Recovering from Disaster

Tim Sandall General Manager - Forests

An Integrated Forest Products Company

- Forests: 36,000 ha – growing high-quality pruned trees
- Sawmills: 530,000 m^3 lumber – emphasis on appearance grade Lumber
- Bleached Chemi Thermo Mechanical Pulpmill: 270,000 adt – board grade
- Biomass boilers: 250,000 GT biomass, 200 GJ of thermal energy
- 13.5 MW electrical generation
- Contributes 6% to Hawkes Bay GDP
- Approximately 3,000 direct, indirect and induced employees
- Converts $150M of logs into $450M in value-added products each year

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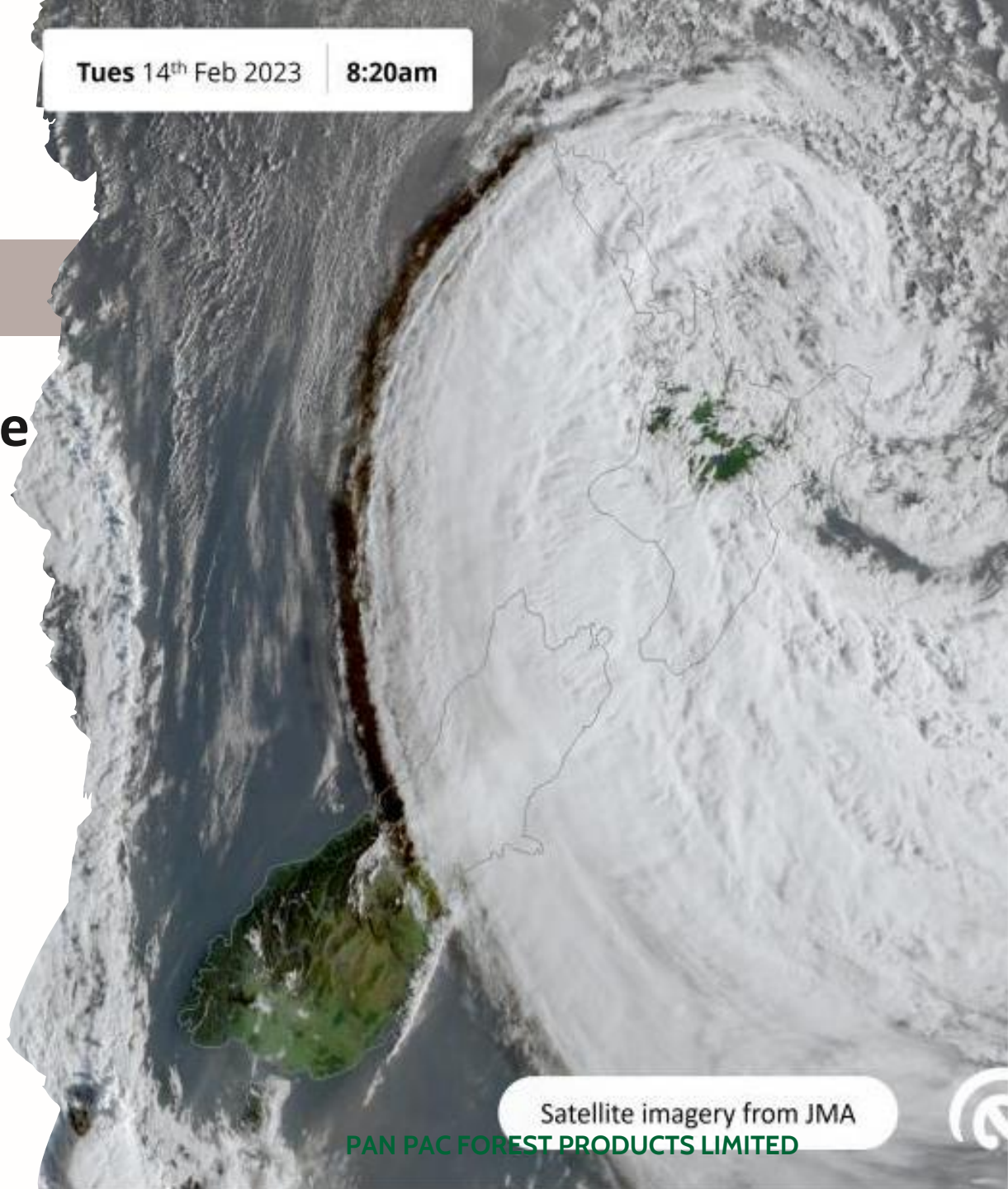
Lead up to Cyclone Gabrielle

- **12 Months of high rainfall & Cyclone Hale**
- **Thursday 8** – it's on our radar
- **Friday 9** – Prepare to close Forests
- **Sunday 12** – Prepare to close sawmill
- **Monday 13** – Prepare to shut down pulpmill and site
- **Approx. 8pm only 6 people on site**



15 February Whirinaki

On Site Rescue

February 2023 Esk Valley

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Pan Pac Workers' Experience

No words required

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4.5% of Forest Estate Damaged

Mix of Slips, Windthrow and Sediment

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Culvert Damage

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$300+ Million Damage

- $150M – Equipment, buildings & vehicles
- $100M – Business Interuption
- $47M – Tree Crop & Forest Infrastructure
- $10M – Stores & Parts Inventory
- 22 Electrical rooms flooded
- 60% - of pulp and Lumber Stock damaged

Cyclone Recovery Stats

- 75,000m3 of silt removed
- 835 culverts built/replaced
- 200+ roads restored
- 700 workers on site per day
- $10M of equipment purchased/week
- $500k invested in Whirinaki Resilience
- 38K GT of Export Wood chip
- NO STAFF LOST THEIR JOB

Plan for Recovery

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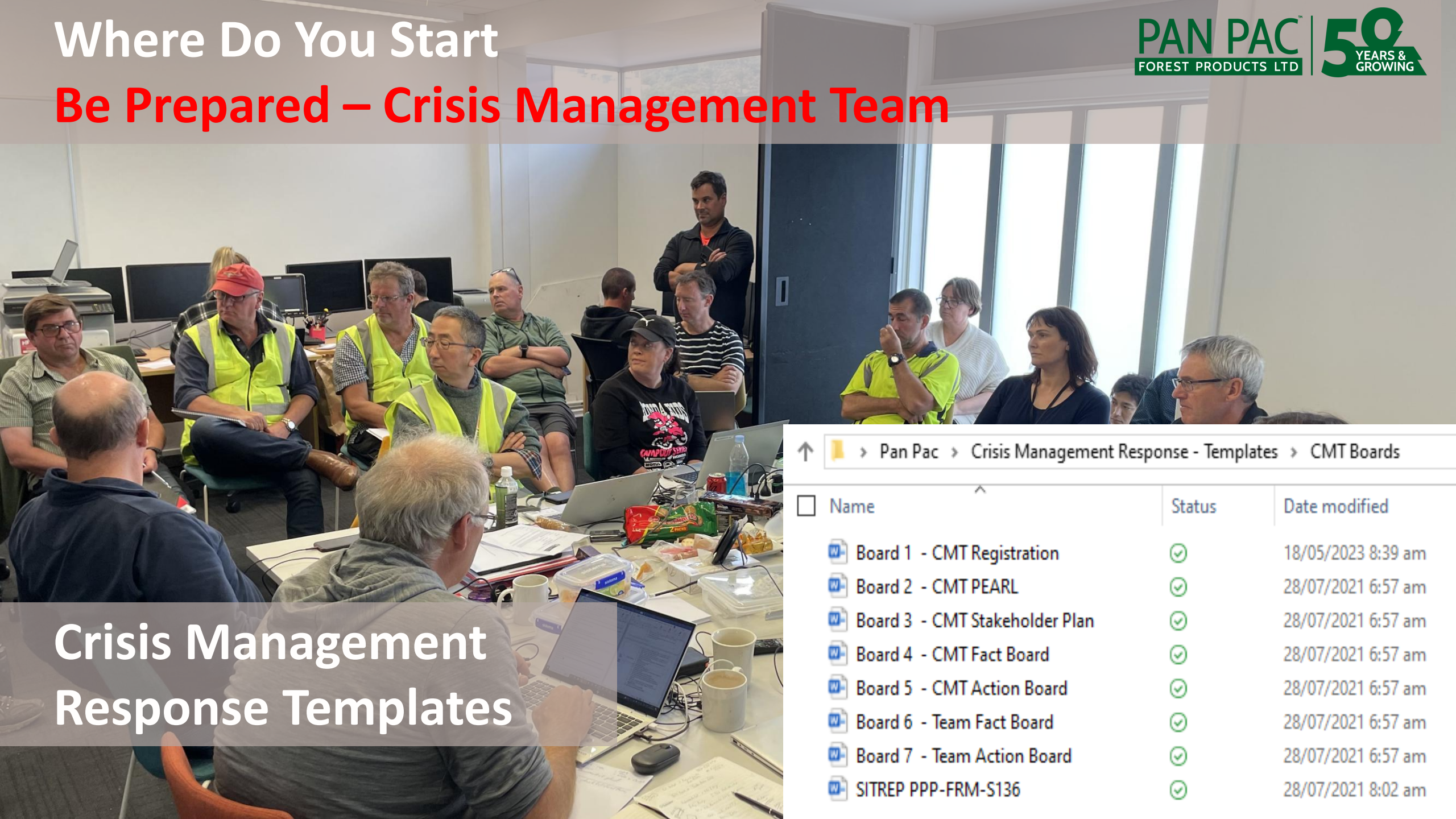
Where Do You Start

Be Prepared – Crisis Management Team



Crisis Management Response Templates

Pan Pac › Crisis Management Response - Templates › CMT Boards

Name	Status	Date modified
Board 1 - CMT Registration	✓	18/05/2023 8:39 am
Board 2 - CMT PEARL	✓	28/07/2021 6:57 am
Board 3 - CMT Stakeholder Plan	✓	28/07/2021 6:57 am
Board 4 - CMT Fact Board	✓	28/07/2021 6:57 am
Board 5 - CMT Action Board	✓	28/07/2021 6:57 am
Board 6 - Team Fact Board	✓	28/07/2021 6:57 am
Board 7 - Team Action Board	✓	28/07/2021 6:57 am
SITREP PPP-FRM-S136	✓	28/07/2021 8:02 am

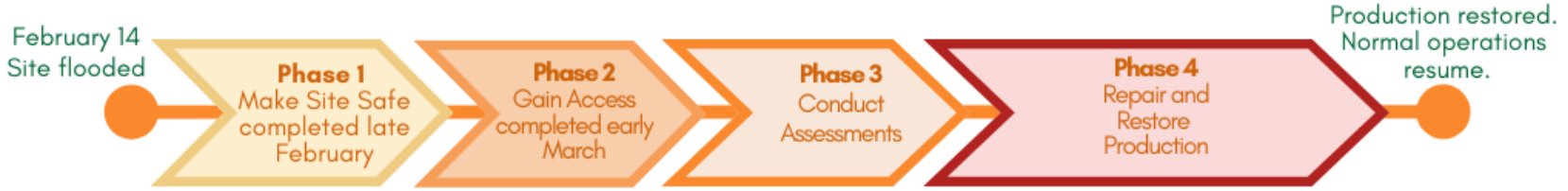
17 Feb – Four Steps of Recovery Defined

Phase 1 – Make sites safe

Phase 2 – Gain Access

Phase 3 – Conduct Assessments

Phase 4 – Repair and restore Production



Project Phoenix was Born

- Project charter drawn up.
- Clearly defined roles and responsibilities.
- People seconded into roles
- Specialist project managers and flood recovery expertise sought.
- Budgets and timelines drawn-up and constantly monitored and reviewed.

Engagement

Prior relationships are critical

- Government at a National and Local Level
- Local Regulatory Authorities
- Iwi and Iwi land owners
- Communities

Forests Response

- Follow the four steps to recovery
- Gave staff and contractors guidance
- Prioritised work based:
  - Make the forests and communities safe
  - Where will be able to stand up operations
  - Make safe access
- Reallocated responsibilities
- Rebuild with increased resilience
- SWELA *(Severe Weather Emergency Recovery Legislation Act)*
- Silt and Debris recovery task force
- NZFM support
- Offices for staff

Kaweka – Kuripapango Rd

Kaweka – Kuripango Rebuilt

Gwavas – Wakarara Culvert

Gwavas – Tin Hut Culvert - Before & After

Contractor SCL won an award for this work

Gwavas – Allan Rd Culvert, Before & After

Gwavas – Dutch Creek Bridge Before

Mohaka – Anaura Bridges

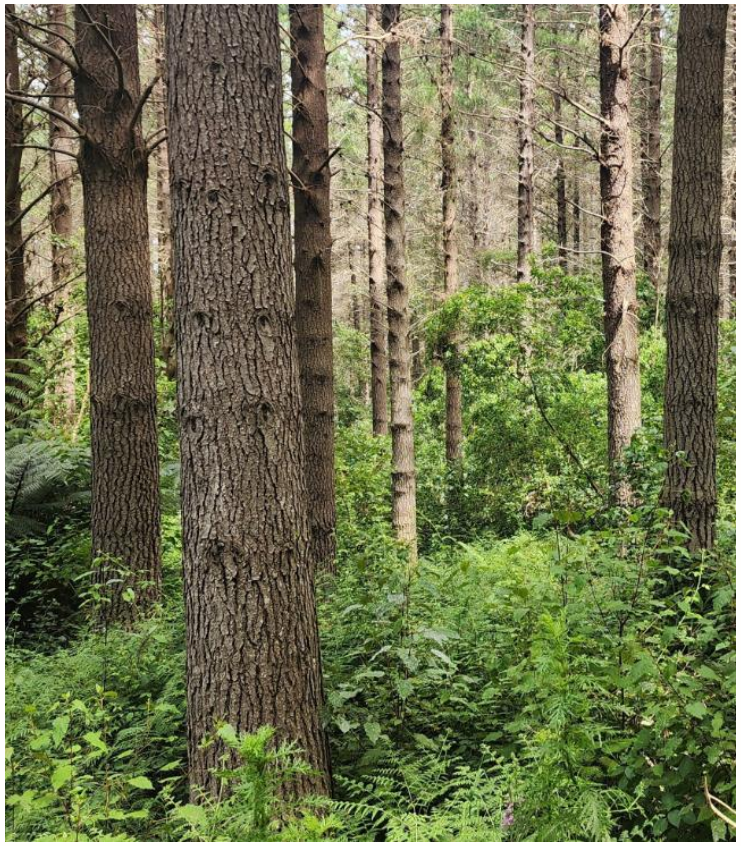
Mohaka – Anaura Bridges Completed

Where are we today….

- Lumber Operations started in early 2024 – currently at 85%
- Pulp Operations started April 2024
  Its has been a hard start up; with reliability, electricity and market challenges
- Boilers – 100% operational
- Electrical Turbine – completion April 2026
- Office rebuild under way – completion July 2026
- Stopbank resilience – work about to commence, completion July 2026
- Forest Operations
  - Only a handful of project left
  - Have been harvesting at a higher level
- Rebuilding profitability and balance sheet – long term

What are the lessons

- Be prepared….
  - Have strong, demonstrated values and business philosophy
  - Strong shareholder support
  - Strong balance sheet
  - Practiced emergency response
- Put people and community above all else
- Have good relationships – built on trust, understanding and openness across all stakeholders and partners
- Always consider how you want to come out of this
- Keep regular comms – the good and the bad
- Prioritise & trust your staff and contractors



So, have we emerged stronger?

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Ka pō, ka ao, ka awatea

From within the darkness comes light and a new day

Shaping Landscapes – Landslide analysis from Cyclone Gabrielle in Hawke's Bay.

Ashton Eaves PhD – Senior Land Scientist

NZ Institute of Forestry 2025, 27 – 29 June, Napier.

Session 1: Assessing Cyclone Impact on Forest Ecosystems and infrastructure

HAWKE'S BAY
REGIONAL COUNCIL
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Introduction

- Erosion & sedimentation impacts.
- Farm-scale analysis at Awapapa & Dumgoyne Stations.
- New modelled spatial data products.

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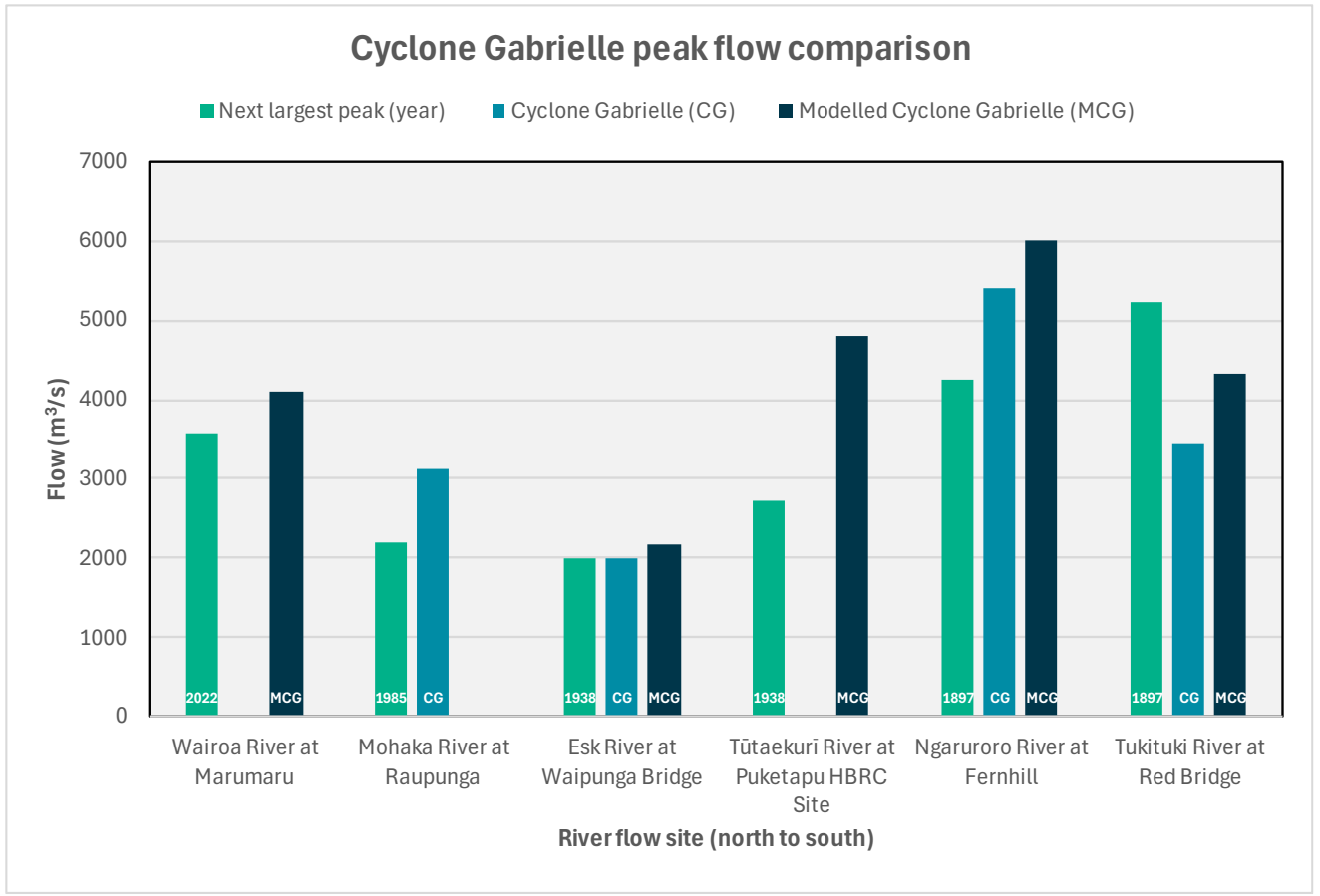
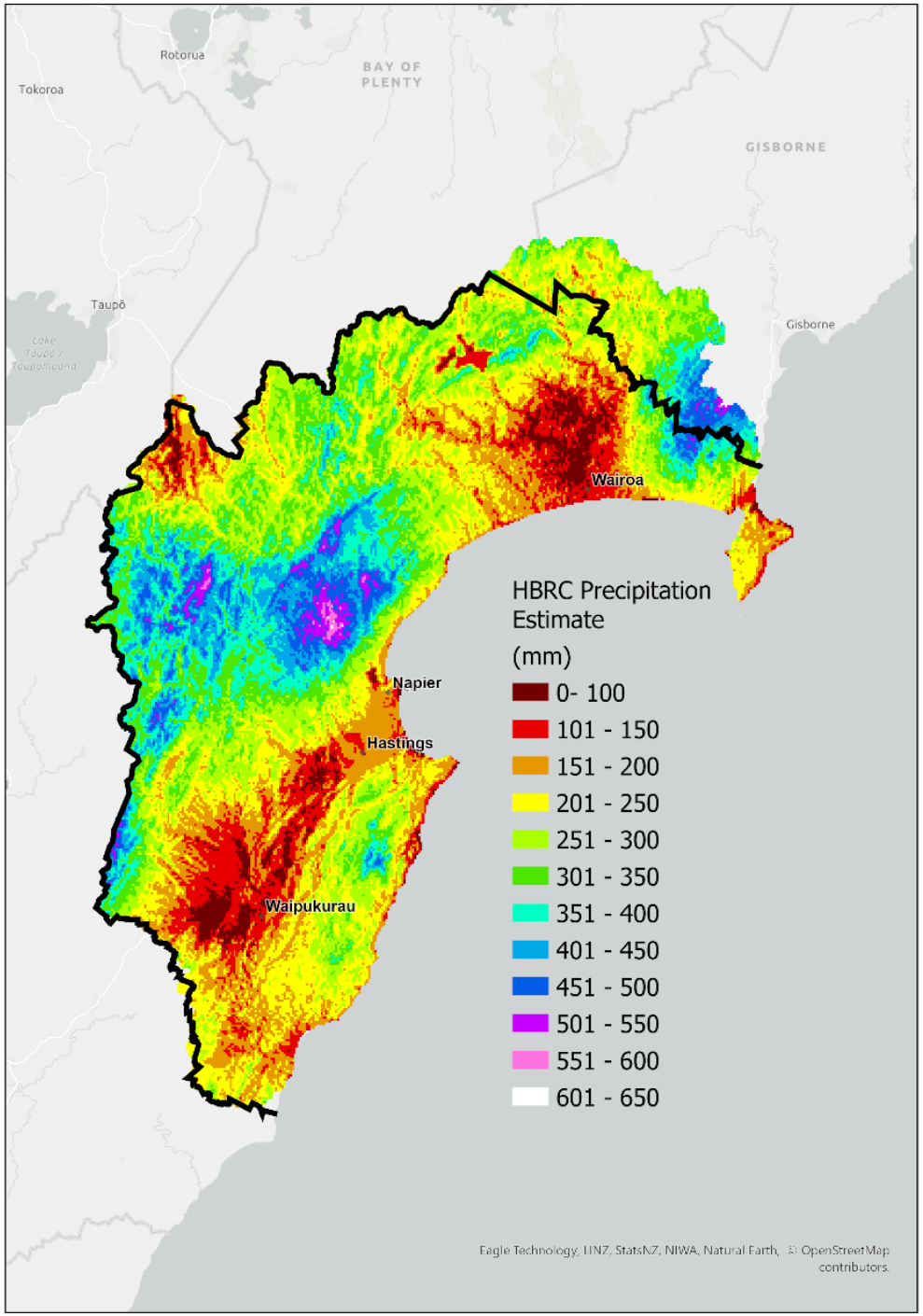
Impacts

- Setting the scene:
  - Rainfall estimates.
  - Peak river flows.





Impacts

- Setting the scene:
  - Hypothetical sediment loads.

Site	Normal Load ($t\ a^{-1}$)	Load By Catchment Area ($t\ a^{-1}\ ha^{-1}$)	Cyclone Gabrielle Event Load (t)	Mean Flow (m^3/s)	Peak Flow (m^3/s)	CG load as percentage of normal
Aropaoanui River at Aropaoanui +	93,220	6	15,117	4.44	134	16%
Esk River at Waipunga Bridge +	115,774	5	737,931	7.05	2,006	637%
Hawea Stream off St Lawrence Road	1,944	1	3,558	0.12	7	183%
Karamu Stream at Floodgates +	143,417	3	287,073	4.1	101	200%
Mangakuri River at Nilsson Road	50,896	7	4,184	0.96	30	8%
Mangamaire Stream at Cooks Tooth Rd	45,650	7	27,930	1.3	218	61%
Mangaone River at Rissington +	129,999	6	1,964,150	6.64	1,393	1511%
Maraetotara River at Waimarama Road	12,647	2	4,307	1.29	137	34%
Ngaruroro River at Fernhill	1,495,003	8	3,699,683	63.78	5,398	247%
Porangahau River at Saleyards +	942,893	14	184,548	14.81	1,299	20%
Sandy Creek at Papakiri +	25,957	13	248,619	0.362	31	958%
Tukituki River at Red Bridge	1,672,278	7	1,362,961	61.48	3,462	82%
Tutaekuri River at Puketapu HBRC Site +*	510,915	7	2,159,201	20.24	4,823	423%
Waiau River at Ardkeen	434,790	3	744,996	65.19	1,656	171%
Waikatuku Stream off Harrison Rd	16,617	18	11,441	0.28	15	69%
Waimaunu Stream at Duncans	11,566	7	5,042	0.53	21	44%
Wairoa River at Marumaru*	2,710,186	15	1,412,675	86.35	4,100	52%
TOTAL	**8,524,808**	**187**	**12,974,589**	**338.92**	**24,831**	

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Impacts

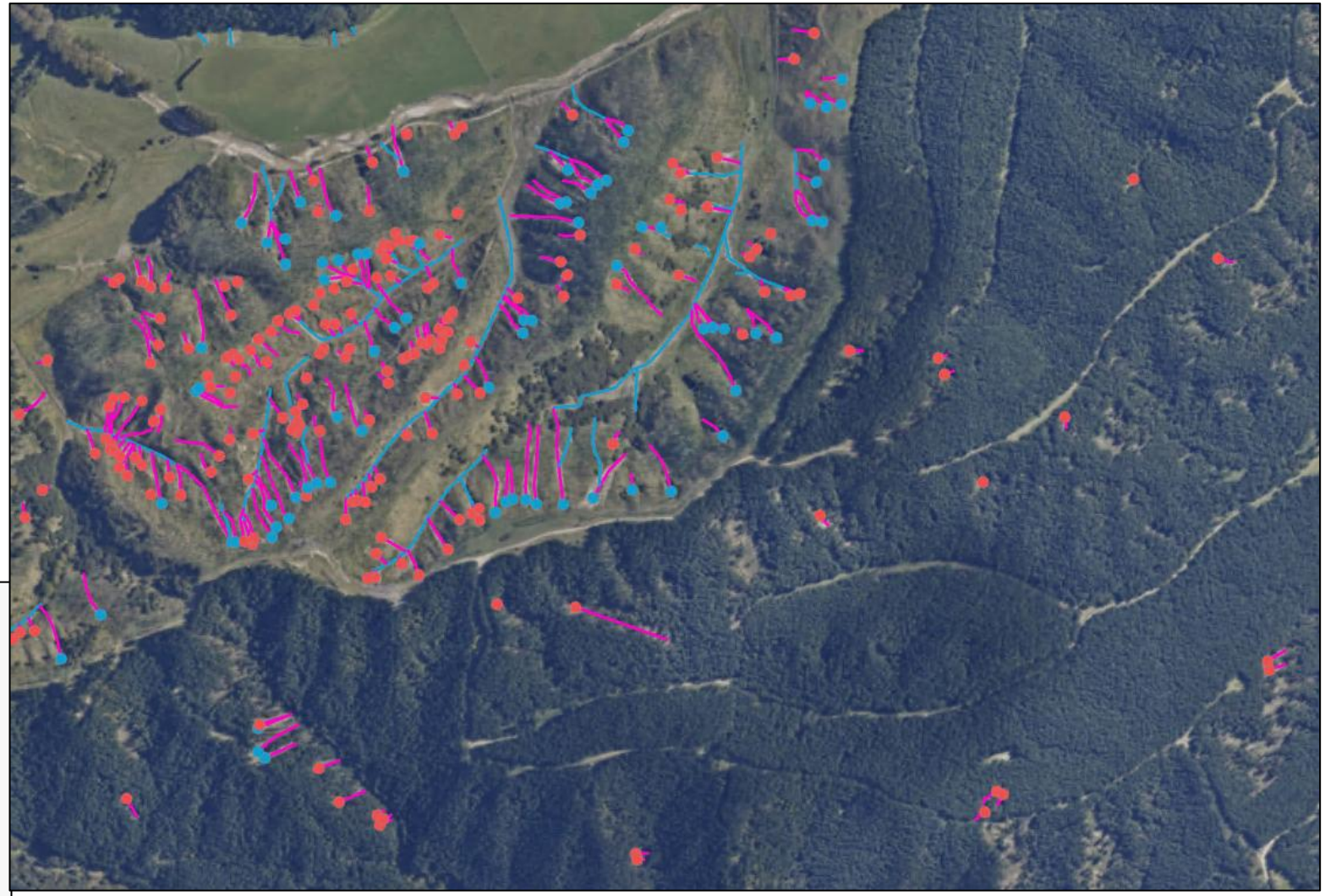
- Manaaki Whenua Landcare Research Rapid Assessment of Land Damage (2023):
  - Over 300,000 landslides along the East Coast, each typically comprising 1,000 tonnes of soil.
  - 61% of damage in Hawke's Bay.
  - Of that, 63% was in High Producing Grassland & 13% in Exotic Forest.
  - Woody vegetation reduced modelled landslide probability by 90%.

Table 1. Area of landslide scars in different land covers, by territorial authority (km^2)

Damage zone	Broadleaved Indigenous Hardwoods	Exotic Forest	Forest - Harvested	High Producing Exotic Grassland	Indigenous Forest	Low Producing Grassland	Mānuka and/or Kānuka	Other	Total
Carterton District	0.04	0.15	0.13	1.11	0.02	0.04	0.10	0.09	**1.66**
Central Hawke's Bay District	0.23	0.48	0.25	27.54	0.17	0.32	0.34	0.93	**30.25**
Gisborne District	1.78	14.36	7.21	20.84	0.53	2.40	2.70	3.30	**53.13**
Hastings District	1.79	12.06	7.77	46.77	0.81	4.64	6.25	2.47	**82.56**
Masterton District	0.13	0.99	1.24	7.75	0.03	0.21	0.32	0.21	**10.88**
Tararua District	0.09	0.60	0.51	17.66	0.06	0.55	0.55	0.32	**20.34**
Wairoa District	0.99	5.26	1.95	10.97	0.36	1.02	1.45	1.15	**23.15**
Total	**5.04**	**33.90**	**19.07**	**132.64**	**1.98**	**9.17**	**11.71**	**8.47**	**221.97**

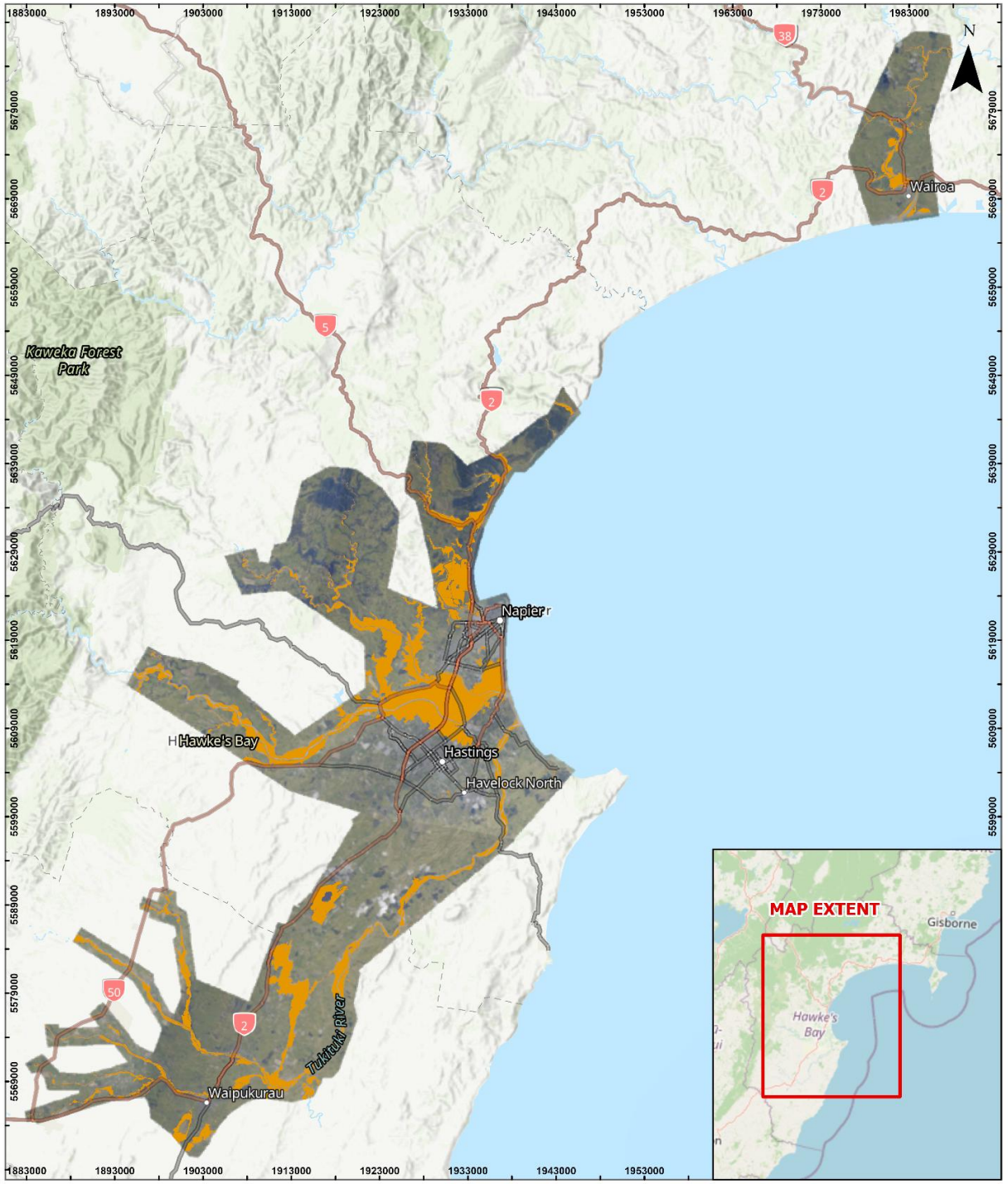
Impacts

- GNS Landslide mapping:
  - Mapped > 85,000 landslide points and debris trails in Hawke's Bay to date.
  - 10,366 occurring in plantation forests (13.47%), or 123 ha.
  - Significant amount of pastoral farmland impacted compared to exotic forestry and native vegetation.



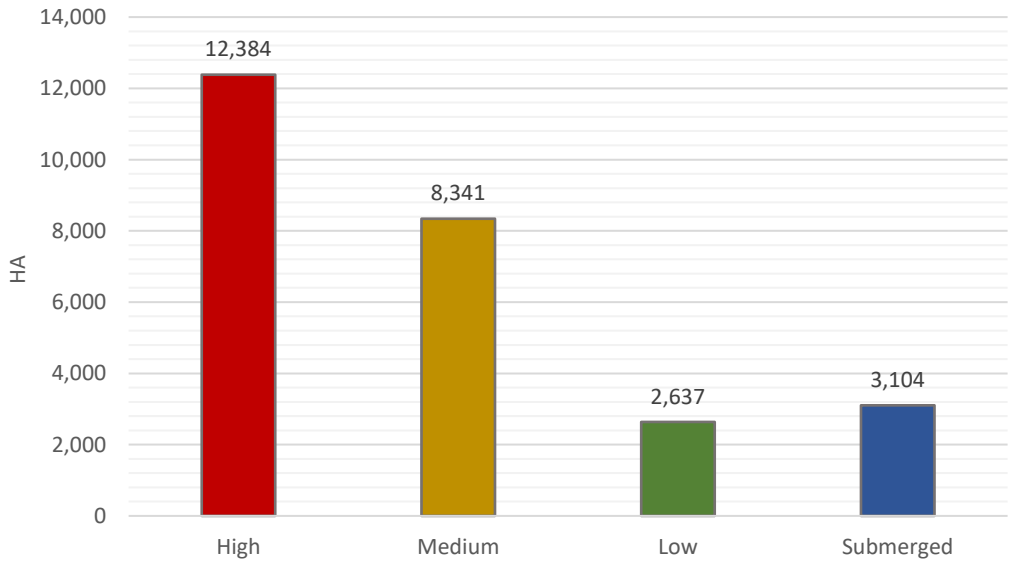
Impacts

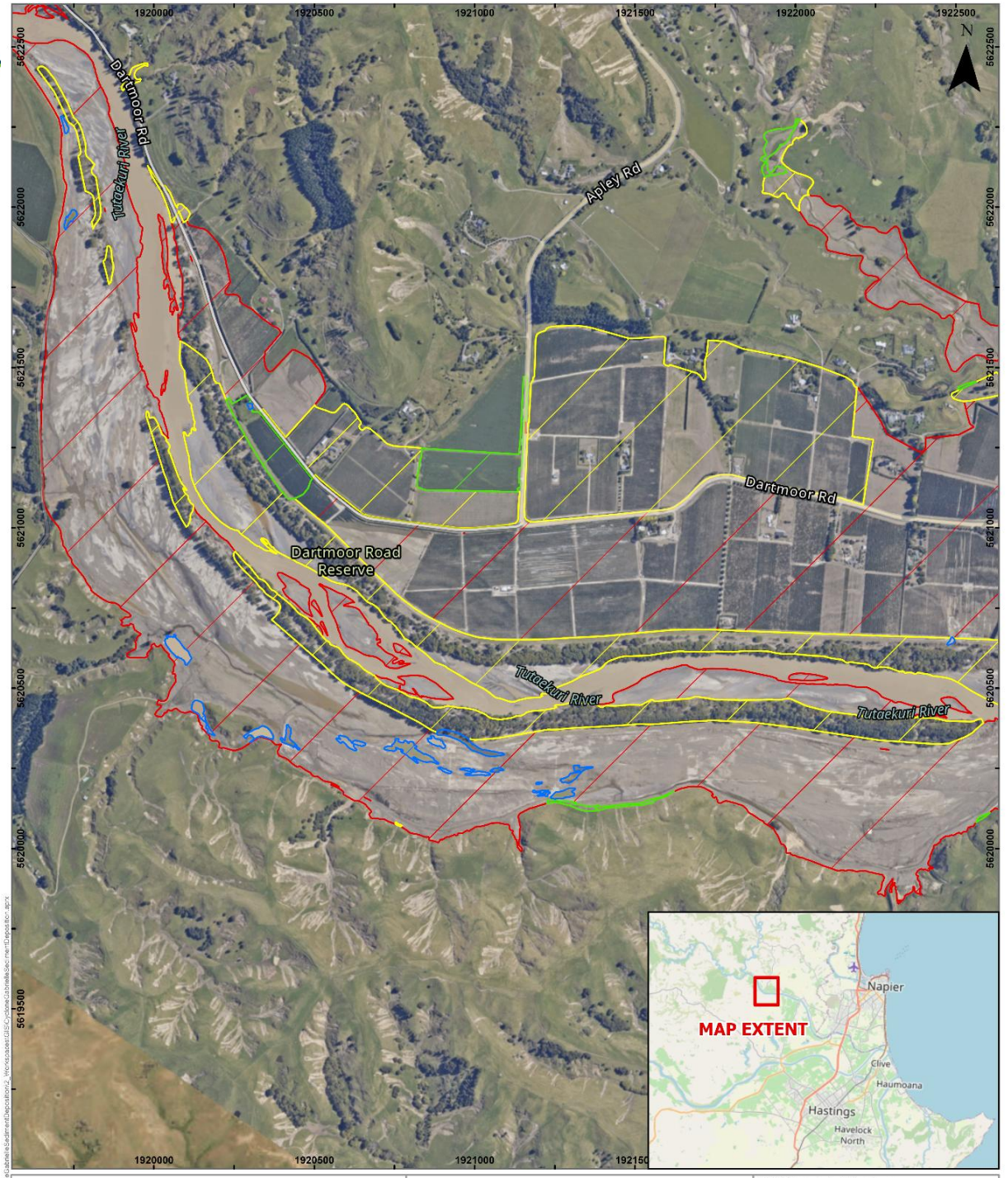
- Sediment deposition mapping:
  - HBRC collected sub-regional aerial imagery to assess the impacts of Cyclone Gabrielle at 10 cm resolution.
  - Mapped the 2D spatial extent of the sedimentation.
  - In total, 26,465 ha were mapped to varying confidence.



Impacts

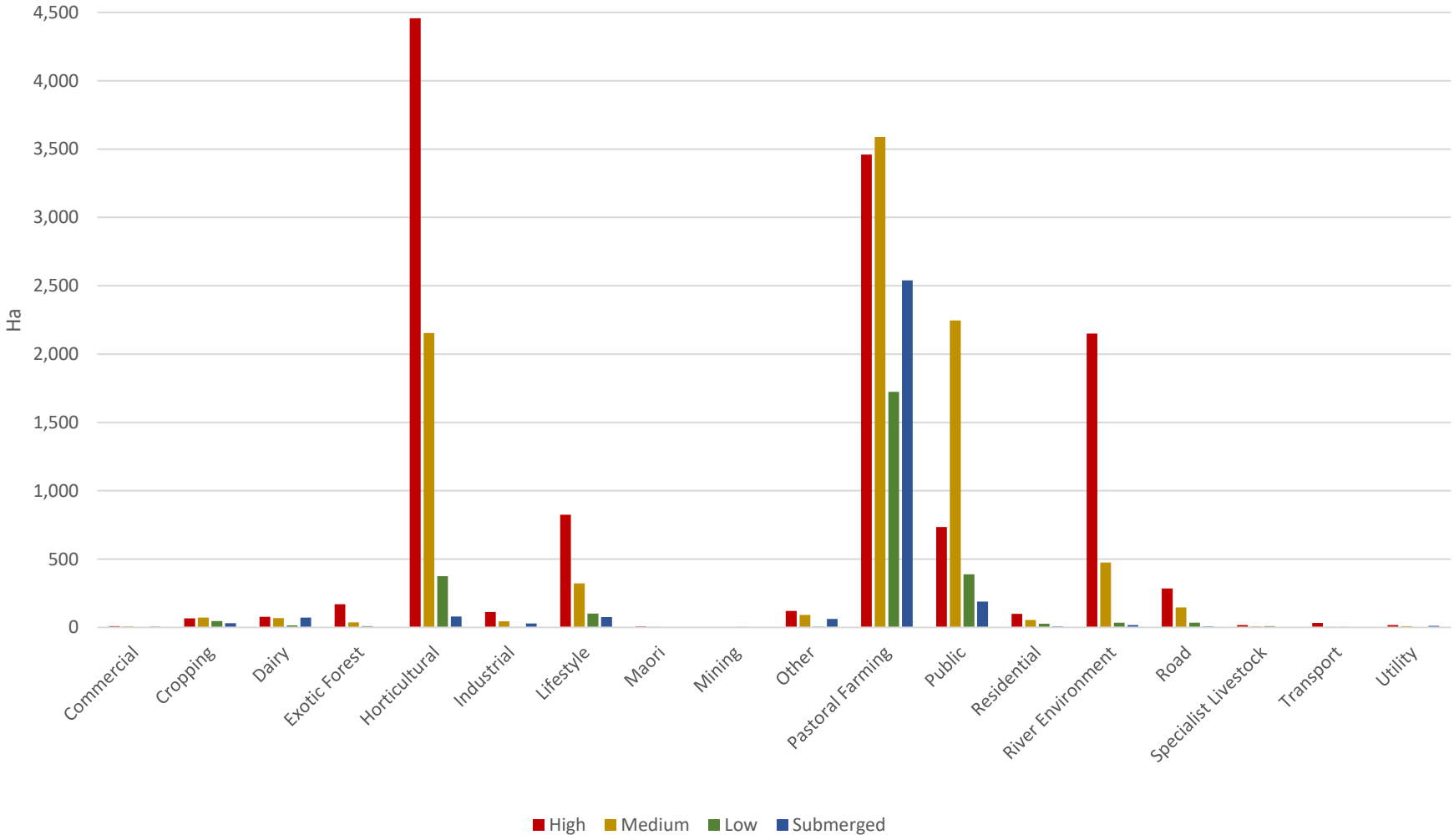
- Sediment deposition mapping:
  - Total area of deposition by confidence.





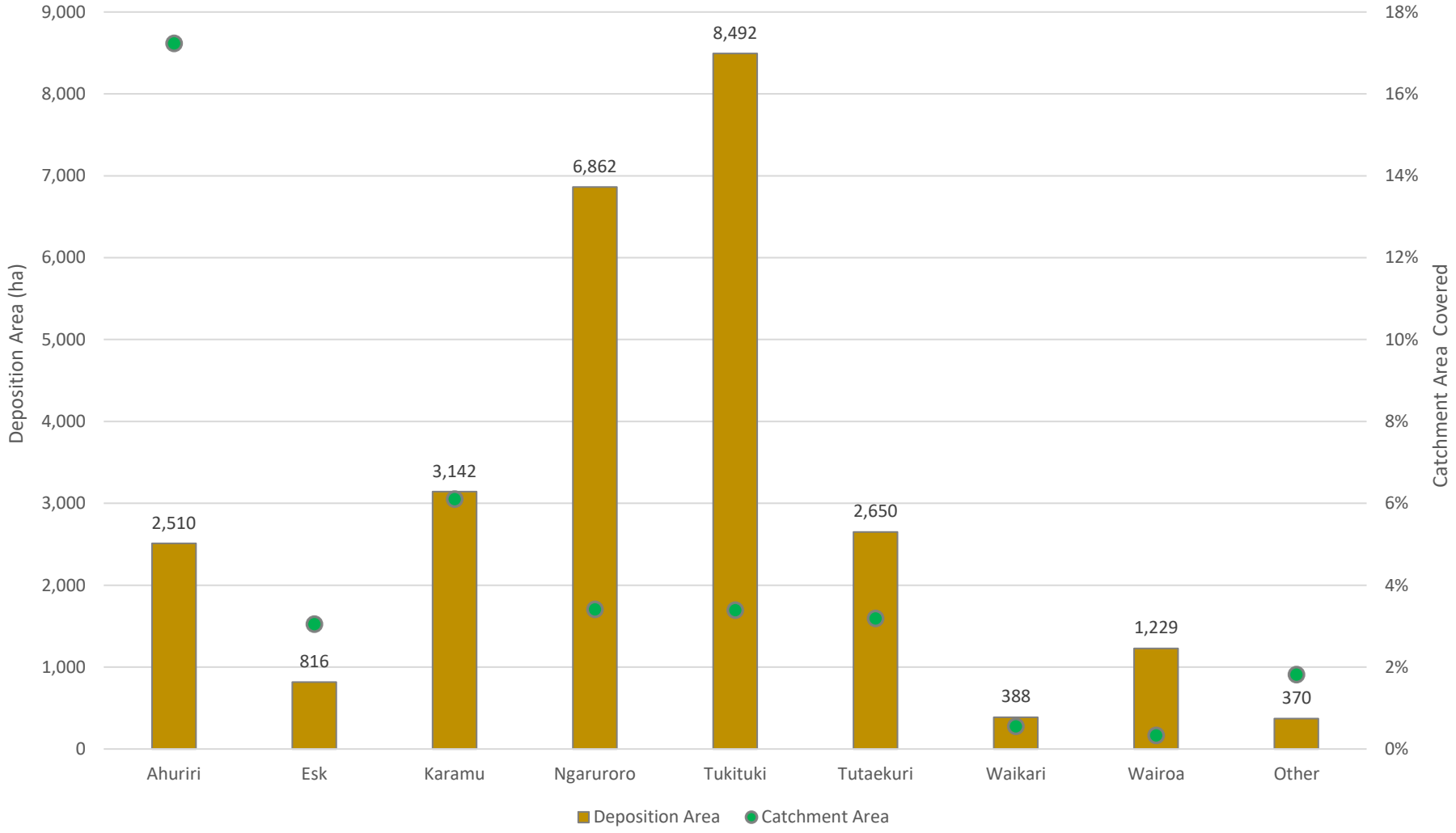
Impacts

- Sediment deposition mapping:
  - Total area of deposition by land use and confidence.
  - Biased by plantations generally on steeper land in Hawke's Bay.



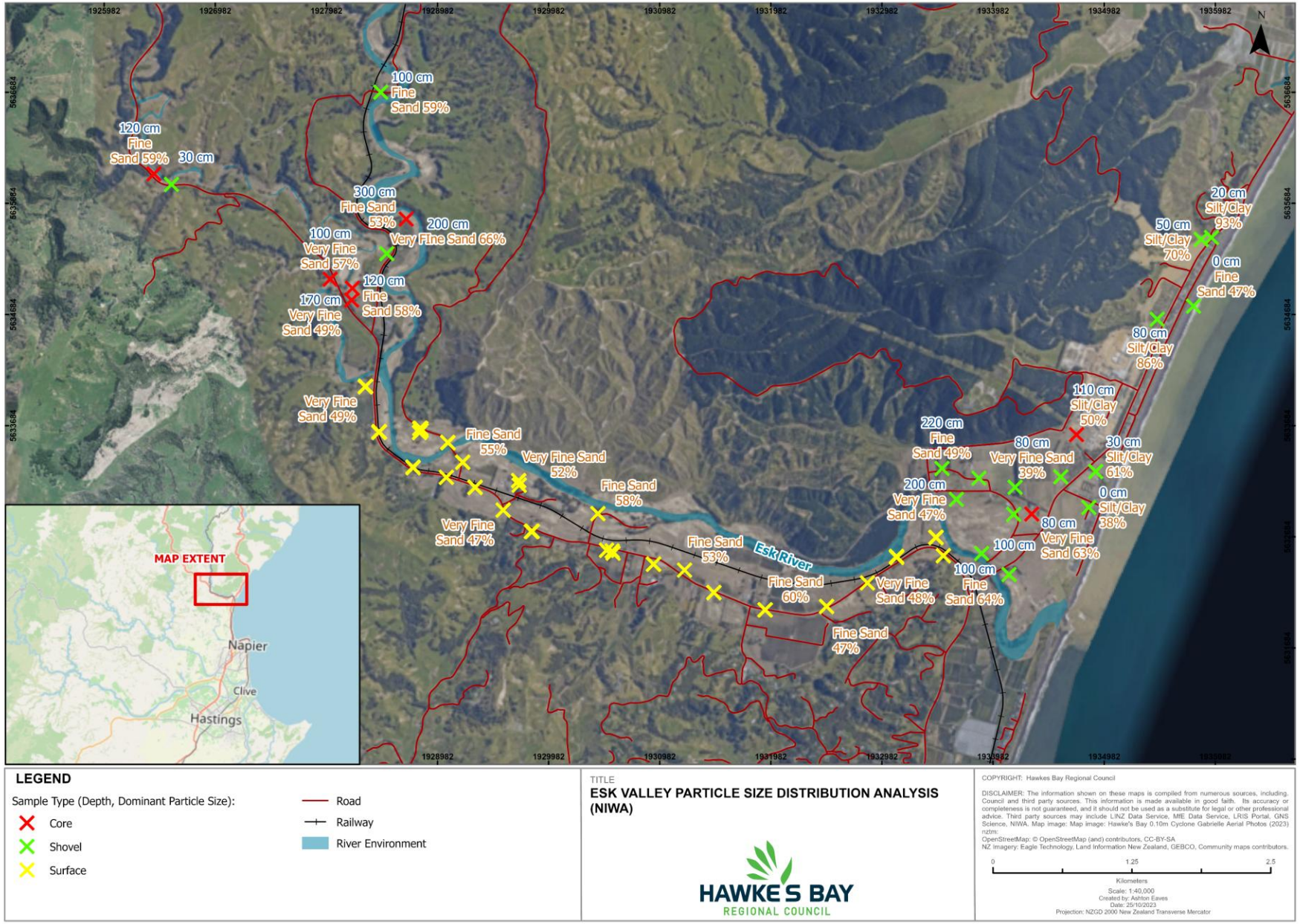
Impacts

- Sediment deposition mapping:
  - Total area of deposition by catchment with the corresponding percentage of the catchment area covered.



Impacts

- NIWA Esk Valley Particle Size Distribution Analysis:
  - Maximum deposition depth from cores was 300 cm.
  - Predominant sediment particle size through main catchment is very fine to fine sand.
  - Predominant sediment particle size at Whirinaki is silt / clay.

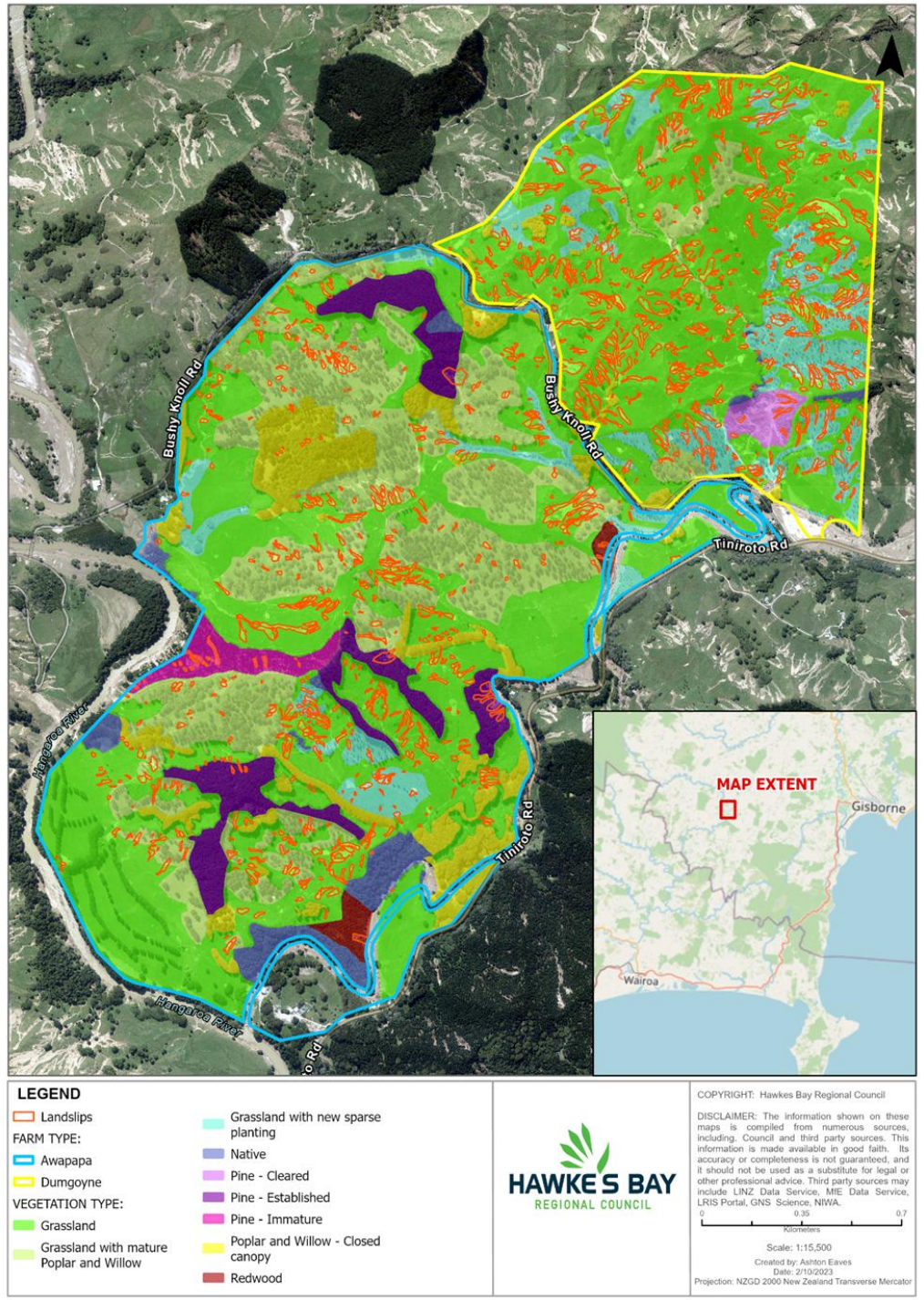


Impacts

- Linden Estate vineyard suffocating in sediment - right
- House relocation (650 m) - bottom

Farm-scale analysis

- Case study Northern Wairoa catchment comparing Awapapa and Dumgoyne Stations.
  - 30% of Awapapa planted in trees following Cyclone Bola & Giselle.
  - Dumgoyne recently purchased with more undulating land and few trees.
  - 1233 slips mapped over 534 ha.
  - Weighting and normalising slips to farm area and slope.
  - Regression analysis confirmed statistical significance at this scale for soil, slope and vegetation against slip area.



Farm-scale analysis

- Awapapa Station - below
- Dumgoyne Station - right

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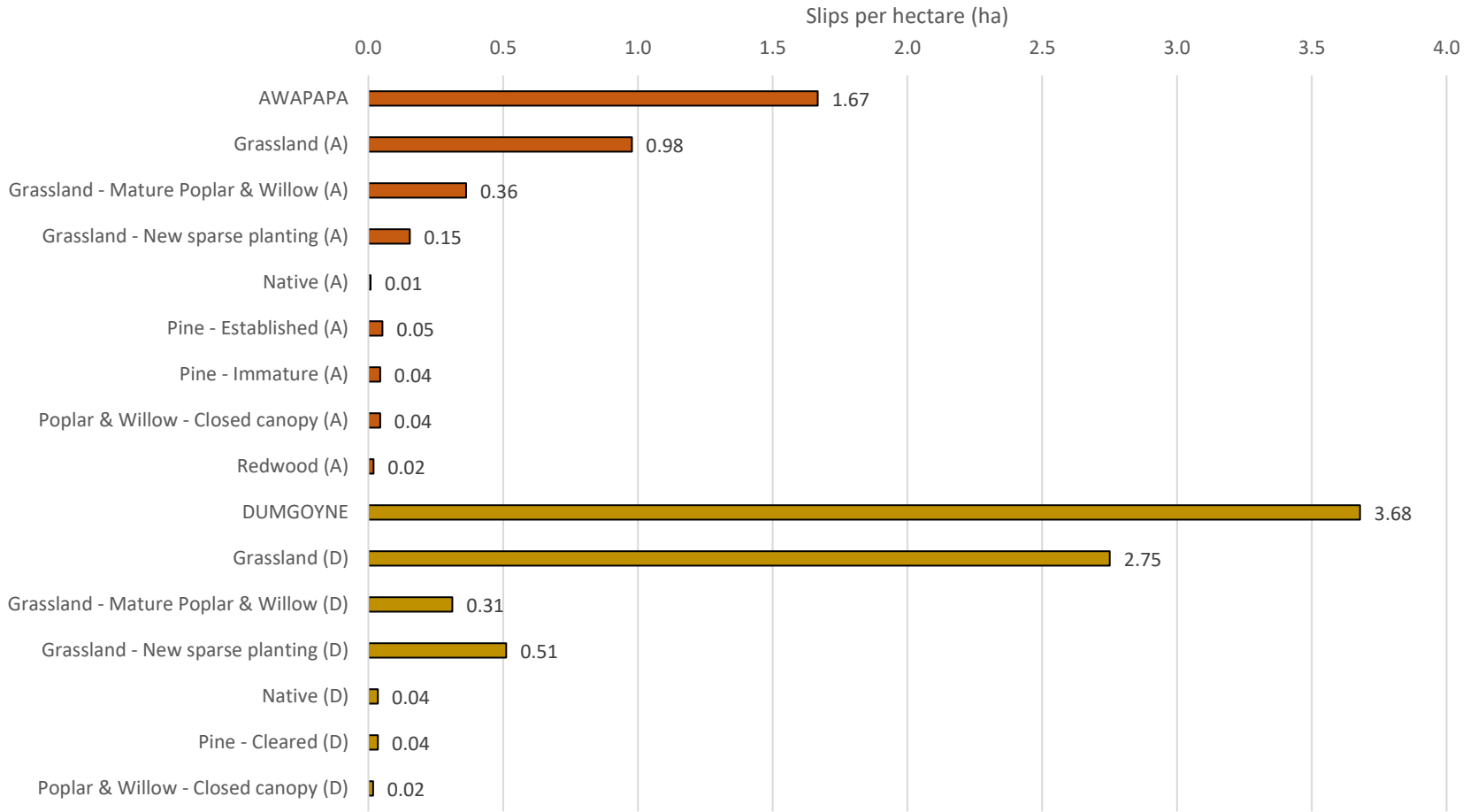
Farm-scale analysis

- Comparing Awapapa and Dumgoyne Stations



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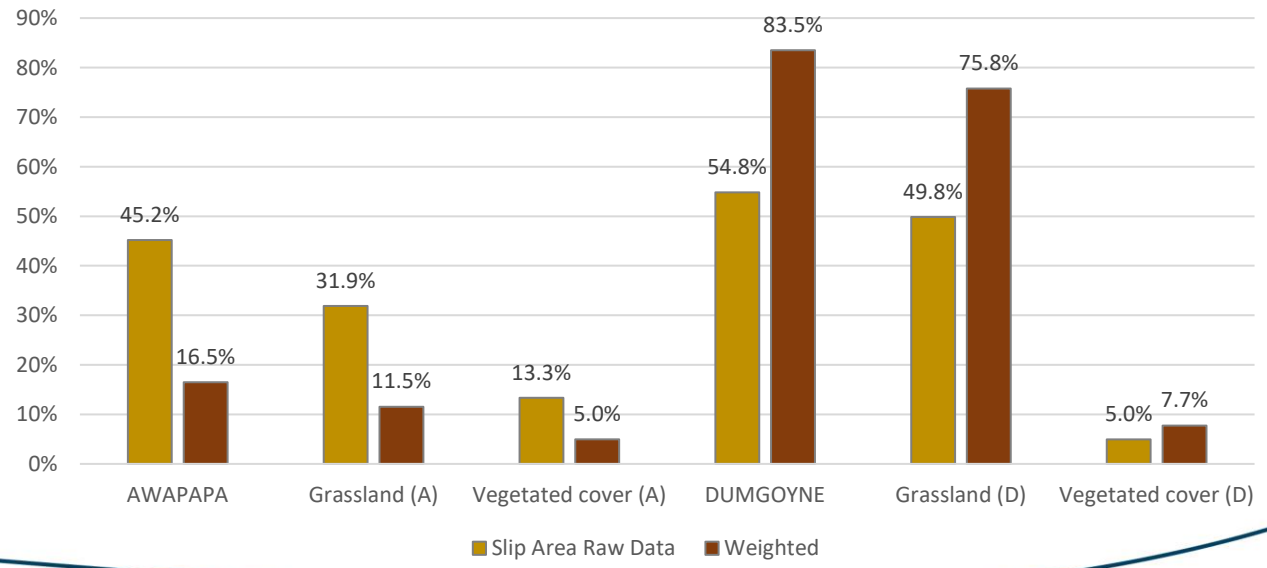
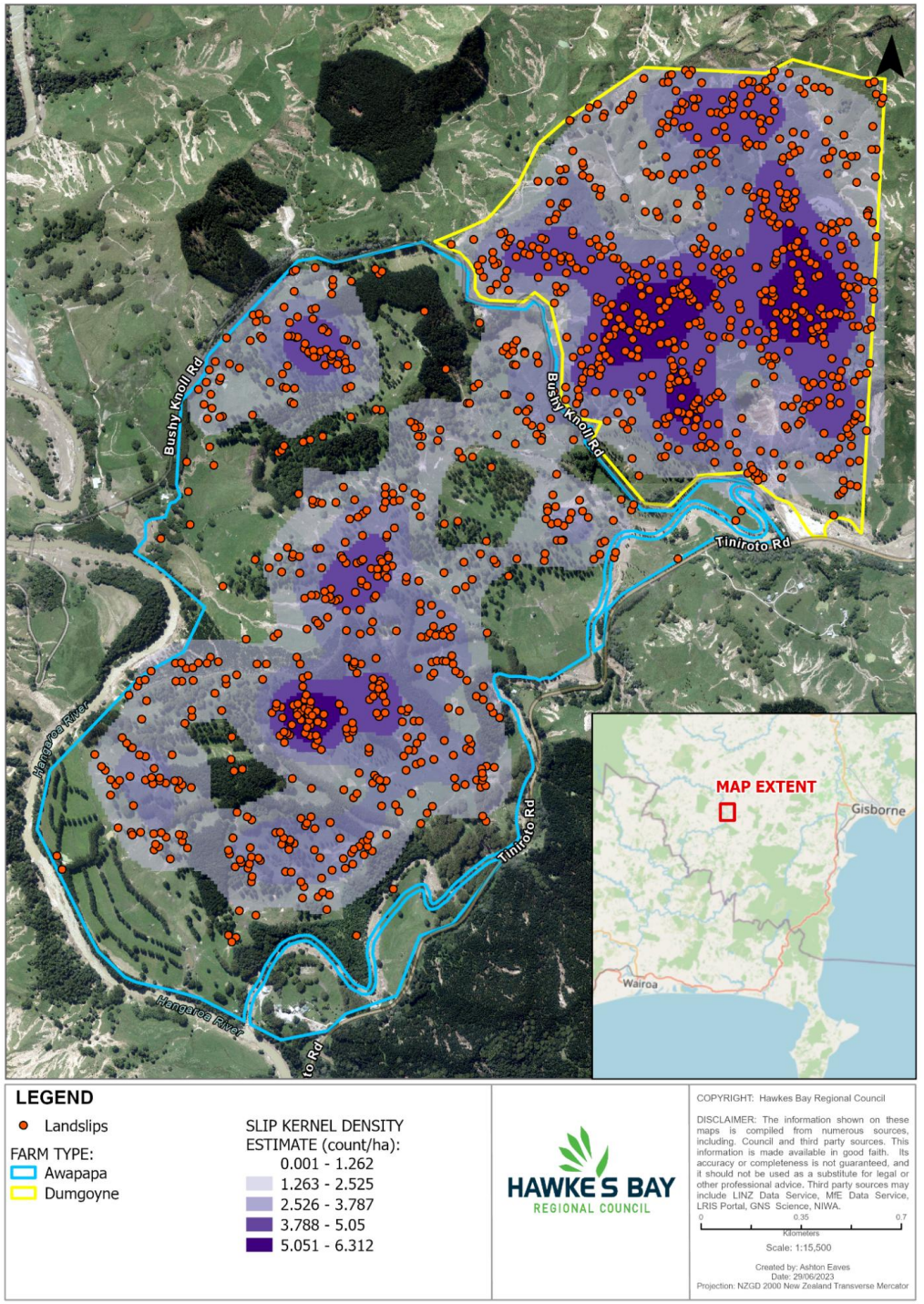
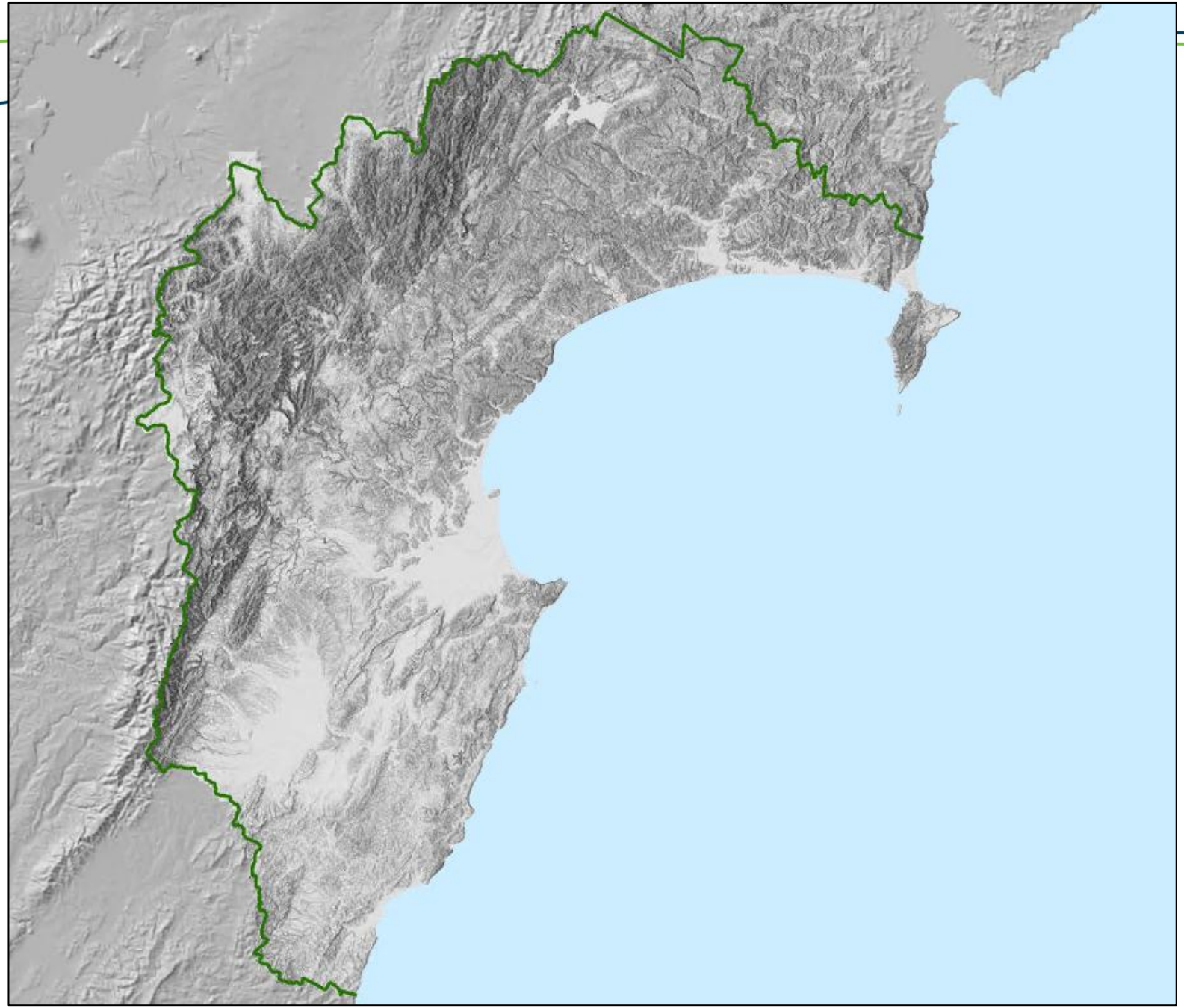
Farm-scale analysis

- Comparing Awapapa and Dumgoyne Stations vegetation cover reduced slips by 67% on Awapapa compared with Dumgoyne.







New Products:
Our Landscapes

MWLR – HBRC LiDAR Partnership Project

Maximising the benefit of the LiDAR (2020) collection.

Manaaki Whenua Landcare Research

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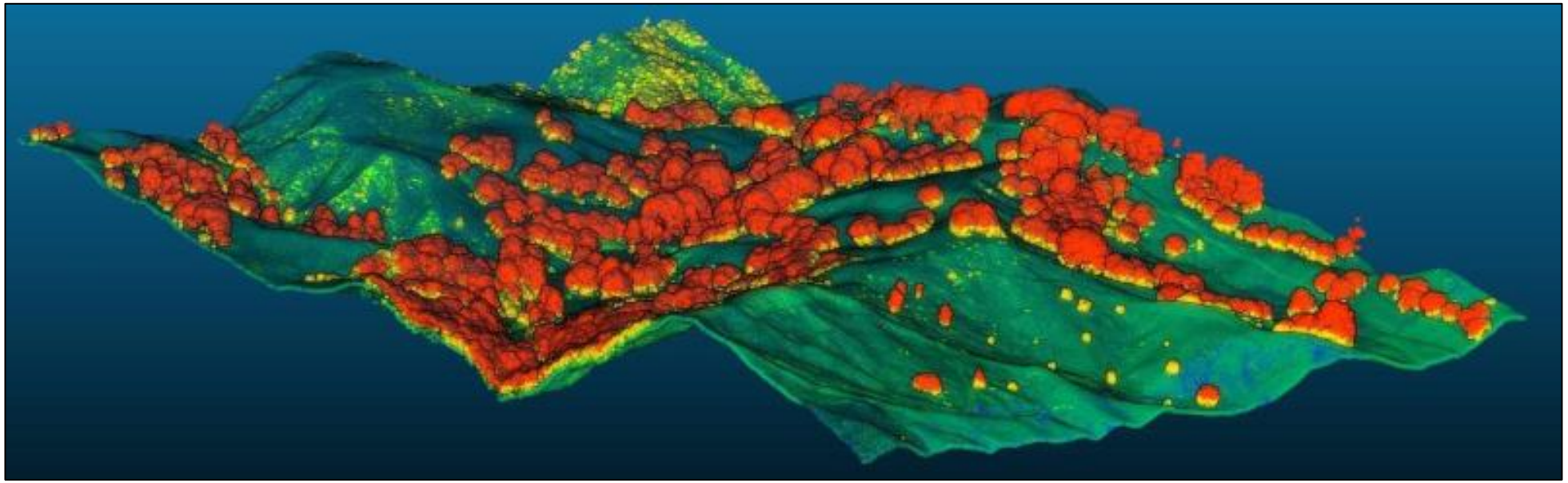
New Products: Our Landscapes

- Improving understanding and management of erosion with LiDAR.
- Vegetation mapping.

LiDAR | Hawke's Bay Regional Council

https://www.hbrc.govt.nz/services/maps-and-gis/lidar



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New Products: Our Landscapes

- Improving understanding and management of erosion with LiDAR:
  - Helping catchment advisors identify erosion-prone land and target
  - poplar pole planting and riparian planting.
  - Inform forestry companies of landslide susceptibility during harvest and
  - connectivity to waterways of sediment.

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New Products: Our Landscapes

- Improving understanding and management of erosion with LiDAR:
  - Upgrade regional SedNetNZ erosion and sediment load modelling.

Estimated sediment loads delivered to the stream network	Previous SedNetNZ		LiDAR SedNetNZ	
	Suspended sediment load (Mt yr^{-1})	Percentage contribution to total load	Suspended sediment load (Mt yr^{-1})	Percentage contribution to total load
Shallow landslide erosion	4.9	66	5.4	64
Surface erosion	1.5	19	1.7	19
Riverbank erosion	0.70	9	1.0	12
Gully erosion	0.13	2	0.15	2
Earthflow erosion	0.27	4	0.27	3
Total load delivered to the stream network	**7.5**		**8.5**	
Total net load delivered to the coast	**7.2**		**8.0**	

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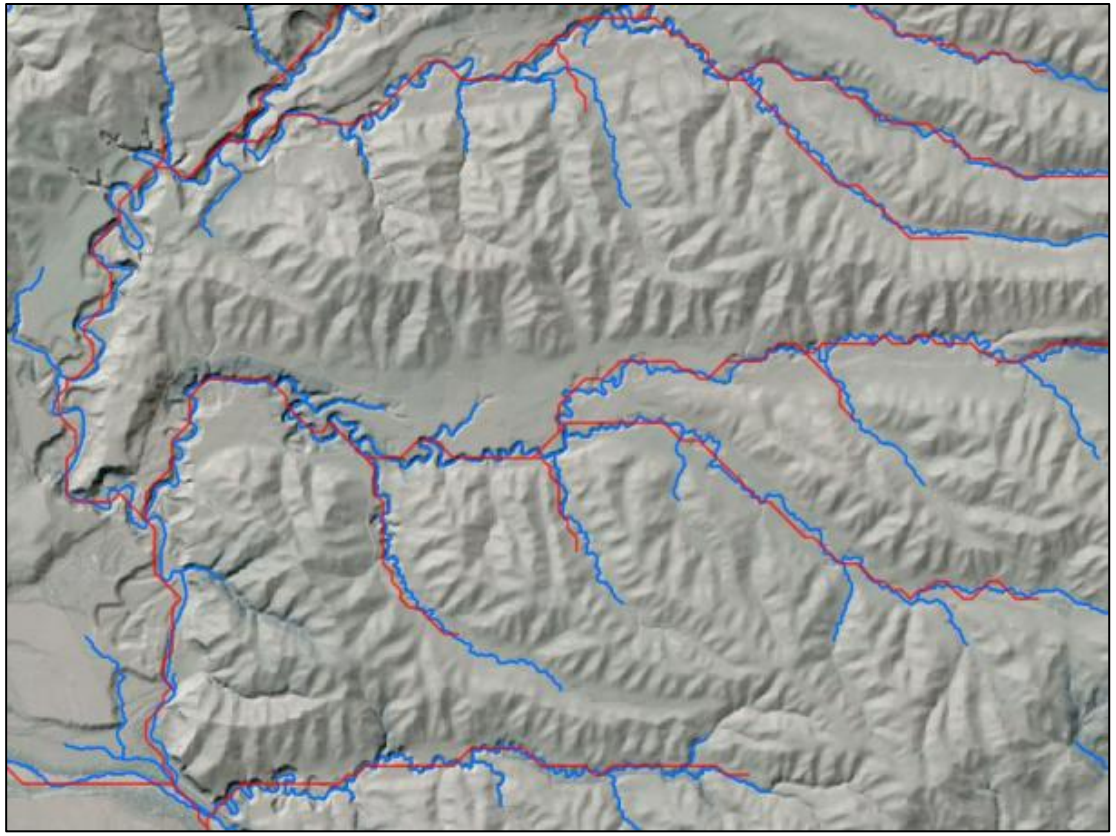
New Products: Our Landscapes

- Improving understanding and management of erosion with LiDAR:
  - Improve the spatial representation of the stream network and watersheds (LiDAR DEM in blue vs. REC2 in red).



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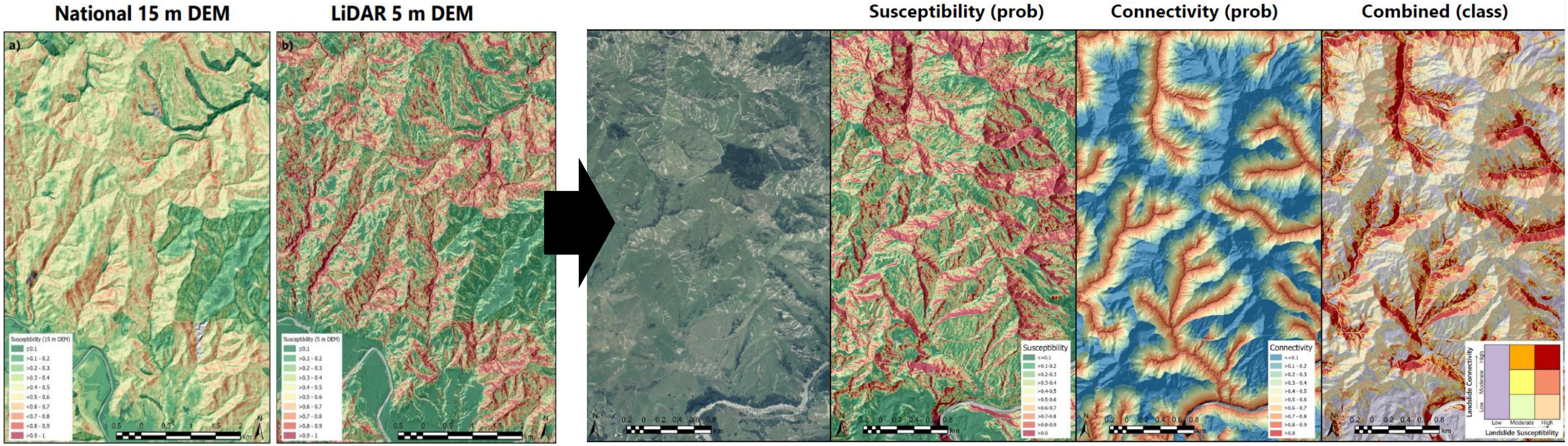
New Products: Our Landscapes

- Improving understanding and management of erosion with LiDAR:
  - Regional-scale shallow landslide susceptibility and waterway connectivity modelling.

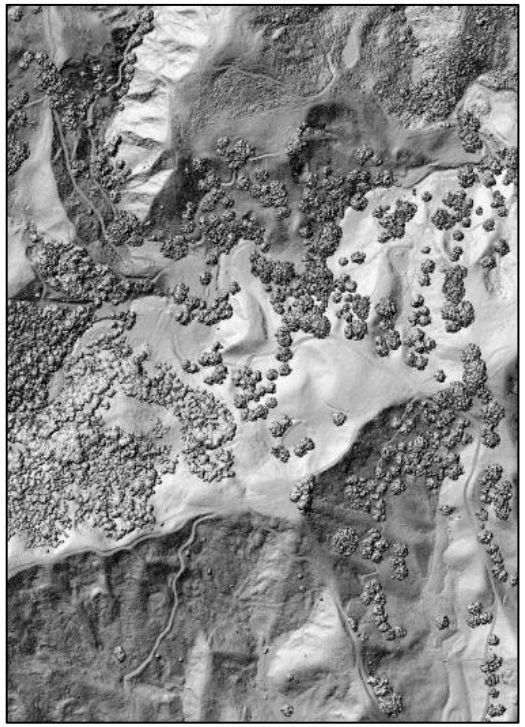


New Products: Our Landscapes

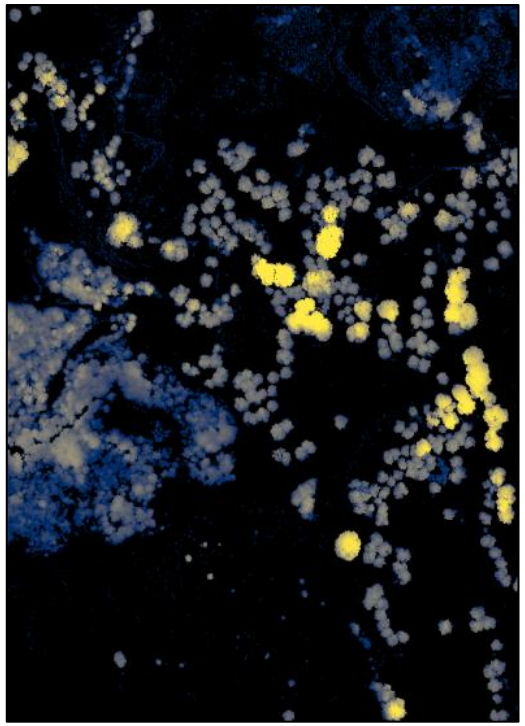
- Vegetation mapping:
  - Digital models of canopy height (CHM), surface (DSM), ground (DEM) and modelled daylight/
  - shadow at very high resolution, i.e. 30 cm pixel size.

DEM + Hillshade

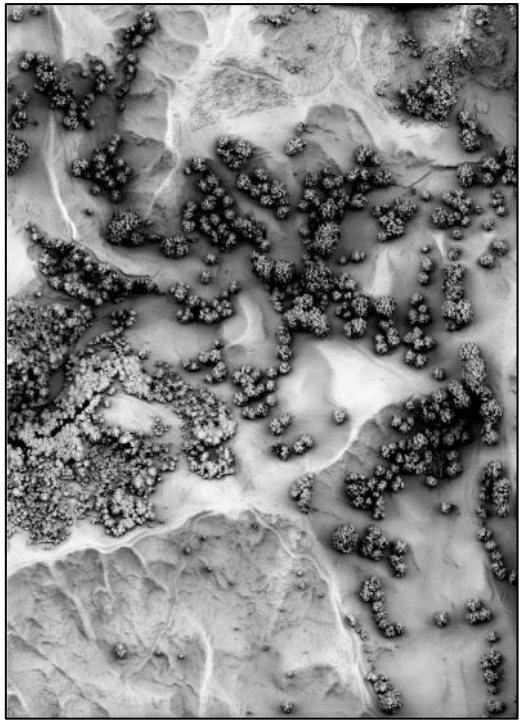
DSM + Hillshade



CHM



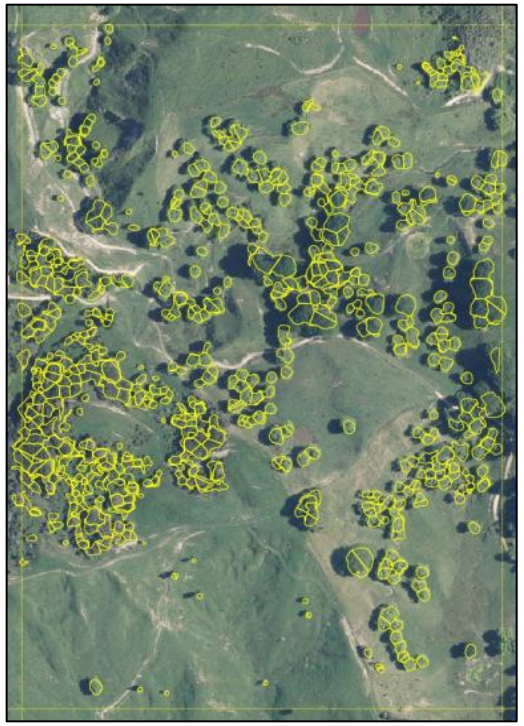
Daylight/shadow



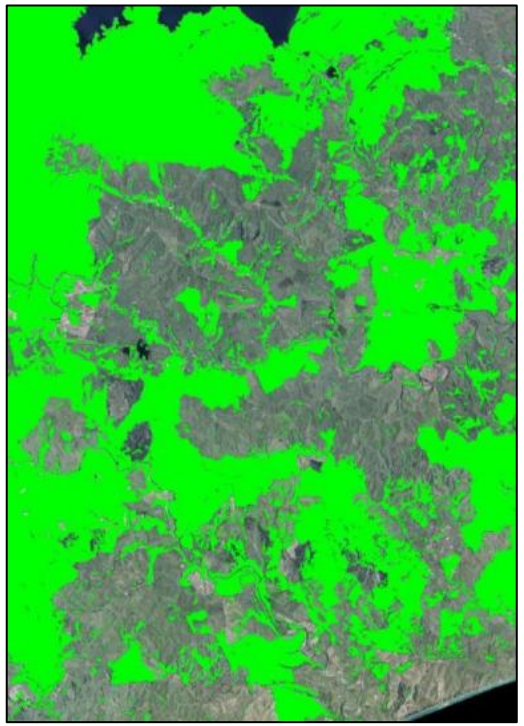
New Products: Our Landscapes

- Vegetation mapping:
  - Specific spatial vegetation layers: individual trees, forests, tree canopy, short vegetation,
  - shelter belts, pine/exotic forest. **Exploratory analysis.**

Individual trees

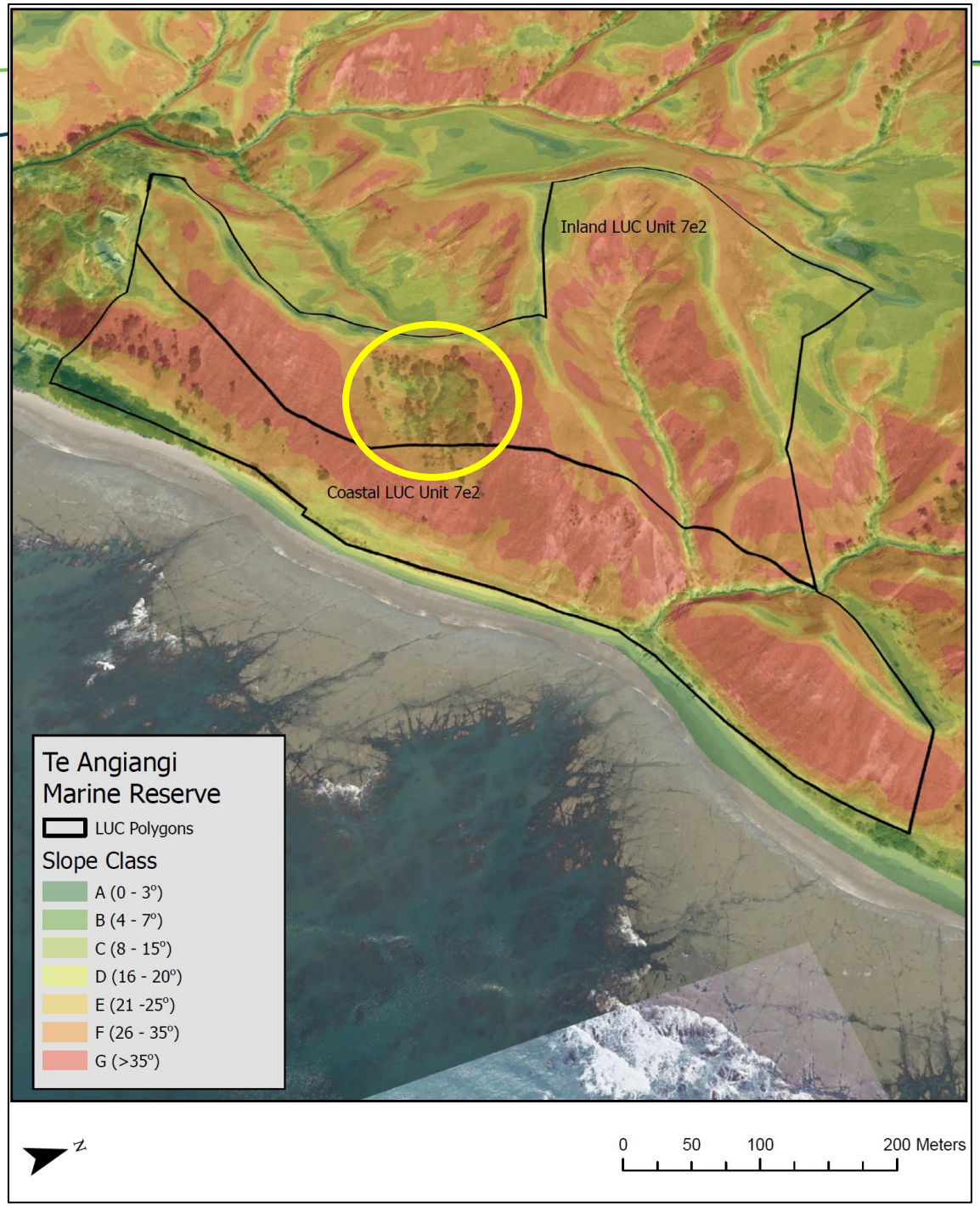


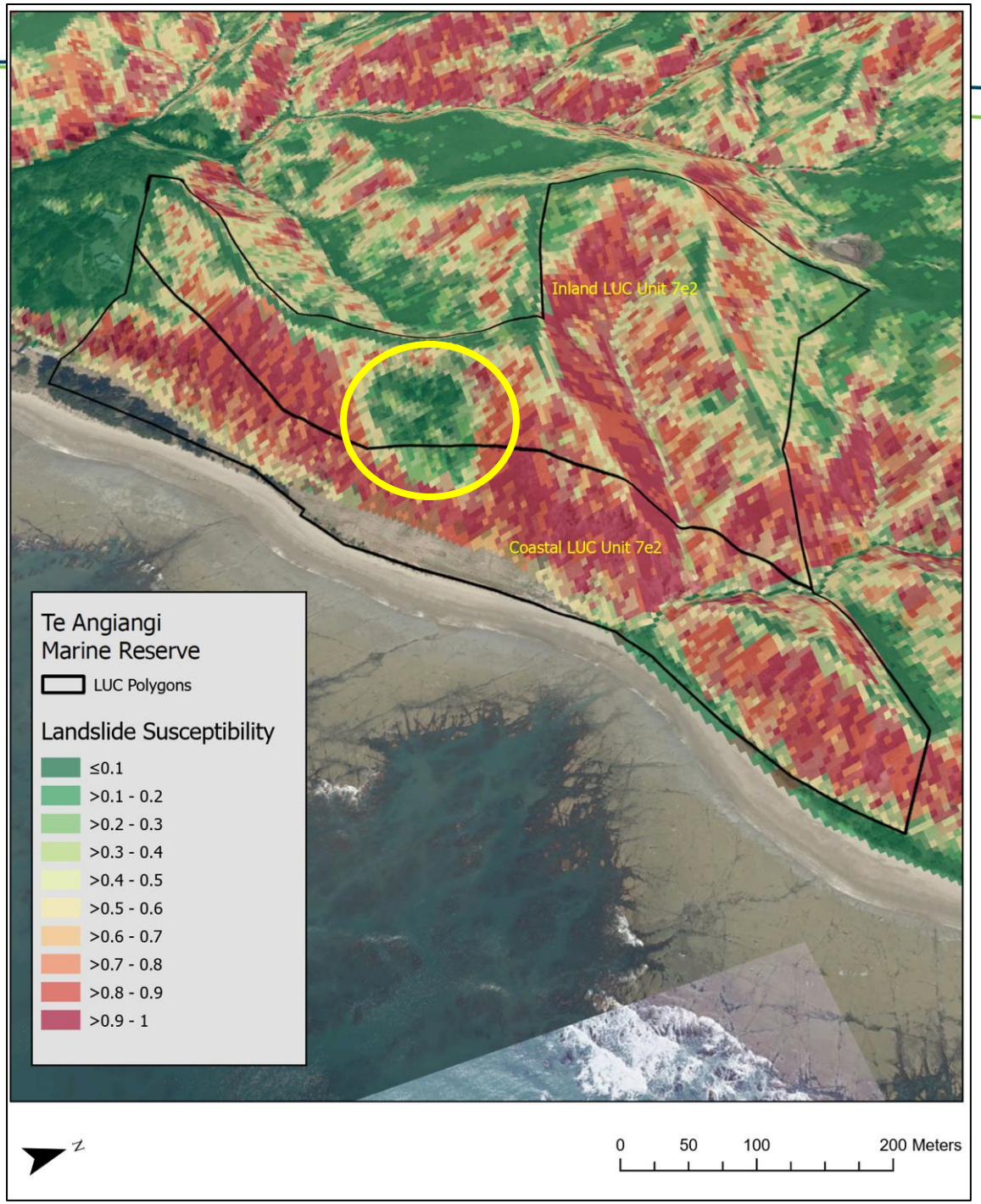
Forests



Shelter belts

Pine forest


Inland LUC Unit 7e2
Coastal LUC Unit 7e2
Te Angiangi
Marine Reserve
LUC Polygons
Slope Class
A (0 - 3°)
B (4 - 7°)
C (8 - 15°)
D (16 - 20°)
E (21 -25°)
F (26 - 35°)
G (>35°)
N
0
50
100
200 Meters


Inland LUC Unit 7e2
Coastal LUC Unit 7e2
Te Angiangi
Marine Reserve
LUC Polygons
Landslide Susceptibility
≤0.1
>0.1 - 0.2
>0.2 - 0.3
>0.3 - 0.4
>0.4 - 0.5
>0.5 - 0.6
>0.6 - 0.7
>0.7 - 0.8
>0.8 - 0.9
>0.9 - 1
N
0
50
100
200 Meters

New Products: Forestry Catchment Planner

- Landslide susceptibility
- Melton Ratios
- Catchment Management Units
- Coup sizes
- Risk reduction

Forestry Catchment Planner

New Products: Forestry Catchment Planner

- Created under the National Science Challenge: Our Land And Water
- Partners:

MapHQ

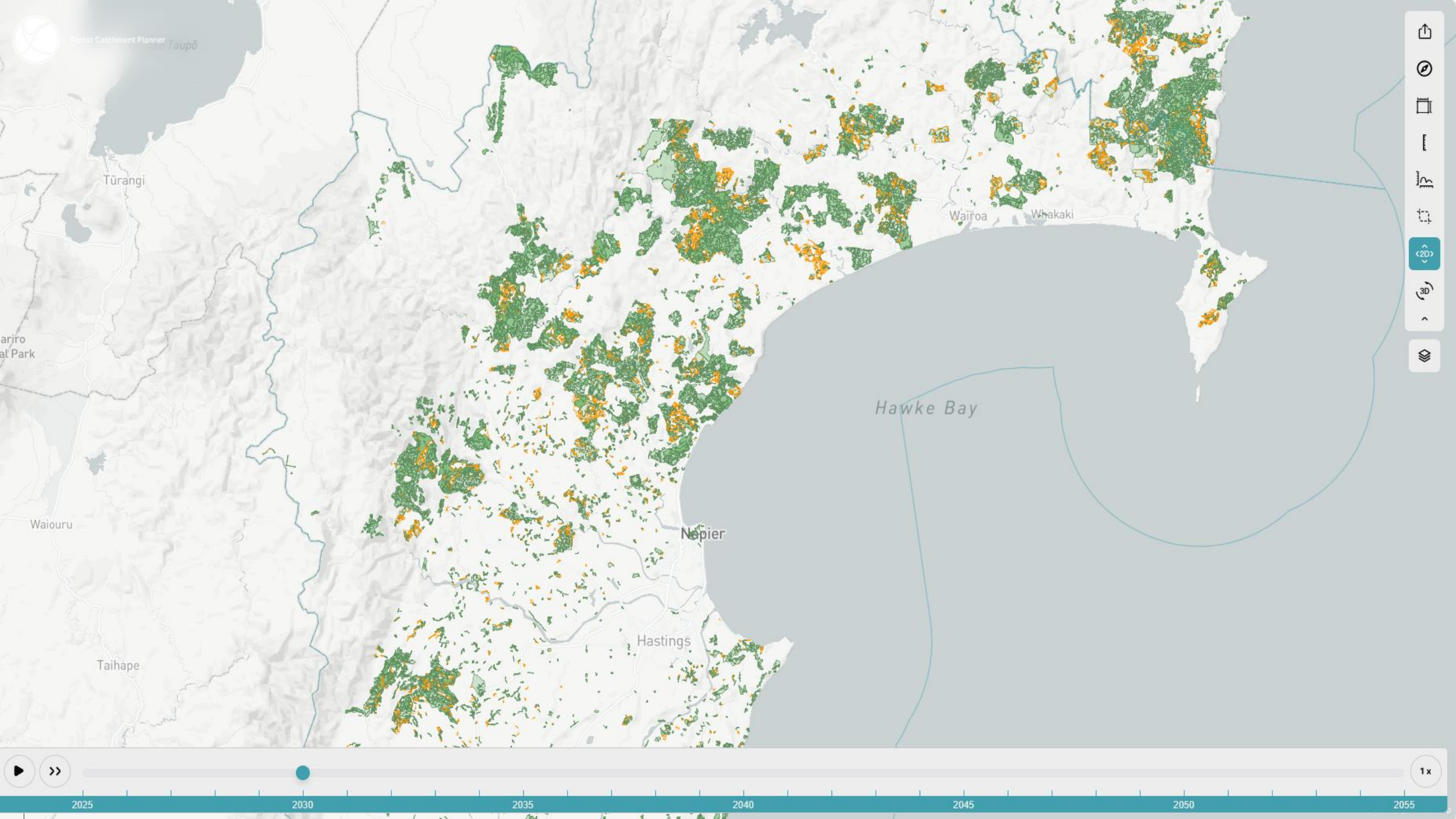
GeoInsight
Mapping • GIS • Software

GNS SCIENCE
TE PŪ AO

UC
UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Indufor

HAWKE'S BAY
REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI


Forest Catchment Planner
Tūrangi
Waiouru
Taihape
Wairoa
Whakaki
Hawke Bay
Napier
Hastings
2D
3D
1 x
2025
2030
2035
2040
2045
2050
2055

Catchment Management Unit

Total Catchment Area

2742 ha

Error loading Forestry data

Please try again

Residential Area

3759 m2

Road Length

9.092 km

Bridges

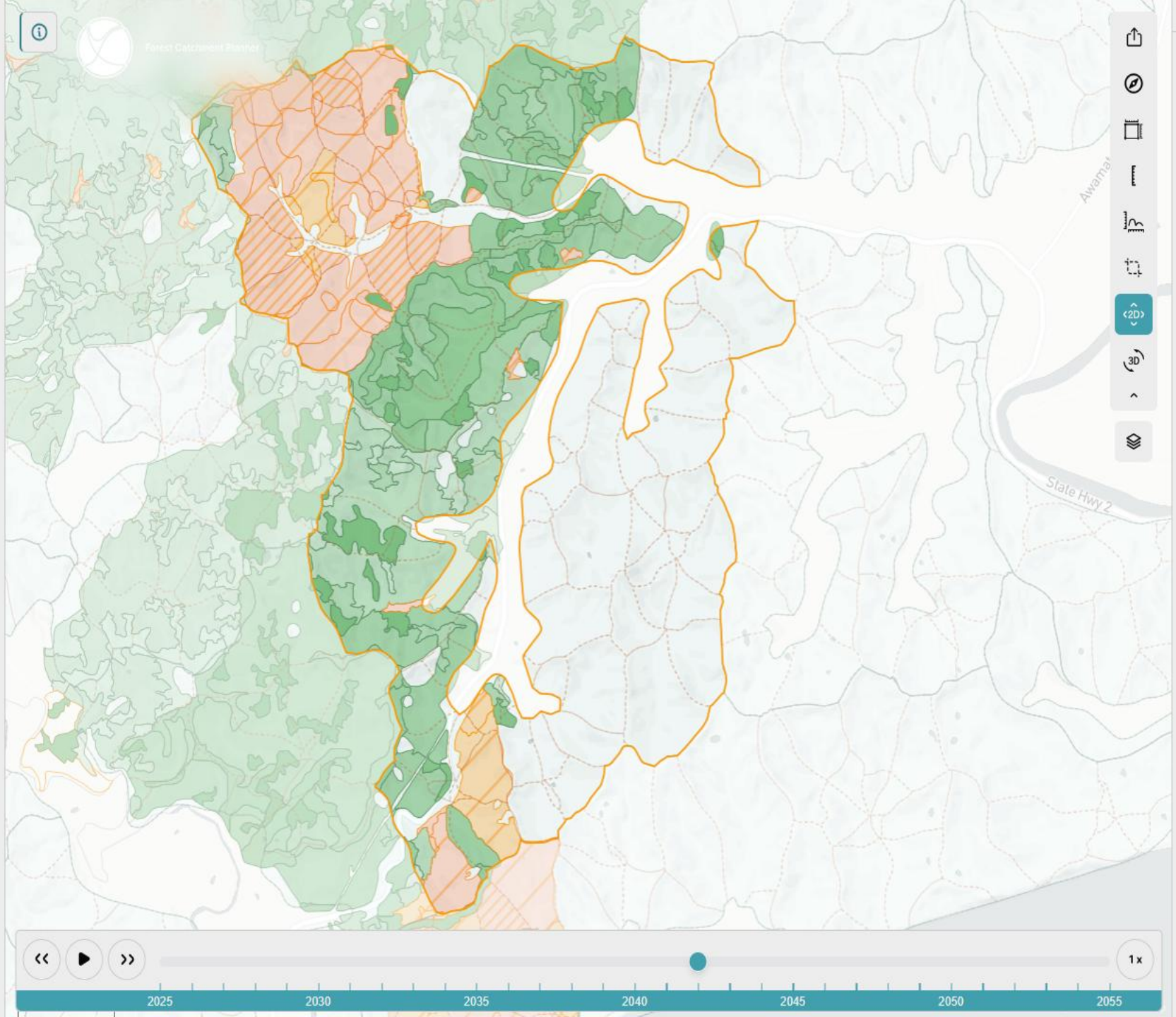
1

Railway

1.583 km

River Length

70.751 km



Layer Control

Base Maps

Landslide Susceptibi...

1

2

3

4

5

Melton Ratio

1

2

3

Forestry Group

Exotic Forestry Stan...

Catchment Management...

Infrastructure

Bridge Centrelines

Powerline Centreline...

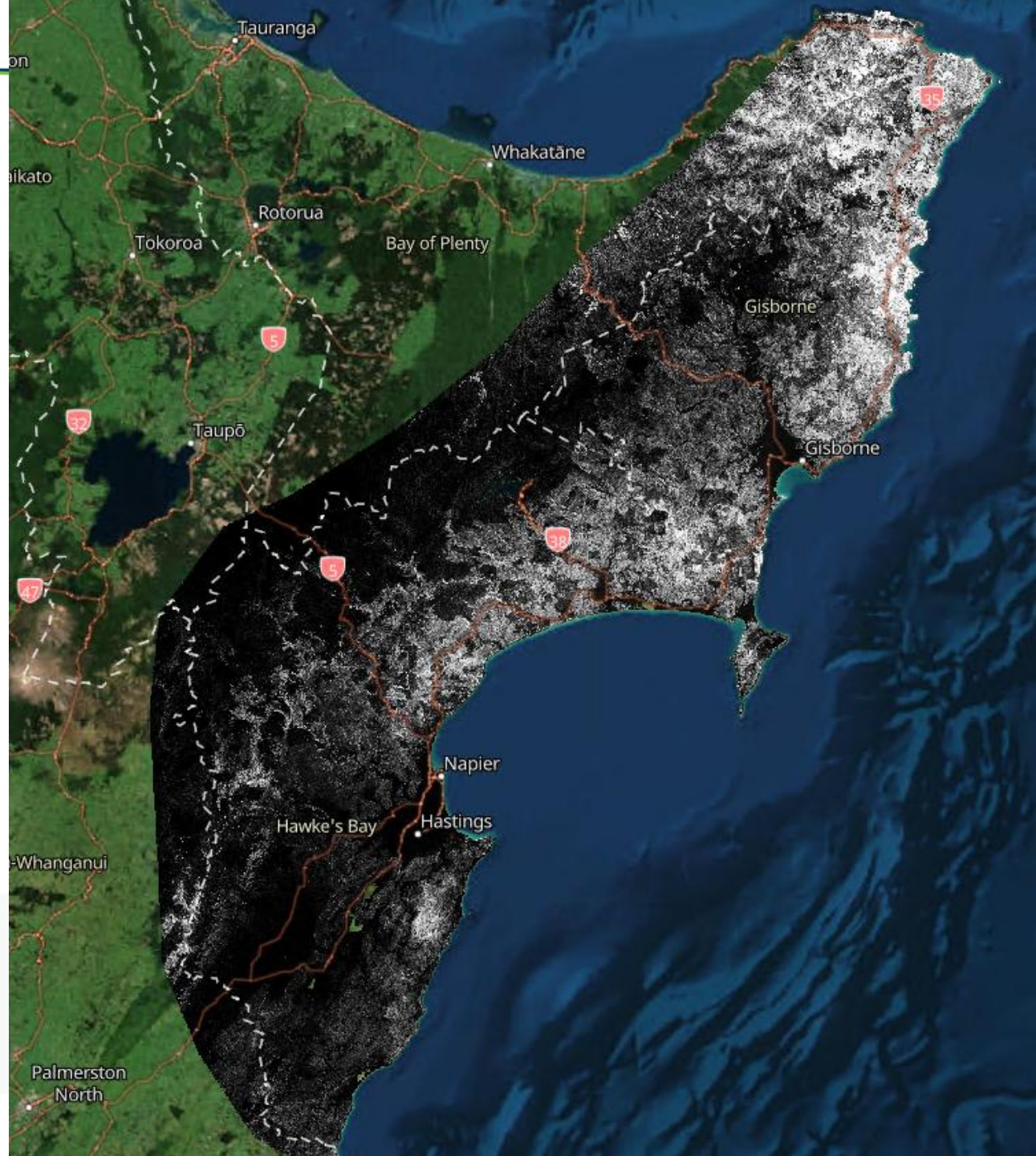
Roads Addressing

Railway Centrelines

Building Outlines

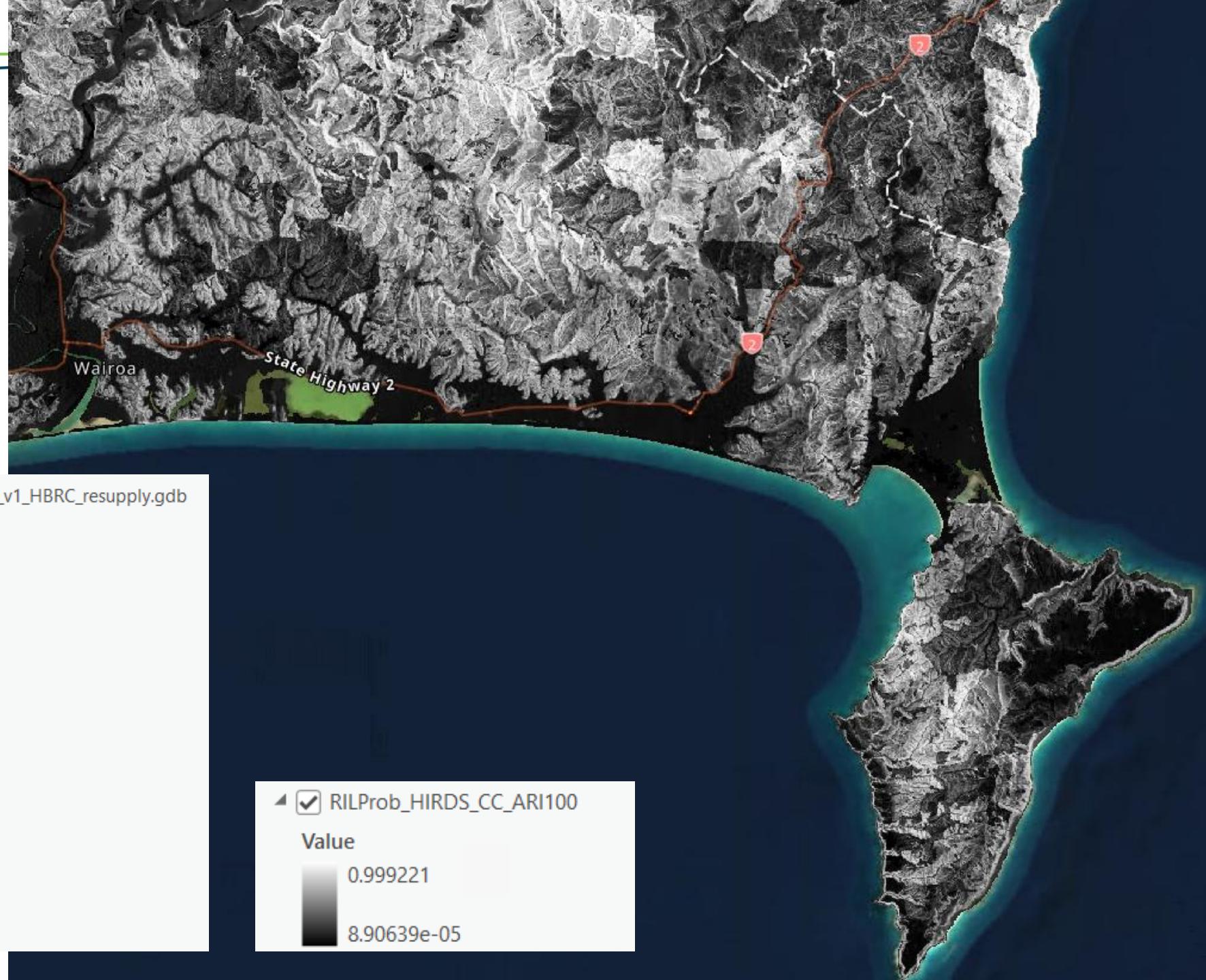
New Products: GNS Landslide Probability Grids

- HIRDs rainfall model.
- Various Annual Return Intervals.
- With or without climate change.



New Products: GNS Landslide Probability Grids

- Scenarios:



- RIL_Probability_EasternNI_TotalSusceptibilityModel_v1_HBRC_resupply.gdb
  - RILProb_HIRDS_ARI50
  - RILProb_HIRDS_ARI100
  - RILProb_HIRDS_ARI250
  - RILProb_HIRDS_CC_ARI50
  - RILProb_HIRDS_CC_ARI100
  - RILProb_HIRDS_CC_ARI250
  - RILProb_UpQ_HIRDS_ARI50
  - RILProb_UpQ_HIRDS_ARI100
  - RILProb_UpQ_HIRDS_ARI250
  - RILProb_UpQ_HIRDS_CC_ARI50
  - RILProb_UpQ_HIRDS_CC_ARI100
  - RILProb_UpQ_HIRDS_CC_ARI250

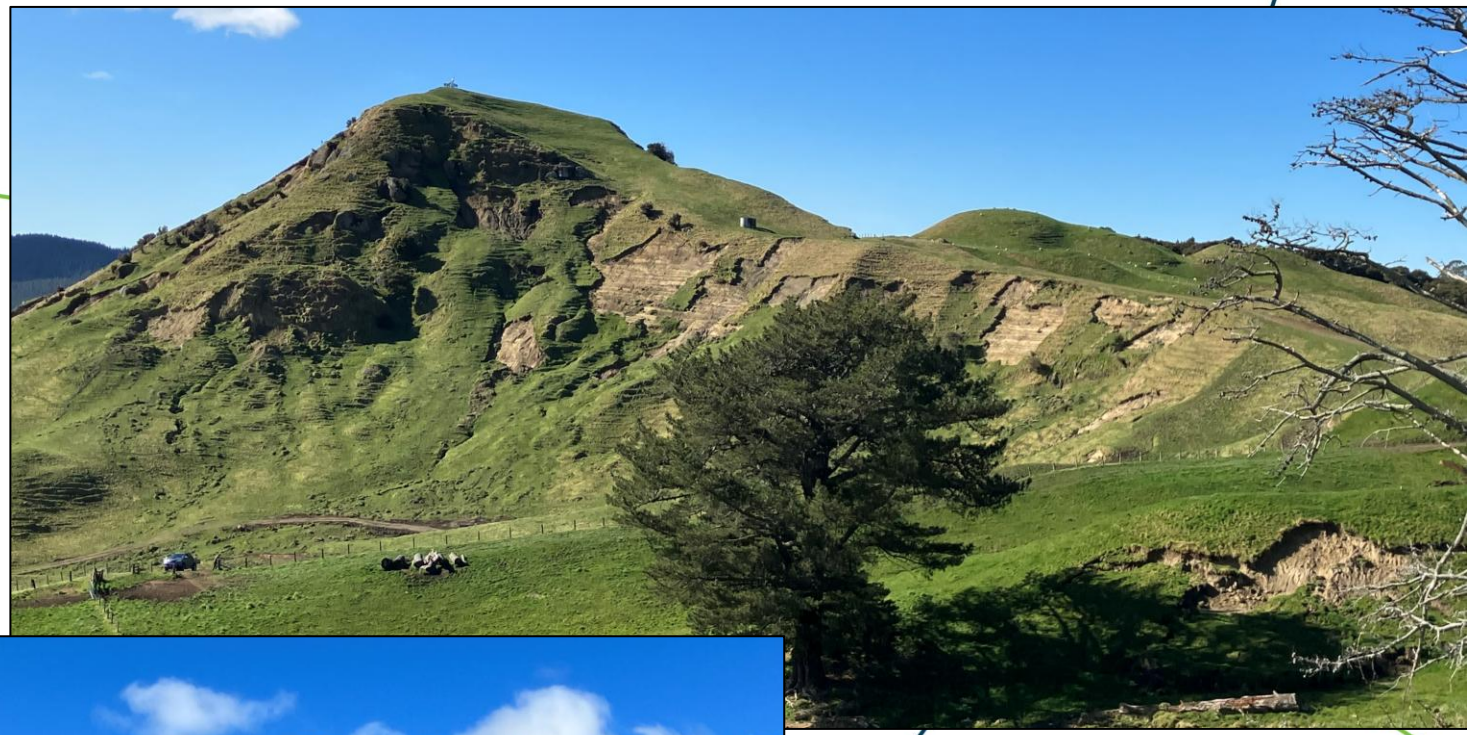
RILProb_HIRDS_CC_ARI100

Value

0.999221

8.90639e-05

Questions?



Dr Ashton Eaves ashton.eaves@hbrc.govt.nz 0272779360

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N.Z. FOREST MANAGERS

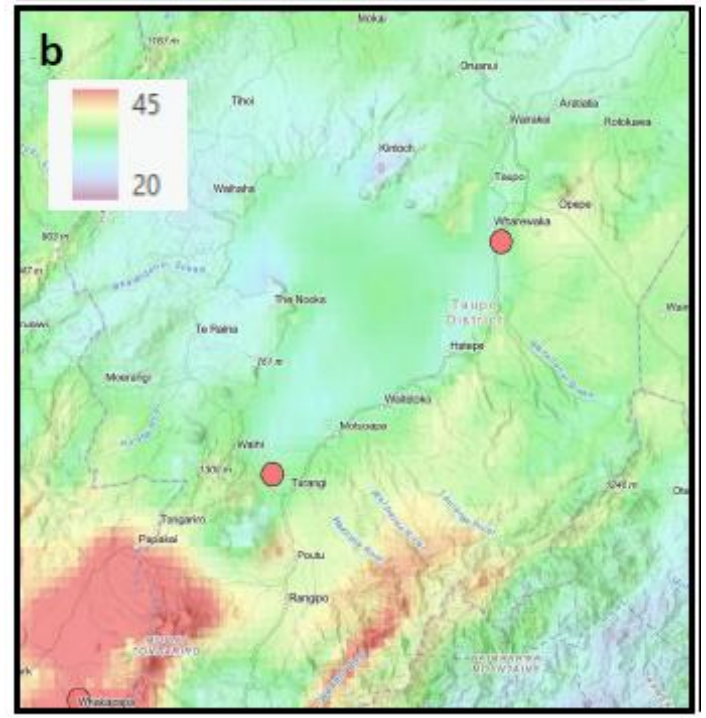
THE EFFECTS OF CYCLONE GABRIELLE IN THE CENTRAL NORTH ISLAND

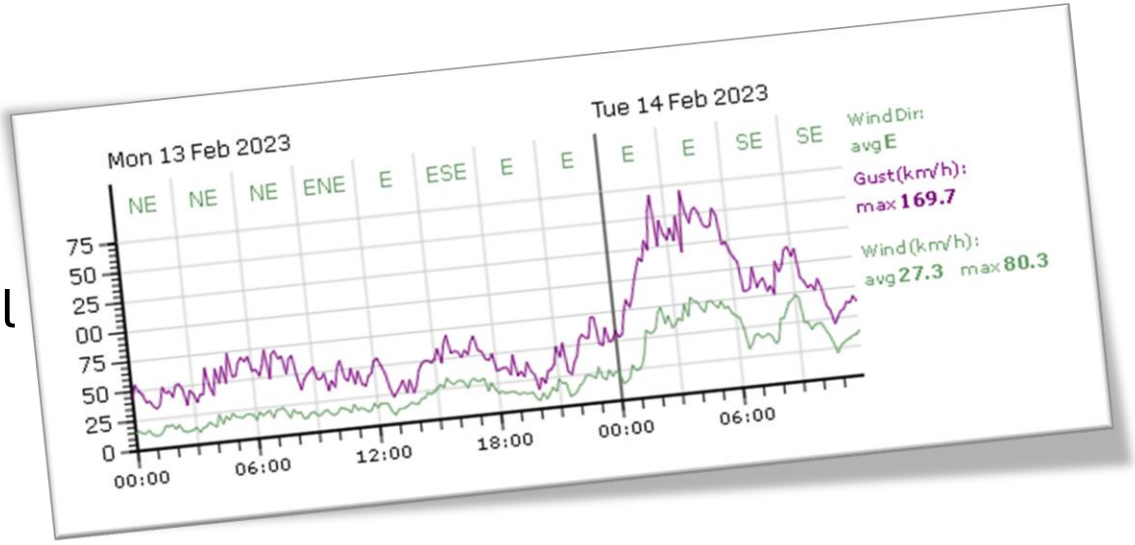
PREPARATION FOR THE CYCLONE

- Warnings that a significant weather system was on its way a week prior to the cyclone arrival. Past experience told us strong winds from East/South-East likely to be damaging to forests in the Taupo-Turangi area
- Adverse weather warning sent out to crews Friday – advising them to monitor weather conditions and to follow standard safety protocols including parking machines away from standing trees over the weekend
- The track of the cyclone was monitored over the weekend. By Sunday afternoon it looked highly likely to arrive in the area late Monday or early Tuesday
- Decision made Sunday afternoon to suspend all forest access on Monday. Staff and forest workers all notified.
- Monday 13th February was uneventful in the forests. Forecast for Tuesday reviewed, and decision made to suspend forest access until further notice, with a review midday Tuesday 14th

CYCLONE GABRIELLE ARRIVES

- Cyclone Gabrielle arrived in the CNI in the early hours of Tuesday 14th February 2023
- Peak wind gusts at local weather stations were:
  - Taupo – 128km/hr
  - Turangi – 170km/hr
  - Rotoaira – 125km/hr
- Period of most severe wind was 4 hours – 2.00am to 6.00am, then gradual easing over next 12 hours





THE IMMEDIATE AFTERMATH

- Obvious from daybreak on Tuesday the damage to the forests was widespread and significant
- Need to develop a Response Plan
- Local communities adversely affected – no power, trees across State Highways
- Scale and extent of the windthrow was going to be the challenge & not the windthrow itself
- Significant resources were going to be required
- Recognised need to put greater emphasis on Health and Safety due to nature & scale of work & bringing in new contractors
- Time – How long have we got – how long will it take????

COMMUNICATION

Engagement with stakeholders in the first few days a key focus

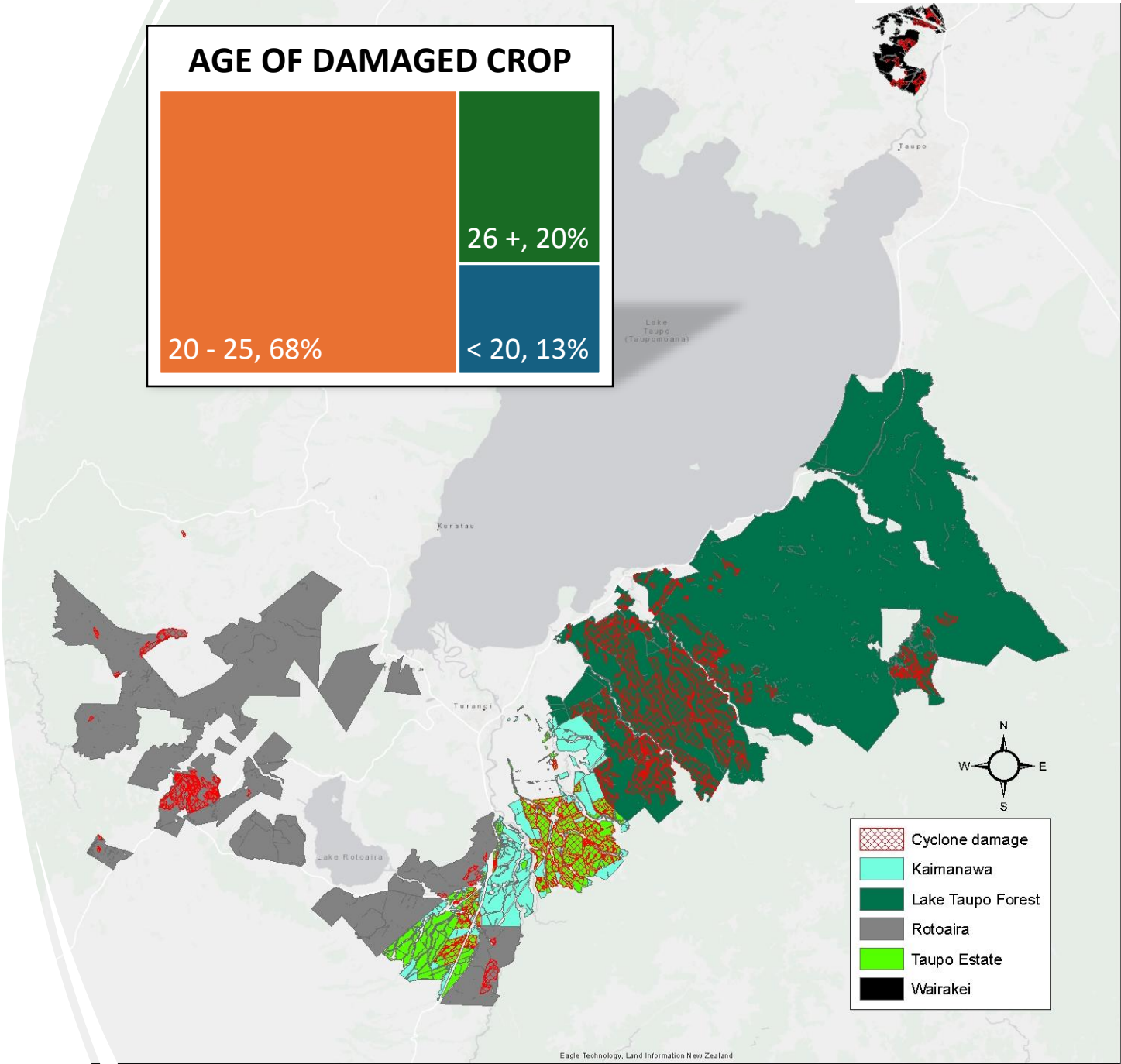
- Forest owners – updates on extent of damage, plans for salvage operation
- Contractors – Return to work timing and safety protocols
- Neighbours – Recording and addressing issues where trees had affected neighbouring properties
- Councils – NES-CF windthrow salvage notifications for entire forests
- Powerline companies – Making plans to move harvesting gear around to open up access to powerlines
- 3rd party forest users – Forests closed for all non-essential activities until safety assessments made
- Communication with neighbours and communities were very important throughout salvage operations

ASSESSING THE DAMAGE

- Staff were out inspecting forests Tuesday morning – very limited access inside the forests
- Photos from helicopters doing powerline survey work started coming through mid-morning
- Satellite imagery – first images available Tuesday afternoon
- Aerial surveys to confirm the extent of the damage from Wednesday onwards
- Reports from further a field suggested local forests only forests where significant windthrow had occurred

QUANTIFYING THE DAMAGE

- As quality satellite imagery became available a mapping exercise was done to identify damaged areas & predominant terrain type affected.
- Limited ability to ground-truth. Drone and aircraft only way to see most of the forests
- Initially rough enough was good enough – high level area & volume estimates – refined over time
- Approximately 6,700 hectares damaged, 3.3 million m^3 to salvage



PLANNING THE SALVAGE

- Planning for the salvage began right away
- Clear objectives were defined:

    1. Get it done – goal of being finished by the end of June 2024
    2. Do everything safely – no compromises
    3. Minimise value loss for forest owners

- A response plan was developed and communicated to forest owners

PRIORITISING THE RESPONSE

- Public safety - closing forest access, erecting signage, clearing roads and roadsides
- Open access for the provision of key services (electricity)
- Value Loss Mitigation - Commence salvage in older pruned stands (existing crews)
- Minimise Loss - Commence salvage in accessible areas where large volumes can be recovered quickly
- Determining Supply Chain Capability & Capacity
- Alternative supply chain and market strategies

Cyclone Gabrielle Response Plan

Company Name: NZFM

Date of Cyclone Gabrielle Wind Event: 14/02/2023

Project Lead - GM

Project Start: 14/02/2023

TASK	ASSIGNED TO	PROGRESS	START	END
Engagement				
Engagement with Clients	GM & SMT	100%	14/02/2023	23/06/2025
Engagement with Contractors	Ops Managers	100%	14/02/2023	23/06/2025
Engagement with Third Parties	GM & SMT	100%	14/02/2023	23/06/2025
Damage Assessment				
Determine Extent of Damage	SMT	100%	14/02/2023	17/02/2023
Map Scale of Damage - Area Assessment - High Level	PM	100%	14/02/2023	23/02/2023
Map Scale of Damage - Volume Assessment - High Level	PM	100%	17/02/2023	3/03/2023
Refine Damage Assessment - Stand Level Assessments	PM	100%	27/02/2023	29/04/2023
Assign Stand Level Salvage Priorities - Value Loss Mitigation	PM	100%	14/02/2023	29/04/2023
Prioritising Response				
Public safety - closing forest access, erecting signage, clearing roads and roadsides	Ops Managers	95%	14/02/2023	5/03/2023
Open access for the provision of key services (electricity)	Ops Managers	90%	15/02/2023	12/03/2023
Value Loss Mitigation - Commence salvage in older pruned stands (existing crews)	HM	50%	15/02/2023	26/04/2023
Minimise Loss - Commence salvage in accessible areas where large volumes can be recovered quickly	HM	50%	15/02/2023	26/04/2023
Determining Supply Chain Capability & Capacity	SMT	80%	17/02/2023	19/03/2023
Alternative supply chain and market strategies	SMT/External	50%	1/05/2023	30/06/2023
Key Constraints				
Maintain customer relationships - approach customers to discuss necessary changes	S&M Manager	90%	15/02/2023	26/04/2023
Secure additional harvesting capacity	HM	60%	17/02/2023	30/04/2023
Secure additional trucking capacity	S&L Manager	40%	17/02/2023	30/04/2023
Secure additional management capacity	GM	60%	17/02/2023	31/03/2023
Explore wharf additional storage capacity	S&M Manager	85%	17/02/2023	19/03/2023
Log Markets				
Work with customers to develop log grades and supply profiles	S&M Manager	50%	17/02/2023	26/04/2023
Explore options of increasing proportion of "at wharf gate' sales	S&M Manager	80%	17/02/2023	26/04/2023
Financial				
Work with clients to develop budgets/forecasts	SMT	10%	19/03/2023	31/03/2023
Work with NZFM board to develop budget/forecast	GM	0%	19/03/2023	31/03/2023
Existing Tree Crop Considerations				
Determine acceptable level of damage in young tree crops - liquidate vs retain	PM/FM	0%	6/03/2023	5/05/2023
Longer Term Implications				
Update Estate Models Evaluate Implications on Long Term Woodflows	PM	10%	6/03/2023	30/05/2023
Replant Considerations	FO/PM/FM	5%	6/03/2023	30/06/2023
Risks				
Log Markets				
Capacity - other forest owners taking their harvesting & trucking crews back				
Degrading wood quality / phytosanitary				

RETURNING TO WORK

- Silvi crews in unaffected forests back to work once areas checked – Wednesday 15th onwards
- Harvesting and engineering crews redirected to road opening work from afternoon of Tuesday 14th – prioritized arterial roads, powerline access, and threats to public safety – damaged and leaning trees near public roads in particular

GETTING THE SALVAGE UNDERWAY

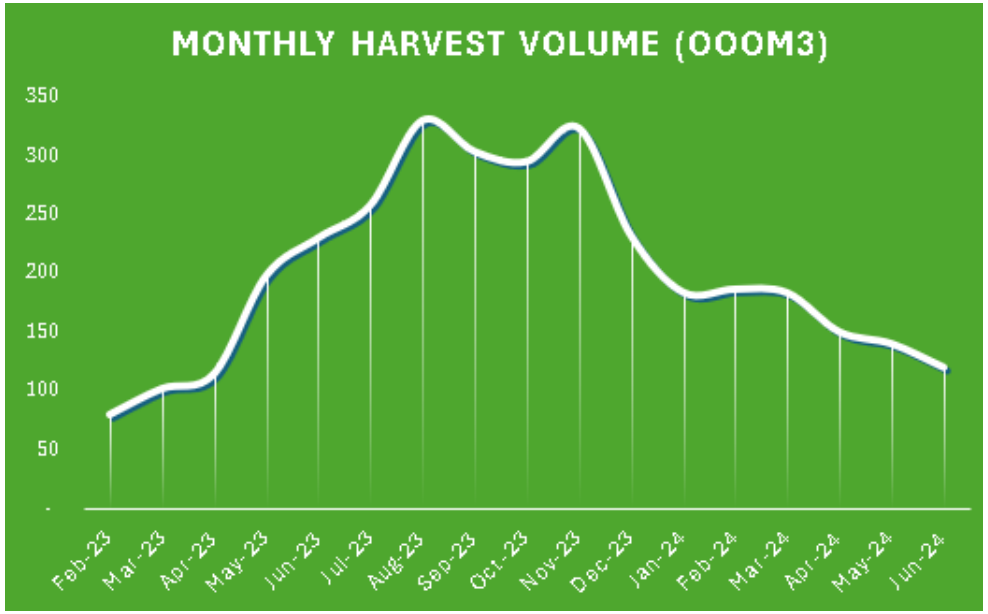
- Started with existing crews diverted to damaged stands. Most didn't have to move to do this
- Some challenges were obvious right from the start
  - More resources needed to scale up operations – harvesting crews, trucks, supervisors, admin staff
  - Engagement with customers – can't salvage what you can't sell
  - Timing important – more crews without more trucking capacity not that useful
- Had to plan the order of stands to salvage.
  - Operational and environmental constraints
  - Equitable resource allocation across forests

ORDER OF PRIORITY

- A model was built incorporating all salvage areas to minimise value loss
- Had to make assumptions about downgrading of logs over time – assumed pruned quality would deteriorate over 6 months to the point where there was no premium over A Grade
- Minimum monthly volume requirements for each forest as a way of spreading crews out – managing operational constraint of too many crews in one area
- Some environmental constraints to contend with – areas not suitable for winter harvesting, timing of operations near residential neighbours et

HARVESTING CREWS

- Quickly established some minimum standards for additional crews
  - Fully mechanized
  - SafeTree (or equivalent) certification
  - History of good environmental performance
- First crews came from Hawkes Bay and Tairawhiti, unable to work in their home forests
- Full NZFM induction and H&S audit by independent contractor on arrival
- As market conditions deteriorated over the course of 2023, more capacity became available
- Wide range of commitment periods. Some available for set timeframes, others keen to stay until the end
- Peaked at 41 crews during 2nd half of 2023.
  - Several operating with two shifts



TRUCKS

- Trucking capacity most likely limiting factor in normal circumstances
- Large proportion of wood destined for export.
  - Long lead distance so lower truck utilization
- Peaked at 500 truck movements per day, with loadout on nightshift and Saturdays from many crews
- Managing stock levels on skids very challenging, especially when pulp not moving

MANAGEMENT STAFF

- NZFM staffing levels, normally 26-27, peaked at 39
- Two recently retired supervisors ‘persuaded’ to come back to work
  - Familiarity with our systems and forests invaluable
- Harvesting team was expanded with additional experienced supervisors taken on
- Arrangements made with some forestry companies to supply supervisors with harvesting crews
  - Effective way of matching supervision capacity with crew numbers
- Large strain on back-office staff – Timbersales and accounts

LOG MARKETS

- Domestic market conditions, wood quality, and sapstain meant export was the only avenue for much of the volume
- Within a few months, the only domestic sales of any significance were pruned and pulp
- Export volumes were far in excess of what our normal export channels could cope with
  - Export volume sold to FOB and AWG across four ports, sometimes at a rate of more than 250k m^3 per month
- NZFM took the view that we could achieve a better return for the forest owners selling into low markets than by waiting for market conditions to improve while log quality deteriorated
  - Loss minimization as opposed to value maximization

SAPSTAIN

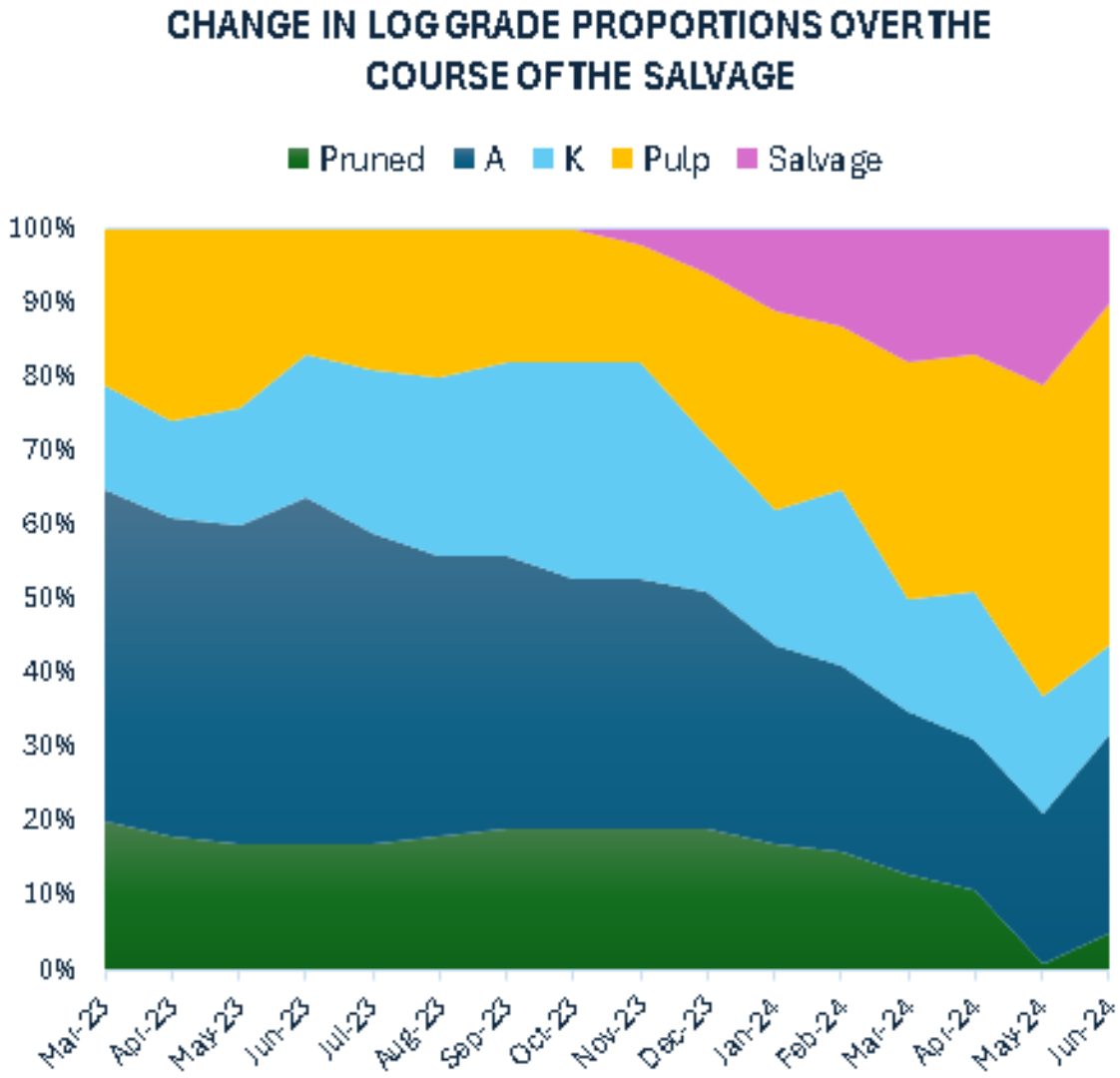
- Sapstain was identified as something that would be an issue from the outset, especially for domestic supply
- Rate of sapstain development difficult to accurately predict
  - Main drivers were snapped v. toppled trees, log diameter, aspect
- Less of an issue for export logs. A salvage grade was introduced midway through the salvage in order to segregate the most stained material and keep the average quality of regular export volume higher.
  - Export pruned, A and K grade with >50% sapstain

WOOD QUALITY

- Wood quality more of a ‘real’ issue than sapstain, both in domestic and export markets
- Shatter and internal cell collapse a problem in pruned logs
  - Sales team worked closely with pruned mills to monitor the extent of this.
- As wood got older and drier, brittleness increased
  - Loading and handling issues, less suitable for end uses

LOG GRADE OUTTURN

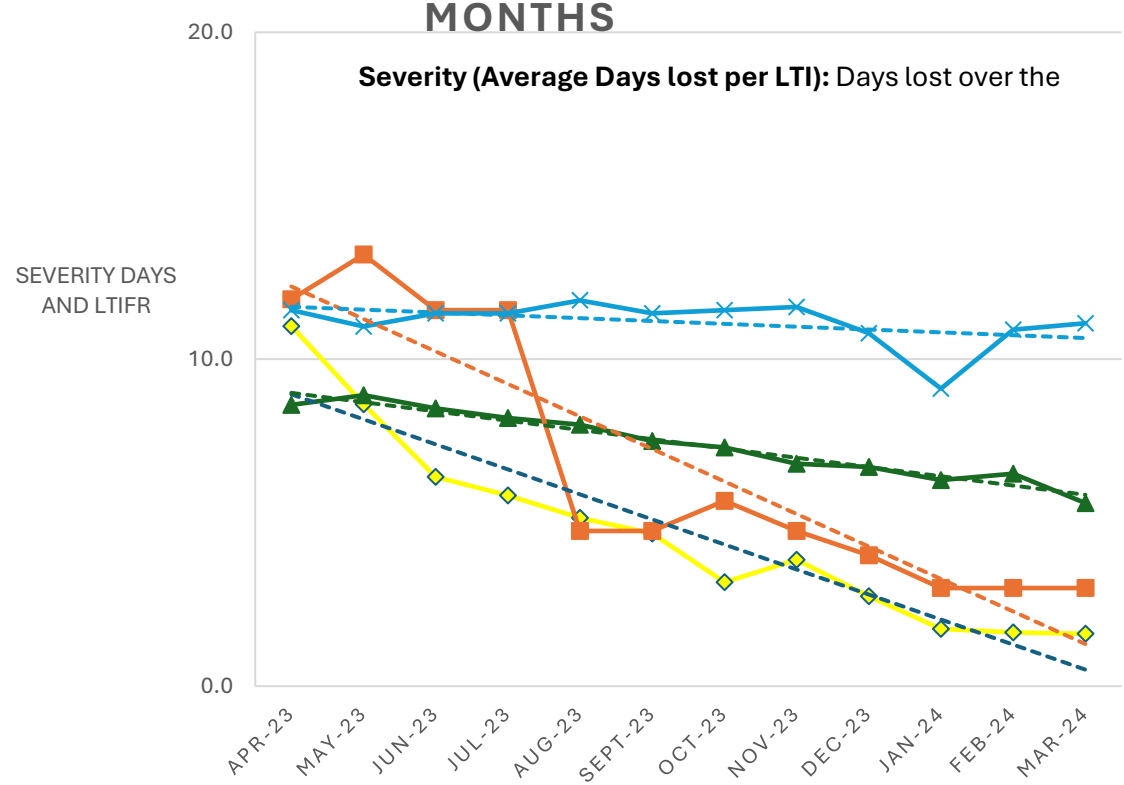
- Log grade mix gradually changed over time
- Pruned proportion stayed around 20% right through until the end of 2023, much longer than anyone expected
- Decrease in A Grade a combination of downgrading as sapstain increased, and a gradual move into younger stands with smaller piece size
- Salvage grade tapered off toward the end – more volume diverted to pulp to minimise risk of phyto issues at the port



HEALTH AND SAFETY

- Heightened focus on H&S for all salvage activity
- Trees in damaged stands still falling over months after the cyclone – hunting and other incidental access was restricted until these stands were cleared
- A total of 5 LTI's recorded during the salvage

NZFM AND INDUSTRY LTIFR AND SEVERITY DATA OVER THE LAST 12 MONTHS



	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sept-23	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	Mar-24
NZFM LTIFR	11.0	8.6	6.4	5.8	5.1	4.7	3.2	3.9	2.8	1.8	1.6	1.6
Industry LTIFR	8.6	8.9	8.5	8.2	8	7.5	7.3	6.8	6.7	6.3	6.5	5.6
NZFM Severity	11.8	13.2	11.5	11.5	4.8	4.8	5.7	4.8	4.0	3.0	3.0	3.0
Industry Severity	11.5	11	11.4	11.4	11.8	11.4	11.5	11.6	10.8	9.1	10.9	11.1

HOW DID IT ALL GO?

- We set a company record for annual harvest volume in FY23. Beat it in under 5 months in FY24
- The salvage was finished mid-June 2024, 16 months after the cyclone
- 3.3million m^3 of logs were salvaged from 6,700 hectares of forest
  - 2.4Mm^3 export, 0.9Mm^3 domestic sales
- A positive stumpage achieved in each forest

N.Z. FOREST MANAGERS

Thank You