TREE GROWERS TAIRĀWHITI – THE GISBORNE EAST COAST BRANCH OF THE NZFFA

Landscape response to the storms in Tairāwhiti

This article looks at questions of mismanagement, various influences (geology, felling indigenous forest, climate and governance), and concludes with what a future response to such events might look like.

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Introduction

Due at least in part to the effects of woody debris on land, homes, infrastructure and beaches after Cyclone Gabrielle, the division between the public sector and advocates of the exotic forest industry widened. While media attention focused largely on woody debris, there was little commentary on why it was originally deemed necessary to re-establish extensive areas of Tairāwhiti with exotic forest or acknowledgement of the wide range of environmental benefits that accrued since reafforestation began in this region over six decades ago.

In this article, the first of a series prepared by the Gisborne East Coast Branch of the New Zealand Farm Forestry Association (NZFFA), we outline physical, climatic and anthropogenic influences that have contributed to the inherent predisposition of parts of Tairāwhiti region to multiple forms of erosion. We also explain why the implementation of targeted erosion mitigation efforts, including further reafforestation at scale and long term, rather than continuing to rely on short-term, piecemeal, corrective actions, will be needed to build resilience before the next cyclone.

Later articles will describe the brief history of the forest industry in Tairāwhiti and present our view of what will be required to stop further deterioration of this region's already significant loss of land resources.

Questions of mismanagement

In February 2023, Cyclone Gabrielle struck the North Island of New Zealand, during which time extensive shallow landsliding, streambank erosion, flooding and sediment deposition on floodplains devastated parts of Tairāwhiti and northern Hawke's Bay.

In the Esk Valley, media focused on the devastating effects of sediment deposition on the floodplain while its derivation, primarily from streambanks and shallow landslides initiated on steep, largely treeless, pastoral hill country, received little commentary. Conversely, commentary on the situation within Tairāwhiti was less on the source of sediment, but focused instead on the volume of woody debris deposited on the region's beaches.

Initially presumed to consist of predominantly *Pinus radiata*, and to have been derived solely from the exotic forest estate, this provoked considerable anti-forestry sentiment from a public who for decades has benefited from the protective role of forests established since the 1960s.

Much of this controversy centred around accusations of the mismanagement of exotic forests as primarily responsible for damage to private properties and regional infrastructure. Indeed, as highlighted in subsequent court hearings, the management of some forests had not been of the standard expected under the Resource Management Act 1991 (RMA) or the National Environmental Standard for Plantation Forests (NES-PF). Nor had it complied with Gisborne District Council's consent conditions for harvesting, which include management of woody debris.

While the source and tree species comprising accumulations of woody debris immediately downstream of production forests and largely derived from cutover areas consented for harvest is irrefutable, not all of it was harvest-related 'slash'. Instead, it included live mid-rotation trees planted with the intent of preventing erosion. Their

Vulnerability of pastoral hill country versus successful mitigation of storm-initiated shallow landslides in closed-canopy forest

presence within stream channels was perceived to be a result of mismanagement.

However, this is a natural phenomenon that occurs only rarely and at specific sites where cover bed materials overlying bedrock are not sufficiently deep for roots to develop enough mass to anchor tall trees to steep slopes. Irrespective of tree species or age, this type of slope failure is not a consequence of mismanagement.

Irrespective of species, erosion control plantings do not always achieve the goal of mitigating storm-related erosion.

Poplars and willows were established with good intent on both pastoral land and as part of exotic forest establishment to conserve soil, to slow gully erosion and protect streambank collapse. While they accounted for a sizeable portion of the total volume of woody debris surveyed on local beaches and cluttering river channels, including whole trees with root systems attached, there appeared to be less public concern about them and no mention that mismanagement of these streamside plantings over decades was a contributing factor.

Irrespective of species, erosion control plantings do not always achieve the goal of mitigating storm-related erosion and instead result in unintended consequences.

Accumulations of woody debris on beaches following future storms is a given.

The landscape response to storm events has been well-documented, and cause and effect relationships between storm characteristics and types of erosion and vegetation are understood. However, in the Tairāwhiti region, the extent, severity and types of response to storms differ in many respects to that experienced during those of similar magnitude in other regions.

Here, a unique combination of geologic and climate-related factors spanning thousands of years, in combination with subsequent anthropogenic factors that span a little over a century and a half, have shaped the current landscape and landforms within it. In places, they have also increased the landscape's inherent predisposition to multiple forms of erosion, most of which are storm-driven.

The influence of bedrock composition and tectonics

Broadly, the geology of this region is somewhat unique in that it comprises two geological terrains within which the age and composition of bedrock lithologies and styles of tectonic deformation are different. These differences are reflected in the scale, timing and type of mass movement process typical of the landscape within each terrain.

Tarndale Gully is untreatable using either traditional soil conservation practices or afforestation

Cretaceous terrain (32% of hill country) comprises alternating mudstones and sandstones that are structurally weak due to tectonic shearing. Over geological periods, as rivers incised into the underlying bedrock, slopes proximal to the drainage network became over-steepened and increasingly unstable. Areas of subdued landscape elsewhere in this terrain are dominated by deep-seated earthflows and rotational slumps and where shallow landslides are less common.

In contrast, Tertiary terrain (68% of hill country) comprises younger, less-deformed, structurally intact bedded-to-massive sandstones and mudstones, and although slopes average >30° they remain relatively stable. Within this terrain the dominant hill slope erosion process is climate-driven shallow landsliding, while earthflows and slumps are less common, smaller and tend to be confined to zones where bedrock is predominantly mudstone and/or likely coincides with a fault crush zone.

The influence of felling indigenous forest

Following European settlement, the felling of vast tracts of indigenous podocarp-hardwood forest from c. 1894 onwards had by 1914 removed 97% of the region's forest cover. Photographs (c. 1903–1910) confirm that in the absence of a forest cover, mass wasting processes and the initiation of gullies within headwater catchments had increased. By the late 1920s, channel widening and sediment aggradation in lower catchment reaches had also become noticeable and widespread.

The influence of climate

Based on historical occurrences of landslide-causing storms in Tairāwhiti dating back to the early 1900s, the average recurrence interval ranges from 2.6 to 5.9 years. Of note, within the last 27 years (1996–2023) there have been an additional 14 such events at a frequency of an event approximately every two years, including four cyclones in the last six years (2018–2023).

Swings in storminess tend to be cyclic, with climate change scenarios for this region predicted to be drier, but nonetheless include more frequent extratropical cyclones with associated higher-intensity rainfall.

These high-intensity rainfall events will inevitably trigger shallow landslides that strip cover bed materials, soil and carbon stocks across the more susceptible land classes, particularly within the Tertiary terrain. However, storms of equivalent intensity are less likely to cause widespread reactivation of deeper-seated earthflows and rotational slumping within the Cretaceous terrain.

Across both terrains, increased rates and volumes of surface water runoff will inevitably result in the initiation of new gullies, expansion of existing gullies and streambank erosion. During such events, elevated flood levels will have the capacity to transport and deposit silt and woody debris across extensive areas of floodplain and on beaches.

Swings in storminess tend to be cyclic.

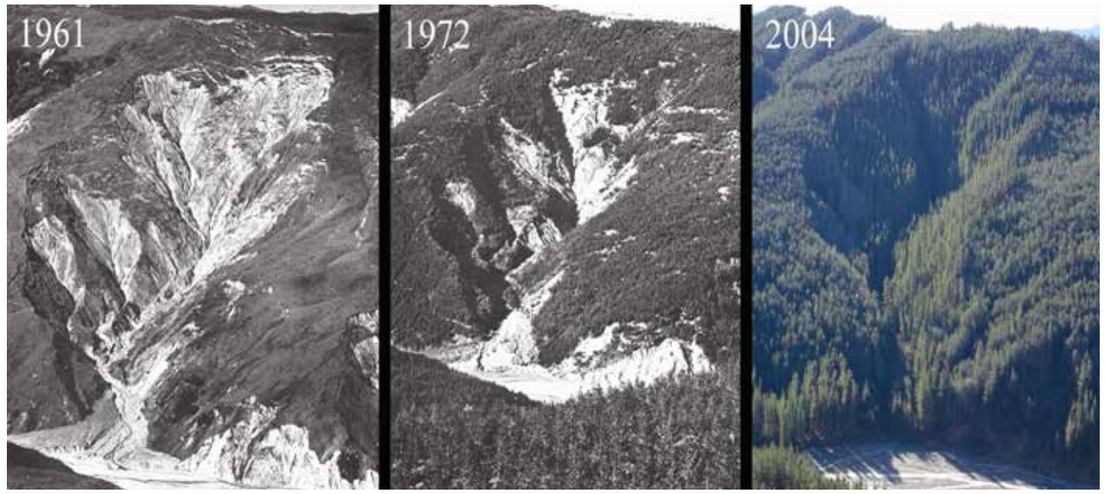
The influence of governance

The distinction of being New Zealand's most erosion-prone is attributable in many ways to historical decisions/indecisions at elevated levels of governance that included:

- An absence of controls on the clearance of indigenous forest by early European settlers when the cause-and-effect relationship between large-scale felling of indigenous forest and the resultant extent of hill slope collapse, coincident with heavy rainfall events and flooding, was clearly understood.
- The failure to heed warnings that in response to the removal of the indigenous forest cover, headwaters of major catchments were by the 1920s showing signs of an increase in erosion severity.
- Although the solution was clear, there was little response to early reports of increased sedimentation within river channels, or to the increasing incidence of flooding and siltation on floodplains and damage to the region's infrastructure.
- A further 20-year delay before the Government purchased severely eroding pastoral hill country for conversion to 'Protection/Conservation Forests', achieving the planting of just 35,000 ha of a projected target of 110,000 ha over a 24-year period (1961–1985) before the state forests were sold.
- The declining health of remnants of indigenous forests as a consequence of pre-European fires, burning and increased storminess, and the influence of introduced feral pests.
- An inadequate response to multiple inquiries into land-use issues within Tairāwhiti, the earliest of which concluded:

  'Erosion … (predominantly gullies, earthflows and shallow landslides) … is as spectacular in its quick and often irreversible degradation of otherwise good land as it is tragic in its economic implications for individual property owners and for the district as a whole. Where such erosion has developed on a large scale the cost of erosion control far exceeds the value of pastoral production from the land concerned. There is therefore no known way of economically controlling erosion of this kind other than by complete reforestation. (NWASCO, 1970)

- A legacy of incentive policies and subsidies introduced between 1979–1982 to clear marginal land that had reverted to shrubland during the 1930s Great Depression, to assist stock retention and confirm existing land use.
- The decision to change the designation of areas established as 'protection forests' to 'production-protection forests', leading to changes in silvicultural practices, which in 'high-risk' areas compromised their erosion-control effectiveness.
- Inaction on the findings of investigations into historical land-use practices before Cyclone Bola (Water and Soil Directorate, 1987) and after Cyclone Bola (PCE, 1994) that, if implemented, afforded an opportunity to promote a farm-forestry approach to land use based on farm-scale mapping of erosion susceptibility.
- The failure to anticipate the unintended outcomes of blanket planting of approximately100,000 ha of exotic forest established largely within a 5-year period (1992–1997) and therefore destined to be harvested within a similar ~5-year timeframe. This increased the susceptibility of large areas of forest cutover to storm-initiated landsliding.
- Until 1990, an absence of guidelines in the NES-PF, amended to Commercial Forestry (NES-CF), on planting set-back distances to ensure adequate protection of waterways.
- A lack of control on consents issued to limit the proportion of catchments harvested within a given period, particularly for areas of the region where the risk of storm-initiated erosion during harvest and post-harvest periods is greatest.
- Delays in implementing adequate and timely erosion control initiatives within Waiapu Catchment, as outlined in a high-level Relationship Accord between the Crown, Ngāti Porou and Gisborne District Council ('Restoring the Waiapu Catchment').
- A lack of support for initiatives that include the removal and utilisation of residual wood waste from forest cutover in a region where the volume of pine residue remaining on-site after harvest is greater than in other parts of New Zealand.



Successful treatment of gullies following exotic afforestation (Mangatu Forest)

Future response

While passing judgement is counterproductive, given the considerable risk of high-intensity rainfall events causing further widespread hill slope failures, soil loss and resultant decline in productivity, much of Tairāwhiti's steep hill country is either one storm away from becoming unsustainable or less sustainable with each passing storm. The cumulatiive response to past and future storms will ultimately dictate the longevity of land-use sustainability across large areas of this region.

The current 'erosion status' assigned to many of the land-use capability units will have changed for the worse.

Slopes with the highest susceptibility to storm-initiated shallow landslides within Tairāwhiti also have the greatest probability of delivering sediment and woody debris to stream channels (referred to as 'Interim Transition Zone'). In excess of 30,000 ha (20% of the region's exotic forest estate), and an additional approximately 30,000 ha of pastoral land considered unsuitable for intensive stock grazing, are likely to be transitioned to a permanent vegetation cover comprising indigenous and/or alternative species, with or without the prospect of harvesting (Gisborne District Council, 2025).

The transition period is expected to take several decades during which time storms of equivalent and/or greater magnitude than Cyclone Gabrielle will be inevitable. As evidenced following that cyclone, and also likely to be a consequence of future storms, the current 'erosion status' assigned to many of the land-use capability units will have changed for the worse.

Mitigating impacts of future high-intensity rainfall events will therefore require the:

- Establishment of further areas of production forest, both exotic and/or indigenous species
- Integration of different forms of afforestation into pastoral systems to create a mosaic of land-use types that include woodlots
- Retention and protection of areas of existing indigenous forest and shrubland, and
- For areas where current land-use and management practices are deemed unsuitable, the establishment of a permanent woody vegetation cover.

The success/failure of future mitigation measures will therefore require a change in the policy approach towards establishing 'protection forests' using regional-specific and well-targeted actions. This is principally designed to promote the long-term protection of 'on-site values' (land, soil, existing vegetation cover) against declining sustainability, rather than the protection of 'downstream values' (productive land, infrastructure). Over time, this will also build greater resilience against storm-initiated erosion, further mitigate their environmental, economic and social impacts, and negate the need for costly restorative actions.

A positive outcome from Cyclone Gabrielle is the recognition and acceptance that pastoral farming and exotic forestry as monocultures are not always sustainable as stand-alone land uses in certain landscapes. Unless

Aggraded riverbed after Cyclone Bola – the bridge (over the Raparapaririki River inland of Ruatorēa) is now buried under several metres of gravel

'high-risk' areas are future-proofed against worsening erosion they inevitably become an increasingly significant source of sediment, more difficult and costly to treat, and in places become untreatable and an increasing threat to downstream values.

'Unless high-risk' areas are future-proofed against worsening erosion they inevitably become an increasingly significant source of sediment.

'Prudent management should identify the values at risk and direct erosion control activities towards processes most likely to affect those values. Steep land erosion is controlled most effectively – both in physical and economic terms – by preventive land use practices rather than corrective action. Management of steep land erosion is merely the appropriate application of varying levels of care and caution when dealing with terrain of varying erosional sensitivity.'
(Ziemer, 1981)

Fundamental to developing and implementing a fit-for-purpose remedial action programme will be a regionwide re-evaluation of the erosion susceptibility of 'high-risk' areas using high-quality, spatial, multi-layered environmental information in combination with AI-driven models. This will generate adaptive, multi-land-use management plans that best suit primary hill country sector groups at an operational level, and the key to which will be the long-term security of funding.

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