SUBMISSION TO MINISTERIAL INQUIRY INTO LAND USES ASSOCIATED WITH THE MOBILISATION OF WOODY DEBRIS (INCLUDING FORESTRY SLASH) AND SEDIMENT IN TAIRĀWHITI / GISBORNE DISTRICT AND WAIROA DISTRICT

on behalf of

THE ENVIRONMENTAL DEFENCE SOCIETY and PURE ADVANTAGE

Submitter Details

Full Name	Environmental Defence Society Incorporated
Address	PO Box 91736, Victoria Street West, Auckland 1142
Phone	09 302 2972
Contact	Gary Taylor
Email	gary@eds.org.nz
Date	5 April 2023

Full Name	Pure Advantage
Address	PO Box 99421, Newmarket, Auckland 1149
Phone	09 600 6408
Contact	Simon Millar
Email	simon@pureadvantage.org
Date	5 April 2023

1 Introductory comments

1.1 This is a joint submission on behalf of the Environmental Defence Society (**EDS**) and Pure Advantage (together, 'we') to the *'Ministerial Inquiry into Land Uses associated with the mobilisation of woody debris (including forestry slash) and sediment in Tairāwhiti / Gisborne District and Wairoa District'* (**Inquiry**).

1.2 Pure Advantage is a registered charity led by business leaders and supported by a collective of researchers and writers who investigate, communicate and promote opportunities for Aotearoa New Zealand to fulfil its potential for green growth.

1.3 EDS is a not-for-profit, non-government national environmental organisation. It was established in 1971 with the objective of bringing together the disciplines of law, science, and planning to promote better environmental outcomes in resource management.

1.4 We welcome this Inquiry into land use, the mobilisation of forestry slash and sediment, and forestry practices generally, on the East Coast. Although well overdue, it presents an opportunity to clearly (and impartially) identify the causes of adverse effects associated with forestry activities so that these can be properly and swiftly addressed, albeit - and crucially - with *long term* ecological, climate and community resilience as the central focus.

1.5 It is a tragedy for the communities of Tairāwhiti and Wairoa that a series of forestry policy failures borne out of visionless, short-term, siloed thinking, together with poor industry practice – plainly evident for many years – have resulted in utter devastation of their lands, coasts, rivers, homes, livelihoods, and community infrastructure, and worse, the loss of lives.

1.6 With effective regulatory settings that take an intergenerational, integrated and precautionary approach to sustainable land use and landscape stewardship, and a genuine commitment by the industry to vastly improve its operational standards and regulatory compliance, this could - and should - have been avoided.

1.7 The focus of this Inquiry is understandably on the Tairāwhiti and Wairoa districts. However, its findings should necessitate a more comprehensive national strategy for ecological, climate and community-resilient land use across Aotearoa New Zealand within which biodiverse productive and permanent native forests thrive. That is because the issues we raise are not locationally-specific. Significant adverse environmental impacts from exotic forestry activities and other inappropriate land uses are happening across the whenua. We need to get the settings right nationwide, and to this end our submission has been drafted with both the local and wider national context in mind.

1.8 To be clear, it is our view that native forests, (as well as, *to an* extent (and subject to meeting ecological objectives and bottom lines),[1] diverse, well managed, properly located exotic plantation forests) should - indeed, must - play an integral role in securing and defining Aotearoa New Zealand's long-term prosperity. They are currently the only way to remove emissions from the atmosphere at scale, and we will need them to meet our emissions budgets, 2050 emissions reduction targets, and as permanent regenerative carbon sinks in perpetuity.[2]

1.9 Forests also fulfil a multiplicity of roles beyond just carbon sequestration, from erosion control, water purification, and climate regulation to habitat for endemic flora and fauna, and places of cultural and spiritual connection and significance.

[1] For example, compliance with the National Policy Statement for Freshwater Management, New Zealand Coastal Policy Statement, Te Mana o te Taiao – Aotearoa New Zealand Biodiversity Strategy, the draft National Policy Statement for Indigenous Biodiversity, and the Climate Change Commission's advice and recommendations for a low emissions future.

[2] He Pou a Rangi | The Climate Change Commission|Ināia tonu nei: a low emissions future for Aotearoa, Chapter 18, at 315, https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-low-emissions-future-for-Aotearoa/Chapter-18-inaia-tonu-nei.pdf.

1.10 Like the rest of nature, forests should be viewed as vital infrastructure[3] and insurance against future risks. But those forests must be planted and managed so as to create an intergenerational, resilient, socio-ecological *asset*, not the social, economic and ecological liability they present for some communities today, and for others in the future.

1.11 Right tree, right place, right purpose. This oft-repeated mantra is simple and sound enough in principle. In practice, however, the proliferation of *Pinus radiata* and other exotic monocrops has continued unabated due to the permissive regulatory context, fuelled by a rising price on carbon and, therefore, an increasingly higher rate of return from the cheapest, easiest, and fastest growing (and sequestering) species. This outcome is not surprising given most production and carbon forests are managed (and incentivised) according to the singular lens of optimising profitability.

1.12 But if we are to ensure the right trees are indeed planted in the right place for the right purpose, we need more nuanced and carefully designed regulatory settings (including well-targeted incentives) that secure a much more holistic set of values and encourage an interwoven land use approach. Such settings should ensure that forests are planted and managed with a view to optimising ecological integrity, flora and fauna biodiversity and habitat protection, long-term climate (and hazard) resilience, soil health and stability, water purification and secure yields, temperature management, recreation and amenity values, and spiritual connection alongside carbon sequestration, sustainable timber and bioenergy production.

1.13 With the increasing frequency and intensity of severe weather events, and social trust in the forestry industry tenuous, it is essential that this Inquiry marks a clear turning point for the future of forestry in Aotearoa New Zealand.

2 Structure of submission

2.1 Our submission is structured around the Inquiry's Terms of Reference (**ToR**) as follows:

(a) History of failed land use strategies on the East Coast (ToR 12.3.1);

(b) Why this is a national problem and how climate change will make it worse (ToR 12.3.2);

(c) The need to ensure that the less visible and sometimes longer term effects of sedimentation are not overlooked nor underestimated (ToR 12.3.2.7 - 9);

(d) Regulatory failure under the National Environmental Standards for Plantation Forestry (**NESPF**) (ToR 12.3.4), including:

i) A baseline of permitted activity status that is irreconcilable with a high-intensity, high-risk industry;

[3] The Editors, "Use Nature as Infrastructure", Scientific American, 1 April 2023.

ii) Limitations of the Erosion Susceptibility Classification (**ESC**) system as an accurate risk assessment tool;
iii) Misalignment of controls relative to erosion risk zone;
iv) Lack of regulatory nuance in relation to harvesting methods such that clear felling is a widespread practice;
v) Weak and inappropriate slash management controls;
vi) Vague and unenforceable permitted activity conditions;
vii) An inexplicable management accountability gap, giving rise to primary sector inequities;
viii) Poor industry compliance and limited monitoring;
ix) Wholly inadequate penalties for non-compliance that are entirely disproportionate to (and thereby permitting the externalisation of) the cost of harm;

(e) The challenge of overcoming economic incentives for *Pinus radiata* and other exotic species under the New Zealand Emissions Trading Scheme (**ETS**) (ToR 12.3.3);

(f) The need for broader policy coherence (ToR 12.3.7.2); and

(g) How systemic change is necessary to achieve land use aligned with long term national prosperity (ToR 12.3.7.1).

2.2 We then briefly outline some initial recommendations that would address these.

3 ToR 12.3.1 | Inherited problems: Legacy issues of failed land use strategies on the East Coast

3.1 Sustainable land stewardship on the East Coast is subject to significant physical constraints. The region is predisposed to regular high intensity rainfall events and cyclonic storms,[4] and

[4] The East Coast's predisposition to regular high intensity rainfall events and cyclonic storms is not a recent phenomenon (Office of the Parliamentary Commissioner for the Environment, Sustainable Land Management and the East Coast Forestry Project, December 1994, (**PCE, 1994)** refers.) Writing in 1995, Bergin et al observed: "*The region has a history of extreme floods, generally resulting from high intensity rainfall during tropical storms. These storms have been a major feature contributing to the unstable nature of the hill country, east of the Raukumara Range. Although commonly considered to be infrequent, there were four East Coast rainfall events within the 1980s that resulted in considerable damage from landsliding*." (Bergin, D.O., Kimberley, M.O. , "Protective Value of Regenerating Tea Tree Stands on Erosion-Prone Hill Country, East Coast, North Island, New Zealand", New Zealand Journal of Forestry Science 25(1): 3-19 (1995), (**Bergin et al**) at 5.) Based on an analysis of storm frequencies, they concluded that "the rationale for promoting conventional plantation forestry establishment techniques on the East Coast hill country currently under regenerating forest should be reassessed." (At 15).
An investigation into the causes of slash damage from Cyclone Cook completed in October 2017 similarly noted that "storm-induced forestry slash events have occurred regularly in the region since 2012 and sporadically before then" (Cave, M., Davies, N., and Langford, J, "Cyclone Cook Slash Investigation" (Gisborne District Council), October 2017 (**Cave et al**), at 3) and that "[i]t seems clear from [historical events] that on average a significant event can be expected somewhere in Tairawhiti every two years but that an event might well occur in any one year based on current harvest volumes." (Cave et al, at 4).

has a geologic and geomorphic risk profile characterised by soft sedimentary rocks and medium to very steep slopes. As a result, the region is highly susceptible to erosion.

3.2 Historic land use patterns have made "[t]he extent and severity of erosion in the [East Coast] region … unique."[5] The conversion of land to pastoralism, mainly between the 1880s and 1920s, resulted in extensive clearance of native vegetation.[6] Decades of intensive grazing gave rise to increased erosion, culminating in significant landslide damage to hill country throughout the region from Cyclone Bola in March 1988.

3.3 Surveys of damage soon after Cyclone Bola showed a strong correlation between the type and extent of vegetation cover and the degree of shallow landsliding.[7] In light of this, and the severity of the erosion problem, the Government established the East Coast Forestry Project (**ECFP**) in 1992.

3.4 It is useful to outline the course of the ECFP as it exemplifies the short-term, profitability-first approach to land use stewardship in Aotearoa New Zealand. This is symptomatic of the 'Siloed World' described by David Hall in his paper, "*The Interwoven World*", and must be understood as a systemic problem which needs to be acknowledged and addressed if our policy strategies and regulatory frameworks are going to achieve long term prosperity. We cover this further in section 9 below.

3.5 The ECFP was a 28 year afforestation project designed to promote large-scale commercial forestry with the objectives (originally) of controlling soil erosion, providing employment and regional development, and to recognise the environmental needs of individual properties.[8] Forestry companies and landowners competitively bid for the opportunity to plant forests, with bids ranked and accepted – *cheapest first* – until the limit of the annual budget was reached.[9]

3.6 In 1994, the Parliamentary Commissioner for the Environment reviewed the ECFP against the context of "sustainable land management". Among the concerns expressed in that review were:

When reviewing the East Coast Forestry Project in 1994, the Parliamentary Commissioner for the Environment observed that the East Coast would be subject to more frequent ex-tropical cyclones, as well as droughts (and thus fire risk). (PCE, 1994, at 74)
In further support of this prediction, a recent study on the causes of Cyclone Gabrielle found that, as a result of anthropogenic climate change, the East Coast's exposure to such events is likely to increase in frequency and intensity. (Harrington, L. J., Dean, S. M., Awatere, S., Rosier, S., Queen, L., Gibson, P. B., ... & Otto, F. "The role of climate change in extreme rainfall associated with Cyclone Gabrielle over Aotearoa New Zealand's East Coast", 2023)

[5] PCE, 1994, at 107.
[6] Ibid, at 6.
[7] Bergin et al, at 4.
[8] Bayfield, M. A. and Meister, Professor A. D., Report to the Minister of Agriculture and Forestry, 2005, at v (**Bayfield and Meister**).
[9] Bayfield and Meister, at 37.

(a) That the development of the ECFP and its decision-making processes were driven by the perceived need to facilitate *commercial* forestry, with limited assessment of its environmental implications;[10]

(b) There were frequent conflicts between the multiple objectives, including the notion of dual-purpose forests, which were to have a productive value as well as a protective one;[11]

(c) The resilience of pines to major pest or disease outbreaks, compared to mixed species forests, preferably indigenous, was untested;[12] and

(d) The difficulties of reducing the erosion impacts of forestry operations to satisfactory levels "in this difficult steepland environment",[13] with the need for "careful planning, early identification of environmental values and hazards, and considerable flexibility of operations to cope with site specific hazards."[14] Materially, the review noted:[15]

> "on some highly erodible sites, **there may have to be a move away from clearcutting and planting toward selective harvesting and more natural systems of replenishment and growth.** In some sensitive sites **detailed zoning may be necessary to delineate areas where permanent retention of vegetation may be warranted.**";

and similarly:[16]

> "Because of the primary importance of erosion as a constraint to land use in the region, and the clear reduction in mass movement erosion resulting from forest establishment, on balance it would seem that the net biophysical impacts of large-scale forest establishment projects in the extensive steeper areas of the region will be favourable. However, **potential detrimental impacts of commercial forestry, particularly those associated with harvesting in fragile steepland environment, may be significant** and will require good planning and implementation of best practices to be minimised. **There may be some very steep slopes or gully bottoms where alternative species are more suitable than pines or on which harvesting should not take place**."

3.7 Changes to the ECFP were implemented in 2000 following a first review in 1998. These included refocusing the objectives of the project to a primary goal of sustainable land management, targeting the worst 60,000 hectares of severely eroding land, and the extension of treatment options from commercial afforestation only, to include (among others) indigenous reversion as well.[17]

---

[10] PCE, 1994, at 109.
[11] PCE, 1994, at 11, 94.
[12] PCE, 1994, at 73-74.
[13] PCE, 1994, at 70.
[14] PCE, 1994, at 70.
[15] PCE, 1994, at 70.
[16] PCE, 1994, at 75, 110.
[17] Bayfield and Meister, at v.

3.8 By the time of the second review, which commenced in June 2005, most of the planting to date had used *Pinus radiata*.[18] The sustainability of commercial *Pinus radiata* plantation forestry was (again) questioned "given the need for clear fell harvesting"[19] and the resulting window of vulnerability to erosion, during which the tensile strength provided by rotting stumps and roots is lost and that provided by new plantings is not yet established.[20]

3.9 In response, the second review considered that "[t]he use of species with longer rotations would mean fewer harvests and less frequency of soil disturbance over time. There could also be less disruptive harvest techniques (compared with clear felling *Pinus radiata*), for example using mixed species plantations with selective harvesting at differing times ensuring a continuous canopy cover."[21]

3.10 In support of this, the authors of the second review noted - under the telling heading "*Long Term View*" - a 2002 report by the Parliamentary Commissioner for the Environment, "which discussed the potential for weaving resilience into our working lands including recommendations for the future roles of native plants."[22] Resilient forestry could use longer rotation high timber value indigenous species like totara, which would foster biodiversity and resilience, and could "be selectively harvested by helicopter logging."[23]

3.11 However, the authors concluded that alternative species had "not been taken up by landowners because of the lack of technical expertise in forestry with alternative species, greater costs involved in the[ir] establishment and longer rotations meaning costs are carried over a longer period of time."[24] Ultimately, and although mixed species plantations with variable harvesting would provide more effective long term erosion protection, "the economics of this type of proposal are unlikely to be attractive to landowners."[25] To overcome this, additional support and encouragement would be necessary to ensure the most effective, long term solution is implemented, not the cheapest.[26]

[18] Ibid, at 12.
[19] Ibid, at 13.
[20] Ibid.
[21] Ibid.
[22] Ibid, at 26.
[23] Ibid.
[24] Ibid, at 13.
[25] Ibid, at 26.
[26] Ibid, at 40.

3.12 But, short term economic considerations prevailed,[27] and by 2016 the East Coast had a total of 141,581 hectares in exotic forestry.[28] And "with these forests now ready to harvest has come the problem of slash mobilisation in the forests of Tairāwhiti."[29]

3.13 Forecast harvest volumes over the coming decades (as at 2018) are set to grow, with harvest pressures (and their associated risks) expected to rapidly increase from around 2026, and not likely to peak until around 2036.[30] This presents a very limited intervention window within which regulators and industry can formulate a genuinely effective management response[31] that will address both the immediate risks of adverse environmental effects whilst also securing sustainable, long term resilience.

4 ToR 12.3.2 | Geographic scope: Significant adverse environmental effects from plantation forestry activities is a national problem - and climate change will only exacerbate these effects

4.1 The exacerbation of significant adverse environmental effects associated with clear felling exotic monocrops planted on erodible steeplands and hill country is not a uniquely East Coast problem:

(a) Cave et al noted: "Tairāwhiti is also not the only region with problems with forestry slash. A storm in the Marlborough Sounds in early November 1994 resulted in eight landslides in an area that had been harvested over the previous months. The storm was not particularly intense compared with what the area can receive but the damage was locally significant. It was observed that slope failures in forested land will be an issue during intense rain events and that harvest on slopes of 30 degrees will need to be managed in a way that it does not seriously disturb the soil."[32]

(b) Visser similarly records that "In New Zealand, post-harvest landslides and debris flows that transport large quantities of woody residue have been recorded in Northland, Coromandel, Bay of Plenty, Gisborne/East Coast, and Nelson-Marlborough, whereby it was reported that they are usually caused by storms with return periods greater than 20 years, though smaller events have occasionally caused problems."[33]

---

[27] Reminiscent of Aldo Leopold's observation in "The Land Ethic" (in *A Sand County Almanac* (1949)), whereby he lamented "Some species of trees have been 'read out of the party' by economics-minded forests because they grow too slowly, or have too low a sale value to pay as timber crops…. In Europe, where forestry is ecologically more advanced, the non-commercial tree species are recognized as members of the native forest community, to be preserved as such, within reason. Moreover some … have been found to have a valuable function in building up soil fertility. The interdependence of the forest and its constituent tree species, ground flora, and fauna is taken for granted."

[28] Cave et al, at 2.

[29] Ibid, at 93.

[30] Ibid, at 2.

[31] Ibid, at 2.

[32] Ibid, at 93.

[33] Visser, R., "Best practices for reducing harvest residues and mitigating mobilisation of harvest residues in steepland plantation forests", 2018, prepared for Gisborne District Council (**Visser**), at 26.

(c) At the national scale, at least 24% of the current plantation forest estate is rated either high or very high under current ESC mapping;[34]

(d) Writing in relation to the impacts on marine and freshwater environments from plantation forestry in the Marlborough and Tasman districts, Bright notes that the area is characterised by steep topography that is exposed to high intensity rainfall;[35]

(e) The second review of the ECFP referred to "**lessons from other regions**" subject to flooding that "demonstrates **how vulnerable New Zealand's hill country is** to storm-initiated erosion and the damages that follow."[36] It also acknowledged that:

i) "[c]limate change will increase the frequency and magnitude of future storm events" and that "**New Zealand** can expect to sustain further loss of steep hill country soils and off-site damage to property";[37] and

ii) "**It is important to address soil erosion throughout New Zealand**. Not dealing with the issue today will only increase the magnitude of the disaster that will occur in the future after a severe rain storm or a cyclone event."[38]

4.2 The geographic spread of prosecutions for slash discharges in breach of the Resource Management Act 1991 (**RMA**) further demonstrate that the adverse effects of plantation forestry on erodible slopes is a national problem, and must be addressed accordingly.

4.3 That is also because, as noted in the second review of the ECFP, the increasing frequency and intensity of extreme weather events are predicted to be experienced across the country. Indeed, "unprecedented weather events are becoming the norm."[39] Very extreme precipitation, defined as events with a recurrence interval of 2 years or greater, are projected to increase *throughout* the country.[40]

4.4 We also note that the incidence and intensity of precipitation and storm events, though clearly relevant to the mobilisation of slash and sediment, are not the only climate change effects of significance to sustainable forestry policy and regulation. Increasing mean temperatures, extreme winds, and prolonged droughts, which will increase the risk of wildfire and wilding spread in even-aged, single species coniferous forests, as well as

[34] See https://www.mpi.govt.nz/dmsdocument/29804-Erosion-Susceptibility-Classification-by-class-area-of-plantation-forestry-excluding-Department-of-Conservation-Land.
[35] Bright C. E. 2021 Impacts on Marine and Freshwater Environments from Plantation Forestry. Prepared for Marlborough District Council and Tasman District Council. Envirolink Report 2118-MLDC 158 (**Bright**), at 19.
[36] Bayfield and Meister, at 35.
[37] Ibid.
[38] Ibid.
[39] Norton, D., "We planted pine in response to Cyclone Bola, it is now time to invest in natives", 23 February 2023, https://www.stuff.co.nz/environment/climate-news/300814466/we-planted-pine-in-response-to-cyclone-bola-it-is-now-time-to-invest-in-natives
[40] Ministry for the Environment 2018. *Climate Change Projections for New Zealand: Atmosphere Projections Based on Simulations from the IPCC Fifth Assessment, 2nd Edition*. Wellington: Ministry for the Environment, at 15.

pressures on freshwater resources (for example, where afforestation occurs too close to wetlands and other waterbodies), must also inform what we plant, where, and for what purpose to achieve climate resilient and adaptable forests and landscapes. The potential for adverse effects from forestry activities, and adequacy of the NESPF to regulate for these, must be considered with all climate risks in mind.

5 ToR 12.3.2.7 - 9 | Slash damage effects are obvious, but sedimentation effects are as significant and ubiquitous

5.1 Footage of the catastrophic scale of devastation wrought by the mobilisation of woody debris on the East Coast makes plain many of the resultant adverse environmental effects from plantation forestry, and it would be understandable for the Inquiry to focus on these.

5.2 However, the effects of accelerated sedimentation (associated with earthworks, vehicles and machinery, river crossings, harvesting and the post-harvest window of vulnerability) are no less damaging to receiving environments. Those from Cyclone Gabrielle will be extensive and long-lived. Sedimentation effects are clearly articulated by Professor Simon Thrush's statement prepared in support of this submission (**Appendix A**).

5.3 The table below also summarises some of the environmental and biophysical effects of both sediment and debris flows on freshwater and marine environments.[41] In short, "[e]xcess sediment in freshwater and marine environments reduces the growth of plants, damages fish gills, and can smother riverbed and seabed ecosystems."[42] In the case of *Gisborne District Council v Aratu Forests Limited*, J Dwyer concluded that:[43]

> "the discharge of forestry debris into the streams on the Wakaroa block had a range of identifiable adverse impacts on those water bodies. Sediment discharges smother stream beds, destroying invertebrate, fish and plant life. They cloud the water column making it difficult if not impossible for some fish species to see and breath. They can settle and accumulate so that their effects are repeated and add to the effects of other sometimes naturally occurring sedimentation. Slash destroys stream edges and beds and blocks water bodies it enters…. The combination of slash and sediment interferes with the natural processes and flow of the water it enters."

5.4 Further, unlike slash, sediment is hard to remove. And because sediment can be readily resuspended, its effects on receiving waterbodies are more acute and long-lived, with the risk of repeated harm during successive storm events. These factors make sedimentation effects particularly significant.

[41] Sources: Ryan (1991); Gillespie (2007); Bilotta and Brazier (2008); Geertsema *et al.* (2009); Davies Colley *et al.* (2015); Visser and Harvey (2020); Urlich (2015, 2020), cited in Bright, at 21.
[42] Bright, at 20.
[43] [2020] NZDC 2808, at para [18].

Summary of environmental effects of sediment and debris flows on receiving freshwater and marine environments

	Deposited Fine Sediment	Suspended Sediment	Debris Flows
Marine Environment Coastal/Estuary/ Lagoons	Smother benthic habitats and thereby change ecological composition by killing and displacing macrofauna. Seagrass reduced in extent and fine sediment coating on the leaves. Effects of changing sediment fluxes are frequently observed at the coast, as excessive loading of riverine sediment can cause smothering of estuaries and the seafloor and can cause beach erosion or aggradation. Fine sediments on the relatively flat seabed surface can be readily resuspended by tidal and wave-generated currents to the extent that they interfere with the growth/survival of suspension-feeding shellfish.	Increase turbidity and reduce light transmission in the water column and thereby affect photosynthesis; change biogeochemical gradients and cause negative effects to benthic microalgae; clog fish gills and the feeding parts of sediment-dwelling filter-feeders, and cause chronic effects on macrofauna physiological condition and behaviour. Excess fine sediment in the nearshore zones is a natural hazard and can silt up harbours and estuaries affecting shipping and navigation.	Debris flows deposit material at the coast typically in fans. Boulders and logs deposited in washouts and flooding. Forestry waste and slash washing up on beaches and log debris clogging river outflows to coast. Sediment-laden plumes can extend over large areas of coastline. Very fine-grained sediments can be carried tens of kilometres, or much further, offshore and transported along the coast by wave action and tidal currents. Foreshore and seafloor smothering with logs and forestry slash, mud and silt.
Freshwater Rivers/Lakes/ Wetlands	Deposited sediment affects the substrate composition of a waterway and therefore changes the coverage of fines and bed stability. Deposited sediment provides a readily available in-stream source of sediment that can have flow-on effects downstream. Fine deposited sediment has a complex relationship with periphyton and macrophytes. Affects fish habitat and food supply. Increased drift and decreased abundance of benthic invertebrates. In lakes, deposit sediment causes benthic smothering, sediment resuspensions and alteration to sediment oxygen demand.	Deposits sediment into a stream or pollutes a drinking water source with sediment and fine organic debris. Clogging riverbed sediments and reducing habitat function. Reduce light transmission in the water column and thereby affect light penetration, suspended sediment concentration, the visual clarity, and sediment budget of a waterway. In lakes light transmission, oxygen demand, conveyance of sorbed contaminants is affected by sediment concentration, visual clarity and photosynthesis, depth limit for benthic plants, foraging efficiency, food quality.	Exacerbate flood hazard and potentially cause severe impacts for downstream infrastructure and communities. Debris flows have a very high sediment concentration by weight and are more powerful and destructive than water alone and may carry woody material and boulders. Damage to river channels by filling and/or eroding the stream channel for great distances. Capable of relocating and depositing large amounts of material from the slopes to the valley bottoms. Dam streams and rivers impacting both water quality and fish habitat.

6 ToR 12.3.4 - 7 | Why is this happening? Permissive regulatory regime irreconcilable with such a high intensity, high risk industry

6.1 The inability of the NESPF settings to ensure that significant adverse effects from forestry activities are avoided is attributable to a raft of regulatory flaws that are well documented in EDS's comprehensive review of the NESPF (**EDS NESPF Review**),[44] and EDS and Pure Advantage's recent joint submission on the Ministry for Primary Industries' (**MPI**) consultation on extending and amending the NESPF for permanent exotic forestry.[45]

6.2 These pieces of work (attached as **Appendix B** and **C** respectively) inform, and should be read in conjunction with, this submission, and we cross-reference them where appropriate.

6.3 This submission does not cover all of the issues traversed in those pieces of work. However, they both conclude that review and strengthening of the NESPF is necessary, including because of the specific shortcomings outlined below.

Activity status: presumption of permitted activity status for plantation forestry activities irreconcilable with risk of significant adverse effects

6.4 The NESPF are regulations promulgated under the Resource Management Act 1991 (**RMA**). Their origin came at the behest of industry, which claimed that regional variances to planning controls were a threat to forestry investment and that a consistent management framework was required to reduce any actual or perceived barriers to future investment.[46]

6.5 The industry's influence over the formulation of policy and regulatory settings has been highlighted in recent media coverage, revealing the persistence and extent of industry capture.[47] Perceptions of privileged influence also arise in relation to the appropriateness of Te Uru Rākau's (as a business unit of MPI) lead role in relation to administering the NESPF. As an RMA and environmental regulatory instrument, the NESPF should fall primarily within the Ministry for the Environment's remit, as is the case for other resource management instruments in which other agencies have big stakes (for example, the Ministry for Business, Innovation and Employment vis-à-vis the National Policy Statement for Renewable Energy Generation).

---

[44] Wright, M., Gepp, S., and Hall, D., A Review of the Resource Management (National Environmental Standards for Plantation Forestry) Regulations 2017 - Are the settings right to incentivise "the right tree in the right place", and is a high trust regulatory model the right fit for a high risk industry? Environmental Defence Society Inc and Royal New Zealand Forest & Bird Protection Society of New Zealand, April 2019 **(EDS NESPF Review)**.

[45] Environmental Defence Society and Pure Advantage, *Joint Submission on Discussion Document "National direction for plantation and exotic carbon afforestation"*, 11 November 2022.

[46] Gisborne District Council Report to Council for decision on "Implications of the Proposed National Environmental Standard for Plantation Forestry", 30 September 2010 (**GDC Report to Council on proposed NESPF**), at 3.

[47] https://www.rnz.co.nz/news/lobbying/486670/lobbyists-in-new-zealand-enjoy-freedoms-unlike-most-other-nations-in-the-developed-world

6.6 As a result, the NESPF established a permissive approach to a highly intensive industry, which some saw as "an attempt to 'front load' the plantation forestry regulatory regime … [such that] once a plantation forest is established, management and harvesting rights are secure."[48]

6.7 The NESPF came into force on 1 May 2018 with the objectives of:[49]

(a) ***maintaining or improving*** *the environmental outcomes associated with plantation forestry activities*; and

(b) ***increasing the efficiency*** and certainty ***of managing plantation forestry activities***.

It is worth observing that these two objectives will seldom align.[50]

6.8 The NESPF regulates eight core plantation forestry activities: afforestation, pruning and thinning, earthworks, river crossings, harvesting, forestry quarrying, mechanical land preparation, and replanting.

6.9 To encourage commercial afforestation (following a period of net deforestation in Aotearoa New Zealand), most of these activities enjoy permitted activity status by default (meaning no resource consent is required),[51] subject to compliance with conditions.

---

[48] GDC Report to Council on proposed NESPF, ibid, at 4.

[49] https://www.mpi.govt.nz/forestry/national-environmental-standards-plantation-forestry/

[50] The same is true of the 2013 Forest Stewardship Council's (**FSC**) National Standard for Certification of Plantation Forest Management in New Zealand, Principle 5 – Benefits from the Forest, which provides that "Forest management operations shall **encourage efficient use** of the forest's multiple products and services **to ensure economic viability and a wide range of environmental and social benefits**"; and Criterion 5.1, which states that "Forest management should **strive towards economic viability, while taking into account** the full environmental, social, and operational costs of production, and ensuring the investments necessary to maintain the ecological productivity of the forest." By comparison, Preface A1 of the 2023 FSC Forest Stewardship Standard for New Zealand (2023 FSC Standard), which will come into effect on 15 April 2023, states that "Economically viable forest management means that forest operations are structured and managed so as to be **sufficiently profitable, without generating financial profit at the expense of the forest resource, the ecosystem, or affected communities.** The tension between the need to generate **adequate financial returns** and the principles of responsible forest operations can be reduced through efforts to market the full range of forest products and services for their best value." (at 15). However, Principle 5 of the 2023 FSC Standard still requires efficient management "to maintain or enhance long-term economic viability **and** the range of social and environmental benefits."

[51] Councils *can* apply greater stringency in their plans that that applicable under the NESPF to: achieve an objective of the National Policy Statement on Freshwater Management (**NPS FM**); give effective to Policies 11, 13, 15 and 22 of the New Zealand Coastal Policy Statement (**NZCPS**); protect outstanding natural features and landscapes and significant natural areas (**SNAs**); and manage activities in certain unique and sensitive environments. Accelerated sedimentation in the marine environment and woody debris deposited on the coast is inconsistent with several policies in the New Zealand Coastal Policy Statement. Similarly, accelerated sedimentation in freshwater environments is inconsistent with several National Policy Statement for Freshwater Management policies and with meeting relevant freshwater national bottom lines. Bright queries whether it would be possible to meet national bottom lines related to sediment in freshwater in light of the predisposition to slope failures in areas where plantation forestry is situated. Bright, at 36, 44.

6.10 A presumption that it is appropriate for large scale, intensive plantation forestry activities to be "permitted" is irreconcilable with the high risk of significant adverse environmental effects associated with these activities, particularly earthworks and harvesting. It also puts the forestry sector at odds with more stringent regulatory regimes that apply to other primary sectors. As Gisborne District Council outlined in its reservations regarding initial proposals for an NESPF:[52]

> "Forestry harvesting and associated earthworks are large scale activities involving large areas and large volumes of material. Both are potentially conducive to large scale erosion and adverse downstream effects. **No other land use carries out such activities at this scale, so the risks are high.** The proposed NES lowers the permitted activity baseline; that **is it permits environmental effects from plantation forestry that would not be permitted for other land uses.**"

6.11 It is therefore unsurprising that the EDS NESPF Review concluded that:[53]

> "… the NESPF's presumption that plantation forestry activities should be a permitted activity needs to be revisited. A complex, intensive activity that not only has immediate impacts but contributes to diffuse pollutants does not easily lend itself to the certainty and specificity required for a permitted activity standard of national application. This is particularly so when that activity occurs across a national landscape that is extremely diverse and which, in many areas, is reaching environmental limits."

6.12 The inappropriateness (and illegality) of the NESPF's permissive approach to forestry activities is informed by a combination of regulatory flaws. These include:

(a) Reliance on the ESC, which does not accurately map site-specific risks;
(b) Inadequacy of controls relative to erosion risk zoning;
(c) Absence of regulatory nuance in relation to harvesting systems;
(d) Weak and inappropriate slash management provisions; and
(e) Vague, ineffective and unenforceable permitted activity conditions.

I. Erosion risk mapping: Inadequacy of primary risk assessment tool

6.13 The NESPF relies on the ESC to determine the level of regulation applicable to certain plantation forestry activities, and therefore how any associated environmental effects are managed. Its accuracy is critical since "[a]bout one-third of the New Zealand plantation forest estate is located on steeplands with fragile erodible soils, where many of the forests were originally planted as protection forests to control erosion and are now managed almost exclusively for wood production."[54]

[52] GDC Report to Council for decision on "Implications of the Proposed National Environmental Standard for Plantation Forestry", 30 September 2010, at 7.
[53] EDS NESPF Review, at 2.
[54] Raymond, K. "Crisis. What crisis? Maintaining our social licence to harvest steepland forests" NZ Journal of Forestry, August 2015, Vol. 60, No. 2, at 43.

6.14 The ESC ascribes an *erosion* susceptibility profile to all land across Aotearoa New Zealand, which is depicted on a map according to four colour-coded risk zones: green (low risk), yellow (moderate), orange (high), or red (very high risk).

6.15 Developed as an initial screening tool, the ESC applies an erosion risk assessment scale of 1:50,000. At such a coarse scale of granularity, it is unable to determine site-specific risk accurately or, therefore, to assign appropriate regulatory controls. Steep slopes within an area of gentler topography may be highly susceptible to erosion but will not be depicted at a scale of 1:50,000. As a result, most hill country and steeplands are classified as orange or yellow, but there are also significant areas of hill country and steeplands classified as green, mainly in the South Island. It is also informed by out-dated data in some areas.

6.16 A 2020 research article published in the New Zealand Journal of Forestry Science stated that "the coarse spatial resolution of the ESC may be ill-suited to managing forestry activities at the scale of forestry operations"[55] and:[56]

> "… in our study **the ESC failed to reliably discriminate areas of high landslide occurrence from areas of low landslide occurrence**. This probably relates to the resolution of the ESC and the New Zealand Land Resource Inventory (NZLRI) (Newsome et al. 2008) on which it is based, as **the scale (1:50000) of these data layers may be too coarse to adequately represent local scale (1:10000) variation** in land cover, climate, or topography. Deficiencies in the ESC could also be due to the **quality of the data contained in the NZLRI, which in some areas is 40 years out of date** (Bloomberg et al, 2011). The potential shortcomings of the ESC are well recognised (Basher et al. 2015a; Bloomberg et al. 2011; Marden et al. 2015) and it was intended as a regional rather than local land use management tool (Bloomberg et al. 2011). Nevertheless, the failure of the ESC to discriminate areas of high landslide occurrence from areas of low landslide occurrence in our study area, which covers almost 20,000 ha, raises questions about the reliability of the ESC as a regional land management tool in Tasman, New Zealand, and may warrant investigation elsewhere."

6.17 Although the NESPF requires that earthworks management and harvest plans include maps at "a scale not less than 1:10,000",[57] the provision of these plans is only required in accordance with permitted activity conditions or as a matter of control/discretion for controlled or restricted discretionary activities.[58] Thus, the finer scale assessment is not the information basis for determining what regulatory controls should apply in the first place.

[55] J Griffiths, C Lukens, R May, 2020, *Increased forest cover and limits on clear felling could substantially reduce landslide occurrence in Tasman, New Zealand*, New Zealand Journal of Forestry Science, 50:13, p 2.
[56] Ibid, p 9.
[57] NESPF, Schedule 3(2).
[58] We also understand, anecdotally, that mapping at this scale is not commonly undertaken as many New Zealand forestry companies do not have the in-house skills to undertake assessments at this scale or do not do so properly.

II. Inadequacy of ESC zoning controls relative to risk

6.18 In addition to recalibrating the scale at which an ESC assessment is undertaken, and as foreshadowed in the preceding paragraph, the distinctions made between, and thresholds and controls applied to, the various ESC zones should better reflect relative risk.

6.19 Very little distinction is made between the yellow zone, where the erosion susceptibility risk is moderate, and the orange zone, where the risk is high. Indeed, for harvesting, no distinction is made at all. And because the NESPF does not differentiate between harvesting systems, this means that clear felling in green, yellow **and orange** zones is permitted **without any spatial or temporal limitations**.

6.20 Clear felling on red zoned land is also permitted, subject to a 2-hectare cutover limit in any three month period.[59] In light of the erosion risk on such land, plantation forests should not be permitted there at all. Whilst there may be some short-term stabilisation benefit (around 28 years for a standard *Pinus radiata* rotation), the erosion and sediment discharge that follow harvesting (particularly clear felling) can be significant, even from smaller areas.[60] The NESPF should better reflect that:[61]

> "the erosion-control benefits of plantation forests are short-lived, lasting only as long as the trees are in the ground. On extraction, the benefit is gone and the bare face that remains can itself result in significant amounts of sediment ending up in sensitive receiving environments. This issue is particularly acute in respect of clear fell extraction as this opens a window of vulnerability between when new trees replace the rotting roots from the previous rotation."

During this window, which can last between 3 and 8 years from the time of harvest,[62] the site is vulnerable to landslides, mobilisation of slash, debris, and sediment. Radiata pines are associated with a longer window due to inferior root strength and their rapid decay. Indeed, "[t]he length of time between the death of trees and the onset of root decay is species dependent with *Pinus radiata* losing half its tensile strength in 15 months compared with more than 30 months for native trees."[63]

6.21 Ultimately, the NESPF should not be permitting plantation forestry in areas where the risk of adverse environmental effects from tree removal is high.[64] These are areas where permanent native forests should be nurtured due to their superior and multiple long-term benefits, which we outline further in this submission.

---

[59] NESPF, Reg 63(2)(b).
[60] EDS NESPF Review, at 2.
[61] EDS NESPF Review, at 25.
[62] EDS NESPF Review, at 17.
[63] Amishev, D., Basher, L., Phillips, C., Hill, S., Marden, M., Bloomberg, M., Moore, J.,*"New Forest Management Approaches to Steep Hills"* (MPI Technical Paper No. 2014/39) November 2014, at 23, (citing Philips and Watson, 1994), at 32.
[64] EDS NESPF Review, at 2.

III. Tacit acceptance of clear fell harvesting contrary to avoidance of adverse effects

6.22 Designed with "a focus on managing the effects of clear fell harvest, which is the dominant harvest model in Aotearoa New Zealand",[65] the NESPF does not differentiate between harvesting methods. Consequently, clear fell harvesting in green (low risk), yellow (moderate risk) and orange (high risk) erosion susceptibility zones is permitted *at any scale*: no spatial or temporal limitations apply. Clear felling on red zoned land is also permitted, subject to a 2 hectare cutover limit in any three month period.

6.23 Clear cut harvest systems involve felling an entire forest at once, making (m)any of the environmental benefits of exotic forests temporary: stored carbon is released, biodiversity is lost,[66] soil is destabilised and prone to erosion and subsequent weed invasion, and the quantity and turbidity of rainwater run-off increases.[67]

6.24 Furthermore, our commonly used cable harvesting systems rely on "rigging configurations [that] tend to pull the trees with only one end slightly suspended in the air while yarding and the rest of the tree [is] dragged on the ground because of insufficient clearance. This usually results in increased ground disturbance and when deflection is poor these configurations lead to significant gouging of the terrain."[68] Amishev et al also observed that:[69]

> "In order to achieve suitable deflection for maximising payload and hence system productivity, cable harvesting crews in New Zealand almost exclusively use the "ridge-to-ridge" setup where landings are located on a ridge-top and the mobile tailhold is located on the next ridge across a gully bottom and often across several smaller gullies. Thus **the whole area between the two ridges is harvested and extracted at once**. ... When extracting trees for the opposite (to the yarder) face of the gully, they are **pulled across the gully bottom (often through riparian vegetation if there is a riparian streamside zone)** and extracted up to the landing. During this process, the so called "**sweeping" occurs where broken tops and pieces from the felled trees are swept into the gully bottom leading to substantial accumulation of woody residue in these places."**

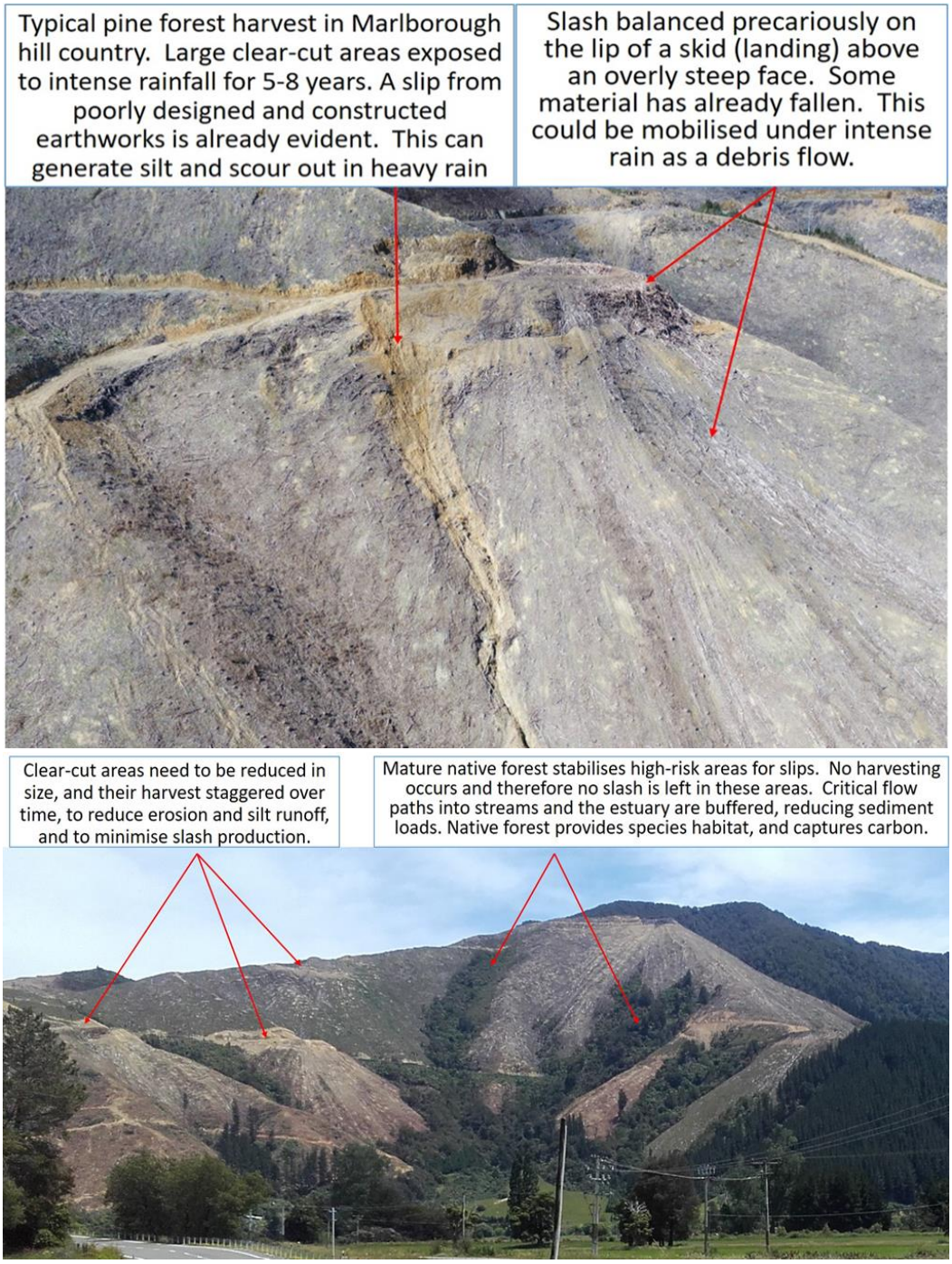
Retrieving this woody debris from steep gullies is often too difficult and unsafe.

6.25 Clear felling large areas of a catchment in this way will increase the hydrological response from a rainfall event,[70] as well as the availability of harvest residues and movement of soil. In recently harvested areas, even small rainfall events can lead to significant erosion,

---

[65] Ministry for Primary Industries, "*National direction for plantation and exotic carbon afforestation",* MPI Discussion Document 2022/10, at 16.
[66] We discuss the impacts of harvest methods on biodiversity at paras 9.22 – 9.24 in our joint submission on MPI's "National direction for plantation and exotic carbon afforestation"
[67] PCE, "Seeding the carbon storage opportunity in indigenous forests – Comments on the draft Climate Change (Forestry Sector) Regulations 2008", June 2008, at 5.
[68] Amishev, D., Basher, L., Phillips, C., Hill, S., Marden, M., Bloomberg, M., Moore, J.,*"New Forest Management Approaches to Steep Hills"* (MPI Technical Paper No. 2014/39) November 2014, at 23 (**Amishev et al, 2014**).
[69] Ibid, at 25.
[70] Visser, at 37.

sedimentation and debris flow events.[71] These adverse environmental effects are more severe on steep slopes, as evidenced by the following images.[72]



6.26 New Zealand's permissive approach to clear fell harvesting, particularly in high erosion risk zones, is misaligned with international best practice precedents, where clear cut limits and alternative silvicultural and harvest systems have been implemented to secure better environmental outcomes.

[71] Visser, at 29.
[72] Images provided courtesy of Dr Steve Urlich / Marlborough District Council.

6.27 In support of this, Visser notes that "Austria, with a large forest industry, **legally restricts clearcuts** to 0.5 ha. with an exception allowing a harvest up to 2 ha".[73] Germany, Italy and Switzerland all champion **continuous cover forestry** and "in principle restrict all 'clearcuts', allowing only patch-cuts, thinning or single tree selection."[74]

6.28 Exclusive use of **multi-span extraction systems with intermediate supports**, **"gully-to-ridge"** harvesting setups, and a prohibition on extraction through **permanently planted and protected riparian zones** apply in Chile.[75]

6.29 **Small coupe harvesting with adjacency constraints** apply in North America,[76] "which prevent a stand from being harvested before all adjacent stands are well established and "free to grow", which usually means having well developed root systems."[77]

6.30 Raymond points out that:[78]

> "The Pacific Northwest region of the United States and Canada has had its **harvesting volumes drastically curtailed due to environmental issues and strong public reaction against the forest industry.** In the very steep terrain countries of Europe (Germany, Austria, Italy and Switzerland) **they use silvicultural systems, hazard planning processes and harvest engineering technologies to protect the environment that are very different to those in New Zealand**. **Very steep terrain forests (over 80% slope) are managed primarily for watershed protection and recreation, and timber harvesting is secondary. Continuous cover forestry is the silvicultural system of choice with partial or selective tree harvesting**."

6.31 In light of these alternative and less ecologically destructive forestry practices overseas, it is unclear:

(a) Why these are perceived or presented as 'niche' in Aotearoa New Zealand;[79] nor

(b) Why the NESPF:

i) only applies a harvest limit on red zone land;[80]

ii) permits plantation forestry on vulnerable slopes at all given the challenges of managing significant adverse effects on and from such land;[81] and

iii) does not distinguish between harvesting systems.

---

[73] Visser, at 38.
[74] Visser, at 38, citing Spinelli et al, 2015.
[75] Amishev et al, at 63.
[76] Visser, at 38, citing Amishev et al, 2014.
[77] Visser, at 38.
[78] Raymond, K. "Crisis. What crisis? Maintaining our social licence to harvest steepland forests" NZ Journal of Forestry, August 2015, Vol. 60, No. 2, at 43.
[79] Indeed, the Forests Act 1949 requires such methods for the sustainable management of indigenous forests – see Schedule 2, clause 10.
[80] A 2 hectare limit in any 3 month period.
[81] EDS NESPF Review, at 26.

6.32 Based on what was observed in the countries visited by Amishev et al on their benchmarking study tour of forest management approaches to steep hills, they saw "at least two possible trajectories for future forests that have a production element on steep erosion-prone land" for Aotearoa New Zealand. These are worth repeating here:[82]

> "One sees a continuation of the current "corporate" forestry model of mostly larger-scale "mono-cultural" commercial plantation forests. The other could see the development of smaller-scale forests that might be managed as continuous cover forests (single or multiple species), multifunctional forests (ecosystem service forests), or approaches similar to many farm forestry activities seen in many parts of New Zealand.
> In the second "type" of forest there is likely to be **more species diversity** with "forests" or groups of trees occupying landscape niches within a pastoral agricultural system that target land not directly suited to pastoral agriculture. The **wood produced could be high value single trees for specialist markets** or for use on the farm itself. **Harvesting would likely be on a single tree or group section basis** and in many cases the timber would be sawn on the property. This type of forestry **would not require substantial investment in roading or earthworks** and **may be able to use smaller less capital-intensive forms of harvesting technology.**
> A further possibility exists for land that has a high risk of debris flows. **Areas identified as being of high risk of landslide-debris flows on steeplands could be "abandoned" and allowed to revert to scrub and or native forest.** Weed control and some management may be required for this option to succeed."

6.33 The Forestry and Wood Processing Industry Transformation Plan, in identifying the promotion of continuous cover forestry as an action point,[83] may indicate a softening of attitudes to alternative silvicultural systems. But facilitating the transition to continuous cover forestry should be *prioritised*, in respect of which continuity of canopy cover and root structure is retained, helping to preserve (rather than periodically disrupt) biodiversity habitats and improve ecosystem functionality and resilience,[84] and to significantly reduce the incidence of sedimentation and erosion.

6.34 Alternative silvicultural and harvesting systems can have higher operational costs[85] and may impact profitability.[86] However, the economic expediencies of clear fell harvesting rely on the externalisation of downstream costs facing communities and receiving environments. We have seen as a consequence of Cyclone Gabrielle that those costs can be extreme. Accepting the possibility of a reduced economic return in the short term (which the industry

---

[82] Amishev et al, at 74.
[83] Action 7.2.
[84] Due to uneven-aged forest structure and the use of diverse tree species.
[85] Hall, D. (June 2018). The Interwoven World | Te Ao i Whiria: Toward an Integrated Landscape Approach in Aotearoa New Zealand. Discussion paper. Auckland: The Policy Observatory. Retrieved from https://thepolicyobservatory.aut.ac.nz/ (**Hall, Interwoven World**), at 47.
[86] Although higher costs may be somewhat compensated for by larger piece sizes and higher log quality extracted: see https://nzjf.org.nz/free_issues/NZJF63_4_2019/E24BCB64-19DE-476d-8A15-3F4B3A74E4B0.pdf, at 25, 28. Note also references to no run-off after heavy rain. There will also be lower replanting costs due to reliance on natural regeneration for replacement trees, together with broader environmental and social benefits (some of which may be monetized, for example, by way of a biodiversity payment scheme).

has been unwilling to do)[87] may be a necessary price of transitioning to a truly sustainable and prosperous forestry model in Aotearoa New Zealand for the long term.[88]

6.35 Clear policy direction, regulatory measures and transitional support are essential to facilitate a shift to ecologically superior silvicultural systems and lower impact harvesting methods here.[89] Evidently this is how plantation forestry is undertaken now in many countries with similar characteristics, where the downstream social, economic and ecological costs associated with more damaging harvest methods are internalised. It is past time for Aotearoa New Zealand to catch up.

IV. Weak and inappropriate slash management controls

6.36 Because the NESPF are essentially designed around the expectation that plantation forests will be clear felled, they anticipate the generation of, and therefore need to manage, slash.

6.37 However, the regulations simply assert that:

(a) slash from harvesting is to be placed on stable ground;

(b) slash piles "*on the edge* of landing sites must be managed to avoid collapse"; and

(c) that harvesting slash should not be deposited into a water body or onto land that would be covered by water during a 5% AEP event - or if it does, it must be removed to avoid blocking or damming water bodies; eroding river banks; significant adverse effects on aquatic life; and damaging downstream infrastructure, property, or receiving environments.[90] (Of course, by the time it is removed, the damage to be avoided is likely already done).

6.38 In light of the extent to which unconstrained clear fell harvesting is permitted on steep erodible slopes, and the prevalence of "gully-to-ridge" cable harvesting systems, these regulatory settings are simply not fit for purpose. The volume of woody debris accumulation of slash piles ("birdsnests") on gully heads and erodible slopes present a significant mobilisation risk and should not be permitted on-site, let alone "*on the edge* of landing sites". For as long as clear felling persists, associated slash should be processed promptly on-site if feasible or trucked off-site for appropriate disposal, to avoid the risk of mobilisation, collapse or spontaneous ignition.

6.39 Reliance on slash traps, which are permitted under the NESPF,[91] should also be revisited. Slash traps anticipate the deposition of harvesting slash into water bodies, contrary to regulation 69(3), and the avoidance of associated adverse effects listed in regulation 69(4).

---

[87] Bloomberg, M. "Cyclone Gabrielle triggered more destructive forestry 'slash' – NZ must change how it grows trees on fragile land", The Conversation, 17 February 2023.

[88] Hall, The Interwoven World. Amishev et al note that in Germany, Switzerland, Italy and Chile "***very low rates of return are accepted and sometimes zero or negative remain acceptable because of the other values attributed to the forest***." Amishev et al, at 67.

[89] EDS NESPF Review, at 2.

[90] NESPF, Reg 69.

[91] NESPF, Reg 83.

This internal inconsistency should be addressed, particularly in light of their questionable efficacy and appropriateness, which are considered further at paras 6.55 – 6.56 below.

V. Vague and inadequate permitted activity conditions

6.40 Although permitted activity status is subject to compliance with specified conditions, many are inadequate to achieve the necessary level of environmental protection in all situations, or are uncertain and subject to value judgement on the part of the forest operator, making them difficult to translate into appropriate site-specific management responses or to enforce.[92]

6.41 For example, sediment controls require the management of sediment originating from applicable forestry activities to ensure that "after reasonable mixing" it does not give rise to "any conspicuous change in colour or visual clarity", the rendering of fresh water unsuitable for consumption by farm animals, or any significant adverse effect on aquatic life in the receiving waters. Although the phrase "reasonable mixing" derives from the RMA's provisions regarding discharges, it is unclear how to determine the point at which "reasonable mixing" may have occurred, nor indeed what would constitute "any conspicuous change in colour or visual clarity", making implementation, compliance with, monitoring and enforcement of this standard challenging.

VI. Permissive approach therefore in breach of s 43A(3) of the RMA

6.42 Section 43A(3) of the RMA does not allow national environmental standards to state that an activity that has significant adverse effects on the environment is permitted. Yet the NESPF's permissive approach to intensive forestry activities, particularly harvesting (in respect of which there is no regulatory nuance in relation to systems), together with its reliance on the ESC as a risk assessment tool, does precisely that.

6.43 Provided a forest operator is of the view that the relevant permitted activity conditions can be met (which are often vague, subject to value judgement, and unenforceable), clear felling (and associated earthworks) can occur on highly erodible land with significant and inevitable adverse effects as a result. In these respects, the NESPF are contrary to the RMA.

Management accountability gap, contrary to obligations on other primary sectors

6.44 Forest operations in Aotearoa New Zealand enjoy a very high trust management regime, with "heavy reliance on industry self-policing the implementation of permitted activity

[92] EDS NESPF Review, at 2. A different set of effects must be managed in relation to "disturbed soil" from harvesting, which "must be stabilised or contained to *minimise* sediment entering into any water and resulting in (a) the diversion or damming of any water body; or (b) degradation of the aquatic habitat, riparian zone, freshwater body, or coastal environment; or (c) damage to downstream infrastructure and properties.[92] The term "minimise" is inherently subjective and there are no clear baseline attributes, nor measurable quantitative or qualitative level of 'acceptable' effects, against which to assess compliance.[92] Clear standards are essential, providing how and where to measure an acceptable percentage change in visibility, and within what time periods.

standards."[93] The NESPF requires the promulgation of earthworks and harvest management plans. However, there is no requirement for these to be independently verified, peer-reviewed or qualitatively assessed in any way. Compliance is achieved simply by preparing and submitting the plan.

6.45 This unverified management plan approach:[94]

> "assumes that forestry operators will submit management plans that are high quality, and which adequately address the environmental risks that they are intended to manage. That assumption is untested, and this 'high trust' model of regulation is unlikely to be warranted across the board."

6.46 As we have noted previously:[95]

> "Using management plans that cannot be certified or rejected relies heavily on foresters designing adequate management plans and complying with vague permitted standards. This is **a very high trust model, which may not be warranted given the seriousness of potential environmental impacts, variability in practice around the country, and poor compliance outcomes in some areas**."

6.47 This contrasts starkly with the new obligations for Farm Management Plans that are compulsory and are subject to a strict regulatory regime requiring certification and independent auditing. It is anomalous for a land use that carries with it potentially worse adverse environmental effects to be exempt from such obligations.

6.48 Furthermore, the management plans that *are* required are limited in scope to specific time and effects related activities (harvesting and earthworks only). Such a narrow approach to forest management gives rise to a significant accountability gap in relation to how forest operators are identifying and assessing risks, and selecting appropriate management actions in relation thereto.

6.49 A comprehensive forest lifecycle management plan should be mandatory for all forests. However, the efficacy of such plans depends on the scope and quality of content; the translation of clearly identified risks to specific, measurable, proportionate, and effective responses; and proper implementation and monitoring.

6.50 Forestry Stewardship Council (**FSC**) certified forests are required to have management plans appropriate to the scale, intensity and risk of their operations.[96] And given that "[t]here are 22 FSC certified exotic plantations in New Zealand, consisting of a total of roughly 1.22 million hectares (72% of the total productive plantation forest area)",[97] a high proportion of

[93] Bright, at 17.
[94] EDS NESPF Review, at 32.
[95] EDS NESPF Review, at 2.
[96] The FSC Forest Stewardship Standard for New Zealand, 2023, Principle 7.
[97] FSC Forest Stewardship Standard for New Zealand, 2023, C.3.

plantation forest operators are, or should be, operating pursuant to an FSC-compliant management plan.

6.51 Among other things, FSC-aligned management plans must provide the rationale for the selection of species, regime, and harvesting rates of timber.[98] However, as we note below in relation to industry compliance, there is reason to question the rigour of the FSC certification scheme and management planning thereunder given that convictions for slash damage associated with poor management practices do not seem to preclude ongoing FSC certification.

Poor industry compliance monitoring and enforcement

> *"[T]he overall performance of the forest industry in managing the environment for future generations (kaitiakitanga) is in my view rather mediocre. This is confirmed every time a group of non-forestry members of the public, or overseas visitors, goes out to a logging site anywhere in New Zealand and comments on the impact that harvesting methods have on soil disturbance, erosion potential and the landscape in general."*[99]

6.52 Recent slash event investigations and prosecutions reveal a trend of poor industry practice,[100] further demonstrating the inappropriateness of the current high trust regulatory settings.

6.53 Following ex-tropical Cyclone Cook in 2017, Gisborne District Council initiated an investigation into slash mobilisation events after high intensity rainstorms (**Cyclone Cook Slash Investigation**).[101] Cyclone Cook was a "relatively small storm with an average recurrence interval of between 1 and 8 years depending on location."[102] It followed Cyclone Debbie, which had occurred just over a week earlier.

6.54 The Cyclone Cook Slash Investigation found:

(a) **Storm-induced forestry slash events have occurred regularly in the East Coast region since 2012** and sporadically before then;[103]

(b) "[O]n average a significant event can be expected somewhere in Tairāwhiti every two years but **an event might well occur in any one year based on current harvest volumes**"[104] and **that risk "becomes extreme in the decade between 2026 and 2036"** due to the area of plantation forestry due for harvest during that period;[105]

(c) F**orestry operations were not aligned with best practice**:

---

[98] Ibid, Annex D.
[99] Raymond, K. "Crisis. What crisis? …", at 43.
[100] We acknowledge that not all forest operators fall into this category.
[101] Cave, M., Davies, N., and Langford, J, "Cyclone Cook Slash Investigation" (Gisborne District Council), October 2017.
[102] Cave et al, at 1.
[103] Cave et al, at 3.
[104] Cave et al, at 3.
[105] Cave et al, at 4.

i) earthworks were observed adjacent to streams without suitable safeguards to stop sediment generation reaching the stream;[106]

ii) a significant number of landing / landing edge failures occurred where they were situated close to river level making them vulnerable to flooding;[107] and

iii) forestry roads and access tracks were poorly designed and associated with landslides (albeit these were not extensive or numerous).[108]

6.55 In relation to slash specifically, the investigators observed that:

(a) Pine was the predominant material in the woody debris mobilised based on empirical data of the material involved;[109]

(b) Forestry operations had resulted in **slash being retained in locations vulnerable to mobilisation** in high stream flows.[110] **Gullies and flood plains with accumulations or pine slash were ubiquitous in all forests**.[111] Slash was observed scattered throughout the river systems within forest areas;[112]

(c) At the time of investigation, replacement slash catchers were already accumulating significant woody debris, while some were holding slash despite there being no major floods since Cyclone Cook. This indicated that "clearing slash catchers needs to be a regular maintenance activity within catchments."[113]

(d) Slash catchers in the area of highest intensity rainfall either failed, were damaged and/or overtopped or were bypassed.[114] **This "raises questions about the effectiveness of slash catchers as a tool for mitigating against the migration of slash out of forestry catchments**."[115]

6.56 Constructing, installing, using, maintaining, or removing slash traps are permitted activities under the NESPF.[116] But reliance on improving the design, engineering and/or location of slash traps to improve their efficacy seems a distraction from the more urgent question of why slash is entering - and worse, *anticipated* - in our waterways? Indeed, it renders regulation 69(3), which prohibits the depositing of harvesting slash into water bodies, meaningless.

6.57 Dr Steve Urlich, a senior lecturer in environmental management at Lincoln University, attests to the "industry's overall poor environmental performance", enabled by a permissive regulatory regime. In his submission on MPI's "National direction for plantation and exotic

[106] Cave et al, at 5.
[107] Cave et al, at 1.
[108] Cave et al, at 1.
[109] Cave et al, at 1.
[110] Cave et al, a 5.
[111] Cave et al, at 3.
[112] Cave et al, at 5.
[113] Cave et al, at 3.
[114] Cave et al, at 3.
[115] Cave et al, at 3.
[116] Regulation 83.

carbon afforestation" consultation document, he noted that, from several years monitoring post-harvest forestry earthworks and consent conditions in Marlborough:[117]

> "even reputable companies with putative high environmental standards do not consistently meet them. In fact, the practices were such that skid failures, woody debris left in streams, and repeated heavy vehicle movements over streams with high ecological values were common. I understand this still continues in many areas and may have gotten worse in some places under the NESPF, along with defensive and resistant attitudes to compliance action."

6.58 The geographic spread of recent enforcement decisions shows that non-compliance is an industry-wide issue.[118]

6.59 We also note that some of the companies prosecuted still claim FSC forest certification, which implies that those forests are managed according to strict environmental, social and economic standards.[119] The FSC website states that certification bodies:[120]

> "will conduct audits to ensure that certificate holders continue to conform with FSC's certification requirements. If they do not conform, then their certification body may suspend or terminate their certificate, and FSC may block them from the system."

In light of the non-compliance evident from some certificate holders in Aotearoa New Zealand, we query at what point their continued certification would constitute false and misleading conduct under the Fair Trading Act 1986 worthy of Commerce Commission investigation.

6.60 Compliance monitoring by local authorities has also been called in to question. In *Gisborne City Council v Juken New Zealand*[121] the Court considered that failure by the Council to undertake compliance inspections over the five or six years the consents had been in place was "reprehensible and irresponsible, to say the least".[122] We understand, anecdotally, that at least one Council's approach to monitoring compliance with permitted activity conditions was essentially contingent upon a complaint from the public first.

---

[117] Urlich, SC, Submission on National direction for plantation and exotic carbon afforestation, 18 November 2022, at 5.

[118] In addition to the 2018 enforcement proceedings taken by the Gisborne District Council (https://www.gdc.govt.nz/environment/reports-and-publications/breach-of-rma-sentencing-decisions refers), other recent cases include *Bay of Plenty Regional Council v Whitikau Holdings Ltd* [2018] NZDC 3850; *Great Wellington Regional Council v Farman Turkington Forestry Ltd* [2020] NZDC 10368; *Waikato Regional Council v Glen Martin Ltd* [2022] NZDC 17289; and *Marlborough District Council v Laurie Forestry Services Ltd* [2019] NZDC.

[119] https://anz.fsc.org.

[120] https://connect.fsc.org/certification/certification-system. The 2023 FSC Forest Stewardship Standard for New Zealand, (**FSC Standard**) which comes into effect on 15 April 2023, anticipates that a record is kept of any adverse environmental impacts and corrective actions, measures adopted to prevent further damage and negative impacts mitigated and/or repaired, and changes in future activities recorded that will prevent similar impacts occurring. Clauses 6.3.6 – 6.3.8. But it is not immediately clear from the Standard what the implications are for ongoing certification in the event of regular and/or significant non-compliance.

[121] [2019] NZDC 24075.

[122] *Gisborne City Council v Juken New Zealand Ltd* [2019] NZDC 24075 at [26], per J Dwyer.

Penalties disproportionate to harm, allowing externalisation (and socialisation) of downstream costs

6.61 The penalties imposed on forestry companies for breaching the RMA are doing little to drive industry compliance. Those imposed by the Courts to date appear disproportionately small in light of the extensive damage to land, infrastructure, housing, livelihoods, ecosystems, and financial and psychological wellbeing of downstream communities. As such, they "simply constitute a cost of doing business"[123] and thus do not present a legitimate deterrent to poor practice. Examples include:

(a) $57,000 for pollution as a result of slash following an abatement notice;[124]
(b) $51,000 for significant environmental effects as a result of slash and sediment from forestry entering a stream;[125] and
(c) $45,500 for extensive slash and sediment which would later migrate to the Waikato River.[126]

6.62 Sentencing decisions in relation to the Gisborne District Council's June 2018 slash damage prosecutions suggest a preparedness by the courts to impose slightly higher fines and reparation payments, including for emotional harm. To this end, Ernslaw One Limited (foreign-owned) was ordered to pay $355,000, comprising a $255,000 fine and reparation of $130,000 for emotional harm; Juken (foreign-owned) was fined $152,000; DNS Forest Products was ordered to pay a $124,000 fine and reparation of $6,500; PF Olson Ltd was fined $198,000; and Aratu Forests (foreign-owned) was fined $379,500.[127]

6.63 However, although a maximum fine of $600,000 can be imposed on companies for environmental offences, this often pales in comparison to the cost of downstream social, economic and ecological damage, perpetuating the industry's ability to externalise these costs.[128] This may be ameliorated under the proposed Natural and Built Environment Act, the Bill for which proposes to increase the maximum fines for companies to $10 million. It also proposes to prohibit reliance on insurance indemnities as a means to pay infringement or prosecution fines.

[123] *Gisborne City Council v Juken New Zealand Ltd* [2019] NZDC 24075 at [28], per J Dwyer.
[124] *Bay of Plenty Regional Council v Whitikau Holdings Ltd* [2018] NZDC 3850
[125] *Great Wellington Regional Council v Farman Turkington Forestry Ltd* [2020] NZDC 10368
[126] *Waikato Regional Council v Glen Martin Ltd* [2022] NZDC 17289
[127] https://www.gdc.govt.nz/environment/reports-and-publications/breach-of-rma-sentencing-decisions
[128] We note that the FSC's 2023 Forest Certification Standard now requires forest operators to "demonstrate the positive and negative externalities of operations are included in the management plan", including "costs related to preventing, mitigating, or compensating for negative social and environmental impacts of management activities are included in the management plan."

7 ToR 12.3.3 | The right tree: overcoming the ETS's economic bias towards *Pinus radiata*

7.1 The continuing proliferation of exotic afforestation, particularly *Pinus radiata*, makes plain that stronger direction and more nuanced regulatory controls should be provided around what trees should be planted where in order to achieve the right tree in the right place for the right purpose.

7.2 Of Aotearoa New Zealand's 1.74 million hectares (approx.) of plantation forests, 90% comprise *Pinus radiata*. MPI predicts a significant increase in exotic afforestation rates, largely attributable to increasing NZU prices, but also an emerging bioeconomy. With regard to the latter, MPI is already "starting to see shorter rotation exotic plantation forests to provide feedstock for the growing bioeconomy."[129] According to modelled scenarios, close to 1 million hectares could be planted between 2022 – 2050, of which around 70% would be exotic plantation, 20% permanent exotic forest, and 10% indigenous forest.[130]

7.3 Species choice has implications for a wide range of environmental effects and forest outcomes. These include longevity, stand stability, biodiversity, impacts on water yield, long-term carbon sequestration rates and volume, soil stability (including in relation to root decay during the post-harvest window of vulnerability), risk of windthrow, water purification, and resilience to pest, disease, fire and drought, as well as broader landscape, social, reputational, cultural and economic effects.

7.4 Diverse permanent native forests are superior across the board, and increasingly critical to reversing imminent extinction cascades.[131] In addition to helping regulate local climates, enhancing water quality, reducing erosion, sustaining freshwater and marine ecosystems, native forests are fundamental to conserving our unique biodiversity. They provide habitat for a vast range of plant, animal, fungal and microbial species.[132] With 4000 native species at risk of extinction,[133] it is imperative that we address short and long-term carbon sequestration *alongside* protecting and restoring our precious indigenous biodiversity. The climate and biodiversity crises are interdependent and must be addressed accordingly and urgently.[134]

---

[129] MPI Discussion Document 2022/10, at 13.
[130] MPI Discussion Document 2022/10, at 8-14.
[131] Salmond, Dame Anne, "Seeing the wood for the trees", https://www.newsroom.co.nz/ideasroom/dame-anne-salmond-seeing-the-wood-from-the-trees.
[132] Norton, D., "We planted pine in response to Cyclone Bola, with devastating consequences. It is now time to invest in natives." The Herald, 23 February 2023, https://www.stuff.co.nz/environment/climate-news/300814466/we-planted-pine-in-response-to-cyclone-bola-it-is-now-time-to-invest-in-natives.
[133] https://www.stuff.co.nz/environment/300424903/this-is-how-it-ends-natures-dangerous-decline-is-accelerating-why-its-us.
[134] "In a two-way process, climate change is one of the main drivers of biodiversity loss, but destruction of ecosystems undermines nature's ability to regulate greenhouse gas (GHG) emissions and protect against extreme weather, thus accelerating climate change and increasing vulnerability to it. This explains why the two crises must be tackled together with holistic policies that address both issues simultaneously and not in silos." https://ec.europa.eu/research-and-innovation/en/horizon-magazine/climate-change-and-biodiversity-loss-should-be-tackled-together

7.5 Like exotic plantation and carbon forests, native forests are similarly subject to sudden shocks, including storm events and fire risk, as well as slower onset events like drought, disease and pest incursions. But the key difference is in their respective *resilience* to withstand, absorb and recover from these increasing climate-related risks, and their ability to naturally regenerate.[135] The natural ecology and diversity of native forests, in age and species, ensures that climate-related risks are less uniform and severe.

7.6 However, under the ETS, tree species, diversity, and forest management systems are only of subsidiary interest, insofar as such considerations will optimise short-term sequestration rates.[136] Accordingly:[137]

> "[in] Aotearoa, **this tends to recommend pines**, which [are] fast growing in a range of circumstances, highly adaptable, and well understood by forestry operators. These qualities make this species attractive for plantation forestry, but also for carbon farming, because rapid growth corresponds to rapid carbon sequestration and, consequently, rapid accrual of carbon credits."

7.7 The increasing carbon price has further cemented *Pinus radiata's* preferential status. So too has the design of the ETS carbon stocks look-up tables, which measure the relative carbon sequestration stocks accrued by different species and the rate at which they they can achieve these across 50 years. Measurement across this short-term favours *Pinus radiata*.

7.8 In adopting such a short-term approach to carbon accrual, the carbon stock look-up tables fail to recognise, and therefore secure, the much longer-term and larger carbon yields that indigenous forests deliver (let alone their multiple other benefits). Measurements for indigenous species are presented as a homogenous group, with no differentiation for individual species, for planted versus regenerating native forest, nor for regional carbon stock variances. Furthermore, the measurements are based on naturally regenerating shrubland (not, for example, planted and well managed native forest stands).[138]

7.9 Recent research has shown that, with regard to relative growth and carbon sequestration rates, "[t]he difference between pine and well managed planted native forest is much less than is often suggested."[139] But as presently designed, the carbon stock look-up tables do not present an accurate reflection of total carbon stocks to the material disadvantage of

---

[135] Ogden et al 1991 J Vegetation Science https://doi.org/10.2307/3235948, Wyse et al 2019 NZ Journal of Ecology DOI: 10.20417/nzjecol.42.18

[136] EDS NESPF Review, at 9.

[137] EDS NESPF Review, at 10. Pines are relatively cheap and easy to establish, and because they grow rapidly, revenue from harvested timber can be realized quickly too. Clear felling them is permitted, which is less expensive than alternative harvesting methods, and the cost of harm associated with doing so externalised due to minimal penalties for adverse effects. If that were not the case, it is questionable whether the economics of pines would stack up since they produce a lower quality / value timber compared to other timber species. Research investment in Radiata pines has also "contributed to path-dependency, because timber and carbon yields are highly determined and thus perceived as less risky." (Hall, Interwoven World, at 47).

[138] https://pureadvantage.org/carbon-sequestration-by-native-forest-setting-the-record-straight/

[139] https://pureadvantage.org/carbon-sequestration-by-native-forest-setting-the-record-straight/

indigenous species. Nor do they account for supply chain emissions, which could be quite high for New Zealand exotic plantation forests;[140] or the limited additionality rotational clear felled exotic forests achieve: for "replanting pines only restores the carbon lost from harvesting rather than increasing our sequestration."[141]

7.10 Carbon prices, and agreement to reverse the original proposal to restrict the permanent forest category to natives only from 1 January 2023 as a result of industry lobbying,[142] are exacerbating this market distortion, with 'carbon farmers' keen to take advantage of strong carbon prices (while they last). The forecast quantum of planting is well in excess of the Climate Change Commission's net-zero modelling recommendations.[143] The resulting oversupply of ETS units and suppressing effect on carbon prices will stymy the rate of gross emissions reductions in Aotearoa New Zealand,[144] with attendant reputational and market risks.

7.11 Furthermore, referring to the 'permanence' of carbon *Pinus radiata* forests is oxymoronic given their comparatively short natural lifespan (relative to most indigenous species, and indeed many alternative exotic species)[145], increased vulnerability to fire, disease, and pest incursions, the ability to harvest ETS-registered 'permanent' forests down to just 30% canopy cover after 50 years, and regulatory proposals that anticipate end-of-life management issues, when large areas of pines present increasing stand stability, fire, weed, disease and pest risks for future generations. As Emeritus Professor David Norton recently wrote:[146]

> "For too long we have been fixated in Aotearoa with maximizing short-term returns from exotic tree crops without thinking about long-term consequences. The legacies of this fixation are now really starting to show. Poorly sited and managed exotic tree crops pose risks. And now **we are making the same mistakes with exotic carbon tree crops, again leaving unacceptable legacies for future generations to deal with all because of a focus on short-term financial gains**."

---

[140] https://www.newsroom.co.nz/ideasroom/greenwashing-and-the-forestry-industry-in-nz. See also https://www.newsroom.co.nz/ideasroom/nzs-fatally-flawed-climate-change-strategy.

[141] Oram, R., "World has co-crises it must solve in tandem", https://www.newsroom.co.nz/world-has-co-crises-to-solve-in-tandem.

[142] https://www.rnz.co.nz/news/lobbying/486670/lobbyists-in-new-zealand-enjoy-freedoms-unlike-most-other-nations-in-the-developed-world

[143] The Climate Change Commission's net-zero pathway modelling estimated that Aotearoa New Zealand could meet its net-zero goals by planting around 25,000 hectares of exotics per annum (in addition to complementary actions). Current and projected exotic afforestation rates appear to be around double that.

[144] In addition to a range of ETS design (and re-design) flaws: https://www.linkedin.com/pulse/five-things-wrong-nz-ets-christina-hood, https://thekaka.substack.com/p/labours-climate-policy-bonfire-just#details and https://www.newsroom.co.nz/sustainable-future/govt-to-lower-bar-for-subsidies-for-carbon-polluters all refer.

[145] Around 80 to 90 years: https://www.nationalarboretum.act.gov.au/living-collections/forests-and-trees/forest-76.

[146] Norton, D., "We planted pine in response to Cyclone Bola, with devastating consequences. It is now time to invest in natives." The Herald, 23 February 2023, https://www.stuff.co.nz/environment/climate-news/300814466/we-planted-pine-in-response-to-cyclone-bola-it-is-now-time-to-invest-in-natives.

7.12 In combination, these factors make references to 'permanence' and to managing environmental effects "to ensure a carbon forest is sustainable in perpetuity"[147] misleading and disingenuous. It also suggests that the benefits associated with 'permanent' exotic forests, such as carbon sequestration, providing biodiversity habitats, and erosion-control are likely overstated (or certainly more temporary), particularly where harvesting occurs.

7.13 Moreover, the arguments in favour of so-called transition forests (whereby indigenous forests emerge as the exotics reach the end of their lifespans and fall over), are likely specious and unreliable. Ministers should be very wary of attempts to justify ETS revenues under an unproven forest management approach that may not work and carries with it many risks and concerns about how commitments made now can be assured over the long timeframes involved - more than 80 years.

7.14 The ETS's narrow policy and management focus on a single environmental problem to the exclusion of the broader ecological context is giving rise to 'bio-perversities'. Meanwhile, the opportunity to restore much of our lost indigenous forest cover with its multiple benefits will be lost.[148]

8 ToR 12.3.7.2 | The challenge of achieving broader policy coherence

8.1 Forests affect soil health and stability, freshwater ecology and wellbeing, water yields and quality, flood and fire management, climate resilience, carbon sequestration, air quality and biodiversity. They also provide (or detract from) visual amenity, recreational and cultural opportunities, spiritual connection, ETS revenue streams, timber, biofuels, and associated livelihoods.

8.2 As a result, the location, scale, types, and management of forestry activities directly impact whether Aotearoa New Zealand:

(a) Meets national emissions reductions targets, both in the short-term and in perpetuity, and how it does so (the Climate Change Response Act and Emissions Reductions Plan (**ERP**) relate);

[147] MPI Discussion Document 2022/10, at 20.

[148] During the development of the ETS settings for forestry, the Parliamentary Commissioner for the Environment was evidently concerned that, coupled with revenue generated from timber sale, the calibration of economic reward under the ETS for sequestration volumes and rates would incentivize the planting of exotic species at the expense of indigenous. In something of an understatement, concern was noted that this would be "unfortunate" (Parliamentary Commissioner for the Environment, "Rewarding carbon storage in New Zealand native forests" – Feedback to the Minister for Agriculture and Forestry on the Development of Regulations regarding the Indigenous Sequestration Rate under the NZ ETS, Dr Jan Wright, 29 March 2010, at 2) in light of the greater environmental benefits that accrue within an indigenous forest, and the negative environmental effects to which exotic forests can give rise (including wilding spread, and lower climate, disease and pest resilience). (Parliamentary Commissioner for the Environment, "Seeding the carbon storage opportunity in indigenous forests – comments on the draft Climate Change (Forestry Sector) Regulations 2008.) But this is precisely what has transpired.

(b) Is able to adapt to climate related risks (the National Adaptation Plan relates);

(c) Reverses biodiversity decline and leaves a legacy rich with indigenous flora and fauna (Te Mana O Te Taiao and the draft National Policy Statement for Indigenous Biodiversity (**NPS IB**) relate);

(d) Protects highly productive and erodible soils and minimises the risk of landslides in the face of increasingly frequent and severe storm events (National Policy Statement for Highly Productive Land (**NPS HPL**) and New Zealand's Climate Change Risk Assessment relate); and

(e) Avoids significant adverse effects on receiving freshwater and coastal environments (NPS FM, National Environmental Standards for Freshwater, and NZCPS relate).

8.3 Achieving such broad policy and regulatory alignment is challenging in the absence of an overarching national policy strategy for sustainable land use stewardship in Aotearoa New Zealand, within which a pathway to a prosperous forestry future could be defined.

8.4 A degree of forestry-specific guidance is set out in the Government's first ERP, which establishes a 'vision for forestry' that acknowledges the vital role forests will play as Aotearoa New Zealand transitions to a low-emissions economy:[149]

> "By 2050, Aotearoa New Zealand has a sustainable and **diverse** forest estate that provides a renewable resource to support our transition to a low-emissions economy. Forestry will contribute to global efforts to address climate change and emissions reductions **beyond 2050**, while building sustainable communities, **resilient landscapes, and a legacy for future generations to thrive**."

8.5 In support of this vision, the ERP variously articulates support for the right type, mix, scale and location of afforestation to achieve afforestation rates consistent with the bioeconomy aspirations set out in the Forestry and Wood Processing Industry Transformation Plan, whilst also seeking to balance the need for carbon removals in tandem with driving gross emissions reductions. It recognises the significance of, and expresses a desire to encourage more, permanent native forests as long-term carbon sinks;[150] the need to maintain and increase native biodiversity;[151] and that there is an opportunity to grow and manage the forestry sector in ways that secure positive outcomes for climate change, biodiversity and water quality alongside economic aspirations.

8.6 Translating these interrelated aspirations and the ERP's vision for forestry into practical outcomes appears limited to the extent that these goals are either:

(a) Influenced by the ETS settings (i.e., as a function of carbon pricing); or

(b) Regulated directly or indirectly by the NESPF.

[149] Aotearoa New Zealand's First Emissions Reduction Plan (ERP), Chapter 14.
[150] ERP, at 272 – 273, 276.
[151] ERP, at 274.

8.7 It is clear that the NESPF as currently drafted does not function as an effective cross-cutting regulatory tool in this regard. And its ability to do so is further limited by the absence of a biodiversity credit scheme capable of counteracting the ETS's economic bias towards *Pinus radiata* monocrops.

8.8 Without considerable policy and regulatory intervention to achieve broader policy coherence, we are unlikely to achieve many of the objectives set out for biodiversity, freshwater management, coastal protection, long term carbon sequestration, and climate resilience and adaptation.

9 ToR 12.3.7.1 | Systemic change: From short-term profits to long-term prosperity

9.1 In combination, the NESPF and ETS, regulatory misalignment, and indeed the harms wrought upon the communities of the East Coast from Cyclone Gabrielle, are symptomatic of the 'Siloed World' David Hall describes in his paper, '*The Interwoven World*'.[152]

9.2 Hall writes that in the Siloed World, land use choices are driven by economics, with profitability determining the 'best' use of the land, often due to the absence of prices on environmental harm and weak enforcement of environmental compliance.[153] Regulatory, research, investment, and institutional frameworks are oriented toward an approach whereby what is "more often affordable, or practicable, or feasible, is to simplify and standardize the land and to maximise its financial functions."[154] Singular functions on certain sites are thus given priority (ignoring the interrelatedness of natural systems and ecological limits),[155] encouraging intensification (with high inputs and environmental harms) and homogenisation (thereby reducing the capacity of landscapes to adapt to change or shocks).[156] With respect to forestry, Hall cites conventional reliance upon monocultures and clear-cutting as demonstrative of this.[157]

9.3 Whilst the Siloed World might be well-aligned with short-term gains in profit and productivity, these are offset by mid- to long-term environmental harms that, in turn, create economic burdens.[158] It is therefore misaligned with long-term prosperity.

9.4 Hall submits that long-term prosperity can be realised through alignment with five principles:[159]

(a) Climate alignment: which dictates that agriculture, forestry and land use more generally need to support climate mitigation outcomes;

---

[152] Hall, D. (June 2018). The Interwoven World | Te Ao i Whiria: Toward an Integrated Landscape Approach in Aotearoa New Zealand. Discussion paper. Auckland: The Policy Observatory. Retrieved from https://thepolicyobservatory.aut.ac.nz/
[153] Ibid, at 15.
[154] Ibid, at 17.
[155] Ibid, at 21, 30.
[156] Ibid, at 18.
[157] Ibid, at 7.
[158] Ibid, at 6.
[159] Ibid, at 4.

(b) Sustainability: which dictates that land use choices have a responsibility to meet the needs of the present without compromising the ability of future generations to meet their own needs;

(c) Resilience: which dictates that landscapes ought to have the capacity to absorb change and shocks while still providing the same functions.

(d) Mauri ora: which dictates that the wellbeing of people is strongly correlated with the wellbeing of the land, because of the interrelationships between them.

(e) Biodiversity: which dictates that the preservation of diverse, native species of flora and fauna has both instrumental and intrinsic value.

9.5 Forestry in Aotearoa New Zealand is not presently well aligned with these principles. Of particular concern is its reliance on exotic (predominantly *Radiata* pine) monocultures, which are highly vulnerable to catastrophic loss from extreme weather events and increased risks of pests, diseases and parasites due to the absence of heterogeneity and complexity.[160]

9.6 An integrated landscape approach that fosters synergies and complementarities[161] whilst prioritising the mixing, mingling and co-existence of a diverse palette of land uses,[162] is essential to achieve a prosperous forest future in the long term. This is possible in an Interwoven World, where there is diversification in scale (whereby forests are interwoven with other land uses), in systems (beyond clear cutting to retention, selection, and continuous cover); and in species, recognising the need for long-term resilience as well short-term carbon sequestration.[163]

9.7 The Interwoven World should not be construed as economically unviable. However, economic viability in the Interwoven World is informed by a more honest and optimal balancing of economic, environmental, and social outcomes across both the short and long term.

9.8 Overcoming the entrenched extractive, growth-based economy requires transformational systemic change, political courage, and a shift in societal consciousness, tolerances and wants.[164] But it is essential for a truly prosperous future. In pursuit of this, the development of a national sustainable land use and landscape stewardship strategy aligned with Hall's five principles for prosperity would help to transcend the current siloed approach to forestry (and land use generally) in Aotearoa New Zealand, achieve policy synergies and regulatory coherence, and improve environmental outcomes. This should be underpinned by a Leopoldian land ethic that escapes economic expediency, whereby "A thing is right when it

[160] Ibid, at 27.
[161] Ibid, at 11.
[162] Ibid, at 31.
[163] Ibid, at 11.
[164] In 1933, Aldo Leopold framed the behavioural challenge this way: "The ultimate issue, in conservation as in other social problems, is whether the mass-mind *wants to* extend its powers of comprehending the world in which it lives .... I simply affirm that a sufficiently enlightened society, by changing its wants and tolerances, can change the economic factors bearing on the land." Flader & Callicott, Leopold Essays,at 192.

tends to preserve the integrity, stability, and beauty of the biotic community. … it is wrong when it tends otherwise."[165]

10 ToR 12.3.7 | Recommendations for change

10.1 Having set out a range of contributing factors why plantation forestry activities are resulting in significant adverse environmental effects across Aotearoa New Zealand, particularly on highly erodible slopes, we briefly identify some recommendations for change below.

Short term: Strengthen the NESPF

10.2 The current review of the NESPF should be expanded to address the following recommendations:

I. Activity status: From permissive to precautionary

10.3 The activity status for forestry activities under the NESPF should be recalibrated to better align with their high intensity, high risk nature such that resource consents will be required in all cases, and plantation forestry activities prohibited in areas where they are not desirable due to the risk of significant adverse effects.

10.4 Such changes should seek to ensure that plantation forest activities are considered from a lifecycle perspective, from the point of afforestation, through to harvest and replanting. Such an assessment would ensure forest operations and management are appropriately calibrated according to a more holistic risk profile.

II. Revise or replace the ESC to ascribe effective regulatory controls

10.5 Regulatory controls under the NESPF should be underpinned by an accurate hazard risk assessment, including erosion, rainfall and vulnerability to landsliding, at a site-specific scale.

10.6 At minimum, the ESC calculations that inform afforestation, earthworks, harvesting and replanting activities, should be revised so that they are informed by current data and apply a finer resolution to enable better attribution of appropriate regulatory controls according to site-specific risk.

10.7 Once remapped, the regulatory controls applicable to the erosion (or hazard) susceptibility zones should be recalibrated to better reflect relative risk (i.e. based on the current ESC traffic light system, we would expect to see a greater distinction between the regulatory controls applicable to orange zoned areas compared with yellow).

[165] Aldo Leopold, "The Land Ethic" in *A Sand Country Almanac* (New York, Oxford University Press, 1949) 201-206.

III. Introduce regulatory nuance recognising impacts of different forest management and harvesting systems

10.8 A strengthened NESPF should implement regulatory nuance that reflects the risk of adverse effects associated with a range of forest management and harvesting systems, including selective, small coupe and continuous cover systems. The regulations should introduce a moratorium on clear fell harvesting on highly erodible slopes and require:

(a) Progressive retirement of such land from plantation forestry and natural or assisted reversion to permanent indigenous forest; and

(b) Prevent future plantation afforestation on such land.

10.9 In all other cases, a reverse burden should apply for applications to clear fell harvest such that this harvesting system becomes the exception, not the norm. Clear felling would be prohibited unless it can be established that clear felling will not result in significant adverse environmental effects. Spatial and temporal restrictions should apply.

10.10 Government support may be required to facilitate the transition to alternative (less intensive harvesting) systems and methods (including research and resource). As clear fell harvesting is either discouraged or limited elsewhere, Aotearoa New Zealand runs reputational and market risks in not adopting international best practice.

IV. Review efficacy and appropriateness of slash management controls

10.11 The NESPF should not permit the accumulation of slash on erosion-prone slopes. Slash should be processed promptly onsite or removed.

10.12 This would obviate the need for reliance on slash traps, the permission of which (under regulation 83), together with NESPF regulation 69(4), entirely undermine the requirement under regulation 69(3) **not** to deposit slash into water bodies and therefore the avoidance of significant adverse effects associated therewith (which are described in regulations 69(4)(a) – (d)).

V. Strengthen accountability, compliance, and monitoring

10.13 Certified and audited forest management plans should be mandatory and must be subject to independent, expert review to ensure that forest management risks and opportunities are comprehensively identified and translated into credible management objectives and actions, with measurable outcomes. The implementation of forest management plans should be regularly monitored, periodically reviewed and updated, underpinned by a performance bond or guarantee, and enforcement action taken in the event of non-compliance.

10.14 There may be administrative costs for Councils associated with reviewing, monitoring and enforcing forest management plans. Such administrative costs are outweighed by the ecological, social and economic costs of poor forest planning and mismanagement, which are currently falling to Councils, ratepayers, local communities, and ecosystems to pay. In

any event, as for freshwater farm management plans, a number of these functions could be outsourced to independent certifiers and auditors.

10.15 Precedent for a workable, qualitatively robust management planning regime is set out in Part 9A of the RMA with respect to freshwater farm plans.[166] This regime provides a clear line of sight between regulation and management practice. Introducing a comparable regime for forest operators would also address sector equity concerns.

VI. Agency oversight

10.16 As an RMA instrument, agency oversight of the NESPF should be transferred to the Ministry for the Environment.

Short term: Other compliance tools

10.17 The draft Natural and Built Environment Bill is proposing to increase penalties for non-compliance, and prohibit the use of insurance indemnities to pay fines. This may deter non-compliance and drive the internalisation of downstream costs to the community and receiving environments. The draft bill also proposes to introduce power to revoke resource consents.

10.18 In further support of these compliance tools, consideration should also be given to:

(a) The requirement for, and design of, a performance bond or guarantee (such as holding back a proportion of payments for NZUs for ETS-registered);

(b) Investigating the integrity of the FSC-certification auditing and process and grounds for suspension or termination of such certification;

(c) Exploring whether continued FSC-certification in light of regular and/or significant non-compliance would constitute misleading and deceptive conduct under the Fair Trading Act 1989;

(d) The Overseas Investment Office's approach to enforcing the "good character" obligations to which overseas stakeholders in New Zealand forestry (who own 57% of New Zealand's commercial forests),[167] are subject, and the grounds upon which investment consents could be revoked / disposal of the asset ordered. Convictions for repeated and/or egregious regulatory offending causing harm of the scale and severity evident on the East Coast would seem to contravene the "good character" condition.

[166] Our joint submission on MPI's "*National Direction for plantation and exotic carbon afforestation"* refers, see paras 6.17 – 6.24.

[167] https://www.nzherald.co.nz/business/overseas-investment-watchdog-probes-east-coast-forestry-companies/HEMB7RDAUBADNFENJEKDLL7MQM/

Short term: Address the bio-perversities of the ETS by levelling the playing field

10.19 Recognising that the current design of the ETS and price of carbon are not ensuring the right tree in the right place for the right purpose and are instead exacerbating future climate-related risks and biodiversity losses, we recommend the following:

I. ETS amendments

10.20 The ETS carbon stock look-up tables should be revised to:

(a) Account for supply chain emissions associated with plantation forestry when calculating total carbon stocks;

(b) Recognise the carbon sequestration rates of:

i) different native species relative to age and location;

ii) planted and well managed native forest stands, not just regenerating shrubland;

(c) Extend the carbon look-up tables beyond 50 years to recognise the true total carbon stocks of native forests that accrue over a much longer timespan;

(d) Establish a premium class of NZU generated by indigenous forests to incentivise both plantation and permanent indigenous forests.[168]

(e) Reverse the egregious inclusion of exotic species in the permanent forest category.

II. Establish a complementary biodiversity payment scheme[169]

10.21 The ETS is limited in scope to incentivising carbon sequestration in the short-term. A biodiversity payment scheme is necessary to realise broader and longer-term benefits (or 'ecosystem services') that forests, particularly indigenous forests, provide. Proposals[170] and pilots[171] for this already exist. This may involve the establishment of a compliance market[172] and/or regulatory obligations to create demand. It could also support the establishment of a Continuous Cover Forestry Fund (suggested below), whereby a biodiversity payment could secure cashflow during the early phase of forest establishment when revenue from carbon sequestration is lower, but biodiversity improvements the greatest.[173]

[168] As proposed in The Aotearoa Circle's Native Forests: Resetting the balance Report, https://www.theaotearoacircle.nz/reports-resources/biodiversity.

[169] Hall suggests such a scheme could operate as a compliance market like the ETS to essentially create demand for a 'biodiversity unit.' Hall, Interwoven World, at 46.

[170] Including The Aotearoa Circle's Native Forests: Resetting the balance Report, https://www.theaotearoacircle.nz/reports-resources/biodiversity, at p 24.

[171] See for example https://www.agriculture.gov.au/agriculture-land/farm-food-drought/natural-resources/landcare/sustaining-future-australian-farming/carbon-biodiversity-pilot.

[172] Hall, Interwoven World, at 46.

[173] David Hall suggests that a "well-designed biodiversity payment could reward the rate of change in species composition toward indigenous species dominance, which means that the biodiversity payment declines while the carbon revenue increases." Hall, D, "Proposal for a Continuous Cover Forestry (CCF) Fund", prepared for the Minister for Climate Change, 2023.

III. Establish a Continuous Cover Forestry Fund

10.22 Hall and Lindsay have also proposed the establishment of a public-private Continuous Cover Forestry Fund,[174] which would acquire forestry assets for management under continuous cover forestry principles "to catalyse a nationwide shift to alternative forestry systems."[175] Through "a cornerstone investment, the government could mobilise private capital markets to support revenue-generating forestry assets that create regional economic opportunities, while also serving multiple policy objectives in climate adaptation, biodiversity enhancement, protection of freshwater and marine ecosystems, and long-lived carbon storage."[176] This proposal was presented to the Minister for Climate Change for consideration at the Minister's request, a copy of which is appended (**Appendix D**).

IV. Address other barriers

10.23 Continued research and investment to address barriers to native seedling supplies, including increasing propagation and additional funding for nurseries and research on a scale comparable to that which has been conducted for *Pinus radiata*[177] is essential.

10.24 Funding and training should be made available to overcome gaps in technical expertise associated with the establishment and management of indigenous forests.

V. Urgent scaling up of permanent indigenous forest restoration, regeneration and afforestation: Recloaking Papatūānuku

10.25 To secure a permanent, climate adaptive, biodiverse carbon sink in perpetuity, we recommend the Government supports an ambitious native restoration, regeneration and afforestation plan to restore and enhance five million hectares of native forest over the next 10 years. Pure Advantage is currently leading the development of, and rationale for, such a programme. A high-level assessment of how this could be achieved would involve:

(a) New restoration plantings (target 0.5 million ha) on farmland, in urban parks and other non-forest land, and converting exotic pine plantations located in the wrong places into native forests. The focus would be on establishing diverse native plantings with tall forest species (tōtara, rimu, kahikatea, tawa, beech etc) as well as shorter-lived nurse species (mānuka, kanuka, kōhūhū etc);

(b) Natural reversion of marginal farmland to native forest where this process is most likely to be successful (target 1.5 million ha);

(c) Enhancement of existing areas of regenerating forest (target 2 million ha), especially those dominated by seral tree species such as kānuka whose development to a taller

[174] Hall, D. and Lindsay, S (2020) "Scaling Climate Finance: Forest Finance" Mōhio Research: Auckland.
[175] Hall, D. "Proposal for a Continuous Cover Forestry (CCF) Fund", at para 19.
[176] Ibid.
[177] Consistent with Action 7.3 of the Forestry and Wood Processing Industry Transformation Plan: https://www.mpi.govt.nz/dmsdocument/54472-Te-Ara-Whakahou-Ahumahi-Ngahere-Forestry-and-Wood-Processing-Industry-Transformation-Plan.

forest state is currently compromised by livestock and feral ungulate browsing and/or lack of seed sources; and

(d) Enhancement of degraded mature forests (target 1 million ha) that have been impacted by historical logging coupled with heavy livestock and feral ungulate browsing.

Longer term

10.26 The recommendations outlined above will go a considerable way to correcting some of the current policy and regulatory failures and can all be implemented in the short term. But they will not address their root causes. This will require an understanding of, and commitment to, genuine transformational system change.

10.27 Change of this scale will take longer to implement, but is necessary if policy and regulatory failures that prioritise economic viability at the expense of ecological integrity and intergenerational equity are not to be repeated, and long-term prosperity is to be realised. To this end, we recommend the following:

I. Address systemic issues to achieve the Interwoven World: The need for a national sustainable land use and landscape stewardship strategy

10.28 A comprehensive review of land use stewardship in Aotearoa New Zealand should be undertaken and an overarching strategy prepared in light of the *Interwoven World* and other policies to which all land uses (including forestry) should be aligned. An overarching land use and landscape stewardship strategy would help identify areas, or principles that would inform, where permanent biodiverse indigenous forests and plantation forests should be located, their scale and purpose.

II. Achieve policy synergies and regulatory coherence pursuant to sustainable national land use and landscape stewardship strategy

10.29 With the benefit of a national sustainable land use and landscape stewardship strategy in place, a further review of the NESPF and ETS should be undertaken so as to better achieve the policy synergies and regulatory coherence discussed in section 8 above.

11 Concluding note

11.1 The findings and recommendations of this Inquiry present a seminal opportunity to correct a history of short-term siloed approaches to forestry management in Aotearoa New Zealand, and to galvanise the transformative change necessary to achieve truly sustainable land use and landscape stewardship for the long-term prosperity of *all* living things. We hope that the issues and recommendations outlined in this submission will inform that change and would be pleased to engage further with the Panel to this end.

APPENDIX A

Summary of adverse sedimentation effects on rivers, estuaries, the sea and fisheries – Statement of Professor Simon Thrush

I have been asked by EDS to provide a statement on the impacts of land-derived sediment and wood debris on estuarine and coastal ecosystems. I will address the two phenomena separately. I focus specifically on the consequences to marine ecosystems.
New Zealand is a signatory to international agreements and has national policies that seek to enhance or, at least, maintain biodiversity. This must include consideration of marine biodiversity in environmental management and conservation. Biodiversity has intrinsic value, but it is also linked to a range of ecosystem services (e.g., carbon sequestration, habitat provision, nutrient cycling) that underpin climate regulation, food production, productivity, limiting eutrophication. A healthy and functioning ecosystem also underpins the quality of experience many people have when interacting with the environment.

Coastal marine ecosystems are squeezed between the land and the open ocean. They encompass our estuaries, harbours, and the adjacent continental shelf. Ecosystems are the product of interactions between physical, chemical, and biological processes and do not have fixed spatial scales. Ecosystems always have imperfect or fuzzy boundaries – water, organisms, sediment and chemicals can move across these boundaries in or out of a geographically defined ecosystem. This means that we need to be aware of influences across boundaries. These connections between ecosystems are profoundly important in understanding our coasts and in managing the impacts we have on them.

Woody debris "slash"

The direct effect is accumulation of material on the seafloor and beaches. While this decreases amenity values, impacts on the seafloor are not well understood. This material does provide physical structure to the seafloor (much of which has been removed by other human activities) but at high densities this material will reduce access to the seafloor by many organisms and change the near seabed water flow. In estuaries the material will likely move around and repeatedly disturb shallow and intertidal habitats. On the open coasts floating logs are likely to batter shallow and intertidal reef habitats. Material that ends up on beaches will likely influence the suitability of beach and dune habitats as nesting and roosting sites for shore and seabirds. Across all habitats, the smaller fragments of wood, chips and bark add to the organic loading of the sediments, this is refractile material that will either degrade slowly or be buried in the sediment. In areas of low water flow and high rates of debris input hypoxic conditions could occur.

The indirect effects of this material are also potentially significant. As this material flows down the stream network it is likely to elevate bank erosion though direct physical disturbance, this may include eroding sediment but also other materials that have been historically buried or disposed of next to riverbanks. The trapping of this material by bridges

and other engineering structures leads to failure and the addition of further material that can contaminate the estuary and coasts.

Sediment impacts

Sediment is our largest and most significant contaminant to Aotearoa-New Zealand's estuaries and coasts (Thrush et al. 2004). Sediment impacts have been extensively studied here over the last 30 years. There are two types of ecological effects – smothering and decreasing water clarity.

Smothering

Most of the terrestrial sediment entering the estuary or coast occurs during 'events' associated with rainfall. Depending on where material is initially deposited in the marine environment, there is potential for tide and wave driven resuspension to increase the footprint of impact (Norkko et al. 2002). A large proportion of the sediment load is highly charged silt and clay particles which quickly flocculate and settle in seawater, smothering the seafloor. Field-based experiments have shown that once terrestrially derived sediment settles and forms a layer 2 cm thick, the sediment beneath rapidly becomes anoxic killing most of the resident animal community if the terrestrial sediment stays in place for more than about 5 days (Hewitt et al. 2003, Thrush et al. 2003). Even if less sediment settles to the benthos, as little as 2 mm of deposited silt has been shown to alter biodiversity and critical ecosystem services (Lohrer et al. 2004, Lohrer et al. 2006, Vieillard and Thrush 2021).

While seafloor communities may recover from a single deposition event, a succession of deposition events at shorter intervals than the recovery time for the sediment dwelling animals can result in cumulative effects (Thrush et al. 2006, Thrush et al. 2008a, Thrush et al. 2013). Long-term effects are associated with changes in the suspended sediment concentration, seafloor habitats, food quality and the loss of ecologically important species. As the sediment becomes muddier, lower sediment permeability limits oxygen penetration changing biogeochemical, redox, and hydrological conditions (Thrush et al. 2021). This muddying of coastal sediments changes coastal nutrient cycling making the system more prone to other stressors such as eutrophication (Thrush et al. 2008b, O'Meara et al. 2017, Thrush et al. 2020).

Decreased water clarity and elevated suspended sediment concentrations

The map "TeTairāwhiti, Tūranganui-a-Kiwa, and Te Wairoa regions" in the Ministerial Inquiry into Land Use clearly shows the plumes of suspended sediment in the region and around into the Bay of Plenty.

Increased suspended sediment concentrations decreases light reaching the seafloor, reducing primary productivity and oxygen production (Mangan et al. 2020a, Mangan et al. 2020b). This impacts on the large plants such as seagrass and kelp but also the microscopic plants (microphytobenthos) that live on the seafloor – these small plants are a particularly

important components at the base of coastal food webs and influence many critical processes in marine sediments (Hope et al. 2020, Blain et al. 2021). Increased suspended sediment can also clog the filter feeding mechanisms of suspension feeding organisms and reduce their feeding efficiency (Ellis et al. 2002, Hewitt and Pilditch 2004). Many suspension feeding organisms, especially bivalves, are key to maintaining benthic-pelagic coupling by transferring water column nutrients to the benthos via their feeding process (Norkko et al. 2001, Sea et al. 2021). Therefore, a reduction in their feeding efficiency also reduces organic carbon and nutrient delivery into the sediment, further affecting the delivery of ecosystem services from the coastal ecosystem.

The tragic and extreme weather events that hit New Zealand early in 2023 will have long term consequences for many of our coastal ecosystems. This highlights one of the major policy challenges for coastal ecosystems, much of the mess comes from the land but we do not set policy based on impacts in the coastal receiving environment (Thrush et al. 2016, Gladstone-Gallagher et al. 2022).

Professor Simon Thrush, FRSNZ

Blain, C. O., S. C. Hansen, and N. T. Shears. 2021. Coastal darkening substantially limits the contribution of kelp to coastal carbon cycles. Global Change Biology **27**:5547-5563.

Ellis, J., V. Cummings, J. Hewitt, S. Thrush, and A. Norkko. 2002. Determining effects of suspended sediment on condition of a suspension feeding bivalve (*Atrina zelandica*): results of a survey, a laboratory experiment and a field transplant experiment. Journal of Experimental Marine Biology and Ecology **267**:147-174.

Gladstone-Gallagher, R. V., J. M. Tylianakis, J. Yletyinen, V. Dakos, E. J. Douglas, S. Greenhalgh, J. E. Hewitt, D. Hikuroa, S. J. Lade, R. Le Heron, A. Norkko, G. L. W. Perry, C. A. Pilditch, D. Schiel, E. Siwicka, H. Warburton, and S. F. Thrush. 2022. Social–ecological connections across land, water, and sea demand a reprioritization of environmental management. Elementa: Science of the Anthropocene **10**.

Hewitt, J. E., V. J. Cummings, J. I. Ellis, G. A. Funnell, A. Norkko, T. S. Talley, and S. F. Thrush. 2003. The role of waves in the colonisation of terrestrial sediments deposited in the marine environment. Journal of Experimental Marine Biology and Ecology **290**:19-48.

Hewitt, J. E., and C. A. Pilditch. 2004. Short-term feeding responses of *Atrina zealandica* to suspended sediment concentrations: effects of environmental history and physiological state. Journal of Experimental Marine Biology and Ecology **306**:95-112.

Hope, J. A., D. M. Paterson, and S. F. Thrush. 2020. The role of microphytobenthos in soft-sediment ecological networks and their contribution to the delivery of multiple ecosystem services. Journal of Ecology **108**:815-830.

Lohrer, A. M., S. F. Thrush, J. E. Hewitt, K. Berkenbusch, M. Ahrens, and V. J. Cummings. 2004. Terrestrially derived sediment: response of marine macrobenthic communities to thin terrigenous deposits. Marine Ecology-Progress Series **273**:121-138.

Lohrer, A. M., S. F. Thrush, C. J. Lundquist, K. Vopel, J. E. Hewitt, and P. E. Nicholls. 2006. Deposition of terrigenous sediment on subtidal marine macrobenthos: response of two contrasting community types. Marine Ecology-Progress Series **307 115-125**.

Mangan, S., K. R. Bryan, S. F. Thrush, R. V. Gladstone-Gallagher, A. M. Lohrer, and C. A. Pilditch. 2020a. Shady business: The darkening of estuaries constrains benthic ecosystem function. Marine Ecology Progress Series **647**:33-48.

Mangan, S., A. M. Lohrer, S. F. Thrush, and C. A. Pilditch. 2020b. Water column turbidity not sediment nutrient enrichment moderates microphytobenthic primary production. Journal of Marine Science and Engineering **8**.

Norkko, A., J. E. Hewitt, S. F. Thrush, and G. A. Funnell. 2001. Benthic- pelagic coupling and suspension feeding bivalves: linking site-specific sediment flux and biodeposition to benthic community structure. Limnology & Oceanography **46**:2067-2072.

Norkko, A., S. F. Thrush, J. E. Hewitt, V. J. Cummings, J. Norkko, J. I. Ellis, G. A. Funnell, D. Schultz, and I. MacDonald. 2002. Smothering of estuarine sandflats by terrigenous clay: the role of wind-wave disturbance and bioturbation in site-dependent macrofaunal recovery. Marine Ecology Progress Series **234**:23-41.

O'Meara, T. A., J. R. Hillman, and S. F. Thrush. 2017. Rising tides, cumulative impacts and cascading changes to estuarine ecosystem functions. Science Reports **7: 10218 | DOI:10.1038/s41598-017-11058-7**.

Sea, M. A., S. F. Thrush, and J. R. Hillman. 2021. Environmental predictors of sediment denitrification rates within restored green-lipped mussel Perna canaliculus beds. Marine Ecology Progress Series **667**:1-13.

Thrush, S., J. H. Hewitt, C. A. Pilditch, and A. Norkko. 2021. Ecology of Marine Sediments: Form, Function and Change in the Anthropocene. Oxford University Press, Oxford, UK.

Thrush, S. F., J. S. Gray, J. E. Hewitt , and K. I. Ugland. 2006. Predicting the effects of habitat homogenization on marine biodiversity. Ecological Applications **16**:1636-1642.

Thrush, S. F., J. Halliday, J. E. Hewitt, and A. M. Lohrer. 2008a. Cumulative degradation in estuaries: The effects of habitat, loss fragmentation and community homogenization on resilience. . Ecological Applications **18**:12-21.

Thrush, S. F., J. E. Hewitt, V. Cummings, J. I. Ellis, C. Hatton, A. Lohrer, and A. Norkko. 2004. Muddy waters: elevating sediment input to coastal and estuarine habitats. Frontiers in Ecology and the Environment **2**:299-306.

Thrush, S. F., J. E. Hewitt, R. V. Gladstone-Gallagher, C. Savage, C. Lundquist, T. O'Meara, A. Vieillard, J. R. Hillman, S. Mangan, E. J. Douglas, D. E. Clark, A. M. Lohrer, and C. Pilditch. 2020. Cumulative stressors reduce the self-regulating capacity of coastal ecosystems. Ecological Applications **n/a**:e02223.

Thrush, S. F., J. E. Hewitt , C. W. Hickey, and S. Kelly. 2008b. Multiple stressor effects identified from species abundance distributions: Interactions between urban contaminants and species habitat relationships. Journal of Experimental Marine Biology and Ecology [J. Exp. Mar. Biol. Ecol.] **366**:160-168.

Thrush, S. F., J. E. Hewitt , A. Lohrer, and L. D. Chiaroni. 2013. When small changes matter: the role of cross-scale interactions between habitat and ecological connectivity in recovery. Ecological Applications **23**:226-238.

Thrush, S. F., J. E. Hewitt, A. Norkko, V. J. Cummings, and G. A. Funnell. 2003. Catastrophic sedimentation on estuarine sandflats: recovery of macrobenthic communities is influenced by a variety of environmental factors. Ecological Applications **13**:1433-1455.

Thrush, S. F., N. Lewis, R. Le Heron, K. T. Fisher, C. J. Lundquist, and J. Hewitt. 2016. Addressing surprise and uncertain futures in marine science, marine governance, and society. Ecology and Society **21**.

Vieillard, A. M., and S. F. Thrush. 2021. Ecogeochemistry and Denitrification in Non-eutrophic Coastal Sediments. Estuaries and Coasts.

APPENDIX B

EDS NESPF Review

[attached separately]

APPENDIX C

EDS and Pure Advantage Joint Submission on MPI Discussion Document "*National direction for plantation and exotic carbon afforestation*", 11 November 2022

[attached separately]

APPENDIX D

Proposal for a Continuous Cover Forestry (CCF) Fund – by Dr David Hall

[attached separately]