The Aotearoa Circle

Mā te Kaitiakitanga ko te Tōnuitanga
Prosperity Through Guardianship

NATURAL INFRASTRUCTURE PLAN

Part 4A: Our Bioeconomy

The economic dependencies and growth opportunities presented by natural infrastructure for Aotearoa New Zealand's bioeconomy.

Contents

Introduction

Why investment in natural infrastructure matters

By recognising natural infrastructure as the productive infrastructure that it actually is, we can strengthen our economy, reduce risk, create jobs, and build a future we can proudly say we helped shape.

Aotearoa New Zealand's economy is intrinsically linked to the environment. With 70% of our exports reliant on natural resources, investing in resilience and natural capital is not a trade-off - it is a win-win.

That's why we believe our Natural Infrastructure Plan presents a 1 + 1 = 3 investment: it addresses today's challenges while building capacity for tomorrow.

It also points to the need for a shift in conversation beyond hard engineering solutions that may appear cheaper upfront, but often cost more over time in maintenance, repairs and lost co-benefits.

We understand why infrastructure matters. Roads move goods and services. Pipes deliver water and power. Bridges connect communities and enable commerce.

Natural infrastructure is less visible and therefore less valued. It exists in wetlands, native forests, dunes, rivers and floodplains. It quietly provides flood mitigation, water filtration, erosion control, carbon sequestration and temperature regulation without invoices, contracts or maintenance schedules.

Nature may be the most undervalued infrastructure asset we have. And because we undervalue it, we underinvest in it.

For too long, we have framed economic growth and environmental health as competing interests. This Plan demonstrates that we can - and must – achieve both. By doing so we can capitalise on the multiple benefits that investment in natural infrastructure offers - often with lower, long-term operating costs.

And as the New Zealand Infrastructure Commission Te Waihanga has identified, long-term strategy and planning are essential to guiding infrastructure investment and enhancing national resilience. This Plan adds a powerful tool to our infrastructure toolkit to support this.

Practical Actions

The Natural Infrastructure Plan has been developed through a coalition of 200+ contributors with over 10,000 combined hours of research, debate and collaboration. It reflects deep expertise and shared ambition.

What it is not is a list of aspirations. Instead, it provides practical actions from clear policy levers for government to significant opportunities for business, leadership and investment.

The plan also includes six case studies demonstrating the measurable benefits of incorporating nature-based solutions into infrastructure planning.

It encourages decision-makers to widen the lens through which infrastructure investments are assessed.

The Investment Decision Toolkit, for example, provides a structured way to evaluate natural infrastructure alongside traditional engineered solutions.

Public agencies, private companies and iwi can use these tools to compare options, assess long-term value and capture multiple co-benefits.

When making decisions that will shape infrastructure for decades, the greatest risk is not choosing the wrong option. The greatest risk is failing to consider all available options.

Natural infrastructure is not an environmental add-on. It is a credible, investable infrastructure asset.

By investing in natural infrastructure, we can reduce the risk in insurance, improve returns on investment, and know we will have enduring growth.

The question is no longer whether we can afford to invest in natural infrastructure.

It is whether we can afford not to.

Vicki Watson

Chief Executive
The Aotearoa Circle

About The Aotearoa Circle

The Aotearoa Circle, a unique leadership organisation, convenes public and private sector partners to tackle complex climate and nature challenges that threaten economic growth and future prosperity.

We know that our economy is intrinsically linked to our natural capital, yet it has been declining for decades.

That's why we have a mission and a deadline. If nature loss is not halted and reversed by 2035, Aotearoa New Zealand will reach a tipping point with lasting consequences for our economy, communities and global standing.

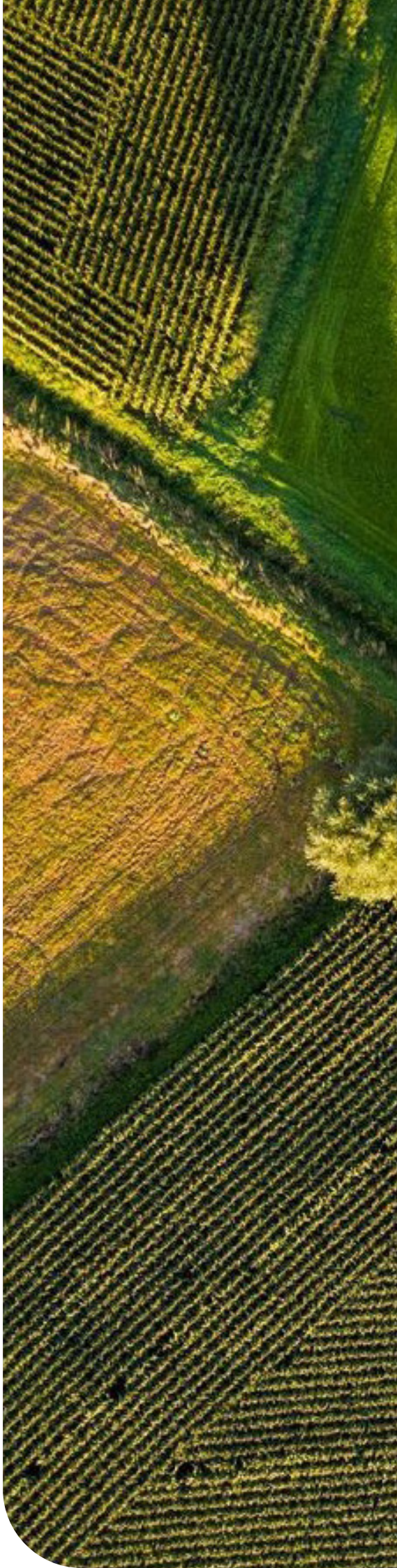
Our work considers pressing climate change and nature challenges facing our key sectors - from agriculture, energy and seafood to transport, finance, and tourism. We do this by delivering practical, cross-sector solutions that reduce risk, strengthen resilience, and ultimately aim to restore natural capital.

The Circle is guided by Guardians (our Board) and strengthened by future voices through our Rangatahi Advisory Panel (RAP) who actively participate in major workstreams, including the development of this plan.

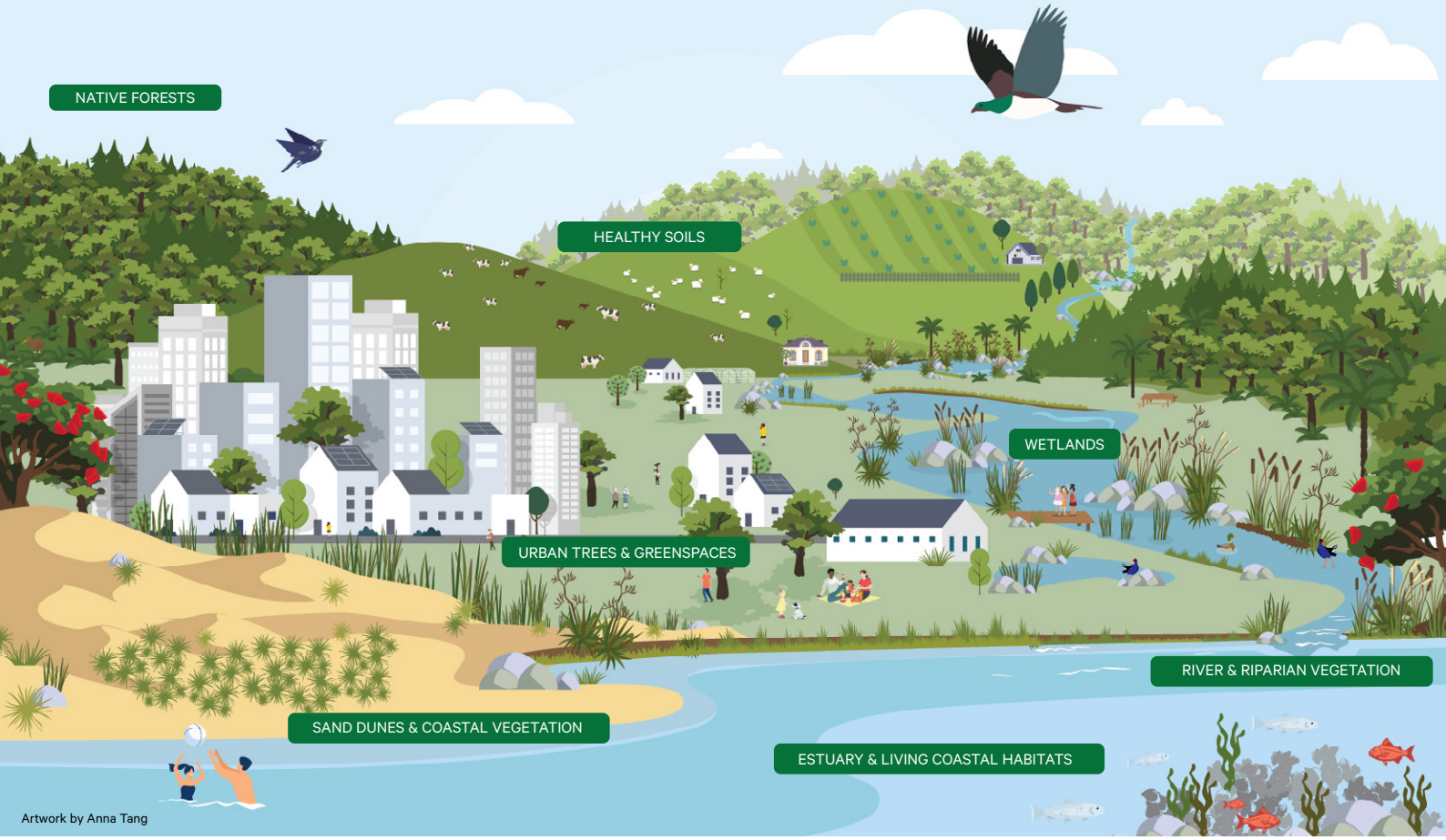
Formed in 2019, our co-founder Sir Rob Fenwick stated at the time that, “Time is running out for the treasures of nature that we love, and it is worth using every last breath, all of our collective energy, to save our land and secure our future.”

Sir Rob’s vision continues to inspire and guide us each day.

www.theaotearoacircle.nz



What is Natural Infrastructure?



NATURAL INFRASTRUCTURE	SERVICES IT PROVIDES
NATIVE FORESTS	• Stabilises slopes and reduces erosion and landslides • Regulates water (slows runoff, sustains baseflows, improves quality) • Habitat for native species; supports cultural values and recreation • Stores carbon over long timeframes; provides local cooling and shade
RIVER & RIPARIAN VEGETATION	• Filters sediment, nutrients and some pathogens before they reach waterways • Shades streams, lowering temperatures for aquatic life • Stabilises banks and reduces erosion • Provides habitat corridors for native species and inanga spawning areas
WETLANDS	• Temporarily store floodwaters and buffers stormwater • Retain water and supports drought resilience • Filter nutrients and contaminants, improving water quality • Sequester and stores carbon (notably peat systems) • Provide habitat and mahinga kai values
URBAN TREES & GREENSPACES	• Reduce urban heat and provide shade for people and places • Intercept rainfall and reduce stormwater runoff • Improve air quality and support urban biodiversity and wellbeing
SAND DUNES & COASTAL VEGETATION	• Trap and stabilise sand, reducing coastal erosion • Buffer storm surge and waves; enable natural shoreline adjustment • Provide habitat for coastal species and protect communities and assets inland
ESTUARY & LIVING COASTAL HABITATS	• Attenuate waves and help stabilise shorelines • Filter water, cycle nutrients and improve clarity • Store “blue carbon” in sediments and vegetation • Provide nursery habitat that supports fisheries and biodiversity
HEALTHY SOILS	• Provide the foundation for food production by cycling nutrients, retaining moisture and supporting fertile land • Reduce erosion and sediment loss when healthy, protecting waterways and downstream ecosystems • Help buffer flooding by absorbing, storing and slowly releasing water across the landscape • Filter contaminants and improve water quality before water reaches rivers, estuaries and aquifers • Store carbon and support soil biodiversity that underpins ecosystem resilience

Executive summary

Securing Aotearoa New Zealand's bioeconomy through strategic investment in natural infrastructure

Aotearoa New Zealand's bioeconomy is a cornerstone of national prosperity, covering around 60% of land, employing a quarter of the workforce, and generating over 80% of goods exports[1]. National strategies aim to double the value of food and fibre exports by 2034 while improving environmental performance. Achieving this growth relies on the enduring management of natural assets namely soils, water, forests, and biodiversity as well as more resilient traditional infrastructure (roads, ports, water, energy, and telecommunications).

The bioeconomy is facing significant challenges from climate change, declining natural systems, degraded catchments, erosion-prone landscapes, and the loss of natural buffering assets like wetlands (about 90% have disappeared[2]). These pressures threaten productivity, supply chain reliability, and export credibility. Fragmented governance and slow adoption of nature-based solutions further constrain greater resilience.

Investing in natural infrastructure - catchment restoration, riparian planting, wetlands, and afforestation - offers major opportunities to stabilise production, reduce risks, enhance feed and biomass reliability, support high-value, low-emission products, and strengthen market access.

Initiatives like the Mountains to Sea programme in the Bay of Plenty[3] demonstrate how coordinated catchment-scale restoration can deliver resilience, economic and environmental benefits including reduced sedimentation, improved water quality, stronger supply chains, regional resilience and employment opportunities.

Realising the bioeconomy's opportunities to thrive requires policy settings and investment frameworks that recognise natural infrastructure as core productive assets. Targeted incentives such as co-investment in priority catchments, asset-classification approaches, sustainability-linked finance, and ecosystem-services payments have the potential to unlock long-term, catchment-wide benefits not yet fully reflected in business cases.

Clear government direction through infrastructure planning, investment frameworks, and verified-outcome finance tools can mobilise capital at scale supporting a resilient, high-value bioeconomy and strengthening Aotearoa New Zealand's position in markets where measurable environmental performance is increasingly essential for competitiveness.

1 https://environment.govt.nz/publications/aotearoa-new-zealands-first-emissions-reduction-plan/circular-economy-and-bioeconomy/

2 https://www.doc.govt.nz/news/media-releases/2025-media-releases/further-losses-predicted-for-wetlands-in-future/

3 Rijkse, W. C. & Guinto, D. F. (2010). Soils of the Bay of Plenty, Vol. 1: Properties and Classification of the Soils of the Bay of Plenty. Bay of Plenty Regional Council Publication 2010/11-1.

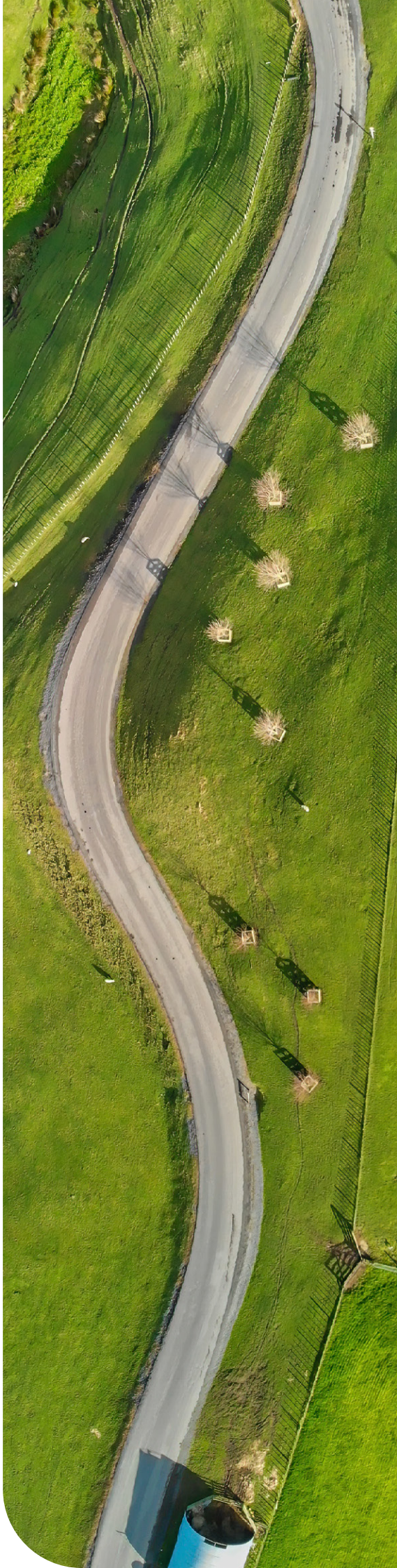
About this report

Purpose

This report, prepared in February 2026, outlines the key economic dependencies and growth opportunities presented by natural infrastructure as it pertains to one of Aotearoa New Zealand's key economic sectors.

With our natural infrastructure being our most fundamental infrastructure, the purpose of this report is to outline, in a single document, the economic dependencies and growth opportunities presented by natural infrastructure.

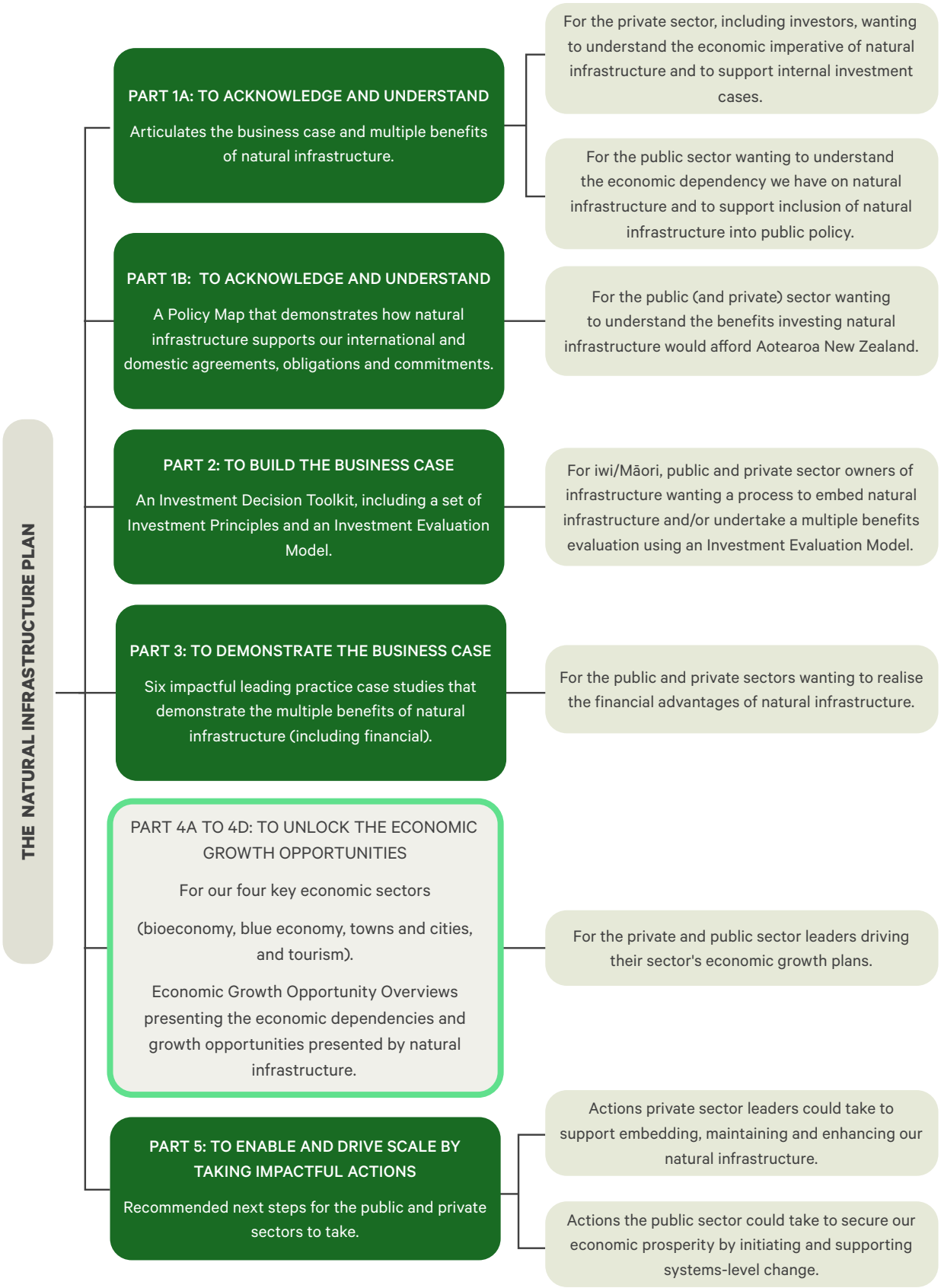
This report has been prepared to support The Aotearoa Circle's Natural Infrastructure Plan (NIP).



Structure of the Natural Infrastructure Plan

The Natural Infrastructure Plan comprises several sections framed against the five objectives. Each has a specific purpose and intended audience.

Note: Parts 1B, 2, 3 and 4A-4D are available as separate PDFs to download



Next steps

It is envisaged that sector leaders and others responsible for developing national growth strategies utilise the insights and recommendations outlined in this document.

There are opportunities for the national growth strategies to acknowledge and integrate the economic dependencies the bioeconomy sector has on natural infrastructure, and include plans to embed, maintain, and enhance the natural infrastructure upon which the sector relies upon.

To achieve enduring prosperity, and to realise economic growth opportunities, system-level changes are required. These systems-level changes, and other recommendations, are contained within the Natural Infrastructure Plan.

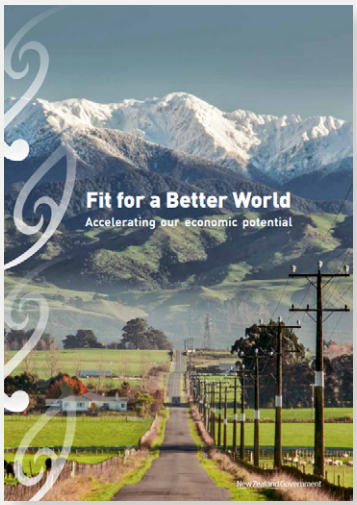
A. Summary of the bioeconomy national growth plans

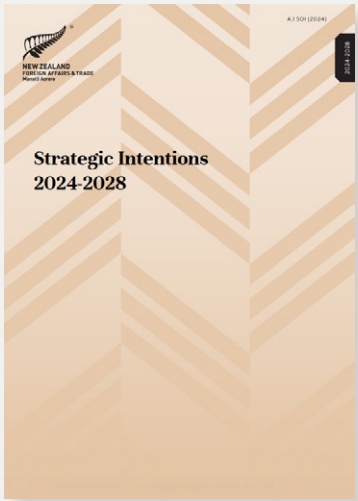
Aotearoa New Zealand's bioeconomy covers around 60% of land use, employing at least a quarter of the workforce, and generating more than 80% of all goods exported[4]. As a land-based activity inherently dependent on nature, the sector's growth relies on protecting the natural assets (such as soils, forests, water, and biodiversity) that support production and the infrastructure that enables it.

The bioeconomy sector is at the heart of national plans for economic growth and innovation, while having significant potential to contribute to the protection and regeneration of nature. The Government has produced several strategies to guide the future of the bioeconomy, each aiming to increase value from the land while improving environmental performance[5,6,7]).

These documents acknowledge the sector's dependence on healthy soils, water, and ecosystems, and recognise that long-term competitiveness requires restoring and protecting these natural systems. While these documents set direction, they are largely strategic and do not outline the policy levers, investment tools, or implementation mechanisms needed to secure nature positive outcomes at scale. As such, they offer an important national overview but require dedicated action plans, operational settings, and targeted incentives if they are to translate ambition into delivery.

At the centre of these documents is a shared national goal to double the value of food and fibre exports by 2034, positioning the bioeconomy as a key driver of future growth. Achieving this goal will depend on shifting from volume to value; growing high-quality, low-emission products, improving productivity through innovation and technology, and strengthening global market access. It also calls for investment in the resilience of natural infrastructure such as landscapes and catchments that sustain production, ensuring that economic growth and environmental regeneration move in partnership.





[4] New Zealand Institute for Bioeconomy Science (2025). Bioeconomy Science Initiative Report. Available at: https://www.bioeconomyscience.co.nz/pdf/BSI%20SCI%202025.pdf

[5] Ministry for Primary Industries (2023). Fit for a Better World – Accelerating Our Economic Potential: 2023 Progress Update.

[6] Coriolis Ltd for the Ministry of Business, Innovation and Employment (2023). Thirty Opportunities: Emerging and Future Platforms in New Zealand's Bioeconomy.

[7] Ministry for Primary Industries (2024). Strategic Intentions 2024–2028

B. Scale of the investment opportunity and expected contribution to GDP

The bioeconomy sector's revenue trajectory is strong: annual food and fibre export earnings are projected to reach around $67billion by 2028[8], up from $53 billion in 2024[9].

Public–private investment is mobilising at scale with $664 million co-invested through Sustainable Food and Fibre Futures from 2018-2024[10] and a further $400million[11] committed over the next four years for greenhouse gas mitigation and innovation.

The iwi/Māori food and fibre economy is also gathering momentum, having more than doubled in asset value between 2013 and 2018[12]. This points to the potential for an ambitious and transformative decade ahead - one that brings significant opportunities, but also a greater need to manage risk, resilience, and the natural infrastructure supporting this growth with care.

Unlocking this growth potential depends on smart, enduring management of Aotearoa New Zealand's natural infrastructure which underpins the bioeconomy.

8 Ibid

9 Ibid

10 Ministry for Primary Industries (2024). Strategic Intentions 2024–2028

11 Ministry for Primary Industries (MPI). Accelerating New Zealand's Greenhouse Gas Mitigations – Programme Overview. Accessed November 2025, https://www.mpi.govt.nz/funding-rural-support/environment-and-natural-resources/accelerating-new-greenhouse-gas-mitigations.

12 the wider iwi/Māori economy is projected to reach $100 billion by 2030

C. Nature-related dependencies of Aotearoa New Zealand's bioeconomy

While ambitious growth plans are commendable, the sector must understand their underlying natural infrastructure dependencies to achieve economic growth and prosperity.

(i) Economic dependencies on natural infrastructure

Figure 1 shows that most major activities within Aotearoa New Zealand's bioeconomy have High or Very High dependencies on natural infrastructure, highlighting how deeply production systems rely on the stability of soils, water, climate regulation and ecological processes. For details on how this data was determined, please refer to Appendix 2 of the Natural Infrastructure Plan.

The concentration of Very High dependencies across dairy, sheep and beef farming, horticulture, arable production, forestry, aquaculture and fisheries signals that the sector's core value chains are exposed to any decline in ecosystem condition or functioning. These dependencies reinforce that growth in the bioeconomy is fundamentally tied to the health of natural systems, and that shortages of biomass, water stress, erosion, declining soil quality or increased climatic variability will directly constrain productivity.

The pattern in the graph strengthens the case made throughout this section, that **restoring and maintaining natural infrastructure is not optional, but a prerequisite for a reliable, resilient, and internationally competitive bioeconomy.**

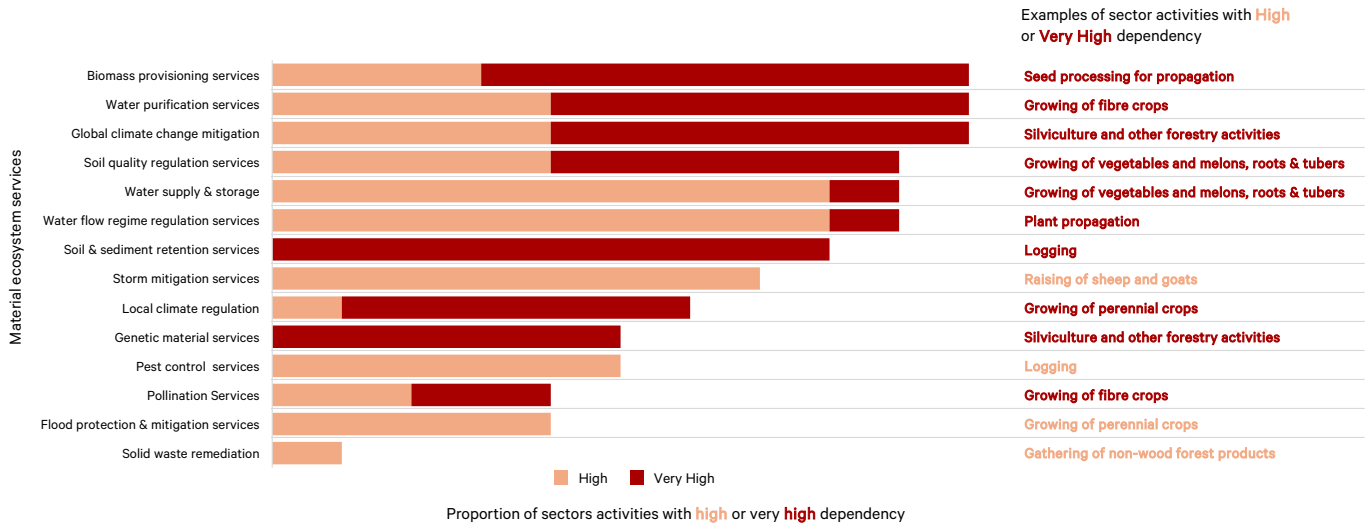


Figure 1: Examples of sector activities with High or Very High dependencies

Aotearoa New Zealand's natural infrastructure contributes to around three quarters of our exports. More broadly, biological resources and the ecosystems that underpin them are fundamental for Aotearoa New Zealand's prosperity, providing carbon sequestration and storage, water, food and material along with other ecosystem services[13].

Conserving and enhancing the provisioning, regulating, and maintenance services provided by natural infrastructure in Aotearoa New Zealand are fundamental for the growth and production of food and fibre.

Declining biomass

Aotearoa New Zealand is not self-sufficient in biomass, currently importing significant quantities to support the bioeconomy, the majority of which is used for animal feed[14]. There is an opportunity to address this gap and meet the Government targets for export growth.

Climate change resilience

Changes in seasonal rainfall, longer and more severe dry spells, fewer days below 0°C, and increasing mean temperatures are all reducing the capacity of Aotearoa New Zealand's ecosystems to provide healthy and reliable services required for bioeconomy productivity. While the impacts of these chronic changes are less evident than the acute shocks of natural hazards, the costs of production are predicted to increase[15].

These growing pressures on natural systems will have direct consequences for the traditional infrastructure that supports the bioeconomy. As healthy soil, water availability, and ecosystem functions become increasingly under pressure from the impacts of climate change and increasing land-use change, the networks that move products, supply water, manage hazards and connect rural operations will come under greater strain. Understanding this connection is essential as the performance of built infrastructure and the productivity of the bioeconomy are increasingly shaped by the condition of the landscapes and catchments they rely on. This provides the bridge to considering the traditional infrastructure that underpins production today, and where its vulnerabilities intersect with the declining resilience of natural systems.

[13] Saunders, C., Guenther, M., Whitehead, J., Saunders, J., Rutherford, P., McIntyre, T., & Dalziel, P. (2024). Situational Analysis of New Zealand's Bioeconomy. Agribusiness and Economics Research Unit (AERU), Lincoln University, commissioned by the Ministry of Business, Innovation & Employment (MBIE).

[14] https://static1.squarespace.com/static/5ab02d7d0dbda3c18dad1d50/t/68783d7ed783b724c59355ba/1752710564100/situational-analysis-of-new-zealands-bioeconomy.pdf

[15] Climate Change: Likely Impacts on New Zealand Agriculture (NZ Government, 2001). https://environment.govt.nz/assets/Publications/Files/impacts-agriculture-sep01.pdf

D. Nature-related impacts from Aotearoa New Zealand's bioeconomy

In 2018, around half of Aotearoa New Zealand's landmass was covered with native ecosystems and the other approximate half was covered with farms, pasture and plantation forests.

(ii) Impact drivers

Figure 2 highlights that many of the core activities within Aotearoa New Zealand's bioeconomy exert High or Very High impacts on natural systems, reinforcing the importance of restoring and maintaining natural infrastructure. For details on how this data was determined, please refer to Appendix 2 of the main Natural Infrastructure Plan.

The pattern across the chart shows that land-intensive and water-dependent activities such as dairy, beef, sheep and grain production, forestry, and horticulture place sustained pressure on soils, waterways, and catchments, contributing directly to the degradation described throughout this section. These impacts reduce the buffering capacity of landscapes, increase erosion and sedimentation, accelerate nutrient loss, and heighten the volatility of water supply. As a result, the very ecosystems that the bioeconomy relies on for stability, productivity, and market credibility become progressively less resilient.

Figure 2 underscores a central challenge: **Natural infrastructure degradation is not only a risk to the bioeconomy, but is also being driven by it, creating a feedback loop that increases exposure to climate extremes and supply-chain disruption.**

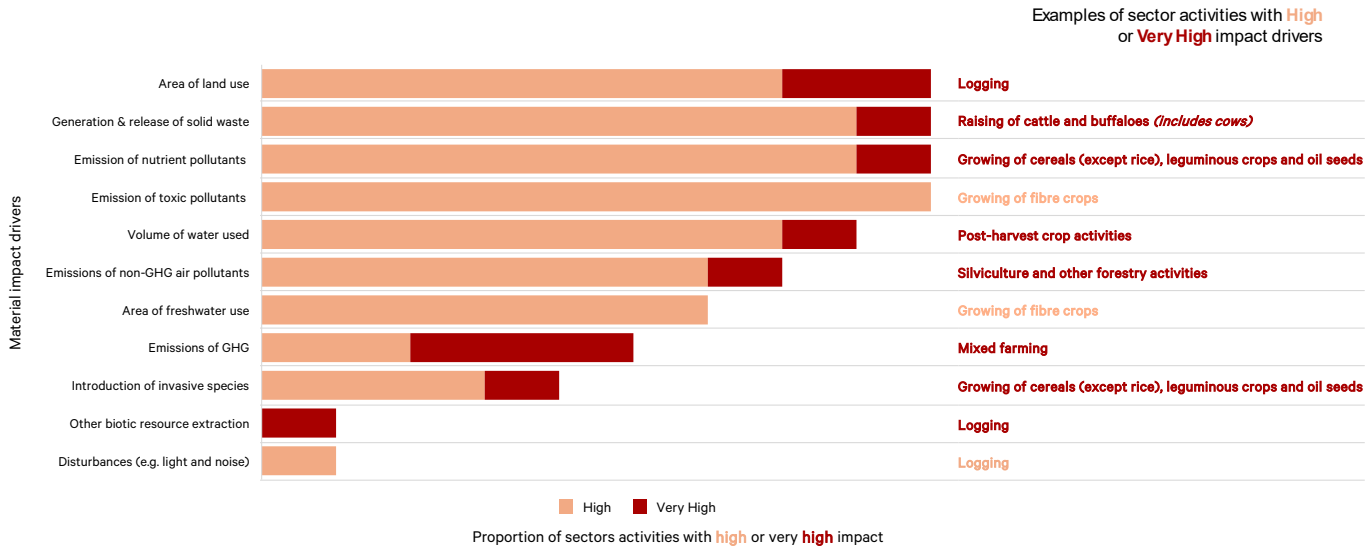


Figure 2: The bioeconomy's greatest impact drivers on natural infrastructure, with examples of sector activities with High or Very High impact drivers

Aotearoa New Zealand's bioeconomy continues to drive land use change

Land use change for agriculture, horticulture, and forestry heavily impacts Aotearoa New Zealand's natural assets and ecosystem services. Native landcover has continued to decline in recent decades, particularly in scrub and shrubland, tussock grasslands, and lowland ecosystems. The area of exotic forestry increased by 12% between 1996 and 2018 influenced by the growth of Aotearoa New Zealand's Emissions Trading Scheme, contributing to the spread of wilding conifers across approximately 2 million hectares. Without management, wilding conifers will form dense forests and could invade about 25 percent of land in 30 years, threatening ecosystems across the landscape. Exotic forestry has expanded into pastoral hill country, typically used for agriculture, over the past few decades.

Agriculture contributes significantly to greenhouse gas emissions

The agricultural sector contributes over half of Aotearoa New Zealand's gross greenhouse gas emissions each year. Methane from Enteric fermentation is the dominant source, contributing 78% of the agricultural sectors emissions and 41.4% of Aotearoa New Zealand's gross emissions across all sectors in 2023.

While methane is a short-lived gas in the atmosphere, it creates a far greater warming effect than carbon dioxide.

Agriculture, horticulture, and forestry impact water resources

Agriculture, horticulture, and forestry activities in highly modified catchments can result in the increase of contaminants like harmful amounts of nutrients, such as nitrogen and phosphorus, and sedimentation through soil erosion.

Aotearoa New Zealand has experienced one of the highest rates of agricultural land intensification internationally over recent decades. The amount of irrigated land has almost doubled between 2002 and 2019 from 384,000 hectares to 735,000 hectares. Modelling indicates that the long-term changes in Aotearoa New Zealand freshwater quality measured nationwide between 1990 and 2017 was closely associated with the proportion and intensity of upstream land dedicated to agriculture and forestry.

E. Traditional infrastructure the bioeconomy relies upon

Our bioeconomy relies on an extensive network of traditional infrastructure that enables production, processing, and export across primary industries. This includes rural roads and bridges, state highways and rail that link farms and forests to processors and export hubs; ports and airports that move bulk and time-sensitive goods offshore; irrigation schemes, dams, aquifers, and council water services that supply water for cropping, livestock, frost protection, cleaning and processing; retaining infrastructure and stop banks that provide flood and slip protection; electricity transmission and distribution and gas pipelines for power and process heat; and telecommunications networks (cell towers, radio and satellite) that connect operations and markets. Aotearoa New Zealand moves around 280million tonnes of freight each year, with 92.8 percent of domestic freight volumes carried by trucks, 5.6 percent by rail, and about a third of all tonnage made up of primary products, underscoring how dependent the bioeconomy is on these networks[16]

For example, grapes or livestock feed move by rural road to a processor, then by highway or rail to port, where export flows are consolidated for sea or air freight. These critical public network assets (roads, rail, wharves, runways) serve horticulture, viticulture, meat, dairy, arable and forestry alike, and when they fail, the economic costs are immediate. The 2016 Kaikōura earthquake is estimated to have reduced GDP by around $465million over two years, largely because higher freight transport costs and disrupted road and rail links increased costs for transport-dependent industries[17] .

Across farms and processing sites, day-to-day operations depend on specific utility services delivered through these networks. Water supply from scheme takes, bores and council systems feeds irrigation lines and frost-protection pumps during cold snaps; electricity and gas via grid connections and mains power mills, wineries and chillers, and keep frost fans and pumping running when needed; and telecommunications support monitoring and control for instance, farmers monitoring storage tanks need cellular or satellite links to understand water levels and respond quickly to protect stock.

[16] Te Manatū Waka Ministry of Transport. Freight and Supply Chain Issues Paper. 2022.

[17] Market Economics Limited. Economic impact of the 2016 Kaikōura earthquake, report for Ministry of Transport; summarised in “Economic impact of Kaikōura quake revealed,” Beehive release, 28 April 2017.

F. Infrastructure-related challenges for the bioeconomy

1. **Rural land-transport networks** - roads, bridges, and rail carry most inputs and products, but many assets are ageing, capacity-limited, or repeatedly affected by floods and slips. Where routes have single-lane bridges or few detours, closures quickly slow freight to processors and export hubs. At ports, sediment from eroding catchments accumulates in harbours, increasing dredging demand and reducing port efficiency, while small regional ports have limited ability to flex during disruptions.
2. **Water infrastructure** – both traditional and natural faces complex challenges. In many places, older schemes, storage and drainage operate in catchments where declining water quality and high sediment loads now arrive more often with drought–deluge cycles. The effect of limited storage and dated stormwater assets combines with reduced wetlands and riparian extent to lower reliability of water supply for irrigation, frost protection, cleaning, and processing.
3. The **electricity and gas networks** that the sector relies on are exposed to wind, flood, and slip damage, while telecommunications coverage remains uneven in some production areas. Outages interrupt processing, pumping, and logistics particularly where the coverage and/or resilience of traditional infrastructure is lacking. These outages are often triggered by slope failure, bank erosion, or debris from surrounding landscapes. The interdependence across these systems means a fault in one can cascade into the other. Finally, maintenance backlogs, limited redundancy, and fragmented responsibilities constrain upgrades to small regional systems, even where risks are well known.
4. **Consenting pathways** can also delay practical improvements - such as new water storage, making space for rivers, or catchment planting - leaving both built and natural defences under pressure. For example, undersized culverts and stop banks in rural areas often sit alongside drained or degraded wetlands that can no longer absorb peak flows, meaning roads and bridges take the full impact of heavy rain. Without coordinated upgrades to both the physical networks and the landscapes that support them, infrastructure across many regions remains poorly placed to deliver reliable growth.
5. The sector faces growing risks as ageing traditional infrastructure is increasingly vulnerable to **climate extremes.**

According to Lloyds Bank, in 2018, Aotearoa New Zealand was ranked second only to Bangladesh in terms of its vulnerability to natural hazards in terms of average losses in relation to the size of our economy[18]**.** Further, our existing assets are ill-equipped to handle New Zealand's changing climate and more frequent extreme weather events. Investing in natural infrastructure such as wetlands beside key transport corridors, riparian buffers to protect drainage basins, and afforested slopes to stabilise soils can reduce the burden on built assets by absorbing flood peaks, preventing slip-events, and reducing sediment loads. By doing so, natural infrastructure would not only extend the life of existing networks but also strengthen the sector's resilience, reduce downtime, and improve credibility for sustained export growth.

[18] https://www.lloyds.com/insights/risk-reports/a-world-at-risk

G. Natural infrastructure-related challenges for the bioeconomy

Aotearoa New Zealand's bioeconomy depends on the condition and performance of natural infrastructure systems, yet many of these systems are degraded, fragmented, or unable to keep pace with increasing climate, land-use, and market pressures. Declining soils, waterways, forests, wetlands, and erosion-prone slopes are reducing the reliability of ecosystem functions essential for food, fibre, and bio-based manufacturing[19]. As climate extremes intensify, the resilience of these natural assets becomes a central constraint on production and export growth.

1. Degraded catchments and declining water quality

In many regions, catchments are experiencing reduced water storage capacity, increased sediment loads, nutrient losses, and loss of buffering capacity. Wetland extent has dramatically diminished, riparian networks remain incomplete, and river systems are often disconnected from their natural floodplains. These conditions lead to less reliable water supply, increased frequency in pollution and contamination risks for farms and processing sites, and greater volatility in pasture and crop yields. Declining water quality is also eroding the environmental credentials that underpin market access for premium export sectors.

2. Erosion-prone landscapes and unstable slopes

Large areas of hill country remain highly susceptible to landslides and mass movement during extreme rainfall. Historic and current deforestation, limited mixed-species planting, fragmented native cover, reduced slope stability and increased sediment delivery to waterways all undermine the consistency of biomass supply for forestry, biofuels, and engineered timber, while also increasing the maintenance burden on downstream assets such as dams, intakes, and drainage systems. In severe events, slope failure can isolate rural communities and restrict access to key production sites as experienced in Cyclone Gabrielle and during January 2026 across the Bay of Plenty, Poverty Bay, Northland and the Coromandel. The cost to the country of Gabrielle is estimated to have been $14.5billion.

3. Loss of natural buffering systems

Natural defences including wetlands (Aotearoa New Zealand has lost around 90% of its original wetlands[20]), floodplains, native forests, dune systems, and headwater vegetation, have been reduced or degraded in many landscapes. Their diminished capacity to absorb flood peaks, regulate water flows, maintain soil moisture, and moderate microclimates increases exposure to climatic shocks such as those Aotearoa New Zealand has been experiencing. Droughts become more damaging, floods more destructive, and recovery periods longer. This amplifies production downtime, disrupts supply chains, and increases costs for growers, processors, and exporters[21]. These events have long-tail effects as seen with Cyclone Gabrielle with ongoing disruption to lives, infrastructure, farmland and tourism sites.

4. Fragmented governance and slow pathways for nature-based solutions

Despite growing global interest and implementation, natural infrastructure is not yet embedded into local planning, consenting, or investment frameworks in a consistent or predictable way. Catchment-wide solutions such as afforestation of erosion-prone land, wetland reinstatement, and coordinated riparian planting, often face lengthy consenting processes, unclear regulatory signals, or misaligned incentives across agencies and landowners. Unlike traditional "engineered" assets, natural infrastructure lacks clear asset classes, depreciation treatments, and uniform guidance, slowing uptake even where benefits are well understood.

5. Cascading risks from degraded natural systems

When natural systems fail, whether through drought, slips, flood surges, or sediment pulses, the effects cascade quickly across the bioeconomy. Pasture productivity declines, forestry operations face access disruptions, biomass supply chains become unreliable, and processors face contamination and water scarcity risks. These impacts compound stresses on built infrastructure and reduce overall sector reliability. Lloyds of London has identified Aotearoa New Zealand

[19] Ministry for the Environment & Stats NZ (2025). Our Environment 2025.
[20] Ministry for the Environment & Stats NZ (2025). Our Environment 2025.
[21] Ministry for the Environment & Stats NZ (2025). Our Environment 2025.

as one of the most hazard-exposed economies globally[22], and degraded natural systems amplify these vulnerabilities by allowing more damage to reach built assets and supply chains.

Why these challenges matter

Without stronger, restored, and well-governed natural infrastructure, the bioeconomy faces increasing volatility, higher costs, reduced reliability for export markets, and greater exposure to climate extremes. Conversely, investing in natural infrastructure such as catchment restoration, riparian networks, wetlands, and afforested slopes reduces erosion, stabilises supply chains, and increases the resilience of both landscapes and built infrastructure.

Addressing these natural infrastructure challenges is fundamental to Aotearoa New Zealand's sustained productivity, market credibility, and long-term sector competitiveness.

[22] Lloyd's of London. A World at Risk: Closing the Insurance Gap. 2018. Retrieved from: https://assets.lloyds.com/assets/pdf-lloyds-underinsurance-report-final/1/pdf-lloyds-underinsurance-report-final.pdf

H. Bioeconomy growth opportunities presented by natural infrastructure

Natural infrastructure offers major opportunities to strengthen Aotearoa New Zealand's bioeconomy by improving reliability, reducing risk and enabling new value streams[23].

As long-lived, fixed assets that provide essential production and environmental services, natural infrastructure such as riparian networks, wetlands, native and mixed forests and integrated woody systems can stabilise supply chains, reduce operational disruptions and create conditions for ongoing innovation across food, fibre, energy and bio-based manufacturing.

1. **Healthy catchments, soils and forests underpin productivity across primary production and processing[24].** By moderating microclimates, reducing erosion and maintaining water quality, natural infrastructure supports consistent yields and provides measurable outcomes that build confidence in Aotearoa New Zealand's export reputation[25]. These attributes are increasingly important as global markets shift toward verified sustainability claims, low emissions products and nature positive supply chains.
2. **Improving feed supply and on-farm productivity** is a key opportunity supported by natural infrastructure. Aotearoa New Zealand research shows that pasture growth and feed quality depend on soil health, water regulation and microclimate conditions[26] [27]. Shelterbelts, riparian planting and mixed tree–pasture systems can reduce wind stress, limit erosion and improve soil moisture retention, helping moderate the impacts of droughts and heavy rainfall[28]. By strengthening the conditions that support reliable pasture production, natural infrastructure contributes to more consistent feed supply and supports more efficient, lower emissions farm systems.
3. **Natural infrastructure also supports premium nutrition and natural ingredient sectors.** Production of nutraceuticals, bioactives (high-value functional biological compounds) and other natural health products relies on clean water, stable yields and high-quality raw materials. Catchment restoration and wetland systems can reduce sediment, nutrients and contaminants, strengthening ingredient safety and meeting transparency expectations in international markets where environmental performance is a factor[29]. Native vegetation and riparian restoration can support the ecosystems that underpin natural ingredient production, helping maintain reliable raw material supply for both native and introduced plant species used in high value products[30].
4. **Low carbon and renewable materials** represent another major opportunity for the bioeconomy. Healthy forests and stable catchments support reliable biomass supply for engineered timber, bioplastics and other bio-based products by reducing erosion risks, maintaining soil stability and protecting transport corridors[31]. Mixed species afforestation on erosion-prone land acts as natural slope stabilisation, reducing erosion and sediment discharge. By lowering slip risks, it supports more consistent access to fibre and residues across forestry operations[32]. As international markets increasingly favour low emissions construction and sustainable materials, natural infrastructure strengthens the resilience and competitiveness of these emerging industries.

23 MfE & Stats NZ (2024), Our Land 2024

24 MfE & Stats NZ (2024), Our Land 2024

25 Tāne's Tree Trust (2024), Investing in Natural Capital – Weaving Native Forest Back Through New Zealand's Landscapes

26 Houlbrooke, D. J., Drewry, J. J., Hu, W., et al. (2021). Soil structure: its importance to resilient pastures in New Zealand (review). New Zealand Grassland Association Research and Practice Series, 17.

27 Climatic factors influencing New Zealand pasture resilience under scenarios of future climate change (Keller et al., 2021)

28 Production and interaction of pastures and shelterbelts in the central North Island (Hawke & Tombleson, NZ Grassland Association Proceedings)

29 Constructed Wetlands (NIWA, Freshwater mitigation systems). Retrieved from https://niwa.co.nz/freshwater-mitigation-systems/constructed-wetlands

30 Creating Beauty from New Zealand: Supporting investment in the emerging natural or bio-based cosmetics platform (MBIE / Coriolis, June 2023)

31 Ecosystem services of afforestation on erosion-prone land: A case study in the Manawatū Catchment, New Zealand (Marden et al., 2010)

32 Identifying key factors influencing the selection of zero-carbon construction materials in New Zealand (Araghi et al., 2025))

5. **Natural infrastructure also supports growth in bioenergy and biofuels.** Most biogenic feedstock for liquid biofuels in Aotearoa New Zealand comes from forestry residues and wood processing byproducts[33], which depend on reliable access to forests, stable hill country slopes and resilient transport corridors[34]. Natural infrastructure such as mixed species planting and erosion control systems can reduce landslide risks, limit sediment movement and improve the reliability of biomass supply chains, particularly during extreme weather. For biogas production from farm and food waste, wetlands, riparian buffers and sediment retention measures can reduce contamination risks, moderate flood flows and stabilise soils around processing sites, supporting consistent operation and improving the resilience of local renewable energy generation[35].

Together, these opportunities show that investment in natural infrastructure is a core enabler of Aotearoa New Zealand's high value, low emissions bioeconomy. By treating natural infrastructure as productive assets with long term value, Aotearoa New Zealand can stabilise production, unlock innovation, strengthen market access and build a more resilient and competitive bioeconomic future.

33 New Zealand Biofuels Roadmap: Growing a biofueled New Zealand (Summary Report) — Scion, 2016

34 Woody Biomass Residues and Resources for New Zealand; projections 2024 — Scion, 2024.

35 NIWA. (n.d.). Riparian buffers | Earth Sciences New Zealand. Retrieved from https://www.niwa.co.nz/freshwater-mitigation-systems/riparian-buffers

I. Innovative examples of natural infrastructure in the bioeconomy

Mountains to Sea – Catchment Scale Natural Infrastructure in the Bay of Plenty

The Mountains to Sea initiative in the Bay of Plenty demonstrates how coordinated natural infrastructure investment can restore catchment function and improve both environmental and economic outcomes. Stretching from the Kaimai Mamaku ranges to Tauranga Harbour, the programme brings together native forest restoration, targeted reafforestation, well considered farm forestry, riparian and wetland restoration, and pest control to rebuild the health and resilience of the entire landscape.

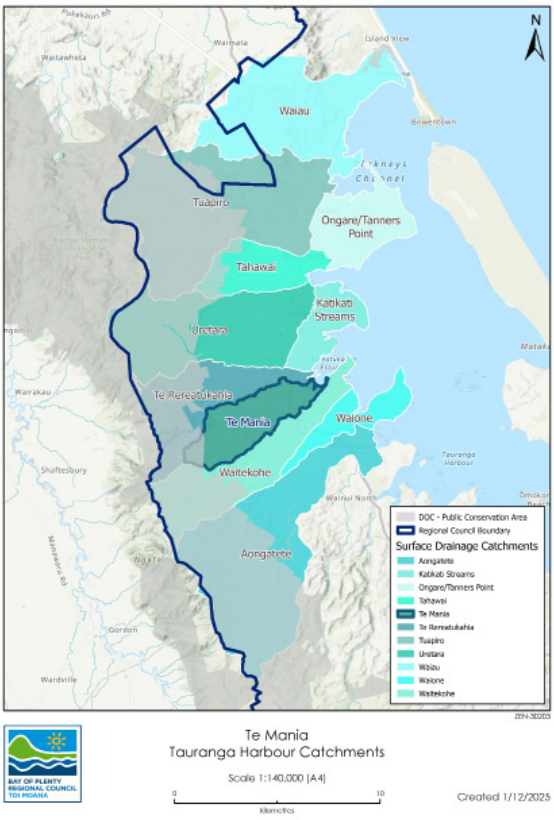
In the upper catchment, the recovery of native forests is reducing erosion and stabilising steep slopes[36]. This has led to measurable reductions in sediment movement into streams and rivers[37], easing pressure on downstream waterways and the harbour. Improved riparian cover and wetland reinstatement are also contributing to better water quality and more stable freshwater flows, creating conditions that support productive farmland while strengthening ecosystem health.

Mid-catchment improvements show clear benefits for landowners. The transition of erosion prone or marginal land into native forest, plantation forestry, or riparian systems has lowered sediment and nutrient losses and helped stabilise water availability. These changes support more reliable pasture and crop performance and reduce the risk of land degradation, which has demonstrated benefits for farm profitability. The programme has also created employment opportunities in pest control, planting and restoration; benefits that are especially important for iwi/Māori landowners, whose economic aspirations are closely tied to whenua-based activity.

The effects are visible downstream. Monitoring in Tauranga Harbour shows declining sediment and nutrient loads, along with early ecological recovery in areas such as seagrass and shellfish habitat[38]. These improvements reflect the cumulative impact of healthier headwater forests, improved riparian networks and restored wetlands buffering storm flows and filtering contaminants before they reach the coast.

Economic assessments referenced in the programme material[39] highlight the value of these gains. Reduced slip and flood damage deliver significant avoided costs to local infrastructure and communities, while the conservation and restoration workforce contributes meaningful economic activity to the region.

Overall, the Mountains to Sea programme provides a clear, real-world example of natural infrastructure. It shows how restoring catchments at scale can protect primary production, strengthen supply chains, support iwi/Māori – and wider regional development, improve freshwater and marine environments, and build long term resilience for the regional bioeconomy.



[36] Rijkse, W. C. & Guinto, D. F. (2010). Soils of the Bay of Plenty, Vol. 1: Properties and Classification of the Soils of the Bay of Plenty. Bay of Plenty Regional Council Publication 2010/11-1.

[37] Te Mania catchment water quality: BOPRC Sub-catchment Action Plan 2012, BOPRC long term water quality data set showing water quality trends. https://www.boprc.govt.nz/environment/fresh-water/focus-catchments/te-mania-catchment/

[38] Park, S. (2016). Extent of Seagrass in the Bay of Plenty in 2011. Bay of Plenty Regional Council Environmental Publication 2016/03.

[39] Rijkse, W. C. & Guinto, D. F. (2010). Soils of the Bay of Plenty, Vol. 1: Properties and Classification of the Soils of the Bay of Plenty. Bay of Plenty Regional Council Publication 2010/11-1.

Contact us

This report forms a key part of a wider Natural Infrastructure Plan.

For questions or additional information on the Natural Infrastructure Plan please reach out to The Aotearoa Circle.

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Program Delivery Lead, **Erica Miles,** Director, Nine West Consulting.

The Natural Infrastructure Plan, including its associated separate parts, have been prepared by The Aotearoa Circle in collaboration and consultation with Circle Partners and other key stakeholders to stimulate discussion, improve understanding and support consideration of nature as critical national infrastructure. The plan reflects the views at the time of publication and is intended for general information purposes only.

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The Aotearoa Circle

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Mā te Kaitiakitanga ko te Tōnuitanga
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