $80 million of public money to reduce the flow of nutrients into Lake Taupō, the sum required to purchase changes in land use intensity across the country on a similar basis would be huge. That is why the first port of call must *always* be finding profitable alternative uses. But it will not always be possible: from our case study work, the cost of restoring one pocket of the Hikurangi repo (wetland) in Northland could be as much as $120 million depending on how you went about it. But just to buy back the land would require nearly $20 million.

Taupō'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. Before anyone starts planning to spend large sums of public money, the Government should satisfy itself that barriers, some of its own creation, are not standing in the way of a smoother and more affordable transition.

Refocusing climate policy

First among these is to **resolve the tensions that open-ended access to forestry carbon offsets has created for land use**. I do not consider that dedicating land to carbon storage in perpetuity is a sensible course. Because carbon dioxide's residence time in the atmosphere is so long lived, forest offsets have to be maintained forever – a multi-generation guarantee we have no way of making because of the risks of fire, storm damage, disease and human negligence. My reasoning is spelt out at length in *Farms, forests and fossil fuels* and my submission on the recent NZ ETS review.[7]

But removing forestry from the NZ ETS would pose its own problems for land use. In the first place, Māori can rightly claim that it would be yet another kick in the teeth to remove the highest value use of the marginal land they have been left with. Other landowners have invested in good faith. Some form of compensation or transition would be reasonable.

Secondly, marginal land that does not get covered in forestry – productive or otherwise – will likely continue to be farmed, with ongoing costs in the form of erosion, water contamination and habitat loss. Few people are prepared to say so openly, but there are plenty of environmentalists who would count conversion to forestry as the lesser of two evils if it meant improved water quality and lower agricultural emissions. For some of the steepest, most easily erodible catchments this is hard to argue with. So, how else could this land use change be facilitated? There are two avenues, both related once again to climate policy.

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6 For further discussion of this topic, please see Hall and Lindsay (2021), Hall (2022) and Kedward et al. (2023).

7 PCE, 2019a, 2023c.

In the first place, **afforestation could be used to mitigate some of the warming effects of agricultural methane emissions**. This could be fully commercial pine production forestry. The detailed reasoning in support of this proposition is set out at length in previous Parliamentary Commissioner for the Environment reports.[8] Here, I will simply remind readers that, unlike carbon dioxide mitigation, a one-off forest planting is all that is needed to offset an ongoing flow of methane emissions. And that if, down the track, the decision is taken to exit livestock farming (and therefore reduce emissions), the trees can in due course be removed. The land's option value is not permanently locked up.

Rather than impose a levy on methane, a methane price could be more effectively imposed if the Government were to **create a separate NZ ETS to manage biogenic methane**. Unlike carbon dioxide, methane does not need to be eliminated – it needs to be dialled back. How much is a political decision to be taken in the context of our national contribution to climate mitigation, but whatever cap is imposed, access to it should be in the hands of the most efficient and productive emitters. Methane offsetting could in this way contribute to land use change – how much would depend on the national cap and the extent to which offsetting was permitted.

Another way to incentivise land use change and habitat protection would be to **commit some of the proceeds from fossil NZ ETS auctions to plant erosion-prone land in native forest**. If offsetting were phased out for fossil emissions, the carbon price would rise and with it the auction revenue raised by the Government. How these proceeds are spent is a political matter. But a case can be made that the rehabilitation and re-creation of habitat would be a worthy destination for some of these funds. After all, the deforestation of Aotearoa is the biggest single contribution humans on these islands have made to increasing the stock of carbon in the atmosphere.

The Government could direct funding to the catchments that are most threatened, and to Māori whose land use choices are most constrained. This would also help shore up highly erodible land as climate change increases the risk of extreme weather events. Having current-day emitters pay to restore some forest seems intuitively reasonable. Planting native trees is a much slower and more expensive way of sequestering carbon, but it is much better for ecological functioning if done well. I'll have more to say on natives and alternative species in a forthcoming report.

Rebalancing decision making

With climate policy refocused – and to some extent the incentives for habitat restoration improved – we are left with the other pressures; most importantly, those degrading water quality.

The difficulty of attributing environmental outcomes from land use at the property level has led to the proposal for all substantive farms to create farm freshwater plans. Depending on implementation, farm plans could be a promising way to encourage the take up of best practice. In particular, farm plans need to be based on good information. However, they are unlikely to encourage land use change. Where plans are ignored, councils can seek to enforce compliance. This is costly, and also means the focus of attention tends to be on the laggards rather than the leaders. The regulatory 'stick' approach alone will not achieve our environmental goals.

[8] *Farms, forests and fossil fuels: The next great landscape transformation?* (PCE, 2019a); *How much forestry would be needed to offset warming from agricultural methane?* (PCE 2022b).

So there need to be some carrots to speed the process along. Economic incentives can be powerful, but property-level market-based mechanisms are limited to outcomes that are objectively measurable and require a revenue source to fund them. Catchments (or sub-catchments) are the level where the environmental impacts of land use are best understood, so it would make sense to offer incentives to those willing to work collectively at this level (especially in the most constrained catchments). This is only possible if we have institutions operating at the catchment level.

Social incentives such as peer pressure can be as powerful as financial ones, particularly if they grow out of grass-roots-based relationships and initiatives that are rooted in the community. Catchment groups are starting to play this role in many parts of New Zealand. The Mataura case study revealed a large network in Southland that has been supported regionally. Catchment groups provide a vehicle for developing a shared understanding of the catchment context, and for willing farmers to learn from each other. The question is how catchment groups can be incentivised to play a larger and more proactive role. This in turn raises the role of regional councils. An example of how this is already working in communities (with some local nuances) is further explained in Box 5.1.

Box 5.1: Iwi leadership in catchment management

Rongomaiwahine Iwi Trust has taken on the responsibility to create catchment groups for the catchments in Māhia, Hawke's Bay, and developed a taiao plan for the whole peninsula. Terence Maru, mana whenua and CEO of the Trust, explains in the quote below that for these plans to be effective you have to mobilise and inspire the whole community, Māori and non-Māori alike:

> "To do this we have to build real relationships and find common aspirations. We won't be popular with all farmers but if we can discuss what really matters on their farms, we will try and assist them and at the same time, also achieve good environmental outcomes."[9]

The Trust plays a significant role in being the conduit between the community and councils, government departments, research institutes and funders. They have put in considerable effort to become a central repository for all environmental data available for Māhia. This information can be used to find solutions to some of their environmental issues, like erosion on steep land and alternative land-use options. Being a conduit works both ways, and this information is only used to inform landowners, not to enforce regulation. Most farms in Māhia are intergenerational, meaning farmers have an intimate knowledge of their land. Experimentation is common and many of the farmers will already know what might work for them on their land.

As Rongomaiwahine whakapapa to Māhia, they are committed to improving the environment and overall health and wellbeing of the community for today and for many generations to come. Taking the leadership in building relationships with external agencies that can provide support to the community is a natural fit.

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[9] Terence Maru, CEO of Rongomaiwahine Iwi Trust, pers. comm., February 2024.

Regional councils need to be the conduit between what happens on the ground, and how the centre understands overall progress. Unlike greenhouse gas emissions, water quality, climate adaptation and biodiversity protection are complex, catchment or sub-catchment specific problems. Since every catchment is different, implementation has to be joined up at a catchment level, and that cannot easily be done from the centre. Regional councils, with mana whenua, are best placed to coordinate the work needed, including identifying when implementation is not working and acting as a regulatory backstop.

With a bird's eye view of their catchments, regional councils should work with catchment groups to set the direction of travel in accordance with central government guidance (the *what*). Catchment groups are best placed to determine the on-the-ground actions needed to implement that direction of travel (the *how*). The regional councils' focus should be on supporting catchment groups to understand the problems and how best to solve them. Catchment groups should include mana whenua and any key elements of the local community who can help make things happen.

Farm plans could be made to dovetail with the work of catchment groups, provided the scope of plans is broadened from freshwater to encompass the Government's aspirations across climate change and biodiversity. Catchment groups should be able to focus farmers' attention on the key issues in that catchment, upskill them on ideal mitigation strategies and help them access funding for implementation. As a result, membership of a catchment group should make completing a farm plan easier for farmers. There may even be scope for reducing compliance costs for farmers through collective certification and auditing of farm plans at a catchment level.

Where catchment groups are established, **regional councils need to work with catchment groups and consider, where appropriate, devolving powers (and funding) to those groups**. A key element of any decision to hand some powers to catchment groups is how those groups would be held accountable. What decisions can be left to the catchment group? What regulatory powers stay with the regional council? And what happens if the catchment group fails to deliver?

Taking a relational approach could be useful in this context. A relational approach builds on strong relationships between the parties involved and would recognise the mutual reliance of regional councils and catchment groups in achieving environmental goals. Under this approach the degree of decision making that is devolved depends on the strength of the relationship and the capacity of the catchment group to deliver. A relational approach is a way of dealing with internal and external uncertainty and a way of making the most of shared goals and a desire to collaborate closely. Relational approaches share much in common with Ostrom's design principles (see Box 3.2), and inspired by that, I can see three elements that could make a rebalancing of decision making work in New Zealand:

(1) **Shared goal and outcome setting**. Agreeing to the *what* (i.e. the desired environmental goals and outcomes) must be made clear from the outset. Central government needs to provide a framework for catchment groups and regional councils to collaborate and to ensure local self-interest does not take over. This framework may include information and process requirements and standards for environmental limits, and outcomes to be achieved. Within this framework, landowners, communities and mana whenua must ensure that the outcomes are realistic and achievable for their circumstances and specific contexts.

(2) **Action and implementation**. The *how* is led and driven by landowners, local communities and mana whenua. Local people hold important relationships, knowledge and skills and have skin in the game. If they can be persuaded to buy into a problem, they will often be able to solve it with more agility, innovation and durability than when solutions are handed down from above. Regional councils and central government can provide support in the form of information, research, and access to experts, tools and resources (ideally with central government providing financial, scientific and technical support). It is useful if actions and implementations are based on a set of shared principles or values, which can reduce the scope for conflict among stakeholders.

(3) **Monitoring, compliance and sanctions**. These three interrelated tasks pertain primarily to central government and regional councils to ensure that the shared goals and outcomes are being worked towards as agreed. Regulatory attention should primarily be focused on those that are unwilling to take part in collaborative catchment processes. Any problems with the collaborative process itself need to be flagged early, and it is therefore crucial to have processes in place for communication, negotiation and resolution of conflicts. Ideally, issues will be sorted out within the catchment groups themselves with regional and central government intervention as a last resort.

Central government has additional vital roles to play.

Everyone – regulators and regulated alike – need cheap, easy access to high-quality environmental information. This is a public good that isn't easily provided by individuals acting alone. Catchment groups (and individual farmers) need to be able to model the impact of different actions and be easily able to identify areas where land use change will yield higher than average benefits. The quid pro quo is that in return, landowners and catchment groups need to be prepared to share the details of their practices and resource use.[10] Monitoring and auditing has to generate information that can tell us, collectively, if we are making a difference at the level of the catchment, rather than just become an inventory of farm-level box ticking.

Central government should make all this information accessible and underwrite it as a public good. Farmers and regional councils should be able to access the same information free of charge. Rolling out farm plans nationwide is an ambitious undertaking that will founder if they rely on expensive access to inadequate data. We seem to be dazzled by physical infrastructures and their multi-billion-dollar price tags. Information is a piece of weightless infrastructure that is orders of magnitude cheaper and likely to yield both economic and environmental benefits that cannot be captured by individual parties.

[10] Provided it is anonymised and they have some control over who accesses it and how it is used.

Removing barriers to land use change, especially water

Central government needs to finance and remove the barriers to land use change. One key barrier to land use change is access to water. Where water is scarce, rights to use it should be transferable. Scarcity creates value, and that value is currently capitalised in the value of land to which use rights attach. This confers first-in-time privileges and locks in existing uses.

The development of tradable water rights should be investigated. That would simultaneously require a resolution of Māori interests in water. That is not something the country should fear. A wise agreement between Māori and the Crown could provide both parties with the means to invest in improving water quality (with flow-on benefits ranging from spiritual values to opportunities for mahinga kai) by paying for ecosystem services. Resource rentals are a sound means of ensuring that scarce resources are used wisely. If that proved impossible, something along the lines of the land use intensity tax described in chapter four could be considered. But one way or another, water needs to be used more efficiently and the financial resources to effect changes in the way we use land need to be mobilised. It will not happen for free.

Planning restrictions that unnecessarily hinder land use change should also be investigated.

Prioritising and experimenting

Effort and money need to be focused on the catchments or sub-catchments where the pressures are greatest and where the biggest changes are required. This is unlikely to be achieved by decree. From both a national and a regional perspective, we need to make progress where we are most at risk rather than advance incrementally everywhere at the pace of the slowest traveller.

The Government should take an experimental approach. Committing to provide high-quality, freely available land and water information to all land users should be universal. But without discarding the progress that has been made through successive iterations of the National Policy Statement for Freshwater Management, the focus beyond that should be on a small number of particularly difficult catchments. These have been identified (see chapter two) and are unlikely to be brought in line through incremental regulatory tweaks. An investment in information, catchments groups and some of the allocation mechanisms discussed above should be trialled. They will almost certainly not work perfectly – there has to be learning by doing. But taking that approach ensures that we are focused squarely on implementation rather than aspiration.

A final word

Whatever the resourcing required to effect change, it can only be attempted by working very closely with land users, who are already contributing and will have to contribute more. This is where effective catchment groups that can take real decisions become important. Their detailed local knowledge can make the best use of fine-grained land information to channel investments to the parts of the landscape that will make the most difference.

No government will have ready answers to the many questions posed here. That is not to be expected. But equally, no government should avoid asking the hard questions. If the answers prove too hard to implement, then so be it. But at least we would have been honest about why environmental decline continues.

I am optimistic that know-how on the ground, research into new techniques and new land uses, and a massive improvement in our ability to manipulate land-based information could improve environmental performance. I am less optimistic about the capacity of our institutions to deliver the sort of socially and economically informed understandings we need to address our problems. But I am very happy to be proved wrong.

Polystichum wawranum

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C.12

Exploring land use change under different policy settings in two case study catchments

May 2024

Parliamentary Commissioner for the Environment
Te Kaitiaki Taiao a Te Whare Pāremata

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Parliamentary Commissioner for the Environment
Te Kaitiaki Taiao a Te Whare Pāremata

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Simon Upton

Parliamentary Commissioner for the Environment
Te Kaitiaki Taiao a Te Whare Pāremata

Contents

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1

Botrychium biforme

Introduction

Almost half of the land area of Aotearoa is currently being used for agriculture and production forestry.[1] These land uses provide employment in rural areas and account for a significant share of export revenue. But our current ways of using and managing land are interfering with the natural carbon, nitrogen and phosphorus cycles, and damaging the ecosystems that underpin our health, wellbeing, incomes and cultural identities. Tackling these environmental issues while improving the quality of life for communities and tangata whenua in rural areas is one of the biggest challenges facing the agriculture and forestry sectors.

Over the past few decades, many different policies and initiatives have been announced to deal with climate change, freshwater quality and indigenous biodiversity. The result is a mass of overlapping laws, policy instruments and funding programmes. These policies all influence land uses and land management practices. But they are not necessarily pulling in the same direction.

There has been limited consideration to date of the interactions between these policies, or the combined effect they are likely to have at a catchment or sub-catchment scale. There is a risk that opportunities to address multiple environmental objectives could be missed, or that policies aiming to achieve one environmental objective could have unintended negative consequences for another. Furthermore, article 2 of Te Tiriti o Waitangi gives Māori the right to exercise rangatiratanga over their lands and taonga, so a joined-up approach to addressing these challenges has to encompass engagement with mana whenua.

[1] MfE and Stats NZ, 2021, p.18.

To take just one example, current freshwater regulations have a farm-level focus. But while the responsibilities for losses of contaminants typically stop at property boundaries, the environmental effects of those contaminants do not. This mismatch means cumulative environmental effects are rarely factored into decisions related to land use and land management.

Further, while some property boundaries are aligned with physical features of the landscape such as waterways or ridge lines, many are not. As a result, in the absence of voluntary cooperation between landowners sharing the same catchment or enforced regulations that make collective action mandatory, there is often a limit on the impact that any individual can have on improving freshwater quality or biodiversity in their area.

Regulating on the basis of property boundaries therefore enshrines a status quo that makes no environmental sense in some places. To look beyond property boundaries is to start to see the world differently.

Freshwater regulations would ideally account for variation in landscape characteristics such as topography, spatial connectivity, climate, hydrology, geology and the physical and chemical properties of soils and the subsurface environment. Alongside land use and land management practices, these physical and chemical characteristics operating at different scales can be key drivers of spatial variability in freshwater quality outcomes in some places.

The currently fragmented approach to managing different elements of the environment can be complex and confusing for the landowners, land managers, communities and tangata whenua who live in it. Neither does it fit well with how Māori see their relationship with te taiao and how mātauranga Māori is used to illustrate this. Different ways of perceiving and understanding landscapes influence what needs to be managed, for what reason, and how to go about doing so.

In response to what I perceived to be an increasingly myopic focus on carbon sequestration in the context of climate change mitigation, in my report *Farms, forests and fossil fuels: The next great landscape transformation?* I called for a 'landscape approach' that would "integrate all that we know about environmental processes at the landscape scale with bottom-up, grass-roots knowledge".[2]

Meanwhile, in *Overseer and regulatory oversight: Models, uncertainty and cleaning up our waterways*, I highlighted the importance of advancing our understanding of the drivers of freshwater quality by "extracting extra value from existing information and data – for example, by joining up datasets across domains, rethinking existing conceptualisations and designing new ones".[3] This follow-up work aimed to explore both ideas in greater detail.

I did not begin this investigation with a fixed view of what a landscape approach is, or what a more effective approach to environmental policy might look like. I had an inkling that the current way of doing environmental policy – fragmented by domain, with a focus on farm-level regulations and emissions pricing – will not achieve the goals New Zealand has set itself for freshwater quality, biodiversity and greenhouse gas emissions. I suspected that an approach focused on integration between domains and catchment-level processes, bringing people and the landscape together, and learning from different knowledge systems might fare better. So I decided to conduct an exercise to further develop and test this idea.

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[2] PCE, 2019, p.156.

[3] PCE, 2018, p.113.

During the course of the investigation, I was often asked for a more specific definition of what I meant by the terms 'landscape' and 'landscape approach'. I deliberately did not attempt to provide one. This was in part because different solutions will be needed at different scales in different places, and there are various ways of considering landscapes, so no single definition exists that will work everywhere. It was also because there is already an established body of academic literature around 'integrated landscape approaches' that I did not wish to wade into.

When I use the term landscape, it is the everyday idea of a landscape that I am talking about – the whenua, the wai, everything under your feet and as far as you can see – leaving nothing out and avoiding a compartmentalised and schematic view of something that is a living entity (existentially) and in our minds (culturally). Avoiding one definition also allows for other definitions to be considered. All people in Aotearoa will have a different opinion on what a landscape is. For Māori, if that landscape is connected to physical and metaphysical elements and whakapapa, then what is important to manage will be directly linked to that definition.

The aim of this work was to explore different perspectives on:

- the likely consequences for landscapes and the environment of pursuing a disconnected mix of environmental policies
- the likely outcomes relative to the status quo of implementing alternative policy mixes
- the perspectives of tangata whenua on the kaupapa of integrated landscape management and how those perspectives might be included as part of any future approach to managing land and water resources at a catchment scale.

A series of hui and workshops were held in the Mataura catchment in Murihiku Southland and the Wairoa catchment in Te Tai Tokerau Northland to capture different perspectives on the issues above. I also commissioned work on landscape susceptibility mapping, land use modelling, and mana whenua perspectives for both case study catchments to help inform the exercise.[4]

Work began on this project in 2019 after the release of *Farms, forests and fossil fuels*. It was completed in 2023, following delays caused by COVID-19. Inevitably, some of the policy settings on which the case studies were based have either been reviewed or delayed. Such is the challenge that faces anyone trying to do work at the catchment level in New Zealand's dynamic policy environment.

This exercise was exploratory and intended as a proof of concept. It raised more questions than it provided definitive answers. As a result, this document contains no recommendations. What it does contain is a summary of the findings I took from the two case studies. It is also being published alongside *Going with the grain: Changing land uses to fit a changing landscape*,[5] a report that synthesises some recurring themes that have emerged from all the work I have done on land use change and policies that change land uses.

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4 Based on how mana whenua wanted to be involved, these perspectives were either reflected in the modelling exercise as discussed further in the next chapter, or outlined in a standalone piece as summarised in chapter four.

5 See https://pce.parliament.nz/publications/going-with-the-grain-changing-land-uses-to-fit-a-changing-landscape.

2


Asplenium flabellifolium

How the exercise was undertaken

To better understand the trade-offs and consequences of different policy mixes for landscapes, an integrated exercise in two case study catchments was undertaken. The exercise attempted to integrate information on the biophysical features of the landscape with land use modelling, as well as input from tangata whenua, landowners, communities and other local experts. It explored how the two landscapes might change in response to different mixes of policies for addressing climate change, freshwater quality and biodiversity, considering specific local contexts.

The aim was to explore what an integrated exercise to explore these issues might look like. If considered useful, exercises of this type could be developed further by landowners, communities and tangata whenua to assist them in making decisions relating to land uses and land management practices. They could also potentially be used by regional councils as part of formal decision-making processes. Further, they could help central government agencies to understand what the local consequences of national-level policies are likely to be.

This exercise focused on the consequences for landscapes of different policies for reducing greenhouse gas emissions, improving freshwater quality, and restoring or enhancing indigenous biodiversity. There are of course many other environmental issues related to land and water management that need to be tackled, such as freshwater quantity, biosecurity, weeds, pests, chemical contaminants and climate change adaptation. While not the focus of this exercise, it is possible that the type of process explored here could lend itself to some of these other challenges, especially if a more holistic approach is taken to managing landscapes.

Two contrasting case study areas were explored – the Mataura catchment in Murihiku Southland and the Wairoa catchment in Te Tai Tokerau Northland (Figure 2.1). Although both case studies are situated within the wider national policy context, they are characterised by very specific regional circumstances that shape what the impact of different policies would be on the ground.

The questions explored with local people in each case study were:

- How is land currently being used and managed in the catchment? What are the main environmental issues?
- How would the landscape be expected to change in the future if climate change mitigation, freshwater quality and biodiversity policies are addressed separately? What would be the environmental outcomes?
- How could things be done differently? What changes to land uses and land management practices could be made, and what can science tell us about where the best places would be to prioritise these actions? What would be the environmental outcomes?
- What can mātauranga Māori and te ao Māori frameworks and tools tell us about the landscape, and what actions would be needed to restore the mauri of the whenua and the wai from a Māori perspective?
- What would the costs and other impacts of the transition be under different scenarios?

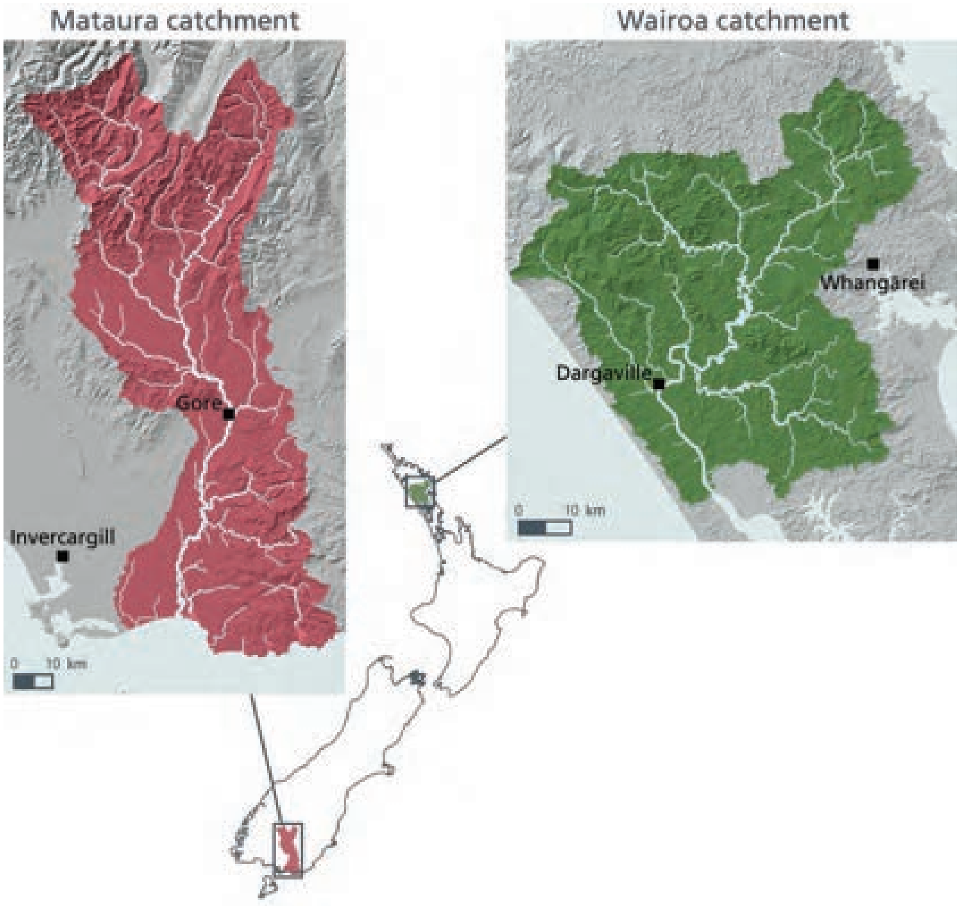


Figure 2.1: Location of the Mataura and Wairoa catchments. The boundary of Wairoa is the sea-draining catchment. For Mataura, the proposed freshwater management unit was used as the catchment boundary.

For each case study, a series of hui and workshops were organised to discuss the questions above. In addition, the following pieces of work were commissioned for each catchment.

- Landscape susceptibility mapping
- Land use modelling
- Tangata whenua perspectives

The project was designed to test whether integrating different perspectives and tools could yield useful information to inform decision making. It was not designed to lead to recommendations about what specific changes to land uses and land management practices should be made in each place. That said, the information gathered might well be useful for those living there if they decide to pursue a more bottom-up approach to managing environmental pressures in the future.

The landscape susceptibility mapping and land use modelling are discussed in more detail in the following sections. The work on tangata whenua perspectives is discussed in chapter four.

Landscape susceptibility mapping

Trying to make rules to govern the environmental impact of land use and land management runs up against the fact that landscape characteristics are often too complex to be accounted for in decisions that affect specific properties. The impacts of land uses do not stop at property boundaries. They are felt throughout the entire receiving landscape and will depend on many fine-grained factors that are very difficult to incorporate into regulatory decision making, including where within a landscape the activity occurs. Our understanding of the dynamics of contaminants moving through the landscape is limited, and we either lack or have limited data available to rely on.

It is against this backdrop of interconnected factors that Land & Water Science was commissioned to examine the landscape characteristics and landscape susceptibility to loss of seven freshwater contaminants plus nitrous oxide emissions from soil for both case study catchments.[1] The aim was to improve our understanding of the role landscape characteristics play in driving freshwater quality and soil nitrous oxide outcomes in these catchments, based on available data and expert knowledge.[2]

To do this, controlling factors within the landscape that best describe the spatial variability in water quality were identified and compared with direct measurements from the water quality monitoring networks in each catchment.[3] Controlling landscape characteristics included topography, climate, geology, hydrology, weathering and other physical and chemical processes, such as reduction and oxidation in soils, sediments, rocks and aquifers.

Once identified, these relationships were used to build maps of landscape susceptibility for each contaminant. These maps represent the relative susceptibility of the landscape within the catchment to contaminant loss, based on landscape characteristics. The aim was to develop susceptibility classifications that are independent of land use, though land use decisions do tend to be influenced by landscape characteristics, so fully untangling the effect of land use is challenging.[4] Susceptibility is represented on a 0-to-100-point scale – with 100 indicating the highest susceptibility and zero indicating no susceptibility.[5]

An example of what the landscape susceptibility maps look like is shown in Figure 2.2. The figure displays two different sources of environmental pressure: total suspended sediment, which dominates in Wairoa, and nitrate-nitrite nitrogen, which is a key pressure in Mataura. For nitrate-nitrite nitrogen in Mataura, areas of high susceptibility are associated with well-drained soils and areas with an abundance of oxygen (i.e. oxidising conditions). For total suspended sediment in Wairoa, areas of high susceptibility are associated with weak sedimentary mudstones (which are highly susceptible to weathering) and poorly drained soils on steeper slopes where slips are more likely and overland flow is more erosive.[6]

[1] Rissmann et al., 2022. The seven freshwater contaminants modelled were nitrate-nitrite nitrogen (combining nitrate [NO_3^-] and nitrite [NO_2^-]); organic and ammoniacal nitrogen (NH_3 and NH_4^+); dissolved reactive phosphorus; particulate phosphorus; turbidity; total suspended sediment (in Wairoa only); and *Escherichia coli (E. coli)*.

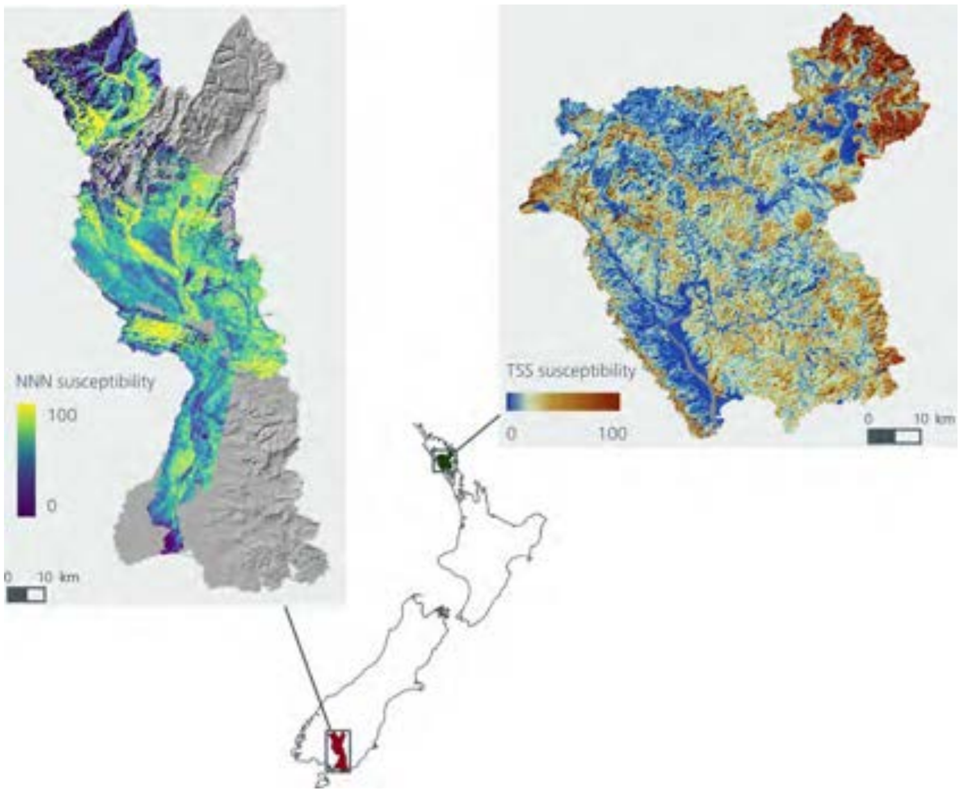
[2] Landscapes' contribution to freshwater quality in New Zealand is further described in Rissmann et al. (2024). They found that climate, geomorphology and lithology are key factors that determine landscape susceptibility to loss of contaminants, particularly phosphorus, *E. coli* and turbidity.

[3] For soil nitrous oxide, expert knowledge was used to identify controlling landscape factors in the absence of monitoring data.

[4] The modelling team did their best to remove the effects of land use by regressing long-term average water quality measurements against land use intensity and extracting the residuals.

[5] A detailed description of the approach and methods employed for the landscape susceptibility mapping can be found in Rissmann et al. (2022), available at https://pce.parliament.nz/publications/exploring-land-use-change-under-different-policy-settings-in-two-case-study-catchments.

[6] Rissmann et al., 2022, pp.22–25.



Source: Adapted from Rissmann et al. (2022)

Figure 2.2: Contaminant susceptibility maps for nitrate-nitrite nitrogen (NNN) in the Mataura catchment (left) and total suspended sediment (TSS) for the Wairoa catchment (right). Areas with higher values have a higher susceptibility to the loss of the selected contaminants relative to other locations within the catchment. For some areas in the north and southeast of the Mataura catchment (representing 54% of the total catchment area), landscape susceptibility could not be estimated because radiometric survey data were unavailable. Where possible, the Nature Braid model was used to fill in these gaps for the purposes of the land use modelling exercise.

As with any modelling exercise, there are strengths and limitations to the modelling of landscape susceptibility in Wairoa and Mataura. The main strengths of this approach are its cross-disciplinary, data-driven nature, its high spatial resolution, and its potential to integrate multiple landscape characteristics. The methodology can evolve as understanding of processes improves and new datasets become available. If these datasets are updated, or better representations of landscape characteristics become available, spatial landscape susceptibility layers can be reasonably easily updated.

However, like any modelling exercise, the results are highly dependent on the input assumptions. It is a nascent discipline that suffers from the gaps that currently exist in environmental data collection and reporting. This makes it difficult to calibrate or validate the modelled relationships, though Land & Water Science did test the model outputs against existing soil and geological classifications and found statistically significant relationships in both catchments. The method works best in parts of the country that have high-resolution datasets available, such as radiometric survey data. Older records and datasets with coarser spatial resolutions tend to have higher associated uncertainty. Furthermore, in many places there are only a limited number of water quality monitoring sites and associated biases in distribution of the sites.[7] Completely removing the effects of land use from these relatively small datasets is very challenging.

Landscape susceptibility mapping provides an example of the type of spatially explicit information that can be drawn on to make better informed decisions that work with the landscape, rather than against it.[8] In this respect it represents an evolution from the use of Land Use Capability information to identify areas for protection in the National Policy Statement for Highly Productive Land 2022,[9] or identification of areas of high erosion risk in the National Environmental Standards for Commercial Forestry.[10] These are, by comparison, comparatively coarse characterisations of landscape variability, though they are relatively cheap and readily accessible.

As part of the exercise to test a more landscape-based approach to environmental policy, landscape susceptibility maps of key contaminants were used to inform some of the land use decisions in the land use modelling. This modelling is described in more detail below.

Land use modelling

WSP were commissioned to undertake catchment-scale land use and environmental modelling.[11] The modelling was designed to show how land management practices and land uses could change in the two case studies under different policy scenarios, and to estimate the associated changes in environmental and economic outcomes between now and 2060. The aim of the modelling was to provide a sense of the extent to which whole-of-landscape approaches to environmental policy could result in different landscapes and different environmental and economic outcomes compared to the current approach.

To do this, the environmental and economic impacts of a range of policy scenarios were modelled by integrating land use maps, farm system information, physical and chemical characteristics of the catchments, and economic variables. The outputs include changes in land use areas in response to policies and regulations, changes in economic indicators such as profitability, and modelled impacts on a range of environmental indicators related to freshwater quality, erosion, greenhouse gas emissions and biodiversity. The modelling did not account for the effects of climate change itself.

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7 Rissmann et al., 2024.

8 The resolution of the landscape susceptibility maps that can be generated depends on the resolution of the underlying monitoring data and inputs.

9 Land Use Capability is a spatial classification of land based on its rock type, soil, slope angle, erosion type and severity, and vegetation cover information. For more on the methodology see Lynn et al. (2009). For an interactive map, see the Manaaki Whenua – Landcare Research website (https://ourenvironment.scinfo.org.nz/maps-and-tools/app/Land%20Capability/lri_luc_main).

10 The National Environmental Standards for Plantation Forestry were amended and renamed the National Environmental Standards for Commercial Forestry in November 2023.

11 The reports by WSP for Wairoa (WSP, 2023b) and Mataura (WSP, 2023a) are available at https://pce.parliament.nz/publications/exploring-land-use-change-under-different-policy-settings-in-two-case-study-catchments.

The outputs from this exercise are just modelled outcomes. Like any modelling exercise, simplifications had to be made to represent the complex environmental, economic and social systems that are at play within the catchments. The results provide an indication of the direction and magnitude of change that might be expected under different policy settings. They are not about what *will* or *should* happen. The results of the modelling should be read alongside the Māori perspectives work in chapter four.

The following sections describe the policy scenarios modelled and the models used by WSP to investigate the potential impacts of the policy scenarios in the Wairoa and Mataura catchments.

Policy scenarios

Six policy scenarios were developed to test and compare the outcomes of different approaches to environmental policy. The scenarios were informed by current and forthcoming climate, freshwater and biodiversity policies (as described in chapter one), as well as input from local people in both catchments, including mana whenua in Wairoa.[12] In Mataura, mana whenua chose not to participate in this process, preferring instead to provide an alternative analysis of how existing tools developed by Ngāi Tahu ki Murihiku can be used to help achieve outcomes from different environmental policies in an integrated way.

The general approach taken was to test the environmental and economic outcomes of different policy and regulatory settings that drive land use change, such as an agricultural emissions levy, the New Zealand Emissions Trading Scheme (NZ ETS) and freshwater regulations. The exercise did not evaluate the policies and regulations required to achieve a specific environmental or economic target. In other words, the environmental and economic outcomes achieved were outputs of the modelling, not inputs. This meant that existing national targets for reducing greenhouse gas emissions and improving freshwater quality were not necessarily met in the scenarios modelled.[13]

This approach was chosen for two main reasons. First, emissions reduction targets are set at a national level. No single catchment or farm is, for example, required to reach a 24–47% reduction in biogenic methane emissions as set down in the Climate Change Response Act 2002.

Second, the level of ambition for freshwater quality (i.e. the extent to which targets are more stringent than the national bottom lines in the National Policy Statement for Freshwater Management 2020) should be informed by those who live and connect to the catchment. At the time of writing, processes to determine the desired freshwater quality outcomes for the Wairoa and Mataura rivers were ongoing.[14] Naturally, national bottom lines will need to be met, but tougher limits need to be set to ensure the objective of Te Mana o te Wai is achieved and in doing so the mauri of the water is protected.[15] In the absence of freshwater quality targets to achieve Te Mana o te Wai set by communities and tangata whenua, any targets used in the modelling would have been arbitrary.

[12] Mana whenua in Wairoa also participated by providing information on their values and aspirations for the catchment that was supplementary to the input into the modelling.

[13] An example of a modelling exercise where climate and freshwater targets were met is McDowell et al. (2022). This national-level land use optimisation modelling exercise tested New Zealand's ability to grow a healthy diet and meet climate and freshwater objectives within two scenarios.

[14] For example, a range of draft freshwater objectives have been proposed for waterbodies in Southland. These have been developed to reflect qualities of hauora that support the health and wellbeing of waterbodies within Murihiku Southland (Bartlett et al., 2020). The final objectives and limits are expected to be in place by 2025.

[15] Te Mana o te Wai – the life-supporting capacity of freshwater – is the fundamental concept of the Essential Freshwater regulations.

What the outcomes of the modelling can tell us is how far different policies and policy approaches might take each catchment towards reducing greenhouse gas emissions, improving freshwater quality and enhancing indigenous biodiversity. If the tested policies yield an outcome that falls short of the community's expectations, that would potentially indicate the need for even more far-reaching land use change in the future.

Four main policy interventions were modelled in the scenarios.

- **A farm-level split-gas levy on agricultural emissions.** The decision to model a levy on agricultural emissions was based on the outcome from He Waka Eke Noa – Primary Sector Climate Action Partnership and the Government of the time anticipating an agricultural emissions levy of some form being implemented from 2025.[16,17] A low and a higher levy price pathway were modelled in each catchment to understand how agricultural emissions pricing may impact the profitability of different pastoral land uses.
- **Levy revenue spending.** In the low levy scenarios, the revenue was spent on national research and development for reducing agricultural emissions (the effect of this spending was not modelled). In the higher levy scenarios, some revenue was still allocated to research and development, but the rest was used to fund changes in land management practices and land uses in Mataura and Wairoa.
- **Freshwater quality regulations.** Targeted freshwater quality regulations were implemented in some scenarios to understand the potential benefit of spatially targeted (as opposed to uniform) interventions to reduce contaminant losses. The targeted regulations tested were (i) a variable cap on nitrogen fertiliser application rates, with more stringent caps in places that are highly susceptible to loss of nitrate-nitrite nitrogen; and (ii) mandatory conversion of pastoral farmland to agroforestry systems in areas at high risk of sediment loss.
- **Policies for supporting forestry.** The main forestry support policy modelled was the NZ ETS. In some scenarios, alternatives to pine production forestry were modelled,[18] such as agroforestry (spaced poplar in Wairoa and spaced red beech/tawhairaunui with a broadleaf/kāpuka nurse crop in Mataura), tōtara continuous cover forestry and unharvested native forestry. Scenario 5 assumed no new forests registered in the NZ ETS from 2030 onwards and subsidies for tōtara continuous cover forestry.

A summary of the six scenarios is presented in Table 2.1.[19]

[16] In this report, the term 'agricultural emissions' is used to refer to biogenic methane and nitrous oxide emissions from the agriculture sector.

[17] HWEN, 2022.

[18] In this report the term pine production forestry is used to refer to rotational clear-fell harvesting of single-age stands of monoculture pine plantations which have an average rotation age of approximately 28 years. Pine plantation forestry is used as a wider term referring to all types of pine plantation, which also includes the likes of permanent pine carbon forests and continuous cover forestry operations.

[19] These policy scenarios have different labels in the WSP reports for Wairoa (WSP, 2023b) and Mataura (WSP, 2023a). They correspond as follows: scenario 1 = 1A, scenario 2 = 1B, scenario 3 = 2A, scenario 4 = 2B, scenario 5 = 2C, and scenario 6 = Variation: Conversion of marginal pastoral land to native forest.

Table 2.1: Summary of the six policy scenarios. Differences in how the scenarios were applied in the two catchments are noted in the descriptions.

Scenario	Description
Scenario 1. **Low levy, no revenue recycling back to catchment**	**Levy:** Low farm-level levy on agricultural emissions that increases gradually over time. • Biogenic methane: \$0.11 per kilogramme of methane ($kgCH_4$) in 2025, rising to \$3.19 per $kgCH_4$ in 2060. • Nitrous oxide: \$4.25 per tonne of carbon dioxide equivalent (tCO_2e) in 2025, rising to \$127.48 per tCO_2e in 2060. **Use of levy revenue:** Levy revenue is spent on national-level research on reducing emissions from agriculture (the effect of this spending was not modelled). **Freshwater quality regulations:** All farms comply with the freshwater quality regulations (nitrogen fertiliser cap, winter grazing, stock exclusion) current at 2022. **Biodiversity regulations:** No loss of existing native forests or wetlands. **Forestry:** Pine production forests remain eligible for registration in the NZ ETS.
Scenario 2. **Higher levy, untargeted revenue recycling back to catchment**	**Levy:** Higher farm-level levy on agricultural emissions that rises more rapidly over time. • Mataura: Biogenic methane \$1.06 per $kgCH_4$ in 2025, rising to \$7.97 per $kgCH_4$ in 2060; nitrous oxide \$42.50 per tCO_2e in 2025, rising to \$318.70 per tCO_2e in 2060. • Wairoa: Biogenic methane \$0.49 per $kgCH_4$ in 2025, rising to \$5.10 per $kgCH_4$ in 2060; nitrous oxide \$19.55 per tCO_2e in 2025, rising to \$203.96 per tCO_2e in 2060.[20] **Use of levy revenue:** Revenue from the levy is recycled back into central government funding programmes and spent on national-level research (the effect of this spending was not modelled) and funding the costs of riparian planting along all waterways in each catchment. In Mataura, some levy revenue was also spent on untargeted subsidies to reduce stocking rates and to restore indigenous forests. **Freshwater quality regulations:** All farms comply with the freshwater quality regulations (nitrogen fertiliser cap, winter grazing, stock exclusion) current at 2022. **Biodiversity regulations:** No loss of existing native forests or wetlands. **Forestry:** Pine production forests remain eligible for registration in the NZ ETS.

[20] The levy price for Wairoa in scenario 2 was lower than the price used for Mataura. This was because if the same high price pathway had been used for Wairoa, it would have led to all pastoral farming becoming economically unviable by 2060, which would have defeated the purpose of the modelling.

Scenario 3. **Low levy, tailored freshwater regulations**	**Levy:** Low farm-level levy on agricultural emissions that increases gradually over time (same as scenario 1). **Use of levy revenue:** Levy revenue is spent on national-level research on reducing emissions from agriculture (the effect of this spending was not modelled). **Freshwater quality regulations:** All farms comply with the winter grazing and stock exclusion regulations current at 2022. In addition, the following tailored caps on fertiliser application rates are applied: • Both catchments: A more stringent cap on nitrogen fertiliser application rates of 85 kilograms of nitrogen per hectare per year (kgN/ha/yr) in 2030 and 65 kgN/ha/yr in 2060 applies in areas with high susceptibility to loss of nitrate-nitrite nitrogen. • Wairoa: Livestock farms in high-sediment-risk areas (based on landscape susceptibility mapping and Nature Braid modelling) must convert to agroforestry systems, which are eligible for registration in the NZ ETS. • Mataura: A limit on phosphorus fertiliser application rates applies in areas with high susceptibility to loss of phosphorus. **Biodiversity regulations:** No loss of existing native forests or wetlands. **Forestry:** Pine production forests remain eligible for registration in the NZ ETS.
Scenario 4. **Higher levy, targeted revenue recycling back to catchment**	**Levy:** Higher farm-level levy on agricultural emissions that rises rapidly over time (same as scenario 2). **Use of levy revenue:** Some revenue from the emissions levy is spent on national-level research (the effect of this spending was not modelled); the rest is recycled back to the catchment and used to support targeted actions aimed at achieving multiple environmental objectives. The actions are: • Wairoa: riparian planting, loans for converting dairy land to macadamia orchards, restoring one pocket of the Hikurangi Repo (Otonga pocket) back to wetlands • Mataura: riparian planting, subsidies for converting dairy land to sheep dairying, restoring and constructing wetlands. In addition, unprofitable hill country and lowland sheep and beef farms on moderate to high production capacity land convert to agroforestry systems, which are eligible for registration in the NZ ETS.[21] **Freshwater quality regulations:** All farms comply with the freshwater quality regulations (nitrogen fertiliser cap, winter grazing, stock exclusion) current at 2022. **Biodiversity regulations:** No loss of existing native forests or wetlands. **Forestry:** Pine production forests remain eligible for registration in the NZ ETS.

[21] In the supporting WSP report for Mataura, this scenario is referred to as 'Scenario 2B Variation: New agroforestry systems applied to three farm systems'. The assumptions and results for this scenario are in Appendix 12 of the WSP report (WSP, 2023a, pp.188–213).

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Scenario 5. **Higher levy, targeted revenue recycling back to catchment, forestry phased out of NZ ETS**	**Levy:** Higher farm-level levy on agricultural emissions that rises more rapidly over time (same as scenario 2). **Use of levy revenue:** Some of the revenue from the emissions levy is spent on national-level research (the effect of this spending was not modelled); the rest is recycled back to the catchment and used to support targeted actions aimed at achieving multiple environmental objectives. The actions are: • Wairoa: riparian planting, loans for converting dairy land to macadamia orchards, restoring all seven pockets of the Hikurangi Repo back to wetlands • Mataura: riparian planting, subsidies for converting dairy land to sheep dairying, restoring and constructing wetlands. **Freshwater quality regulations:** All farms comply with the freshwater quality regulations (nitrogen fertiliser cap, winter grazing, stock exclusion) current at 2022. **Biodiversity regulations:** No loss of existing native forests or wetlands. **Forestry:** No new forests are allowed to be registered in the NZ ETS after 2030. Subsidies are provided for planting alternative forestry types with significant biodiversity and/or erosion control benefits, such as tōtara continuous cover forests and gully planting with native species in Mataura.
Scenario 6. **Low levy, no revenue recycling back to catchment, trees integrated into farms (farm–forestry)**	**Levy:** Low farm-level levy on agricultural emissions that increases gradually over time (same as scenario 1). **Use of levy revenue:** Levy revenue is spent on national-level research on reducing emissions from agriculture (the effect of this spending was not modelled). **Freshwater quality regulations:** All farms comply with the freshwater quality regulations (nitrogen fertiliser cap, winter grazing, stock exclusion) current at 2022. **Biodiversity regulations:** No loss of existing native forests or wetlands. **Forestry:** All livestock farming on moderate, high, or very high production capacity land with low erosion risk remains in its current land use. Livestock farming on marginal land with low erosion risk is converted to pine production forestry. Livestock farming on high-sediment-risk land and/or negligible production capacity land is converted to permanent native forest. All new forests are eligible for registration in the NZ ETS.

Modelling approach

To illustrate changes through to 2060 under each policy scenario, three modelling tools were combined: FARMAX, Nature Braid and additional economic modelling. These modelling tools are described in Box 2.1. More detailed information on how these models work and the method used by the modelling team is available in the supporting WSP reports.[22]

The general approach to modelling the land use change and environmental impacts of the different policy scenarios is shown in Figure 2.3.

Box 2.1: Overview of models used in land use modelling

FARMAX

FARMAX is a farm system modelling and decision support tool. It was used to estimate production and profitability for a set of representative farm systems in each case study catchment. The inputs include physical farm parameters (e.g. farm size, regional location, livestock numbers, fertiliser application), economic data and farm performance information.

For Wairoa, the farm systems modelled in FARMAX were dairy, hill country sheep and beef, lowland beef finishing, and mixed cropping (kūmara cropping and lamb finishing). For Mataura, the systems modelled were dairy, dairy support, high country sheep and beef, hill country sheep and beef, lowland sheep and beef finishing and breeding, and mixed cropping (beef, sheep, barley, wheat and oilseed rape).

Nature Braid

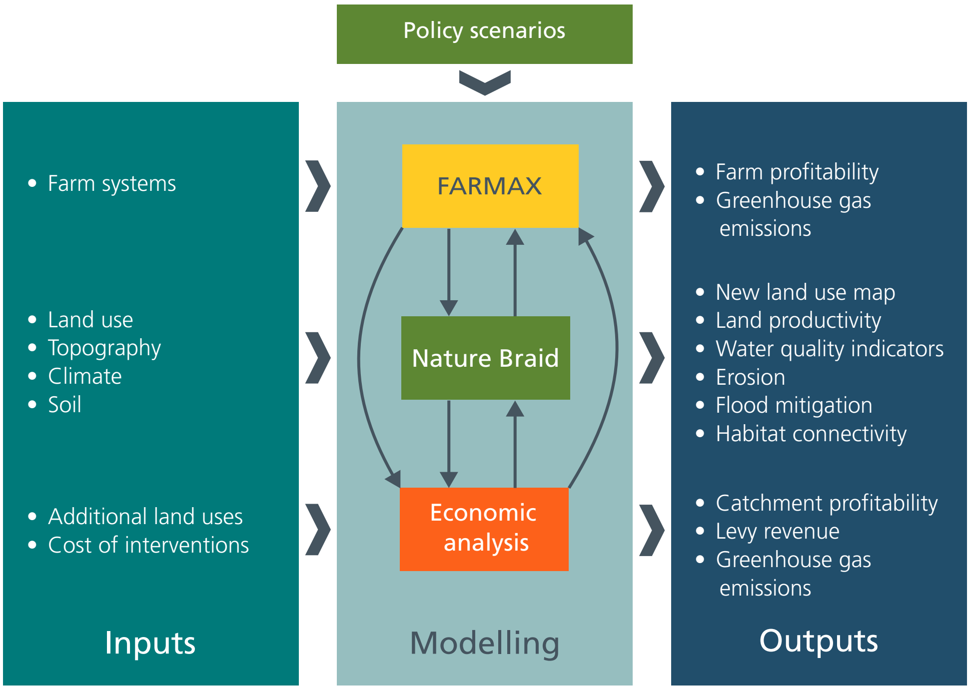
Nature Braid is a spatially explicit ecosystem services model that was used to estimate the impact of land use change on ecosystem services and environmental indicators.[23] The input data includes a digital elevation model, soil information, river and stream networks, and climate data (rainfall and evapotranspiration). Nature Braid runs at fine spatial scales (5–10 metres). The output indicators from Nature Braid were:

- agricultural productivity
- terrestrial loads and instream concentrations for total nitrogen and total phosphorus
- terrestrial soil loss and sediment delivery[24]
- habitat connectivity for kererū
- flood mitigation.

Additional economic analysis

Additional economic analysis was undertaken to determine how land use would be likely to change in each scenario, and to integrate the outputs from FARMAX and Nature Braid. It considered the likely responses of landowners and land managers to policies such as agricultural emissions pricing, the NZ ETS, and freshwater regulations. It estimated how much levy revenue would be collected and how it would be spent in each scenario. It also estimated the profitability of land uses not able to be modelled in FARMAX, such as forestry and horticulture.

[22] WSP, 2023a, b.
[23] Nature Braid was formerly known as the Land Utilisation Capability Indicator (LUCI) framework.
[24] These were calculated using the Revised Universal Soil Loss Equation, which uses information about rainfall erosivity, soil erodibility, topography, land use/cover, and management to estimate soil erosion by water (i.e. rainfall and runoff). It mainly accounts for terrestrial soil losses by water, but not explicitly for soil losses from landslides or mass wasting.



Source: Adapted from WSP (2023a)

Figure 2.3: Simplified workflow showing the inputs, modelling and outputs undertaken in the land use modelling.

The first step of the land use modelling process was to gather information on current land uses, types of farm systems, and the physical makeup of each catchment (which was used to determine the productive potential of the land). The modelling team worked with local industry experts to ensure the representative farm systems modelled in FARMAX reflected the unique characteristics of farms within each catchment.

Information on farm systems and the existing spatial distribution of land uses within each catchment were fed into the Nature Braid model, which assessed the impact of existing land uses on water quality, erosion, flood mitigation and biodiversity. Greenhouse gas emissions were estimated by combining emissions outputs from FARMAX for pastoral systems with additional analysis of emissions and removals from land uses modelled outside FARMAX. Collectively, the existing land use information, profitability and environmental indicators represented a modelled 'present' state for each of the case study catchments.

The modelling team then estimated how the catchments would be likely to change under each scenario for two future time steps (2030 and 2060), and calculated what the environmental and economic impacts of these changes would be. Major points in the analysis included assessment of the impact of an agricultural emissions levy on the profitability of pastoral farm systems, the likely response of farmers to increasing cost pressures and freshwater regulations, and the impact of the actions funded by the recycled levy revenue. The analysis assumed fixed commodity prices and no new technologies to reduce ruminant methane emissions.[25] The impact of climate change on the catchments was also not modelled.

In most cases, land use changes in the model were triggered by decreases in profitability due to the agricultural emissions levy. The modelling assumed that farmers would decide to change land use if the profitability of their farms turned negative. In general, farms with low but positive profitability did not automatically switch to a more profitable land use in the model.[26] This is because in the real world there is often inertia in land-related decision making due to a range of barriers such as debt, lack of information and limited access to expertise.

In some cases, changes in land uses and/or land management practices in the model were driven by freshwater regulations. Areas subject to more stringent regulations were identified using a combination of the Land & Water Science susceptibility maps and Nature Braid outputs. Farms within high-risk areas were remodelled in FARMAX to ensure compliance with the new rules.

For farms that were no longer profitable, the modelling assumed the land use would change to the most profitable alternative. In most scenarios, this was pine production forestry for hill country and high country sheep and beef farms, and some lowland sheep and beef farms. For dairying and some lowland sheep and beef farms, it was high-value alternative land uses such as tulips and sheep milking in Mataura, and macadamia orchards in Wairoa. These were simply used as examples of high-value alternative land uses for modelling purposes – in reality, there are no doubt other options that could be considered in each catchment.[27] Climate and soil limitations were considered, but other barriers to scaling up alternative land uses – such as supporting infrastructure needs and labour market constraints – were not modelled.

Further changes to farm systems and land use were also initiated in some scenarios through the recycling of the agricultural emissions levy revenue. Actions funded via the levy included riparian planting, loans or subsidies for land use changes that bring environmental benefits, and restoring or constructing wetlands.

In all cases, the revised farm systems (e.g. with new fertiliser application rates and stocking rates) and land uses were then fed back into the Nature Braid model to determine the environmental consequences of the policies in 2030 and 2060.

[25] If new technologies to reduce on-farm emissions become widely available, this would reduce the amount of land use change expected to occur in response to an agricultural emissions levy.

[26] Though in some cases, land use change was assumed to occur where a much higher profitable land use was available that complemented the existing farm system (e.g. tulips in Mataura, agroforestry in Wairoa).

[27] The Southland Food and Fibre Investment Acceleration Project led by Thriving Southland aims to identify key opportunities for growth in the food and fibre sector in Southland through community engagement (Thriving Southland, 2023b).

Involving local people in the exercise

Engagement with local people in each catchment was an important part of the exercise.

The choice of modelling tools used and the general framing of the policy scenarios were determined by the Parliamentary Commissioner for the Environment (PCE), WSP and the Nature Braid team at the start of the project. Additionally, local authorities, mana whenua (in Wairoa), landowners, industry groups and other local experts were involved in the process, providing advice on appropriate parameters for representing land uses in the modelling, identifying locally appropriate mitigation actions for scenarios 4 and 5, and interpreting the modelling results and key conclusions. This engagement took the form of a series of hui and workshops (in-person and online) at different stages of the project.[28]

In Mataura, the events were attended by farmers, catchment groups, the regional council and representatives of the wider agriculture and forestry sectors. The purpose of the initial engagement and first workshop was to introduce the investigation, understand perspectives and concerns with current and forthcoming environmental policies, and identify key environmental concerns, barriers to change, and land use opportunities in the catchment. In the second workshop, interim modelling results were shared, and participants were asked to identify issues and opportunities.

Mana whenua in the Mataura catchment shared their perspectives separately by outlining mana whenua led frameworks and tools. These pre-existing tools were developed to assist mana whenua in the management of various portfolios and help them in their decision making across environmental regulations and policies.

In Wairoa, the kōrero began with an online whanaungatanga event for tangata whenua. The purpose of the online whanaungatanga event was to introduce the investigation and the project team. Following this initial engagement, a series of in-person and online hui were held with tangata whenua and other local stakeholders to understand the local context, issues and potential mitigation options, and to share and discuss the modelling results.

Once the land use modelling and other aspects of the project were completed, the findings were shared in a final hui in each of the catchments. Participants were asked to share their perspectives on the findings, highlight the problems they see with current climate, freshwater and biodiversity policies and the consequences for their catchment if they continue, and provide their feedback on how things could be done differently.

[28] To ensure that the modelling inputs and parameters used to represent farms and other land uses were locally appropriate, WSP also engaged directly with experts from the agriculture and forestry sectors in the Wairoa and Mataura catchments.

Limitations of this exercise

An exercise of this nature will be inherently complex. Each aspect of it has so many variables. The landscape has multiple biophysical parameters, some of which vary at the sub-paddock scale. Most catchments have multiple land uses, and the spatial distribution of these land uses is determined by history, what the current land managers and kaitiaki want to do with that land, and the economic feasibility of different land use options.

Central government and local authorities have multiple and often overlapping policies in place to achieve certain outcomes and avoid other outcomes. Integrating them all gets very messy very quickly, especially as the regulatory landscape is often subject to change. It would be nearly impossible to factor all of these variables into a modelling exercise. Doing so was certainly well beyond the resources available for this exercise. Choices had to be made. Each choice introduced limitations.

To understand where the riskiest parts of the case study landscapes are and where the best places for interventions would be, physiographic modelling by Land & Water Science and outputs from the Nature Braid model were used. Other environmental models could have been used. Regardless of which models were used, the paucity of environmental data, especially at a granular level, would have introduced errors and limitations.

Likewise, a number of different economic models for modelling farm systems are available in New Zealand. FARMAX was used for this project. Others could have been chosen. Each one would deliver different results because they are designed differently, use different algorithms and have different underlying assumptions. Even with a single model, there are multiple different input assumptions that could be used, all of which will affect the results. Many other scenarios could have been modelled, but the number of times the models could be run was limited.

There are multiple environmental and economic policies that influence land uses and land management practices, and the resulting state of the environment. Some policies work together, some potentially undermine each other. Modelling the impact of interacting environmental policies is complex enough for the existing set of policies. It is much harder and more uncertain to test different mixes of future policies. This exercise focused on the impact of a potential levy on agricultural emissions (and the impact of recycling levy revenue back to the catchment), the NZ ETS and selected freshwater quality regulations. Other policy mixes could have been chosen.

More rigorous testing of the robustness of the assumptions and other choices used for this exercise would have been necessary if the point of this exercise had been to feed into the formal decision-making processes of government, businesses, land managers, communities and tangata whenua. But it was not. The point of this exercise was to test whether the concept of integrating spatial susceptibility mapping, land use and economic modelling with input from local people could deliver useful insights into the potential alternative futures arising from different mixes of policy. If the approach is determined to be useful, the tools would need to be developed further so they are fit to be used to inform decision making. It would be at that point that the appropriateness of the models and the robustness of their assumptions would need to be rigorously tested and debated.

Botrychium australe

Case study catchments today

Some of the most rapid and widespread changes in New Zealand's landscapes have been due to the expansion and intensification of pastoral farming. This was made possible by draining wetlands, straightening and channelling rivers, deforestation and clearing other vegetation. The legacy of these past actions shapes, in some cases literally, the catchments we see today.

The following sections outline the land uses and state of the environment in the Wairoa and Mataura catchments today.

Mataura River catchment

The Mataura River is the heart of the catchment. It is important culturally, socially and economically.

For mana whenua, the Mataura River is an important source of mahinga kai. The practice of mahinga kai is central to mana whenua identity, ways of knowing, social cohesion and overall wellbeing.[1] In particular, the harvest of kanakana (pouched lamprey, *Geotria australis*) during their migration is a very important activity that maintains mana whenua connection to the area and their responsibility as kaitiaki to harvest the resource in a sustainable way. This responsibility includes understanding land-based and other impacts that affect the ecosystem and migratory pathway of mahinga kai species.

Te Au Nui Pihapiha Kanakana (Mataura Falls) is a culturally significant site for mahinga kai of kanakana (Figure 3.1). The falls were heavily modified in the late nineteenth century to provide water for a freezing works, a paper mill and a hydropower station. Today there is still a meat processing plant on one side of the awa and a hydropower scheme on the other. In 2006, Te Au Nui Pihapiha Kanakana became part of a wider mātaitai reserve covering ten kilometres of the Mataura River, established by Hokonui Rūnanga.[2]

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[1] Kitson and Cain, 2023, p.13.

[2] Thriving Southland, 2021, p.40; Kitson and Cain, 2023, p.2. As part of the mātaitai reserve rules there is to be no take of lamprey, shortfin or longfin eel allowed except on the authority of Tangata Tiaki/Kaitiaki (Fisheries (Mataura River Mataitai Reserve Bylaws) Notice 2009 (No. F485)).

Source: Alexander Turnbull Library, Mataura River, original photographic prints and postcards from the file print collection, Box 16, ref: PAColl-7344-81, records/23077784

Figure 3.1a: Te Au Nui Pihapiha Kanakana (Mataura Falls) before it was heavily modified in the 1890s to provide water for a freezing works, a paper mill and a hydropower station.

Source: PCE

Figure 3.1b: The Mataura River downstream of Te Au Nui Pihapiha Kanakana in 2021. There is still a meat processing plant on one side of the awa and a hydropower scheme on the other.

The Mataura River catchment (Box 3.1) is dominated by sheep and beef farming, dairying and pockets of pine production forestry (Figure 3.2). While agricultural expansion into undeveloped areas has largely ceased since the mid-1980s, changes are still occurring. The main change is a shift from sheep and beef farming to more intensive dairying.[3] There are also some high-value crops grown within the catchment, including tulips, which are exported in various forms to international markets.

Current land use activities and increasing intensification of agriculture are key contributors to the degradation of water quality in the Mataura catchment.[4] Water quality is particularly degraded in the middle and lower reaches of the catchment where the most intensive farming occurs.[5] The levels of *E. coli* and dissolved inorganic nitrogen are particularly concerning. Water clarity also decreases markedly between the upper and lower reaches of the Mataura River.

Box 3.1: Mataura catchment physical setting

Flowing south from the Eyre Mountains, the Mataura River dissects the Garvie Mountains before flowing across the Waimea plains and being joined by the Waikaia River. The Mataura continues to flow south through Gore and the Hokonui Ranges before entering the sea at Toetoes (Fortrose) Estuary.

The Mataura River traverses a variety of geologies, shaped most recently by Quaternary glacial activity. There is a complex array of soil types within the catchment that vary in their physical, chemical and biological components.[6] Under the surface, much of the catchment has accessible groundwater aquifers. The connection between surface water and aquifers in some regions plays an important role in how and when nutrients flow through the catchment.

Relatively cool and wet overall, the climate varies along the length of the Mataura catchment, transitioning from subalpine conditions in the north to marine-dominated in the south. In the future, temperatures are expected to rise. Rainfall will generally increase in intensity but become less frequent as the number of dry days increases.[7]

Today, little indigenous cover remains over large parts of the Mataura catchment. Wetlands in particular have been degraded. Close to 90% have been drained for agriculture since European settlement. This has resulted in the loss of important habitat as well as other ecosystem services, such as the processing of nutrients and sediment.[8]

The Mataura River is also subject to a Water Conservation Order (promulgated in 1997) that stipulates that at any point, 95% of the natural flow in the Mataura River must remain. While the primary goal of the order is to protect the trout fishery, its terms inevitably protect other species to some degree.

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[3] Ledgard, 2013, p.1; Freeman et al., 2020, p.10.

[4] Thriving Southland, 2021, p.21.

[5] LAWA, 2023a. Point source discharges also contribute to degraded water quality, particularly in and around Gore, but improvements have been made in recent times (Thriving Southland, 2021, p.21).

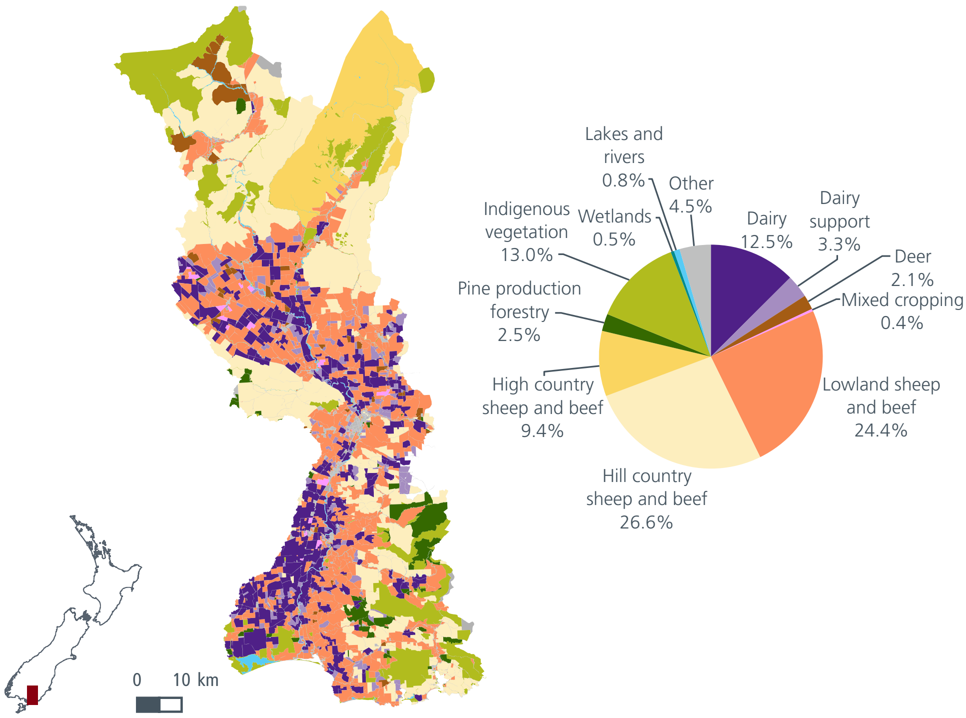
[6] Freeman et al., 2020.

[7] Zammit et al., 2018.

[8] Freeman et al., 2020; Clarkson et al., 2013.

Intensification of land use in the Mataura catchment has come with land management practices that have the potential to significantly degrade water quality. For example, if managed poorly or too widespread, intensive winter grazing can have detrimental effects on freshwater quality (as well as animal welfare).[9] It is, therefore, not only the *type* of land use that is important, but the associated management *practices* that will determine freshwater quality outcomes.

Actions are being taken to improve land management practices within the Mataura catchment. This includes the work of catchment groups and Thriving Southland to target interventions based on the physiographic approach and landscape susceptibility (Box 3.2).[10] The Whakamana te Waituna initiative has also delivered projects aimed at improving the health of Waituna Lagoon, which is located to the west of Toetoes Estuary.[11]



Source: Adapted from WSP (2023a)

Figure 3.2: Land use in the Mataura catchment.

[9] Environment Southland, 2020; MfE, 2022.

[10] For example, see the Thriving Southland Beyond Regulation Mataura Catchment Project (https://www.thrivingsouthland.co.nz/beyond-regulation-mataura-catchment-project/). Rissmann et al. (2023) provide an example of the use of susceptibility mapping to prioritise interventions to reduce contaminant losses from a dairy farm in the Mataura catchment.

[11] Whakamana te Waituna (https://www.waituna.org.nz/) is a partnership between Te Rūnanga o Awarua/Te Rūnanga o Ngāi Tahu, Department of Conservation, Environment Southland, Southland District Council and Fonterra (through the Fonterra–DOC Living Water partnership).

However, changes in land management practices can only achieve so much. For example, modelling undertaken as part of setting freshwater objectives in Murihiku Southland suggests that a 79% load reduction in total nitrogen and 58% load reduction in total phosphorus would be needed in the Mataura catchment to meet draft objectives.[12] Research suggests that even if the use of existing best management practices were universally undertaken, they would be insufficient to achieve desired outcomes.[13] De-intensifying existing land uses in some parts of the catchment and shifting to alternative land uses in others will be needed to achieve the desired environmental outcomes.[14]

Intensification has also led to significant pressure on the quantity of water remaining in the Mataura River. Despite the requirements to retain flows under the Mataura Water Conservation Order, a 2020 review found that the river has been overallocated north of Gore.[15]

Box 3.2: Southland's catchment groups and Thriving Southland

A large number of catchment groups have been established in Southland – 35 as of August 2023.[16] Many of these are voluntary, bottom-up groups that were formed by farmers in response to the freshwater regulations being introduced as part of the Essential Freshwater programme. The activities being undertaken vary from group to group. Examples include field days, talks by guest speakers, freshwater monitoring, education and outreach activities, and piloting alternative land management practices.[17]

Thriving Southland was set up in 2020 to support and connect Southland's catchment groups. The projects undertaken or supported by Thriving Southland include a study of Southland's food and fibre opportunities, a wetland development project, a winter crop establishment trial, and a project to develop and trial the use of physiographic modelling to better understand spatial variation in freshwater and soil nitrous oxide emissions. It also provides free resources, supports events, and has a team of catchment group coordinators to assist with setting up and supporting catchment groups in Southland.[18]

The loss of native ecosystems in the catchment generally reflects changes nationally, with upland and mountain ecosystems remaining the most intact while lowland and coastal ecosystems have suffered widespread clearance and modification. For example, podocarp forest formerly covered most of the lowland plains, but now only small fragments remain scattered across the catchment. Intensification over the past 30 years has led to the further loss of shrubland, red tussock and wetlands.[19] As a result, there has been a continued loss of connectivity between larger areas of indigenous vegetation and wetlands.[20]

[12] Snelder, 2021, pp.98–99.
[13] McDowell et al., 2021, p.399; Southland Regional Forum, 2022, p.21.
[14] Southland Regional Forum, 2022.
[15] Water Conservation (Mataura River) Order 1997; PDP, 2020.
[16] Thriving Southland, 2023c.
[17] Thriving Southland, 2023a.
[18] Thriving Southland, 2022.
[19] There was a 45% decline in the extent of wetlands on private land in Southland between 1990 and 2012, with the majority shifting to pasture (Robertson et al., 2019, p.6).
[20] Wildland Consultants, 2008, p.16.

Wairoa River catchment

From the top of the ranges to the entrance of the Kaipara Moana (Kaipara Harbour), mana whenua of the Wairoa catchment are deeply embedded in the landscape. As kaitiaki their responsibility is to ensure a prosperous environment for the future, where their connection to the area is unsevered and enduring. Historical settlement sites, mahinga kai sites and wāhi tapu are found all along the awa. Many hapū relied heavily on their taonga resource, tuna (eel), as sustenance.

The decline of the mauri of natural resources is a significant issue in the Wairoa catchment. Degraded water quality negatively affects kai moana harvesting sites and the ability for tangata whenua to mahinga kai and feed their whānau. The loss of indigenous biodiversity has also negatively impacted the ability of tangata whenua to carry out traditional cultural activities.[21]

The Wairoa catchment (Box 3.3) is dominated by pastoral farming (dairy, sheep and beef) with some exotic pine production forestry (Figure 3.3). High-value horticulture crops, such as avocado and kiwifruit, are increasingly grown in the catchment due to its favourable climate and soils. The lower reaches of the Wairoa River near Dargaville are also one of the main kūmara production areas in New Zealand. This arrangement of land uses is the product of significant land use change over a long period of time, resulting in environmental degradation throughout the catchment.

Box 3.3: Wairoa catchment physical setting

The Wairoa River (also known as the Northern Wairoa River) begins where the Mangakāhia and Wairua rivers meet, near Tangiterōria. It reaches the sea in what is now known as the northern branch of the Kaipara Moana.

The largest catchment in Te Tai Tokerau, it is characterised by a mild, humid and windy climate due to its northern location, low elevation and close proximity to the sea.[22] Rainfall varies substantially between years, with some years punctuated by erratic, heavy events. Ex-tropical cyclones occasionally bring heavy rain and strong winds to the region, but droughts are common. Northland is predicted to become significantly drier and hotter by the end of the century. Projections for the coming century show a decrease in the frequency of very heavy rainfall in Northland, though extreme rainfall from tropical cyclones was likely to be underestimated in these results.[23]

The geology of the Wairoa River catchment is a mixture of volcanics, alluvium and sands, and sedimentary rocks (sandstones and mudstones). The latter are highly erodible, increasing the potential for sediment loss to rivers and streams. Much of the original land cover has been lost, with remnants of indigenous vegetation scattered throughout the catchment, on both public and private land.

The catchment is home to a diverse range of aquatic species. Many, such as tuna (longfin eels, *Anguilla dieffenbachii*), are a valued source of kai for tangata whenua. It is also one of the main tributaries of the Kaipara Moana, an important nursery for juvenile fish such as snapper (*Chrysophrys auratus*).[24]

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[21] Northland Regional Council, 2017; Royal, 2022.

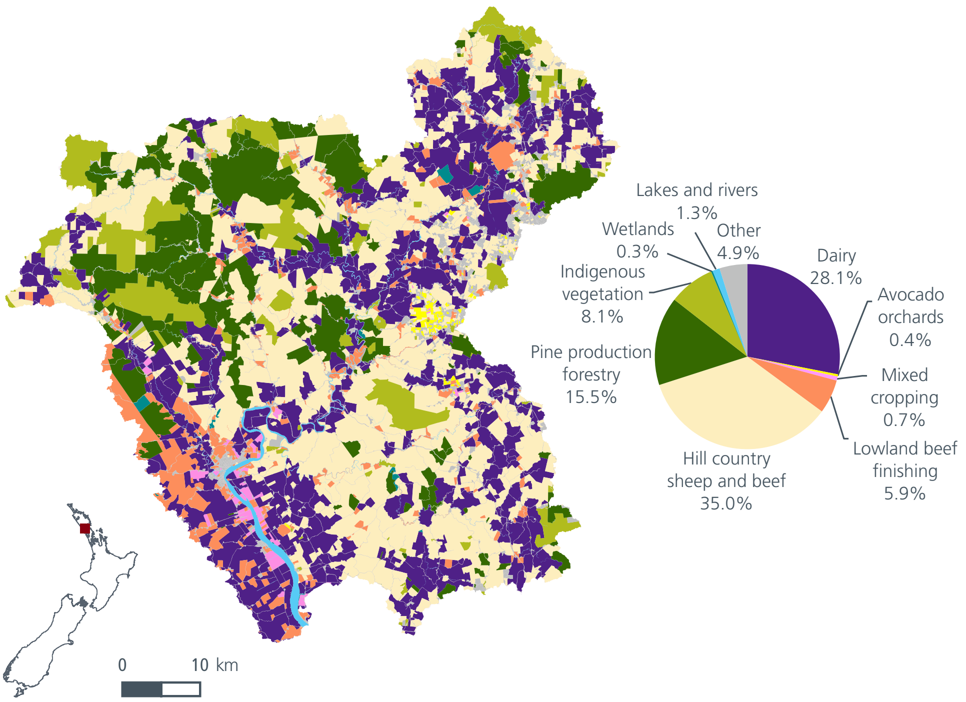
[22] Chappell, 2013.

[23] Pearce et al., 2016, p.74.

[24] For example, the majority of snapper found on the west coast of the North Island come from the Kaipara Moana (Morrison et al., 2009, p.68).

Sediment is the main freshwater quality concern in the Wairoa River, although there are elevated nutrient levels across many indicators in most of the catchment.[25] The causes of high sediment loss can be attributed to the highly erodible geology in some parts of the Wairoa catchment exacerbated by pastoral farming and forestry.[26]

Sediment lost from the Wairoa catchment is ultimately deposited in the Kaipara Moana, degrading its mauri and the harbour's ecological health and wellbeing.[27] To combat sedimentation in the harbour, the Kaipara Moana Remediation Programme (Box 3.4) has been established to coordinate and implement changes in land management to reduce sediment loss in the wider catchment.



Source: Adapted from WSP (2023b)

Figure 3.3: Land use in the Wairoa catchment today.

[25] NRC, 2019, pp.40–41; LAWA, 2023b.
[26] Green and Daigneault, 2018, p.10; Rissmann et al., 2022, p.109.
[27] Swales et al., 2011, p.12; KMR, 2020.

Box 3.4: Kaipara Moana Remediation Programme

Kaipara Moana is the largest estuarine body in Aotearoa. Containing a range of rare and significant ecosystems, it is of profound importance for hapū, with great spiritual, cultural and economic value. It is facing severe environmental degradation primarily due to sedimentation, with an estimated 700,000 tonnes deposited into the harbour each year. This is about six times the amount before human settlement.[28]

In October 2020, the Crown signed a memorandum of understanding with project partners (Kaipara Uri,[29] Northland Regional Council and Auckland Council) to launch the Kaipara Moana Remediation Programme. The agreement built on years of work by hapū who were concerned that Kaipara Moana was in poor health and, if left unchecked, would be at risk of degrading beyond repair.[30]

The Government is contributing $100 million towards the total project cost of $200 million for the first six years (of an anticipated ten-year programme). Co-funding is being provided by councils, landowners, industry and others.

The remediation programme's key focus areas include the restoration of wetlands, fencing and riparian planting around waterways, and stabilising highly erodible land.[31] Given that the Wairoa River catchment makes up over half of the entire Kaipara Moana catchment, it features prominently in the scheme.

Land clearance has meant that native ecosystems have been lost or restricted to a fraction of their original extent in the Wairoa catchment. Prior to the arrival of humans, the catchment was a mixture of broadleaf-podocarp-kauri forests, alluvial forests and wetlands.[32] Currently, less than 10% of the catchment is covered in indigenous vegetation. Taonga species, such as tuna whakaheke (migrating eel), have been adversely impacted by drainage and land use changes. Draining and development of the Hikurangi Repo (Hikurangi Swamp) provides a particularly marked example of this. Once a large wetland consisting of marsh, swamp, fen and bog, it has been mostly drained for agriculture since in the early twentieth century (Box 3.5).[33] In addition to land clearance, introduced species and predators are putting native species, such as North Island brown kiwi (*Apteryx mantelli*), under pressure.

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[28] KMR, 2020, p.2; Green and Daigneault, 2018, p.16.
[29] Kaipara Uri include the following iwi/hapū: Ngā Maunga Whakahī o Kaipara, Te Rūnanga o Ngāti Whātua and Te Uri o Hau.
[30] KMR, 2020.
[31] KMR, 2022, p.6.
[32] Conning, 2001, pp.52, 65, 67.
[33] Conning, 2001, p.52; Clarkson et al., 2015.

Box 3.5: The Hikurangi Repo and Hikurangi Flood Management Scheme

The Hikurangi Repo lies at the heart of the Wairua sub-catchment, in the upper reaches of the Wairoa River catchment. The repo (swamp) is of cultural significance to many local hapū. It is an important source of mahinga kai, a source of healing and a place for burial and baptismal practices.

Originally covering most of the floodplain, the repo has been progressively drained since 1919 to develop the area for agriculture. Only the Otakairangi and Wairua River wetlands remain relatively intact. Other smaller fragments are scattered across the Hikurangi floodplain, mostly on private or conservation land.[34]

Ongoing flooding issues throughout the mid-twentieth century led to development of the so-called 'Hikurangi Swamp Major Scheme'. The purpose of the scheme was to limit the frequency and extent of flooding on drained farmland.[35] Stopbanks and floodways were constructed, dissecting the scheme's 5,670 hectares into seven pockets. Each pocket has large pumps to limit the extent and duration of flooding of the surrounding farmland (which is primarily used for dairying). Whangarei District Council is currently the owner and consent holder for what is now known as the Hikurangi Flood Management Scheme.[36]

Freshwater quality, biodiversity and climate change issues converge in the Hikurangi Repo, with competing stakeholder interests. These issues include:

- **Protecting biodiversity:** The remaining fragments of undrained land are home to remnants of a rare type of fen wetland and remain threatened by the ongoing impacts of drainage, habitat loss and elevated nutrients from farms. The drains in and surrounding the Otakairangi remnant in particular contribute to a lowering of its water table, accelerating peat decomposition, and an ecological shift in favour of mānuka, accompanied by biodiversity loss. Drains are also conduits for weeds.[37]
- **Sediment and freshwater quality:** Sediment and other nutrients are no longer filtered through the Hikurangi Repo due to the channelisation of the river and loss of wetland extent. As a result, there has been increased degradation of the Wairoa River and ultimately the Kaipara Moana. Improving the Wairoa River and the Kaipara Moana (see Box 3.4) will require addressing the issue of the Hikurangi floodplain to some degree.[38]

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[34] Conning, 2001, p.52; Clarkson et al., 2015.

[35] WDC, 2012b, p.12.

[36] WDC, 2012b, p.15

[37] Clarkson et al., 2015, p.vi.

[38] Royal, 2021, p.3. Modelling also suggests that the majority of sediment delivered to the Kaipara Moana comes from the Wairua and Mangakāhia catchments in the upper Northern Wairoa, highlighting the importance of restoration initiatives in these areas (Daigneault et al., 2017, p.48).

- **Tuna whakaheke:** A significant concern for mana whenua is the scheme's impact on tuna whakaheke. Hikurangi Repo is an important habitat for tuna.[39] Tuna whakaheke begin their autumn journey from the repo into the Kaipara Moana and on to the Pacific Ocean after the first rains. The pump stations within the scheme represent significant barriers to fish passage and can kill tuna if the pumps are switched on during heavy rainfall.[40] While management actions are in place, these have failed in the past.[41]
- **Increasing flood frequency and magnitude:** The scheme was originally designed to prevent flooding from a one-in-five-year flooding event. With the intensity of rainfall expected to increase in the future, the scheme will come under further pressure and maintenance costs are likely to increase.[42]

[39] WDC, 2012a, p.9.

[40] For example, tuna were chopped up by the scheme's pump stations in 2021 after autumn rain. The pumps switched on automatically to reduce river levels and to stop surrounding farmland getting flooded. At the same time, the rain triggered the start of the tuna migration (Botting, 2021).

[41] For example, pumps are not to be turned on within the first eight hours of rain to allow the tuna whakaheke to successfully start their migration (WDC, 2022, p.3).

[42] WDC, 2012b, p.12; WDC, 2021, p.78.

Asplenium haurakiense

Tangata whenua frameworks, tools and knowledge

Any approach to landscape management has to include mana whenua, the people who have a spiritual and cultural connection to the land they have lived on for many generations. It was therefore important to understand the perspectives of tangata whenua in both case studies on the kaupapa of integrated landscape management and how Māori perspectives might be included as part of any future approach to managing land and water resources at a catchment scale.

We were guided by mana whenua groups from each case study catchment as to how they would like their mātauranga Māori represented within this investigation. They also provided advice on what a good process of inclusion would look like, based on their views of Treaty partnership and data and resource equity.

The two mana whenua groups chose to provide their input into this investigation and to express their tino rangatiratanga within this process in different ways, reflecting different local contexts. Although they took different approaches and expressed themselves in different ways, what was similar was that any input provided was underpinned by their values and concepts of landscapes and integrated management from a te ao Māori perspective.

For the Murihiku Southland case study, we worked with Hokonui Rūnanga, who developed a report reflecting the collective mātauranga of Ngāi Tahu ki Murihiku. The view of Ngāi Tahu ki Murihiku was that because the land use modelling did not include parameters pertaining to te ao Māori, their mātauranga could not be integrated into it. At the same time, they perceived a risk that having no representation of mana whenua values and pre-existing methods in the exercise could mislead the reader to assume that there were no mana whenua led tools or perspectives that could support this kaupapa, or that Ngāi Tahu ki Murihiku implicitly approved of the investigation's process and outputs. To avoid that outcome, they chose to develop a separate piece of work to sit alongside the land use modelling.[1] The report outlined:

- related mana whenua frameworks and tools that have been developed by iwi and mana whenua for the Mataura catchment (including a summary of the methodology and results of the tools for two sites within the catchment)
- commentary and questions on the framing of the PCE investigation
- discussion of the integrated landscape approaches being explored by the PCE and a mana whenua approach.

[1] Kitson and Cain, 2023.

In Te Tai Tokerau Northland, a facilitator was contracted to lead the engagement with mana whenua and coordinate input from hapū into the exercise, including ways that mātauranga might either be included within the modelling framework or aligned with it. Ngā mana whenua o Wairoa – Te Tai Tokerau provided some input directly into the land use modelling. They also shared generalised views about what was important to them in their rohe that must also feed into any catchment-scale decision-making process.

The different approaches, tools employed and outcomes for each mana whenua group are summarised below.

Ngā mana whenua o Mataura

Ngāi Tahu ki Murihiku represent the shared interest areas of Hokonui, Awarua, Ōraka-Aparima and Waihōpai Papatipu Rūnanga (Ngāi Tahu). The Mataura catchment is a part of their rohe. The input provided into this investigation was led and reviewed by Hokonui Rūnanga. It reflects the collective mātauranga of Ngāi Tahu ki Murihiku.

Understanding landscapes from a Ngāi Tahu ki Murihiku perspective is founded in their principles, epistemology and ontology, and is firmly placed in te ao Māori. Ngāi Tahu have centuries of customary associations, rights and interests in the Gore District (including the Mataura catchment) and its resources. These associations are historical and contemporary, and include whakapapa, place names, mahinga kai, tribal economic development, and landholdings."[2]

Whakapapa connects them to the landscape and carries responsibility for looking after the environment and their connection to it.

Te Tiriti o Waitangi and the Ngāi Tahu Claims Settlement Act 1998 (signed in 1997) created a "binding legal relationship between the Crown and Ngāi Tahu, however, this is much broader than simply a contract and includes aspects of beneficial/fiduciary relationship".[3] For Ngāi Tahu, this means applying their environmental philosophy in their takiwā (area) as a management right guaranteed to them through this relationship.[4]

Ki uta ki tai and integrated landscape approaches

Ngāi Tahu ki Murihiku define integrated landscape approaches through the concept of ki uta ki tai. This means all things are connected, and mana whenua belong to the environment and are only borrowing resources from future generations. A key component to this concept is the importance of mahinga kai and the role it plays in understanding the connections of resources, people and landscapes. Ki uta ki tai is used to:

> "analyse the interconnected effects across a region. For example, if an estuary is degraded, what is the extent of that state and where, if anywhere, along the contributing waterbodies does the state change from degraded to hauora."[5]

[2] Kitson and Cain, 2023, p.1.
[3] Kitson and Cain, 2023, p.11.
[4] Kitson and Cain, 2023, p.12.
[5] Kitson and Cain, 2023, p.11.

Ngāi Tahu ki Murihiku have developed frameworks and tools for integrated landscape approaches drawing on Te Tiriti o Waitangi and a localised understanding of the principles, deed of settlement arrangements and policy frameworks for iwi environmental management – for example, their iwi management plan and Te Mana o te Wai (under the National Policy Statement for Freshwater Management).

Te Tangi a Tauira, the Ngāi Tahu ki Murihiku Natural Resource and Environmental Iwi Management Plan 2008, assists them to effectively participate in environmental policy and planning as it allows for the articulation of their values and their expression of kaitiakitanga. It also aids in the council's statutory obligations to provide for their issues and policies in planning documents.

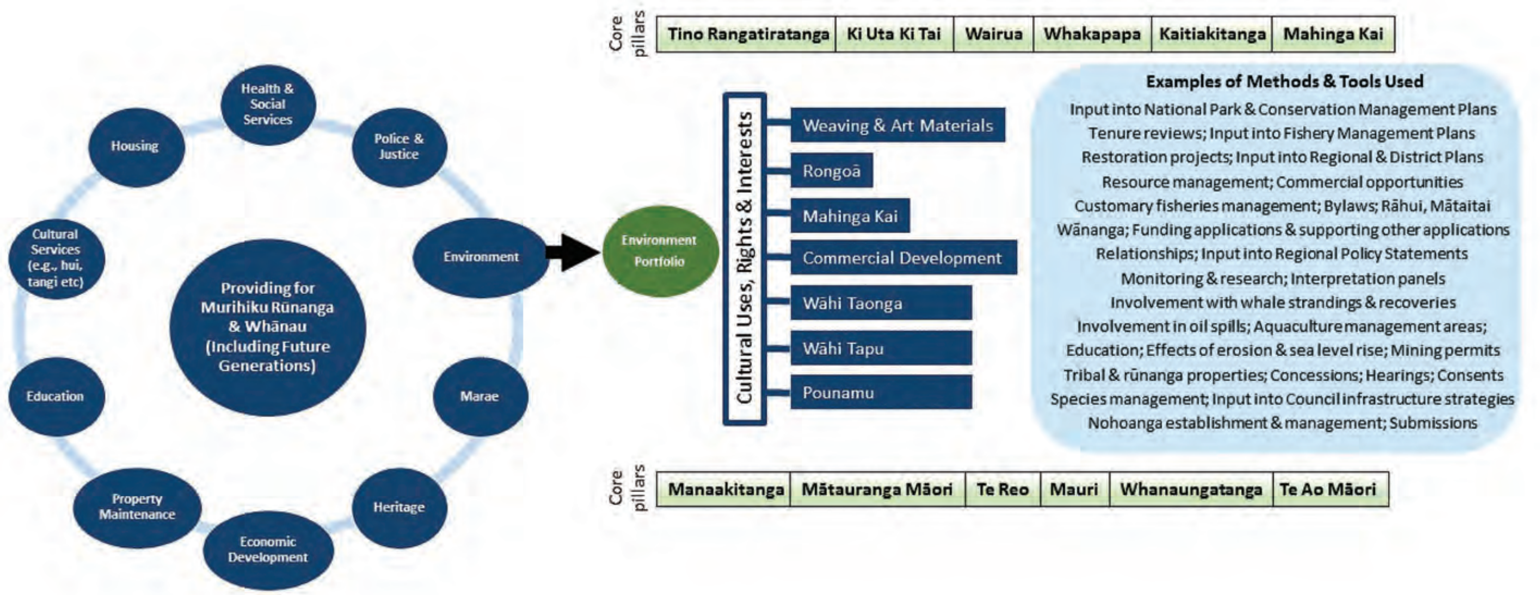
Te Kawa o te Taiao is a strategic document that Hokonui Rūnanga developed to bring together various strands and relevant information for a clear purpose and is often referred back to when conducting environmental kaupapa.

Te Mana o te Wai has been included in the proposed Southland Water and Land Plan as it centres on the health of the water and land itself rather than human use. Ki uta ki tai is then used to bind and integrate all of the elements together. Ngāi Tahu indicators work with the attributes in the National Policy Statement for Freshwater Management and Te Mana o te Wai to maintain and improve water quality and quantity in a culturally relevant manner across the Murihiku takiwā.[6]

The policies and approaches above direct how engagement between local authorities and mana whenua must be conducted and express the needs and expectations of mana whenua. For Ngāi Tahu ki Murihiku, this has shaped regional and district plans to date and should be applied in any attempt to conduct integrated landscape management in the Mataura catchment.

The integrated landscape management approach taken by Ngāi Tahu ki Murihiku encapsulates more than policies related to freshwater, climate change and biodiversity and goes beyond economic impacts. It includes social, health and wellbeing impacts. In their view, these cannot be excluded from an approach that looks at landscapes. Figure 4.1 illustrates the multiple policies, plans and government processes that Ngāi Tahu ki Murihiku need to consider when developing tools to manage the environment and inform policy development.

[6] Kitson and Cain, 2023, p.17.



Source: Kitson and Cain (2023, p.23)

Figure 4.1: The multiple portfolios operated by Murihiku Papatipu Rūnanga (left), and the core pillars guiding the implementation of the environment portfolio and some examples of the services facilitated by Papatipu Rūnanga on behalf of, and in collaboration with, Murihiku whānau (right).

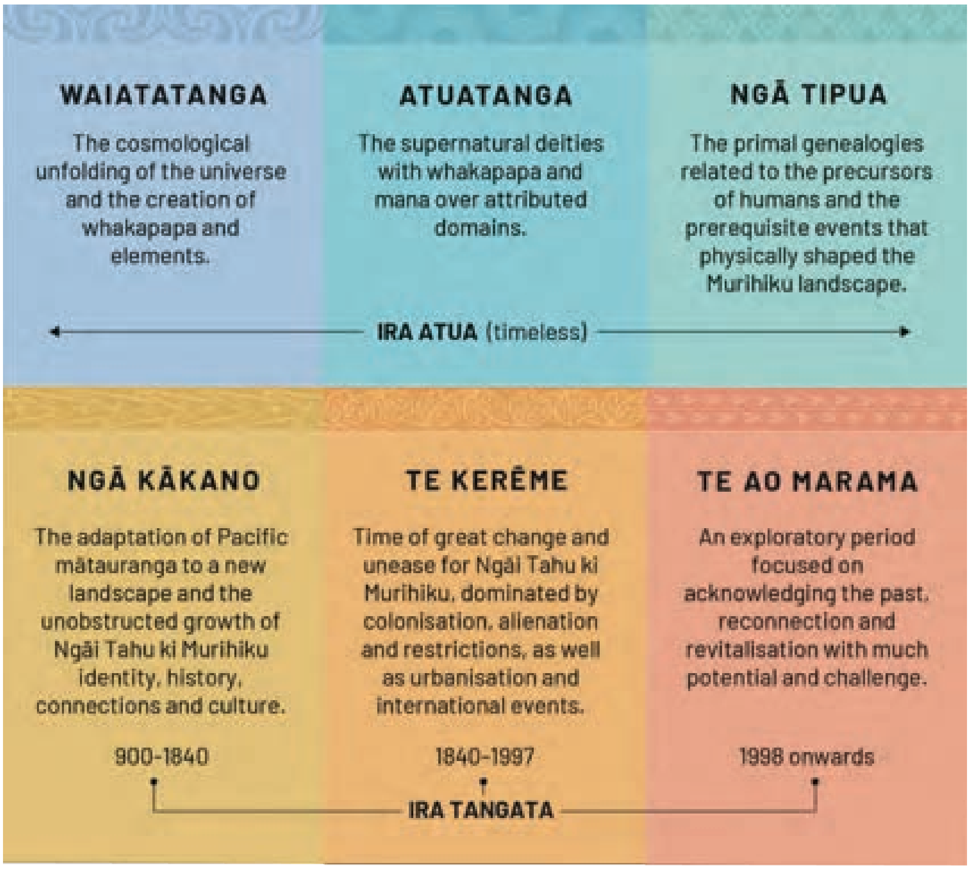
Ngāi Tahu ki Murihiku have developed two tools from these frameworks:

- Āpiti Hono Tātai Hono, which enables a comprehensive understanding of landscapes as known to Ngāi Tahu ki Murihiku and what is appropriate at place
- Murihiku Cultural Water Classification System, which assesses the state and thresholds around particular cultural uses (e.g. wai noho and wai tuna).

Both tools can incorporate different knowledge systems within their te ao Māori frameworks. Both provide information and data relevant to their environmental management needs within a ki uta ki tai integrated approach.

Āpiti Hono Tātai Hono

Āpiti Hono Tātai Hono is ordered by whakapapa and centred on ira atua and ira tangata. It is categorised into six layers representing the relationships between people and atua as pertaining to landscapes (Figure 4.2).



Source: Kitson and Cain (2023, p.19)

Figure 4.2: Summary of ira atua and ira tangata layers.

Ira atua recognises the metaphysical elements of culture and landscape that have always been there, and always will be.[7] The ontological understanding of the world as seen from a Ngāi Tahu ki Murihiku perspective is held in this category. This includes the creation of the universe and the atua who hold mana over certain environmental domains and events that physically shaped the landscape. Ira tangata includes the connections that people have with the landscape over time, including into the future.

In this framework, Ngāi Tahu ki Murihiku are able to recognise, assess and manage fundamental components of their culture and identity (ira atua) and safeguard their historical connections to the landscape, while also evolving their own mātauranga (ira tangata).

Assessing the landscape using these layers is iterative, evolving and collectively agreed. No single practitioner or source of information is emphasised. Layers are collectively interpreted, and whakapapa is used as a tool to resolve conflict. The tool can be used across all of the landscape or for parts of it (air, water, soil). It takes a holistic view by integrating the humanistic and environmental components of the landscape.

As part of their input into this investigation, two sites were assessed by Hokonui Rūnanga and the whānau within the Mataura catchment. The sites were Te Au Nui Pihapiha Kanakana (Mataura Falls) and Waikākahi (Waikaka Stream – Maitland). Through a desktop review, hui and site visits, Hokonui Rūnanga determined that in order for the mauri of the falls to improve and for whānau to reconnect to the area for mahinga kai and other cultural purposes, changes such as safer access to the site, improved migratory pathways, and improved water and air quality are needed.[8]

An aspiration for the Waikākahi site is to naturalise the site and its wider ecosystem by planting, weeding and improving water quality. This would allow for mana whenua to engage with the area in similar ways to their tīpuna while also improving the ecological health of the stream, including mahinga kai species.

Murihiku Cultural Water Classification System

Ngāi Tahu ki Murihiku developed the Murihiku Cultural Water Classification System as a response to multiple pieces of legislation with overlapping impacts, which in their view were impeding the protection of mahinga kai species and practices of Ngāi Tahu ki Murihiku. It is a system that allows them to express their uses, values, aspirations and expectations of freshwater, and to monitor for better management in an integrated way and at a landscape scale.

The classification system currently centres on the following cultural uses:[9]

- wai pounamu (waters for the movement, collection and working of pounamu)
- wai nohoanga (seasonal camping areas across the landscape)
- wai tuna (waters that sustain the intergenerational harvest of tuna).

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7 Kitson and Cain, 2023, p.19.

8 Other actions needed were also identified that would contribute to the improvement of mauri at that site (Kitson and Cain, 2023, p.50).

9 Kitson and Cain, 2023, p.21. Others are in development.

Each cultural use has a set of themes, attributes and indicators/measures that reflect the needs of the resource itself, the user and the supporting environment. The system uses various knowledge systems and sources of information (including mātauranga Māori, social science, science and cultural heritage) to determine the state of each attribute. For example, for the cultural use of Wai Tuna, some examples of attributes that would reflect sustainable harvest include the abundance of tuna, the quality of tuna for consumption and their ability to migrate.

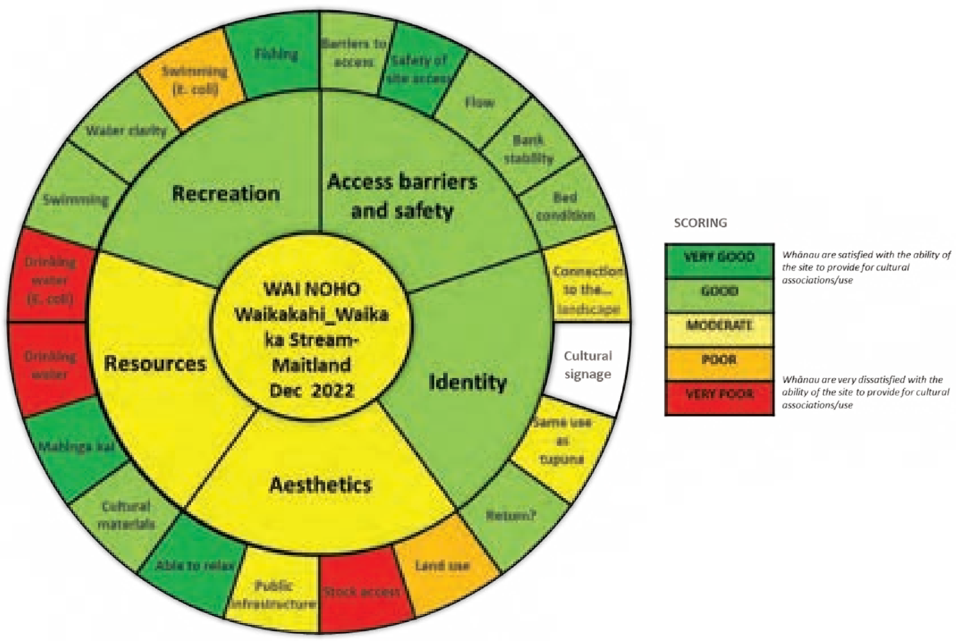
The same two sites in the Mataura catchment were assessed as for the Āpiti Hono Tātai Hono assessments. Data were captured by mana whenua using a cultural health assessment (cultural health index), science measures (Stream Health Monitoring and Assessment Kits) and monitoring assessments (fyke nets for tuna population assessments). Targets were also developed for analysis and interpretation of the data. A collective understanding of the individual assessments was reached by mana whenua after the site assessments.

He Puna Whakaata o Mātauranga visualisation tool was developed to illustrate the current state of cultural uses at each site. It shows the current state as a circle with the cultural use being considered at its centre. A segmented inner circle represents the themes of that cultural use, and an outer segmented circle represents the attributes. The colours represent the collective scores given during the assessment of the sites, ranging from very poor (red) to very good (green).

For the Murihiku Cultural Water Classification System assessment at the Waikākahi (Waikaka Stream – Maitland) site, wai noho and wai tuna were assessed. Only the wai noho assessment is summarised here. Examples of the targets for this site and assessment include:

- water is safe to swim in
- site can be used for mahinga kai
- stock are unable to access the site
- public infrastructure does not impact access for whānau to cultural sites.

The whānau scored each indicator individually on a five-step scale from very poor to very good. These scores were then combined to give a total score for each attribute. Five themes were identified with 21 attributes. Most themes scored good to moderate (inner circle). The overall state for this cultural use was scored as moderate (centre circle) (Figure 4.3).



Source: Kitson and Cain (2023, p.56)

Figure 4.3: Murihiku Cultural Water Classification System assessment for wai noho: He Puna Whakaata o Mātauranga at Waikākahi (Waikaka Stream – Maitland) site.

For the Te Au Nui Pihapiha Kanakana – Mataura Falls site, only wai noho was assessed. Five themes were identified, with various targets, attributes and indicators/measures determined for each theme. Examples of the targets that whānau identified at this site included:

- having safe access to the site
- to reconnect as mana whenua of the site
- to access the site for resource use.

Most attributes were moderate to very poor, with only 3 out of 21 being good or very good. All five themes were determined to be moderate to very poor.

Commentary on the PCE's investigation

Ngāi Tahu ki Murihiku were clear on their definition of a landscape approach, and thus the tools needed to inform catchment-scale decision making. Their position on this kaupapa was clearly articulated in their report and is summarised here.[10]

[10] Kitson and Cain, 2023, pp.26–27.

The way Māori view and therefore manage the environment is holistic. This view has been used to develop tools that join up the siloed nature of the environmental management system. Ngāi Tahu ki Murihiku landscape values include social, cultural and economic parameters that have been used to develop their targeted approach to integrated landscape management – ki uta ki tai. This understanding of the importance of landscapes is largely invisible within the current system, but is necessary.[11] A relevant question then is, why have Māori frameworks and tools not been used in targeted responses regionally and locally? What are the barriers to a ki uta ki tai landscape approach?

Ngāi Tahu ki Murihiku acknowledge that integrated landscape approaches are perhaps the only way we can tackle complex environmental issues. However, in their view, an approach like this needs to ensure and recognise different paradigms at the outset to accommodate a more diverse understanding of landscapes.

Ngāi Tahu ki Murihiku considered that the approach taken by the PCE was unable to incorporate regional expressions of mātauranga Māori and tikanga because they were not used in the framing of the questions for the problem definition and model selection. As a result, any findings from the project were divorced from the inherent meanings, social norms and epistemological traditions of each iwi/hapū. Ngāi Tahu ki Murihiku consider that the inclusion of a fragment of a culture or its mātauranga divorced from its paradigm is not a sustainable or ethical approach to integrated landscape approaches, nor is it useful or relevant to Māori.

The full commentary of Ngāi Tahu ki Murihiku on the PCE's investigation is available on the PCE website.[12]

Ngā mana whenua o Wairoa – Te Tai Tokerau

The Māori perspectives component of this exercise for the Wairoa catchment included a desktop review and co-facilitation of local hui and workshops to collate whānau narratives on landscapes and integrated landscape approaches. Due to the diversity of these narratives, the summary below is only a snapshot of mana whenua views. The initial intention was to determine whether these narratives could inform the land use modelling and to discuss how hapū whakaaro and narratives could inform integrated management at a catchment scale. The content of the rest of this section is based on commentary from mana whenua at the hui and workshops, as well as additional input from hapū representatives.

Traditional Māori philosophy has shaped the way mana whenua see the Wairoa catchment. Through whakapapa and principles derived from te ao Māori ways of understanding, important aspects of landscapes are understood. These include the physical parameters of the landscape and how mana whenua connect to them, historical impacts, kaitiakitanga and mana. When thinking about integrated landscape management, these all need to be considered.

The cultural landscape of the Wairoa catchment is rich and diverse. It contains 310 parcels of ancestral Māori land, more than 24 marae, and is part of the identity of 43 hapū and 6 iwi (Figure 4.4). The mountains and ranges of Huruiki, Ruapekapeka, Mangōnui and Tūtāmoe are part of the physical representation of their cultural connection.

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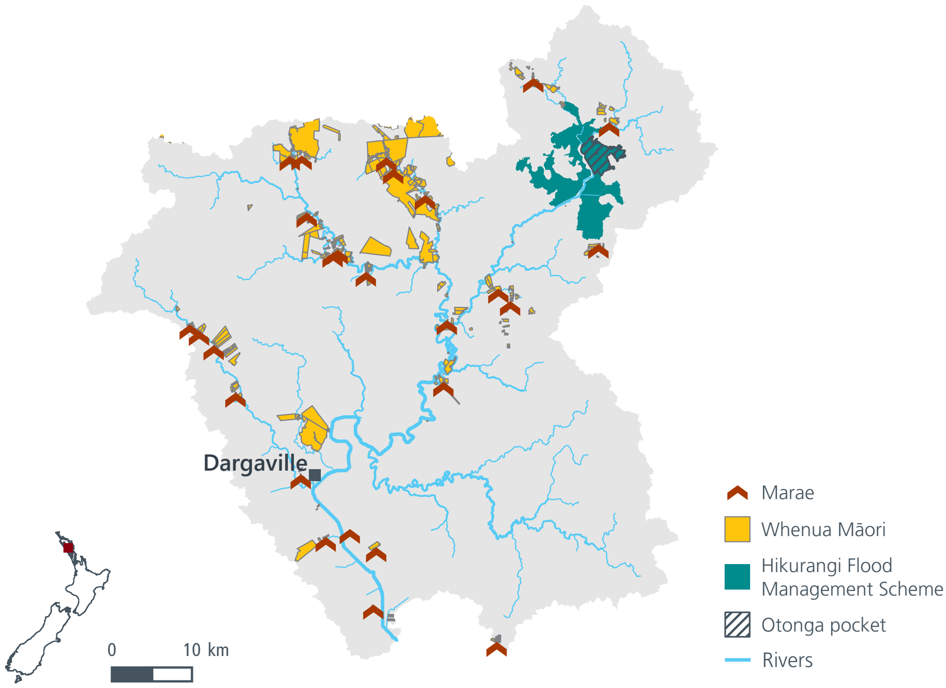
[11] Ki uta ki tai is recognised in the National Policy Statement for Freshwater Management, which requires every regional council to "give effect to Te Mana o te Wai, and in doing so must … adopt an integrated approach, ki uta ki tai, to the management of freshwater" (Clause 3.2).

[12] See https://pce.parliament.nz/publications/exploring-land-use-change-under-different-policy-settings-in-two-case-study-catchments; Kitson and Cain, 2023, pp.26–27.



Sources: Ministry of Justice (2017); Te Puni Kōkiri (2017); Whangarei District Council (pers. comm., 2023)

Figure 4.4: Map of the Wairoa River catchment showing marae (red arrows), whenua Māori (yellow areas) and the extent of the Hikurangi Flood Management Scheme (teal area).

The cultural landscape of the Wairoa catchment is about connection and is not purely economic. Some local farmers also whakapapa to the catchment. They work on land that has been passed down through the generations, or play an important part in local and Māori communities. These relationships are important. Any attempt at managing landscapes in an integrated way requires a good understanding of the diversity of relationships that are held within the landscape: the relationship that mana whenua have with the land; the relationship that farmers and other landowners have with the land; and the relationships between people.

The landscape represents the history of settlement by people, from the various waka arriving from the Pacific over many generations, to new settlement today. Hapū lost tino rangatiratanga through colonisation, and attempted to retain it through the signing of He Whakaputanga o te Rangatiratanga o Nu Tireni (the Declaration of the Independence of New Zealand) and Te Tiriti o Waitangi. The hapū of the Wairoa catchment emphasise that this is a part of history that must not be forgotten. They state that they never ceded sovereignty over their lands, fisheries, water, taonga, culture and resources, yet their authority has been superseded by the Crown. The current approach taken by mana whenua is the progression towards a Treaty-based future where authority to govern is shared between those the Treaty represents.

The catchment encompasses both iwi who have settled some of their grievances with the Crown and others who have not. This diversity of hapū adds complexity. The approach that most hapū take in the Wairoa catchment is one of independently addressing local matters while acknowledging that whānau and hapū within the catchment and beyond are also interdependent and engaging on matters of shared importance. As one hapū member noted, "What we do impacts on other hapū, so it makes sense to do some things together. We are stronger together." This approach has challenges but also brings opportunities. For example, at least five hapū in the upper catchment are monitoring the wai in their rohe as a collective, using innovative techniques and tools to demonstrate Te Mana o te Wai.[13]

Hikurangi Repo

The Hikurangi Repo is a very important area for many hapū in the Wairoa catchment. Identified as a wāhi tapu, the repo was a source of healing, and resources like harakeke and tuna were traditionally harvested there. Kaitiaki and different hapū from the surrounding area would come to harvest from the repo. It belonged to everyone; it was the kai cupboard for all and trade would go on between coastal hapū and hapū at the repo. Because of this, everyone had to agree on how they would protect and collect from it.

The repo was also used to bury bones, for baptismal practices, and in recent times has been a focus of activism concerning the decline of tuna and rongoā plants. The development of a flood management scheme to permit and protect farming has seen the repo significantly modified and drained. What was previously around 6,000 hectares of fen and wetland has been reduced to only 200 hectares (see Box 3.5). In the early 2000s, one of the hapū (Ngāti Hau) voiced concern about the killing of tuna by the large pump stations that were installed in the repo to pump floodwater from agricultural land during heavy rainfall events (see Figure 4.5).[14]

Following the loss of tuna, peatlands and natural habitat, mana whenua have mobilised to prevent further degradation and make clear their aspirations to restore the mauri of the repo and the surrounding area. A business case is currently being developed to retire an area of the repo called the Otonga pocket (Figure 4.4). It is an important peat site that could potentially be developed into a natural water retention area, which could play a significant role in holding water and cleaning it. Restoring some of the repo back to a healthy functioning wetland would also assist the local hapū to reclaim their rangatiratanga and improve economic and socio-cultural outcomes for the community.[15]

As part of the scenario development phase of the modelling exercise, the importance of the repo was emphasised by mana whenua at the workshops. In response to this input, the scenarios were modified to include the retirement of one part of the repo (the Otonga pocket) by 2060 in scenario 4, and all seven pockets of the repo by 2060 in scenario 5. It is possible to use current land values to estimate the cost of purchasing the land required. However, given there are no local precedents for returning an area of this size from farmland to wetland it is very difficult to estimate the total cost of restoration and maintenance.[16]

[13] Hapū member at PCE integrated landscapes hui, pers. comm., September 2023.

[14] Armstrong-Read, 2016, p.4.

[15] Hapū member at PCE integrated landscapes hui, pers. comm., July 2023.

[16] The cost of remediation and restoration will depend on a range of factors, including earthworks required, planting costs and fencing requirements (Tanner et al., 2022).

The land use modelling estimated the cost of purchasing the Otonga pocket to be around $19 million, with a *maximum* total restoration cost of $128 million. Economies of scale and the use of volunteer labour for planting natives are likely to substantially reduce the total cost. For all seven pockets the respective figures were $243 million and $908 million. The modelling assumed that the restoration was funded by recycling revenue collected from the agricultural emissions levy (refer to chapter two for more detail on each of the scenarios).

Source: PCE

Figure 4.5: The Hikurangi Repo after heavy rainfall. Most of the Hikurangi Repo has been drained for agriculture since the early twentieth century. Pump stations are used to control the flooding of farmland after heavy rainfall events, but their operation can endanger migrating tuna.

Additional commentary from ngā mana whenua o Wairoa – Te Tai Tokerau

Commentary from ngā mana whenua o Wairoa was broad, ranging from highlighting the fractured way that science deals with environmental problems to the lip service paid to mātauranga Māori as a robust evidence base. Key points are listed below.

- A more holistic, integrated view to the problem is needed – for example, by including spiritual and social parameters into the thinking.
- Innovative ways of managing land were highlighted, such as alternative native forestry options and harvesting methods, and diverse pastures using deep-rooting species that can have positive impacts on soil health. The view of ngā mana whenua o Wairoa is that clear-felled pine forestry diminishes the mauri of the whenua and increases the risk of erosion. They also highlighted that in many cases the profits do not stay within the community, nor are they put back into cleaning up the environment.

- Making decisions on land use requires a more balanced view than just considering economic factors alone. For example, the principle of kaitiakitanga must be considered when making land use change decisions, and an intergenerational view of the land must be taken as opposed to maximising the profitability of the land in the short term. Mana whenua questioned why the New Zealand Emissions Trading Scheme does not currently provide rewards for restoring or constructing wetlands, which can sequester carbon from the atmosphere and store it as peat.
- The Hikurangi Repo was not the only important site for mana whenua. All waterways in the catchment are in some way important, and mana whenua would like them to be restored for their children and their grandchildren.[17]
- Understanding and including all forms of relationships is also important. Connectivity across hapū, cultures, land uses and relationships between people and the environment would need to be considered in any exercise attempting to develop integrated management approaches with the mana whenua of the Wairoa catchment. As noted by one hapū member, "The wellbeing of our waterways is reflective of the wellbeing of our people."[18]
- Taonga species that are important to mana whenua would also need to be considered in modelling. For the Wairoa catchment, this includes tuna as a potential indicator species and kahikātoa as a potential preferred species for future forestry.[19]

The hapū of Wairoa catchment identified the following themes as being important to consider in any catchment-scale approach to land management.

- Te Tiriti o Waitangi and He Whakaputanga o te Rangatiratanga o Nu Tireni need to underpin decision making.
- Te Mana o te Wai and the environment must be prioritised over short-term economic needs and must be factored into all land use decisions.
- Understanding historical impacts is essential if decisions are to enhance the wellbeing of the landscape and the people of the area.
- The hapū in Wairoa are already working in an integrated way across many important kaupapa. For example, the hapū are not just concerned about rural land use change but also the expansion of urban areas and conversion of rural land to housing and other urban land uses, which place different strains on the landscape. These kaupapa, as well as other social, health and economic issues, should be considered in any integrated approach.

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[17] Hapū member at PCE integrated landscapes hui, pers. comm., July 2023.
[18] Hapū member at PCE integrated landscapes hui, pers. comm., July 2023.
[19] Kahikātoa is the Northland name for mānuka (*Leptospermum scoparium*).

Whakapapa and landscapes

In both catchments, mana whenua provided valuable insights and information on how to include their views in an approach like this. Mana whenua in both catchments define and understand landscapes through their whakapapa (their connection). This influenced the way they approached this exercise as well as the input they chose to provide.

Te Tiriti o Waitangi and other founding documents and current policies that embed te ao Māori concepts set the foundation for how relationships are forged and reinforced. But they are not the only driving force behind mana whenua actively engaging in environmental management. Their whakapapa – their connection to the landscape – means they are responsible for the health of the environment.

This active role is multi-faceted as many kaitiaki have responsibilities as both mana whenua and landowners. Any attempt to manage landscapes in an integrated way must consider how to ensure mana whenua and their rangatiratanga are acknowledged within a process that provides for different definitions of landscapes.

5

Consequences of disconnected environmental policies in Mataura and Wairoa

Environmental policy is currently characterised by policies that have been developed separately and are focused on achieving domain-specific outcomes at different spatial scales. For example, climate change mitigation policy is concerned with managing greenhouse gas emissions at the national and global level. By contrast, freshwater policy is mainly concerned with local and catchment-based outcomes.[1] While each of these policies may have been the subject of careful development, the way they interact with one another seems to have been less well considered. As a result, the way the policies operate can be disconnected.

The disconnected nature of the goals of different environmental policies was a recurring theme in conversations with people in the Wairoa and Mataura catchments. Improving the health and wellbeing of the awa came through time and again as a critical concern. Climate change mitigation was often a less urgent priority at the local level. The conversations also highlighted that not enough attention is given to the potential consequences of policies for Māori, and that there is limited support available for iwi, hapū and whānau to fulfil their role as kaitiaki of the whenua, as discussed in the previous chapter.

The previous government proposed introducing a levy on agricultural emissions. If one is implemented in future, an agricultural emissions levy – combined with the price signals from the New Zealand Emissions Trading Scheme (NZ ETS) – would be likely to have a significant impact on the landscapes of Aotearoa.[2] There could be some co-benefits for freshwater quality and biodiversity, though these would depend on the policy settings (e.g. the levy rate) and catchment circumstances.

Two key themes are discussed in this chapter regarding the consequences (intended or otherwise) and trade-offs that may arise from current and forthcoming environmental policies. Modelling results from scenarios 1 and 2 are used to illustrate these potential consequences (see Table 2.1 for descriptions of the scenarios).

The first theme is how the current policy trajectory could have significantly different outcomes depending on the context of the catchment and the farm systems located there. It draws on the contrasting impacts of the low agricultural emissions levy price on land use in the Wairoa and Mataura catchments, using the modelling results from scenario 1.

[1] McDowell and Kaye-Blake, 2023, p.2.
[2] For more information, see NZPC, 2018; PCE, 2019; He Pou a Rangi, 2021; HWEN, 2022.

The second theme is the consequences and trade-offs that may need to be dealt with if environmental policies are not considered in a joined-up way. In particular, the impact of a medium agricultural emissions levy driving wholesale land use change and the flow-on environmental and non-environmental effects in the Wairoa catchment are illustrated, drawing on the modelling results from scenario 2 in Wairoa.

The uneven effect of a low agricultural emissions levy in different catchments

To meet New Zealand's national emissions reduction targets, the previous government suggested the introduction of a price on agricultural emissions at a farm level from 2025. The exact price (and scope) is still to be finalised, but when a price is imposed, it will impact some farms, sectors and catchments more than others. When added to the impact of the NZ ETS and existing freshwater rules and regulations, the introduction of a levy has the potential to drive significant land use change.

The price at which the levy is set will play an important part in how and where land use change occurs. The land use modelling conducted as part of this exercise (scenario 1) clearly demonstrated that, even under a relatively low price pathway, there will be very uneven impacts on different sectors and catchments.

For example, with a low agricultural emissions levy there would likely be minimal impact on land use in the Mataura catchment, although all livestock farms become less profitable. The modelling indicated that the only major land use change would be the transition of areas of high country sheep and beef out of pastoral farming (Figure 5.1).[3] Whether pine production forestry would be established in these areas would depend on site-specific factors such as climate, elevation and slope, along with logistic factors affecting the ability to harvest and distance to the nearest port or processing plant. For example, it was noted by workshop participants that some areas of high country sheep and beef in the Mataura catchment would not be suitable for pine production forestry due to elevation, biodiversity values and tenure type.[4]

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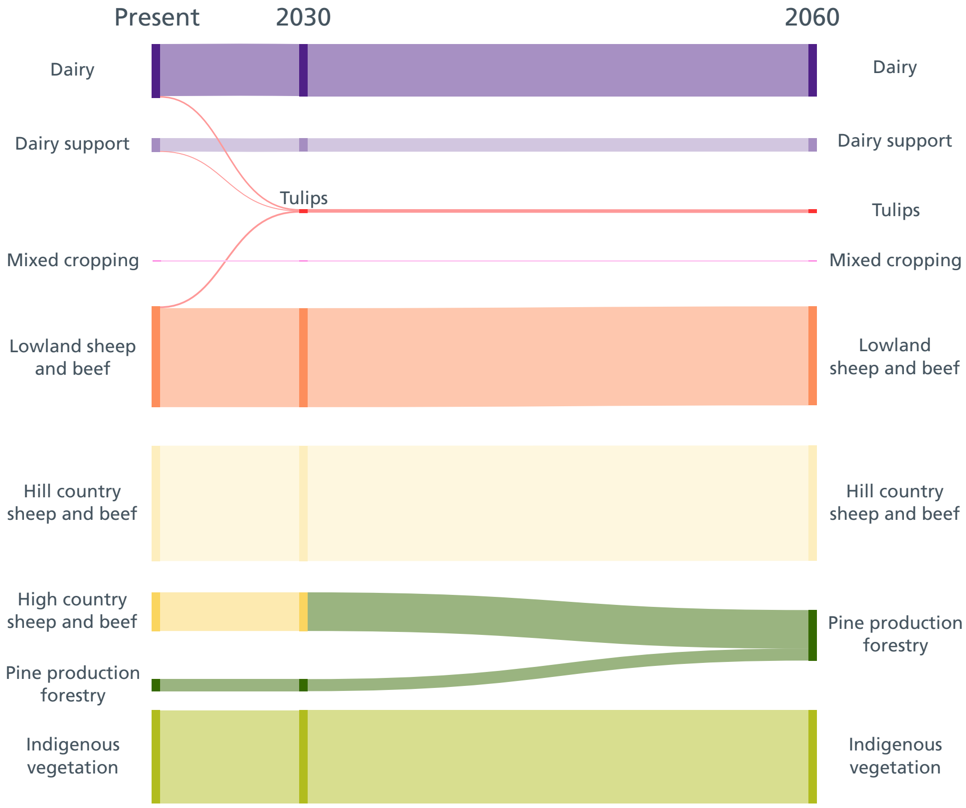
[3] WSP, 2023a, pp.60–68. This increases the area of pine production forestry from 3% of the catchment area in 2025 to 13% in 2060. Dairy support also becomes unprofitable in 2060 but is retained to ensure that a functioning dairy sector is maintained. Hill country sheep and beef are also very close to becoming unprofitable by 2060.

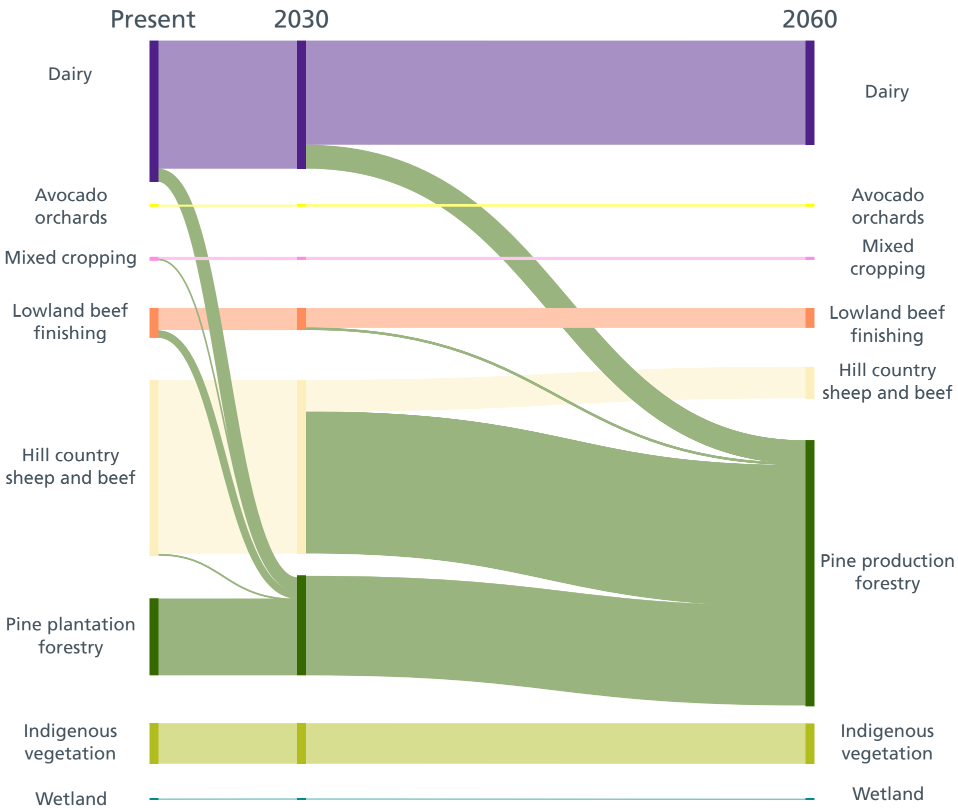
[4] See WSP (2023a, pp.232–249) for information on how the economic and environmental outcomes would change if high country sheep and beef land above 600 metres in Mataura were to transition to tussock instead of pine production forestry. Note that some of the land categorised as 'high country sheep and beef' in the baseline land use map is in fact high altitude tussock with high biodiversity values.



Source: Adapted from WSP (2023a) modelling

Figure 5.1: Modelled land use change in the Mataura catchment under a low agricultural emissions levy and untargeted freshwater policies (scenario 1). Flows between timesteps represent land transitioning to a new land use. Tulips are included as an example of a higher-value, lower-intensity land use, though the area of land suitable for tulips in Mataura is small. In this scenario, the modelling assumed that all high country sheep and beef land transitioned to pine production forestry by 2060; in reality, some of this land may be unsuitable for pine production forestry.

In stark contrast, even a low levy price resulted in significant land use change in the modelling for Wairoa (Figure 5.2).



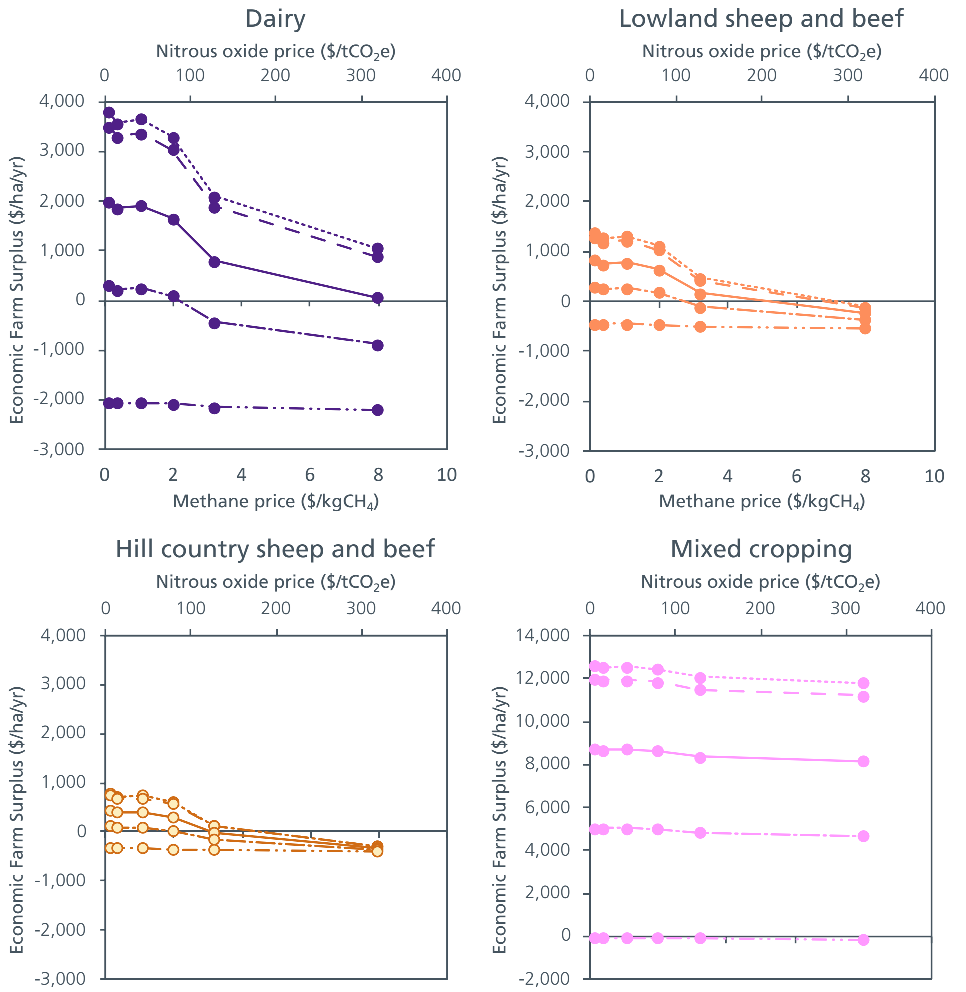
Source: Adapted from WSP (2023b) modelling

Figure 5.2: Modelled land use change in the Wairoa catchment under a low agricultural emissions levy and untargeted freshwater policies (scenario 1). Flows between timesteps represent land transitioning to a new land use.

Hill country sheep and beef farms were significantly affected by emissions pricing in the modelling. The modelling indicated that once the levy is introduced, most hill country farms would become unprofitable and transition to the most profitable alternative use for that land, which in most cases would be pine production forestry. Lowland beef finishing farms would also be impacted, with a high proportion barely making a profit by 2060 (Figure 5.3).[5] This result is in line with modelling commissioned by Beef + Lamb New Zealand, which found that the profitability of some sheep and beef farms will be significantly impacted by the introduction of an agricultural emissions levy, even at a low level.[6]

[5] WSP, 2023b, pp.57–58.

[6] Beef + Lamb New Zealand, 2022, p.19.



Source: Adapted from WSP (2023b).

Figure 5.3: Profitability per hectare at different emissions prices for dairy, lowland sheep and beef, hill country sheep and beef, and mixed cropping farms in Wairoa. For each farm type, farms on land with high production capacity have greater profitability than farms on low production capacity land. As the price on biogenic methane and nitrous oxide emissions increases, the profitability of farm systems decreases, all else being equal. These calculations assumed a 5% discount rate and no changes in commodity prices.

Ultimately, 82% of hill country sheep and beef land in Wairoa transitions to pine plantation forestry by 2060 in this low levy scenario. The proportion of the catchment in pine production forest increases from 17% at present to 57% in 2060. Whether such a significant shift would occur in practice depends on a range of factors, including landowner preferences. For example, some hill country sheep and beef farmers may forgo the higher profitability of pine production forest for other less profitable, but preferred, land uses.

There are smaller reductions in lowland beef finishing and dairy farming because the productive capacity of the land used for these land uses is higher and the profitability per hectare is greater.

The impact on greenhouse gas emissions follows a similar pattern to the modelled land use change in both catchments. In Mataura, there is a negligible reduction (~5%) in biogenic methane emissions between now and 2060. For Wairoa, there are greater modelled reductions in biogenic methane emissions (~44% reduction). The increase in pine plantation forestry also increases carbon dioxide removals in Wairoa substantially, though future carbon dioxide removals from forestry are difficult to estimate accurately in the absence of catchment-specific data on age classes and sequestration rates.[7]

Given the limited impact on land use in Mataura, minor changes in modelled freshwater quality and biodiversity indicators occur.[8] Changes in land management practices were not modelled in scenario 1, meaning that where a land use persisted, greenhouse gas emissions and loss of freshwater contaminants were largely unchanged.

The limited impact on freshwater quality also highlights that untargeted national freshwater policies such as the current cap on synthetic nitrogen fertiliser (which permits a maximum fertiliser application rate of 190 kilograms per hectare per year for pastoral land uses) are unlikely to be enough to achieve catchment freshwater quality goals in Mataura. Given that good farm management practices are also unlikely to achieve draft catchment freshwater objectives even if fully achieved,[9] catchment-specific rules and regulations enabled through the National Policy Statement for Freshwater Management, and its linking of Te Mana o te Wai and ki uta ki tai, are likely to be needed.

In Wairoa, greater improvements in freshwater outcomes occur under scenario 1 due to the shift from pastoral farm systems to forestry. For example, the modelling indicated that instream concentrations of total nitrogen would be reduced considerably in some areas of the catchment.[10]

[7] WSP, 2023b, p.142.
[8] WSP, 2023a, pp.58–64.
[9] Southland Regional Forum, 2022, p.21.
[10] WSP, 2023b, p.59–60.

The uneven effect of pricing agricultural emissions highlights the need for the Government to be clear on the desired outcomes of its policies and to be upfront about the likely consequences for landscapes of pursuing those outcomes. The indication that introducing even a relatively low levy on agricultural emissions may lead to substantial land use change in some locations emphasises the role that catchment context plays on the impact of national policies. Complementary policies alongside emissions pricing could be considered to help mitigate the impacts on individuals, communities and tangata whenua who may be negatively affected by the introduction of an agricultural emissions levy.

The wider environmental trade-offs between climate change mitigation and other environmental and economic outcomes are thrown into stark relief when a higher emissions price is introduced. This is discussed in the next section.

Consequences and trade-offs of a higher agricultural emissions levy

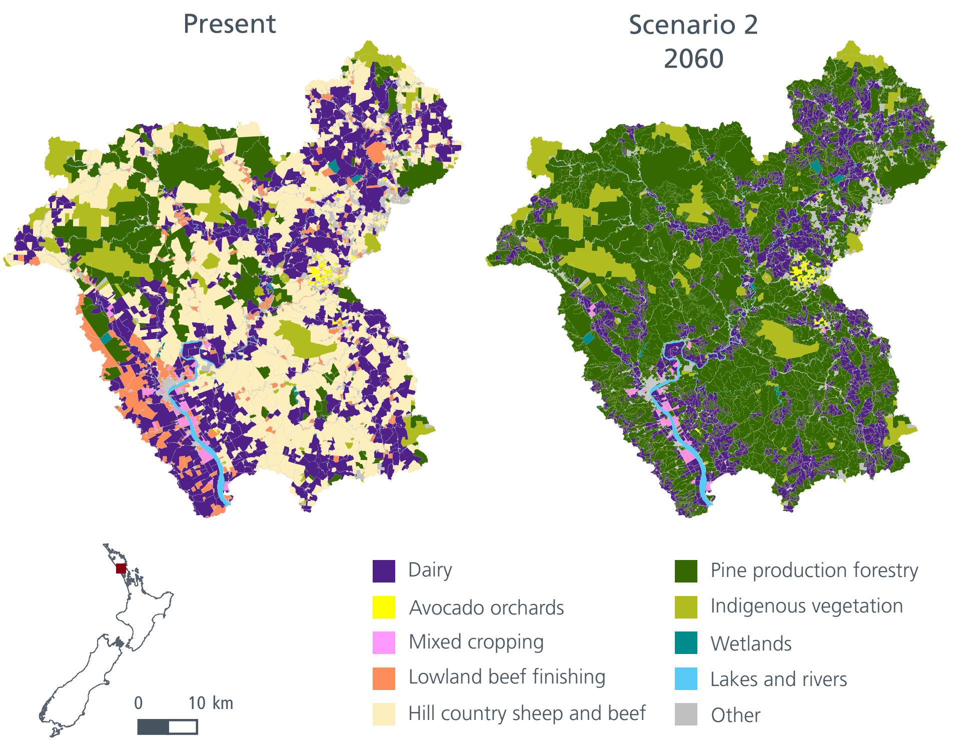
The combination of a levy on agricultural emissions and the attractiveness of tree planting under the NZ ETS would see a shift in the relative profitability of pine plantation forestry compared to pastoral farming. As a result, large-scale land use change can be expected. The likelihood of this occurring increases as the level of any price on agricultural emissions increases. The effect of a relatively high price on agricultural emissions on the Wairoa and Mataura catchments (modelled in scenario 2) demonstrates how this might play out and what the consequences might be for the environment and for the people living in these catchments.

Similar to the low levy scenario, the greatest changes to land use would be expected to occur in the Wairoa catchment. If a high levy price pathway had been applied in the modelling for Wairoa, all pastoral farming in the catchment would have become unprofitable and transitioned to pine production forestry.[11] Rather than model such an extreme outcome, a medium levy was modelled instead of a high levy in scenario 2 for Wairoa.

Even with the levy rate set at a medium level,[12] significant land use change would still be expected to occur in the Wairoa catchment under this scenario (Figure 5.4 and Figure 5.5). In the model, all sheep and beef farms transitioned to pine production forestry with only dairy farms in the most productive areas surviving.

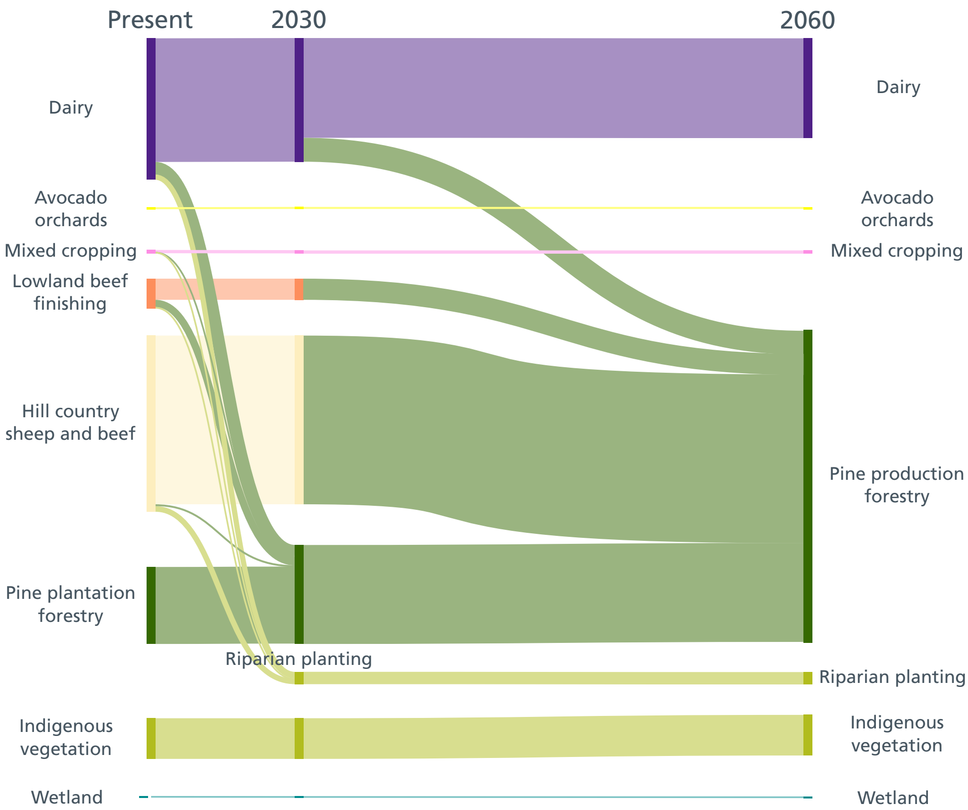
[11] WSP, 2023b, p.32. Transitions to other high-value crops were not modelled to occur due to limited water availability (e.g. in the case of avocados) and/or the high costs of establishment and processing infrastructure required.

[12] See WSP (2023b, p.32) for more details.



Source: Adapted from WSP (2023b) modelling

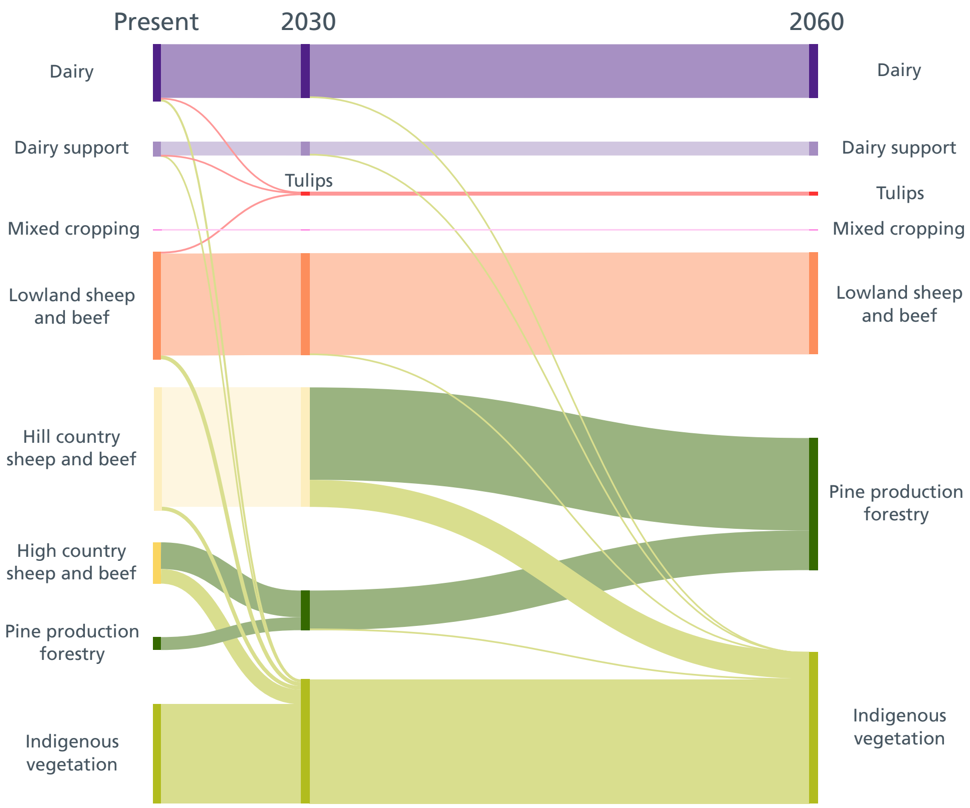
Figure 5.4: Map of the modelled change in land use between the present and 2060 in the Wairoa catchment under scenario 2 – medium agricultural emissions levy and untargeted freshwater policies. 'Indigenous vegetation' includes riparian planting. 'Other' includes all other land uses.



Source: Adapted from WSP (2023b) modelling

Figure 5.5: Modelled land use change in the Wairoa catchment under scenario 2.

In Mataura, a high levy would also be expected to result in a significant change in land use, with all high and hill country sheep and beef farms becoming unprofitable by 2060 (Figure 5.6). Dairy farming is the only land use that continues relatively unchanged under the assumptions in this scenario, although profitability is reduced by around 79%.



Source: Adapted from WSP (2023a) modelling

Figure 5.6: Modelled land use change in the Mataura catchment under scenario 2.

The following discussion focuses on the Wairoa catchment, given the significant transition in land use that may occur under this scenario.

Transitioning to what is in effect a binary pine-and-dairy landscape in the Wairoa catchment would have a range of economic, social and environmental consequences.

A large-scale expansion of pine production forestry driven by the NZ ETS could increase profitability at the catchment scale due to the combined income from wood production and carbon credits. However, pine production forestry operations differ from sheep and beef farms significantly in their scale and type of operation. For example, pine production forestry jobs are largely tied to the harvest cycle, with gaps in employment demand between planting and harvesting periods. This variability can be smoothed to some degree by larger planted areas and staggered planting.

Nationally, pine production forestry is estimated to provide greater employment per hectare then sheep and beef farming.[13] However, a local analysis of employment rates in the Wairoa district in Hawke's Bay suggested that sheep and beef farming has greater direct employment on a per hectare basis compared to pine production forestry.[14] One explanation for the difference between national and local estimates is that forestry workers, and forestry-related processing jobs, are often located in larger regional centres. The result is that although changes in employment may not be large nationally, the type and location of those employed are likely to change, having flow-on effects.[15]

Economically, the catchment's economy would be tied to the NZ ETS price to a much greater extent. Volatility in the price due to regulatory uncertainty and potential oversupply of forestry units could leave the catchment exposed to rapid shifts in fortune. This is something that He Pou a Rangi Climate Change Commission has highlighted.[16]

Further, if the transition to pine in the Wairoa and Mataura catchments were to be reproduced in other parts of the country,[17] the increasing reliance on funding from the NZ ETS (which ultimately comes from emitters in the transport, energy and industry sectors) as the main source of rural income becomes increasingly problematic nationally for a range of economic, social and environmental reasons.[18]

The loss of most pastoral farming in the catchment would also have distributional and social impacts on the community. What these social impacts are and how they might affect those in the catchment were not quantified in the modelling. However, the feedback at the workshops from people in the case study catchments was that the impact of large-scale land use change on individuals and the community is a key concern. They highlighted that land use change does not happen in a vacuum. It affects people, their livelihoods and the wider community, most obviously in terms of employment. Other potential negative social impacts include a reduction of business services in the catchment, the ongoing viability of health and education services, and an undermining of social cohesion and a sense of community.[19] Social issues are likely to disproportionally affect Māori.[20]

In reality, other barriers to the establishment of pine production forestry would likely delay any large-scale transitions. Barriers include volatility in the carbon market price, uncertainty around future climate change mitigation policy, technological advancements, commodity prices, landowner preferences and skills, and land banking to increase land value and retain future flexibility.[21] Given the significant impact on profitability modelled for a range of land uses, these factors would likely only delay rather than halt land use change in this scenario.[22]

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[13] PwC, 2020, p.5. In comparison, permanent carbon forestry would significantly reduce employment compared to both sheep and beef and pine production forestry (PwC, 2020, pp.6–7).

[14] Harrison and Bruce, 2019, p.17.

[15] ICCC, 2019, p.81; PCE, 2019, p.151.

[16] He Pou a Rangi, 2023, p.60.

[17] As indicated in, for example, modelling of the Hurunui catchment in PCE, 2019, pp.144–145.

[18] PCE, 2019, pp.149–154.

[19] ICCC, 2019, p.81; PCE, 2019, p.150.

[20] Forestry Reference Group, 2018, p.4.

[21] NZPC, 2018, p.305.

[22] Though regulatory intervention through national direction or regional rule setting could directly limit the area of land converted to forestry.

The stark transitions in land use in scenario 2 are, of course, partly a function of the assumptions that were used in the land use modelling. For example, no new technologies to reduce agricultural emissions were assumed to come into effect during the modelling period. If viable technologies such as a methane vaccine become widely available at low cost, agricultural emissions pricing might not have such a significant effect on farm profitability. Similarly, commodity prices are assumed to be static over time. Any increase in commodity prices would improve farm profitability, potentially mitigating some of the impact of the agricultural emissions levy (though of course the reverse would also be true).

Environmentally, the large-scale transition to pine production forestry modelled for the Wairoa catchment highlights the complex trade-offs present between competing environmental policy domains.

On the climate change mitigation side, emissions are significantly reduced in this scenario due to the decrease in livestock numbers in the catchment. In Wairoa, modelled biogenic methane emissions were reduced by 54% by 2060 relative to the current level. This is the largest change in greenhouse gas emissions across all the scenarios modelled. At the same time, the expansion of fast-growing pine forests would be expected to remove significant quantities of carbon dioxide from the atmosphere.

Biodiversity conservation would also improve in the Wairoa catchment under scenario 2. Pine forests can provide habitat for some native species, representing an improvement over pasture.[23] For example, pine production forests can provide habitat for native species such as the North Island brown kiwi (*Apteryx mantelli*).[24] The expansion of forested area would also increase connectivity between indigenous vegetation remnants scattered through the landscape, providing easier passage for native bird species – although it could also provide avenues for pest species to move more easily. Riparian planting across the catchment in this scenario, funded by revenue from the agricultural emissions levy, would also provide additional habitat for terrestrial and aquatic native species.

There would also be co-benefits for freshwater quality. For example, the removal of livestock from large areas of the catchment would eliminate the primary source of nitrogen and pathogens from many rivers and streams (Figure 5.7). Riparian planting can also intercept nutrient runoff, further reducing potential nutrient loss.[25] In addition, as pine production forest transitions through mid-rotation to mature forest stages, erosion risk is reduced compared to pasture.[26] Canopy closure also contributes to freshwater quality improvements by restricting unwanted aquatic plant growth.[27] However, benefits may be offset during and after the harvest phase when the land is left exposed, leaving it vulnerable to erosion (see below). Other ongoing issues for freshwater ecosystems that were not modelled, such as fish passage barriers, will also continue to be an issue in the Wairoa River catchment.

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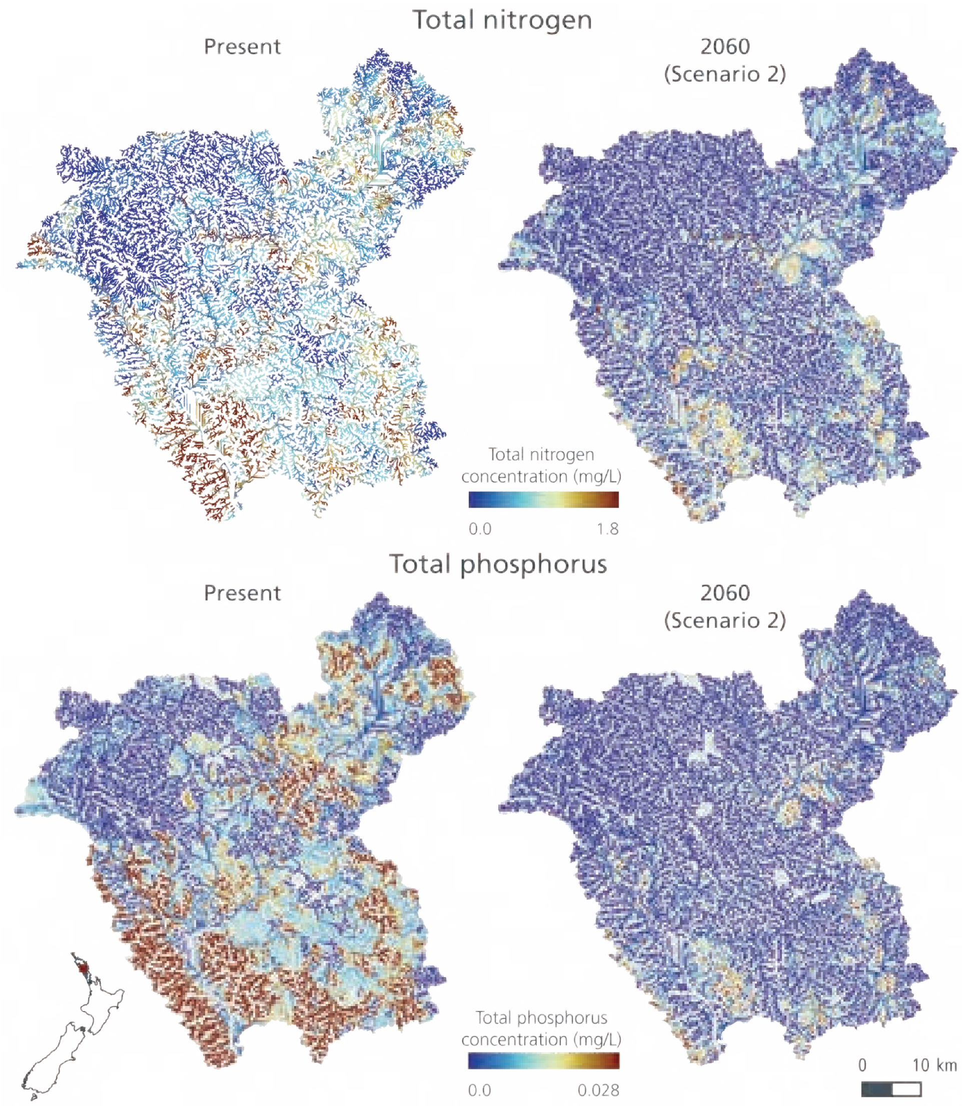
[23] Norton, 1998; Brockerhoff et al., 2008; Pawson et al., 2010.

[24] Sporle, 2016. Another example is the kārearea (New Zealand falcon, *Falco novaeseelandiae*), although they are not found within Northland (Seaton and Hyde, 2013).

[25] For example, the area of the catchment whose flow is intercepted prior to reaching a waterbody increased 201% between 2025 and 2060 in scenario 2 (WSP, 2023b).

[26] Fahey and Marden, 2006.

[27] Baillie and Neary, 2015.



Source: Adapted from WSP (2023b) modelling

Figure 5.7: Change in modelled total nitrogen and total phosphorus concentrations in the Wairoa River catchment between the present and 2060 under scenario 2. Improvements in freshwater quality indicators is due to a combination of the loss of large areas of pastoral farming and livestock and the interception of contaminants by forested and riparian areas. Note that total nitrogen concentrations in the Wairoa River are generally low compared to other waterways in New Zealand.

One of the trade-offs in environmental outcomes modelled for Wairoa is the potential increase of post-harvest erosion risk in the catchment. The modelling undertaken for this project highlighted that erosion and soil loss from clear-felled pine production forests can be very high in the period after harvesting.

Prior to harvesting, soil losses from pine production forests are generally lower than losses from pasture.[28] This has been demonstrated in empirical studies of instream sediment concentrations in forested and unforested sub-catchments in New Zealand.[29] However, disturbances caused by clear-fell harvesting (the most common type of harvesting in New Zealand; Figure 5.8) and replanting will intermittently impact on water quality. There is a window of around eight years between harvesting and when newly planted pine trees are established, during which the land is more susceptible to erosion, particularly during periods of heavy rainfall.[30] As a result, large amounts of sediment and nutrients can be deposited into waterbodies during this time. Heavy rainfall events can also lead to large amounts of harvest debris (commonly known as slash) being washed into waterways and out to the coast.[31]

Source: PCE

Figure 5.8: Clear-fell harvesting of a production forest in Southland. The risk of erosion increases in the years after production forests are clear-felled.

[28] Established pine trees can reduce erosion by improving soil strength and reducing soil moisture due to their roots and canopy intercepting rainfall (Lambie et al., 2018, pp.10–11).

[29] Fahey and Marden, 2006.

[30] Ritchie, 2012, pp.9–14; Lambie et al., 2018.

[31] A fact that has been made all too clear in the aftermath of repeated heavy rainfall events in Tairāwhiti in recent years (Ministerial Inquiry into Land Uses in Tairawhiti and Wairoa, 2023).

Management practice and regulations under the National Environmental Standard for Commercial Forestry go some way to reducing erosion risk and issues associated with harvest debris. However, with such large areas modelled to transition to pine production forests there is a high likelihood of harvesting coinciding with heavy rainfall events. This is compounded by the expected increase in frequency of heavy rainfall events predicted as a result of climate change. In short, we do not yet know what the overall net effect on erosion and sediment would be from converting large areas of pasture to pine production forestry.

Although not modelled, a large-scale transition to plantation forestry could have other negative environmental effects depending on site characteristics. For example, large-scale forest planting can change catchment water flows, which can be a problem in drought-prone, highly modified landscapes.[32] Forests also absorb more heat because they are typically darker than pasture.[33] Therefore, while planting forests has a cooling effect globally, the local temperature effects are more uncertain.[34]

There are also inherent issues with relying on pine plantation forestry to remove and store carbon. For example, carbon stored in forests can be rapidly released back to the atmosphere in the event of fires, pests, droughts, storms and other disturbances. Climate change is expected to exacerbate these risks in the future. It also locks up land in forestry in perpetuity, forever changing the landscape of our case study catchments – or at least until a cheap and effective way to remove carbon dioxide from the atmosphere and store it permanently underground becomes widely available.[35]

Alternative forestry approaches such as continuous cover forests, native production forests and agroforestry systems can ameliorate some of these issues. However, they come with their own set of barriers and concerns. The use of alternative forestry types is explored in the following chapter.[36]

The results presented here highlight how broad-brush national policies can significantly impact catchments – and the consequences may be exacerbated by not joining up environmental policies. Trade-offs (intended or otherwise) between environmental, economic, social and cultural outcomes need to be considered together to avoid changes that may later be regretted but are locked in for decades to come.[37] The outcome of not doing so will be suboptimal in many regards.

[32] Harnett, 2019, p.18.

[33] Kirschbaum et al., 2011. The change in heat absorption between colours is known as the albedo effect.

[34] The soils under pine forests may also help to remove methane from the atmosphere. Scion is undertaking research to better understand this effect (Scion, 2023).

[35] PCE, 2019, p.103; He Pou a Rangi, 2021, p.316.

[36] Permanent exotic forests are another alternative forestry option but were not modelled.

[37] He Pou a Rangi, 2021, p.316.


Cyclosorus interruptus

6 How could things be done differently?

The previous chapter explored what the various consequences of disconnected environmental policies could be in the Mataura and the Wairoa catchments. This chapter explores what alternative mixes of policies could look like and what the outcomes might be. It draws on discussions with and input from local people and mana whenua (Wairoa catchment only), as well as the results of the physiographic susceptibility mapping and scenarios 3–6 of the land use modelling (see Table 2.1 for descriptions of the scenarios).

More diverse landscapes

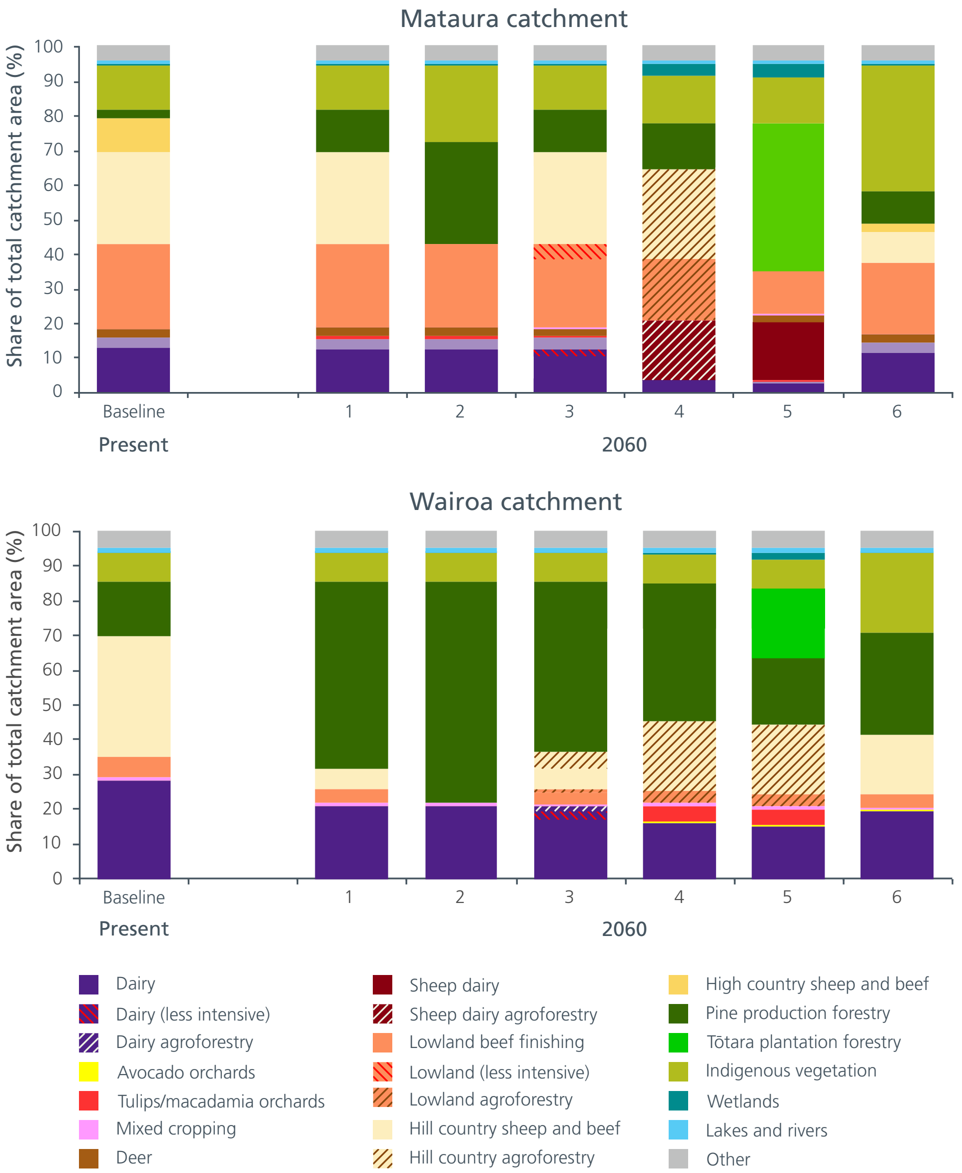
Moving to more diverse landscapes has been proposed as a way to mitigate environmental pressures and enhance resilience.[1] As part of the exercise, alternative land uses were discussed with local people in the hui and workshops in each catchment, and some representative examples of alternative land uses were selected for inclusion in the land use modelling (Figure 6.1).

In the Mataura catchment, some of the relatively low, flat, highly productive areas could be suitable for alternative land uses (Figure 6.2). The alternative land uses modelled for these areas were sheep dairying and tulip growing. These are relatively high-intensity land uses, but if located in the right areas they could be part of the mix. Sheep are lighter and produce smaller urine patches than dairy cattle, so soil compaction and nitrogen losses tend to be lower. Tulip farms do not emit biogenic methane and have lower greenhouse gas emissions than dairy farms, though they still use nitrogen fertilisers and produce nitrous oxide emissions.

In Wairoa, macadamia orchards and lowland agroforestry systems were included as examples of alternative land uses for modelling purposes (Figure 6.3). Other land use opportunities will obviously exist in both catchments, and the options available may well shift as the climate changes.[2] The alternative land uses used in this exercise should be thought of as plausible placeholders for what will, in reality, always be driven by access to capital, skills, technologies and markets.

1 Hall, 2018.

2 A comprehensive analysis of land use opportunities nationwide, and how these are likely to change as the climate changes, is being undertaken by the Our Land and Water Whitiwhiti Ora programme (OLW, 2023).



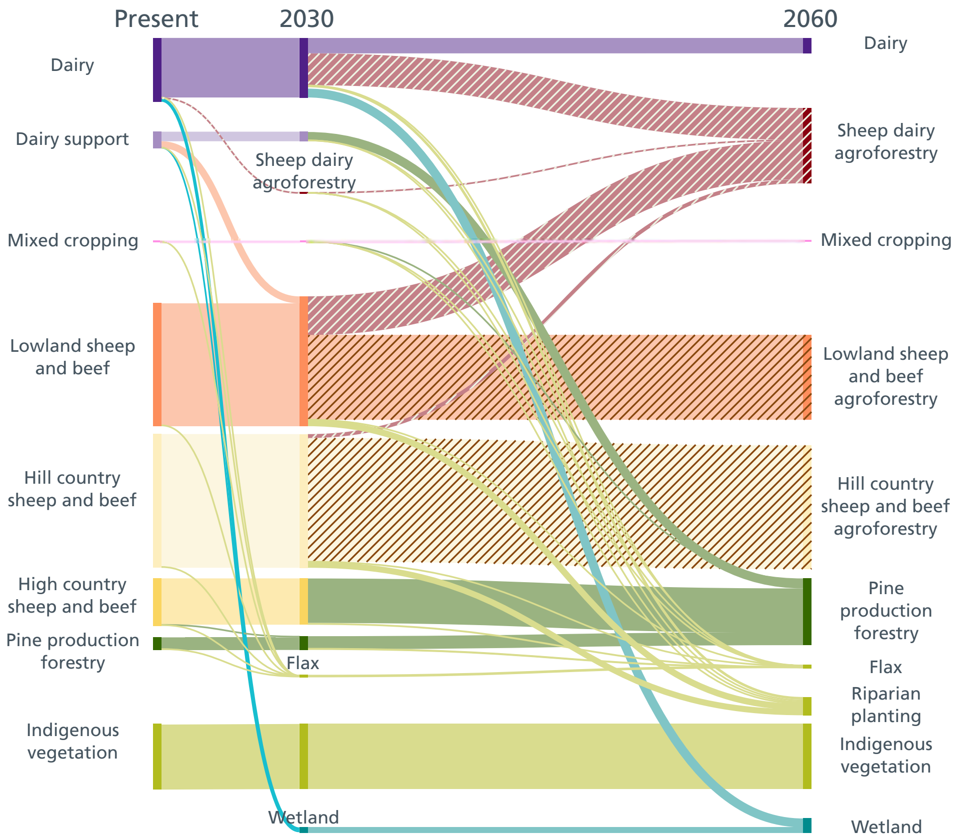
Source: Adapted from WSP (2023a, 2023b) modelling

Figure 6.1: Land uses in Mataura and Wairoa under the six policy scenarios. 'Indigenous vegetation' includes riparian planting. 'Other' includes all other land uses.

When considering alternative land uses, there are often trade-offs to be managed between different environmental objectives. No land use is without environmental impacts. Crops such as tulips, oats and avocados may have low greenhouse gas emissions per hectare compared to dairying, but they can require significant amounts of water and fertilisers and entail the use of chemical herbicides and pesticides.

In Wairoa, for example, an average avocado orchard uses around 26 times more water than a typical dairy farm.[3] For this reason, the area of avocado orchards in Wairoa was not expanded in any of the modelling scenarios.

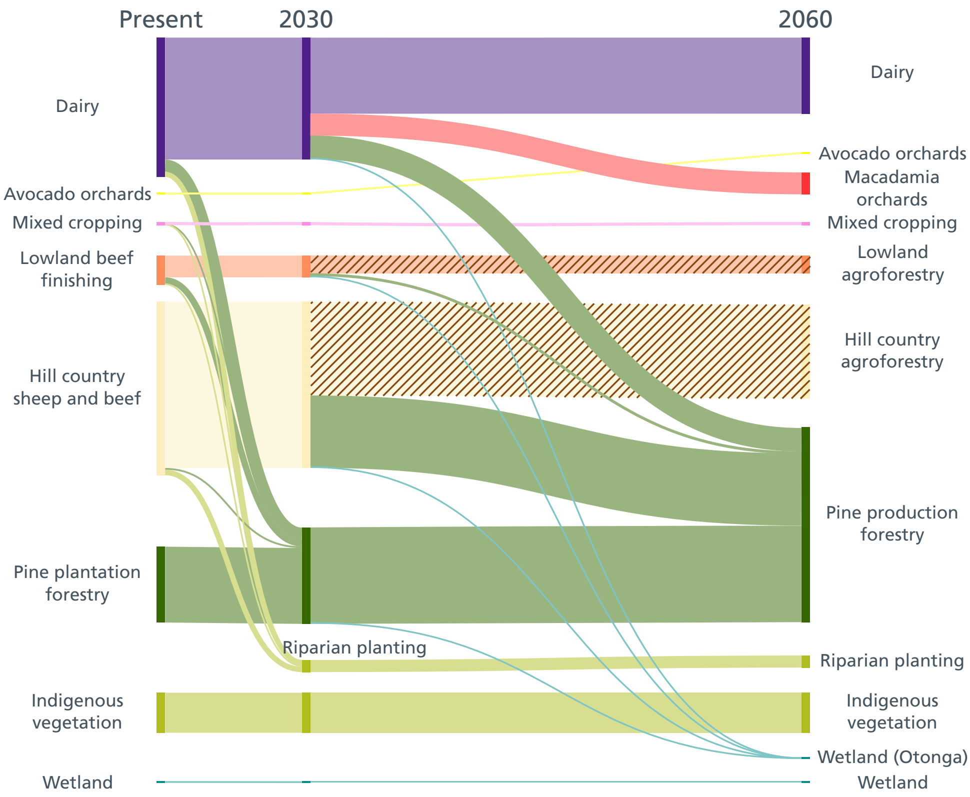
Converting some areas from intensive pastoral farming to less emissions-intensive land uses can increase profitability and reduce emissions, and it may also improve freshwater quality in some cases. For example, in a scenario where more land in the Mataura catchment was used for sheep dairying, tulip growing and pine production forestry (scenario 5, Figure 6.6), biogenic methane emissions were reduced by 14% by 2060 and nitrous oxide emissions were reduced by 21% by 2060 relative to the current level, while overall profitability at the catchment scale increased (Figure 6.4). Freshwater quality was also improved, with a 46% reduction in mean nitrogen terrestrial load (Figure 6.5) and a 55% reduction in mean phosphorus terrestrial load over the same period.



Source: Adapted from WSP (2023a) modelling

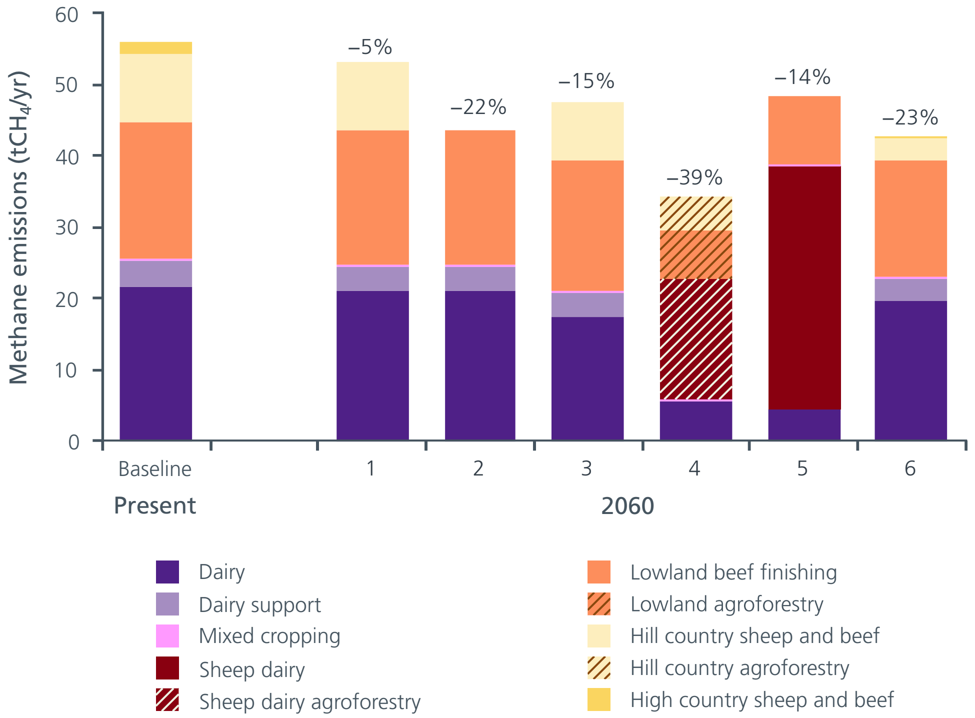
Figure 6.2: Modelled land use change in the Mataura catchment under scenario 4.

[3] WSP, 2023b, p.38.



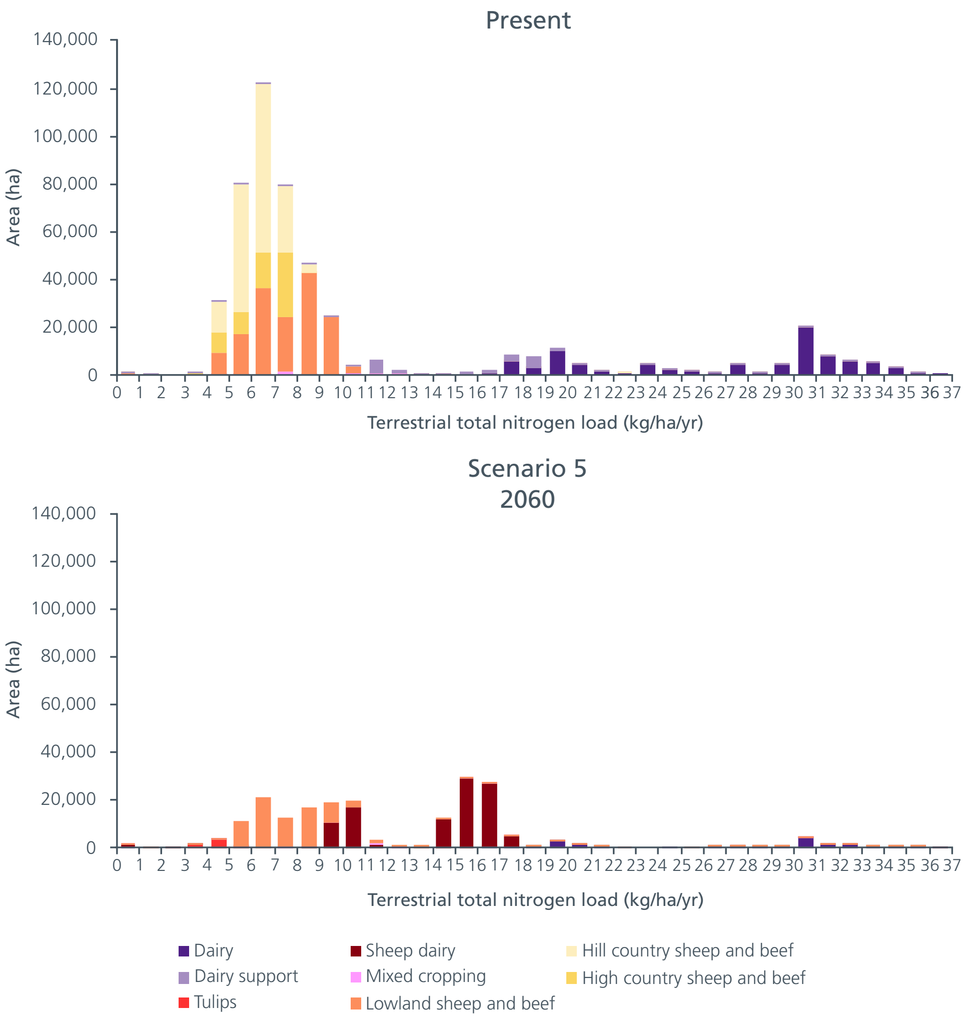
Source: Adapted from WSP (2023b) modelling

Figure 6.3: Modelled land use change in the Wairoa catchment under scenario 4.



Source: Adapted from WSP (2023a) modelling

Figure 6.4: Biogenic methane emissions in Mataura (present and 2060) under the six policy scenarios. The percentages above the bars are the reductions in biogenic methane emissions by 2060 under each scenario relative to the present level.

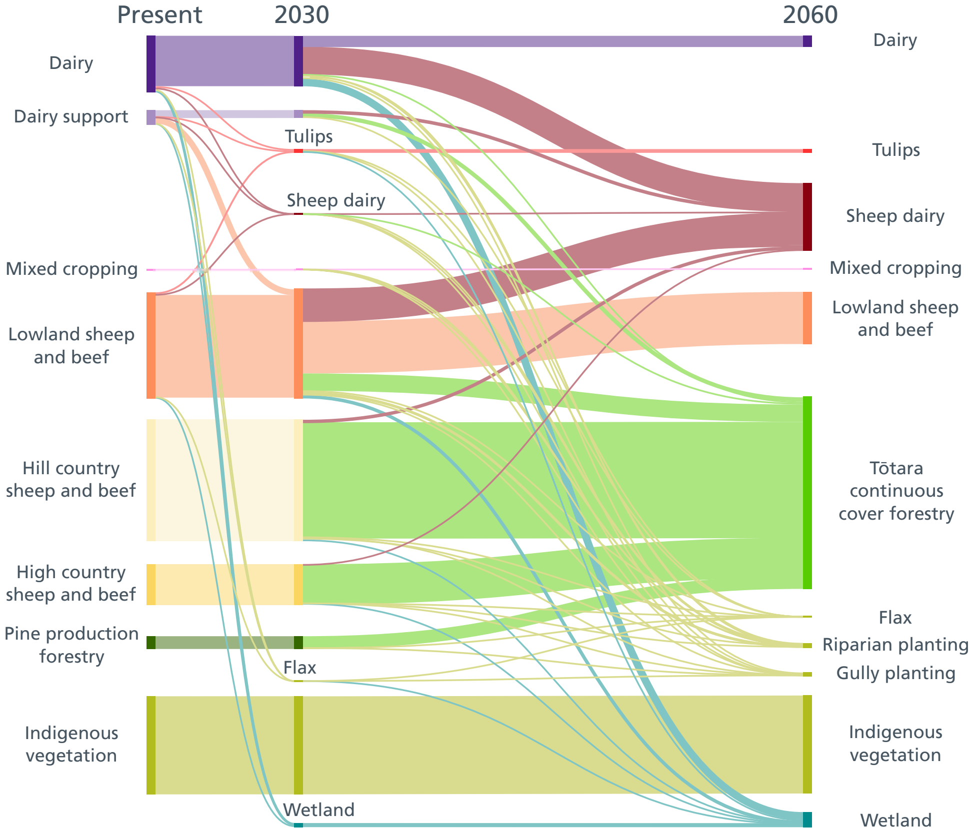


Source: Adapted from WSP (2023a) modelling

Figure 6.5: Change in total nitrogen load by land use in Mataura catchment between the present and 2060 under scenario 5 (estimates from the Nature Braid model).

Alternative forestry

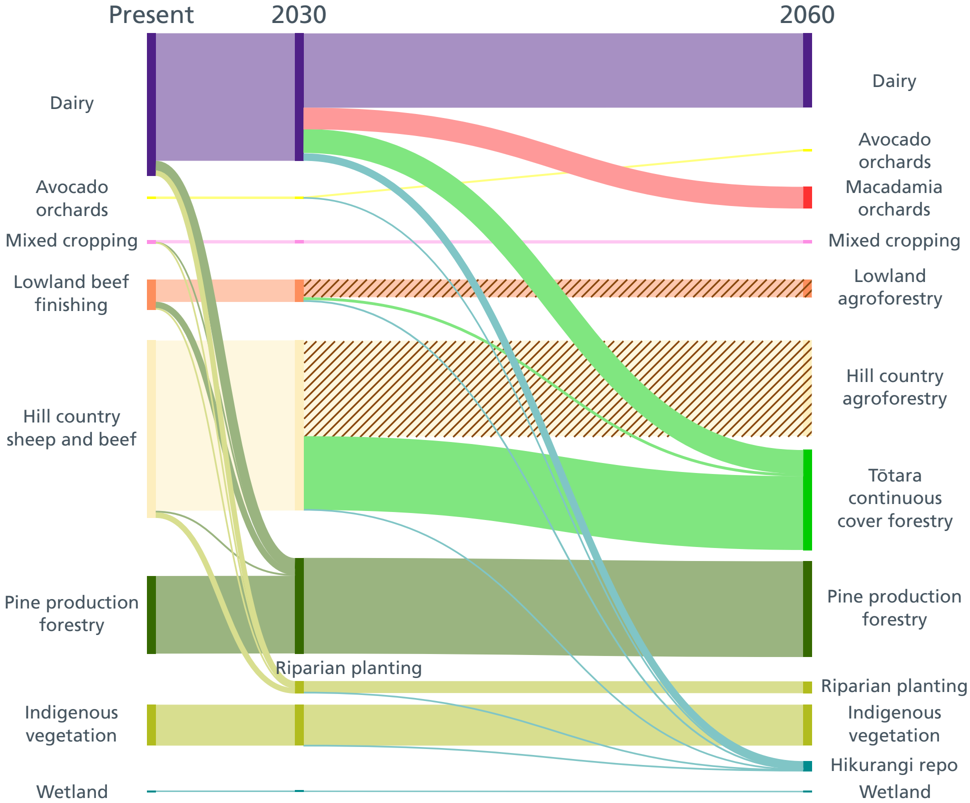
Most of the forests in Aotearoa are currently either native forests that are not harvested or *Pinus radiata* plantation forests that are clear-felled.[4] The modelling exercise considered the potential co-benefits (and costs) that might come from encouraging greater diversification of the forestry estate in Mataura and Wairoa (for example, see Figure 6.6 and Figure 6.7).



Source: Adapted from WSP (2023a) modelling

Figure 6.6: Modelled land use change in the Mataura catchment under scenario 5.

[4] Unharvested forests are sometimes referred to as 'permanent' forests. In the context of the New Zealand Emissions Trading Scheme (NZ ETS), for example, a 'permanent' forest is a forest that will not be clear-felled for at least 50 years. However, using the term 'permanent' in this way is potentially confusing because harvested forests can also be permanent, in the sense that land can be used for plantation forestry indefinitely.



Source: Adapted from WSP (2023b) modelling

Figure 6.7: Modelled land use change in the Wairoa catchment under scenario 5.

Alternative forestry types such as agroforestry systems, native continuous cover production forests, and unharvested native forests typically have lower carbon sequestration rates than fast-growing pine plantation forests.[5] On the other hand, they can offer benefits in terms of biodiversity and potentially erosion control (depending on the spacing of the plantings). The magnitude of these benefits is highly dependent on what species is planted and where. The 'right' forest to plant depends on the relative priorities of these different environmental objectives for the landscape concerned.[6] The PCE is currently undertaking further work on the topic of alternative forestry options to better understand the potential trade-offs they imply.

[5] For modelling purposes, the sequestration rates for tōtara were assumed to follow the default rates for indigenous vegetation from the NZ ETS lookup tables. These were likely underestimates because the lookup tables are based on naturally regenerating shrubland dominated by mānuka and kānuka and are undifferentiated by species or region (MPI, 2017, p.5; Aotearoa Circle, 2020, pp.14–15). A guide published by Thriving Southland shows how the carbon sequestration rates of tōtara forests in Southland can vary depending on the assumptions used (Thriving Southland et al., 2023).

[6] The benefits of integrating diverse tree clusters into landscapes are being assessed in Manaaki Whenua – Landcare Research's Trees in Landscapes (Te Kapunipunitanga a Tāne Mahuta) work programme (MWLR, 2023).

Improved forestry, climate, freshwater and biodiversity outcomes could be achieved through forestry policies that recognise the broader benefits that forests can provide beyond carbon sequestration. In the current approach, the main incentive for planting forests is provided by the NZ ETS. The financial reward from the NZ ETS depends only on the quantity of carbon sequestered by the forest. This incentivises the planting of fast-growing exotic tree species.

One way to recognise the broader benefits of forests would be to phase forestry out of the NZ ETS.[7] This would decouple incentives for forest planting from demand for offsets from fossil carbon dioxide emitters. If new forest planting were no longer funded by fossil emitters with unit surrender obligations under the NZ ETS, an alternative source of funding would need to be found to support new forest planting that could contribute to multiple environmental, social and cultural benefits.

Relying on funding from taxpayers alone to fill this gap is unlikely to be a realistic or durable solution. Removing forestry from the NZ ETS would likely boost auction revenues from the ETS. Some of that money could be reinvested in forestry. Other options to incentivise forest planting that delivers a wider range of benefits will be explored in forthcoming work.

Tailored actions to improve freshwater quality based on landscape characteristics

In addition to land use, landscape characteristics such as elevation, slope, climate, soil type, geology and hydrology are likely to be a significant driver of freshwater quality outcomes in some places. However, existing freshwater quality regulations such as the synthetic nitrogen fertiliser cap treat all pastoral land the same way. As part of the land use modelling undertaken for this investigation, tailored actions to improve freshwater quality based on landscape characteristics were considered as an alternative to uniform regulations.

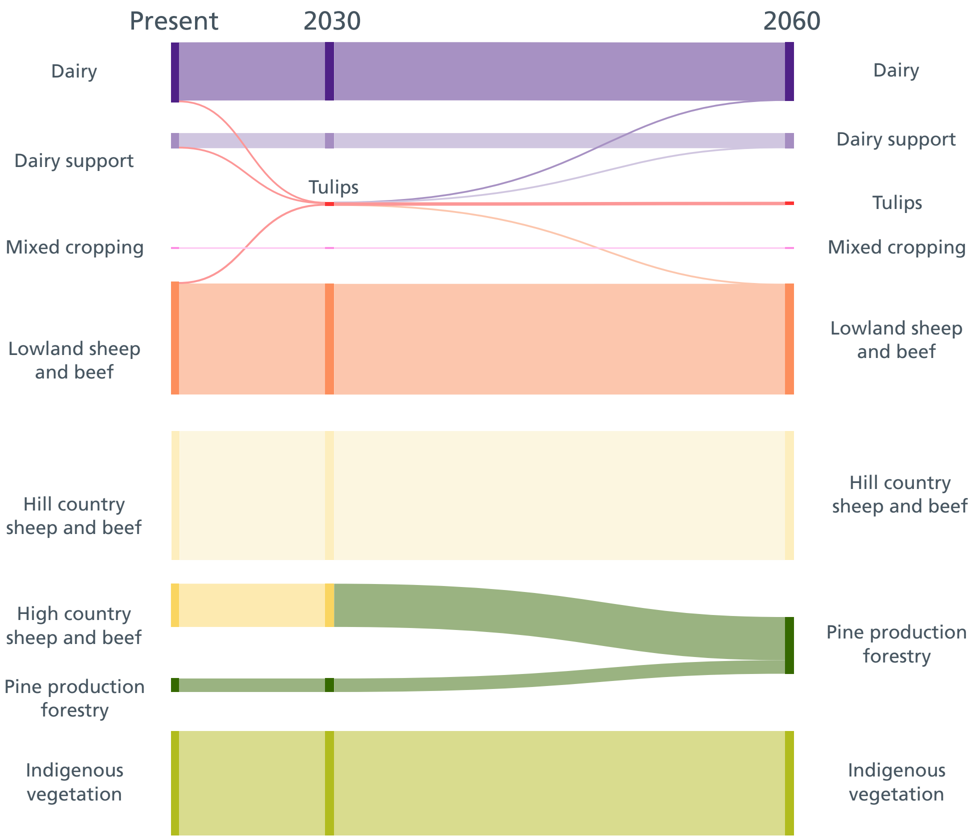
Some landscape characteristics can be quantified using a combination of direct measurements and modelling of characteristics that cannot be measured directly. For this exercise, the tools used to quantify the characteristics of the landscape and identify priority areas for interventions were the landscape susceptibility mapping work undertaken by Land & Water Science and the modelling of hotspots for management interventions by Nature Braid.

However, much of the knowledge and understanding that tangata whenua hold about the characteristics of the landscape cannot be quantified. There is therefore a risk of this information being ignored or undervalued in the policymaking process. While quantitative spatial information on landscape characteristics can be a useful resource for landowners, communities and tangata whenua when deciding what to do where within the landscape, any numerical information from models should be considered alongside (not at the expense of) qualitative forms of local and indigenous knowledge.

7 Removing forestry from the NZ ETS was one of the options proposed in the Government's review of the NZ ETS that took place between June and August 2023 (MfE et al., 2023). In July 2023, the Government also released a discussion document exploring a biodiversity credit system as a potential funding mechanism for forestry (MfE, 2023).

One way that spatial information on landscape characteristics could be used would be to prioritise actions in areas that are highly susceptible to loss of freshwater contaminants such as nitrogen, phosphorus, sediment and *E. coli*. This idea was tested in one of the land use modelling scenarios (scenario 3). In Mataura, the maps from Land & Water Science were used to identify areas of high susceptibility to loss of nitrate-nitrite nitrogen. The modelling then assumed that the maximum amount of synthetic nitrogen fertiliser applied in highly susceptible areas was reduced from the current limit of 190 kilograms of nitrogen per hectare per year (kgN/ha/yr) to a maximum of 85 kgN/ha/yr in 2030 and 65 kgN/ha/yr in 2060. In other areas, the limit remained unchanged. Figure 6.8 shows the land use changes under this scenario.

The resulting environmental benefits were modest – a 5% reduction in mean nitrogen terrestrial load and a 7% reduction in mean phosphorus terrestrial load from dairy farming in Mataura by 2060 relative to the current level.[8]



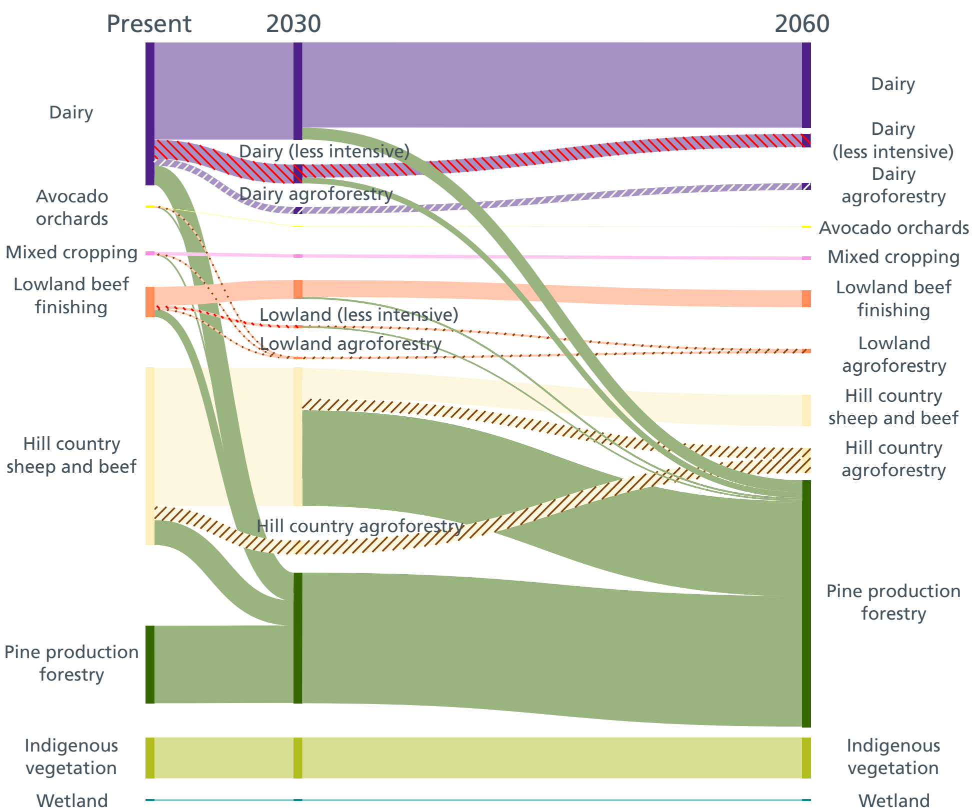
Source: Adapted from WSP (2023a) modelling

Figure 6.8: Modelled land use change in the Mataura catchment under scenario 3.

[8] Around 17% of land currently used for dairying in Mataura was identified as high-nitrogen-risk land. This means it was identified by Land & Water Science as being highly susceptible to loss of nitrate-nitrite nitrogen.

Reducing synthetic fertiliser use was one of the land management practices highlighted in a white paper published in 2019 outlining priorities for regenerative agriculture research in New Zealand.[9] Other examples included using diverse crops and pastures, minimising soil disturbance, maintaining soil cover, minimising chemical inputs and using adaptive grazing management. Projects to investigate the impacts of regenerative farming practices are being funded by the Ministry for Primary Industries through the Sustainable Food and Fibre Futures fund.[10]

In Wairoa, estimates of susceptibility to loss of sediment and pathogens from Land & Water Science as well as estimates of sediment delivery from Nature Braid were used to identify high-risk areas (Figure 6.9). The modelling indicated that integrating spaced poplars into hill country sheep and beef farms in high-sediment-risk areas at a minimum density of 100 stems per hectare could roughly halve soil losses per hectare. The modelling also assumed the poplars were registered in the NZ ETS and harvested for timber, adding an additional source of revenue for the farm.



Source: Adapted from WSP (2023b) modelling

Figure 6.9: Modelled land use change in the Wairoa catchment under scenario 3.

[9] Grelet et al., 2021, p.20.
[10] MPI, 2022a.

In addition to erosion control, poplars can provide shade for stock and can also be used as stock fodder. The light-coloured wood has a fine texture and can be used for furniture, toys, paper and plywood. The New Zealand Poplar & Willow Research Trust is supporting a breeding programme for poplar, and the New Zealand Farm Forestry Association established a Poplar Action Group in April 2023 to develop poplar as a commercial timber species in New Zealand.[11]

In Mataura, an agroforestry system using a mix of red beech/tawhairaunui with broadleaf/kāpuka as a nurse crop was modelled. Poplar is another promising option for agroforestry in Mataura, offering biodiversity enhancement, carbon sequestration, soil conservation and timber production benefits.[12]

While the wood yield and economics of agroforestry are highly site-specific and dependent on the demand for timber, the economic analysis suggested that planting widely spaced tree species such as poplar or red beech on livestock farms could be an opportunity for some farmers to increase their profitability while reducing their greenhouse gas emissions and mitigating soil erosion. The agroforestry systems in both Mataura and Wairoa were designed to reach crown cover of more than 30% and therefore be eligible for registration in the NZ ETS.[13] However, there are significant set-up costs for this sort of farm system change, including education and training. Further, cattle must be excluded during the transition period until the young trees are robust enough to withstand being knocked into and grazed by livestock.

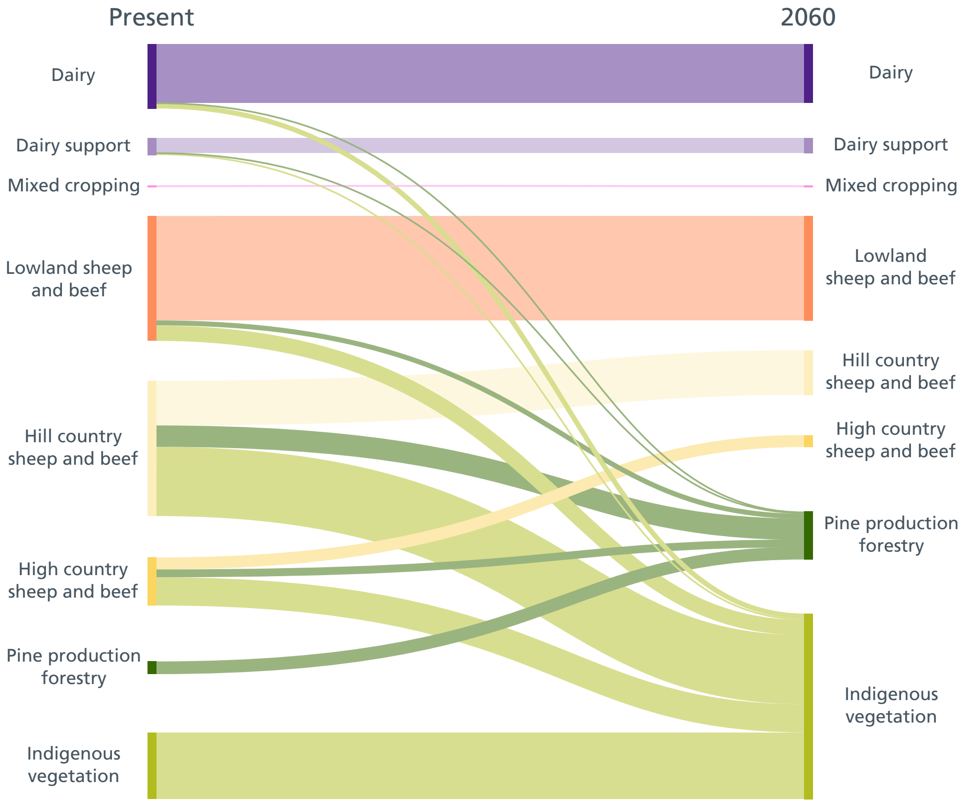
The modelling also explored the impact of livestock farms converting to mixed farm–forestry systems instead of whole-farm conversions to pine production forestry only. The farm–forestry systems integrated blocks of permanent native forests and pine production forests into the parts of the landscape that were least suitable for livestock farming. Under this scenario, some land was still being used for hill country sheep and beef farming in both catchments in 2060, though the area of land used for this purpose was reduced by two thirds in Mataura and halved in Wairoa relative to the present level (Figure 6.10 and Figure 6.11). The planting of pine production forests on marginal farmland provided an additional source of income for farmers, while the conversion of high-sediment-risk and/or negligible production capacity land to permanent native forest delivered benefits in terms of erosion control, flood mitigation and improved habitat connectivity for kererū.[14]

[11] New Zealand Poplar & Willow Research Trust, 2023.

[12] PCE integrated landscapes hui, pers. comm., August 2023.

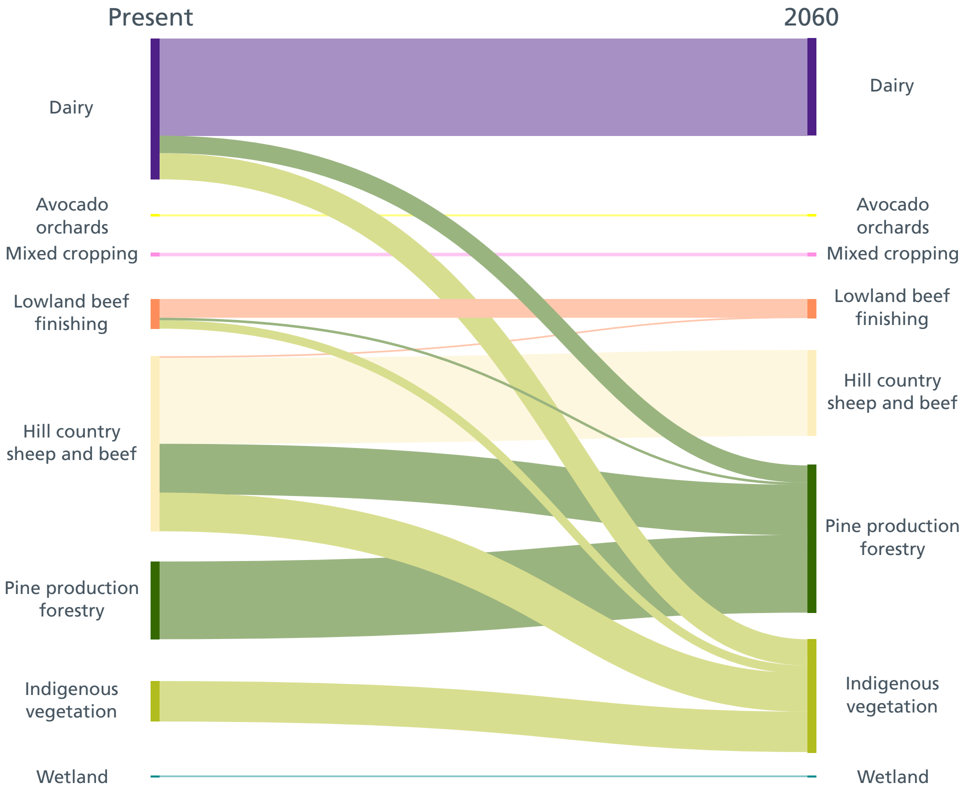
[13] A consultation on what the default carbon tables should be for space-placed poplars and willows in the NZ ETS was undertaken by the Government in September–October 2023 (Te Uru Rākau – New Zealand Forest Service, 2023).

[14] WSP, 2023a, pp.214–230; WSP, 2023b, pp.160–172.



Source: Adapted from WSP (2023a) modelling

Figure 6.10: Modelled land use change in the Mataura catchment under scenario 6. The impact of policies on land use in 2030 was not modelled in this scenario.



Source: Adapted from WSP (2023b) modelling

Figure 6.11: Modelled land use change in the Wairoa catchment under scenario 6. The impact of policies on land use in 2030 was not modelled in this scenario.

Using levy revenue recycling to connect climate, freshwater and biodiversity policies

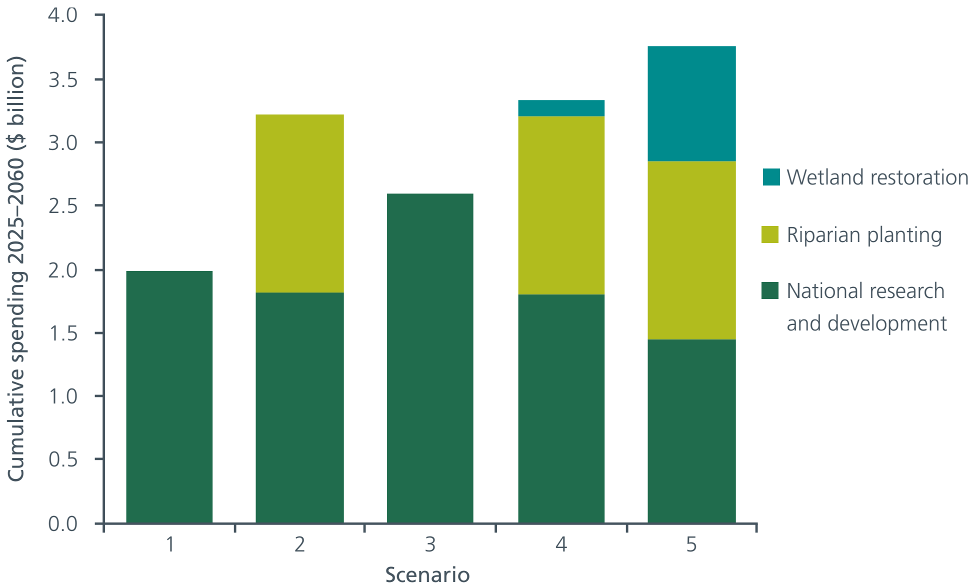
The investigation explored how different mixes of climate change, freshwater quality and biodiversity policies could be developed and implemented. In particular, with help from local people from each catchment, it considered what could be achieved if the revenue from a levy on biological greenhouse gas emissions were recycled back to the catchment it came from and used to fund actions that reduce emissions, improve freshwater quality and/or enhance biodiversity.

How the revenue will be used is an important aspect of the design of any agricultural emissions pricing policy. This modelling exercise assumed some of the levy revenue was used to fund national innovation policies and research and development of new technologies to reduce emissions (though the impacts of this spending were not modelled). He Waka Eke Noa recommended this as one of the ways to use the revenue from an agricultural emissions levy.[15]

[15] HWEN, 2022, pp.66–67.

This exercise also explored what might be achieved if the rest of the revenue from the levy were recycled back to the catchment it came from and used to enable landowners and kaitiaki to undertake actions within the catchment to reduce emissions, improve freshwater quality and/or enhance biodiversity. These actions included changes in land management practices and land uses, with interventions prioritised in the riskiest areas, as discussed above. If recycled in this way, the magnitude of funding coming back into each catchment could be significant. For example, in Wairoa the cumulative levy revenue collected during the period 2025–2060 varied from a low of $2.0 billion in scenario 1 to a high of $3.8 billion in scenario 5. Figure 6.12 summarises how this levy revenue was spent in five of the scenarios modelled for Wairoa.

There are some potential disadvantages to ring-fencing the levy revenue for specific activities in this way. For example, it risks precluding the allocation of the revenue to higher value public goods. Also, in the absence of additional sources of funding from elsewhere, the funding available for mitigation actions would be limited to the amount raised through the levy. To address this, other funding mechanisms such as government-backed loans or subsidies could be considered in addition to recycled levy revenue.



Source: Based on modelling by WSP and Nature Braid (WSP, 2023b)

Figure 6.12: Cumulative levy revenue spending in Wairoa for the period 2025–2060. Excludes subsidies for tōtara and loans for converting dairy land to macadamia orchards because these were not funded by levy revenue in the modelling. Excludes scenario 6 because levy revenue recycling was not modelled in that scenario.[16]

[16] Note that wetland restoration cost is a rough, high-end estimate. Actual costs would likely be lower than indicated due to economies of scale (Muller, 2020).

6 How could things be done differently?

7

Trichomanes endlicherianum

Findings and lessons learned

This report offers no recommendations for policy settings. In part this is because the modelling was experimental and those engaged in the two catchments were asked to take part on the basis that the aim was to learn from the exercise rather than to apply it. Furthermore, given the highly place-based nature of the exercise, it seemed prudent to avoid the temptation to extrapolate any learnings from Wairoa and Mataura to other places. Below is a summary of some learnings from the two case studies that may inform future work in this area.

Current land uses and main environmental issues

Significant land use change has already occurred in the Mataura and Wairoa catchments. Prior to human arrival, both catchments were mainly covered by indigenous forests and wetland ecosystems that provided habitats for a highly diverse range of plant and animal species. Returning to that world is beyond reach. Only fragments of these native ecosystems remain. Most of the land is now being used for dairying, sheep and beef farming, and exotic production forestry. Other existing land uses include deer farming in Mataura and horticultural crops such as avocado, kiwifruit and kūmara in Wairoa.

But it is not as though some new equilibrium has been reached. The way land is currently being used and managed in both catchments continues to degrade the environment. In the Mataura catchment, the biggest freshwater quality issues are associated with nitrate and *E. coli*. The amount of organic waste discharged from point sources such as factories and meat processing plants into the Mataura River has decreased since the 1970s. This has improved the appearance of the river. However, the level of nutrients and bacteria in the river remains elevated, largely due to diffuse sources within the catchment, such as pastoral livestock farming.

The biggest freshwater quality issue in the Wairoa catchment is sediment from pastoral farming and production forestry. Sediment from the Wairoa River is deposited in the Kaipara Moana, where it degrades the mauri of the harbour and damages its ecological health. For example, fine sediment can smother sea grass and overwhelm filter-feeding shellfish.[1]

[1] Increased sedimentation in Kaipara Moana has been attributed to reductions in the abundance of scallops (*Pecten novaezelandiae*), toheroa (*Paphies ventricosa*), tuatua (*Paphies subtriangulata*), cockles (*Austrovenus stutchburyi*) and pipi (*Paphies australis*) (Gibbs et al., 2012; Morrison et al., 2014).

Historical deforestation and draining of wetlands in Mataura and Wairoa transferred significant quantities of carbon dioxide from the terrestrial biosphere to the atmosphere. In addition to this contribution to warming from historical land use change, the ruminants that have been added to these landscapes are producing biogenic methane and soil nitrous oxide emissions. New forests are also being planted in these catchments. By removing carbon dioxide from the atmosphere, these forests are returning a small fraction of the carbon previously lost from past forest clearance back to the land.

What did we learn from the physiographic mapping of landscape susceptibility?

The physiographic mapping undertaken for this project indicated that there is significant spatial variation in the susceptibility of land to loss of nutrients and soil nitrous oxide within the Mataura and Wairoa catchments.[2] It also showed that in many parts of these catchments, the susceptibility can be high for one pollutant (e.g. nitrate) but low for another (e.g. nitrous oxide), and vice versa. In other words, there are often trade-offs that need to be managed between different environmental objectives. This underlines that solutions need to be place-specific. The best actions people can take in each place to improve the environment (and the best places to undertake them) also depend on what they are trying to achieve on the land.

The type of physiographic approach used for this modelling and mapping exercise was novel and remains at a relatively early stage of development. However, with further improvements (such as more comprehensive validation, quantification of uncertainties and wider ground-truthing of the results), tools such as this have the potential to be used to aid land-related decision making at scales ranging from whole-of-catchment down to sub-paddock.

The primary purpose of this model is to provide a pragmatic tool to help landowners, land managers and catchment groups to better understand their landscape and identify the best locations for making changes to land management practices and land uses. It remains unclear what formal role, if any, spatial modelling tools like this should play in a regulatory context. The PCE is currently undertaking a review of the use of freshwater models for regulatory purposes and intends to publish the findings on this topic in 2024.

The susceptibility modelling undertaken for this exercise was based on high-resolution spatial datasets coupled with scientific understanding of the physical and chemical processes driving freshwater and soil emissions outcomes. From a Ngāi Tahu ki Murihiku perspective, such a model cannot incorporate those metaphysical elements of culture and landscapes that are central to their world view. Therefore, any insights from landscape susceptibility mapping must be set alongside the insights from tangata whenua led frameworks and tools when making decisions related to land use and land management practices in the Mataura catchment.

[2] Rissmann et al., 2022. See also Rissmann et al. (2024) who showed that landscape factors (climate, geomorphology and lithology) accounted for as much, if not more, of the spatial variation in water quality in parts of New Zealand.

What did we learn from the land use modelling?

The land use modelling provided insights into how different environmental policy mixes might shape the Mataura and Wairoa catchments over the coming decades. It revealed how the impact on livestock farms of an agricultural emissions levy would likely be different in the two catchments studied.

At a low levy rate, the modelling indicated that all hill country sheep and beef land in Mataura would remain profitable in 2060 (though profit margins would be reduced). By contrast, only around one fifth of hill country sheep and beef land in Wairoa would remain profitable. This reflects the difference in the current profitability of hill country sheep and beef farming in these two catchments, with farms in Mataura generally having a higher profitability than farms in Wairoa. At medium or high levy rates, all sheep and beef land in both catchments would become unprofitable. In most locations, the model assumed that unprofitable sheep and beef land would be converted to pine production forestry registered in the New Zealand Emissions Trading Scheme (NZ ETS). In reality, what the best alternative use would be depends on the objectives and values of the landowner.

In general, an agricultural emissions levy would be expected to result in less land use change away from dairying than sheep and beef farming because most dairy farms are more profitable than sheep and beef farms – but again, the expected impacts would be highly place-specific. The modelling suggested that even at a high levy rate, all dairy land in the Mataura would remain profitable in 2060. By contrast, in Wairoa a high levy would make all dairy land unprofitable, while at a medium levy rate, dairy farms on moderate, high and very high production capacity land (around three quarters of current dairy land) would remain profitable.

A medium to high agricultural emissions levy – in combination with increasing rewards from the NZ ETS for planting fast-growing forests – would be expected to transform both catchments into largely binary landscapes of exotic forests and dairy farms by 2060. These potential impacts should be key considerations in the design of any levy on agricultural emissions or changes to the role of forestry in the NZ ETS.

The modelling suggested that the type of price-driven transition described above could bring some environmental benefits. For example, it would reduce flows of diffuse pollutants such as nitrate and *E. coli* into waterways, reduce agricultural emissions and increase carbon dioxide removals (though keeping this carbon safely stored in the terrestrial biosphere as the climate warms would become increasingly challenging). The sediment outcomes would depend on how the pine production forests are managed and harvested. The sediment loads from unharvested forests are generally lower than those from pasture, all else being equal. However, if pine production forests are clear-felled, there is a period of around eight years after harvest during which elevated levels of sediment and harvest debris can be lost from the land, particularly when extreme weather events occur.

The modelling also highlighted that the scenario outlined above would be expected to result in a decrease in revenue from sheep and beef farming and an increase in revenue from selling carbon credits from forests into the NZ ETS market in both catchments. The extent to which the increased revenue from forestry would benefit the people living in these catchments would depend on who owns the forests. Also, tying a significant share of people’s income to the price of forestry units in the NZ ETS is risky.

The future role of forests in the NZ ETS (and the associated value of the units they generate) is uncertain. Registering forests planted after 1989 in the NZ ETS is not mandatory – it is a voluntary decision that involves weighing up the financial reward of revenue from future unit sales against the opportunity cost of locking up land indefinitely in forest. Significantly, even without revenue from the NZ ETS or a levy on agricultural emissions, producing timber (and potentially other wood-based products such as bioenergy) is likely to be a more profitable use of land than hill country sheep and beef farming in most parts of the Mataura and Wairoa catchments.

Unsurprisingly, introducing a more nuanced, place-based mix of policies produced different insights. The modelling demonstrated how spending the revenue from an agricultural emissions levy on actions such as fencing off waterways, planting up riparian buffers and restoring wetlands in Mataura and Wairoa could help to reduce the quantities of nitrogen and phosphorus entering waterways, provide habitat and biodiversity corridors for indigenous species such as kererū, and help to mitigate the risk of flooding. It also demonstrated how planting tōtara continuous cover forests instead of clear-felled pine production forests would be likely to reduce erosion and soil losses.

Using some of the revenue from an agricultural emissions levy to assist the scaling up of less emissions-intensive land uses could help to reduce greenhouse gas emissions. Macadamia orchards in Wairoa and tulips in Mataura were used as examples of high-value, low-emissions land uses for the purposes of this modelling exercise. However, these alternative land uses may have other environmental effects that need to be considered, such as demand for water or the use of chemical herbicides and pesticides that are potentially harmful to ecosystem and human health. No productive land use is entirely environmentally benign.

There are several different ways that trees could be integrated into farm systems. Options explored in the modelling included mixed farm–forestry systems (with permanent native forests planted on high-sediment-risk land, exotic production forestry planted on marginal but not high-sediment-risk land, and livestock farming retained on the best land) and agroforestry systems that combine wide-spaced poplars or red beech trees with pasture.

The modelling indicated that integrating trees on farms has the potential to increase the profitability of farms in Mataura and Wairoa while reducing emissions, increasing carbon dioxide removals, and providing erosion control and biodiversity benefits. However, there is limited experience with agroforestry in New Zealand. Further research and pilot projects are needed to investigate the potential economic and environmental benefits of agroforestry systems and how these are likely to vary in different parts of the country.

The land use modelling exercise did not assess the social or cultural impacts of the hypothetical land use transitions outlined above. Some commentary from other sources on these aspects is provided in the sections below.

Wider social and economic considerations

Land uses will need to change in some places if their environmental impacts are to be reduced and the mauri of the wai and the whenua is to be protected and restored. The social and economic impacts of any transition will vary depending on how it is managed and the policies put in place to support the people affected.

Agriculture and forestry are significant contributors to the local economies of Mataura and Wairoa. In 2021, agriculture accounted for 7.8% of Northland's gross domestic product, while forestry, fishing and mining accounted for 3.7%. In Southland, the shares were 18.3% and 4.7%, respectively.[3] In terms of employment, the dairy sector employed 2.7% of the workforce in Northland and 7.6% of the workforce in Southland in 2023.[4] Many forestry-related jobs are part-time and/or seasonal, which makes measuring and estimating regional employment in the forestry sector difficult.

Estimates of the economic impacts of large-scale land use change are uncertain and highly dependent on the assumptions used. The modelling undertaken for this investigation indicated that the introduction of a levy on biological greenhouse gas emissions would decrease the profitability of livestock farming, making less emissions-intensive land uses such as forestry and horticulture more attractive. Alternative income streams such as tourism, bioenergy, wind power and solar power could also help farmers and tangata whenua to maintain viable businesses while reducing their emissions.[5]

Like any large-scale economic transition, significant land use change is likely to result in winners and losers – as there are under the status quo. Exploring the possible consequences for landscapes of different policy mixes could help the Government to design targeted support policies for people negatively affected by any transition. A just transition is needed in the agriculture sector, not just in the energy sector.[6]

Having a variety of income streams would help to improve the resilience of the community and tangata whenua to external economic shocks. This is because if one source of income suddenly decreases, at least some income is likely to continue from other sources. By contrast, if there is high reliance on only one or two sources of income, communities and tangata whenua are at greater risk of significant income losses in the event of external shocks.

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[3] StatsNZ, 2023.

[4] Sense Partners, 2023, p.6.

[5] A regional energy strategy for Southland for 2022–2050 prepared by Beca Ltd identified over 100 potential sites for wind farms and concluded that embedded solar farms close to electricity loads could also contribute to electricity generation in Southland (Beca, 2023). Further, a 2023 study funded by the Our Land and Water Rural Professionals Fund found that a significant area of Canterbury is suitable for integrating solar energy production with livestock farming (known as 'agrivoltaics') and indicated this could be a significant opportunity for some sheep and beef farmers to increase their profitability (Vaughan et al., 2023).

[6] A guide to just transitions in any sector was developed by a team of contributors led by Motu and published in 2023 (Allen et al., 2023).

The economic and social benefits of production forests partly depend on their proximity to wood processing facilities and ports, as well as demand for timber and other wood products. The greater the capacity of wood processing facilities within a region, the greater the share of the economic benefits that can be captured locally. Of all the logs produced in 2021, 39% were processed in New Zealand.[7] A Forestry and Wood Processing Industry Transformation Plan was released by the Government in 2022. One of the key objectives of this plan is to modernise and expand domestic wood processing.[8]

While there is potential to expand the forest industry in Northland, realising this potential could be challenging.[9] For example, without a rapid upskilling of the local workforce, there may be limits to the amount of land in a region like Northland that can be converted to production forestry. Incentives for land use change therefore need to be accompanied by policies to enhance the skills and training (as well as infrastructure) needed to expand alternative land uses and supply chains. The rate of expansion of alternative land uses such as forestry also needs to be acceptable to the community and tangata whenua.

What did we learn from Māori perspectives on this kaupapa?

Māori have a deep connection to landscapes reinforced over many generations. The knowledge that was gained from fine-grained observations has not been lost but now needs to be embedded and truly acknowledged. Unsurprisingly, the scale of environmental upheaval caused by the large-scale changes in land use that have occurred in the Mataura and Wairoa catchments since the arrival of Europeans is felt most intensely by Māori. Much of what was of greatest value to them has been destroyed or severely diminished. A lot of the land they do still hold or act as kaitiaki of has relatively low productive potential and remains under-developed. Māori should not be penalised for this.

Restoring parts of the native ecosystems that have been lost (such as the Hikurangi Repo) by retiring land from farming would undoubtedly provide significant environmental and cultural benefits. However, it would be expensive. If this option were to be pursued, an inclusive and carefully designed process involving mana whenua, local authorities and farmers would be needed to work through thorny issues such as who pays.

Mana whenua are actively expressing their rangatiratanga by developing their own frameworks and tools that illustrate their understanding and connection to their landscapes. These include, but are not limited to, economics, biodiversity and freshwater, and also encapsulate concepts beyond what was modelled here or can be modelled. Both mana whenua groups provided us with a description of these concepts.

Engagement with mana whenua needs to start early and be sustained and adequately resourced. Ensuring all mana whenua are able to assert their rangatiratanga as kaitiaki and contribute their mātauranga will take time. This will be time well spent if it secures involvement and a clear idea of what the outcomes of the exercise might be.

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[7] Of the 37.2 million tonnes of logs produced in the year ended December 2021, 14.5 million tonnes were processed in New Zealand (FOA, 2023, p.23).

[8] MPI, 2022b, p.28.

[9] Martin Jenkins, 2015, p.1.

Any collaborative approach going forward would need to consider how to ensure mana whenua and their role as kaitiaki are acknowledged and how to co-develop solutions using different knowledge systems and ontologies. Taking a more joined-up approach to addressing environmental challenges at the landscape level requires getting inside what the landscape as a whole signifies to Māori and the community, while also ensuring that the voices of mana whenua as kaitiaki can express that and see it reflected in regulatory decisions. What is essential is understanding the values and aspirations of Māori for landscapes in their rohe and ensuring that these are taken into account in land use decisions.

The multiple overlapping policies and plans that tangata whenua are currently requested to contribute to in a disjointed way creates fatigue and adds complexity to deciding how they might like to participate. Spreading themselves too thinly across too many projects results in fewer people involved in important work. Any such complex and collaborative process is likely to be resource-heavy due to the need for endorsement by the appropriate people of the hapū. This may come from mandated organisations, marae, whenua Māori trusts, or individual kaumātua, hapū or whānau members. For this reason, early engagement to enable mana whenua to identify capability and capacity needs is essential – something this project failed to achieve.

Mana whenua are a part of environmental decision making and many whānau, hapū and iwi are kaitiaki of whenua in Aotearoa. Most are already using their definitions of landscapes to better manage and restore degraded landscapes within their rohe. The long-held connection that tangata whenua have with the land means they have a deep understanding of their landscapes and knowledge that can provide an essential perspective for decision making in their catchments.

What else did we learn from our conversations with people in these two catchments?

Landowners and tangata whenua in both catchments are under increasing pressure from current and forthcoming climate change, freshwater quality and biodiversity policies (not to mention the effects of extreme weather events themselves). There is also pressure on people to respond to the large number of consultations and policy announcements that emanate from different government agencies. It is difficult to see how these all fit together.

It was clear from our conversations that people fear that, in the absence of complementary policies or support, large-scale land use change driven by price-based mechanisms for dealing with greenhouse gases could result in negative impacts on low-income households, rural communities and tangata whenua in the Mataura and Wairoa catchments. These impacts include loss of employment in the pastoral agriculture sector and related industries, reduced viability of local businesses and services, and a decline in social cohesion and sense of community. On the other hand, improved freshwater quality (in terms of instream concentrations of nitrogen, phosphorus and *E. coli*) could provide better opportunities for mahinga kai, while people with interests in exotic forestry would stand to benefit economically under such a scenario.

Another recurring theme in our conversations with people was that climate change is likely to exacerbate many of the problems outlined above. An increased frequency of extreme weather events is already being experienced – this project spanned several heavy rainfall events in Northland. In Wairoa, events like these are likely to become more frequent and intense in the future, which could increase the risk of sediment loss from pasture and clear-felled plantation forests. Droughts could increase the risk of forests being lost through fire, thereby re-releasing their carbon back into the atmosphere. Heatwave days are expected to increase for most of the Mataura.[10] There will also be changes in the crops that can be grown in both catchments. Communities are coming to terms with the need to build their resilience in the face of a changing climate. For example, nearly all of Wairoa's kūmara production is currently located in one low-lying area near Dargaville, which is risky from a flooding perspective.

While promising alternative land uses exist in both catchments, communities are aware that these cannot be scaled up overnight. Joined-up investment in infrastructure, skills and market analysis would be needed for them to succeed.

There is an understanding that setting freshwater quality targets for the whole of these catchments makes sense because all the waterways within each catchment are connected. However, these catchments are probably too large for people to coordinate and work together effectively. Building trust and relationships is key to the success of networks such as catchment groups, but this will be hard to do if the members are far apart.[11] Any bottom-up approach to meet catchment-wide goals may therefore need to be implemented through networks of smaller groups at the sub-catchment scale.

[10] Zammit et al., 2018, p.12.
[11] Sinner et al., 2023, p.18.

Conclusion

This project originated in an earlier modelling exercise to determine what continued reliance on afforestation to meet New Zealand's climate change mitigation targets might mean for catchments and the people who live in them. By extending the analysis to include policies designed to address freshwater quality and biodiversity, as well as the economic costs of implementing them, the complexity of the task was increased significantly. With the resources available, the output was never going to be more than illustrative of the scale and nature of the task – both technically and in human terms. Nevertheless, the exercise demonstrated that integrating landscape susceptibility mapping, land use and economic modelling, and community and Māori input at a catchment level can generate insights into what the future of a landscape might look like under various policy mixes.

My hope is that others find the approach useful and interesting and will take the work forward. However, the concept would need substantially more development before being used to inform decision making by regulators, mana whenua, businesses, land managers or communities. The work needed includes rigorous testing and debate about which models to use, the appropriateness and the robustness of their assumptions, and how to integrate or not integrate Māori perspectives in different places.

What seems clear is that the scale of environmental pressures (of which climate change is only one) will make significant land use change increasingly likely. Whether and how such change is managed is a matter for both the market and policymakers. But whatever choices are made, they will be fraught with environmental consequences.

Blechnum zeelandicum

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This report and other publications by the Parliamentary Commissioner for the Environment are available at pce.parliament.nz.

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Parliamentary Commissioner for the Environment
Te Kaitiaki Taiao a Te Whare Pāremata

9.6 Our Role In Regional Transport Planning

Report by: Russell Hawkes – Lead Transport Planner}
Approved by: Lucy Hicks, General Manager Policy & Government Reform
Report Date: 21 May 2024

Purpose

The purpose of this report is to brief the Council on legislation that sets out the responsibilities Council has for Regional Transport Planning.

Summary

The report provides an indication of the legislation that governs the role regional councils have in transport planning. A brief summary of the current situation is provided, highlighting the role of the Regional Transport Committee, Regional Land Transport Plans and Regional Public Transport Plans in Southland.
A short presentation will accompany this report to highlight issues currently being faced in the transport planning area.

Recommendation

It is recommended that the Strategy and Policy Committee resolve to:

1 Receive the report - Our Role in Regional Transport Planning

Background

The role Regional Councils have in Transport Planning is set out in the Land Transport Management Act 2003 (LTMA) and subsequent amendments. The LTMA came into effect in 2003 and combined the requirements of the Transport Licensing Act 1989 and the Transit New Zealand Act 1989. The Transport Licensing Act dealt with public transport requirements for Regional Councils and the Transit NZ Act 1989 dealt with roads, state highways, motorways and funding of the transport system.

The LTMA has the following major sections that have implications or responsibilities set out for Regional Councils:

- Part 2 - Planning & Funding of land transport systems:
    - Regional Land Transport Plans.
    - Police activities.
    - National Land Transport Programme.
    - Rail Network Investment Programme.

- Part 3 – Land Transport strategic documents:
    - Government Policy Statement on Land Transport.

- Part 4 – New Zealand Transport Agency and Regional Transport Committees:
    - NZTA roles, objectives functions and Operating Principles.
    - Regional Transport Committees.
    - Appointed by the Regional Council as soon as practicable after each triennial election.
    - Has two members from the Regional Council and one from each of the territorial authorities plus one from NZTA.
    - Prepare the Regional Land Transport Plan on behalf of the Regional Council.
    - Provide the regional council with any advice and assistance the council may request.

- Part 5 – Regulation of Public Transport

- Prepare a Regional Public Transport Plan if the council intends to enter into a contract for the supply of a public transport service, operate a service itself or provide financial assistance to an operator of any passenger service.

Current Situation

Regional Transport Committee

The Council appointed the current Regional Transport Committee at their meeting on the 25 January 2023. The Committee meets jointly with the Otago Regional Transport Committee at least three times per year and more often if required. Joint meetings have been held since mid-2012 to coordinate and prepare a joint Regional Land Transport Plan for the two regions.

In 2012, both Regional Councils agreed there was a direct benefit to be gained in terms of efficiency and effectiveness for a joint Regional Land Transport Plan to be developed. The joint approach has been held up by NZTA as an example of regions working effectively together and of good practice.

Regional Land Transport Plan

The Regional Land Transport Plan (RLTP) is prepared every six years with a requirement for a mid-term review. The current RLTP was submitted to NZTA in June 2021 to cover the period July 2021 to June 2027. The RTCs are currently in the process of completing the required mid-term review.

The RLTP sets the vision, ten-year priorities and the policies to achieve both, and includes a funding and project section where Road Controlling Authorities submit their request for funding assistance from the National Land Transport Fund. A major component of the funding and project section of the RLTP is the proposed state highway works for the ensuing three-year period.

Regional Public Transport Plan

On the 28 July 2001 responsibility for the preparation of a Regional Public Transport Plan and the operation of the public transport services within the Invercargill City Council area was delegated to the Invercargill City Council. This transfer was completed under the legislation in place at the time but would not be possible under the now current LTMA.

The delegation remains in effect until such time as either party wishes to revoke the agreement. Invercargill City Council prepare the Regional Public Transport Plan and manage the services under that plan.

Current Issues and the future

The current review of the Regional Land Transport Plan has been substantially disrupted by late delivery of the Government Policy Statement (GPS) following the general election. The RLTP must be consistent with GPS while NZTA must give effect to the GPS. A draft GPS was released for consultation in March 2024 and is expected to be finalised and released by the end of June. This delayed the state highway programme development and subsequent timeframe for completion of the RLTP review. The RTC will have a recommended Regional Land Transport Plan for the period 2024/27 to be considered by Council and submitted to NZTA by the due date of 31 August 2024.

Submissions on the Regional Land Transport Plan have largely been supportive of the Plan's priorities of maintaining and renewing the existing network, safety and resilience improvements. Requests have been made for transport options between Invercargill and Christchurch, provision of link cycle trails between communities and improved access for the transport disadvantaged. The submissions are being heard on the 31 May and 4 June with deliberations to follow. The Regional Land Transport Plan will be considered again by the combined RTCs on the 24 June.

Presentation to support the report

A short presentation will be provided to highlight specific issues around the current misaligned land transport planning framework and the subsequent implications.

Fit with strategic framework

OUTCOME	CONTRIBUTES	DETRACTS	NOT APPLICABLE
Managed access to quality natural resources			X
Diverse opportunities to make a living	X		
Communities empowered and resilient	X		
Communities expressing their diversity	X		

Attachments

Nil

9.7 Land 2024 report update

Report by: Shana Lee, Policy Planner
Approved by: Lucy Hicks, General Manager Policy & Government Reform
Report Date: 19 June 2024

Purpose

To inform Councillors of the findings of *Our land 2024* report published by the Ministry for the Environment in collaboration with Stats New Zealand, and to note implications for Southland and Environment Southland's operations.

Summary

This report is the third in New Zealand's environmental reporting series on land. Recognising the uniqueness of New Zealand's land and associated ecosystems and the importance it plays in the lives of many here, the report explores the current state of the various ecosystems, the benefits they provide us, and how we've placed them under pressure.

Recommendation

It is recommended that the Strategy and Policy Committee **resolve to:**

1 Receive this update.

Background

This report is the third in a series of environmental reports, following reports in 2018 and 2021, released under the Environmental Reporting Act 2015. The report focuses on the natural or semi-natural structural elements of ecosystems and landscapes that are particularly important to delivering benefits for the environment and people. The benefits offered by Aotearoa's land and associated ecosystems include improving water quality, absorbing atmospheric carbon, enhancing flood control, supporting biodiversity, and supporting our mental, cultural and physical health. They also provide the foundation for our economy which heavily relies on primary production and tourism sectors.

Our soils

Maintaining soil quality and quantity is critical as they play an important role in supporting biodiversity, purifying water, cycling nutrients and storing carbon. They underpin our agricultural and horticultural industry with the latest records show that the food and fibre sector accounted for over 75 percent of New Zealand's total in export goods. Various land uses like deforestation, urban sprawl and densification, and agricultural intensification degrade soil quality and quantity.

- 5% of our land was classified as highly erodible in 2022, and approximately 182 million tonnes of eroded soil entered our rivers in 2022.
- More than 300,000 landslides occurred in the affected areas from Cyclone Gabrielle in 2023.

Highly productive land and urban green spaces

Urban expansion has been putting significant pressure on highly productive land near cities and urban green spaces. Highly productive land is crucial for primary production, like market gardening whereas urban green spaces are vital for community's mental and physical well-being as well as environmental services such as lowering ambient temperatures, reducing stormwater runoff, and supporting biodiversity. In particular, the reduced availability of highly productive land in the Auckland and Waikato regions could contribute, alongside other factors, to an increase in fruit and vegetable prices of up to 58 percent across the country by 2043.

- Approximately two-thirds of our population growth is projected to occur in less than 3% of our land area, in and around Auckland, Hamilton, Tauranga, Wellington and Christchurch. A 54% increase in highly productive land used for urban or residential purposes has occurred between 2002 and 2019, from 69,920 to 107,444 hectares.
- Private garden space as a proportion of urban area declined by 20% in Auckland, and 15% in Hamilton between 1980 and 2016.

Our indigenous forests
Forests in New Zealand serve as crucial habitats for numerous threatened species, valued for their cultural significance and medicinal resources. They also play essential roles in soil protection, carbon sequestration, and climate regulation. Historically, indigenous forests were cleared for agriculture, while exotic forestry, particularly radiata pine, has expanded into pastoral areas, driven partly by international demand and climate mitigation efforts. Although exotic plantations offer economic and climate benefits, they also present challenges like slash production, wilding pine spread, and carbon loss during harvesting.

- A quarter of remaining native vegetation is hosted on private land.
- 12,869 ha of indigenous land cover was lost in Aotearoa between 2012 and 2018.

Our floodplains and braidplains
Floodplains and braidplains in New Zealand are vital ecosystems that serve several critical functions. They support diverse habitats, help regulate river systems during floods, and filter sediment and nutrients. However, their appeal for development has led to increased risks for communities and infrastructure from flooding and erosion, necessitating engineered flood protection measures. Urban and agricultural development alongside our braided rivers are exacerbating the issues by constraining river channel margins. Climate change is expected to intensify these pressures, threatening both natural habitats and cultural/recreational values. While engineered protections aim to safeguard communities, they also disrupt the natural functions of river systems. There's a growing realisation that current flood protection measures may not be adequate to handle future climate-related risks.

- More than 400,000 residential buildings, an estimated 12% of our housing value, are exposed to flooding during extreme weather events.
- 11,630 ha of riverbed and riparian margins, across 20 braided rivers were converted to agricultural use between 1990 and 2012.
- Damage from Cyclone Gabrielle and the Auckland floods may total between $9 billion to $14.5 billion in recovery costs.

Our dunes and wetlands
Coastal dunes and wetlands play crucial roles in protecting coastlines, filtering nutrients, and storing carbon. They also offer recreational and cultural opportunities, serving as important habitats. For Māori, wetlands hold significant cultural value, supporting traditional food-gathering practices and offering insights into ecosystem health. However, urban development along coasts has hindered the natural migration of dune systems, reducing their effectiveness in flood protection. Total wetland loss has been substantial, with a significant portion converted for agricultural use, resulting in carbon release and loss of ecological and cultural values.

- 80% of sand dunes was lost between 1950 and 2008.
- 5,761 ha of freshwater wetland was lost between 1996 and 2018.
- 72,000 New Zealanders are exposed to extreme coastal flooding. At least 50,000 buildings worth $12.5 billion and 191 marae are within 1 km of the coastline.

The evidential base

The current understanding of our impact on natural infrastructure highlights its degradation, yet gaps in data hinder a comprehensive assessment of its ecosystem effects and value. Monitoring typically focuses on species abundance or habitat extent rather than ecosystem health, and there's a lack of standardised terminology and typology for ecosystems. Furthermore, quantifying the value of nature is complex, especially considering evolving relationships with nature and challenges in translating this value into terms that allow visibility within decision-making, such as monetary terms. However, recognising and valuing natural infrastructure is essential for realising its potential as an alternative to conventional solutions and leveraging its multiple benefits.

Implications for Southland

The findings provide valuable data and observations that can be incorporated into future regional decision-making and environmental management.

- The report's emphasis on the importance of soil quality and quantity reinforces the imperative for continual investment in measures aimed at preventing and reducing soil erosion and improving soil health.
- The report noted the dilemma of using exotic forests for climate change mitigation when they result in adverse effects for other environmental issues. Ongoingly engaging with relevant authorities and agencies to explore other options that provide a more integrated solution to multiple environmental challenges.
- It acknowledges the necessity of shifting from rigid flood protection structures to natural solutions for community safety. Additionally, it cautions against constraining channel margins through riverbed development. This reinforces the importance of integrating natural solutions into river management to realise multiple benefits in climate adaptation, biodiversity protection, and water quality improvement.
- Similarly, coastal development is flagged as a mis-guided step that can exacerbate coastal flooding risk and undermining natural protection offered by sand dunes. We will need to partner with territorial authorities and iwi to address this challenge.
- By highlighting the dramatic loss of wetlands, the report underscores the need to continue strengthening measures to protect and restore the wetlands of Southland.
- It also highlights the need for Southland to invest in ongoing monitoring of ecosystems, including assessing their condition and health as well as the extent of habitats, and abundance of species.
- Moreover, to facilitate essential systematic enhancements, Environment Southland can explore collaboration with other regional authorities to advocate for the necessary enhancements including:
    - quantifying natural values;
    - developing common terminology and typology for ecosystems.

Fit with strategic framework

OUTCOME	CONTRIBUTES	DETRACTS	NOT APPLICABLE
Managed access to quality natural resources	X		
Diverse opportunities to make a living	X		
Communities empowered and resilient	X		
Communities expressing their diversity			X

Attachments

Our land 2024 report

Our land 2024: a snapshot

1. Our-land-2024 [**9.7.1** - 65 pages]
2. Our-land-2024-snapshot [**9.7.2** - 8 pages]

C.11

Our land 2024

New Zealand's Environmental Reporting Series

Ministry for the Environment
Manatū Mō Te Taiao

Stats NZ
Tatauranga Aotearoa

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Message to readers

Tēnā koutou katoa

Aotearoa New Zealand is a relatively young nation, situated on the boundary of the Pacific and Indo-Australian tectonic plates. Our geological setting gives rise to a range of dynamic landscapes, from the alpine environments of the south to the volcanic landscapes in the north. This diverse geography, and our isolation, laid the foundation for Aotearoa to become home to a wide range of ecosystems and species found nowhere else on Earth.

Over millennia these ecosystems and species have evolved, developing ways to thrive across a variety of landscapes. Human habitation has always placed additional pressure on this balance. Our pursuit of economic prosperity, founded in the rich natural resources Aotearoa has to offer, has often diminished the functioning and resilience of our natural environment – which in turn has social, economic and environmental consequences for us.

Previous reports in the *Our land* series have explored these pressures and their impacts (2018) and the intensity with which we're using and managing them (2021). This report, our third in the *Our land* series, builds on its predecessors and explores environmental trade-offs, and the potential of our natural infrastructure to provide solutions, while also seeking to take full account of the services they provide.

What the evidence in this report shows us is, when we look after our natural environment, and work within its limits, it has the capacity and resilience to provide for us as well. Examples include our wetlands, which serve as ecological hotspots while providing water filtration and mahinga kai, and our urban greenspaces which supported the mental health and wellbeing of many New Zealanders during the COVID-19 pandemic. And they include our coastal dune systems which protect coastlines during storms, and our highly productive land which underpins our agricultural and horticultural economy. The evidence shows how we're reliant on the services that nature provides.

The choices we make today about how we manage our relationship with land are also central to improving outcomes for our freshwater and marine environments and mitigating climate change. The solutions that lie in our natural infrastructure can help us adapt to a future where we are exposed to more frequent natural hazards that pose a threat to our physical security, wellbeing, and economic prosperity.

Recognising the value that nature provides and the full range of benefits we receive from healthy, functioning ecosystems is crucial to building a safer and more prosperous future for everyone. We all have a role to play in shaping that future and we hope the evidence contained in this report helps you understand the environmental challenges and take part in the solutions.

James Palmer
Secretary for the Environment

Mark Sowden
Government Statistician

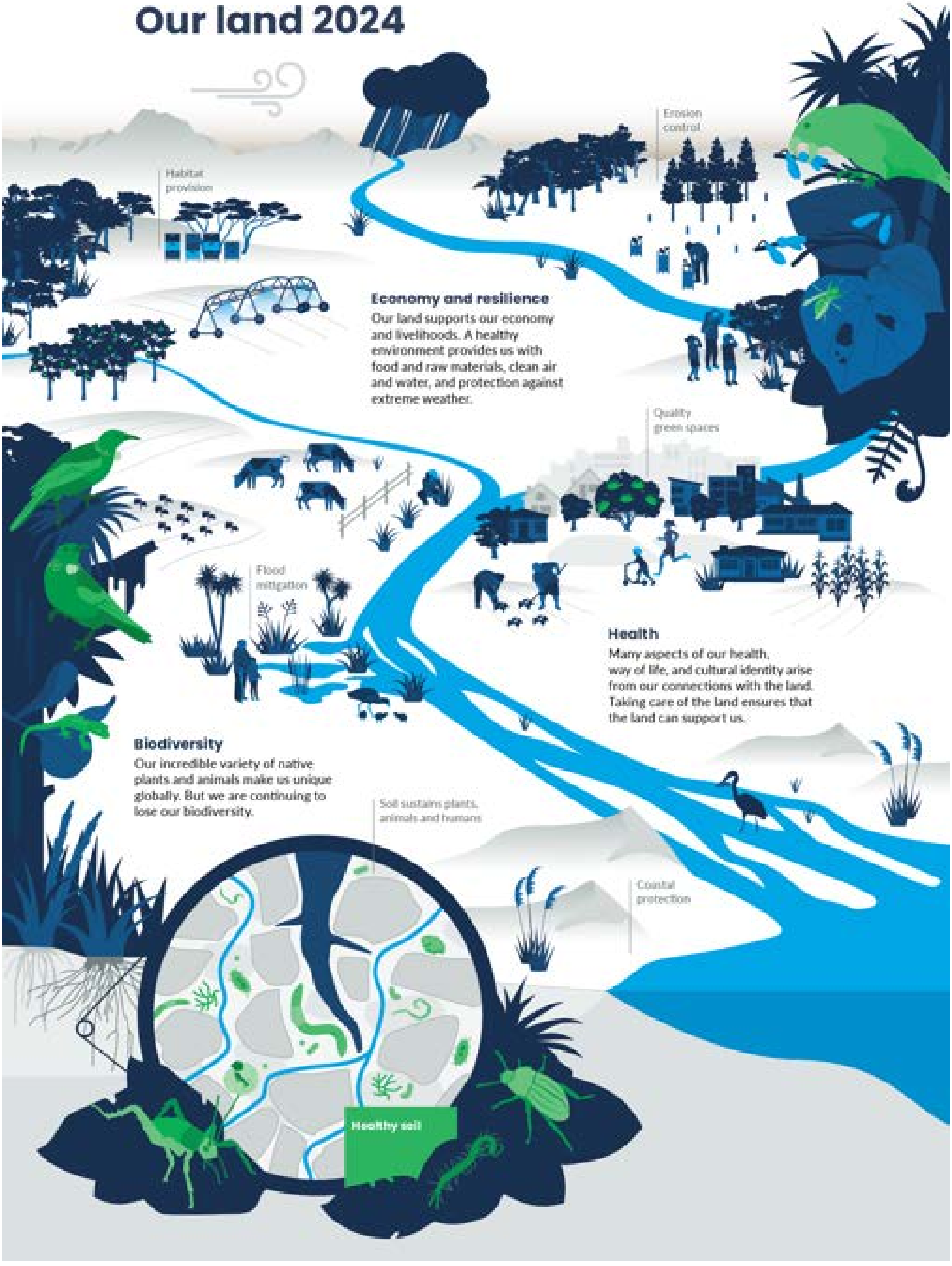
Introduction

The health of our land underpins our lives and livelihoods

The land and ecosystems of Aotearoa New Zealand are globally unique and nationally significant. Our connections to and relationship with the land are a defining characteristic of life in Aotearoa.

Today, all New Zealanders benefit from the many contributions land makes to our lives. Land supports our livelihoods and large parts of our economy, provides the places we are connected to, and has inherent value within ecosystems. Land is an asset and resource that our prosperity depends on, and it is also a source of meaning and value.

Our land 2024 describes how the ways we use the land have wide-ranging effects on our diverse ecosystems and the biodiversity they support, with cascading impacts on our economy, our resilience to disasters, and our cultural, mental and physical health.


Our land 2024
Habitat provision
Erosion control
Economy and resilience
Our land supports our economy and livelihoods. A healthy environment provides us with food and raw materials, clean air and water, and protection against extreme weather.
Quality green spaces
Flood mitigation
Health
Many aspects of our health, way of life, and cultural identity arise from our connections with the land. Taking care of the land ensures that the land can support us.
Biodiversity
Our incredible variety of native plants and animals make us unique globally. But we are continuing to lose our biodiversity.
Soil sustains plants, animals and humans
Coastal protection
Healthy soil

How we relate to the land can shape our impacts on it

There are different ways of viewing nature and the multiple and complex roles it plays in our lives (IPBES, 2022). Natural processes provide us with food, clean air and water, energy, raw materials, the regulation of climate, and protection against extreme weather events. The importance of land to our economy means that it can also be viewed as an asset, supporting our lives and livelihoods.

Despite the immense value of these services, their contribution is not always reflected in traditional economic accounting (Dasgupta, 2021).

The role of land in our lives is bigger than just providing us with resources and services. Our relationship and connections with the land also support our physical, mental and emotional health, our way of life and cultural identity.

For some Māori, connection to land is through whakapapa (ancestral lineage), placing people in a special relationship as a part of ecosystems (Harmsworth, 2022a; Timoti et al, 2017). These connections are emphasised in te reo Māori (Māori language), where the word 'whenua' means both 'land' and 'placenta', to give nourishment and sustenance (Harmsworth & Awatere, 2013).

The Māori worldview (te ao Māori) acknowledges a natural order to the universe, which is in balance or equilibrium. When part of this system shifts, the entire system is put out of balance (Harmsworth & Awatere, 2013).

When the system is out of balance, this affects its mauri. Mauri is a te ao Māori concept that describes the spark of life (Mead, 2003) and is the binding force that holds together the physical and spiritual components of a being or thing (Durie, 1998; Morgan, 2006). An ecosystem is more able to provide benefits when its mauri is vibrant (Timoti et al, 2017).

The enormous variety of plants and animals, ecosystems, and landscapes also have their own intrinsic value, and research shows that conservation of our natural spaces is important to the majority of New Zealanders (DOC, 2011).

These different views of how we relate to our land influence our decisions over land use, the benefits of which change over time (Meyfroidt et al, 2022). For example, urban green space became even more valuable in supporting people's physical and mental health during the COVID-19 pandemic (Davies & Sanesi, 2022). Ecosystems that support flood control, such as wetlands and peatlands, but they have become increasingly important as the incidence and severity of heavy rainfall events increase with climate change.

Natural infrastructure is one way to explore nature's contributions to our lives

A key theme of this report is that when we look after nature, we are looking after ourselves by actively conserving the key advantages ecosystems provide. Some of these benefits are not as easily quantified as others, contributing to the reasons why they have often been systemically overlooked (Dasgupta, 2021).

One way of recognising the value of nature is to view our ecosystems and natural environment as a type of foundational natural infrastructure that supports our lives, livelihoods, health and relationships to nature.

In this report, we use the term 'natural infrastructure' to describe natural or semi-natural structural elements of ecosystems and landscapes that are important to delivering benefits for the environment and human wellbeing.

Examples of natural infrastructure explored here include:

- soils (including highly productive land)
- forests and grasslands
- urban green spaces (public and private)
- floodplains and their riparian margins
- wetlands and peatlands
- dunes.

Our natural infrastructure is crucial to our economy in many ways. Our primary production sectors, the basis of our export economy, depend on healthy land and soil. Aotearoa New Zealand's tourism sector and our international brand and identity rely on our natural environment. Natural infrastructure that is in a degraded state reduces productivity and lowers our resilience to disasters, raising recovery costs in the aftermath.

Healthy, functioning natural infrastructure provides benefits to people and the wider environment. These can include improving better water quality, absorbing atmospheric carbon, enhancing flood control, supporting biodiversity and ecosystems, providing habitat, giving a sense of place and identity, and supporting our mental, cultural and physical health – among many others.

If we take care of our natural infrastructure, it can support the resilience of our society and ecosystems to environmental challenges now and into the future.

About Our land 2024

Our land 2024 is the latest in a series of environmental reports produced by the Ministry for the Environment and Stats NZ. It is the third report in the series dedicated to our land, following the 2018 and 2021 reports. It is part of the third cycle of reports released under the Environmental Reporting Act 2015.

Our land 2024 builds on previous reporting and contributes further information while we progress the fundamental changes needed to improve the reporting system in line with recommendations from the Parliamentary Commissioner for the Environment (PCE) (PCE, 2019). The primary focus is on updating recent indicators and scientific evidence about land. This report updates some of the indicators reported on in previous years and brings those indicators together with what we know from past reports and insights from the research literature.

Report structure

As required by the Environmental Reporting Act 2015, we use the concepts of pressure, state and impact to report on the environment and this forms the basis for the report's structure. The logic of the framework is that pressures can cause changes to the state of the environment, and these changes may have impacts on land and associated human (anthropogenic) values. The report also includes future outlooks throughout each section. The evaluation of specific policies is out of scope for environmental reporting releases under the Environmental Reporting Act 2015, and therefore they are not discussed here.

The data used in this report came from many sources, including Crown research institutes and central and local government. Further supporting information was provided using a 'body of evidence' approach. This body of evidence includes peer-reviewed, published literature, as well as mātauranga Māori (Māori knowledge) and observational tools used to identify changes in the land environment.

All data used in this report, including references to scientific literature, were corroborated, and checked for consistency with the original source. The report was produced by a team of analysts and scientists from within and outside the Ministry for the Environment and Stats NZ. It was also reviewed by a panel of independent scientists. The indicators related to our land and the date they were last updated are available on the Stats NZ indicator web pages (see Environmental indicators).

Outlook assessments

Throughout the report, we use structured analytical techniques to assess the outlook for our land, with a particular emphasis on 'natural infrastructure', based on international and domestic evidence. This represents a continued shift in our approach to environmental reporting. The shift is away from a focus on what has happened, towards a focus on what might happen in future, to improve public awareness of issues and support decision-making.

Unlike *Our atmosphere and climate 2023*, there are no commonly agreed upon scenarios specific to Aotearoa on which to base the assessments about the state and trends in *Our land 2024*. Therefore, to support the development of these assessments, baseline assumptions were made across a spectrum of issues.

These assumptions depict the future state that we believe to be true at the time the assessments were developed, based on the information available, and that we believe will remain true for the time period in which the assessments apply.

In making these assumptions, we have also acknowledged that other outcomes are possible. Policy initiatives, grassroots innovations, and sustainability measures could all have an impact on our future, though it can be challenging and take a long time to measure and attribute these outcomes to specific policies or innovations.

At the time of writing, there was not enough evidence to support assessments about how recent initiatives and innovations may evolve. For these reasons we have chosen to make outlook assessments for sections with a greater body of evidence supporting them, which can allow assessments to be made with a higher level of confidence.

The following key assumptions have been made for the outlook assessments in *Our land 2024*.

- Recent environmental trends are expected to continue on a similar trajectory in response to pressures, with compounding effects on our natural infrastructure, including ecosystems and biodiversity.
- Aotearoa New Zealand's population will continue to grow in line with recent projections.

- Changes in technology, land management practices, and adaptation measures might partially offset the negative impacts of land use.
- The environmental effects of Aotearoa New Zealand’s approach to environmental policy, management and interventions will remain relatively stable in the short to medium term at a national level.
- A resource-based view of nature will continue to be prioritised in decisions about how we use our land.

The future will always be uncertain. For this reason, the assessments should be read not as statements of fact but as descriptions of what might occur based on what we know now. To support this, we have used expressions of likelihood and confidence to help in interpretation. This methodology is aligned with other domestic agencies for consistency of language and understanding by our decision-makers. It ensures we can make assessments about current and emerging issues even when our confidence in them may be limited by the currently available evidence.

Assessments have been made only where evidence available on the past and current state of a system is sufficient to form an outlook. The assessment approach used in *Our land 2024* acknowledges the need for an analytical process that can be applied across all environmental domains and knowledge systems, from science to mātauranga Māori. Importantly, the evidence and analysis produced by the international community, along with other domestic evidence and knowledge, have been incorporated into the assessments contained here.

Expressions of likelihood are underlined. Expressions of confidence, which give an indication of the reliability and level of corroboration of evidence used in an assessment, are presented in brackets at the end of each assessment (see appendix A for further explanation).

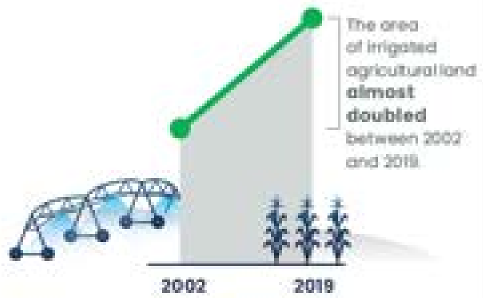
Pressures on our land

Human activities place great pressure on terrestrial ecosystems. The key pressures faced by our land environments are changes in land use, along with adverse effects from pollution, climate change, and invasive species. Pressures can stem from various underlying causes or drivers, including production and consumption patterns, human population dynamics, trade, technological innovations, and local and global governance.

Since the late 1800s, an extractive approach to land use has prevailed. This emphasises its ‘improvement potential’ for both productivity and economic purposes. Aotearoa New Zealand has witnessed the expansion of land area used for farming and commercial forestry, alongside urban intensification and ‘grey’ infrastructure growth (eg stop banks, sea walls, and roading) linked to population and consumption, and increased pollution and waste. The resulting land-use intensification has led to degradation of our soils and waters, the clearance and fragmentation of vast tracts of indigenous forest, as well as the reclamation and drainage of lakes, estuaries, wetlands, dunes, and river margins.

Our land environments continue to face these pressures. Climate change is increasingly amplifying the impact of these pressures on our natural and productive ecosystems, as observed with the increased risks due to extreme weather events and the spread of invasive species.

Pressures on our land



Intense agriculture places pressure on the health and functioning of ecosystems.

Pests are a pressure on our native biodiversity and productive landscapes.

Climate change is a direct pressure that worsens the impact of other pressures.

Waste and contaminants place growing pressure on soil and water quality.

It is <u>highly likely</u> that urban densification will increase pressure on urban green spaces, while urban expansion will continue to put pressure on highly productive land (moderate confidence).

Land that is particularly suitable for food production is classified as *highly productive land* (Curran-Cournane et al, 2021a). Aotearoa New Zealand's highly productive land is vital and natural infrastructure that, due to its unique land and soil characteristics, can be used for a variety of purposes (Lynn et al, 2009). Highly productive land is often on the fringes of our cities and therefore under pressure from development and subsequent land fragmentation as cities grow outwards (Curran-Cournane et al, 2018).

Eighty-four percent of New Zealanders live in urban areas (Stats NZ, 2024b), and much of our population growth between 2018 to 2048 (likely 70 percent or more) will be in the main urban centres (Stats NZ, 2021). Our population is growing, reaching an estimated 5.3 million in September 2023, and may reach 6 million by 2050 (Stats NZ, 2020, 2024b). Around two-thirds of this growth is projected to occur in less than 3 percent of our land area, in and around Auckland, Hamilton, Tauranga, Wellington and Christchurch (Stats NZ, 2020). By 2043, a 37 percent increase in the number of households from 2018 is expected in Auckland, Hamilton and Tauranga, and around 20 percent in Wellington and Christchurch (PCE, 2023).

Population growth in Aotearoa has contributed to the expansion of our towns and cities, with the total urban area in Aotearoa growing by 15 percent between 1996 and 2018 (see Indicator: Urban land cover). In the future, demand for new housing in some cities will be met in part by building on the outskirts of urban areas, which can include highly productive land (Davis et al, 2023; PCE, 2023). For example, the Waikirikiri Selwyn district within the Ōtautahi Christchurch peri-urban zone is experiencing significant expansion of residential developments, particularly in terms of dwelling construction, which is encroaching on highly productive land. This rapid growth is projected to continue into the foreseeable future (Davis et al, 2023).

The last decade has seen a rise in the construction of higher density dwelling types, including townhouses and apartments. A record 51,015 homes were consented in the year ended May 2022, but home consents have decreased from this peak, with 36,453 homes consented in the year ended January 2024 (Stats NZ, 2024a). The number of multi-unit homes consented (25,562) exceeded stand-alone houses (25,402) for the first time in the year ended March 2022. Multi-unit homes include townhouses, apartments, retirement village units, and flats (Stats NZ, 2022). Most of these additional homes are being built through low-rise infill development: the conversion of private yards and sections into houses and driveways in existing urban areas (PCE, 2023). Meanwhile, our towns and cities are also expanding outwards, with new subdivisions at the city margins increasingly characterised by larger houses on smaller sections (PCE, 2023).

The ongoing shift towards urban intensification helps address the country's housing supply shortage and offers opportunities to reduce our transport emissions. Reducing urban sprawl can reduce pressure on productive soils near the urban fringe (PCE, 2023). However, the style of infill townhouse that is currently being used to intensify our cities puts pressure on our existing urban green space. It often results in the removal of soil and vegetation from private yards and sections (PCE, 2023, 2024). At the same time, increases in population density mean more people use nearby public parks and reserves, which can reduce the benefits they offer (PCE, 2023).

Urban green spaces make cities nicer places to be, providing spaces for people to meet, which fosters community cohesion, and they support physical, spiritual and mental health (Rodgers et al, 2023). They reduce stormwater runoff, clean the air, lower ambient temperatures, and increase the diversity of plants and animals that can live in our cities (PCE, 2023). These services will become more important as our cities become hotter and increasingly subject to extreme rainfall events in a changing climate. Approaches to urban development that preserve the quantity of urban green space while improving the quality of public parks can help reduce the pressures on our urban green space (PCE, 2023).

Agricultural expansion and intensification put pressure on soil health, water quality, and indigenous biodiversity.

Following human settlement, generations of people have modified Aotearoa New Zealand's soils and landscape to support their need for food, water, housing and other essential living products. Lowland indigenous forests, grasslands and wetlands were largely replaced by agricultural landscapes, predominantly exotic grasses used for pasture, including dairy, sheep and beef farming (MacLeod & Moller, 2006) (see Our land 2021). These changes in land use and land cover, coupled with agricultural intensification, are driving the loss, fragmentation and degradation of indigenous habitats and the species they support (Clarkson, 2022; DOC, 2020).

Recent decades have seen intensified use of agricultural land, predominantly in dairy farming and horticulture. Intensification can be indicated through higher stocking rate or increased harvest per crop, as well as increased use of fertiliser and irrigation (Manderson, 2020) (see Environment Aotearoa 2022). Much of the intensification has been a result of a switch from sheep and beef livestock production to irrigated dairy farming, driven by an increasing global demand for dairy products and higher milk prices (Wynyard, 2016). Dairy cattle numbers have increased by 82 percent from 3.4 million in 1990 to 6.3 million in 2019, although numbers have stabilised in recent years (see Indicator: Livestock numbers). The area of irrigated agricultural land increased by 91 percent (nearly doubled) between 2002 and 2019 (see Our freshwater 2023 and Indicator: Irrigated land).

Fertiliser, irrigation and higher stocking rates can also compromise the health of our soils and freshwater (see Our freshwater 2023). These pressures from intensive agriculture can be reduced through on-farm mitigation practices such as nutrient management (Monaghan et al, 2021). Natural infrastructure such as riparian vegetation along waterways and trees on erodible land can also help stabilise banks and soils, reducing erosion and pollution while providing wildlife habitat benefits (Basher, 2013; Hughes, 2016; Maseyk et al, 2017).

As the domestic and global population continues to grow, the demand for our food sector, including dairy, is set to surge by 2050. This has the potential to drive further agricultural intensification (MPI, 2023d). At the same time, our primary sector is facing increased expectations to reduce greenhouse gas emissions and environmental impacts, build resilience in the face of a changing climate and improve standards to meet increased consumer concerns about health, ethics (including animal welfare), food safety and sustainability (MPI, 2023d).

Some agricultural practices focus on food productivity while reducing their environmental impacts (MPI, 2022b). These practices focus on promoting soil health, water quality, animal welfare, biodiversity, and quality nutrient-dense food, while reducing greenhouse gas emissions and dependence on agricultural chemicals (Grelet et al, 2020; MPI, 2022b). Such practices align with regenerative agricultural principles, and are projected to rise in Aotearoa (MPI, 2023d). Regenerative agriculture combines a focus found in traditional practices in te ao Māori (Māori worldview) with a focus on our reverence for and obligations to the natural environment.

It is <u>highly likely</u> that the area of exotic forest plantation will increase by 2030, with a growing proportion being managed for carbon sequestration (moderate confidence).

Forests support nature through providing habitat for our native biodiversity, and are also an important form of natural infrastructure that provides us with a range of benefits (Kotula, 2022; Yao et al, 2013). Natural and plantation forests are valuable in different ways.

Plantation forests provide important economic benefits, with production forestry being the fourth-largest food and fibre sector export earner in 2023 (MPI, 2023c). The forestry sector has enhanced its productivity through long-term improvements in genetics, breeding and intensified management (Jones et al, 2023). Alongside international demand for forest products, production forestry can earn money through carbon sequestration (PWC, 2020).

Our plantation forest is currently comprised of around 90 percent radiata pine and includes Douglas-fir, Cypress species, and Eucalyptus species (MPI, 2023b). Plantation forestry can also comprise native species such as mānuka, which can be used for honey production and carbon credit trading (Lambie et al, 2021). Planted exotic forests greatly exceed native plantation forestry (MPI, 2023b), because species such as pine, eucalypt and fir trees grow quickly, therefore providing financial return on investment in a shorter timeframe (McGlone et al, 2022). This financial return for land owners of some land types (eg hard hill country) generally exceeds the return that other land uses such as sheep and beef farming could provide (PWC, 2020).

Afforestation is being incentivised as a tool for climate change mitigation (MPI, 2022a; Watt & Kimberley, 2023). Such incentives therefore heavily influence afforestation rates. In 2021, afforestation projections showed baseline exotic afforestation projections of around 416,150 hectares between 2021 and 2030, comprising around 82 percent exotic plantation and 18 percent permanent exotic (carbon) forest (MPI, 2022a).

Development on and near floodplains in coastal areas exposes many communities and infrastructure to flooding risk. It is <u>almost certain</u> that pressures on flooding protection measures and coastal dune systems will increase under climate change (high confidence).

Floodplains are areas next to rivers that are only covered by water during flood events. They play a crucial role in filtering and storing water, providing natural flood protection, maintaining the health of river ecosystems, and supporting rich biological diversity. However, floodplains are also considered prime locations for urban and rural development (Abell et al, 2023; Hicks et al, 2021; Peters, 2016). They are desirable due to flat land, naturally fertile soils, and proximity to water for irrigation, as well as for recreation and culture (Abell et al, 2023; Hicks et al, 2021; Peters, 2016).

Rural and urban development on floodplains puts pressure on floodplain ecosystems and functioning (Abell et al, 2023; Greenep & Parker, 2021; Peters, 2016). Development also exposes communities and infrastructure to flood and erosion risk, which has led to the need to build flood and erosion control schemes such as stopbanks, engineered channels, and exotic willow buffers (Crawford-Flett et al, 2022; Brierley et al, 2022a, 2022b).

While offering some protection, these practices can work against nature, putting pressure on our rivers and their floodplains and the natural benefits they provide (Abell et al, 2023; Greenep & Parker, 2021). Structural flood control measures can also compound other problems – during intense and sustained rainfall events, where the water is confined to a narrower channel, high flows can contribute to changes in sediment transport (Hicks et al, 2021). On top of this, extreme weather events are getting more frequent and more severe due to climate change (see Our atmosphere and climate 2023). Recognition is growing that our existing structural flood protection is inadequately prepared for these changes (Te Uru Kahika, 2023).

Coastal settlements and infrastructure are at risk from both river flooding and coastal storm inundation, which can be exacerbated by climate change (Bodeker et al, 2022; Collins et al, 2013) (see Our atmosphere and climate 2023). Over 65 percent of New Zealanders live within 5 kilometres of the coast, putting many communities, infrastructure and supply chains at risk (OECD, 2019) (see Our marine environment 2022). Coastal ecosystems, like dunes and wetlands, can play a crucial role in protecting coastal areas. These ecosystems also face ongoing challenges from development, as well as from invasive species and pollution (Clarkson et al, 2013; Thompson, 2022).

It is almost certain that climate change will put increasing pressures on the ecosystems and biodiversity that underpin the functioning of our natural infrastructure (high confidence).

Driven by global increases in greenhouse gases, annual average temperatures are rising in Aotearoa, with temperatures increasing across all seasons in most places (see Our atmosphere and climate 2023). The annual average temperature across the country increased by 1.26 (± 0.27) degrees Celsius between 1909 and 2022 (see Indicator: Temperature).

Annual rainfall patterns are changing too, with short-duration, high-intensity rainfall events projected to become more frequent in some parts of the country. This can cause significant damage and changes in the landscape (see Our atmosphere and climate 2023). Areas with highly erodible land are particularly affected, such as the East Coast region (Basher, 2013; McMillan et al, 2023) (see case study: Our land use and management decisions have consequences in extreme weather events).

Our natural infrastructure depends on healthy, functioning ecosystems. Climate change is putting pressure on our land ecosystems and therefore is damaging our natural infrastructure (IPCC, 2022; Keegan et al, 2022). How we use the land also influences climate change through greenhouse gas emissions and carbon sequestration (Ausseil et al, 2019a). Our resilience against climate change highly depends on the choices we make about where and how we use the land (Ausseil et al, 2019a; Ausseil et al, 2019b).

Some ecosystems contribute to climate regulation and help protect us from the impacts of climate change. For example, forests and wetlands, particularly peatlands, are an important carbon store (Ausseil et al, 2013, Ausseil et al, 2015). However, our terrestrial ecosystems are being harmed by increasingly warm temperatures and extreme weather events (see Our atmosphere and climate 2023).

Climate change exacerbates some land degradation processes such as landslides, erosion and sedimentation (Neverman et al, 2023; Smith et al, 2023). It also increases the risk of fire (Wyse et al, 2018), including to some ecosystems that are not well adapted to recover from fire, such as wetlands (Scion, 2022). More frequent extreme weather, along with our land-use choices, reduce the capacity of both natural and non-natural infrastructure to help absorb some of the impacts of these events (NIWA, nd). This was observed in 2023 during and following Cyclone Gabrielle (see case study: Our land use and management decisions have consequences in extreme weather events).

Extreme weather and a changing climate make our unique native plants and animals, including taonga (treasured) species, more vulnerable. Climate change poses a direct threat to ecosystems and makes pre-existing pressures worse. This includes more habitat loss and fragmentation and increasing the introduction and spread of invasive species (Macinnis-Ng et al, 2021). Climate change is already contributing to population declines of species, including long-tailed bats, and reducing important areas of habitat in alpine areas (Keegan et al, 2022). The impacts we see from climate change on many aspects of our biodiversity will escalate with every increment of global warming (see Our atmosphere and climate 2023).

It is highly likely that pressures from pests and diseases will increase, threatening our biodiversity and putting our vulnerable ecosystems at risk (moderate confidence).

Aotearoa has one of the highest recorded numbers of introduced invasive species in the world (Turbelin et al, 2017). Introduced species become invasive when they reproduce and spread quickly, threatening native biodiversity and causing ecological, environmental or economic damage (IUCN, 2021). There are currently approximately 15,000 unwanted pests and diseases that, if introduced in Aotearoa, could damage our environment, economy and way of life (MPI, 2023a). There is a risk of introducing species to Aotearoa when imports, vessels and passengers arrive by air or sea. Introduced species are therefore most likely to enter through airports, commercial seaports, and transitional facilities, which are closely monitored (MPI, 2019).

The overseas pests prone to invade and establish, as well as the distribution and abundance of pests that are already here, will change with climate change, changes in transport networks and infrastructure, and land-use change (Keegan et al, 2022; Meurisse et al, 2023; PCE, 2021). This will pose a growing threat to both our natural environment and primary sectors (Meurisse et al, 2023) (see Our atmosphere and climate 2023).

Mammal pests such as mustelids, feral cats, hedgehogs, possums, pigs, mice, rats, rabbits and deer are widespread in our terrestrial ecosystems. They threaten many native animals, invertebrate and plant species. Some eat sensitive vegetation including native trees, grassland and alpine and sub-alpine vegetation (DOC, 2020). In 2019, possums were more common in woody areas where their mean occupancy was nearly 60 percent compared with around 25 percent in non-woody areas. For hooved animals (such as deer and goats), mean occupancy was around 70 percent in non-woody areas and 85 percent in woody areas (see Indicator: Land pests).

Productive pasture in Aotearoa is extremely vulnerable to invasive insect pest species such as weevils, which cause extensive damage to plant roots and stems through feeding and burrowing (Goldson et al, 2020).

Introduced pathogens (disease-causing microorganisms) also threaten native plants and commercial crops. These pathogens include the kauri dieback disease (caused by the pathogen *Phytophthora agathidicida*), and the kiwifruit vine disease, PSA (*Pseudomonas syringae actinidiae)* (Royal Society of New Zealand, 2014). In 2017 the airborne, fungal disease myrtle rust (*Austropuccinnia psidii*) was discovered in Aotearoa. This disease puts pressure on culturally and economically significant plants in the myrtle family, including ramarama, rātā and pōhutukawa (Clarkson, 2022; Diprose et al, 2022).

Weeds can damage ecosystem functions and reduce biodiversity by outcompeting other species, altering habitats, increasing fire frequency, and disturbing food webs (Clarkson, 2022;

PCE, 2021). Weeds can become dominant and interfere with the integrity and balance of an ecosystem, or how plants relate to other species. From a Māori perspective, weeds can disrupt the balance that Papatūānuku (Earth mother) needs to be well. This disruption can create a system that no longer provides for life (McGowan, 2021; PCE, 2021). Weeds pose a threat to many of our critically endangered ecosystems (Rapson et al, 2023) and are the main hazard to one-third of our nationally threatened native plant species (Hulme, 2020; PCE, 2021).

Many of our plant pests are exotic plants that humans have introduced. In Aotearoa we have 1,800 exotic plants that can maintain populations in the wild without human assistance. Both the North and South Island have more of these plants than almost any other island in the world, with the total making up 44 percent of our vascular plant life (PCE, 2021). New exotic plant species are escaping from gardens every year, and modified landscapes such as exotic pasture and production forest provide habitat for weeds to thrive (Clarkson, 2022; PCE, 2021).

Plants grown as crops or timber can also become environmental pests. Wild kiwifruit (*Actinidia deliciosa*) is an invasive weed that can pose a threat to several native habitats and plantation forests. It is recognised as a pest in certain regions such as the Bay of Plenty, Tasman–Nelson region, and Auckland regions, and is a growing concern in other parts of the country (Auckland Council, 2020a; Tasman District Council and Nelson City Council, 2019; Corbett, 2023; Waikato Regional Council, 2024; West Coast Regional Council, 2023). Wilding conifers are exotic conifer trees, including radiata pine, that can be invasive across Aotearoa and spread through natural regeneration or seeding (Edwards et al, 2020; Froude et al, 2011). Wilding conifers are a serious threat to the ecology and biodiversity of many native ecosystems (Etherington, 2022; Peltzer, 2018).

Waste and contaminants are polluting our soil and water.

Waste and chemicals pollute air, soil and water (UNEP, 2023). Waste pollutes ecosystems when it is not managed and disposed of properly. The improper use of chemicals can leave a legacy of soil contamination. Pollution and degradation in land and freshwater systems alter the balance of mauri (mauri is an important Māori concept that describes the health and vitality of living systems) and damage our native and managed ecosystems (Hikuroa et al, 2018; Stewart-Harawira, 2020).

Some of our waste doesn’t make it to landfill and ends up as litter. Plastic is the most common type of litter found on beaches, in freshwater and in stormwater, comprising over 66 percent of items measured in 2023 (Litter Intelligence, nd). Plastic and microplastic are widespread throughout the environment. They particularly affect freshwater and marine species and their habitats. In Aotearoa, microplastics have been detected in urban streams, rivers and oceans, and internationally they are a growing concern for soils (Brahney et al, 2020; Lwanga et al, 2022; Mora-Teddy & Matthaei, 2020) (see Our marine environment 2022). Long-term effects of plastic waste on animals and their habitats are not well understood.

Aotearoa was consistently among the highest in per capita waste disposal in the developed world between 2000 and 2018 based on OECD reporting (OECD, 2024). Much of our waste ends up in landfills, which can leak leachate, a liquid produced by landfill sites. There are controls to protect against leachate, although it can contaminate nearby soil and water, and cause harm to ecosystems and people (Siddiqua et al, 2022; MfE, 2004). Waste accounted for 9 percent of our methane emissions in 2021 (see Our atmosphere and climate 2023).

On average, municipal landfills together received 3.9 million tonnes of household and commercial waste each year between 2021 and 2023. Of this material, 9.8 percent was reused, repurposed or recovered (MfE, 2023c). We disposed of 688 kilograms of waste per person in municipal landfills each year on average between 2021 and 2023 (MfE, 2023c). From 2010 through 2018, the household and municipal waste disposed per capita grew on average by about 3.7 percent per year. More recently this has been trending down: between 2018 and 2023, the household and municipal waste disposed per capita decreased on average by about 2.3 percent per year (MfE, 2023c).

Chemical contaminants pose risks to the health of soil, plants, animals and humans, including soils that provide our food. These stem from the use of chemicals, including hazardous substances, in industry, agriculture, horticulture and forestry (MfE, 2021). Contaminants are also issues for Māori, particularly where they significantly affect cultural values and customary resources (Cavanagh & Harmsworth, 2023). In the 12 months ended 31 June 2022, over 50,000 sites were estimated to have been used for hazardous activities or industries that might cause contamination, as reported by councils to the National Monitoring System (MfE, 2023a).

Copper chromium arsenate (CCA) is used widely in Aotearoa to increase the resistance of timber, such as radiata pine, to pests and fungi. Disposal of CCA-treated timber in Aotearoa is restricted to secure landfills, but toxic CCA leachate could be a problem (University of Canterbury, 2023). CCA is restricted or banned in many countries due to its harmful impact on soil and water, and concerns about public health (Morais et al, 2021).

Excess nutrients can be caused by application of more nutrients in fertiliser or animal waste than plants or microorganisms can uptake, and through grazing animal waste. While intensive application of nitrogen and phosphorus fertilisers on agricultural land produces economic benefits, excessive use pollutes our soil and water. Nitrogen leaching can contaminate waterways and cause toxic algal blooms in downstream ecosystems, as well as contributing to climate change through nitrous oxide emissions (see Our freshwater 2023 and Our atmosphere and climate 2023).

Many urban rivers are polluted with pathogens and heavy metals, arising from intense industrialisation, urbanisation and transport (see Our freshwater 2020). Rainwater enters storm drains carrying substances from the land such as heavy metals from vehicle wear (copper from brake pads and zinc from tyres) (see Environment Aotearoa 2019). In some cases, plants and microorganisms can reduce the harm from contaminants near the surface by breaking them down, although there are challenges with this, including subsequent disposal of the contaminated plants (Awasthi et al, 2022).

Case study: Our land use and management decisions have consequences in extreme weather events

Erosion in a pine plantation in Te Tairāwhiti. Photo: Matt McCloy, 2023

Severe tropical Cyclone Gabrielle hit the northern and eastern parts of the North Island, with a national state of emergency declared on 14 February 2023. It devastated the area with slips and flooding, and took the lives of 11 people. Over 300,000 landslides carried large volumes of soil from pasture and forest down the hills behind Te Tairāwhiti, Hawke's Bay, Wairoa, and the Wairarapa. Each landslide moved about 1,000 tonnes of soil on average, the equivalent weight of 548 single-cab utes, and deposited it on floodplains and waterways below.

Forests played a role as natural infrastructure to help reduce the risk of erosion. Most of these landslides occurred where intense rainfall fell on steep land without protective forest cover (McMillan et al, 2023). Trees can protect erosion-prone landscapes during intensive storm events by providing a canopy that intercepts rainfall, reducing water in the soil, and increasing structural integrity by binding the soil together with their roots (Li et al, 2019; Phillips et al, 2018; Rey, 2021).

Before Cyclone Gabrielle, other storms have also caused devastating landslides in Te Tairāwhiti. The region is known for its extremely erodible land and has a long history of extreme weather carrying sediment and woody debris down its slopes. The impacts of Cyclone Bola (1988) showed a clear difference in landslide vulnerability between pastoral land and forested land (Marden, 2004).

Following this, a decades-long movement began to plant forests on the steep hills in the region, mainly converting pasture to production forest (Basher, 2013). For more context, see 'Finding a way through disaster to environmental and economic sustainability' in Our land 2021.

While the main driver of this planting post-Cyclone Bola was to stabilise highly erodible land, recently harvested forests in Te Tairāwhiti were a substantial source of landslides following Cyclone Gabrielle (Marden & Seymour, 2022; McMillan et al, 2023).

The type of forest has an impact on landslide probability. After Cyclone Gabrielle, in Hawke's Bay and the Wairarapa hill country, it was estimated that land covered by indigenous forest was 90 percent less likely to slide than hill country pastoral land, while land under exotic forest was between 60 and 80 percent less likely to slide than hill country pastoral land. Coastal hill country in Te Tairāwhiti under indigenous forest was estimated to be 50 percent less likely to slide than hill country pastoral land; however, exotic forestry and pasture had similar estimated extents of land sliding in this region (McMillan et al, 2023). Generally, indigenous forest had less probability of landslides compared to other landcover types, relative to pasture (McMillan et al, 2023).

There are several possible reasons why exotic forestry and some native vegetation were less effective than indigenous forest at reducing landslide probability in Te Tairāwhiti and Hawke's Bay. These reasons could include soil and rock type and rainfall intensity, alongside the age, density and maturity of vegetation cover at the time of the storm (Phillips et al, 2018). Other factors that can increase vulnerability to landslides include thin soils caused by a long erosion history, and forestry management practices such as non-thinning or multiple rotations of forestry (McMillan et al, 2023). While exotic tree species' root systems can often outperform indigenous ones in reinforcing soil (Phillips et al, 2023), these erosion control benefits are lost when forests are harvested until trees in the next rotation have grown enough to close the forest canopy (Phillips et al, 2015).

The type of tree, the place it is planted in a catchment and the way it is managed all have consequences downstream. For example, when a forest is standing or harvested can determine the extent of erosion, sedimentation and flood impact in an extreme event. These considerations are crucial in planning decisions for forests as effective natural infrastructure.

State of our land

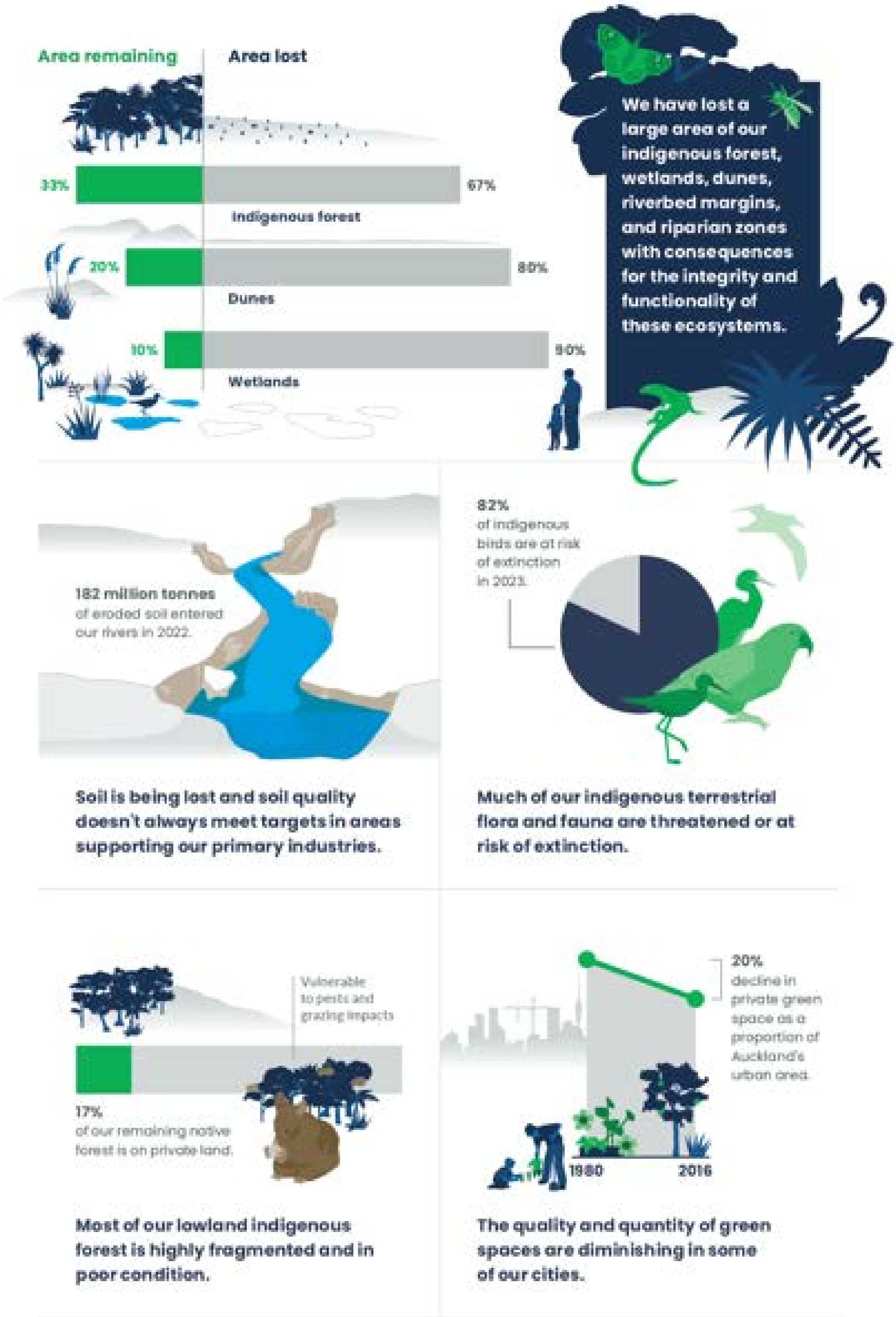
The ways that we use the land, including for agriculture, forestry, and urban land uses, puts pressure on important ecosystems that support the wider landscape. This affects the state of these ecosystems, including soils, forests, floodplains, wetlands, dunes, and urban green spaces.

Soil is the foundation of land-based ecosystems, but soils in Aotearoa New Zealand face many challenges. The land has naturally high levels of soil erosion, which can be accelerated by deforestation, grazing animals, and intensive land use. Soil quality is also showing signs of impairment in many areas used for primary industries, and this can impact the receiving environment. Our versatile soils for food production have become more fragmented, and their availability has decreased. The area of exotic forest has also expanded, mostly with conversion of land that was typically used for agriculture.

Meanwhile, lowland ecosystems including scrub and lowland forests are vulnerable as they are located in areas commonly cleared for agriculture and urban development. Urban and agricultural development continues to encroach on our rivers and floodplains. Wetlands and coastal dunes are among our most degraded ecosystems, and losses and degradation continue today. Urban green spaces are also in decline and have lost a large amount of native vegetation. The decline in these ecosystems has placed pressure on the species living in them, leading to high levels of extinction threat to indigenous species.

Our monitoring often focuses on the extent of ecosystems or distinct characteristics of the environment, rather than the broader health (or integrity) of those environments. In te taiao (the environment) all things are connected and are integral to the well-functioning environment for now and the future, but by compartmentalising the environment, we can only tell part of the story. Broadening our understanding of the state of the environment to include the intrinsic connections between natural systems gives a more fulsome picture of how our environment is coping with pressures, and can further support the connections between the state of the environment and impacts on the things we care about.

State of our land



Soil quality is not always within target ranges on land that supports our primary industries.

Soil is the foundation of all land-based ecosystems, from tussock grasslands and wetlands to forests and agricultural landscapes. Healthy soils support biodiversity, purify water, cycle nutrients, filter contaminants, and store carbon (Stevenson, 2022). From a mātauranga Māori (Māori knowledge) perspective, soil has an ancestral lineage that we are a part of (Harmsworth, 2022a).

Soil quality is monitored routinely through seven indicators encompassing both chemical and physical properties essential for plant growth and to maintain environmental quality. It is conducted across nine land uses, including those that support our primary industries (see Indicator: Soil quality and land use).

Target ranges are defined for each of the indicators that point to a compromise between optimal crop yield and fewest environmental impacts (for a full description of soil quality target ranges, see Our land 2021). Over 80 percent of measured sites did not meet targets for at least one indicator for 2014 to 2018 (see Indicator: Soil quality and land use and Our land 2021). But over 80 percent of sites were within their target ranges for four out of the seven indicators for the same period.

Macroporosity (a measure of soil compaction) was below the target range at 65 percent of measured dairy sites for the period 2014 to 2018. For drystock sites, 48 percent were below the macroporosity target. Low macroporosity indicates compacted soil that limits the flow of oxygen and water, which can impair plant growth. Compacted soil also increases the risk of sediment and pollutants flowing from land into water through surface runoff. Olsen phosphorus, which is a measure of soil fertility, was above the target range at 61 percent of monitored dairy sites (see Indicator: Soil quality and land use).[1]

Other studies also report issues with soil compaction and elevated levels of Olsen phosphorus (Houlbrooke et al, 2021; McDowell et al, 2020). For example, 63 percent of 450,000 soil samples collected between 2001 and 2015 had Olsen phosphorus levels above the target range (McDowell et al, 2020).

Looking at individual indicators does not tell the full story of how healthy our soils are. The concept of *soil health* takes a more comprehensive view of soil composition and ecosystems than soil quality. Soil health refers to a soil's ongoing capacity to function as a living ecosystem that sustains microorganisms, plants, animals and humans (Harmsworth, 2022a). An estimated 59 (± 15) percent of the world's biodiversity is found in soil (Anthony et al, 2023), yet our understanding of its effects on the wider environment are not well understood (Hermans et al, 2020) (see Our land 2021 and Environment Aotearoa 2022).

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[1] Note that the Stats NZ Indicator: Soil quality and land use reports on state and trends of environmental effects, using data from 13 regional authorities from 2014 to 2018. The indicator uses data from around 500 to 600 sites per soil variable. The Fertiliser Association of New Zealand (FANZ) has data for around 100,000 sites per year for Olsen phosphorus, used for fertiliser recommendations (FANZ, nd). The datasets are reported in different units and cannot be compared directly (Drewry et al, 2021).

Measures of soil biodiversity, such as soil bacterial communities, have been identified as an encouraging bioindicator of soil quality that can improve our understanding of healthy soils, although soil biodiversity is not routinely monitored in Aotearoa (Hermans et al, 2020; Louisson et al, 2023). Similarly, preliminary target levels for earthworm abundances as indicators of soil health have been established for Aotearoa pastures (Schon et al, 2023). Intensive land use generally reduces soil biodiversity, but its effects on the environment more generally are not well understood (see Our land 2021). Diversity of microorganisms in the soil is lower at sites with a history of nitrogen fertilisation, which may limit future restoration of soil ecosystems and habitats (Addison et al, 2021).

Many core Māori values provide a strong basis for soil indicator development (Harmsworth, 2022a). Māori have differentiated soils for many years, with over 100 names for soil that help describe its qualities and characteristics, such as wetness, stoniness and colour. Understanding land quality, fertility and health centres on its ability to support life, health and wellbeing. Other factors considered important, based on a holistic approach, include the biology of soils, such as the quantity and health of microbes and organic matter (eg soil carbon) in the soil, the number of earthworms (eg worm counts per unit area or volume of soil), and other culturally important fauna and flora. Part this is to learn the whakapapa (ancestral lineage) of the soil, and the interdependencies and interconnections between ecosystems, plants, animals and humans (Harmsworth, 2022a; Hsu et al, 2022).

The availability of highly productive land has decreased. Should present trends persist, it is highly likely that the availability of highly productive land will continue to decrease (moderate confidence).

About 14 percent (approximately 3,830,000 hectares) of our total land area has been classified as highly productive land (NZLRI, 2021; Rutledge et al, 2010). Between 2002 and 2019, highly productive land that had an urban or residential land use and so was unavailable for or restricted from use as farmland, increased 54 percent from 69,920 to 107,444 hectares (see Indicator: Land fragmentation). During this same period, highly productive land became more fragmented, with an increase in small-sized parcels (2 to 8 hectares) with a dwelling, representing an increase of 64,165 hectares unavailable for farmland (see Indicator: Land fragmentation). Smaller blocks of highly productive land, while still productive, are often shifted out of commercial production (Curran-Cournane et al, 2021a; Hart et al, 2013).

Highly productive land is a finite resource and converting it to housing is effectively irreversible, which means that the amount available can only remain stable or decline (Curran-Cournane et al, 2018; Curran-Cournane et al, 2021b). Highly productive land continues to be under pressure from land fragmentation and urban expansion.

The area of exotic forest has expanded, mostly with conversion from exotic grassland.

In 2018, about half (12,635,000 hectares) of Aotearoa was covered with native ecosystems and the other approximate half (about 13,483,000 hectares) was covered with farms, pasture and plantation (exotic) forests (see Indicators: Indigenous land cover and Exotic land cover).

Exotic forests covered approximately 2.1 million hectares in 2018. The area of exotic forest in Aotearoa increased by 220,922 hectares (12 percent) between 1996 and 2018 (see Indicator: Exotic land cover). The Gisborne region showed the greatest increase in exotic forest area (measured in hectares) between 1996 and 2018, contributing to 20 percent of the increase for Aotearoa as a whole. The two regions with the most exotic forest by area, Waikato and Bay of

Plenty, were also the only two regions that showed a decline in the amount of exotic forest between 1996 and 2018 (see Indicator: Exotic land cover).

There is a lot of uncertainty around wilding conifer area as it is hard to measure. Approximately 2 million hectares across Aotearoa are thought to be invaded by wilding conifers (Peltzer, 2018), with the affected area expanding by around 90,000 hectares a year (MPI, 2023e). The affected area includes grasslands, rare ecosystems, and subalpine habitats, with some areas being more densely or sparsely populated with wildings (MPI, 2014; Peltzer, 2018). Without management, wilding conifers will form dense forests and could invade about 25 percent of land in 30 years, threatening ecosystems across the landscape (MPI, 2023e).

Exotic forestry has expanded into pastoral hill country, typically used for agriculture, over the past few decades (Basher, 2013). Of land cover converted to exotic forest between 1996 and 2018, 75 percent was from exotic grassland (see Indicator: Exotic land cover).The area of exotic grassland decreased by 247,848 hectares (or 2 percent) between 1996 and 2008 and then increased by 68,274 hectares through to 2018 (see Indicator: Exotic land cover).

Indigenous forest, scrub and tussock are particularly vulnerable in lowland areas, with some ecosystems fragmented and in poor condition.

Aotearoa New Zealand's indigenous land cover includes cover such as forests, tussock grasslands, and shrublands. The area of land covered with indigenous ecosystems continues to shrink, mainly through conversion to agriculture or forestry (see Indicator: Indigenous land cover). Net loss of indigenous land cover area is an ongoing trend: the area decreased by 12,689 hectares between 2012 and 2018. Among regions over the same period, Southland had the highest net loss at 3,944 hectares (see Indicator: Indigenous land cover). In Aotearoa, land covered with original or regenerating native vegetation ranges from vast areas of conservation land to small, isolated stands of regenerating bush on farms and in cities.

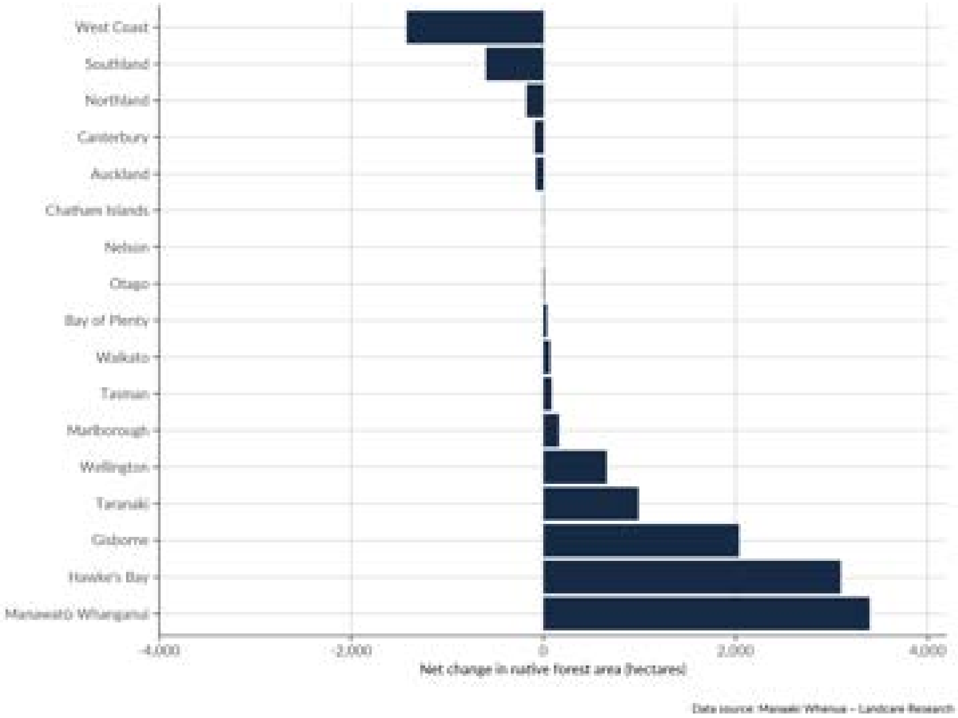
Before the arrival of humans, more than 80 percent of the land was covered with forest (see Indicator: Predicted pre-human vegetation). The area covered by indigenous forest has reduced to under 30 percent of Aotearoa New Zealand's land area and has remained fairly stable since 1996 though regional changes have occurred. Some regions, including the West Coast and Southland, have seen net decreases. Other regions, including Manawatū-Whanganui, Hawke's Bay, and Gisborne, have seen net gains in indigenous forest area (see figure 1 and Indicator: Indigenous land cover).

Meanwhile, indigenous scrub and shrubland decreased by 18,684 hectares between 2012 and 2018, with decreases occurring in every region. Where loss occurred, most of that land was converted to exotic grassland (52.3 percent) or exotic forest (19.9 percent). Tussock grassland also continued to decline between 2012 and 2018, but at a slower pace than previous periods, with 1,472 hectares lost (see Indicator: Indigenous land cover).

Lowland ecosystems, including scrub and lowland forests, are vulnerable as they are in areas commonly cleared for agriculture and urban development (Ausseil et al, 2011; Pannell et al, 2021; Walker et al, 2008). Although a significant portion of our native forests is legally safeguarded within protected conservation land, most of this is in upland areas (Cieraad et al, 2015; Pannell et al, 2021). Little of our lowland or coastal forest remains, and the primary land use in these areas is now pastoral farming (Ausseil et al, 2011; Ewers et al, 2006; Lyver et al, 2015). This has led to a disproportionate decline in the distinctive fauna and flora that the remaining forests can support (Walker et al, 2008, Walker et al, 2023).

Private land hosts a quarter of the remaining native vegetation nationwide, including 17 percent of native forest types that are under-represented in legally protected land. Sheep and beef farms, with their steep topography and lower livestock densities, safeguard more native vegetation than intensive farming does (Pannell et al, 2021). Much of our lowland indigenous forest within pastoral landscapes is fragmented and in poor condition, often due to lack of pest management and the impacts of grazing (Norton et al, 2020; Pannell et al, 2021).

Figure 1: Native forest area net change by region, 2012–18



Natural erosion varies across Aotearoa, though erosion rates have accelerated due to deforestation, grazing animals, and intensive land use. Climate change is <u>likely</u> to spur an increase in mass-movement erosion in some areas, particularly in soft-rock hill country (moderate confidence).

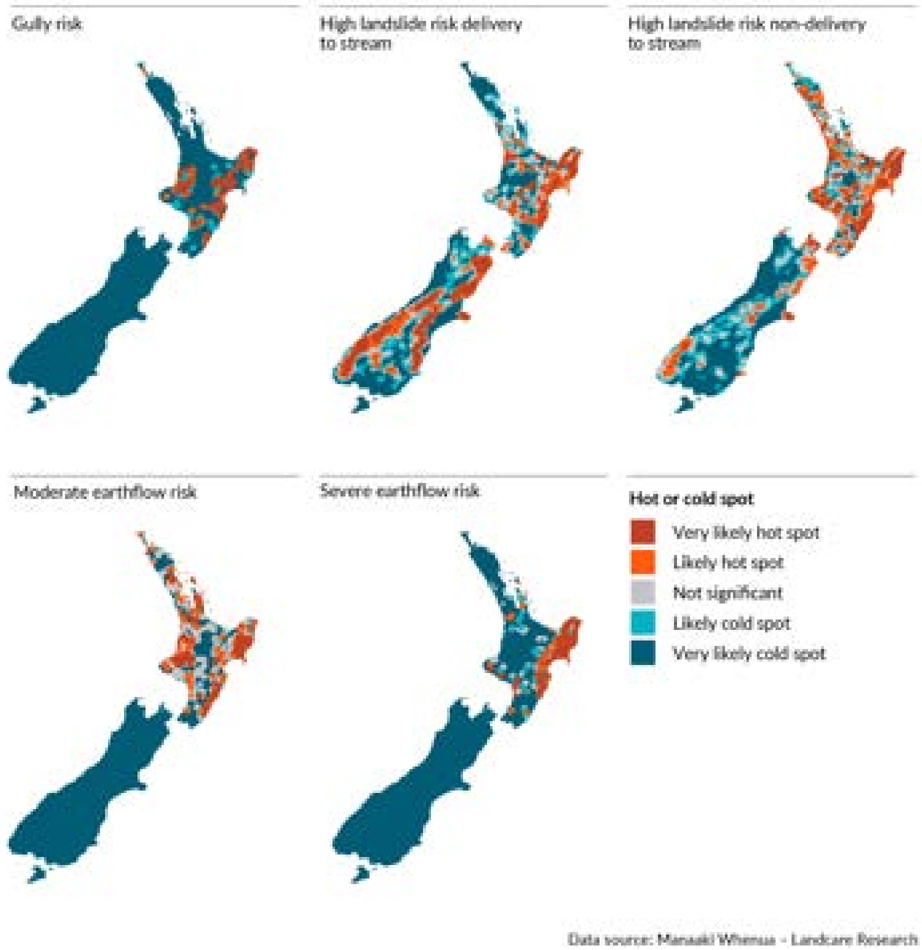
Aotearoa experiences naturally high levels of soil erosion. Mass-movement erosion is the dominant type of erosion due to steep terrain, high rainfall, erodible geology, frequent intense rainstorms, and tectonic activity. These processes can be accelerated when human activities modify soil, vegetation or climatic conditions (Basher, 2013; Neverman et al, 2023). High rainfall and the mountainous terrain of the South Island influence natural erosion there, while in the North Island erosion driven mainly by mass movement is amplified by the clearance of forest for pastoral agriculture, particularly in vulnerable soft-rock pastoral hill country (Dymond, 2010 as cited in Neverman et al, 2023). Over 80 percent of all Māori land is hilly or mountainous and susceptible to major erosion events like landslides (Awatere et al, 2021).

In 2022, 5 percent (12,693 square kilometres) of Aotearoa New Zealand's land was classified as highly erodible land (see Indicator: Highly erodible land). This is land that is at risk of severe mass-movement erosion through landslide, or earthflow towards waterways, or at gully heads (see appendix B). Of these categories, land at risk of erosion through landslide represented 75 percent of the area at risk of erosion, corresponding to 4 percent of Aotearoa New Zealand's total land area. Manawatū-Whanganui had the largest area of highly erodible land at risk of mass-movement erosion (2,208 square kilometres, which represents 17 percent of total highly erodible land at risk of erosion in Aotearoa) and had the greatest area in the country with high landslide risk (non-delivery to stream) (547 square kilometres) (see Indicator: Highly erodible land). Overall, it is estimated that 182 million tonnes of eroded soil entered Aotearoa New Zealand's rivers in 2022 (see Indicator: Estimated long-term soil erosion).

The risk of erosion varies regionally. Of all regions, Gisborne had the highest proportion of its area classified as highly erodible land (15 percent, or 1,280 square kilometres). Of all regions, Gisborne also had the greatest areas with severe earthflow risk (228 square kilometres) and gully risk (161 square kilometres) (see Indicator: Highly erodible land). Gisborne has particularly high soil erosion due to very soft rock, which also means more sediment is delivered into rivers after storm events that cause mass-movement erosion (Dymond, 2010 as cited in Neverman et al, 2023; Dymond & Shepherd, 2023; MfE, 2024). Erosion risk is related to the levels of sediment movement into waterways, which were highest in the West Coast (48 million tonnes) and Gisborne (36 million tonnes) in 2022 (see Indicator: Estimated long-term soil erosion). The high soil erosion rates in the western Southern Alps are predominantly influenced by physical rock breakdown due to tectonic activity (Larsen et al, 2023).

Hot spots were identified in many areas across Aotearoa, representing areas with significantly higher proportions of highly erodible land at risk of erosion compared with Aotearoa on average. The five maps of Aotearoa in figure 2 show locations coloured according to whether an area is a hot spot or a cold spot for gully risk, high landslide risk (delivery to stream), high landslide risk (non-delivery to stream), moderate earthflow risk, and severe earthflow risk (see Indicator: Highly erodible land and appendix B).

Figure 2: Hot and cold spots for landslide, earthflow and gully erosion risk, 2022



In Aotearoa, modelling predicts a large increase in mass-movement erosion in soft-rock hill country with climate change, largely driven by increasing storm magnitude and frequency (Neverman et al, 2023). Localised studies find that grassland productivity can recover from the loss of soil in the decades following landslides, but only partially (Rosser & Ross, 2011). Production forests have a window of vulnerability after harvesting that can increase erosion risks (see case study: Our land use and management decisions have consequences in extreme weather events).

Floodplains and braided rivers are important habitats, but have lost area to urban and rural development.

Floodplains play a significant role in supporting the broader ecological health of the catchments in which they are found (EEA, 2020). They are home to biologically rich habitats, providing spawning grounds for fish and vital areas for birds (Hibbert & Brown, 2001; EEA, 2020). For example, taonga (treasured) bird species like kakī (black stilt), ngutu pare (wrybill), tarapirohe (black-fronted tern) and tarāpuka (black-billed gull) depend almost exclusively on braidplains for nesting and breeding (DOC, nd-a). In addition to flood and erosion control, floodplains act as natural filters when inundated, effectively removing excess sediment and nutrients (Hicks et al, 2021; Peters, 2016). However, degradation of floodplains and braided rivers is decreasing their ability to provide these important habitats (Greenep & Parker, 2021; Hicks et al, 2021).

Our rivers and floodplains, including our rare and endangered braided rivers, face encroachment from development for urban and agricultural use (Abell et al, 2023; Brierley et al, 2022a; Greenep & Parker, 2021) (see Indicator: Rare ecosystems). Around 60 percent of braided river habitat is in Canterbury (Hibbert & Brown, 2001). Across the margins of low-plain braided rivers in Canterbury, 11,630 hectares of riverbed and riparian margins were converted for agricultural use between 1990 and 2012. From 2012 to 2019, this loss continued at an average rate of 178 hectares per year, with some braided river margins declining by as much as 80 percent (Greenep & Parker, 2021).

The use of stopbanks, engineered channels and other means of restricting the natural movement of a river has altered the hydrology of many of our river systems and disconnected waterways from their natural floodplains (Brierley et al, 2022a, 2022b; Crawford-Flett et al, 2022). This has resulted in loss of habitat, along with an associated decline in cultural and recreational amenity, and a decline in the natural flood and erosion benefits that those systems provide (Brierley et al, 2022a, 2022b) (see Our freshwater 2023). Our degraded rivers and floodplains will be subject to increased flood risk with an increase in extreme rainfall events and climate change (Hicks et al, 2021; MfE, 2008).

Wetlands and dunes are among our most degraded ecosystems and continue to be lost.

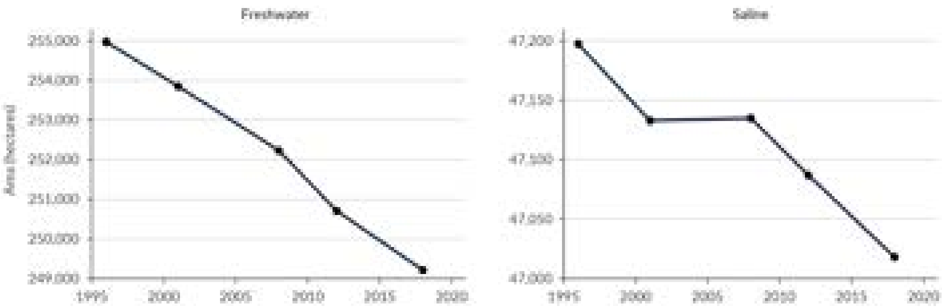
Dune and wetland environments are home to many nationally and regionally threatened species. For example, wetlands are vital for the survival of many of our taonga bird species, including the tētē whero (brown teal), mātātā (New Zealand fernbird), koitareke (marsh crake), matuku-hūrepo (Australasian bittern) and kōtuku (white heron), who rely entirely on remaining wetlands (DOC, nd-b) (see Our freshwater 2023). These ecosystems filter large volumes of seawater, prevent floods and erosion, store carbon, process nutrients, and offer recreational, cultural and aesthetic value (Dymond et al, 2021; Ryan et al, 2023; Thompson, 2022).

Wetlands provide mahinga kai (traditional food-gathering practices), natural resources, and rongoā (medicine) (Taura et al, 2017, 2021), while coastal dunes have significant archaeological and recreational values. Wetlands are taonga (treasured) and reflect a deep history and kōrero (set of narratives) of whakapapa stories (pūrākau), offering crucial insights into the overall health of the entire ecosystem (Taura et al, 2021). Despite their significance, our wetlands and sand dunes are among our most degraded ecosystems in Aotearoa (Bataille et al, 2021; Dune Restoration Trust of New Zealand, 2011).

We have lost around 90 percent of our wetlands in the past 150 years, and this decline is continuing (Ausseil et al, 2011; Dymond et al, 2021). Between 1996 and 2018, saline wetland area decreased by 180 hectares (see figure 3). Over the same period, freshwater wetland area decreased by 5,761 hectares, with 87 percent of this loss occurring through conversion into grazing grassland (see Indicator: Wetland area). Our remaining wetlands continue to degrade due to drainage, pollution, increased sedimentation, invasive weeds, animal pests, and climate change (Denyer & Peters, 2020) (see Our freshwater 2023). In 2022, large areas of the Awarua, Kaimaumau-Motutangi and Waituna wetland were ravaged by fire, with climate change escalating fire risk (see Our atmosphere and climate 2023). In 2023, Whangamarino wetland experienced a botulism outbreak linked to a large die-off of fish and birds due to a high level of pollution (Waikato Regional Council, 2023).

Our dune ecosystems have also suffered extensive loss. In 2008, sand dunes covered 25,208 hectares of our land surface, an 80 percent decrease from the 1950s (see Indicator: Active sand dune extent). Marram grass (*Ammophila arenaria*) is a widespread introduced dune species and is a key threat to our remaining active dune systems, limiting their integrity and functionality. The cover of marram grass increased significantly between 1985 and 2005, largely due to intentional planting as a means of dune stabilisation (Hilton, 2006). Grazing, land development, pollution, erosion, coastal structures, and daily disturbances also contribute to the degradation of our remaining dune ecosystems (Thompson, 2022).

Figure 3: Wetland area in Aotearoa New Zealand, 1996–2018 (excluding Chatham Islands)



Data source: Manaaki Whenua – Landcare Research

It is <u>highly likely</u> the quantity and quality of urban green space will continue to decline in some cities over the next two decades (high confidence).

In some major cities, the availability of urban green space such as parks and green belts is not keeping pace with urban expansion. The expansion of Auckland, Hamilton and Wellington has consumed 60,000 hectares of peri-urban land in the past 80 years, and Auckland and Hamilton have grown less green through time. Private green space is also declining, and this trend is accelerating (PCE, 2023).

Our urban areas have also lost a large amount of native vegetation, contributing to a decline in ecological diversity and disrupting the natural balance in these environments (Jang & Woo, 2022; Rodgers et al, 2023).

The quality of urban green space determines how much we can benefit from it and in what ways. Lawns account for a significant portion of urban green space in some cities – half in Auckland and two-thirds in Hamilton. However, lawns provide fewer biophysical benefits than more diverse and complex green spaces. Higher-quality urban green spaces are those that are planted in adequate soil, are well maintained, and include wetlands and trees. These support air filtering, biodiversity, cooling and shading, stormwater control, and water filtering to a much greater extent than open grassed areas or spaces with low shrub (PCE, 2023, 2024).

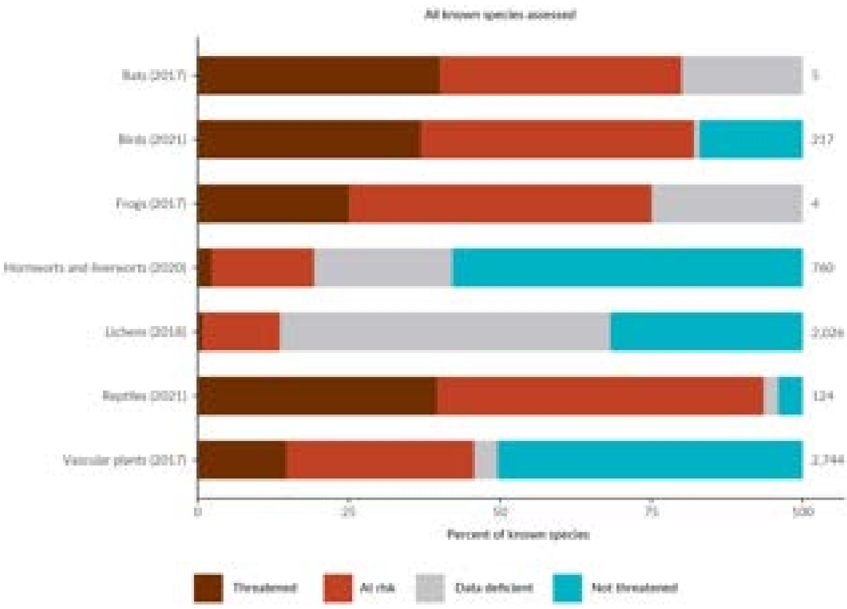
Private green spaces in our cities are declining in area due to an ongoing shift toward denser infill housing and smaller sections and yards. The area of private green space, as a proportion of each city's urban area, declined by around 20 percent in Auckland and 15 percent in Hamilton between 1980 and 2016 (PCE, 2023). Today, around 30 percent of Auckland's urban area consists of private green space. Expected population growth and intensification could potentially reduce this area by 5 to 10 percent (3,000 hectares) over the next two decades (PCE, 2023).

Should present trends persist, the extent of existing parks and reserves is not expected to change significantly during future development. Conversely, ongoing intensification is likely to replace many lawns and private gardens with new dwellings or cover these green spaces with impermeable surfaces for vehicle access and parking. This will result in fewer large trees or diverse patches of bush in private gardens, impacting resilience to rainfall and flooding events (PCE, 2023, 2024). Land development in urban areas also reduces soil quality through over-compaction, as well as reducing the amount of topsoil and subsoil, which is often excavated to build foundations (PCE, 2024).

Many indigenous species are at risk.

Indigenous ecosystems are important habitats for our unique species, which are also at risk from climate change, pollution and invasive species. The world is in a biodiversity crisis, with our unique biodiversity in Aotearoa declining (DOC, 2020; IPBES, 2019). In 2023, 94 percent (116 of 124) of our reptiles and 82 percent (178 of 217) of our birds were threatened with or at risk of extinction. Among vascular plants, 46 percent (1,253 of 2,744) were threatened or at risk. Further, many of our indigenous species are categorised as 'data deficient' (see figure 4) (see Indicator: Extinction threat to indigenous species).

Figure 4: Extinction threat to indigenous terrestrial species



Data source: Department of Conservation

Impacts on people and nature

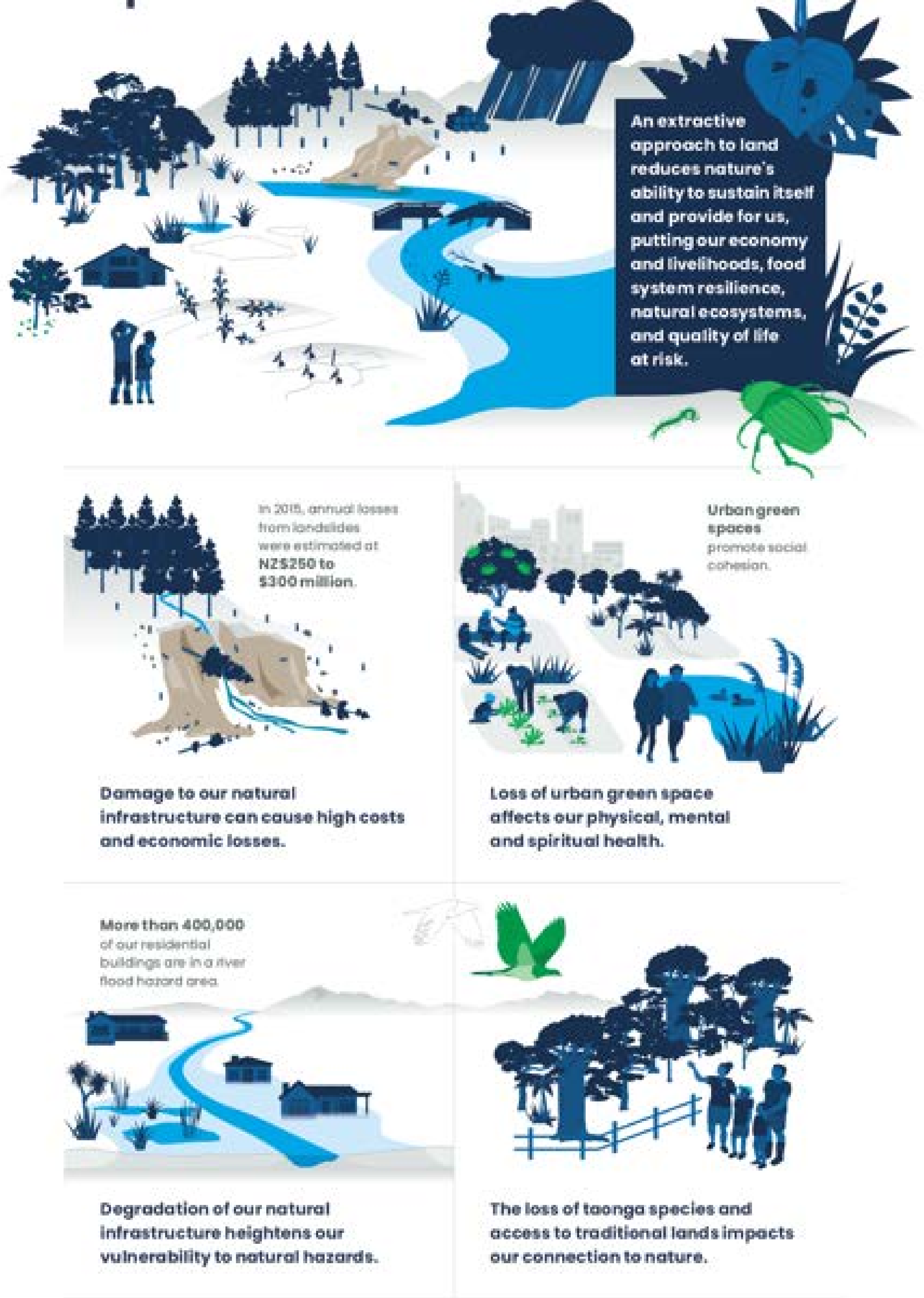
Land supports our economy, food systems, resilience to natural hazards, health, and our cultural connections and practices related to te taiao (the environment). Our connection to, and reliance upon, our natural infrastructure means that we are impacted by changes to the state of soils, ecosystems and the species they support. When the health of our land comes under pressure, its ability to support us is diminished.

The current state of land environments means that our economy, grey infrastructure and natural environments are more vulnerable. While only some of these vulnerabilities are quantifiable, those that are show that our natural infrastructure is suffering significant losses due to soil erosion, droughts, landslides, floods and pest species.

Impacts related to biodiversity and our relationships to te taiao are more difficult to quantify. Qualitative evidence suggests that the decline in the health and extent of indigenous ecosystems is impacting cultural practices, our senses of identity and place, and our mental, physical, and spiritual health, and that these impacts are likely to continue.

Sustaining, restoring, and enhancing the natural infrastructure that supports us mitigates the impacts of environmental pressures, both for us and future generations.

Impact on our land



The reduced availability of highly productive land can challenge types of food production.

Highly productive land offers a wide range of land-use options and choices (Lynn et al, 2009) and is important due to its contribution as a major export earner for Aotearoa New Zealand (Curran-Cournane et al, 2021a). Horticulture, which has typically been located on highly productive land close to urban fringes (MPI, 2019), was the third-largest food and fibre sector export earner in 2023 (MPI, 2023c).

Due to its proximity to urban fringes, horticulture is particularly vulnerable to urban expansion and land fragmentation (Curran-Cournane et al, 2021a, Greenhalgh et al, 2017; MPI, 2019). Outdoor horticulture production and arable cropping are constrained by climate and a range of land and soil characteristics, which limit the ability to move horticulture and arable cropping elsewhere (Curran-Cournane & Rush, 2021; MPI, 2019).

Reducing the amount of highly productive land available for horticulture through urban expansion and land fragmentation can result in increased intensification on the remaining land resource (Deloitte, 2018; Curran-Cournane et al, 2021a). Intensive horticulture production systems can negatively impact the health of the soil and receiving environment (Curran-Cournane et al, 2021b; Norris et al, 2023).

The loss of highly productive land for food production could affect the price of fruit and vegetables (Deloitte, 2018). Alongside other factors, the reduced availability of highly productive land in the Auckland and Waikato District could contribute to an increase in fruit and vegetable prices of up to 58 percent across the country by 2043 (Deloitte, 2018).

The availability of highly productive land, and its sustainable management, contributes to food system resilience by supporting production of nutritious and diverse food (Curran-Cournane et al, 2021a; Curran-Cournane & Rush, 2021; Davis et al, 2023). Alongside reduced access to highly productive land, food production is facing increasing threats such as climate change, biosecurity risks and water access issues (Davis et al, 2023; Deloitte, 2018; Te Puna Whakaaronui, 2022).

The loss of highly productive land also means the loss of cultural and historic heritage, with 90 percent of our historical māra kai (gardening, horticulture) sites now removed or absent (Harmsworth, 2022b). Areas that were historically used by Māori for gardening were often located on highly productive land. There are extensive historical areas for māra kai where iwi and hapū Māori practiced horticulture and modified the soils for growing various crops (as cited in Harmsworth, 2022b: Coffin, 2020; Harmsworth & Roskruge, 2014; McFadgen, 1980).

Damage to our natural infrastructure can incur high costs and cause significant economic losses. Land-based industries will almost certainly experience increased economic risks due to degrading natural infrastructure (high confidence).

Our economy and livelihood are embedded in nature. While some industries are more obviously reliant on nature, such as agriculture and forestry, every sector benefits from our natural ecosystems (Dasgupta, 2021). Examples of this interdependence include having a healthy workforce and strengthening our resilience to the impacts of extreme weather events (SBN, 2023).

Our food and fibre sector is an important part of our export economy. In the year ending June 2023, the sector (excluding seafood) accounted for $55.3 billion in export revenue, which represented over 75 percent of Aotearoa New Zealand's total in export goods (MPI, 2023c). The sector is particularly susceptible to issues such as soil erosion, pests, diseases and the effects of climate change and extreme weather events (Dalziel et al, 2018) (see Our atmosphere and climate 2023).

The costs associated with landslides have been estimated to be at least $250–300 million a year (Page, 2015, as cited in Rosser et al, 2017). A case study in the Manawatū-Whanganui region estimated marginal costs of surficial and mass-movement erosion, showing higher relative marginal costs associated with erosion in vegetable, fruit and dairy land uses (Soliman & Walsh, 2020).

Weeds and invertebrate pests are compromising productivity in land-based industries. Intensified production systems may be more vulnerable to disruption by pests and diseases (Meurisse et al, 2023). The total economic costs of pests to Aotearoa were estimated at $9.2 billion in 2019/20 (2.9 percent of gross domestic product (GDP)), with about $4.3 billion attributed to losses in primary sector production (MPI, 2021). Climate change is creating more favourable conditions for overseas pests and diseases to establish and invade and can favour the geographical spread of pests and diseases that are already present in Aotearoa (Keegan et al, 2022) (see Our atmosphere and climate 2023).

Primary industries, particularly agriculture, are highly vulnerable to the effects of climate change – changes in temperature, rainfall patterns, and extreme weather events (see Our atmosphere and climate 2023). Natural disasters such as droughts, landslides and floods can cost Aotearoa billions annually (ICNZ, 2021). Estimated damages following Cyclone Gabrielle and the Auckland floods are between $9 billion and $14.5 billion (New Zealand Treasury, 2023). Estimated damage to the food and fibre sector alone from Cyclone Gabrielle may total between $700 million and $1.1 billion in recovery costs (MPI, 2023c). The growing number of extreme events can increase associated costs under climate change (see Our atmosphere and climate 2023). The Māori economy faces significant vulnerability as Māori own substantial shares in primary sector assets, including 40 percent of forestry assets (MFAT, 2019).

Forestry and wood processing employs a workforce of approximately 40,000 people (MPI, 2024). However, forestry plantations are particularly at risk from extreme events, many of which are projected to increase in severity and frequency (Villamor et al, 2023; Watt et al, 2019) (see Our atmosphere and climate 2023).

The condition of our natural infrastructure supports our natural environment's aesthetic and recreational values, which are important attractions for visitors to our country. Where these values are degraded, there is risk to international tourism (PWC, 2023). Tourism directly contributed $13.3 billion, or 3.7 percent of GDP, to Aotearoa in the year ending March 2023 (Stats NZ, 2024c).

Measuring the costs of natural infrastructure degradation from an economic perspective often uses changes in GDP. This does not account for all the benefits our environment and natural infrastructure provide for us, including services like healthy soil, clean air and water, and pollination for food. Because of this, we often cannot measure and account for the full value of nature including the losses that are incurred when the environment is degraded (Bodey et al, 2022; Dasgupta, 2021).

It is highly likely that the degrading state of our natural infrastructure will reduce the regulating and flood protection services provided to surrounding communities and built infrastructure (high confidence).

The loss of our natural infrastructure contributes to vulnerability to hazards like flooding and fire (Munang et al, 2013).

Ongoing rural development and urban fringe expansion expose more people to wildfire threats due to proximity to highly flammable vegetation like ungrazed pastures or forestry plots in some areas (Huggins et al, 2020; Langer & Wegner, 2018; Langer et al, 2022). During the 2016/17 fire season, more homes were destroyed than had been in any of the previous 100 years, and this was surpassed in 2020/21 (Langer et al, 2021). Our changing climate is increasing the frequency and severity of wildfires and escalating the risks (Langer et al, 2021; Langer et al, 2022). Vegetation management and replacement with less flammable species on properties and community spaces can help reduce risk and slow the spread of fire (Langer et al, 2022).

Development near rivers can confine them to restricted spaces and increased flood risk. This puts communities and infrastructure at risk and limits flexibility to adapt to a changing climate (Hicks et al, 2021; Brierley et al, 2022b). It is estimated that more than 400,000 residential buildings, an estimated 12 percent of Aotearoa New Zealand's housing value, are exposed to flooding in an extreme weather event (Paulik et al, 2023).

Impermeable surfaces in our urban areas limit the amount of water that soaks into the soil. Stormwater instead flows through pipes directly to waterways. Stormwater systems are only designed to cope with rain and runoff to specific levels, so are vulnerable to extreme weather events which can overwhelm them (Feng et al, 2021; PCE, 2023, 2024). We have seen this in recent extreme rainfall events. Our natural infrastructure, if in good health, is resilient to changing flow regimes (DPMC, 2023; MacKinnon et al, 2023). It has been estimated that urban vegetation can help soak up a third of the water from extreme rainfall events (PCE, 2023).

Coastal development has increased our vulnerability to rising seas. Sea-level rise is a direct consequence of climate change and is accelerating globally and in Aotearoa. When sea levels rose in the past, both dune systems and wetlands that protect our coasts migrated inland. Today, this migration is not possible in most places as it would threaten public and private assets and infrastructure built along our coasts (Thompson, 2022). An estimated 72,000 New Zealanders are currently exposed to present-day extreme coastal flooding, along with about 50,000 buildings worth $12.5 billion (NIWA, 2019) and 191 marae identified within 1 kilometre of the coastline (Bailey-Winiata, 2021).

The health of our natural infrastructure affects the wider environment, including the climate, and freshwater and coastal ecosystems.

Many of the environmental challenges facing Aotearoa today stem from the state of our land (Meyfroidt et al, 2022; Renwick et al, 2022). Healthy natural infrastructure protects and enhances the wider environmental system and the many interactions between land, climate, air, lakes, rivers and oceans (Bennett et al, 2016).

Land use plays a crucial role in the climate system and contributes significantly to global climate change. In Aotearoa, our agricultural sector accounted for 49 percent of our gross emissions in 2021, making it the largest contributor to our greenhouse gas emissions (MfE, 2023b) (see Our atmosphere and climate 2023).

Land ecosystems are offsetting some, but a decreasing percentage, of our emissions. Land use, land-use change and forestry offset 27 percent of gross greenhouse gas emissions in 2021 in Aotearoa. This was 4 percent less offset than in 1990 (MfE, 2023b) (see Our atmosphere and climate 2023).

Healthy peatlands and wetlands offer vast and long-term carbon storage potential (Ausseil et al, 2015). However, the degradation and drainage of these ecosystems for agriculture result in significant releases of stored organic carbon into the atmosphere for as long as they remain drained (Clarkson et al, 2013).

Trees act as carbon sinks, absorbing atmospheric carbon dioxide as they grow, and helping mitigate climate change (Zhang et al, 2022). Forests protect underlying soils from winds, the forest canopy protects from rainfall, and tree roots reinforce soil. Together they minimise the risk of mass-movement erosion (Basher, 2013; Li et al, 2019; Phillips et al, 2023; Rey, 2021). Differences in tree species, age, soil type, and climate affect the impact of the individual forest on erosion and carbon sequestration (Phillips et al, 2023; Zhang et al, 2022).

Exotic plantation forest can also bring challenges associated with intensification and management. These include slash production, loss of water-regulating functions, loss of sequestered carbon during clear-fell harvest, and adding to the risks of wildfire, pest invasion, and wilding pine spread (Himes et al, 2020; Jones et al, 2023; Messier et al, 2022). During harvest in each forestry rotation, a window of vulnerability occurs when the forest canopy and roots no longer provide services such as erosion mitigation (Phillips et al, 2015).

The ways that forests are managed and cleared on steep terrains have increased the loss of valuable topsoil and the amount of sediment debris and landslide materials entering rivers. This excess sediment further harms downstream freshwater and coastal ecosystems (Brierley et al, 2022a; Marshall et al, 2023).

Land-use practices for agriculture, forestry and urban development contribute significantly to declines in freshwater quality and biodiversity. Excess sediment, nutrient, pathogen and contaminant pollution harm our freshwater ecosystems (see Our freshwater 2023). Afforestation of catchments can reduce sediment loss and erosion and improve waterway health (Baillie & Neary, 2015; Basher, 2013; Drewry et al, 2022).

Our marine habitats and biodiversity are under threat from the discharge of land-based pollutants and sediments. For example, increased sedimentation can smother coastal habitats, such as nursery areas for fish and shellfish (Fisheries New Zealand, 2021) (see Our marine environment 2022).

Lowland indigenous forests are important habitats for a high proportion of our threatened native species (Walker et al, 2008). Some species occasionally persist in the remnant indigenous forest in pastoral systems, such as the brown kiwi in the North Island. However, species that need large, connected forest area, like the kōkako, are generally not present in these modified landscapes (Norton et al, 2020). The native biodiversity persisting in these modified landscapes performs important ecological functions such as pollination, water-quality mitigation, erosion control, and carbon sequestration, while also retaining cultural and heritage values, among other benefits (Case et al, 2023; Pannell et al, 2021).

Exotic plantation forests can also have some positive effects on native species by protecting the edges of native bush remnants and improving connections between them (Marshall et al, 2023). Planted exotic forest in Aotearoa can contain native ecosystem remnants and provide habitat for indigenous species where no alternative exists. For example, records show that up to 118 species classified as threatened by the Department of Conservation are found in plantation forests (Pawson et al, 2010). Of the species recorded in exotic forest, 16 are classified as 'Nationally Critical', 17 'Nationally Endangered' and 17 'Nationally Vulnerable' (Pawson et al, 2010). These species include bats, insect-eating birds such as riroriro (grey warbler), pīwakawaka (New Zealand fantail), and kiwi, and a wide variety of invertebrates found in leaf litter layers, soil and wood (MWLR, 2018).

The decline in the health of our natural infrastructure and biodiversity reduces the ability of our environment to recover from disturbances caused by extreme weather events, long-term environmental changes, and climate change (Key et al, 2022; Dasgupta, 2021). Studies have compared similar ecosystems that differ in their numbers of species. Those with more species, indicating healthier natural infrastructure, tend to be able to keep functioning in the face of environmental stress. This comes through an 'insurance effect' whereby at least some species are able to adapt to changing conditions and maintain essential ecosystem functions (Key et al, 2022).

Our physical health reflects the health of the environment that we spend time in.

We rely on our natural infrastructure to support our physical health. It provides us with food and water, regulates our climate and temperature, and reduces air and noise pollution (Meurk et al, 2013).

Our growing urban areas produce, absorb and retain more heat than outlying areas, which will make them even hotter as temperatures rise with climate change (IPCC, 2021). Urban heat can place stress on infrastructure and ecosystems, and worsen certain health conditions, particularly for older people and youth (PCE, 2023). Urban forests and green space lower temperatures through transpiration and shading buildings, reducing this urban heat island effect (PCE, 2023). Reductions in urban green space will widen health inequities, especially for lower-income communities who already have less access to diverse green spaces and the benefits they provide (PCE, 2023; Regional Public Health, 2010; Whitburn, 2014).

Urban trees also combat air pollution. It is estimated that trees in Auckland alone remove 1,230 tonnes of nitrogen dioxide, 1,990 tonnes of ozone, and 1,320 tonnes of particulate matter annually (PCE, 2023). This is important for public health because particulate matter ($PM_{2.5}$) and nitrogen dioxide (NO_2) from human-made air pollution were associated with an estimated 3,317 premature deaths and 13,155 hospitalisations in Aotearoa in 2016 (see Indicator: Human health impacts of $PM_{2.5}$ and NO_2). Natural infrastructure also contributes to carbon sequestration, thereby helping to reduce the diverse range of public health impacts related to climate change (see Our atmosphere and climate 2023).

Some land-use practices contaminate the rivers we swim in and collect kai (food) from. This can be through sediment loading, microbes from sewage discharge that infect humans and livestock, and runoff from farmland and urban areas (French et al, 2022). This contamination makes rivers unsafe for swimming and depletes the mauri (mauri is an important Māori concept that describes the health and vitality of living systems) of many mahinga kai (traditional food-gathering practices) areas. Some sites are under harvest bans because kai is not safe to eat (Clough, 2013; Morrison et al, 2023; van Hamelsveld et al, 2023) (see Our freshwater 2023).

Healthy soil in our gardens allows us to grow our own food. However, some urban and suburban soils are contaminated by heavy metals (Ashrafzadeh et al, 2018).

As urban green space declines and demand for it increases, it is likely that these changes will alter our connection to urban green space and, consequently, the recreational and mental health benefits it provides (moderate confidence).

We rely on the natural world for recreation, building social connections, and supporting our mental and spiritual health (see Environment Aotearoa 2022). Land is an anchor for our collective identity and connection to land underpins Māori spirituality and health (Hond et al, 2019; Thom & Grimes, 2022). Our native ecosystems have scenic landscapes and unique wildlife and provide opportunities for recreation. A survey of over 3,800 New Zealanders about their experiences in the outdoors found that 84 percent of respondents felt having access to the outdoor spaces of Aotearoa is a major advantage of living here (DOC, 2020) (see Environment Aotearoa 2022).

Our increasing population continues to drive the demand for land to supply opportunities for recreation and to enjoy nature (see Our land 2021 and Environment Aotearoa 2022). Much of our population growth between 2018 and 2048 (likely 70 percent or more) will be in the main urban centres (Stats NZ, 2021). In cities such as Auckland and Hamilton, the amount of new green space being allocated is not keeping pace with urban development, meaning the proportion of green space available is shrinking (PCE, 2023).

Green spaces have been shown to promote good mental health, improve attention, reduce stress, and lower blood pressure and muscle tension (Hartig et al, 1991; Tzoulas et al, 2007; Ulrich, 1984). The importance of urban public green spaces was highlighted during COVID-19 lockdowns, when nearby parks and reserves were frequently visited by many people (Mackinnon et al, 2022; MfE, 2022). Living closer to green spaces has also been linked to decreased instances of anxiety and other mood disorders in urban populations (Nutsford et al, 2013).

The accessibility of urban green space for adolescents is associated with reductions in stress, substance problems, depressive symptoms, and psychological distress, as well as with improvements in mood, emotional wellbeing, and behaviour (Hobbs et al, 2023; Mavoa et al, 2019; McCormick, 2017; Tzoulas et al, 2007). This is important, as one-third of Aotearoa adolescents aged 15 to 17 years reported having difficulties in everyday activities, including communicating and social interaction, due to mental illness (HPA, 2020).

In te ao Māori (Māori worldview), people are related to their environment through whakapapa (ancestral lineage). These kinship relations to each other and within the natural world evoke reciprocity, active kaitiakitanga (the ethos of sustainable resource management, environmental guardianship) and the enduring aroha (love) and care for nature (Reihana et al, 2023). The importance of desirable, meaningful and reciprocal relationships between nature and humans reflected in te ao Māori has been adopted by the Treasury's Living Standards Framework to capture broader dimensions of wellbeing.

The degradation of our land and ecosystems impacts te taiao as a whole and, by extension, our national identity in Aotearoa (see Environment Aotearoa 2022). Changes in land cover and biodiversity loss have reduced people's attachment to their local environment over multiple generations**.** Loss of direct connection is particularly pronounced in urban spaces, where the loss of indigenous vegetation can cause disconnection from natural heritage and subsequent loss of identity and sense of place (Rodgers et al, 2023). Making natural heritage visible in urban areas, where most people live, can have many co-benefits beyond increasing biodiversity, through enhancing our connections to nature (Rodgers et al, 2023).

Loss and degradation of te taiao results in a loss of Māori knowledge, practices and culture.

The degradation of our natural infrastructure and wider biodiversity reduces opportunities for connecting with and maintaining relationships with te taiao, including Māori knowledge and practices such as kaitiakitanga (Harmsworth, 2022b; Mark et al, 2022).

Damage or loss of culturally important sites, including rare ecosystems such as wetlands, affects community interactions and tikanga practices (Awatere et al, 2021; Harmsworth &

Awatere, 2013) (see Our marine environment 2022). Maintaining connection to customary sites for food growing and gathering, such as mahinga kai and māra kai, supports relationships within local Māori communities, including in terms of identity, cultural revitalisation, social cohesion, intergenerational approaches to health promotion, and Māori resistance (Hond et al, 2019; Taura et al, 2017, 2021). Losing the ability to practise mahinga kai and the loss of access to relevant resources diminish mana (authority) (Awatere et al, 2021; Timoti et al, 2017).

Rongoā rākau (plant medicines) is integral to traditional Māori healing practices (Mark et al, 2022), and the plants necessary for these practices are vulnerable to changes in the landscape (Awatere et al, 2021; Marques et al, 2023). Many native plants have decreased in abundance or have been lost due to changes in land use and are under compounding pressures from introduced species, disease and climate change (Bond et al, 2019; DOC, 2020; Keegan et al, 2022). This can reduce rongoā practitioners' ability to connect with and harvest the plants they need (Marques et al, 2023).

Important knowledge derived from cultural metaphors, pūrākau (stories), and Māori ancestral sayings (whakataukī) guide customary management of plants and animals – for example, practices around the cultivation of harakeke (flax) (Erueti et al, 2023; Wehi, 2009). Maintaining this knowledge and connection to taonga (treasured) species is reliant on species resilience and survival. For example, the loss of mana and retraction of mauri was observed with declining kererū populations in Te Urewera Forest (Timoti et al, 2017). This can impact the ability to uphold traditional roles and responsibilities to protect the environment, and reflects a decline in health of the whenua (land), forest and communities (Lyver et al, 2009; Timoti et al, 2017).

Loss of, or lack of access to, traditional lands has cultural, practical and economic implications for Māori land owners. Nationally, it is estimated that approximately 20 percent of Māori freehold land is landlocked, meaning that the piece of land has no reasonable access (Waitangi Tribunal, 2024). This prevents use and enjoyment of the land, makes it difficult to reconnect to historical knowledge, and challenges the duty to practise kaitiakitanga and care for te taiao (Hond et al, 2019; Mark et al, 2022; Waitangi Tribunal, 2024). The term 'tangata whenua' expresses an understanding of the relationship to land as one where Māori 'belong' to the land (Hond et al, 2019). Place names of natural landscapes hold the historical lineages of peoples, places and species that retain the community genealogy of place (Davis et al, 1990; Reihana et al, 2023). They serve as reminders of the past and indicators of previous events (King & Goff, 2006).

Case study: Te Auaunga, Oakley Creek restoration

Te Auaunga, Oakley Creek. Photo: Kāinga Ora

Te Auaunga, known as 'swirling waters' or Oakley Creek, stands as the longest urban river, or awa, in the Auckland isthmus. It winds its way approximately 15 kilometres from the high ridgeline above Waikōwhai to the Waitematā Harbour (Kāinga Ora, 2023).

Two hundred years ago, the awa was nestled within a vibrant wetland named Te Wai-inu-roa o Rakataura, meaning 'the long drink of Rakataura'. This wetland served as a habitat for taonga like native birds, fish and plants used in rongoā while Māori harvested abundant harakeke and raupō (bulrush) for textiles (Auckland Council, 2016). Papakāinga were sustained by the abundance of resource (Auckland Council, 2016). Te Wai-inu-roa o Rakataura also played a crucial role in flood mitigation and drainage (Kāinga Ora, 2023).

From the 1840s, settlers drained the wetland and cleared the forests, transforming the area into farmland and later residential space. In the 1930s, flood mitigation led to the straightening and deepening of Te Auaunga. By the mid-1950s, Te Auaunga was confined within concrete pipes and channels to prevent flood damage to houses built on the natural floodplain (Auckland Council, 2016). The continued development of housing through the 20th and early 21st centuries increased the amount of impermeable surfaces, causing increased water flows and erosion in the lower catchment (Auckland Council, 2018). The mauri of Te Auaunga stream had been much reduced; in its degraded state, it was unable to support the rich ecosystems of the wetland (Kāinga Ora, 2023).

Healthy Waters Auckland and six iwi authority groups led the flood management and restoration project for Te Auaunga, which began in 2015/16 with extensive local engagement (Auckland Council, 2018). The project prioritised a range of social, cultural and ecological outcomes alongside flood risk reduction (Auckland Council, 2020b).

Before restoration, flooding in the area was managed with a fast-flowing culvert. This frequently failed to safeguard nearby houses, which continued to endure damage following heavy rainfall events (Auckland Council, 2020b). The concrete flood management system was not only inadequate, but also unlikely to handle projected increases in stormwater volume caused by climate change (Auckland Council, nd).

Transforming the concrete infrastructure into a more natural stream and wetland involved removing basalt, realigning the stream, and replacing road culverts with bridges. Te Auaunga was widened to increase water-carrying capacity, thereby improving flood management for the surrounding area. Thousands of native plants provide natural water filtration and reduce pressure on downstream stormwater management systems by enabling more water to be absorbed (Auckland Council, nd). Community engagement led to the inclusion of cycle paths, walking trails and recreational spaces, with the result that more people used the park and they reported that the stream appears healthier (Auckland Council, 2020b).

Green infrastructure projects like Te Auaunga can have economic benefits as well. While sometimes having high upfront costs, they can be more cost-effective over time compared with grey infrastructure. The restoration of Te Auaunga employed 30 young people to construct and maintain the new infrastructure. It costs less to insure green than grey infrastructure and costs associated with damage from flooding are lower (Spicer, 2023).

Years of collaborative efforts on the project have united community groups, fostering a shared sense of identity linked to Te Auaunga and the revitalised parkway. After Cyclone Gabrielle, efforts from community groups and extra volunteers quickly helped clear debris and restore the area, showing their connection with Te Auaunga (Volunteering Auckland, 2023). This unity is further represented by an artwork named Te Tohu o Te Auaunga, which can be seen along the stream (Kāinga Ora, 2023).

In its restored state, Te Auaunga is again able to serve as natural infrastructure through improved flood management and water filtration, as well as providing an urban green space for the residents (Auckland Council, nd).

Knowledge gaps

Nature's worth to society – whether it is related to providing benefits to the economy, resilience, culture, identity or public health – is often not reflected in decision-making. Many of our actions that have an effect on ourselves and others, including future generations, therefore go unaccounted for and give rise to widespread 'externalities' or indirect costs (Dasgupta, 2021).

Knowledge has a critical role to play in giving visibility to all the benefits we receive from healthy ecosystems and functioning natural infrastructure. Below we highlight four key knowledge gaps that became apparent when compiling this report.

Pressures on the environment interact with each other in complex ways.

The drivers and pressures highlighted in 'Pressures on our land' do not act in isolation. Our decisions and actions on land use intersect with each other to create compounding pressures on biodiversity and people, many of which are increasingly amplified by climate change, invasive species and pollution.

What we do on the land has consequences for all other parts of the environment. Our impacts flow through our freshwater environments to our oceans and have cascading impacts that travel through our air and atmosphere. In many cases we still lack understanding of these relationships between cause and effect, and stress and response.

Modelling is one tool that can help us make sense of this complexity. Modelling crystallises our current understanding of connections, building on past changes to understand future changes and the consequences of our actions. Modelling can also offer a tool to fill gaps where measurements are challenging to make and can be used to inform indicators.

Advances in our computing environment and an increasing diversity of data, including new measurement approaches like satellite data or LiDAR, make integrated environmental modelling a viable opportunity to inform decision-making. However, more effort is needed to ensure that research models are suitable for use in policy and decision-making, including testing of assumptions and uncertainties.

We lack a good understanding of what effects our interventions and policies have on nature and natural infrastructure.

Evaluation of the effect of interventions is essential to targeting investment and prioritising effort. We generally lack robust data to assess the extent to which everything – from national policy instruments to community-led initiatives – achieves its intended objectives and goals. This makes it challenging to attribute impacts to specific policies or innovations. It also limits the likelihood and confidence for outlook assessments.

We require an assessment approach that includes greater analysis of what effects policies have, and that can be applied across all environmental domains and knowledge systems, including mātauranga Māori (Māori knowledge).

We need better monitoring of the condition of natural infrastructure and how it relates to provision of economic, resilience, health and cultural benefits.

To effectively translate indicators in 'State of our land' into measures in 'Impacts on people and nature' requires different measures and therefore different monitoring approaches. Conventionally we monitor the abundance or extent of species and habitats such as threatened species or wetland extent, as noted in the 'State of our land'.

The health and condition of ecosystems are typically less well monitored. There is also a lack of a common terminology and typology for ecosystems. Without this, it is difficult to build an estimate of how nature supports our economy, resilience, culture and public health.

Potential exists to draw on a wider range of indicators and knowledge, including qualitative and quantitative indicators and information. Collectively this information can help us understand the condition of natural infrastructure and how it relates to functional support and benefits to people.

This includes intergenerational Māori knowledge that spans over hundreds of years through a long and close association with te taiao (the environment). Many Māori communities have developed localised approaches for monitoring land environments, or indicators, based on various forms of knowledge and their values and worldviews. These approaches are fundamental for local communities to reduce or adapt to environmental pressures.

Fully capturing the value that ecosystems and natural infrastructure provide to the landscape and to people is challenging.

Quantifying the value of nature and natural infrastructure is challenging, particularly as our relationship with nature changes over time. It is also a challenge to describe this value in a currency that allows visibility within decision-making (eg in monetary terms). However, doing so is essential if we are to realise all the co-benefits, fully appreciate nature and draw on natural infrastructure as a viable alternative to conventional infrastructure solutions.

There are several reasons that the benefits of natural infrastructure can be difficult to quantify. There is a lack of standardised and endorsed method for economic non-market evaluation, and putting a monetary value on nature may not bring the best outcomes (Maechler & Boisvert, 2024). Economic valuation still struggles to capture many of the non-material benefits we receive from nature (NZIER, 2017). For example, it is challenging to quantify the value of urban green space in enhancing our relationship with nature and improving our physical and mental health. We could consider the avoided healthcare costs, but even this wouldn't necessarily paint a representative picture that includes the co-benefits for our wellbeing, identity and culture, along with the inherent value of the ecosystem.

There are systems in use internationally that we could draw on to help capture this value. Most progress has been made where nature is viewed as a resource or asset, as is explored within Natural Capital Accounting, adopted in Australia and the European Union, or the System of Environmental-Economic Accounting (SEEA). Approaches such as True Cost Accounting can capture externalities to consider all hidden costs and benefits when it comes to how we use and manage land.

Appendix A: Probabilistic and analytic confidence language used in this document

Probabilistic language

Probabilistic language	Associated numeric probability
Almost certain / Highly likely	>90%
Highly likely / Very probable / Likely	75–85%
Probable / Likely	55–70%
Realistic possibility	25–50%
Improbable / Unlikely	15–20%
Remote chance / Highly unlikely	<10%

Analytic confidence

High confidence	Assessments are based on high-quality information, and/or the nature of the issue makes it possible to render a solid judgement. A 'high confidence' judgement is not a fact, however, and still carries a risk of being incorrect.
Moderate confidence	Assessments are based on credibly sourced and plausible information, but not of sufficient quality or corroboration to warrant a higher level of confidence.
Low confidence	Assessments are based on questionable or implausible information, the information is too fragmented or poorly corroborated to make solid analytic inferences, or significant concerns or problems with sources exist.

Outlooks assessments contained in this report should not be read as statements of fact and may be based on a variety of sources of differing reliability. Certain words in this document are used to convey the probability of analytical assessments. These words are underlined in this report, to clearly identify assessments. These are used in conjunction with expressions of confidence, which provide an indication of the reliability and level of corroboration of sources used in an assessment. The language and probability ranges we use are the same as those of other government agencies, to maintain consistency.

Appendix B: The Highly Erodible Land model and hot spot analysis

Highly erodible and model

The Highly Erodible Land (HEL) model identifies land at risk to the main forms of mass-movement soil erosion in Aotearoa New Zealand (landslide, earthflow and gully) if it does not have protective woody vegetation (Dymond et al, 2006). Figure 2 illustrates hot spots for this erosion.

The HEL model identifies five classes of land at risk of erosion:

1. high landslide risk – delivery to stream
2. high landslide risk – non-delivery to steam
3. moderate earthflow risk
4. severe earthflow risk
5. gully risk.

These classes are not ranked in severity, except for earthflow risk, which has severe and moderate classes of risk.

Landslide erosion is the sudden failure of soil slopes during storm rainfall. Earthflow erosion is the slow downward movement of wet soil slopes towards waterways. Gully erosion is massive soil erosion that begins at gully heads and expands up hillsides over decadal time scales. See Indicator: Highly erodible land for more information.

Hot spot analysis

Hot spot analysis identifies locations of statistically significant hot spots and cold spots in data by aggregating points of occurrence into polygons. This is one way to account for spatial autocorrelation. The analysis groups features together when similar high (hot) or low (cold) values are found in a cluster. We used hot spot analysis to analyse the data from the HEL model that use the 'Woody layer'. The data cover all of Aotearoa at a resolution of 10 metre by 10 metre pixels and for seven consecutive years (2016–22). See Indicator: Highly erodible land for more information.

Additional information

Environmental indicators

Listed below are the environmental indicators incorporated in this report, including two updated indicators shown in bold.

- Active sand dune extent
- **Estimated long-term soil erosion**
- Exotic land cover
- Extinction threat to indigenous species
- **Highly erodible land**
- Human health impacts of $PM_{2.5}$ and NO_2
- Indigenous land cover
- Irrigated land
- Land fragmentation
- Land pests
- Livestock numbers
- Predicted pre-human vegetation
- Rare ecosystems
- Soil quality and land use
- Temperature
- Urban land cover
- Wetland area

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Our land 2024
A snapshot

New Zealand's Environmental Reporting Series

Ministry for the Environment
Manatū Mō Te Taiao

Stats NZ
Tatauranga Aotearoa

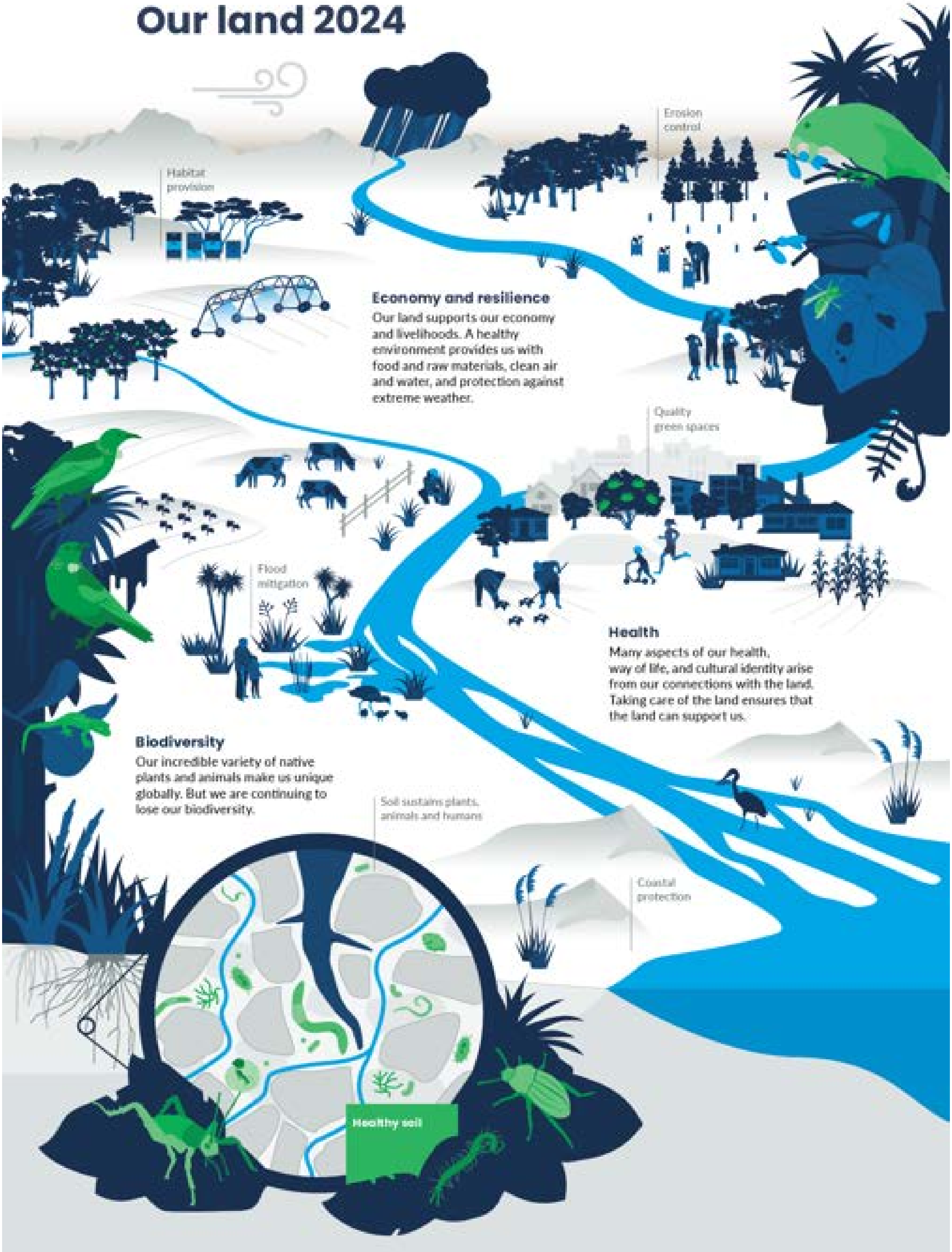
Our land 2024: A snapshot

The land and ecosystems of Aotearoa New Zealand are globally unique and for many people our relationship with the land is a defining characteristic of life in Aotearoa. Today, New Zealanders benefit from the many contributions land makes to our lives.

In *Our land 2024*, we use the terms ‘natural assets’ and ‘natural infrastructure’ to describe natural or semi-natural structural elements of ecosystems and landscapes that are important to delivering benefits for the environment and people. Examples of natural infrastructure include our soils, forests and grasslands, urban green spaces, and wetlands.

Functioning natural infrastructure provides us with a range of benefits, including improving water quality, absorbing atmospheric carbon, enhancing flood control, supporting biodiversity, and supporting our mental, cultural and physical health. Our natural infrastructure is also crucial to our economy. Our primary production and tourism sectors as well as our international brand and identity rely on our natural environment.

This snapshot of *Our land 2024* explores the current state of our natural assets and natural infrastructure, the benefits they provide us, and how we’ve placed them under pressure.


Our land 2024
Habitat provision
Erosion control
Economy and resilience
Our land supports our economy and livelihoods. A healthy environment provides us with food and raw materials, clean air and water, and protection against extreme weather.
Quality green spaces
Flood mitigation
Health
Many aspects of our health, way of life, and cultural identity arise from our connections with the land. Taking care of the land ensures that the land can support us.
Biodiversity
Our incredible variety of native plants and animals make us unique globally. But we are continuing to lose our biodiversity.
Soil sustains plants, animals and humans
Coastal protection
Healthy soil

Our soils

Key facts

5%
of our land (12,693km²) was classified as highly erodible in 2022.

Approximately
182 million
tonnes of eroded soil entered our rivers in 2022.

300,000+
landslides occurred in Tairāwhiti, Hawke's Bay, Wairoa, and the Wairarapa from Cyclone Gabrielle in 2023.

Our soils are a finite resource in our lifetime and yet a strategic natural asset. They play a critical role supporting biodiversity, purifying water, cycling nutrients, storing carbon, and underpin our agricultural and horticultural economy. In the year ending June 2023, the food and fibre sector (excluding seafood) accounted for $55.3 billion in export revenue, which represented over 75 percent of Aotearoa New Zealand's total in export goods.

For many Māori soil is also of great cultural significance, fundamental to māra kai (gardening, horticulture) and viewed as a living entity with deep connections to whakapapa (ancestral lineage).

But our activities on land have compromised both the quality and quantity of our soils through deforestation, urban sprawl and densification, and agricultural intensification. Climate change is adding to these pressures, exacerbating flooding, landslides and erosion.

The loss of soils through human-driven excess erosion, on top of our naturally high erosion rates, impacts the health of our indigenous land, freshwater and marine ecosystems. It also has significant consequences for the productivity and resilience of the food and fibre sector.

Our highly productive land and urban green spaces

Key facts

Approximately **two-thirds** of our population growth is projected to occur in less than 3% of our land area, in and around Auckland, Hamilton, Tauranga, Wellington and Christchurch.

54% increase in highly productive land used for urban or residential purposes between 2002 and 2019: from 69,920 to 107,444 hectares.

20% Auckland **15%** Hamilton decline in private green space as a proportion of each city's urban area between 1980 and 2016.

Highly productive land is a vital form of natural infrastructure. Its unique characteristics make it particularly suitable for some forms of primary production such as market gardening and vegetable production.

Urban green spaces provide important places for interaction with nature, foster community cohesion, and provide critical services such as lowering ambient temperatures, reducing stormwater runoff, and supporting biodiversity.

But our population is growing and is heading for 6 million by 2050. Population growth has contributed to the expansion of our towns and cities, with the total urban area in Aotearoa growing by 15 percent between 1996 and 2018 (See indicator: Urban land cover).

This means that highly productive land, often on the fringes of our cities, comes under pressure from development and land fragmentation as cities grow outwards. Reducing the land available for horticulture can have consequences for food prices. The reduced availability of highly productive land in the Auckland and Waikato District could contribute, alongside other factors, to an increase in fruit and vegetable prices of up to 58 percent across the country by 2043.

Whilst urban densification provides a solution to housing availability, in some major cities, the availability of urban green space such as parks, green belts, and private gardens is not keeping pace with development. This has consequences for our physical and mental health and our ability to connect with nature.

Our indigenous forests

Key facts

A quarter of remaining native vegetation is hosted on private land.	**12,869 ha** of indigenous land cover was the net loss in Aotearoa between 2012 and 2018.	**27%** of gross greenhouse gas emissions were offset by land use, land-use change and forestry in 2021.

Our forests are an important habitat for a high proportion of threatened species, many of which are considered taonga (treasured), as well as culturally significant sources of rongoā (medicine). They also reinforce and protect underlying soils from rainfall, reducing the risk of erosion and landslides, and function as carbon sinks, sequestering atmospheric carbon dioxide.

Following human settlement, our lowland indigenous forests were cleared in favour of agricultural landscapes. More recently exotic forestry, in particular species such as radiata pine, has expanded into pastoral hill country. Alongside international log demand, production forestry is incentivised as a tool for climate change mitigation.

While exotic plantation forests provide economic, climate and some biodiversity benefits, they can also cause challenges associated with slash production, wilding pine spread, and the loss of sequestered carbon and erosion during clear-fell harvesting.

Our floodplains and braidplains

Key facts

400,000+ residential buildings, an estimated 12% of our housing value, are exposed to flooding during extreme weather events.	**11,630 ha** of riverbed and riparian margins, across 20 braided rivers in Canterbury, were converted to agricultural use between 1990 and 2012.	Damage from Cyclone Gabrielle and the Auckland floods may total between **$9B** to **$14.5B** in recovery costs.

Our floodplains and braidplains are ecologically significant habitats. They also provide critical capacity for our river systems during floods and remove excess sediment and nutrients when inundated. Due to their flat and naturally fertile soils and proximity to water for irrigation, floodplains and braidplains are also desirable for urban and rural development.

However, development on floodplains has exposed communities and built infrastructure to flood and erosion risks and led to the need for engineered flood protection systems. Urban and agricultural development is also occurring alongside our braided rivers, constraining their channel margins. Extreme rainfall associated with climate change is also likely to place increased pressure on these systems over time.

These pressures have resulted in a loss of habitat for indigenous species as well as a decline in cultural and recreational amenity. While measures that restrict the natural movement of river systems such as engineered channels and stopbanks are designed to protect communities, they also alter river systems' natural capacity to provide flood and erosion benefits. Climate change is expected to increase risks to communities in flood-prone areas and there is growing recognition that existing structural flood protections are inadequately prepared for these pressures.

Our dunes and wetlands

Key facts

In 2008, sand dunes covered **25,208 ha** of our land surface, an 80% decrease from the 1950s.

5,761 ha of freshwater wetland area was lost between 1996 and 2018.

72,000 New Zealanders are exposed to extreme coastal flooding. At least 50,000 buildings worth $12.5 billion and 191 marae are within 1 kilometre of the coastline.

Our coastal dunes protect coastlines from flooding and erosion while our wetland ecosystems filter nutrients, reduce flooding, and store carbon. Dunes and wetlands also provide opportunities for recreation and cultural connection and provide crucial habitats. For many Māori, wetlands are taonga, providing opportunities for mahinga kai (traditional food-gathering practices) and rongoā as well as providing insight into the health of ecosystems.

Urban development in coastal areas has limited the ability of our dune systems to migrate inland in response to sea-level rise and storms, reducing their flood protection benefits.

We have lost around 90 percent of our wetlands in the past 150 years. Between 1996 and 2018 freshwater wetland area decreased by 5,761 hectares, with 87 percent of this loss occurring through conversion into grazing grassland (see Indicator: Wetland area). Drainage of wetlands for agricultural purposes has released significant stores of carbon into the atmosphere and significantly diminishes their capacity to mitigate flooding or provide ecological and cultural value.

Our evidence base

Existing data and research show us how the pressure we're placing on our natural infrastructure impairs its function. However, gaps in our evidence base limit our ability to fully understand the ecosystem effects while taking full account of the value of our natural infrastructure.

Conventionally we monitor the abundance of species or extent of habitats such as wetlands. The health and condition of ecosystems are typically less well monitored. There is also a lack of a common terminology and typology for ecosystems. Without this, it is difficult to build an estimate of how nature supports our economy, resilience, culture and public health.

Quantifying the value of nature and natural infrastructure is also challenging, particularly as our relationship with nature changes over time. It is also a challenge to describe this value in ways that allow visibility within decision-making (eg in monetary terms). However, doing so is essential if we are to recognise natural infrastructure as a viable alternative to conventional infrastructure solutions and realise all the co-benefits it can provide.

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9.8 Water and Land Portfolio update

Report by: Liz Devery, Regional Planning Manager
Approved by: Lucy Hicks, General Manager Policy & Government Reform
Report Date: 19 June 2024

Purpose

To provide an update on the water and land portfolio work that has advanced since the last update to this committee on 8 May 2024.

Recommendation

It is recommended that the Strategy and Policy Committee **resolve to:**

1 Receive the report - "Water and land portfolio update".

Proposed Southland Water and Land Plan (pSWLP) appeals

There are a few matters relating to the pSWLP that remain live with the Environment Court. Since our last report, there has been no changes in relation to the remaining water quantity matters that relate to the appeals on Policy 42 and Appendix L.5.

The parties to the High Court appeal relating to a proposed Rule 78A on 'Weed and sediment removal for drainage maintenance' have filed a memorandum seeking the adjournment of that appeal. A working group is being established to advance a resolution to these appeals with the initial meeting of representatives from the parties proposed for the start of July.

Council has sought leave to appeal to the Court of Appeal part of the High Court decision relating to Rule 24 Incidental Discharge. This is particularly in relation to the potential implications of the High Court's interpretation of s70 of the Resource Management Act and its application in the Southland context.

Proposed Southland Water and Land Plan Implementation

While technically we are to continue referring to the plan as being 'proposed', on 27 May 2024 a significant portion of the pSWLP was made operative. As outlined above, there remain only five provisions subject to the appeals referred to above that are not yet resolved.

There has been some communication with the broader community and stakeholders, engagement on the implementation of the Plan has been initially focussed on internal staff, rural professionals and consultants to ensure a detailed understanding of the technical implications. Some of these key messages being shared through this engagement, to date, include:

- Activities that were established lawfully and are continuing with no change in nature, scale and intensity, can continue for now. However, in accordance with s20A of the Resource Management Act, by 27 November 2024, these activities will need to either meet the operative provisions of the pSWLP or apply through a resource consent, in order to continue. Anyone proposing new or altered activities, will need assess their activities with consideration of the operative pSWLP provisions.

- There is some commentary in some parts of the community that central government is removing regulatory barriers to rural activities. In Southland, in many cases, the removal of some of the central government legislation may remove regulatory duplication. However, our messages to the community have been clear that until national direction changes have been made, we still need to apply the legislation as it stands. The regional plan provisions will continue to apply in Southland.

Fact sheets for a number of activities have been published and are available on the Council's website.

The implementation of farm environmental management plans is progressing. 22 certifiers completed the certification training earlier in the year. These have been assessed and the majority will be recommended to be approved as certifiers. A further seven attended the regional training portion for certifiers on 4 June. These applicants were also of a strong standard. The certifier training process involves both national and regional level training. The training is an important step towards ensuring that both the national objectives and those set out in the Proposed Southland Water and Land Plan are understood and pathways towards meeting these objectives are built into on-farm actions. Feedback on our regional training has been positive. Staff have been working with rural industries to identify opportunities for alignment and extension of existing plans. Government has announced their intention to change elements of the national farm plan regulations, details of these changes are expected in the next few months.

With the six-month existing activities provisions under s20 (of the RMA) as outlined above, the operative pSWLP decision rules, on Intensive Winter Grazing, will impact activities next season, in most situations. If there are any changes to the nature, scale and intensity of these activities this season, the provisions of the pSWLP will need to be considered. Where there are no changes, this season is being treated in a similar way to the last season.

Plan Change Tuatahi

The plan change will continue to sit within the wider body of land and water work across the organisation and within the community in the pathway towards reaching the existing pSWLP Objectives, including integrated management of resources and providing for te hauora o te tangata (the health of the people), te hauora o te taiao (the health of the environment) and te hauora o te wai (the health of the water body).

A broad Southland solution to freshwater management will involve a mix of regulatory and non-regulatory actions developed and implemented across a generation. It is acknowledged that the success of this pathway of action will require community understanding and ongoing engagement. Staff will continue to progress work towards implementation of the National Policy Statement for Freshwater Management by the 2027 deadline. In the interim, a work programme building on the Water and Land Plan, and the vast amount of work already undertaken, will be developed and implemented. This may involve some policy and provision changes to be notified in early 2025. Future changes to the Water and Land Plan will address implementation issues ensuring regulation supports positive action and will consider the articulation of goals specific to our Southland catchments.

Fit with strategic framework

OUTCOME	CONTRIBUTES	DETRACTS	NOT APPLICABLE
Managed access to quality natural resources			
Diverse opportunities to make a living			
Communities empowered and resilient			
Communities expressing their diversity			

Attachments

Nil

9.9 Group Programme Update

Report by: Liz Devery, Regional Planning Manager
Approved by: Lucy Hicks, General Manager Policy & Government Reform
Report Date: 19 June 2024

Purpose

This report is an update on the work being carried out by the Strategy, Science and Engagement Group and the Policy and Government Reform Group.

Summary

There are various projects progressing forward across the group from consultation to policy development.

Recommendation

It is recommended that the Strategy and Policy Committee **resolve to:**

1 Receive the report - Group Programme Update.

Background

The Strategy, Science & Engagement Group are responsible for:

- Developing clear strategy, corporate plans and defined priorities
- Proving coordination and support for the management and successful performance of the organisation's key groups of activities/portfolios – air quality, biosecurity and biodiversity, climate change and community resilience, coast and marine, regional leadership, and water and land
- Leading the generation and reporting of data and insights
- Identifying and managing strategic relationships and partnerships
- Overseeing formal stakeholder and community engagement processes across the organisation
- Providing centralised communications functions
- Delivering science capability

The Policy and Government Reform Group are responsible for:

- Developing resource management and regional plan-making;
- Providing policy advice;
- Providing drafting leadership;
- Monitoring plan effectiveness;
- Managing the review of, and Council's response to, national direction and reform.

Matters of interest

Information about national and regional matters of interest is outlined below. Tables of current and future consultations are below.

National

Fast Track Bill

On 23 May, the coalition government announced the introduction of its first bill to amend the RMA to Parliament.

Named the Resource Management (Freshwater and Other Matters) Amendment Bill, it will seek to make the following changes to the RMA:

- Amendments to exclude the hierarchy of obligations under the NPSFM 2020 from consideration in a resource consent context;
- Amendments to the NES-F and Stock exclusion regulations (including regarding intensive winter grazing);
- Amendments to the timeframes for implementing part of the NPSIB 2023;
- Amendments to the process for making national direction (largely to remove the Board of Inquiry process and provide a single pathway for national direction); and
- Amendments to provide a consenting pathway for coal mines (similar to other mineral extraction activities).

The Bill has been referred to the Primary Production Select Committee who will hear submission and provide direction to ministers.

There are several parts of this Bill (being the hierarchy of obligations in the NPSFM, winter grazing and stock exclusion regulations) are addressed in the Proposed Southland Water and Land Plan (pSWLP). If the proposed amendments do proceed, the pSWLP will still manage these activities despite any changes being made.

Environment Southland has drafted a submission on the Bill and it is attached to these Strategy and Policy Committee agenda for discussion and approval, prior to the deadline of the 30 June 2024.

Climate Change Submission
The Climate Change Commission is currently consulting on three topics being:

- draft advice on the fourth emissions budget (2036-2040)
- review of the 2050 emissions reduction target
- review on whether emissions from international shipping and aviation should be included in the 2050 target.

Councillors and staff attended the Climate Change Commission hui in Gore on 13 May and provided verbal feedback on various elements relating to the primary sector, economic viability, ETS setting and commercial forestry.

A report was put the Council meeting on 29 May. Councillor views were outlined during that discussion were incorporated into the Environment Southland submission. A retrospective report, outlining the final ES submission, will be tabled at Council, as the submissions closed on 31 May.

Regional

Transport planning – RLTP Update
The consultation period for the Otago Southland Regional Land Transport Plan (RLTP) mid-term review closed on 19 April 2024. 58 submissions have been received and with Hearings held over two days at the end of May and start of June.

A Regional Transport Committee meeting is scheduled for the 24 June 2024 for the Hearing Panel to make its recommendations on the RLTP. Council will be presented a report to consider approving the submission of RLTP to NZTA in July.

Regional Coastal Plan Review
Staff are continuing to work on the review of the Regional Coastal Plan for Southland. A workshop was held in June to further conversations on indigenous biodiversity and ecosystems in the coastal environment. The

objectives of the workshop were to brief governance on the current policy requirements for biodiversity and ecosystem protection in the coastal environment in order to get a deeper understanding of the implications of these requirements and management options.

Proposed Gore District Plan
Hearings on the Proposed Gore District Plan commenced on 4 June and will continue for the next 12 months. Environment Southland submitted on the Proposed Plan, the key themes were:

- natural hazard management – accurate modelling and identification of natural hazard areas, a precautionary approach, restricting intensification of development in natural hazard areas, any new zoning to be outside flood and liquefaction prone land. The flood modelling relied on to identify risk and areas for increasing residential/commercial/industrial development needs to be robust. The ES technical teams are undertaking independent modelling to ensure that the flood risk is accurately mapped.
- enabling land use change, and development within areas that have some level of protection with a stop bank. The February 2020 flood met the design limits of the Mataura River stop banks in Gore and Mataura. Predicted climate change impacts are expected to see increasingly high levels of rainfall and more intense floods, which may exceed the capacity of the Mataura River Stop Banks. The submission requests that additional criteria are developed in the District Plan to manage new land use and development in areas with some level of flood protection.
- climate change – natural hazard events such as flooding and drought will have increasing impacts on Gore District moving forward. Natural resources and future development should be managed in a way which anticipates, is adaptive and resilient to climate change impacts moving forward.
- indigenous biodiversity – Mapping of SNAs be undertaken in consultation with the community in order to achieve SRPS and the new National Policy Statement requirements.
- outstanding landscapes maps have been included, based on the regionally commissioned landscape report. The District Plan does not outline any processes for identifying areas of cultural significance, such as the Apiti Hono Tatai Hono framework which was commissioned as a partner-piece to the regional study, and articulates a process to identify mana whenua values. The submission suggests, additional policies are developed to more holistically recognise and enable mana whenua in the identification of significant landscapes whether mapped in the District Plan or not.

Environment Southland staff will be attending hearings when these topics are being heard and will present evidence where necessary to support points made in the submission. A decision on the Proposed Gore District Plan is anticipated in late 2025.

Auditor General Report
On Tuesday 21 May the Office of the Auditor General published a follow-up report outlining how regional council and iwi relationships have progressed since the 2019 relationship report.

In 2019 the report outlined that Environment Southland had built strong collaborative relationships with Ngai Tahu ki Murihiku on freshwater initiatives over many years.

The latest report outlined that trust and confidence between Environment Southland and Ngai Tahu ki Muirihiku has continued to improve since 2019. Some examples are a mana whenua rep being appointed to governance roles, improvements in iwi access to mahinga kai, and improvements in water quality in some catchments.

PROJECT / PROGRAMME	KEY OBJECTIVES
Proposed Southland Water and Land Plan (pSWLP)	Completion of Environment Court hearings on the pSWLP appeals Topic B matters following mediation. Preparation for the future plan change (Plan Change Tuatahi) to be notified this triennium.
Coastal Plan	Stage 2 includes discussion papers and workshops with Council and the TAMI Board on provision details. This further work will continue throughout 2024.
Air	A review of the Clean Air Loans Scheme. A further review of the Air Plan will be advanced once the revised NESAQ is released.
Hazards Management	Ongoing provision of hazard advice and support to communities. Ongoing work underway to update advice.
Transport Management	Co-ordinate approach through the Combined Regional Transport Committees (RTCs). Manage stock effluent dumpsites across the Southland region. Completed development of new Regional Land Transport Plan.
Regional Policy Statement (RPS)	The RPS is being revised to include freshwater visions and implement the National Planning Standards.

2023/2024 "Action ahead" summary

	NEXT MILESTONES	STATUS	RELEVANT DATES
1. pSWLP & limit setting	A large portion of the provisions in the proposed Southland Water and Land Plan have been settled through the Court process and have been made operative. Staff are focussed on the implementation of those provisions. There remains matters that have not yet been resolved. An appeal that raised water quantity related matters is still in Environment Court. A joint memorandum signed by the parties involved in the appeal relating to drainage maintenance is seeking an adjournment of that appeal. The parties involved are actively working through matters raised in the Court to see if there is an alternative means of addressing the various concerns. High Court issued a decision on Rule 24 – Incidental Discharge. Leave has been sought to appeal part of the decision to the Court of Appeal.	**In progress**	**May 2024**
	The scope of the refocused Plan Change Tuatahi, given the changes in national direction, is being developed for further Council discussion and endorsement.	**In progress**	**April 2025**

2. Coastal Plan	A Surface Water Activity Plan Change was notified in July 2022 to address increasing intensification of these activities in Fiordland. The provisions have been referred to the Minister for Conservation for approval of the provisions accepted by Council.	**In progress**	**Early 2024**
	Provision drafting for the wider RCP review continues using the substantial direction already received from councillors and TAMI Board members. A workshop was held in June to get an understanding of obligation and management options relating to biodiversity and ecosystems in the coastal environments.	**In progress**	**End 2024/start 2025**
3. Air	Council received and workshopped the Clean Air Loans Scheme (CALS) review reports in late 2023. A recommendation for Council to discontinue the CALS will be tabled at the Strategy and Policy Committee meeting in June 2024, following further discussion with Invercargill City Council and Gore District Council staff.	**In progress**	**Mid 2024**
4. Hazards Management	LiDAR capture for the majority of the region is available. There remains data from small areas of the region that are being reviewed and corrected prior to release.	**In progress**	**Start 2024**
	The Southland Natural Hazards Portal is live and will continue to be updated as further information is received.	**In progress**	**Ongoing**
5. Transport Management	The Regional Land Transport Plan (RLTP) consultation closed on 19 April. Hearings were held at the end of May and start of June to consider the submissions received. The Regional Transport Committee will consider the recommendations of the Hearing Panel and report to Council in July.	**In progress**	**April 2024**
6. RPS	Following the decision of Council late in 2022, the review of the Regional Policy Statement is focused on the required freshwater changes and is being developed as part of freshwater management process. Any potential changes identified as required through the Southland Coastal Plan Review process are also being considered.	**In progress**	**April 2025**
7. Climate Change and Community Resilience	The proposed Regional Climate Change strategy, endorsed by all Councils at respective Council meetings in late January and early February 2024, has gone through a consultation process with deliberations on submission due to be concluded on 20 June 2024. The focus of the Regional Climate Change Working Group (RCCWG) for 2024 is to begin the second phase of determining collaborative pathways to achieve the aspirations set out in the proposed strategy. An inter-agency report from the group's last workshop on 23 May 2024.	**In progress**	**Ongoing**

8. Environmental Monitoring	Regular State of the Environment monitoring continues along with hydrological work and servicing of data requests.	**In progress**	**On going**
9. Science Strategy and Investigations	Scientific work to inform policy development processes, as well as advice and technical input into consent applications, compliance matters, submissions, national science projects, working groups state of the environment monitoring and science investigations continues. Key activities include analysis of data from the summer monitoring programmes (such as recreational waters, biomonitoring, estuary and marine monitoring), support for Plan Change Tuatahi, the Waiau River bioenergetic model, the Mataura overallocation project and Waituna Lagoon monitoring and reporting.	**In progress**	**On going**
10. Strategic Communications	Key activities include supporting community engagement at various events around the region and responding to emerging issues. The next Envirosouth is in development.	**In progress**	**On going**

Current, relevant initiatives open for consultation

NAME OF INITIATIVE	LEAD AGENCY	DUE DATE	DESCRIPTION	RECOMMENDATION/ACTION
Fast track consenting Fast-track Approvals Bill - New Zealand Parliament (www.parliament.nz)	Environment Committee	19 April 2024	Legislation to meet the Government's 100-day commitment to develop a permanent fast-track consenting regime. NB the carried over Natural and Built Environment Act regime will apply until this legislation is passed. Fast track consenting is for consents, concessions, Wildlife Act, Freshwater regulations, marine concessions, reserves and aquaculture. Supplementary Analysis Report: Fast-track Approvals Bill | The Treasury New Zealand.	Submitted in support and suggested changes to improve outcomes. Presented submission to the Environmental Select Committee – 17 May 2024
Provide Advice for Preparation of Emissions Budgets https://www.climatecommission.govt.nz/our-work/advice-to-government-	Climate Change Commission	31 May 2024	Every five years, the Climate Change Commission must: • review emissions budgets that are already set – they may recommend a budget be revised if there have been changes to the way emissions are measured or reported, or if significant changes have affected the considerations on which the emissions budget was originally based. • Recommend the maximum level of the next emissions budget.	Submission

NAME OF INITIATIVE	LEAD AGENCY	DUE DATE	DESCRIPTION	RECOMMENDATION/ACTION
topic/preparing-advice-on-emissions-budgets/				
Review of the 2050 Emissions Target https://www.climatecommission.govt.nz/our-work/advice-to-government-topic/review-of-the-2050-emissions-target/	Climate Change Commission	31 May 2024	The Commission must review emissions budgets every five years starting in 2024. At the same time as this, they must provide independent expert advice on whether any changes should be made to Aotearoa New Zealand's legislated 2050 targets. These could be changes to what the targets are, what gases they apply to, when the targets have to be met by, and how much can be met in Aotearoa New Zealand or paid for overseas.	Submission
National Environmental Standards for Marine Aquaculture	MPI	11 June 2024	Targeted engagement by MPI on proposed changes to the NES-MA. Topics: - Enabling on-farm innovation through changes to species and structures - Enabling research and trials on existing marine farms - Maintaining a secure spat supply via existing marine farms - Lifting best practice management - Amending the RMA to enable more straightforward changes of consent conditions - Consideration of proposals on Māori	Feedback collated at staff level
International visitor Conservation and Tourism Levy Review 2024	MBIE	11 June	Consultation on the Visitor Levy (4 options), including where it should be spent. References potential for inclusion in Regional and City Deals.	Maintain watching brief
NZ ETS Unit Settings and Annual Regulatory Updates 2024	MfE	14 June 2024	Consultation is now open on the Government's annual review of auction settings and other regulations for the New Zealand Emissions Trading Scheme (NZ ETS). Read the annual updates to NZ ETS limits and price control settings for units 2024 consultation document	Maintain watching Brief

NAME OF INITIATIVE	LEAD AGENCY	DUE DATE	DESCRIPTION	RECOMMENDATION/ACTION
			Read the proposed changes to NZ ETS regulations 2024 consultation document	
Privacy Amendment Bill (added 6 December 2023) Privacy Amendment Bill 292-1 (2023), Government Bill Contents – New Zealand Legislation		14 June 2024	The Bill creates a new privacy principle that individuals must be notified when there is indirect collection of personal information by a third party. The key purpose of this bill is to improve transparency for individuals about the collection of their personal information and better enable individuals to exercise their privacy rights.	No action planned
Inquiry into Climate Adaptation	Finance and Expenditure Committee	16 June	This consultation is calling for further submissions from a previous consultation round in 2023.	Maintain watching brief
Resource Management (Extended Duration of Coastal Permits for Marine Farms) Amendment Bill	Primary Production Select Committee	16 June 2024	The bill would extend the current duration of all coastal permits currently issued under the RMA authorising aquaculture activities by 20 years, but not beyond 2050. The extension would: • cover all of the RMA consents (coastal permits) needed for a marine farm to operate • apply to all marine farms that hold a current resource consent at the time the bill commences • would not extend the duration of any marine farm past 31 December 2050 • would be granted automatically, without requiring an application from the consent holder The bill would provide a bespoke mechanism for consent authorities (councils) to review consent conditions of extended consents.	Submission

NAME OF INITIATIVE	LEAD AGENCY	DUE DATE	DESCRIPTION	RECOMMENDATION/ACTION
Public consultation on modernising approach to the 2028 Census Information about this consultation can be found here: [Future census consultation]()	StatsNZ	18 June	Between 8 May and 18 June 2024, StatsNZ are conducting a public consultation on 'Modernising our approach to the 2028 Census'. They are seeking feedback on how to do a population census in the future. Taituarā have already provided feedback around timing and release of census data to better align with council planning cycles as well as granularity and usability of data from a TA perspective	Maintain watching Brief
Resource Management (Freshwater and other Matters) Amendment Bill	MFE/ Primary Production Select Committee	30 June 2024	• while the NPS-FM is being reviewed and replaced, resource consent applicants no longer need to demonstrate their proposed activities follow the Te Mana o te Wai hierarchy of obligations, as set out in the National Policy Statement for Freshwater Management (NPS-FM). • Amend stock exclusion regulations in relation to sloped land. • Repeal intensive winter grazing regulations. • Align the consenting pathway for coal mining with the pathway for other mining activities in the National Policy Statement for Indigenous Biodiversity (NPS-IB), NPS-FM, and the National Environmental Standards for Freshwater (NES-F). • Suspend the NPS-IB requirement for councils to identify new Significant Natural Areas (SNAs) for three years. • Change to process for amending, developing national direction.	Submission
Proposed minerals strategy to 2040	MBIE	31 July	Particularly interested in the questions below: 1. Are the strategic pillars of the Strategy (Enhancing prosperity for New Zealanders, Demonstrating the sector's value, and Delivering minerals for a clean energy transition) suitable or is there more we need to consider?	

NAME OF INITIATIVE	LEAD AGENCY	DUE DATE	DESCRIPTION	RECOMMENDATION/ACTION
			2. Are the key actions the right ones to deliver on our strategic pillars, and are they ambitious enough? What else might we need to consider? 3. Are there opportunities for our minerals sector we haven't considered? 4. Are there challenges for our minerals sector we haven't considered? 5. Are there any other things we have missed that we should include, or things we should not include? Draft Strategy can be found here: 28387-a-draft-minerals-strategy-for-new-zealand-to-2040 (mbie.govt.nz) Submission form can be found here: submission-form-a-minerals-strategy-for-new-zealand-to-2040.docx (live.com)	
Local Water Done Well Bill	MfE	TBC	The first of two projected bills giving effect to Local Water Done Well, this will focus on the proposed service delivery plans.	Maintain watching Brief. Environment Southland is working with an Otago Southland working group in this space.
Repeal of Good Friday and Easter Sunday as Restricted Trading Days (Shop Trading and Sale of Alcohol) Amendment Bill	Private Member's Bill	TBC	The Bill allows more or less unfettered shop trading and sale of alcohol on Good Friday and Easter Sunday. It is a matter for shop owner discretion. Among other things, the provisions empowering you to set a local policy on shop trading would be removed. The default restriction on the sale and supply of alcohol on these days would be repealed. Repeal of Good Friday and Easter Sunday as Restricted Trading Days (Shop Trading and Sale of Alcohol) Amendment Bill 38-1 (2024), Members Bill Contents – New Zealand Legislation	No action planned

Fit with strategic framework

OUTCOME	CONTRIBUTES	DETRACTS	NOT APPLICABLE
Managed access to quality natural resources	X		
Diverse opportunities to make a living	X		
Communities empowered and resilient	X		
Communities expressing their diversity	X		

Attachments

1. Governance level RCCWG inter-agency joint report - workshop 23 May 2024 [**9.9.1** - 2 pages]

Regional Climate Change Working Group report

To: Environment Southland
Te Ao Mārama Board
Gore District Council
Invercargill City Council
Southland District Council

Meeting Date: Wednesday 19 June 2024

From: Staff-level Regional Climate Change Working group

Purpose

This report provides all Councils and the Te Ao Mārama Board with an update on the governance-level Regional Climate Change Working Group workshop, held on 23 May 2024.

Recommendation

That councils and the Te Ao Mārama Board receive the report "Regional Climate Change Working Group report".

Background

Following a Regional Climate Change Hui in July 2022, Environment Southland and Te Ao Mārama brought together a staff-level regional climate change working group, which has met regularly since October 2022. A governance-level regional climate change working group (RCCWG) was established in February 2023.

The RCCWG met seven times throughout 2023 to develop a proposed regional climate change strategy. Phase 2 of this work has now commenced with three workshops so far to begin developing a regional Framework for Action.

The governance-level group is not a formal joint committee and does not have formal delegations. It is supported by the staff-level working group.

Phase 1: Proposed Regional Climate Change Strategy

The proposed Regional Climate Change Strategy was endorsed by all Councils for consultation, earlier this year. Environment Southland co-ordinated public feedback on the proposed strategy on behalf of all of the agencies involved, alongside their LTP consultation process.

The consultation period ran from 29 February until 8 May 2024. 48 submissions were received during this time and 12 late submissions were accepted. A special hearing was held 16 May 2024, with each of the four Councils and Te Ao Mārama all represented on the hearing panel. 15 submitters were heard in person.

Deliberations were held 20 May 2024 and these are scheduled to conclude 20 June 2024, following which the revised Strategy will be provided to each agency for consideration and adoption.

Phase 2: RCCWG workshop – 23 May 2024
The May workshop was the third RCCWG workshop focussed on development of pathways to achieve the aspirations in the Regional Climate Change Strategy, in order to create a regional Framework for Action. A workshop in February was the starting point for these discussions, and a workshop in March focussed on pathways to achieve the Communications & Engagement aspirations in the Strategy.

The focus of this May workshop was to develop a common understanding of relevant existing and proposed adaptation projects that provide a foundation for achieving aspiration 8 – "We fully understand the risks and opportunities to our communities associated with the impact of our changing climate on Murihiku Southland".

RCCWG governance members were provided with a stocktake of adaptation resources and current and planned regional adaptation activities. ES staff presented on the progress of Slow the Flow nature-based solutions pilot and flood risk modelling programme that is currently underway.

SDC staff presented about the National Climate Change Risk Assessment and National Adaptation Plan. This workshop was an opportunity to reflect on the national risk assessment methodology, as well as the risk areas identified nationally and develop a common understanding on what might be most relevant to our region.

Work continues to integrate the outputs of this workshop with the outputs from previous workshops. The intent is preparation of a high-level work plan including short-, medium- and long-term steps to progress regional climate change aspirations.

Next steps

1. Deliberations by the special hearing panel on the proposed Regional Climate Change Strategy will conclude 20 June 2024;
2. The revised Regional Climate Change Strategy will be put forward to each agency for consideration and final approval (circa July/August 2024);
3. The next RCCWG phase 2 workshop will be held 25 July 2024 focusing on the mitigation aspirations;

Key messages

- The RCCWG appreciated the calibre of the staff presentations received at the workshop;
- There was agreement that the national climate change risk assessment framework and 5 value domains are a good starting point for developing a regional adaptation framework for Southland;
- RCCWG participants emphasized that the communication and engagement aspirations are foundational in progressing regional climate change adaptation activities;

9.10 Update on Councillor Requests and Actions

Report by: Mikayla Wass, Personal Assistant
Approved by: Rachael Millar, General Manager Strategy, Science & Engagement
Report Date: 22 May 2024

Purpose

This report captures Councillor requests and actions that have occurred during Strategy and Policy Committee meetings and provides an update on how these are being responded to.

Recommendation

It is recommended that the Strategy and Policy Committee resolve to:

1 Receive the report - Update on Councillor Requests and Actions.

Report

The following table summarises requests from Councillors that have occurred in recent months:

Date	Councillor Request/Action	Update
November 2023	Action: To have a report presented at the next Climate Change sub-committee meeting on the 12-month work programme for meeting our emissions reductions targets.	This work is being progressed.
February 2024	Request: For a wetland development workshop with external experts.	Roger Hodson from the Waiau Fisheries and Wildlife Enhancement Trust spoke on this topic during the Waiau field-trip on 14 May 2024. Wetlands form part of the water and land workshop schedule and were last discussed on 12 June 2024. There will be further wetland discussions during the workshops over the coming month.
February 2024	Request: For farmers using stock shelters to attend a council workshop.	On-farm interventions form part of the water and land workshop schedule.
29 May 2024	Request: more detail around the Te Anau climate site	See response below the table
6 July 2024	Request: update on the Net Rate of Energy Intake work in the Waiau	NIWA and Cawthron have completed their fieldwork and the modelling and data analysis is well underway. The resulting report is expected by the end of the year.

Te Anau Climate Site

To inform future decision-making, Environment Southland monitors climate data at strategic locations in the region. Information collected includes air temperature data, wind speed and direction, solar radiation, rainfall and relative humidity.

The network is complimentary to NIWA and Metservice sites in the region and enables us to monitor climate trends. Over the long-term it will inform natural hazard planning and management, as well as design levels for our flood infrastructure. It also has immediate value in terms of understanding current weather conditions.

There are several factors considered when we pick a site location. The first, and most important, is whether the location effectively plugs a gap in the data network. The Te Anau climate site was chosen for this reason. In addition, it will play a valuable secondary role in assessing the suitability of weather conditions for launching craft on to both Lake Te Anau and Lake Manapouri. For Environment Southland, this could represent significant savings through the avoidance of wasted trips from Invercargill.

We are in regular contact with both NIWA and Metservice to share knowledge and information.