FOREST OWNERS ASSOCIATION

Submission

Ministerial Inquiry into land uses associated with the mobilisation of woody debris (including forestry slash) and sediment in Tairāwhiti/Gisborne District and Wairoa District

Submission to:
The Ministerial Inquiry Panel: Hon Hekia Parata, Dave Brash and Matthew McCloy
Email: landuse.inquiry@mfe.govt.nz

6 April 2023

Trees for our future

Contents

Submitter

1. The New Zealand Forest Owners Association Incorporated (FOA) is the representative membership body for the commercial plantation forest growing industry. FOA members are responsible for the management of approximately 1.2 million hectares of New Zealand's 1.74 m hectares of plantation forests and over 75% of the annual harvest.
2. Forestry export revenue was $6.2 billion in the year ending June 2022 and this is expected to increase to $6.47 in 2023. Harvest volumes reached 36 million cubic metres in the year ended March 2022. While 2022 saw a significant decrease in log export revenue due largely to the impacts of the Covid interventions in NZ and abroad, this is forecast to recover by 2024 and then see an increase (SOPI June 2022).
3. The forestry sector also supports employment (40,835 FTEs), investment, and development across New Zealand throughout its supply chain in both urban and rural New Zealand.
4. The Forest Grower Levy Trust (FGLT) is the body responsible for collecting the harvested wood products levy from forest growers. Forest growers via the FOA and the New Zealand Farm Forestry Association (FFA) manage the allocation of levy funds to industry good projects.
5. Investment by the industry via the harvested wood products levy, in research and technology, means plantation forestry is highly innovative. This is reflected in the commitment of the FOA and its members to the highest standards of sustainable silviculture, environmental practice and workforce safety.

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Introduction

The FOA has supported an independent inquiry since the outset and welcomes the opportunity to provide input to it. The complexity of dealing with an anxious community, historical landuse decisions, exceptionally challenging geology, limited financial resources, fragile infrastructure and increasing extreme climate events requires a comprehensive review to identify a common, viable, vision for the future. As detailed in our submission, numerous forestry practices have changed in Tairawhiti since 2018, nonetheless we expect the review to provide further guidance on forest management and the industry is committed to playing its part.

Risk mitigation associated with land use is a key element for the inquiry but should not be considered in isolation to building community reliance; this means reviewing historical decisions related not just to land use, but also infrastructure.

We remain concerned about what can be "solved" within the relatively short 2-month assessment period, but fully endorse the independence and scope of the inquiry.

The focus of this submission is not on the assessment of damage which we have been advised will be provided to an extensive degree by government officials. Instead, our submission attempts to offer solutions that will contribute to the collective goal of long-term sustainability for our East coast community as summarized in Table 2.

Summary

The dual cyclone events this year have recalibrated what needs to be managed in the future.

The level of rainfall experienced in parts of Tairawhiti in January and February has been unprecedented. Cyclone Hale was described as devastating with an average 1 in 20-year return probability. Severe cyclone Gabrielle delivered over 450mm of rain and in individual locations across the region delivered return times from 70 to 320 years. What then the probability of two events impacting the same land within 4 weeks? This is the future that needs to be built for.

Woody debris is a multi-source challenge.

A lot of woody material has been inaccurately labelled "slash" and attributed to forest harvest operations, particularly by the media. Any recommendations for the future need to be based on an accurate analysis of what has come from where, and why. Current assessments are inconsistent.

Woody debris in rivers, and on beaches, can be reduced, but not eliminated.

The possibility of large piles of woody debris in rivers and on beaches cannot be prevented. Slash from production forestry has to be reduced but even if plantation forestry was absent from the region such an outcome can still happen as history has proven. This reinforces the need for the emphasis to also be on improving resilience and not re-establishing the same vulnerability.

Silt/sediment is a problem too.

Afforestation was undertaken in Tairawhiti chiefly to reduce the damage from excess sedimentation and massive loss of productive land. Farming spokespeople have pointed out the damage from forestry but have not accepted ownership of the silt damage. Outside the direct impact silt also causes the riverbeds to rise rapidly to new levels thus exacerbating future impacts. Like woody debris this cannot be eliminated but must be part of the focus.

The NES-Plantation Forestry remains a fit-for-purpose framework.

The multi-stakeholder standard for plantation forestry ushered in stricter but consistent controls for forestry with support from the industry. It allows for local authority discretion to impose additional controls which the Gisborne District Council have utilized to require site-specific resource consents across Tairawhiti. In Wairoa implementation and compliance with the NES-Plantation Forestry working with Hawkes Bay Regional Council is functioning well.

Any transition to a new future will need support.

The challenges described above are beyond the capacity of the community and the local authority to address. An equivalent to the "Just Transition" support provided to other regions in New Zealand will be needed here as well. The same consideration may also be needed if it is concluded that forestry becomes unviable in significant areas that the government originally planted, or encouraged private landowners to plant, for harvest.

Alternative forest management approaches offer potential.

This submission discusses a range of potential changes that could mitigate the risk from forest operations. All of the options need careful assessment and will typically not be applicable everywhere. They also differ in the time frame over which they can make a difference. Care needs to be taken to ensure that other, greater, problems such and health and safety risks, or greater susceptibility to windthrow, are not created. Some options are rejected with reasoning provided.

Options considered include:
- Improving land assessment tools
- Improving forest management techniques and practice
- Altered harvesting areas
- Retirement and/or establishment of native forestry
- Utilising carbon or other credits to facilitate change
- Planning changes and assistance to the council with regional planning
- Increased recovery of non-merchantable wood
- Increased afforestation
- Enforcement of good practice guides
- Improvements to NES-PF governance
- Increased research and development
- Support for alternate species

Background and Setting

FOA understands that a national secretariat has been established within Ministry for Primary Industries (MPI) to support the inquiry panel collate information relevant to the inquiry. It is our understanding that records of storm damage such as high-resolution aerial imagery, climate data, etc will be provided by the national secretariat to the inquiry panel. Furthermore, FOA acknowledges that additional evidence of storm damage will be provided to the inquiry panel by the Eastland Wood Council, Hawkes Bay Forestry Group and the individual companies with forests in Gisborne and Wairoa. Ground truthing of the storm damage has also been provided to the panel via onsite visits. Given this, the FOA submission will not be focused on providing further evidence of the damage caused by cyclones Hale and Gabrielle. Rather we will rely on others directly affected and the national secretariat to provide detailed evidence.

Additionally, FOA has not provided detailed information on the physical setting i.e. the geology and climate, or the planting or land use history. We refer the inquiry panel to the submission prepared by the New Zealand Institute of Forestry, which provides comprehensive detail on the setting and background for the inquiry.

Our submission is focused on solutions for the mobilsation of silt and woody debris.

Evidence of cyclone impacts

At a high level and of relevance to the discussion of solutions, a short summary of the unique features of storm damage following Cyclones Hale and Gabrielle is provided below:
- The composition of the woody debris includes:
    - mid rotation trees, approximately 10-15years old. This is unusual and did not occur at the same scale during previous storm events.

        - production thinnings;
        - trees previously damaged by windthrow;
        - and forestry slash, often from older pre-2018 harvesting practices that have since been improved.
        - other tree species such as native trees including riparian setbacks, farm shelter belts, poplars and willows planted as erosion control measures.
- Relative to previous storms, roading and landings have *generally* performed well. Post 2018 engineering improvements have typically been effective.
- The climatic settings were unprecedented, two closely spaced extreme storm events occurred following an extremely wet year where soils were already saturated[1].

Woody debris surveys

Surveys of the woody debris accumulated on East Coast beaches have been undertaken by Gisborne District Council (GDC), Hawkes Bay Regional Council (HBRC), some Gisborne forestry companies and Hawkes Bay Forestry Group (HBFG). Two methodologies have been applied: the first was developed in-house by GDC and has been used by both GDC and HBRC; the second was developed by Interpine[2] and has been applied by HBFG and Gisborne forestry companies. FOA has commissioned a statistical expert to review both methodologies which is attached as Appendix 1.

In summary, the statistical review noted that it was difficult to compare the methods of the two reports, as they appear to be trying to estimate different quantities. That said, the LIS methods described in the Interpine report are well-established and have been the subject of scientific per-review since the 1960s. The report notes that there is no indication that randomisation is to be used when selecting the locations for the plots using the GDC methodology. This could lead to bias (even subconsciously) in the choice of locations, and also makes a standard statistical analysis less justified.

Industry contribution to Tairāwhiti and Wairoa districts

When considering the policy and regulatory settings to find solutions for the impact of silt and woody debris in Gisborne and Wairoa districts it is important to understand the economic environment. Forestry in both districts is a significant contributor to the well-being via employment of the people who live here. Consideration of the impact of silt and woody debris on local communities must also consider forestry employees as members of the effected communities.

Forestry and sheep and beef farming dominate the economy of Gisborne and Wairoa districts. There are 219,760 hectares of plantation forestry within the inquiry area, 13 percent of the national total. Some 158,548 hectares are in the East Coast and another 61,212 hectares in Wairoa. Besides the forests of the major forest companies, there are substantial iwi forests, and 43,420 hectares of forests smaller than 500 hectares each, mostly farm woodlots smaller than 50 hectares. There are also more than four thousand direct investors in forests in the region run by management companies. Forestry contributes the largest GDP for the Gisborne region $253M for the year ended March 2019[3].
There are four small timber processing facilities in Gisborne and one sawmill in Wairoa. The nearest pulp mill, cable of taking woody residues is the Pan Pac Forest Products Limited (Pan Pac) mill located north of Napier.

[1] https://www.preventionweb.net/news/role-climate-change-extreme-rainfall-associated-cyclone-gabrielle-over-aotearoa-new-zealands
[2] https://interpine.nz/
[3] MPI Human Capacity in the Primary Industries 2019.

Eastland Port currently handles nearly three million cubic metres of logs a year, making it the country's second busiest port after Tauranga, contributing $439M in export revenue for year ending March 2020. Eastland is expanding its log ship loading facilities to handle an estimated five million cubic metres a year as plantings in the late 1990s mature. One log train per day travels from Wairoa to Napier. Kiwi Rail says a lack of rolling stock is preventing any increase in that traffic. The rail link from Wairoa to Gisborne is unlikely to ever be reinstated.

In 2019 the forestry sector employed approximately 17% of those employed in the primary sector in Gisborne, in total 1,072 FTEs[4]. Unlike other regions where employment rates declined, in Gisborne employment grew at a rate of 1.1% over the 2019-2020 COVID period.

BakerAg in 2019 and PwC in 2020 both pointed to the superiority of forests to generate more capital per hectare than the average New Zealand hill country farm could. Beef + Lamb New Zealand states, putting aside carbon credits, that the ROI for sheep and beef farming and forestry are about the same. Forestry generates both income for the producer and for subsequent processing. For Tairāwhiti there appear to be no other options.

Viability of Forestry

Given that forestry represents such a significant underpinning of the local community's economic future, it is important that discussions around the economic settings of forestry in Gisborne and Wairoa must acknowledge the rapidly increasing operational costs associated with compliance and social license to operate. Prosecution following storm events is a significant, and previously realised, cost to forestry companies in Gisborne. And forestry companies in Wairoa District, supported by FOA, have had to spend significant amounts of money to appeal a proposal by Wairoa District Council to apply an increased rates differential specifically to large forest owners in the district. Individual forestry companies along the East Coast have contributed significant resources to multiple storm clean ups and infrastructure repair alongside sustaining significant damage to their own businesses, storm recovery costs must now be factored into future operational costs. In addition to locally specific cost increases national policy settings, such as the proposal by MPI to recover operational costs of Emissions Trading Scheme (ETS)[5], are adding further pressure to forestry companies on the East Coast.

Whilst the industry acknowledges that environmental improvements are needed and is in favour of collaboration with Government to find solutions, we note that when the potential costs of solutions are coupled with the increasing operational costs in Gisborne and Wairoa the economic viability of forestry in these areas becomes challenging. Ruling forestry out as a viable proposition will not do our community any favours.

[4] MPI Human Capacity in the Primary Industries 2019.
[5] https://www.mpi.govt.nz/consultations/forestry-in-the-ets-second-set-of-proposed-cost-recovery-fees-and-charge

The National Environmental Standards for Plantation Forestry

A number of critics of the National Environmental Standards for Plantation Forestry (NES-PF) have claimed that it is an overly permissive regime and that this has contributed to the failures that occurred in Tolaga Bay in 2018 and the cyclone events on the East Coast in 2023. There is also a narrative developing in the media that the regulation was developed by the industry for the industry. This is completely incorrect. The NES PF was developed over an eight year process, initially by the Ministry for the Environment (MfE) and subsequently due to funding and priority issues at MfE was picked up by the MPI. The regulatory approach was developed by ministry staff with input from a multi-stakeholder working group. By necessity the working group did include forestry representatives, but also representatives from a range of ministries, regional and district councils and ENGO's. The goal of the NES-PF was to develop a consistent approach for regulation of plantation forestry across the country, broadly reflecting the existing regulation in place in regional and district plans of the time. Given the broad array of approaches and level of regulation across the country at the time, inevitably the NES-PF required some changes. Far from being a 'permissive regime' as has presented, the NES-PF reflected the upper end of regulation that existed at the time, with end result being either equivalent to or more stringent than the regional and district plan rules relating to forestry that existed at the time. Significantly, it introduced for the first time the requirement to obtain resource consents for afforestation of the most erodible terrain.

In Gisborne District, forestry has always been more heavily regulated that in other parts of the country, due to the erodible geology and the philosophy of the council. Under the Soil Conservation and Rivers Control Act section 34 notices were required for vegetation removal and earthworks being undertaken on erosion prone land. Following introduction of the Resource Management Act (RMA), these notices were deemed to be discretionary activities in the transition process until Gisborne District Council (GDC) introduced a regional plan, under which vegetation removal and earthworks required resource consents. When the NES-PF came into force in May 2018 this continued to require resource consents for earthworks on orange and red zone land, harvesting on red zoned land, and afforestation and replanting on red zone land. GDC have exercised their ability to be more stringent under regulation 6 of the NES PF, to write additional rules controlling forestry. Under the Tairawhiti Resource Management Plan any clearance of plantation forestry vegetation is at a minimum a controlled activity, and in a number of circumstances including if it involves cable logging over a surface water body it is a restricted discretionary activity. Most of the areas that failed in Gisborne in recent storm events were zoned red zone land and therefore under the NES-PF required resource consents for harvesting, earthworks and replanting anyway, however the additional Tairawhiti Resource Management Plan rules over and above the NES-PF effectively require that all harvesting in the district requires consent. The harvesting of areas that failed in the 2018 event in Tolaga Bay was actually completed before the NES-PF came into force, and most of the areas that have failed in more recent storm events were harvested under resource consents granted under the old GDC Plan rules.

In Wairoa District the situation is different. Under the Hawes Bay Regional Plan harvesting in Hawkes Bay was largely permitted. The NES-PF significantly changed the regulatory approach introducing the requirement for resource consents for all orange and red zone land, and also introduced more comprehensive permitted activity conditions for forestry on yellow zone land.

In summary, all plantation forestry harvesting in Gisborne District has been regulated through site specific resource consents, both before and after the introduction of the NES-PF. The NES-PF increased the regulation of harvesting in Wairoa District, requiring resource consents for harvesting and

earthworks in higher risk areas that previously would have been permitted. Therefore, the perception that the introduction of the NES PF regulations has contributed to the erosion and debris movement on the East Coast is simply incorrect.

The definition of slash

Slash is defined in the NES-PF as "any tree waste left behind after plantation forestry activities". This definition includes everything down to pinecones and needles. It does however not include windthrow trees nor trees that are included in a slip, whether they are native or exotic trees. The exception would be trees in slips that are a caused by non-compliance with NESPF or resource consent conditions.

After the cyclones the media and others have used the term "slash' to cover a wide variety of woody debris. The NESPF only regulates "slash" as defined. If any tree leaves a persons property one could be prosecuted for discharge of a contaminant without a resource consent. In Gisborne forestry companies were prosecuted for such a situation. The owners of other trees that ended up in waterways or on the beaches were not prosecuted.

Improvements made since the 2018 Tolaga Bay storm

Eastland Wood Council and the Hawkes Bay Forestry Group

Following the 2018 Tolaga Bay storm event forestry companies on the East Coast invested significant resources into practical operational changes to improve environmental outcomes. FOA understands that a number of these changes have been presented to the inquiry panel onsite by members of both the Eastland Wood Council (EWC) and Hawkes Bay Forestry Group (HBFG).
The EWC developed a *Good Practise Guideline for Catchment Management* following the 2018 Tolaga Bay storm. We note that learnings and improvements from Cyclones Hale and Gabrielle will be incorporated into the Guideline. FOA endorses the Guideline and further work that EWC propose.

Forest Growers Research

Forest Growers Research (FGR)[6] is part of the FOA and co-ordinates industry input and funding of research programmes relevant to the forest growing sector via the FGLT levy. FGR programmes are often run in partnership with Government agencies, crown research institutes (CRIs) and industry entities. Following the 2018 Tolaga Bay storm event sector workshops were held to explore solutions, those workshops generated a tranche of research from FGR which is ongoing and summarised below.

FGR has been a partner to the Primary Growth Partnership programme over the past four years, this is a programme between industry, research and government titled "Te Mahi Ngahere i te Ao Hurihuri – Forestry Work in the Modern Age". The programme included the following objectives:

- Reduction of environmental risk / impact to waterways.
- Reduce cost of disposal of harvesting residues.
- Reduce waste – increase utilisation of forest area, reduce landing size required for slash management.
- Improve recycling nutrients/ stabilise slopes / minimise erosion.
- Investigate potential for sales of processed residue (in future).

[6] https://fgr.nz/

- Other benefits (Improved work conditions, safety of workers)

The programme has generated a wealth of literature that FGR has published on improved residue management and which is available on the FGR website, some examples follow:

- International reviews of the literature on *"Biomass recovery operations in New Zealand"* [7]Two FGR technical notes and a technical report have detailed the graduate thesis work of Campbell Harvey at the University of Canterbury looking at residue volumes on steepland harvest sites. The work confirmed that there is a sizable resource available in harvested steepland forests.
- FGR have also progressed a project to design and build a hauler slash grapple which reduces breakage and therefore the volume of harvesting debris. JDT Engineering Ltd in Whanganui completed design and build of the hauler slash grapple. It is now ready for operational trials which are being progressed in Lismore Forest in conjunction with Forest360.

Solutions: what is needed to reduce the environmental impact of forestry?

FOA acknowledges the complexity of the physical, social and economic setting in both Gisborne and Wairoa districts. We note that previously significant effort into practical local and regional solutions for the issues associated with the discharge, damage and accumulation of woody debris and silt has been actioned and investigated but that new climate precedents have been set by Cyclones Hale and Gabrielle, with rainfall totals and intensities not previously recorded. The solutions implemented to improvement environmental outcomes following the 2018 Tolaga Bay storm event have been tested, some solutions have worked well but further solutions are needed to address more severe climatic conditions.

This section of the report will provide discussion around a suite of solutions that could contribute to the mitigation of the issues associated with silt and woody debris. Improving community resilience underpins all of the solutions discussed. We emphasize that there is no one perfect solution and that a cascade of solutions working in tandem will be required to make impactful improvements. The first step is refinement of existing land use assessment tools which will then inform application of a range of land use management options such as which tree species to plant.

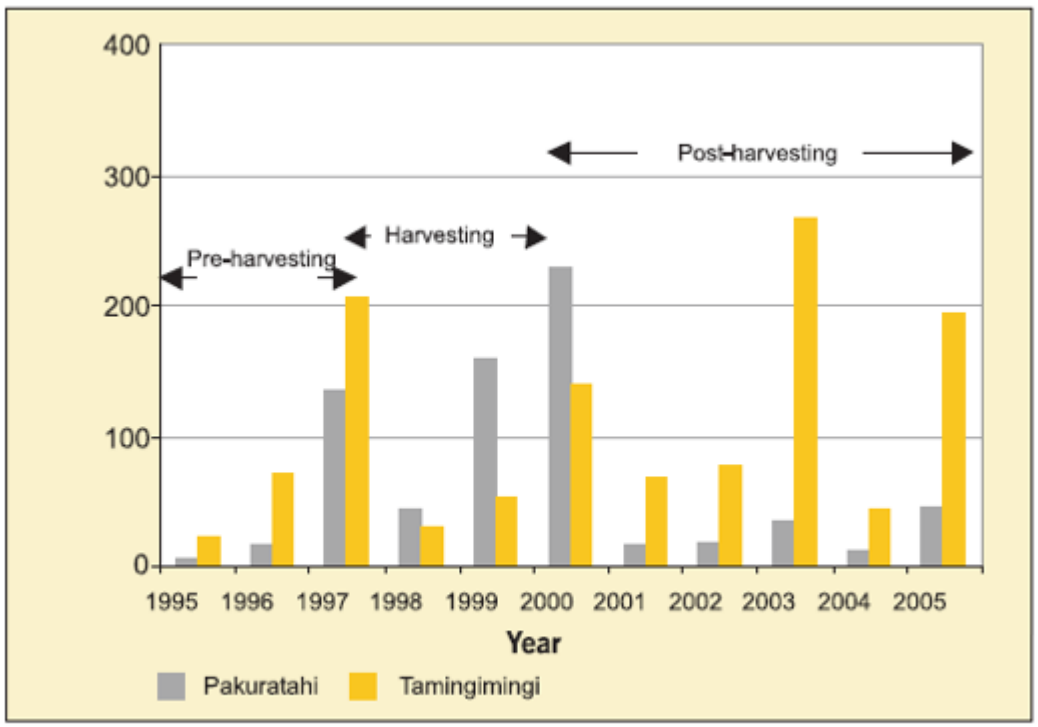
A summary table, Table 2, setting out the proposed solutions in the following time bands is provided at the end of this section.

- 12 months
- 24 months
- 5 years – for sorting economic impacts.
- 10 years – Land use
- Long term vision for region

[7] https://fgr.nz/documents/download/8199

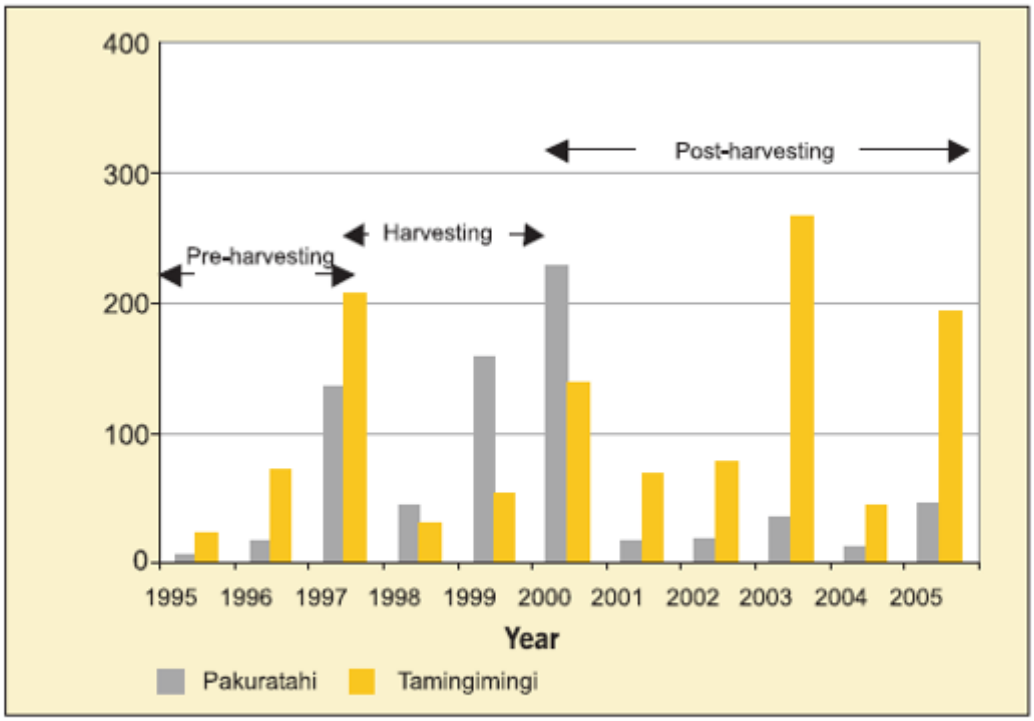
Afforestation

Initiatives to encourage afforestation of steep areas in pastoral use to reduce erosion and sediment loss are key. It is well established that tree cover offers significant soil conservation and water quality benefits over other land use types. The Pakuratahi – Tamingimingi Land Use Study[8] is a paired catchment study undertaken in collaboration with Hawkes Bay Regional Council and commissioned to address the question of whether land in forestry or pasture will generate more sediment. The study collected water quality data over a period of 11 years from adjacent, comparable pasture covered (Tamingimingi) and planted forest (Pakuratahi) catchments. The study period included pre-harvest, harvesting and post-harvest operations and included forestry activities such as roading, logging and replanting. It showed that two-three times more sediment was generated by the pasture catchment during the pre-harvesting period, sediment yields for the first-year post harvesting were then reversed exceeding pasture yields for a two-three year period before returning to pre-harvest levels, this period is referred to as the 'window of risk' (refer to graph below). The Pakuratahi study concluded that over the rotation of a forest (i.e. 28 years) net sediment yield is substantially less from catchments covered in pine forest than pasture covered catchments. The findings of the Pakuratahi study were confirmed by a similar study undertaken in the Waikato/Waipa catchment[9], which showed that sediment loss following harvest was highly episodic and when averaged over a 28-year forest rotation, afforestation provides a 78% reduction in a catchment's sediment yield.



Annual suspended sediment yield for the Pakuratahi and Tamingimingi catchments from 1995 to 2005.

[8] Pakuratahi – Tamingimingi Land Use Study Report, Chapter 5 Forestry Effects on Sediment Yield and Erosion, Barry Fahey and Mike Marden
[9] Draft for Discussion Purposes: Description of mitigation options defined within the economic model for Healthy Rivers Wai Ora Project, Graeme Doole



Suspended sediment yields for storms sampled concurrently at the Pakuratahi (forested) and Tamingimingi (pasture) catchments, and the ratio of the Pakuratahi to the Tamingimingi yields during the post-harvesting period.

Importantly, the Pakuratahi study also demonstrated that significantly less net sediment was lost following storm events from forested catchments (refer to graph below). When compared with pasture catchments, forested catchments offer substantial enhancement to the regulation of storm flow during flood events, typically planted forest can reduce peak flood flows by as much as 50%[10].

The paper titled Water Quality in New Zealand's Planted Forests[11] compares key water quality parameters in various land cover settings throughout the stages of a forest rotation. It was found that that '*forests can rapidly (within 5-6 years) improve water quality from land previously in pasture'* which highlights the potential for afforestation to be used as a *'remedial tool for degraded waterways'.* It is noted that whilst episodic harvesting is likely to result in adverse changes in water quality i.e. greater sediment loads at certain points during a forest rotation however '*planted forests produce high water quality for a large component of the forestry cycle, providing valuable community service to downstream users'.*

In summary, planting trees in some pasture covered hill country will result in net sediment retention, greater resilience to storm events and water quality improvements over the rotation of a forest. By planting pine trees problematic hill country can still be productive whilst offering environmental improvements. To be clear, FOA is not proposing blanket afforestation reminiscent of Cyclone Bola in the most erodible land, we are proposing considered afforestation using the refined land use assessment tools, detailed below, to identify the best land cover to generate environmental improvements on a slope by slope scale while still considering the best productive use of that land. We acknowledge the place for native tree cover and/or permeant tree cover in a mosaiced landscape which

[10] https://www.nzfoa.org.nz/resources/file-libraries-resources/environment/factsheets/846-forest-water-dynamics/file

[11] ty in New Zealand's Planted Forests: A Review, Brenda Baillie and Daniel Neary

will include a mixture of best suited tree species. Alternative and native tree species are discussed in detail below.

We advocate for further funding to support additional study at the Pakuratahi – Tamingimingi study site, harvesting of second rotation trees is due to commence in the next few years. The opportunity to repeat the study using new monitoring technologies could contribute to greater understanding of both silt management and water quality.

We note another study of relevance to advancing our understanding of silt management, OneFortyOne is facilitating a paired catchment study at Donald Creek in Marlborough in partnership with CRIs and funded via the Government. The study compares various sediment management options in similar, adjacent planted forest catchments.

Solutions for woody debris

Establishing an alternative fibre market on the East Coast

The issue of recovering woody residues on the East Coast is exacerbated as most forests here are on steep terrain with limited flat areas to store and dry woody biomass – landings are typically small. Given this a considerable volume of fibre residues may be left on the cutover and also on landings after harvest. The residues on the cutover are widely dispersed and typically require considerable effort to pull back to the landing. In many cases this will not be profitable unless the market value of wood fuel changes dramatically. The wood pulled to the landing, but not currently sold is easier and cheaper to access. Utilising this resource addresses the issue of stockpiled slash heaps but does not address the wood still in the cutover.

Woody debris from harvest operations is greater in areas where there are no or limited fibre markets such as for MDF, particle board or biomass plants. This is currently the case on the East Coast of New Zealand, with only one substantial pulp mill with the capability to take woody debris, the Pan Pac mill located north of Napier. The mill sustained significant damage from cyclone Gabrielle so will remain out of commission for some time. Prior to cyclone Gabrielle the Pan Pac mill was at capacity. Even if expanded, the mill would have limited capability to take substantial additional volumes due to cartage costs. It can only economically utilise waste wood from a limited geographical range around the mill.

The Forestry and Wood Processing Industry Transformation Plan (the ITP) was finalised in November 2022[12], the plan seeks to drive growth, create jobs and underpin New Zealand 's low carbon future by building up the forestry and wood processing sector. The Government has set aside $23M to support the ITP. In the development of the ITP the Ministry for Primary Industries (MPI) commissioned a report, the Indufor Stage 2 study[13] which considered the options for development of the wood processing industry in New Zealand. The study found as a location for investment the East Coast has some of the right fundamental characteristics including a readily available, substantial volume of plantation-based fibre resource. Alternative fibre utilisation options could therefore conceptually reduce the volume of low value fibre currently left in-situ. However, the report identified four major hurdles to this:

[12] https://www.mpi.govt.nz/dmsdocument/54472-Te-Ara-Whakahou-Ahumahi-Ngahere-Forestry-and-Wood-Processing-Industry-Transformation-Plan
[13] https://www.mpi.govt.nz/dmsdocument/51007-NZ-Wood-Fibre-Futures-Project-Stage-Two-Final-Main-Report

1. Regulatory barriers

   Difficultly obtaining resource consent was identified as a significant barrier. Marubeni NZ have twice looked at the feasibility of a processing option on the East Coast however did not proceed given the level of bureaucratic process required. Hikurangi Forest Farms initially spent $1millon on consents and consultants to develop a greenfield processing plant but walked away from the project when the costs to progress the regulatory requirements became too great. It is recommended that Government is actively involved in site selection.

2. Economic barriers

   Development of an East Coast fibre market option must be economically viable supported by sustainable, long-term demand. Government subsidisation as markets are developed could be a viable option, especially through the development of "demonstration" facilities to prove the technology and the economics. It is recognised that in the absence of significant, sustainable biomass consumers locally, such as dairy plants, processors will need to export. Existing sawmillers have identified export tariffs and costs as key barriers to competing successfully offshore. Development of a local fibre market alongside low carbon fuel technology within New Zealand is necessary to support greater use of biomass.

3. Infrastructure constraints

   In most parts of New Zealand, good road and rail connections to processing plants or a nearby port means the cost of exporting is (comparatively) low. Further to the Indufor Stage 2 study FOA notes that for forest owners on the East Coast the cost of freight on the fragile infrastructure either via State Highway 35 or the rail link to Wairoa, and the lack of coastal shipping from Tolaga or Tokomaru Bays makes cartage options expensive.

4. Operational costs for new technology

   Investment in process improvements and knowledge development for biofuel products near to commercialisation that are relevant to the New Zealand market by the Government is key. FGR is exploring options to progress and operationalise existing tranches of work, discussed below. Dr Julian Elder of Scion provides an example, he proposes an on-site solution for surplus woody residues in the form of *a portable, container-sized mini-factory to process forestry waste on-site, turning it into new high-value products. To date the technology, which is available, has not been seen as financially viable, but "when you factor in downstream impacts, if you leave it [slash] behind with logs and large woody items, then it might change the economics of this".* The work Scion is undertaking *is looking at the opportunity to have processing plants in the container and on-site, where they're actually producing chemicals or fuel."* Government funding would be required to get the initiative started. FOA is aware of other technologies and end users that are either trialling alternative fibre uses or have operationalised fibre products in other parts of New Zealand:

   - Container bio- char operations:
     - Massey University BioChar Research Centre[14]
     - Bio-char Network NZ[15]

[14] https://www.massey.ac.nz/about/colleges-schools-and-institutes/college-of-sciences/our-research/research-projects-and-groups/new-zealand-biochar-research-centre/

[15] https://biochar.net.nz/

- LUMBR in Milton, producing fuel-grade wood chips to service the commercial heating market in Otago and Southland.
- Canterbury Woodchip Supplies Ltd. and Steve Murphy Ltd in Canterbury are producing multiple landscape products for the consumer market.
- Mackwell Locomotive Co, Christchurch has developed new wood-fuelled boilers for electricity generation, a business case for 150kW size tractors hauling logs to port versus battery electric and diesel 50Max trucks has been developed.

Options like these should be investigated to test the viability for commercialisation as a sustainable end use in Gisborne and Wairoa for surplus woody residues.

New Zealand dairy companies are responding to market demand and exiting the use of coal for their powder drying operations. Dairying is the nation's major industry and powder drying its main operation. The conversion from coal will create massive demand for alternative energy sources including wood material. Fonterra has committed to end coal use by 2037, has plants at Brightwater and Te Awamutu (pellets) already using wood material and two other plants in the conversion process. Danone is operating the drier at its Balclutha plant with wood waste. In February, Genesis and Fonterra signed a biomass development and usage agreement. Taupo based Natures Flame operates a large-scale wood pellet manufacturing operation, supplying Fonterra Te Awamutu and a range of institutional heating needs in the wider region. It exports pellets to South Korea.

Industries in Gisborne, Wairoa and other towns in Tairawhiti do not need the volume of energy which the dairy industry elsewhere regularly consumes. But in aggregate, institutional and residential heating requirements, land transport fuel usage, forest harvesting and farm machinery fuel needs, forest and meat processing, and the bunker oil consumption of exporting three million tonnes of logs, all amount to a considerable biofuel potential in the region. Other options could include torrefied pellets for the Huntly Power Station or development of a local pellet market at Wairoa for meat processing and/or hospital and school boilers.

Options to develop regional export of woody debris, close to the source of the material to other parts of New Zealand where the demand for biofuel is greater should be explored. Options could include new ports along the East Coast which could also provide greater resilience to the remote communities here.

In summary, to generate a fibre market on the East Coast at the scale required to reduce the volume of woody debris from steepland Gisborne and Wairoa, significant intervention and expenditure by the Government to remove regulatory barriers and infrastructure constraints, to promote the development of a sustainable, economically viable fibre market and to fast-track technology that enables scaled use of biomass is needed.

Solutions for both silt and woody debris

Land assessment tools to upgrade the Erosion Susceptibility Classification

The current risk assessment tool used in the NES-PF is the Erosion Susceptibility Classification (ESC). The ESC is based on Land Use Capability (LUC) units developed under the NZ Land Resources Inventory. As the panel will be aware, the ESC was originally developed by Canterbury University and subsequently refined by erosion specialists from Landcare Research. Through this process each LUC class across New Zealand was assessed based on its erosion susceptibility under plantation forestry

specifically and each LUC unit was assigned to one of four erosion susceptibility classifications – low risk (green zone), moderate risk (yellow zone), high risk (orange zone) and very high risk (red zone).

The purpose of the ESC was to create a drafting gate to underpin the activity status in the NES-PF. The ESC classification was used to assess the relative risk of undertaking each activity in a particular ESC susceptibility classification and therefore the appropriate activity status. Of note a number of Regional Councils previously used the underlying LUC classes for the same purpose in their harvesting and earthworks rules, so it was not a new approach. The NES-PF simply refined it for plantation forestry and applied the approach across New Zealand.

A criticism of the ESC has been that it is not of sufficiently fine scale to accurately represent erosion susceptibility at an operational scale. This was never the intent of the ESC. The original LUC mapping was undertaken at a 1:50,000 scale without the benefit of tools that are readily available today, such as LiDAR, so it is true to that it is not of sufficiently fine scale to be an accurate tool to be used operationally. That said, the LUC does generally provide an accurate description of the geology and risks at a landscape scale, and it was the best information available at a national scale at the time the NES_PF was developed. In the Tairāwhiti region, with the significant focus on erosion issues the LUC (and therefore ESC) is arguably the most accurate of anywhere in New Zealand, with finer scale LUC remapping having been undertaken.

Of the total area of 141,789 hectares of red zoned land under plantation forestry in New Zealand, 104,432 hectares (74%) is located within Gisborne District. Most of the areas that failed in cyclones Hale and Gabrielle in Gisborne were zoned red zone, and therefore all subject to the full regulatory constraints of the NES-PF, with resource consents required for all harvesting, earthworks and replanting. It is therefore hard to conclude that inaccurate ESC mapping (or the NES-PF regulations) contributed to the issues that have been experienced.

It is clear that the scale of the mapping underpinning the ESC means that it is not suitable as a tool for detailed forest management decisions such as siting of infrastructure, or decisions on retirement of areas from production. Such assessments require more detailed analysis informed by accurate slope and landscape information assisted through ground truthing and tools such as LiDAR.

Following completion of the ESC layer, Manaaki Whenua Landcare Research recommended further work to develop an operation-level fit for purpose erosion and debris flow susceptibility analysis tool, at a refined enough scale of mapping that it could be used at an operational level. With the advent of tools such as LiDAR, development of such a tool is now viable. Manaaki Whenua submitted a number of bids for funding from the MBIE Endeavour Fund, with support from FOA, but unfortunately the bids were not successful, and the work has not progressed.

The need for such a tool is now needed more than ever. Operational scale refined information will be essential to inform decision-making regarding the areas of existing plantation forest that should be considered for retirement and other land uses in high-risk areas. The tool would also be invaluable to inform decisions on the appropriate location for both permanent and productive afforestation, ensuring decisions on the ‘right tree in the right place’ are informed by sound science and an objective defensible approach.

Improvements to onsite management techniques and practice

Identifying further improvements to forestry practices in areas that remain in production in the high-risk geology of the East Coast following learnings form the most recent cyclones will be key to continued environmental improvement. Areas of focus may include woody debris management, techniques to trap slash in the landscape via engineered slash traps or living slash traps, planting setbacks and management regimes, harvesting improvements to reduce breakage, catchment limits, silviculture changes, timing of thinning etc. Each of these will require careful consideration in the local context, taking into account expert advice to ensure the solutions won't inadvertently create further problems. FOA defers to the local knowledge of the EWC, HBFG and individual forestry companies operating within Gisborne and/or Wairoa to provide the inquiry panel with the practical, onsite operational improvements that will provide immediate solutions to the storm induced woody debris and silt issues.

We note that the EWC *Good Practice Guideline for Catchment Management* was developed following the 2018 Tolaga Bay storm event, Cyclones Hale and Gabrielle provided new storm precedents that nobody anticipated. FOA understand the EWC will review The *Good Practice Guideline for Catchment Management* in the context of the most recent storms to make improvements, support and resources should be provided to EWC to complete the work.

The use of fire to de-risk slash accumulations on landings should be explored as a viable solution, at least in the short term given there is no viable bioenergy market or pulp mill within 60 to 100 km (the rational maximum economic working-circle). FOA submits that burning non-merchantable woody resides and slash on, and in, birds-nests over the side of, landings is a valid practice to de-risk landings in remote steepland sites.

Non-clearfall vs clearfall harvest

One of the solutions proposed by those outside of the industry is to cease clearfall harvest on the East Coast. The topography of the East Coast is such that the majority of harvest is carried out via cable logging using conventional clearfall harvest. Non-clearfall harvest is practiced in some parts of the world, including either partial strip harvesting or single tree extraction.

It needs to be recognised that on the East Coast the viable harvesting options are significantly constrained by what can safely and practically be achieve in such steep broken topography with high stocking rates. The safe work practices for both falling and extraction are inevitably reliant on an approach of opening up a gap and then falling into that gap and working systematically across a face. Falling in narrow corridors with standing trees either side would be extremely challenging to achieve with a mechanised harvester and unsafe for a manual faller. Similarly, there would be practical difficulties using hauler extraction in corridors. Manual breaking could not be undertaken safely operating in corridors of fallen trees with standing trees either side, so a grapple would be required, which is not viable in some topography. Shifting the backline would also become difficult, requiring a complete reset using a strawline and potentially a drone or helicopter for each line shift rather than simply moving a backline machine, due to the barrier created by the standing trees.

For single tree extraction the only viable option is manual falling and helicopter extraction which would be extremely costly and have a very high carbon footprint per log extracted.

Aside from the practical issues of achieving harvesting in corridors, the more significant issue is the potential additional risks created by such an approach. Forestry companies in many regions of New Zealand have experienced problems with wind throw, which is particularly problematic at the time of

thinning and also harvesting of adjacent stands. Trees develop for the growing conditions they are exposed to, with trees in a stand providing mutual wind protection to each other. It is well understood that removing any trees in a stand will expose the remaining trees and create wind throw risk. For this reason, forest managers implement constraints on the maximum height that stands can be thinned to manage windthrow risk. Harvesting strips in a mature stand would replicate an extreme risk thinning operation, with the tree height well over double the recommended maximum thinning height and creating significantly larger gaps in the canopy. This would inevitably increase the windthrow risk, particularly in erodible geology.

Experience from past storm events has shown that windthrown areas are significantly more vulnerable to erosion than even cutover. As for harvest, windthrow removes the canopy protection, but also the rootballs are ripped from the ground completely removing root reinforcement and creating a conduit for storm water to enter the slip zone between bedrock and overlying soil layer, with the slope loaded with the full weight of the windthrown trees. The effect is effectively an amplified version of the window of risk after harvest. Large areas of windthrow on steep slopes in Tairawhiti has the potential to initiate slope failure and deliver even greater volumes of woody debris to waterways than is currently being experienced. For this reason, corridor harvesting of existing radiata stands is strongly opposed by those in the industry.

In our view it is imperative that any constraints on harvest area must be designed within the limitations of managing windthrow risk.

Native Trees

Native tree restoration of eroded landscapes, or landscapes under threat of erosion, has been frequently cited as a retirement solution to land use problems in the Tairāwhiti and Wairoa districts. While this could well be a valid proposition in many circumstances, it should not be considered as a solution for all situations at all scales.

Native trees are already an important part of the land stabilisation toolkit employed by forest companies in Tairāwhiti, with the planting, restoration or protection of riparian strips of indigenous woody foliage beside waterways. Over time these areas become increasingly effective means of protecting waterways as living slash traps from the intrusion of wood waste from plantation harvests.

Native tree harvest

New Zealand's sustainable indigenous native tree harvest is currently reported at 10,000 tonnes per year, representing less than 0.03% of the total commercial harvest. Native forest consists predominantly of native beech and podocarp species, such as rimu, tōtara, and various beech, but less than 2% of these species are used for timber production.

The main producer of native tree timbers in New Zealand is western Southland based Lindsay and Dixon who have cutting rights over a naturally regenerating 12,188 ha Longwood and Rowallian Forests under an agreement with the Waitutu Holding Company. The forests are primarily Silver beech with some rimu and tōtara. The sustainable harvest of up to 24,727 m^3 per year is provided for under specific legislation, the Waitutu Settlement Act 1997, and operated under an approved MPI sustainable forestry management plan under the Forest Act 1949.

Indigenous forestry has been promoted with FGLT funding of the *Wood our low carbon future* campaign which is a joint venture with Te Uru Rakau. One of the seven themes of this campaign is indigenous forestry, which has focussed on totara prospects in Northland and a black beech operation at Oxford.

The high value of native timber enables low environmental-impact extraction through selective harvesting, and in some instances justify low milling extraction rates and complications. Species such as kauri, kahikatea, rewarewa, rimu, taraire, puriri and beech species require no or minimal preservative treatments, a lesser or non-existent chemical footprint gives further weight to the arguments for native timber harvest.

However, there are significant constraints to native timber harvest, such as the time to harvest, for beech trees it is approximately 80 years, matai and rimu are even slower to mature[16]. Regulatory barriers are significant, approvals for native tree harvest are protracted and time consuming. The Forests Act requires indigenous timber harvesting to be sustainable and on private land.

Native tree propagation

Native plant propagation in New Zealand amounts to some 40million plants a year, including at least 10 million tree seedlings. Advances in nursery technology in recent years could boost this volume quite quickly, particularly for some species.

Minginui Nursery in the Bay of Plenty was formed out of the unique relationship between the forest, Ngāti Whare and Scion – unifying nature, matauranga māori and science. Minginui Nursery is a purely native tree nursery specialising in revegetation, with a capacity for growing more than one million plants a year for riparian planting or returning disused land to native trees. The nursery was developed to regenerate 640 hectares of pine plantation to native tree cover, as part of the settlement between Ngāti Whare and the Crown.

According to the Native Plant Nurseries submission; An indigenous forestry proposal; The Billion Trees Programme Initial Discussion Paper & Proposal To Produce Millions of Native Trees March 2018, seed sourcing is potentially problematic. Debate rages over whether reafforestation should be carried out with seed which are restricted to genetics from the local conservancy. Care has to be taken matching the tree to the environment, rather than a generalised 'plant for natives' approach. Wetlands and gullies will grow quite different mixes of species to establish different ecosystems to those on eroded and steep slopes.

Native tree establishment

The difficulties of establishing indigenous trees across Tairāwhiti to restore the original plant cover should not be underestimated. The costs are inevitably far greater than those for establishing plantation pine forests, at least with most current practices. Based on scale projects in different parts of New Zealand, costs are variable, depending mostly on the challenges of protecting the native plant seedlings over time. Browsing animal pests and invasive weeds threaten the establishment of most native forests well past their original planting time. The issues regarding the establishment of native trees have been examined by various Government reports.

- Climate Change Commission (CCC) explored issues of native tree planting in He Pou a Rangi the Climate Change Commission |Ināia tonu nei: a low emissions future for Aotearoa in May 2021. The Ministry for the Environment also considered native tree planting in Te hau mārohi ki anamata Transitioning to a low-emissions and climate-resilient future, December 2021.
- The Parliamentary Commission for the Environment (PCE) has commissioned a program of work this year to understand the establishment of native trees in New Zealand and transition from exotic forestry to native tree cover.

[16] Wardle's Native Trees of New Zealand, 2011

- In conjunction with Scion and Te Uru Rākau, Ngati Hine Forestry Trust has ambitious indigenous forest expansion plans, He Ringa Ahuwhenua, He Hanga Mahi – Indigenous Forestry Strategy Development Project 2021-2025.

Reported costs range from $6,000 per hectare, up to $50,000 according to MfE's report. Without transitional forestry, Tāmata Hauhā estimates it could cost $20,000 per hectare to establish a native forest and take 40 years to break even with the Emissions Trading Scheme price. Tāmata Hauhā optimistically believes a transitional regime can cut the cost to $2,000 per hectare, which is comparable to pine establishment. The Review of Actual Forest Restoration Costs, 2021, by Forbes Ecology for Te Uru Rākau[17] explained in detail the myriad of factors which led to such variations in the costs of establishing native forests.

In 2011, a Primary Growth Partnership project, the Manuka Research partnership led to the development of the Tīmata method. Tīmata is the use of forestry grade nursery seedlings, kanuka and manuka in particular, on marginal pastoral land especially, to kick start the natural reversion process, which reduces cost and improves propagation and labour efficiency. Canopy closure is achieved at 5-10 years, during which time either natural regeneration of other native species, or planting, can be done.

Native tree establishment must also be balanced in the context of a changing climate, for example predicted and imminent increases in the number of days of soil moisture deficit in the region (as the Southern Oscillation reverts to the more typical El Niño pattern) will have their impact as well. This drying trend will not only kill struggling seedlings, but is even likely to harm mature trees, such as taraire which have recently become vulnerable to fungus infection due to droughts in more northern regions.

Conversely myrtle species, such as pohutukawa/rata, may likewise be infected with myrtle rust should humidity increase, or the atmosphere become more humid. Intensity in future will also jeopardise native tree reestablishment as seedlings will be vulnerable to mid slope loss longer than pines are exposed to.

Little is known about the window of risk for native tree establishment, and is complicated depending on the planting regime selected, for example native trees are typically planted in succession. Kanuka and manuka rapidly form strong rooting systems which are more effective at holding soil together than pasture. A paper looking at the erosion control effectiveness of manuka and kanuka[18] noted that at 1,000 stems/ha manuka canopy closed 7-8 years after establishment. At ten years of age, manuka held soil together 65% better than adjacent pasture and kanuka was 90% better than adjacent pasture at 20 years. It is generally understood that native trees are slower growing, given this and based on the anecdotal observations of foresters it estimated that the window of risk for some species is generally far greater for native trees than it is for radiata pine, in the range of 2-15years.

Besides the struggle for native tree establishment which drier conditions will exacerbate, there are the fire risk complications. Fire resistant species would need to be preferred, such as kawakawa, karaka and tupata. The Timata transition method, relying as it does on highly flammable manuka, kanuka or gorse, may have to be substituted for less efficient or more expensive transitional methods.

[17] https://www.mpi.govt.nz/dmsdocument/50209-Review-of-actual-forest-restoration-costs-Contract-Report-Prepared-for-Te-Uru-Rakau-New-Zealand-Forest-Service-November-2021

[18] https://envirolink.govt.nz/assets/Envirolink/1562-HBRC210-A-review-of-research-on-the-erosion-control-effectiveness-of-naturally-reverting-manuka-and-kanuka.pdf

Below is a short list of just some of the projects that may be of interest to the panel:

- Ngāti Whare, through a joint trust with the Crown were asked to regenerate the land back to its former state as part of the Whirinaki Forest Park.
- Marton based Tāmata Hauhā works with Māori landowners to plant transitional tree regimes on marginal country that is too steep or erosion prone for farming. Exotics such as pine, eucalyptus and cedar eventually give way to native trees.
- Tanes Tree Trust[19]encourages planting native trees to meet objectives from environmental restoration to sustainable production. It uses data from the Tāne's Tree Trust Indigenous Plantation Database to provide foresters, farmers, iwi, environmental NGOs, other community groups and individuals with realistic expectations for their plantings.
- Pan Pac is supporting research to explore transitional forestry and gain a better understanding of how environmental gradients, landscape matrix characteristics and composition effect the transition potential of an exotic plantation forest to native trees. This research addresses the issues of canopy manipulation, passive restoration, pest control, and at-scale cost feasibility.

Native tree carbon sequestration

Native tree forests have been frequently advocated as a preferred means of carbon sequestration. The Productivity Commission in 2018 and then the CCC in 2021 both issued reports which included target or projected targets for native tree planting as part of goals to reduce net greenhouse gas emissions.

As one of three scenarios, the Productivity Commission presented what it called a Policy Driven option area of 0.9 million hectares of native trees to be planted by 2050 (along with 2.3 million hectares of exotic trees) to achieve a carbon zero goal for New Zealand by 2050. The CCC proposed 300,000 hectares of native trees should be planted by 2035 to meet the 2050 goal, along with 380,000 hectares of exotic trees. According to the PCE however, only 1,300 hectares of native trees were planted in 2018.

MfE, in its report, admitted that rather than chase greater native tree area, the main opportunity to improve climate outcomes is through large scale pest management.

The CCC recommended an expansion of native forests for cultural, biodiversity, erosion control and water quality benefits. The Commission called for incentives to plant native forests so they could *'remove sufficient carbon as Aotearoa gets closer to the 2050 target'*.

There is currently insufficient government assistance, for anything like the scale of the two commissions' indigenous planting projections, either in Tairāwhiti or nationally. Apart from manuka for honey income, there is no immediate market incentive either. Moreover, the pressing time imperatives to achieve global greenhouse gas reductions frankly make a reliance on and advocacy for native trees quite irresponsible. It is reasonable to expect a standard hectare of *Pinus radiata* to have sequestered 1,200 tonnes of CO_2 by age 30, and to reach 2,000 tonnes of $C0_2$ by 50 years. In comparison, a typical native forest would be anticipated to have sequestered only 100 or so tonnes at 50 years old, and to have reached just 400 tonnes at 100 years of age.

[19] https://www.tanestrees.org.nz/

Additionality and biodiversity credits

Currently there are significant economic constraints to establishing native trees, a system for incentivising the ecosystem services provided by native trees should be explored. This year the Taskforce on Nature-related Financial Disclosures (TNFD) reporting will be promoted globally, New Zeeland was an early protagonist for Taskforce on Climate-related Financial Disclosure reporting, it is anticipated that the Government will be exploring the options to develop a biodiversity credit system here. The Forico Natural Capital Report[20] is a clever example from Tasmania which demonstrates how this can be achieved in a mosaiced forestry landscape.

FOA is aware of a collaborative programme of research *Maximising Forest Carbon* between MfE, Te Uru Rakau and the Department of Conservation to understand landscape level carbon storage. The research programme will inform work to quantify biodiversity attributes and also provide the data required to capture additionality in pre-1990 forests. Additionality is an expansion of the ETS that would attribute ETS credits to pre 1990 forests, both native and exotic, when enhancements to carbon sequestration are made. Enhancements might include management interventions such as browsing pest control, fencing, the addition of fertiliser or other actions which promote forest growth. Additionality would capture the conservation estate, this could not only incentivise proactive land management but also native tree planting.

Summary of the issues for planting native trees

The issue around establishing natives and generating economic value from a native cover landscape is a complicated one. Establishment of native trees relative to radiata pine is expensive, labour intensive and more likely to fail. Few options currently exist for extracting revenue from land transitioned to native tree cover. Whilst in principle, harvesting of native timber can be undertaken with minimal environmental impact and generate a premium price the timeframes to harvest and the regulatory barriers are significant.

Even when native trees are established they cannot protect the landscape completely from failure. Mid-slope failures and stream bank erosion will remove all forms of tree cover to a greater or lesser extent. The weight of larger trees, whether radiata pine or native on the most erodible land is likely to induce failure. Smaller tree species such as manuka, kanuka could be a viable alternative however their life span of approximately 30 years brings other risks. Tōtara, like pines, is shallow rooted and eventually becomes vulnerable to not only slope failure but to windthrow as well. Work is needed to understand the window of risk, i.e. the timeframe over which tree roots offer reduced soil retention value, associated with native tree establishment. Before scaled planting of native trees in the most erodible Gisborne and Wairoa landscape the model for native tree establishment needs to be tested.

The workforce and subsequent community consequences of large-scale native tree planting must be considered. If large tracts of the land in Gisborne and Wairoa are successfully established in native trees then the impact on the workers here will be significant and potentially devastating. There would certainly be some ongoing work in controlling browsing pests and initial work controlling weeds which could replace some of the jobs loses but it is difficult to anticipate this providing enough work for.

Blanket native tree afforestation reminiscent of the large-scale post Cyclone Bola radiate pine planting could repeat similar mistakes, considered planting using a refined land assessment tool to create a mosaiced, nuanced landscape is preferable.

[20] https://forico.com.au/volumes/images/Natural-Capital-Report-2021.pdf

Alternative exotic tree species

There is a strong view being promoted that the industry should be planting species other than *Pinus radiata* to add diversity in the forest, reduce the single species risk and diversify markets away from principally 3 markets – the NZ framing market, pulp and reconstituted panels i.e. MDF and the China log market. It is argued if an undesirable biosecurity incursion occurs or any of the market sectors fail or change then the industry has a problem. Because of its light demanding characteristic radiata pine does not lend itself well to uneven aged stand and continuous cover management. These are all worthy considerations and the government and industry over a long period of time have supported research into other species in an attempt to diversify the forest resource.

Earlier forest plantings by the state included a wide range of exotic species but their performance was inferior to radiata pine across virtually all sites and they were replaced by the more productive radiata pine. Earlier stock maps of Kaingaroa Forest show radiata as a minority species but over time virtually all of these plantings have been replaced with the more productive and more commercially attractive radiata pine.

The former New Zealand Forest Service adopted a policy of having 10% of its annual planting programme in species other than radiata pine and Douglas fir in the 1980's to address the issues noted above. Drawing on available research from 30 years or more and practical experience from earlier plantings and despite best efforts across the country this was not successful. On the corporatisation of the state forest assets in 1987 this programme was quickly discontinued and many of the earlier plantings of other species, much of it dating back to the 1930's and 40's were liquidated in favour of radiata pine to improve the commercial performance of the forest estate. Liquidation of these plantings has continued since privatisation and much of the gene pool and information from these earlier plantings has been lost.

The Forest Service, via the Forest Research Institute, undertook a broad programme of research into other species, both hardwood and softwoods, but the impact of user pays and reduced government funding for more applied forest growing research meant a significant reduction and narrowing of the programme. Over the past 15 years the research programme has been progressively reduced down to focus on Californian coastal redwoods, three or four cypress species, *Eucalyptus nitens* and *fastigata*, Douglas fir and a range of durable eucalypt species under the Drylands Forest Initiative. Over the past seven-eight years there has been a greater focus on wood products from the species of interest rather than on the growing aspects.

Of these species only redwoods, *E nitens* and *E fastigata* have been successfully grown at commercial scale. The latter have only been grown and processed for pulpwood and chip. Control of paropsis and other chewing insects remains a challenge with *E nitens*. redwoods, other than very limited quantities, have not been processed commercially and markets for the whole tree, other than as export logs, are so far very limited. A range of other species are grown by smaller growers, the resource is small and scattered and processing is cottage industry, there is no market coordination or cooperation.

Barriers to scaling up plantings of other species, other than those that have been planted at more commercial scale are availability of seed, scaling up tissue culture production (for example redwood tissue culture takes 4-5years and needs to be planned a long way in advance of planting), nursery and establishment expertise, development of seed orchards and management of biosecurity issues. Costs of establishing other species are higher and with a lack of decision support tools and market return information it is currently difficult to demonstrate the commercial benefits of growing other species to forest investors. Being confident there are markets for the whole tree at time of harvest is important for investors if they are to maximise financial returns.

Poplar and willow have been successfully planted in forested and pastoral hill country margins as an effective erosion control or stream bank stabilisation measure. The poplar cultivar Kawa has been studied in Northland for it's agroforestry potential[21]. Research into breeding improvements, biosecurity risks i.e. disease and pest insects, and climate adaption has been undertaken. Further evaluation of these species should be considered when in exploring land use solutions for Gisborne and Wairoa.

In summary, forest investors, other than the small-scale operators, currently lack the knowledge and confidence to plant other species at scale due to the higher costs, market uncertainties and history of failures with other species. Finding other species that can be planted at the scale required is not easy and is a much riskier proposition for forest investors.

Obstacles can be overcome with time, with a well-resourced and long-term research programme including genetic selections, field trials, breeding programmes and establishment and silvicultural trials, processing studies and market analysis along with associated data collection to build and improve the range of predictive tools available to investors and forest managers. Support and extension will be required to build this confidence.

Good practice guides

When the NES-PF was developed MPI provided guidance on the implementation, part of this work was the development of supplementary industry good practice guides. In 2019 after discussions between FOA and MPI it was decided that FOA would be the appropriate body to produce and host forest practice guides to provide guidance on how operators could meet the regulations. The guides are not part of the NES-PF but can be enforced as set out below.

The NES-PF provisions for harvesting and earthworks require harvest plans and forestry earthworks management plans. Schedule 3 of the NES-PF sets out the requirements of such plans. Under sections 4 and 5 the plans must set out the management practices that will be used to avoid remedy or mitigate the identified risks of the activities along with the water control measures, sediment control measures and slash management measures.

The process is that an operator chooses the measures that it will implement to meet its regulatory obligations. Once an operator chooses a measure and sets it out in the management plan any non-compliance with that measure is non-compliance with the NES-PF.

FOA has 28 guides version 2 at February 2020[22] and a NZ Forest Road Engineering Manual 2020[23]. The guides are exactly that, guides. They provide a toolbox with options for an operator. The guides are not statutory conditions/standards but when chosen by an operator and set out in an NES-PF required harvest and or management plans they become conditions to be complied with. In the Hawkes Bay region, i.e. of relevance to Wairoa, FOA considers that this policy setting has provided a major step up in regulatory controls and is a policy setting that is working well.

The forest practice guides (FPGs) are reviewed and updated annually. Nationally uptake of the FPGs has been mixed, some view the guides as industry centric. FOA is currently exploring options to expand the guides to incorporate and update the old Environmental Code of Practice[24] (ECOP). Discussions

[21] https://www.poplarandwillow.org.nz/documents/wood-production-of-kawa-poplar-rb14.pdf
[22] https://docs.nzfoa.org.nz/site/assets/files/1517/amalgamated_guides-2-0.pdf
[23] https://docs.nzfoa.org.nz/live/nz-forest-road-engineering-manual/
[24] https://www.nzfoa.org.nz/resources/file-libraries-resources/codes-of-practice

have been held with Te Uru Rakau to explore options for making the updated FPGs/ECOP a co-branded document, to promote greater uptake and acceptance of the document as being an independently robust, nationally consistent industry tool.

In Gisborne the EWC have developed their own good practice guidance, the *Good Practice Guideline for Catchment Management*, specific to the unique physical setting here, which FOA endorses. EWC found that the FOA FPGs did not provide the level of detail to manage the site specific requirements in the most erodible steepland.

FOA is aware of work commissioned by Te Uru Rakau to develop a slash management guidance document, we understand that the consultant engaged prepared a draft document in 2021-2022 but the work has not been finalised. Priority should be given to progress this work and have it reviewed by a group of subject matter experts. Practical and realistic standard should be developed with regard to the mobilisation of slash, with slash defined as it is in the NES-PF. The standard should clearly identify the flood event level a forestry owner should be responsible to ensure slash does not leave a site.

With regards to solutions for silt and woody debris, provision of funding and resources by the government to prioritise the work updating, reviewing and expanding the FPGs is recommended. Collaboration with industry to further develop the draft slash management guidance commissioned by Te Uru Rakau in the context of the new climate settings is also recommended. Any proposed updates to good practice guidance should consider the body of work already undertaken such as the EWC catchment management guide.

Research and development

There is a significant amount of existing information that can be applied to the ongoing silt and woody debris problems in Tairāwhiti and Wairoa. This comes from a significant body of research undertaken over the last 50 years in New Zealand by industry, CRI's, government and universities. It is important to look at what has been undertaken and learned, assess where the gaps are and then direct future effort as appropriate.

In response to the ministerial inquiry and to the extreme weather events, FGR have identified key areas for research, for fast tracking or for commercialisation of existing work, as follows:

Table 1: Research and Development

	1 Year	2 Years	5 Years	10 Years	Ongoing
1. Understanding and stabilising problem and at-risk areas					
Review of existing catchment management tools, gaps analysis, in the context of a changing climate.					
Current high risk sites – how to stabilise harvest or erosion debris in vulnerable areas (options for removing, stabilising, trapping).					
Soil and slope stabilisation – sustainable re-vegetation solutions.					
Retirement and transitioning to native forest – demonstration and guidelines, mosaic landscape approach, co-ordination and review of existing tranches of work.					
Development of a long-term environmental management tranche within FGR. For example, long term programmes similar to existing FGR partnerships, possible collaboration with SFFF funding.					
2. Improving forest management - silviculture					
Pinus. radiata forestry system design and regimes for lower impact					
Diversified species and forestry systems for steep and vulnerable land (including continuous cover forestry and mixed species)					
3. Improving forest management – harvesting					
Improving harvest planning and management, there is a lot of work and knowledge on this already but, there are issues around implementation and commercialisation.					
Development of low impact mechanised harvesting technology with less stem breakage on steep slopes. This is an area that needs more research – to build on the previous steepland harvesting research programme and the current automation and robotics research Programme.					

Maximising wood utilisation at harvest – including integrated harvesting / energy systems. Obvious need for development of better processing and markets within New Zealand.					
'Walking Excavator' for cleaning slash out of waterways in steep terrain forests. Investigation of potential of a highly flexible wheeled machine with stabiliser legs (Menzi-Muck or Kaiser Spyder) to clean out waterways. FGR is exploring options for an operational trial with Schwitzer Contracting Ltd.					
4. Improved log market options, and commercialisation of biofuels					
Exploration of new end uses for example cutting to shorter minimum lengths for pulp/binwood grades, producing wood suitable for road batters or as temporary road or landing aggregate.					
Investigation of biofuel options and promotion/commercialisation of existing pilot programs for example, Mackwell Locomotive Co, Christchurch, wood-fuelled boilers for electricity generation, have agreed that to collaborate with FGR to develop a demonstration project.					

Governance

At a national scale governance of the NES-PF is confused, as a regulation made under the RMA, MfE is the government agency responsible and hosts the NES-PF on its website. Te Uru Rakau are the administrators of the NES-PF and lead engagement and collaboration with the forestry industry. If there is more than one ministry then there must be transparency as to the lines of governance.

Consultation and implementation of the NES-PF

FOA submits that the implementation of the NES-PF has been under resourced. The *One Year Review* of the NES-PF (commenced May 2018) was not completed until April 2021[25]. Of significance the review identified that practical implementation of the NES-PF by councils was a significant issue, including skill levels amongst council staff and differing interpretations of NES-PF regulations. 17 months later in October 2022 the government produced a consultation document *"National direction for plantation and exotic carbon afforestation"*. FOA made a submission on the document that can be provided upon request. In section 6.3.2 of the consultation document there were proposals to manage slash, below is the FOA submission on the matter:

D1e	*Amendments to regulation 66 and 69 to clarify that slash on the cutover must be managed to ensure it is not mobilized in heavy rainfall (5% AEP or greater) and to avoid slope instability.*	*While FOA understands the intent of the change and all care should be taken to avoid slash mobilizing in storm events, the reality is that the proposal as worded could not practically be met by any landowner in erodible geology. As evidenced in numerous extreme rain events, heavy rainfall in erodible geology will cause erosion and movement of the material that is sitting on the eroded land. This cannot be controlled on farms, the state highway network, within urban areas, and even fully protected native vegetation in the Department of Conservation Estate. Regulating that forest owners alone must be able to prevent erosion and avoid debris movement in all weather events is unachievable and unreasonable.* *The proposal is also completely at odds with proposed regulation to exclude forestry afforestation from lower LUC land, potentially placing forest owners in the position that they can only afforest erosion prone land but then must prevent erosion. The only way erosion can practically be avoided in all weather events is to restrict forestry to land with minimal erosion risk (Class 5 and below).* *FOA requests that MPI seek advice from erosion specialists at Landcare Research and work with the Forest Industry to ensure that any wording changes to these regulations reflects the practical reality of operating in erosion prone landscapes.*

[25] https://www.mpi.govt.nz/dmsdocument/44914-Report-on-the-Year-One-Review-of-the-National-Environmental-Standards-for-Plantation-Forestry

The obligation for mobilisation of any vegetation or woody debris other than "slash" should be regulated equitably.

Land Retirement – Just Transition

Tairawhiti contains some of the most erodible land in the world. One of the difficult matters that will inevitably require consideration in this process is whether some of the land currently in plantation forestry is in fact suitable to remain in productive use. One of the solutions available is retirement of the most erosion prone areas where the geology is such that it cannot sustain any form of harvest without unacceptable risk. Forest owners can absorb the costs of small-scale retirements at the margin, such as for increased planting setbacks and retirement of isolated high risk faces, and indeed this is already occurring. But if the outcome is that large scale areas of forests require retirement, then this brings into issue the need for a just transition for affected forest owners, and their contractors and workers who are dependent on the forests for employment.

The majority of forests in Tairawhiti were either established by the NZ Forest Service on Government purchased farmland, or were encouraged on private land through Government funded afforestation schemes, as a solution to the severe erosion caused by clearance of the land for pastoral farming. Forests that were established as protection forests by the NZ Forest Service were on sold by the Government to private interests as production forests, and more recently to Ngati Porou in resolution for treaty claims. If the ultimate decision is reached that substantial areas of these forests now have to be retired from production due to unacceptable risks of downstream damage at harvest time, given the Government's role in establishing the forests it is unjust and untenable for the full cost of this to be borne by the current owners and their workforce.

A system of transition will be a crucial component of any fair transition, potentially including Government buy out of the most erosion prone areas, as was carried out for farmers in the past. Government investment will also be essential to identify and develop alternative employment opportunities and economic support for the workforce to enable a just transition over time.

If large scale retirements are contemplated, consideration also needs to be given to the ongoing management of areas currently planted in radiata pine. The damage that has occurred in standing trees in Cyclones Hale and Gabrielle has shown that simply ceasing harvest and locking gates will not completely remove the risk of ongoing erosion and debris movement. Slopes will still fail and as the tree crop ages windthrow risk will increase. If a transition from production forest to native forest cover is considered the best long-term alternative in some areas, government assistance will inevitably be required to fund the physical transition process.

It must also be recognised that even if full retirement to native forest is achieved, in extreme weather events floods will still occur, and the geology in this area is such that even under full native cover some landscape failures will continue to occur. If failures occur in forested landscapes then inevitably woody debris will be entrained and delivered downstream. The only change will be the species present in the beach debris. Therefore, regardless of the outcome, any package to improve the resilience of the Tairawhiti community in extreme events must inevitably include consideration of retreating housing and infrastructure from the highest risk locations and the appropriate design of infrastructure. Even a wholesale retirement of the East Coast, which is economically unfeasible, will only reduce but not eliminate the risk of erosion and debris movement.

Additionality for pre 1990 forests and a biodiversity credit system, discussed above, could contribute to the feasibility of retiring land.

As noted in the previous section, it is also essential that any decisions to retire land is based on the best available information to ensure the highest risk areas are identified through a robust defensible process, improvements to existing erosion susceptibility classification tools are discussed above.

Regulation, regionally specific changes

Working group collaboration

Establishment of a working group made up of representatives from industry, specifically the EWC, and GDC to work collaboratively rather than defensively towards practical meaningful environmental improvements would be beneficial. Local forestry companies have advised FOA that the relationship with GDC is at times difficult and can a barrier to effective environmental management. Fortnightly meetings at least initially could be set up immediately to establish the terms of reference for the group, share knowledge, discuss planning settings and projects with common objectives could be progressed. We direct the panel towards the collaborative working relationship that HBRC and the HBFG have built up to foster good practice and ensure that compliance with NES-PF is realised. Similar successful working groups have been established between Northland Regional Council and local forestry representatives.

In addition to a working group a technical advisory group (TAG) could be set up to further support GDC. A TAG could include scientific experts to provide links to the most recent research, planning experts, and industry representatives.

Further training for staff and additional staff resources should be considered to empower the GDC to implement environmental solutions identified by the inquiry process.

Catchment clearance limits

Catchment clearance limits have been applied in some high-risk situations. These are applied in recognition of the window of risk that occurs after harvest and also the inevitable increase in sediment loss.

The situation in Tairawhiti is somewhat complicated by the large-scale planting of eroding farmland over a relatively short period of time by multiple parties, meaning that multiple forest owners' forests in one large catchment can reach harvest age at the same time leading to considerable harvest activity occurring simultaneously. Inevitably the harvest is most concentrated in the first rotation of harvest as roads are being built and the trees are all of a similar age.

Some larger companies use catchment limits as a part of their internal response to managing risk, and in limited cases they have been included as a condition on resource consents. To apply limits in a situation with multiple landowners in one catchment would require either the forest owners to voluntarily cooperate to come up with a system to stagger harvest, or for the council to develop a system that is fair to all and then regulate that via resource consents.

It needs to be recognised that catchment limits do nothing to eliminate the risk of erosion and debris movement. They simply limit the area of the catchment that is at its most vulnerable at any one time and thereby the scale of the damage should a cyclone occur at any point in time. Even with a perfectly spread cut in a catchment, and a 5-year window of risk for radiata pine operating on a 28 year rotation length would mean that an estimated 1/6 of the productive area is vulnerable at any one time, so it is by no means a silver bullet.

Catchment Management Groups

Protection of vulnerable downstream receptors from the mobilisation of silt and woody debris cannot stop at a forest boundary. Collaboration between all of the landowners within each catchment will be required to generate the best environmental outcomes. The best entity to drive the establishment of catchment groups where they don't already exist or to enhance the work of existing catchment groups will be GDC. GDC should be adequately resourced and provided with the appropriate training to do so. Landowners and catchment groups will understand best how to manage their properties, GDC should be empowered to support them to do so.

Recovery of non-merchantable wood, health and safety implications

GDC have signalled intent to further regulate the amount of non-merchantable wood left on erosion prone slopes after harvest, and perhaps use the RMA Enforcement Order mechanism (S3124 to 321)[26] to require this. This imperative gives rise to a clear tension between Health and Safety and Environment (under the H&S at Work Act and the RMA) so, to improve worker safety, larger forest owners in Gisborne have directed contractors to use grapples suspended from cables to extract felled trees from steep slopes rather than have workers on those slopes fixing cables (known as chokers) onto trees to facilitate extraction in cable harvesting (in a process termed "breaking out"). Many contractors with grapples struggle to haul difficult to reach logs compared to what was possible with traditional manual breaking out process. The net result is that imperative to improve worker safety has created a sub-optimal environmental outcome (more stems, both non merchantable and merchantable, left on slopes).

Resilience of infrastructure

According to GDC there are 474 bridges in the district, the cyclones destroyed nine of them and 14 were left with major structural issues. The choke points, in a literal sense, were the bridges. Woody material from a range of sources, carried by the massive flood volumes, was seen banking up against bridge piers. How many of the damaged bridges would have succumbed were there less or no woody material is a matter for further investigation. Wood alone cannot be totally responsible.

One of the solutions to the pressure on bridges must be a suit of engineering designs. Longer spans on bridges, or no immersed piles at all, would both reduce the risk of debris accumulating against a bridge and as well provide less impedance to water flow. In some instances where the upstream terrain makes it feasible, settling wetlands and living slash traps could be created, allowing wood debris to demobilise and be cleared at a later date.

Such bridges would be more expensive to build, but less than the expense of frequent repairs or replacement, and without the disruption of waiting for bridges to be repaired. Improved bridges do not reduce the incidence of residue in the watercourses, nor do they prevent the accumulation of wood on beaches. But more resilient bridges would be a backup to upstream woody debris reduction efforts. Bridges without piles would also be appropriate to respect the mauri of the river. Where piles remain, or are necessary, a consideration of in-floodwater engineering diversion structures may lead to effective and inexpensive protection of bridges in the region and people who rely on them.

Environmental regulations limit the area around river and stream beds that forestry companies can access for both storm recovery/clean up works and preparations ahead of storms. The regulatory barriers that prevent forestry companies and others from accessing river and stream beds to take

[26] https://www.qualityplanning.org.nz/node/1099

actions to minimise the deposition, mobilisation or damage caused to infrastructure by woody debris and silt should be reviewed.

Review of design thresholds should be considered, should infrastructure be designed to 1 in 50-year storm events instead of 1 in 20 year events?

Table 2: Summary of solutions in time bands

	12 months	2 years	5 years	10years	Long term
Afforestation	Funding to undertake the Pakuratahi land use study.				
	Development of a planting guide to use in combination with land use assessment tools to inform the best tree species to plant on a slope-by-slope scale.				
East Coast fibre market	Remove regulatory barriers to construction of processing options. Consider special planning settings to fast track.				
	Build up the resilience and capacity of regional infrastructure network, road and rail to reduce transport risks and costs.				
	Explore options to develop additional East Coast ports to enable transport of biofuels to other parts of New Zealand.				
	Prioritise research and development into biofuel products that will make use of surplus woody debris. Set up a governance committee to co-ordinate and direct best expenditure of research effort.				
	Review of projects on biofuels and funding to scale up projects with potential.				
	Facilitation of a fibre market, collaboration with big end users such as Fonterra, DHBs, Ministry of Education, Huntly Power Station, etc.				
Land use assessment tools	Review of existing tools and body of previous work to developed refined scale tool.	Operationalise land use tool in Gisborne and Wairoa, as a demonstration project			
		Review intersection with NES-PF			
	Foster and prioritise research work that adds to NZs understanding and contributions to the development of land use assessment, partnerships with CRIs, FGR and Government departments.				
Onsite, operational management regimes and practice	Support EWC to update their Good Practice Guide for Catchment Management with learnings from the most recent storms, promote to HBFG for use in Wairoa.				
	Remove GDC regulatory barriers to woody debris containment options and other engineering options.				
	Consider new fire management options for burning slash on landings.				
Native tree planting	Co-ordinate body of work being undertaken by a multitude of Government departments, CRIs and other entities by establishing a governance leader to direct research effort and prevent duplication.				

	Remove regulatory barriers for sustainable native tree harvest.				
	Promotion of sustainable native timber.				
	Foster, prioritise and promote research to enhance New Zealand's understanding of native tree establishment and transitional forestry.				
	Urgent work is needed to understand the window of risk associated with native tree establishment before large scale planting is undertaken.				
	Promote and facilitate browsing pest control, link to PF2050.				
	Support for native tree nurseries to upscale production and reduce seed and seedling costs				
	Direction from Government on native tree provenance i.e. can only local tree genetics be used?				
			Operationalise a biodiversity credit system to remove economic barriers for native tree planting.		
			Capture additionality of pre 1990 forests in the ETS.		
Alternative species	Review of existing body of research to identify knowledge gaps.				
	Foster, prioritise and promote research to enhance New Zealand's understanding of the commercial, biosecurity and environmental viability of alternative tree species.				
	Support for alternative species nurseries to upscale production and reduce seed and seedling costs and lag times.				
Good Practice Guides	Fast track work to finalise the slash management guidance that Te Uru Rakau commissioned.				
	Progress work to merge the ECOP and FPGs and co-brand the document with Te Uru Rakau. Expand, combine and update the existing guides.				
Research and Development	Refer to Table 1 for time bound priorities.				
Governance	Review responsibility functions between MfE and Te Uru Rakau with regards to managing the NES-PF, recommend that TUR hosts the NES-PF.				
	Explore options for fair compensation of the most erodible government planted land.				
	Consider managed retreat from high-risk flood plain sites and/or the most erodible land which will be vulnerable to future storm damage				
			Establish and facilitate a biodiversity credit system to supplement economic barriers to land retirement and add settings within the ETS to capture pre 1990 additionality.		
Regionally specific changes	Immediate establishment of a working group made up of industry and council representatives				
	Establishment of a TAG to support GDC with scientific experts.				
	Empower GDC with additional resources and staff training.				

	Review of engineering innovations, look overseas for bridge designs that will allow woody debris to pass beneath (native trees, riparian strips and shelter belts will come down in future storm events). Explore options for other engineering structures that will protect bridges. Consider other in stream engineering options.				
	Set up and support for catchment management groups.				
	Mobilisation of any vegetation or woody debris should be regulated equitably over all land use types.				

Summary and scenario analysis: the impact of possible outcomes

Greater regulation and reduced plantation forestry

If solutions implemented by the inquiry panel include greater regulation, and therefore greater bureaucratic time and cost burden for forest owners in Gisborne and Wairoa, the viability of forestry here, when already under pressure, becomes questionable. A net retreat from forestry in Gisborne and Wairoa will have significant impacts for the communities here who are reliant on the sector. If the forest gates are locked and the land is unmanaged a much greater problem could be generated.
The solutions in Gisborne and Wairoa must remain local and specific to the unique physical setting here. If solutions are rolled out nationally vast areas of New Zealand, in fact most remaining areas, will have to carry the burden of overly prescriptive and conservative regulations that are not fit for purpose in other landscapes.

More forestry with improved environmental management

Considered, nuanced afforestation in the right places with improved environmental practices will offer significant benefits to the communities of Gisborne and Wairoa. Jobs and an emerging bioeconomy coupled with greater environmental outcomes such as net sediment reduction, water quality improvements, biodiversity enhancement (certified forests are required to set aside 10% of their estate as native reserves), and carbon sequestration are all foreseeable potential benefits. A mosaiced landscape including radiata pine in the right places can provide net benefits to the community here.

In summary, it is important that any alternative land use options promoted for this steep, highly erodible, remote landscape do not generate greater perverse outcomes. Whilst there are some solutions that can be implemented immediately, other options will take time. It is critical that the solutions considered are underpinned by robust, tested science. Following the 2018 storm and prior to Cyclones Hale and Gabrielle, the forestry sector has worked hard to find solutions to the mobilisation of woody debris and silt, but in these new climate settings innovative new solutions need to go further. A collaborative approach from the industry, councils, central Government and the research community will be needed to find the most effective solutions.

Note on making this submission public

The FOA does not object to this submission being made public. FOA is happy to provide further information to the inquiry panel as required.

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Environmental Manager

David Rhodes
Chief Executive

Appendix 1:

Review of Statistical Methods Used to Assess the Composition of Woody Debris

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6th April 2023

Executive Summary

I was asked by the New Zealand Forest Owners Association to review the statistical methods used to determine the composition of woody debris, as described in the following reports:

- "Woody Debris Assessment Methodology" (Interpine Innovation, 3rd March 2023)
- "Large Woody Debris Assessment Guide" (Gisborne District Council, Version 2.1, March 2023)

For simplicity I will refer to these as the "Interpine report" and the "GDC report", respectively. Likewise, I will refer to woody debris as "debris", and debris which has a diameter above a specified minimum as "large debris".

Throughout this report I will focus on the objective of estimating the composition of debris in one or more sites. As there will typically be too much debris at a site to assess all of it, there is a need for suitable sampling techniques to estimate the composition at that site.

I was not asked to review any statistical methods underlying

- Estimation of the potential sources of the debris
- Mapping of the locations of debris using aerial/satellite/drone photography
- Estimation of the volume of debris at inaccessible/dangerous sites using drones

My main conclusions are as follows:

1. The Interpine report uses line-intersect sampling (LIS) to estimate the total volume by area for each type of debris. LIS methods have been studied in detail by scientists and statisticians working in forestry and ecology for many years. There is not universal agreement as to exactly how these methods should be implemented, but it is clear that they provide a cost-effective means of estimating volume per area.

2. The GDC report uses square-plot sampling to estimate the total count per area for each type of debris. It is not clear how the statistical analysis should be conducted, especially as there is no indication as to whether the plots are to be placed in random locations.

3. It is difficult to compare the methods in the two reports, as they appear to be trying to estimate different quantities. That said, the LIS methods described in the Interpine report are well-established and have been the subject of scientific per-review since the 1960s.

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Review of Statistical Methods in the Interpine Report

The key points to be made about the methods described in the Interpine report are as follows:

1. These methods are based on line-intersect sampling (LIS), a technique that has been peer-reviewed in the scientific literature, by both forestry scientists and statisticians, and has been used in the forestry industry for several decades.

2. The version of LIS specified in the report involves the following process a. Several three-segment transects are placed in the area. Each transect forms an equilateral triangle, the length of each side being 10m, and each triangle is independently and randomly oriented. The use of triangle-shaped transects, with random orientation, has been shown to provide robustness to non-random orientation of the debris.

b. For each side of each triangle, the diameter of a piece of large debris crossing that line is measured at the point where it crosses, with a piece being defined as large if the diameter at that point is at least 7cm.

c. If a piece of debris crosses more than one side of a triangle, the diameter is measured at each point that it crosses a side (as long as the diameter at that point is at least 7cm). It is not clear from the report if measurements would be made at each point that a piece crosses a single side, if it were to cross that side more than once. There has been an argument put forward in the literature to make at most one measurement per piece per side.

d. If any side of the triangle is on sloping ground, the length of that side is increased to ensure that the horizontal distance covered by that side is still 10m. A table of the required adjustments is given in the Appendix to the report, for a range of possible slope gradients.

e. For each triangle, an estimate of the volume of large debris per area (m_3/ha) is given by a well-established formula. This formula is robust to the shape of individual pieces of debris not being cylindrical (e.g. by tapering) in the sense that it does not lead to substantial bias. On the other hand, departures from a cylindrical shape can lead to a decrease in precision of the estimate.

f. An estimate of the volume of large debris per area for the whole site is the mean of the estimates from the different triangles, with a 95% confidence interval around this mean being calculated in the usual way when estimating a population mean from a sample mean. This confidence interval is typically presented on a percentage scale, and is then referred to as a “probable limit of error” (PLE).

3. Two methods are suggested for determining the locations of the triangles. This first, preferred method, is to select a random location (using geo-spatial sampling tools). The second, which may be preferable for long, narrow accumulations of debris, involves selecting the locations to be at equally-spaced distances along a baseline, the first location being suitably randomised. In the latter case, it would be worth exploring the potential for a slightly different method for

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calculating the PLE. In many survey settings systematic sampling can lead to a more precise estimate than random sampling, but allowance needs to be made for the type of sampling used. If the results are analysed as if they came from a random sample, the PLE is likely to be overly pessimistic, i.e. the precision is likely to be underestimated.

4. The estimation of volume per area can obviously be done separately for different types of debris, and an estimate of the proportion that a particular type of debris constitutes of the total volume per area can be calculated. Calculation of a confidence interval for this proportion has not been discussed in any of the literature I have reviewed, but standard statistical methods for doing so are easy to apply.

5. There is no discussion of the potential for stratifying the site according to the expected volumes, e.g. low-density versus high-density locations. Again, there is potential benefit in the use of stratified random sampling or stratified systematic sampling, and this is straightforward to apply.

Review of Statistical Methods in the GDC Report

The key points to be made about the methods described in the GDC report are as follows:

1. The focus appears to be on estimation of count per area, rather than volume per area.

2. This leads to the use of a different sampling technique, with a 10m x 10m square plot being placed at several locations in a site, and all the debris of a certain type being counted within each plot.

3. There is no indication as to how the results are to be combined into a single estimate for a site, but I assume that one calculates the mean count per area over all plots. Likewise, there is no indication as to how an estimate of precision is calculated, but I assume that a 95% confidence interval is calculated in the usual way when estimating a population mean from a sample mean.

4. There is no indication that randomisation is to be used when selecting the locations for the plots. This could lead to bias (even subconsciously) in the choice of locations, and also makes a standard statistical analysis (point 3 above) less justified.

5. There is discussion of methods for avoiding observer bias in the counting process, so it is surprising that the possibility of sampling bias (point 4 above) is not discussed.

6. As in the Interpine report, there is no discussion as to how to calculate a confidence interval for the proportion that a particular type of debris constitutes of the total count per area.

7. The rule given for deciding whether to count a log that lies partially outside the plot is vague. If 25% or less of the log lies outside the plot it is to be counted, whereas if “only 25%” lies within the plot it is not to be counted. There are two problems with this definition. First, I assume “only 25%” means “25% or less”. Second, and more confusing, it is not clear whether to count a log which lies 26%-74% within the plot. For example, should a log that is 50% within the plot be counted?