
Adverse Weather Events
The Implications for forestry ?
Why?
And
What if anything can be done?

Houston…

we have a problem!!

- *Adverse weather events are not new to forestry nor to New Zealand's landuse in general*
- *They are the reason many of our forestry areas were created.*

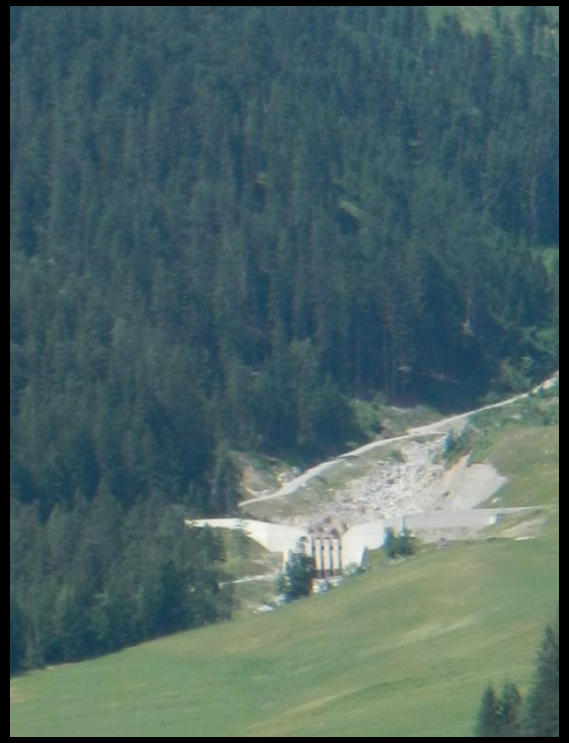
But

- *Recent storms and in particular those that resulted in the mass debris depositions in Tolaga Bay and subsequent prosecutions has highlighted that the spotlight is very focussed on this industry and some things will have to change!*

Adverse weather events - Internationally

They are a nothing new!

- *Mallorca Spain about the same time as Tolga Bay – 200mm in 4 hours.*
- *Tolaga was approx. 75% of the Mallorca accumulation over the same time period with peaks of 50mm/hr sustained.*



Anticipated in Austrian forested areas

https://www.youtube.com/watch?v=oH_Ed6UWxuY

Not anticipated in Spanish town

Adverse weather events – In Native Forest

Aftermath cyclone Ita – Kahurangi NP
Not unduely different to clearfell

Downstream – delivery of woody debris to estuary

Adverse weather events – In hill country farms

Wairoa District – early / mid 2000's

Gisborne & Wairoa Flood Recovery Assessment | *August Report 2022*

Gisborne / Wairoa District - 2022

Foreseeable? Risks should have been managed?

Or the definition of insanity…… "continuing to do the same thing and expecting a different result".

Adverse weather events – In our residential areas

Past severe events such as in TeAroha and Matata have tended to be widely separated in time and space.

But more recently ……Richmond, Piha, Ligar Bay, Marlborough 2021, Nelson / Marlborough 2022

- *Bad luck–careless or new normal!!*

https://fb.watch/eYcgw2ZfiA/ *Devonish Pl Nelson Aug 2022* *Credit: Martin De Ruyter/Stuff*

Defining difference in tolerance

Bad luck! - Tolerance

Careless / Negligent - Intolerance

The discriminating difference is…. woody debris ….from exotic forests

Implications – we do have a problem…Houston?

Secn15 RMA

Illegal to discharge a contaminant to water or onto land where it may get into water without a consent to do so.

Basis of forestry prosecutions.

Most people who have experienced storm events of this nature (50mm/hr sustained) will know that there is very little that is not water or sited on land where it is /will get into water.

Credit Martin De Ruyter Stuff

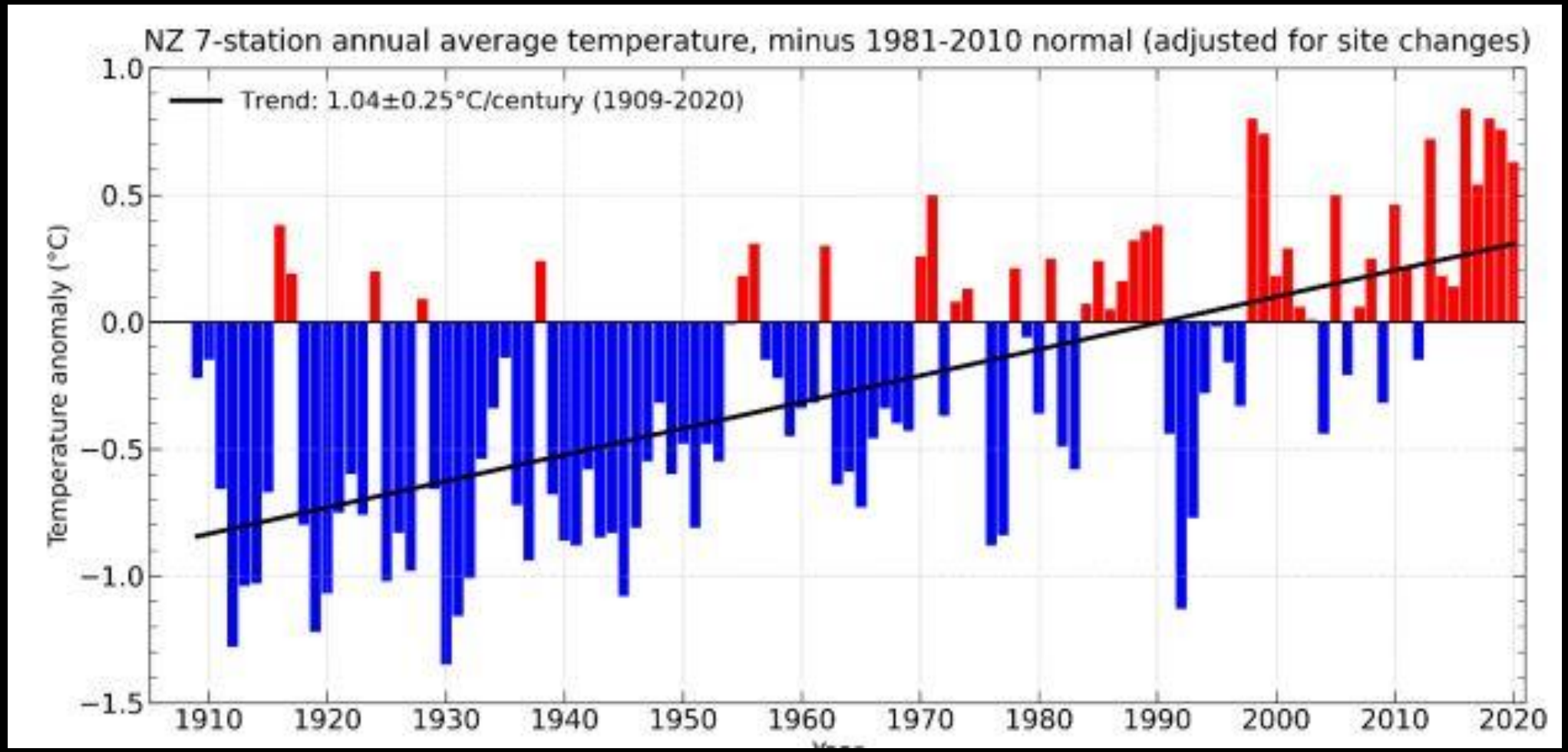
Underlying drivers

- *Steep topography – Historically forests confined to "(Pastorally) unproductive land – by policy and price.*
- *Plantation afforestation was the (policy response) …to avoiding the insanity of pastoralism on erodible lands.*
- *Weak geology (mudstones, separation point granites, loess).*
- *Skeletal soil (Thin soil mantles over impermeable substrate –not productive in pasture.*
- *Large trees.*
- *Practitioner risk recognition*
- *Management practice execution.*
- *Long and intense storm events*

Existing forest- Response options	
	Fixed
	Constrained
	Available
	Random-no control

Long and /or Intense storm events.

If it was unexpected in prior times it is unlikely to be in the future. While natural variation is normal – few can be confident that the current trajectories (world wide) are encouraging.



Credit: Niwa Annual Climate Summary 2021

Risk recognition

Do enough individuals understand what were dealing with?

Failure to recognise nor understand the power and destructive capability of a debris flow or flood.

- *A landslide may wash away after temporary damming.*
- *A landslide carrying debris will erode the sides of a stream channel to bedrock, successively and cumulatively entraining the soil, rock and vegetation in its path and getting larger and larger in volume until reaching gentle open topography where the energy can be dissipated.*

Credit: :Landcare Research Ltd

Takaka / Golden Bay: Native catchment

Risk recognition

- *Extremely dangerous*
- *Very powerful*
- *Fast*
- *Difficult to stop*

Drivers- Skeletal soils

Typified by:

- *Shallow soils*
- *Impermeable (often soft) bedrock*

In high rainfall ……

- *Infiltration to bedrock*
- *Pore spaces fill and pore pressure rises*
- *Soil strength weakens or fails completely (liquefies)*

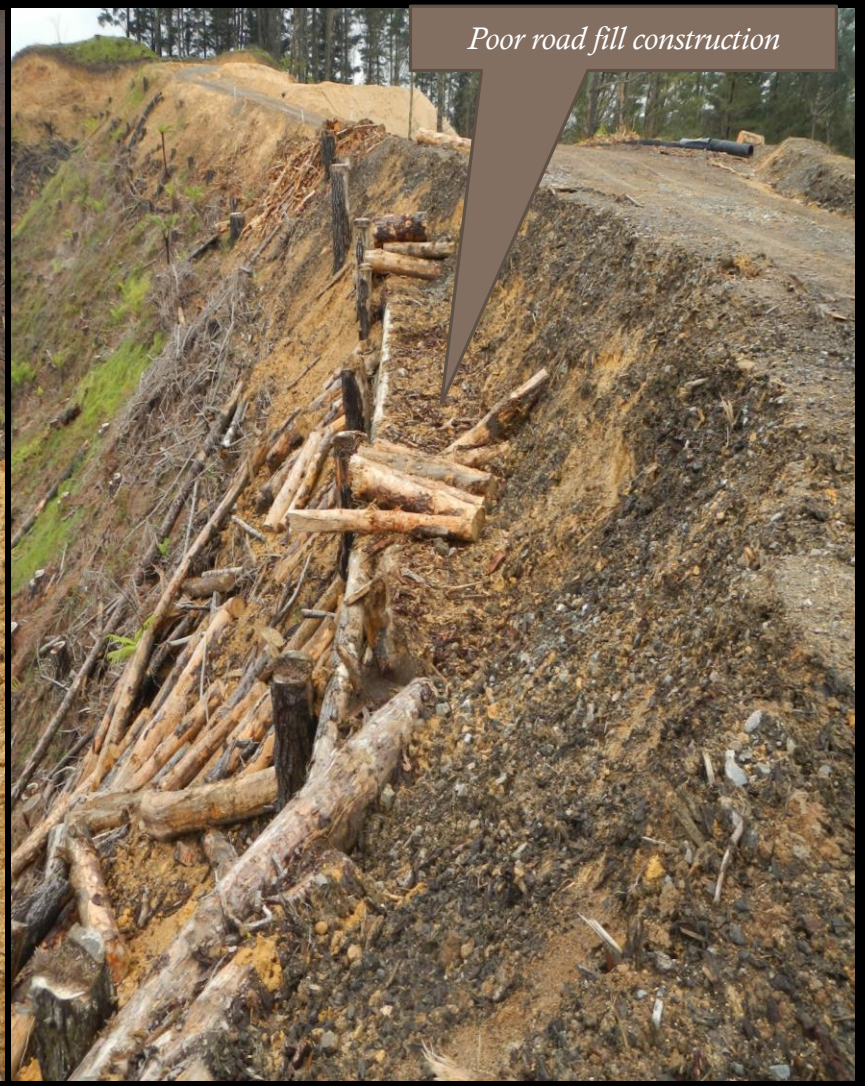
Drivers – Big Trees

Areas of windthrow – big trees on shallow skeletal soils suffered a high density of landsliding delivering woody debris to stream channels.

Upended root plates provided a direct pathway for water to the interface between impermeable bedrock and weak soils.

Drivers -
Management practice execution -
Slash

Drivers-
Management practice execution -
Engineering



Ways forward

As we see repeat events at well above 5% AEP and likely to increase in frequency, landsliding is inevitable and in forested catchments, woody debris will be mobilised!

How can the industry respond?

2 major pathways…..

- *"Avoid" (new forests)*
- *"Isolate" (existing forests)*

In this context what do I mean by Isolate?

To apply excellence in risk based operational execution combined with improved riparian management, limited strategic withdrawal (retirement) and spatial fragmentation so that when and if landslide events occur in severe weather there are limited grounds for prosecution. i.e bad luck!!

New Afforestation

New afforestation is a unique opportunity to avoid the mistakes of the past……

- *Focus on risk ID*
- *Landscape scale planning*
- *An eye to the future – e.g will anyone be harvesting across streams in future.*
- *A recognition that increasing proportions of currently available land banks may not and should not be planted*

Physiographiic Conditions	Landform	Species characteristics	Harvest Access	Harvest systems	Stream morphology	Riparian development	Downstream
Steepness	√	√	√	√	√	√	√
Weak Geology	√	√	√	√	√	√	√
Skeletal Soils	√	√	√	√	√	√	√
Storm History	√	√	√	√	√	√	√

Landscape scale planning

Current mapping, good photography and remote sensing data firmed up with ground truthing can tell us a lot!!

- *What is the storm history?*
- *Where could roads go?*
- *Should areas be retired?*
- *Where should riparians go and should they be expanded?*
- *What tree would be in the right place?*
- *What does stream morphology indicate about debris transport risk?*
- *What are the downstream offsite risks?*
- *How likely will it be to be able to harvest in 26yrs time if you have to pull across a stream?*
- *<u>How much is this land actually worth</u> and is it worth the risk?*

Existing forests

Existing forests provide a much greater challenge. Some of the preconditions of risk are fixed and the opportunities for change often constrained……

- *Focus on risk ID*
- *Operational performance and execution.*
- *Riparian and land retirement planning (within the constraints of the ETS).*
- *A recognition that some proportions of some estate lands may not and should not be re-planted. (do they make economic sense anyway?)*

Physiographiic Conditions	Landform	Species characteristics	Harvest Access	Harvest systems	Stream morphology	Riparian development	Downstream	Harvest Pattern	Retirement
Steepness	Na	√	Constrained	Constrained	Constrained	√	Constrained	Constrained	√
Weak Geology	Na	√	Constrained	Constrained	Constrained	√	Constrained	Constrained	√
Skeletal Soils	Na	√	Constrained	Constrained	Constrained	√	Constrained	Constrained	√
Storm History	Na	√	X	X	Constrained	√	Na	Constrained	√

So your going to have an event? – Operational execution matters!

Read your consents!!

Slash: Must not be over the edge and irretrievable. Carting away if necessary – esp slovens

Post ops. ditto and dig out the bark!!

Forestry practice guides/ FOA engineering & Practice guides. They are the bible- you put them on the altar and pray to them!

The rules – 25-35 deg bench and compact! >35deg "end haul"!!

Skids must have "positive drainage" and a backup

Tracks – cutoffs after use especially when connected to skids.

Water must be controlled and cross culverts flumed

Records - Audits, incidents, internal inspections, skid checks, photos, observations

Caveats……

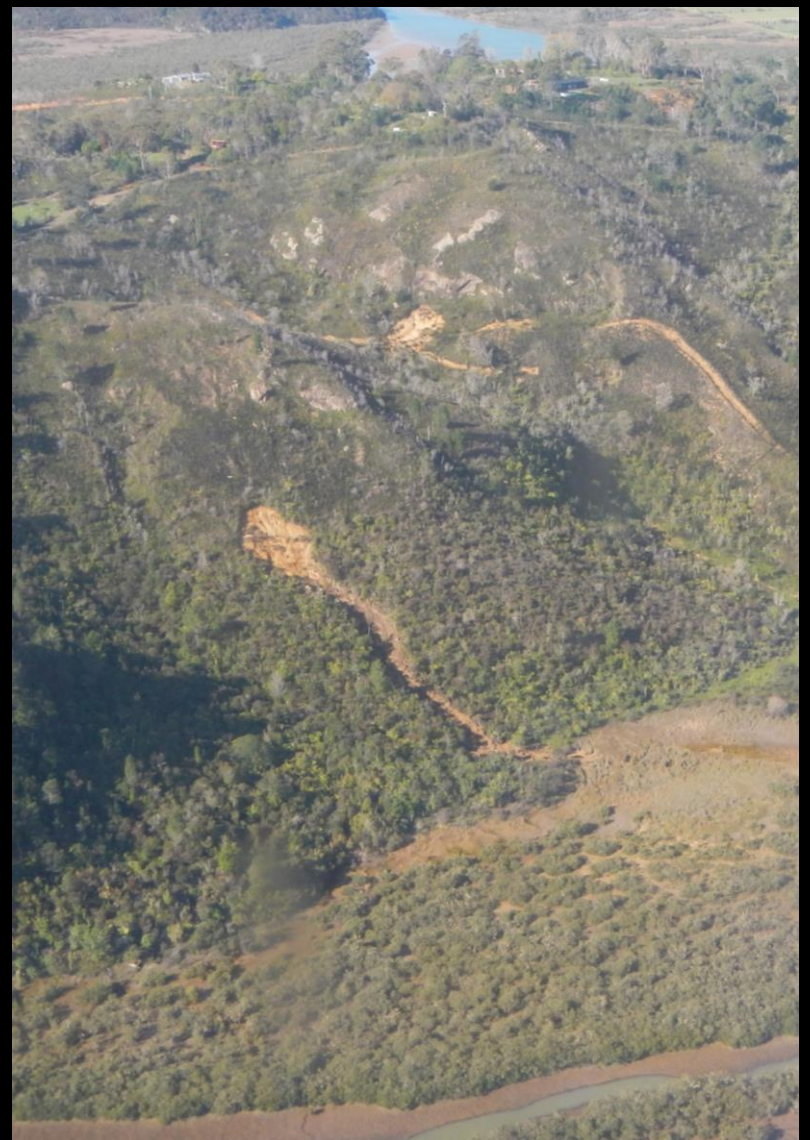
Riparians and retirement

"Rewilding" through retirement reversion, planting or expanded riparians will often not prevent landslides getting to river channels and may contribute woody debris.

But….

Their presence may help sometimes and should re-orientate the narrative from negligent to "bad luck"!

There may be a case for creating structurally stronger secondary buffers around native riparians to assist landslide resistance.



Caveats……

Harvesting patterns

By the nature of much past afforestation, harvesting progresses over the landscape at a rate slower than the initial planting.

At the first harvest – there may be some opportunities within the limitations of infrastructure progression to fragment the cutting pattern.

In the second rotation that opportunity is further expanded.

But….

As Tolaga Bay demonstrated, almost all streams up to first order initiated debris floods.

Areas of windthrow which may be exacerbated in a patchwork harvest also appeared more prone to landslide initiation.

There is an case for looking at fragmentation but its success will be highly dependent upon the landscapes involved, the coverage of the storm event (localised or widespread) in relation to the spatial layout of the forest(s) and catchment(s) involved.

Other opportunities – Soft engineering

Possibilities over and above hard engineering e.g debris traps

Wetlands

Rivers no longer entrained: RH: Artificially created wetland with tall reeds and developing wetland scrub – zero slash exited catchment.

LH: Adjacent catchment ….could horseshoe bend be adapted to enhance a natural wetland entrapment capability?

Problem…. Wetlands (even artificially created) become SNA

Other opportunities – Soft engineering

Possibilities over and above hard engineering e.g debris traps

Structural reinforcement of floodplains

Larger clusters of spaced trees in strategically located low energy sites could add benefit. Preferably relatively fast growing (but not promoting radiate).

Problem…. Riparian setback requirements -

We are entering a new normal where assumptions about the future, based on the past may not be reliable.

People from all walks of life are going to have to start rethinking their decisions!