

Preparing for the next Cyclone Gabrielle

in Tairāwhiti and Hawke's Bay

Between 12 and 14 February, Ex-Tropical Cyclone Gabrielle pounded the north of the North Island.

Lives were lost and large areas were devastated with a cost in the billions of dollars.

Gabrielle's peak rainfall intensity was twice that of the infamous Cyclone Bola in 1988.

Gabrielle is probably the first real manifestation of climate change in Aotearoa New Zealand.

There is no quick fix to prevent similar damage in the future, as the dangers of climate change get worse.

Solutions depend on properly understanding the risks and responding together.

Gabrielle blew over thousands of hectares of pine forest south of Lake Taupō

Long history and tough future

Widescale pine planting in Tairāwhiti followed Cyclone Bola in 1988, as it was realised that much of the land should never have been cleared of native trees for farming in the first place.

Trees hold the land together much better than pasture. The region's future depends on many more trees – not fewer.

But crucial to successfully stabilising the land with a super-glue of trees, is

selection of the right trees, where to plant them and how they are managed.

Income and costs must be assessed and appreciated, along with integration with farming, the only other large scale viable income earner in the region.

But the fragile land, and any trees on it, will still erode away. Even without any pines or climate change, wood will still come down rivers.

“Nearly as much rain fell during the most intense 12-hour period of Cyclone Gabrielle as did during the most intense 24-hour period of Cyclone Bola”

Interpine Report April 2023



HISTORY

The early European settlers set about wiping out the native forests for sheep farming. Slash covered the beaches, and the fragile mudstone was exposed to super-erosion.

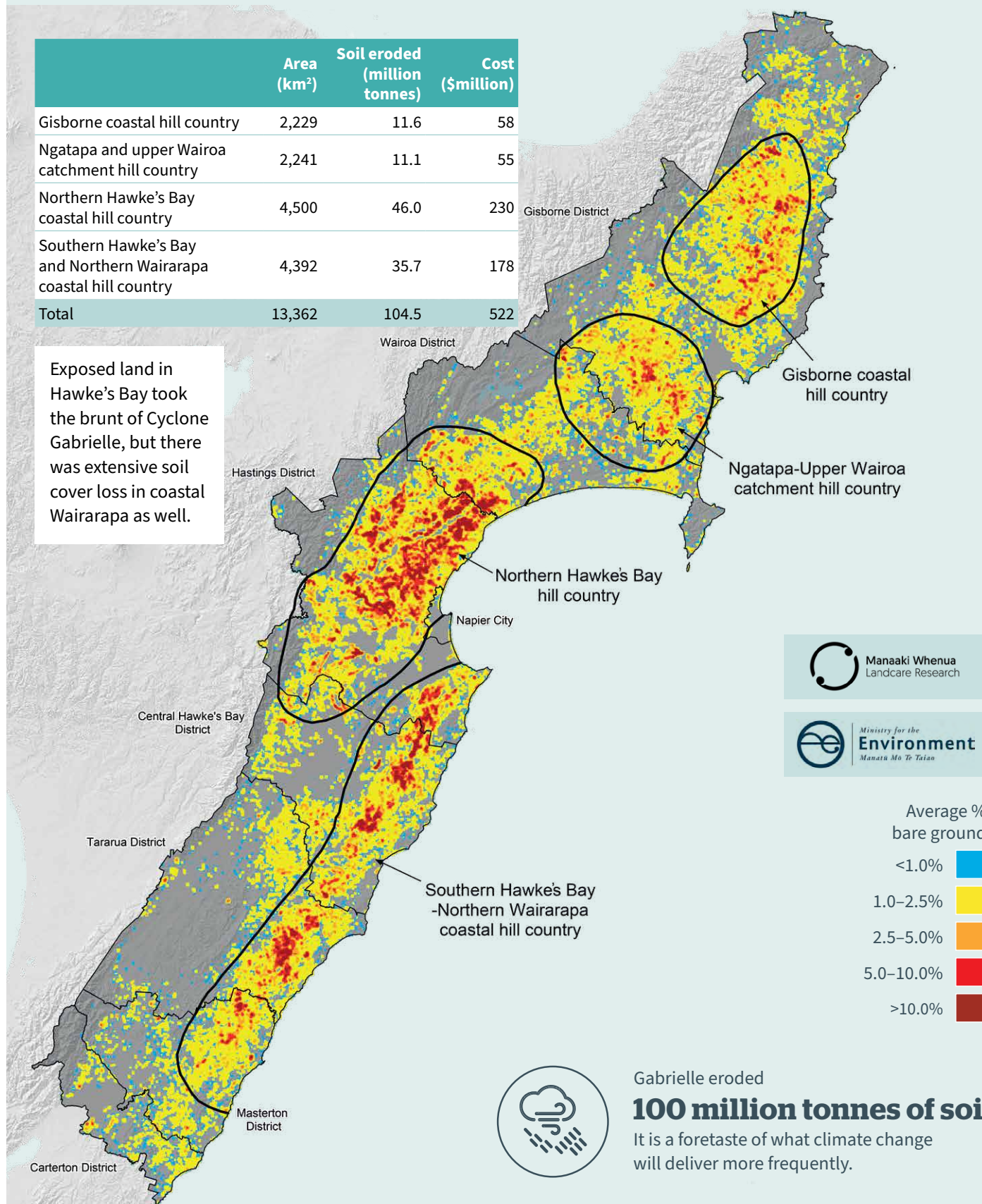


Gisborne circa 1920

Cyclone Gabrielle landsliding

	Area (km ²)	Soil eroded (million tonnes)	Cost (\$million)
Gisborne coastal hill country	2,229	11.6	58
Ngatapa and upper Wairoa catchment hill country	2,241	11.1	55
Northern Hawke's Bay coastal hill country	4,500	46.0	230
Southern Hawke's Bay and Northern Wairarapa coastal hill country	4,392	35.7	178
Total	13,362	104.5	522

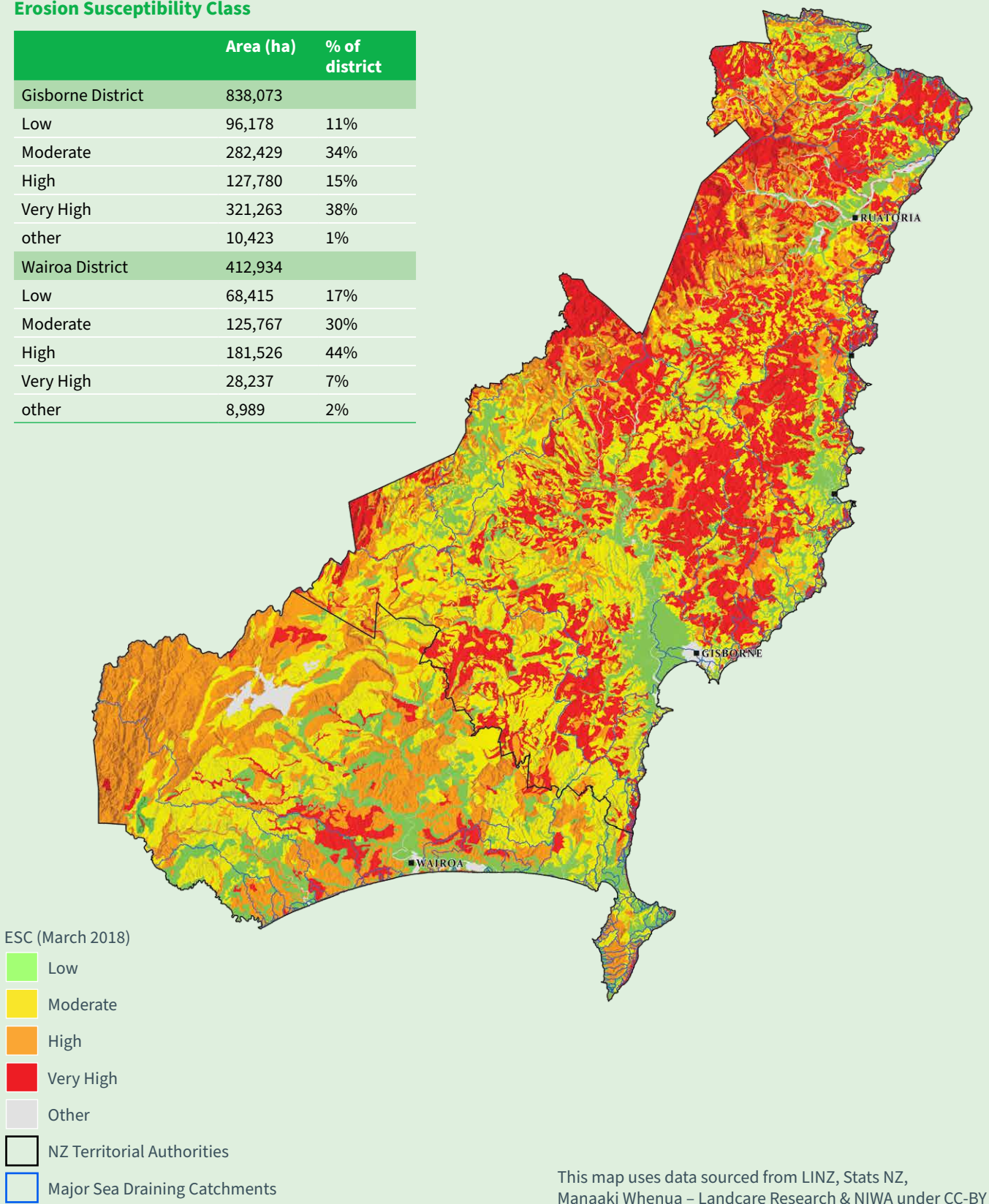
Exposed land in Hawke's Bay took the brunt of Cyclone Gabrielle, but there was extensive soil cover loss in coastal Wairarapa as well.



Erosion susceptibility of Gisborne and Wairoa districts

Erosion Susceptibility Class

	Area (ha)	% of district
Gisborne District	838,073	
Low	96,178	11%
Moderate	282,429	34%
High	127,780	15%
Very High	321,263	38%
other	10,423	1%
Wairoa District	412,934	
Low	68,415	17%
Moderate	125,767	30%
High	181,526	44%
Very High	28,237	7%
other	8,989	2%



This map uses data sourced from LINZ, Stats NZ, Manaaki Whenua – Landcare Research & NIWA under CC-BY

Soil moisture deficit



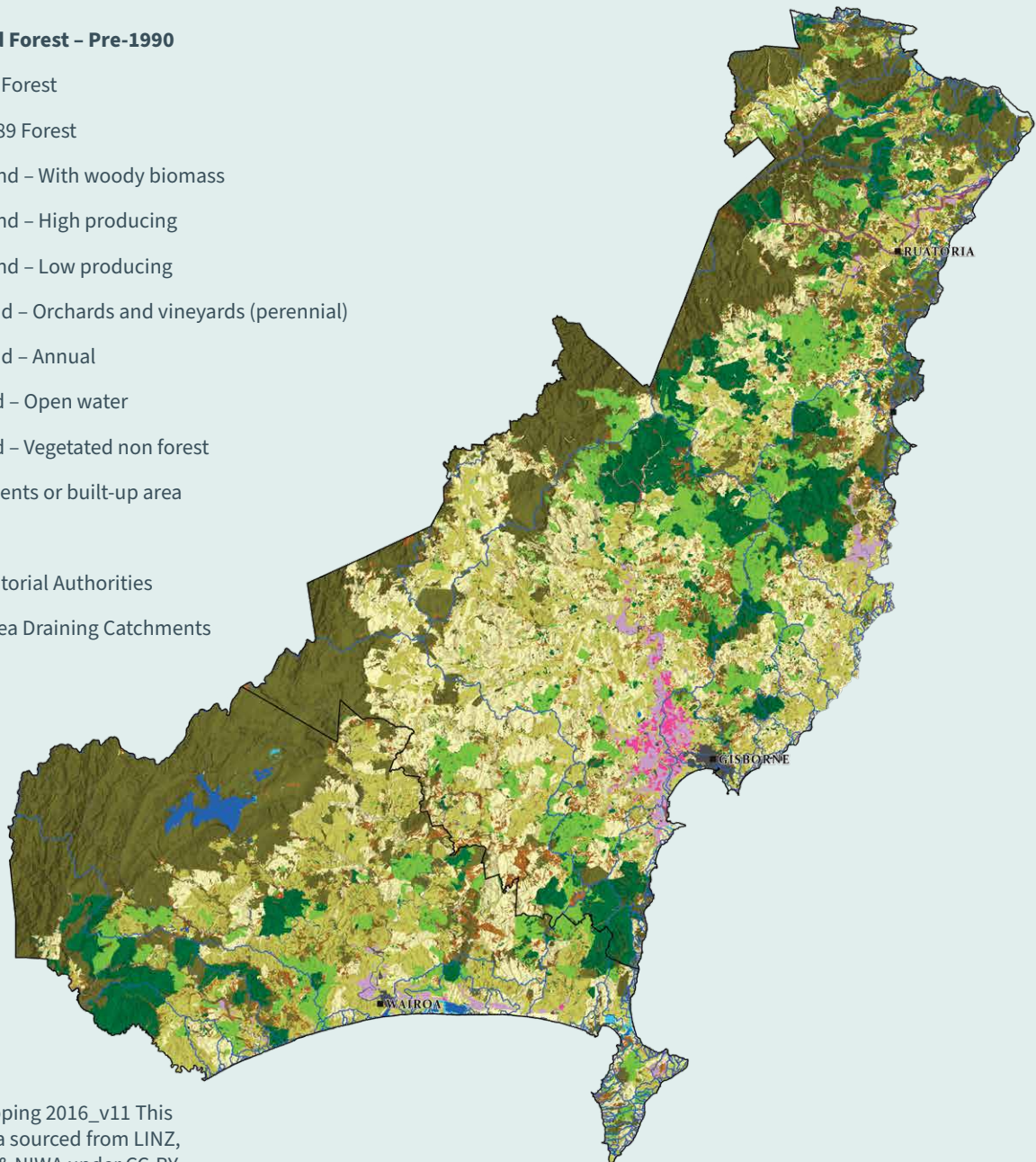
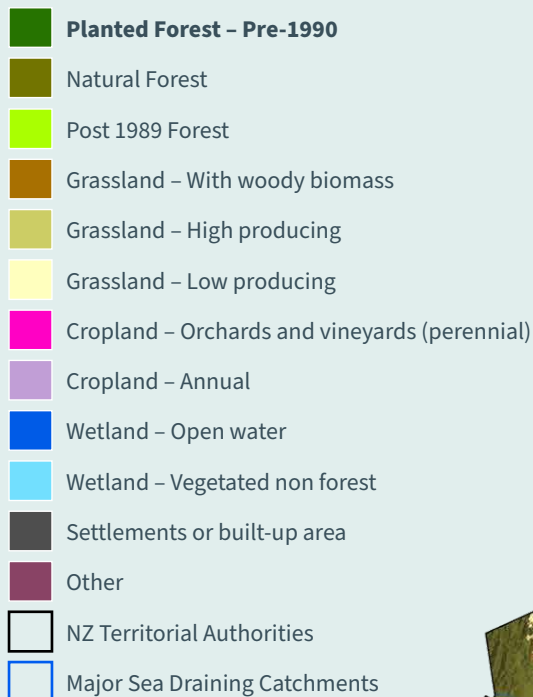
Land use in Gisborne and Wairoa districts

There are 157,000 hectares of plantation forests in the East Coast Region and another 140,000 in Hawke's Bay.

Together they represent 18 percent of the national plantation forest estate, earning more than a billion dollars a year in exports.

Most forestry is on land less productive for farming. It is a major employer in both regions, and provides other jobs in transport, processing and at the ports of Gisborne and Napier.

Local iwi have a large investment. There are at least four thousand New Zealand investors who have a direct stake in Tairāwhiti forests. Thirty thousand hectares of these forests are less than 100 hectares, most of which are farm woodlots smaller than 50 hectares each.

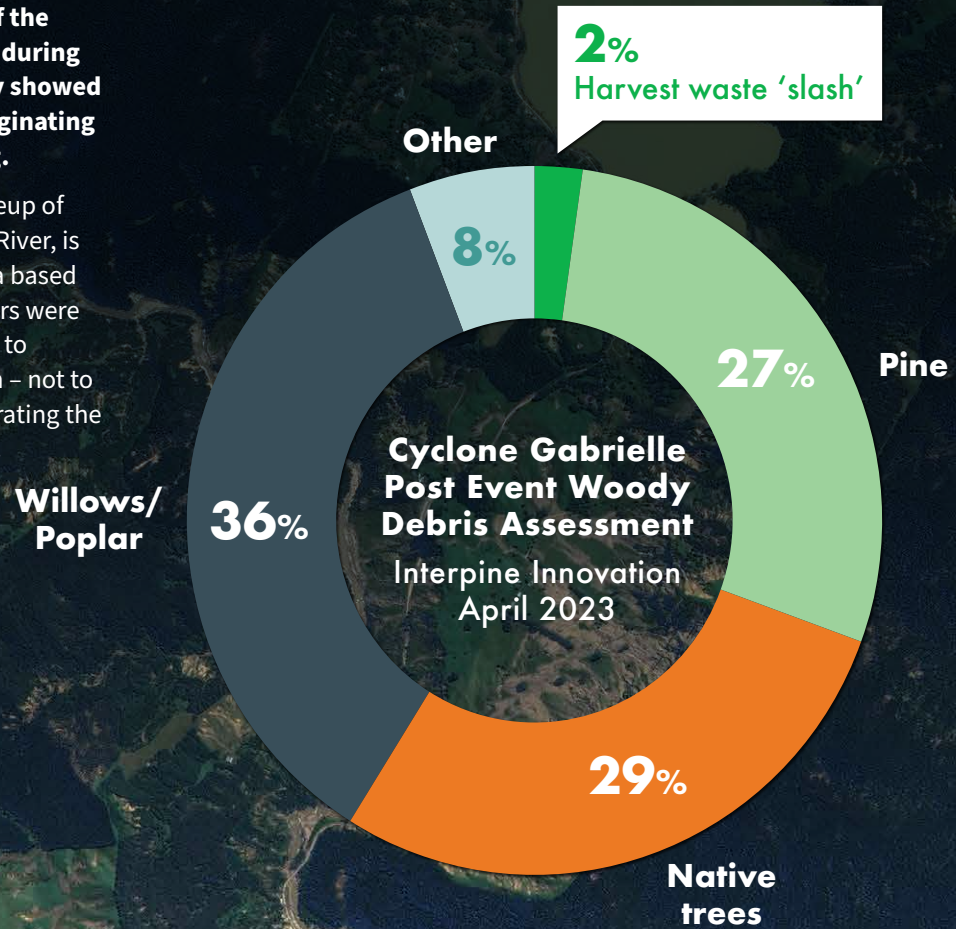


Land Use Mapping 2016_v11 This map uses data sourced from LINZ, Stats NZ, MfE & NIWA under CC-BY

Debris make-up - Wairoa

Scientific measurements of the wood flushed downstream during Cyclone Gabrielle generally showed only a small proportion originating from plantation harvesting.

This graph showing the makeup of woody debris by the Wairoa River, is typical in a report by Rotorua based Interpine. Willows and poplars were the largest category, planted to protect streams from erosion – not to be victim to it – further illustrating the incredible force of the storm.



Reducing wood waste

The 'Tolaga Bay' storm in 2018, sent wood residue downstream to the sea. Forest practices have been addressing the risk since.

Many measures take time to be effective, such as growing riparian strips of native trees to block waste, and introducing other species of trees into the forest mix, such as redwoods which regrow after harvest. New machinery was developed which is less likely to damage a tree when felling it.

Early harvesting

Early harvesting to protect against windthrow.

Continuous cover forests

Trees are removed progressively so a forest canopy is retained.

Riparian natives

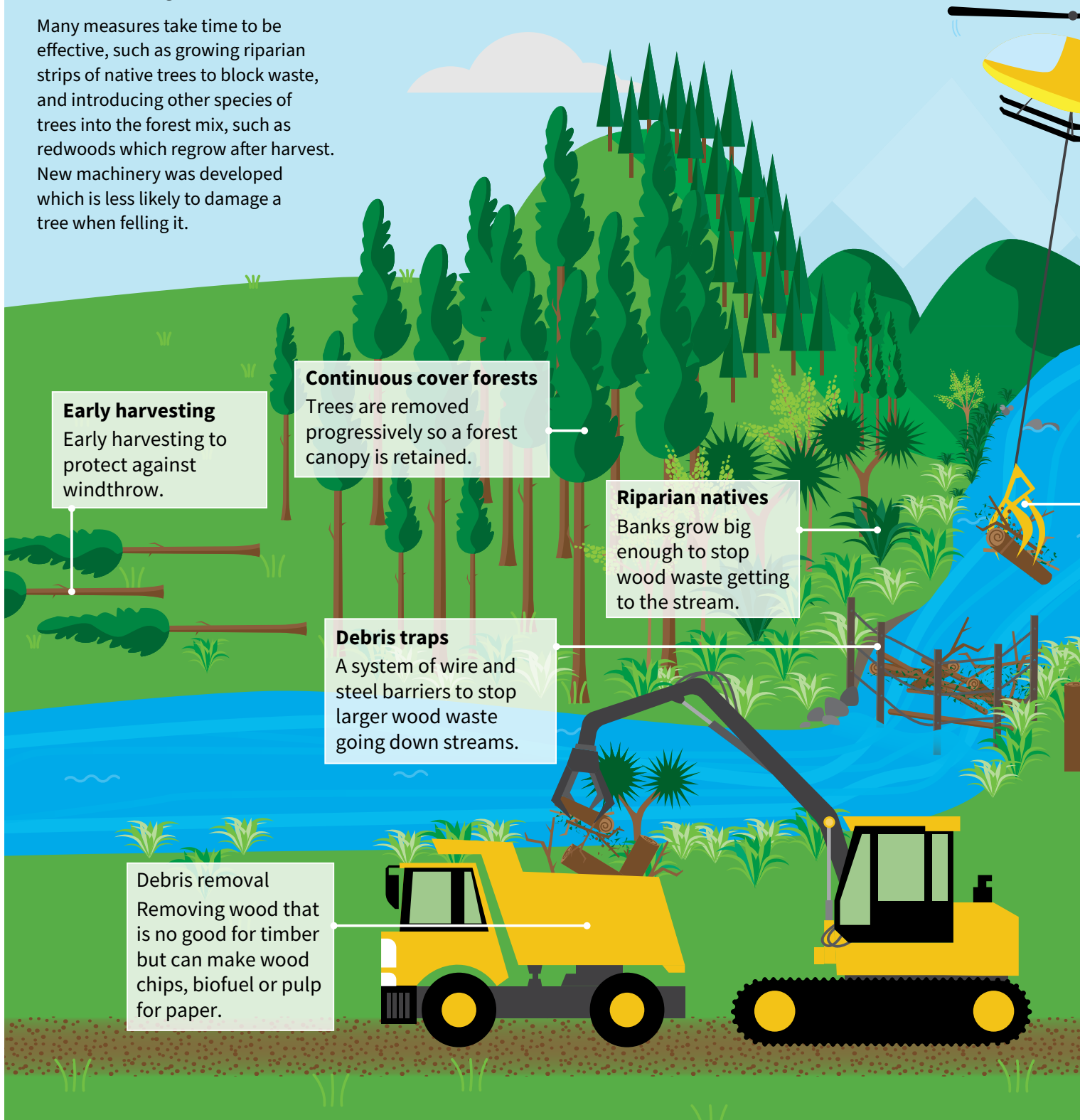
Banks grow big enough to stop wood waste getting to the stream.

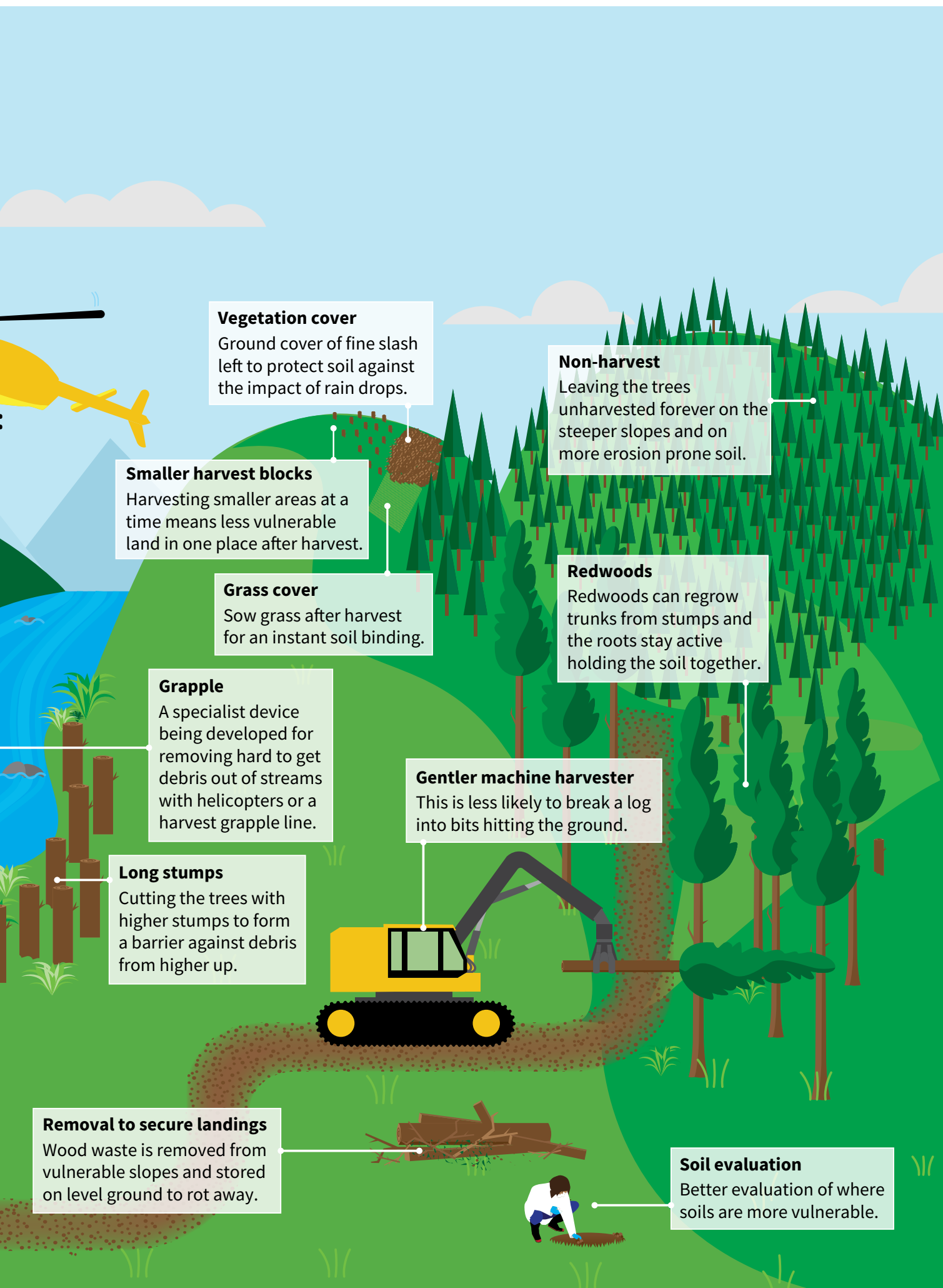
Debris traps

A system of wire and steel barriers to stop larger wood waste going down streams.

Debris removal

Removing wood that is no good for timber but can make wood chips, biofuel or pulp for paper.





Vegetation cover

Ground cover of fine slash left to protect soil against the impact of rain drops.

Non-harvest

Leaving the trees unharvested forever on the steeper slopes and on more erosion prone soil.

Smaller harvest blocks

Harvesting smaller areas at a time means less vulnerable land in one place after harvest.

Grass cover

Sow grass after harvest for an instant soil binding.

Redwoods

Redwoods can regrow trunks from stumps and the roots stay active holding the soil together.

Grapple

A specialist device being developed for removing hard to get debris out of streams with helicopters or a harvest grapple line.

Gentler machine harvester

This is less likely to break a log into bits hitting the ground.

Long stumps

Cutting the trees with higher stumps to form a barrier against debris from higher up.

Removal to secure landings

Wood waste is removed from vulnerable slopes and stored on level ground to rot away.

Soil evaluation

Better evaluation of where soils are more vulnerable.

Slash

Technically ‘slash’ is the residue from harvesting, ranging from minor branches to broken logs. Foresters remove most of it to secure landings to avoid the material getting into waterways.

The news media mistakenly, yet routinely, refer to all wood in rivers following Gabrielle (and Cyclone Hale a month earlier) as slash, when much of the debris was not from pine trees at all.

Some residue on the cutover lessens the impact of rain on the soil and then enriches it. A small amount of wood in waterways improves the stream habitat by creating shade, cover, and food for stream life.

The task is then to reduce the volume, so it doesn’t harm aquatic animals and damage roads, bridges, and other infrastructure.

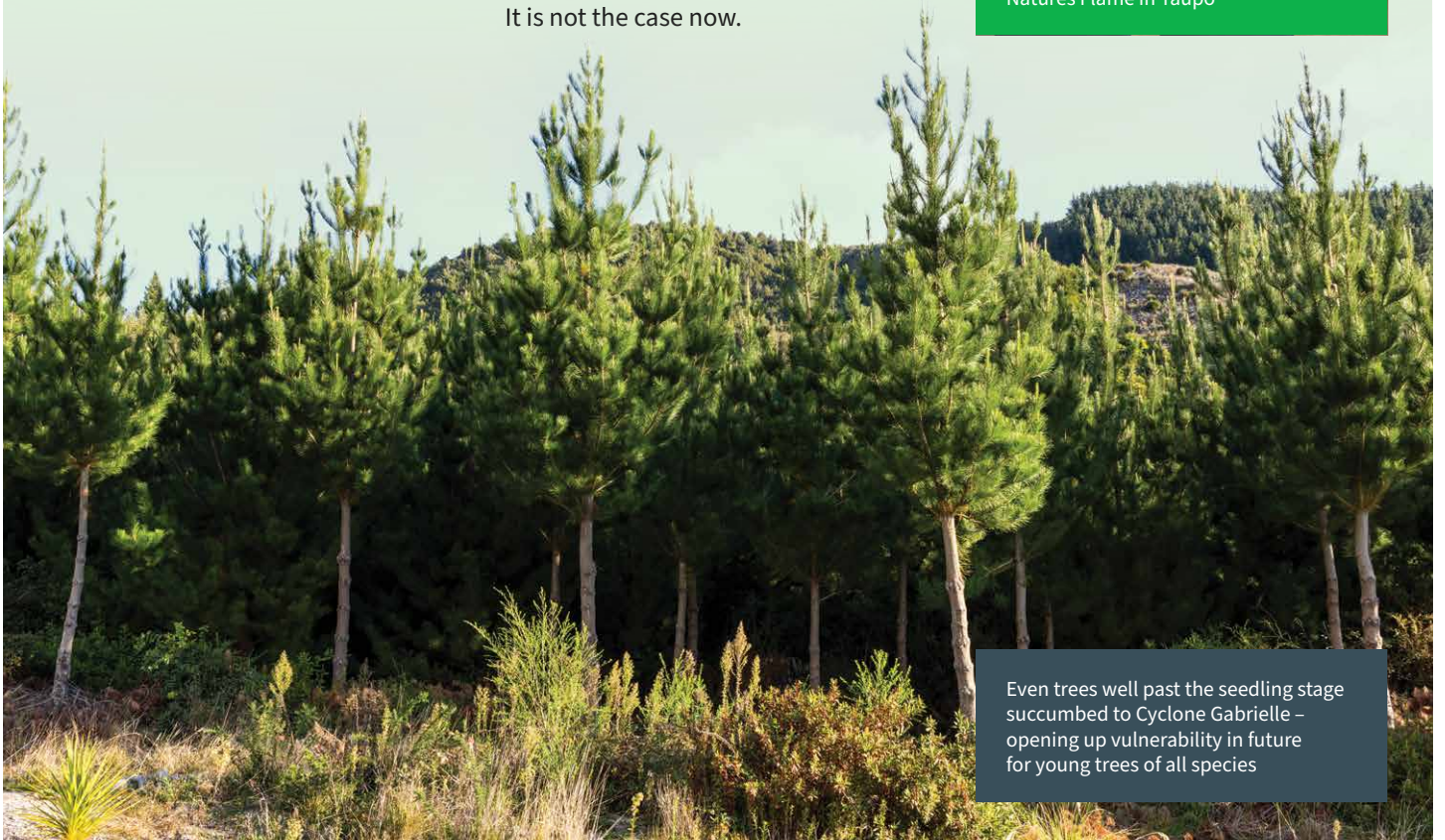
However, just removing slash, and even preventing all wood, from entering waterways, will not stop damage. Floodwaters alone can be immensely damaging. During Gabrielle rain and running water displaced 100 million tonnes of soil. Especially around Napier and inland the sediment damage was immense.

The National Environmental Standard for Plantation Forestry is the most comprehensive set of regulations of its type under the Resource Management Act. Implementation of the NES-PF is supplemented by industry practice guides. On vulnerable terrain, with the intensity of Gabrielle, these need to be updated.

The force of the floodwaters washed out pine trees 10 – 12 years old. This surprised foresters. Their experience was that at least by age about five or six years the trees were sufficiently established to withstand anything. It is not the case now.



Wood waste has many potential uses, such as these wood pellets from Natures Flame in Taupo



Even trees well past the seedling stage succumbed to Cyclone Gabrielle – opening up vulnerability in future for young trees of all species



Clean-up

Ever since the storms, forest companies, some from outside of the Tairāwhiti and Hawke's Bay regions, have extensively deployed crews and equipment in the clean-up operation.

Much of the wood and sediment is from non-forestry sources, yet the industry has responded where they can.



Traps and Chips



Debris traps can block woody debris from travelling down a river to cause damage. They work best as a system throughout a catchment.

Some regulators are however reluctant to approve these devices.

Another way of disposing wood waste is to burn it, as now being explored by Gisborne District Council. As with most waste containment measures there is some risk – in this instance of damage to the soil and wildfires.



Chipping waste wood on site removes risk of wood damage downstream.

It's a potential source of biofuel or raw material for a post-plastic bioeconomy. But transport costs over long distances make the economics difficult.



Downstream

Most damage from woody debris has been downstream where people live, work and travel.

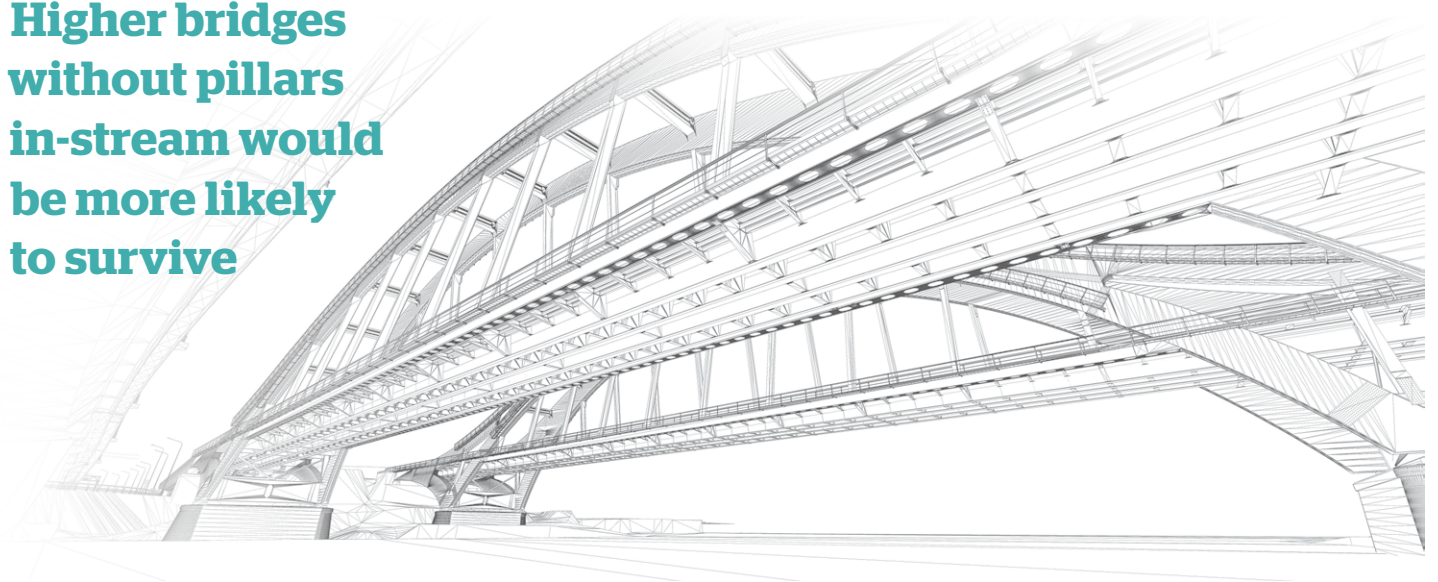
Future storms will be more frequent and intense than they have been until now. It makes no sense to persist with business as usual by repairing the bridges just as they were before. The deadly combination of fragile terrain and more storms will put even the best managed tree planting at risk of failing.

Future proofing to reduce that risk as much as possible is vital. Some river-mouth areas can be reconfigured to absorb floodwaters and debris.

The crucial State Highway 35 north from Gisborne took the brunt of water, debris and sediment during Gabrielle and bridges along it failed. In-stream support pillars gave way. Higher bridges without pillars in-stream would be more likely to survive.



Higher bridges without pillars in-stream would be more likely to survive



Native and other trees

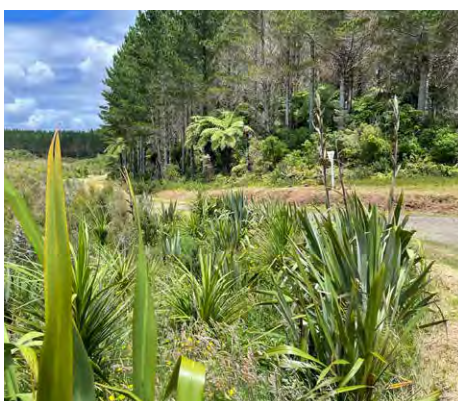
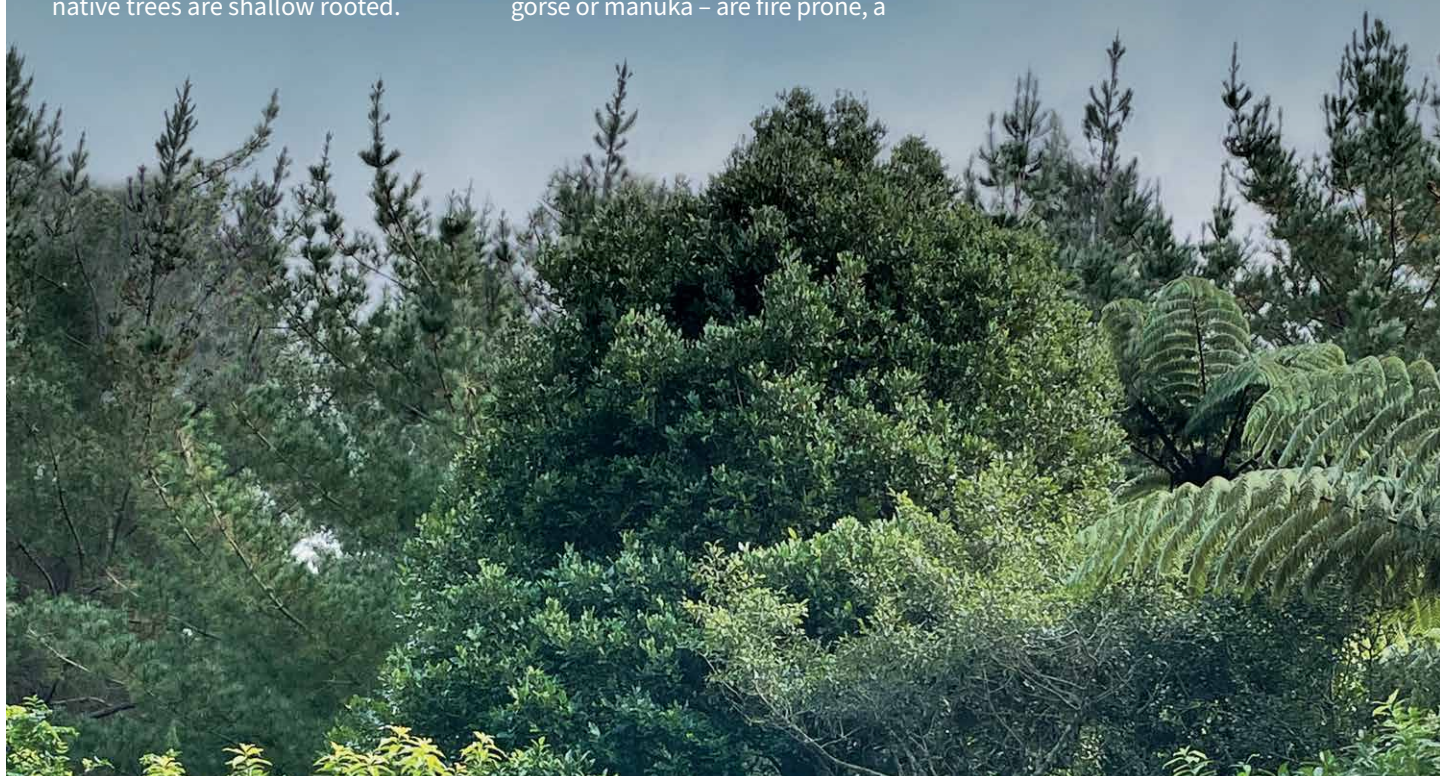
Reafforestation with native trees is invariably recommended to prevent erosion, improve indigenous biodiversity and offer a long-term harvest of valuable timber.

The indigenous tree area will undoubtedly increase. However, a careful and dispassionate analysis of much of the recently eroded farmland would conclude the fast-growing pines are more likely and more cheaply able to make the land more stable initially and sequester carbon very much more quickly – even if never harvested. Most native trees are shallow rooted.

They are also slow to establish and so vulnerable to wash out for a longer period than pine trees are. Increasing frequent droughts will make failure rates higher, as could new diseases encouraged by a warmer environment. In these soils, trees which grow big – such as shallow rooted tōtara – eventually blow over and take the soil with them.

There is a battery of browsing animals and a myriad of invasive weeds to threaten native trees as well. The usually suggested nursery crops – gorse or manuka – are fire prone, a

risk which will again increase in the region. Other exotics are another option. Gisborne District Council is suggesting trees, such as Redwoods, which coppice new shoots after they are harvested which means the still live roots continue to hold the soil. Properly selected willows and poplars are the best solution for some sites – they grow quickly and have deep roots.



On track for a wooden future



Eastland Port, Gisborne

Eastland Port in Gisborne is the third busiest wood export port in Aotearoa New Zealand, handling nearly three million tonnes of logs a year and scheduled to double this over the next few years.



Optimised Engineered Lumber

What is stated to be the only one of its type in the world, Wood Engineering Timber opened its Gisborne facility two years ago, with support from Trust Tairāwhiti.

Re-assembling individual pieces of lower grade wood makes them 40 percent stronger than regular structural pine timber, which means the veneer timber can readily be substituted for carbon emitting concrete and steel.

The plan is to produce 140,000 cubic metres of OEL a year.



Log barges at Te Araroa

There are no communities more remote in Tairāwhiti than Te Araroa and Hicks Bay, right at the northern tip of the region.

Some locals have been trying to get approval for loading barges at Te Araroa as an alternative to the expensive of taking logs to by truck to Gisborne.

Each 80-metre barge would carry the equivalent of 90 log truckloads.

The Te Rimu Trust, which is promoting the project says the new port would employ 40 locals. The Parata Inquiry has backed the project.

Carbon – now and future

There are nearly 300,000 hectares of plantation forests in Tairāwhiti and Hawke's Bay, which deliver an offset against climate warming greenhouse gases by sequestering about four million tonnes of carbon dioxide from the atmosphere every year.

4,000,000 tonnes of CO₂
per year



sequestered by

300,000 ha of plantation forest

A vision for 2123 includes: Carbon being captured on a long-term basis through the right mix of indigenous and exotic forest, to the point the region is known as 'the lungs of the Pacific'.

Ministerial Inquiry into harvest waste and land use in Tairāwhiti, May 2023