

The Challenges of
**Quantifying
Woody Debris**
Using Machine Learning

David Herries

CTO / Director



INTERPINE

Bringing innovation to our natural resources

He rangahau tenei ra he hangarau apopo

Plot Level Analysis – Compliance and Auditing



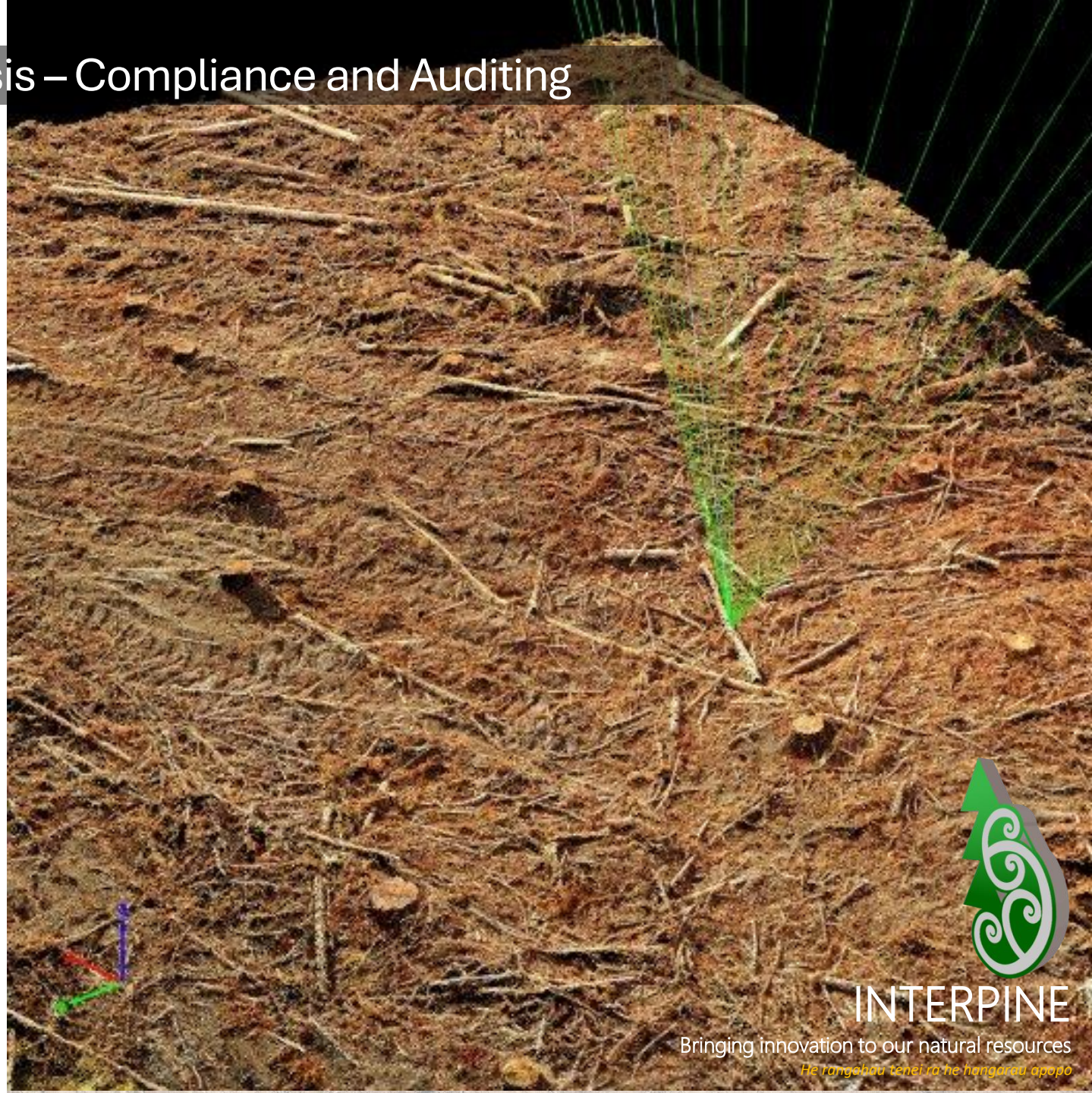
File Ref: Pages: 1/5, Report Run: 05/06/2024 03:15 PM

WW Assessment	Job No	Forest	Start	End	Plots Installed
			25-Mar-24	25-Mar-24	25

Harvest System: , Crew: , NSA Area: 34.9 ha, Species: P.RAD, TV_PLE: 36.7 % TV_SDEV: 1.1 m3/ha

Stratum: ESC HIGH/V.HIGH, Area: 5.3 ha

Plot	Area	Slope deg	Status	M1 m3/ha	M2 m3/ha	TRV m3/ha	Waste m3/ha	ROT m3/ha	TotalVol m3/ha	NES Slash ROT	NES Slash m3/ha	Step Ht Avg (cm)	Stump Ht (cm)	Plot Comments and Hazards
3	0.01	2						6	6			10.0	11	Medium undergrowth regrowthskida trak cross plot
21	0.01	18	Zero Stems										13	Medium undergrowth regrowthskida trak cross plotMOSTLY CLEAR
22	0.01	14						39	39	39			11	Medium undergrowth regrowthnot much logs hea
23	0.01	11						26	26	19				Medium undergrowth regrowthskida traks cross plot
25	0.01	22						33	33	33			13	Medium undergrowth regrowthskida trak cross plot
Averages:		13		0.0	0.0	0.0	0	21	21	18	0	10	12	

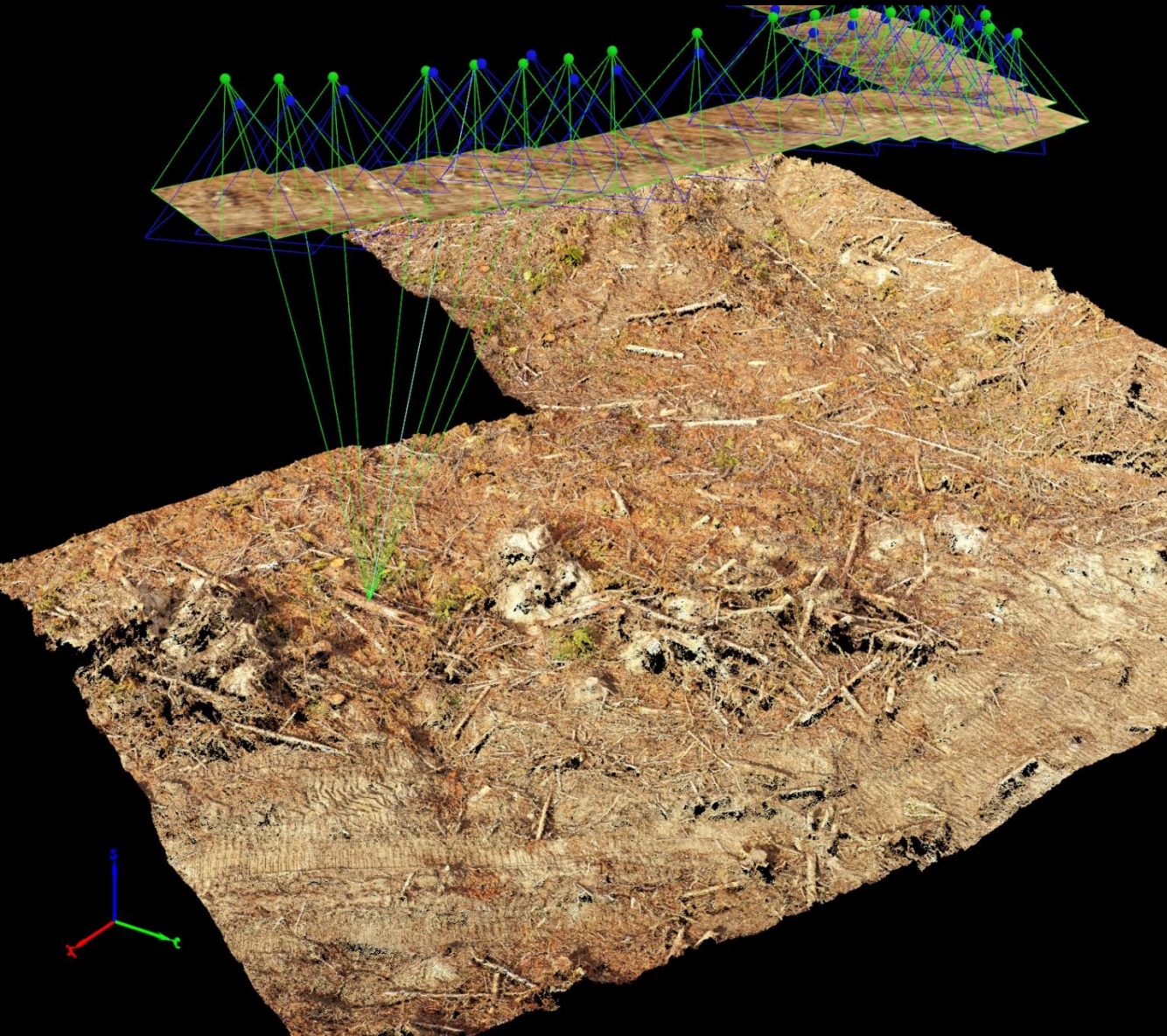


INTERPINE

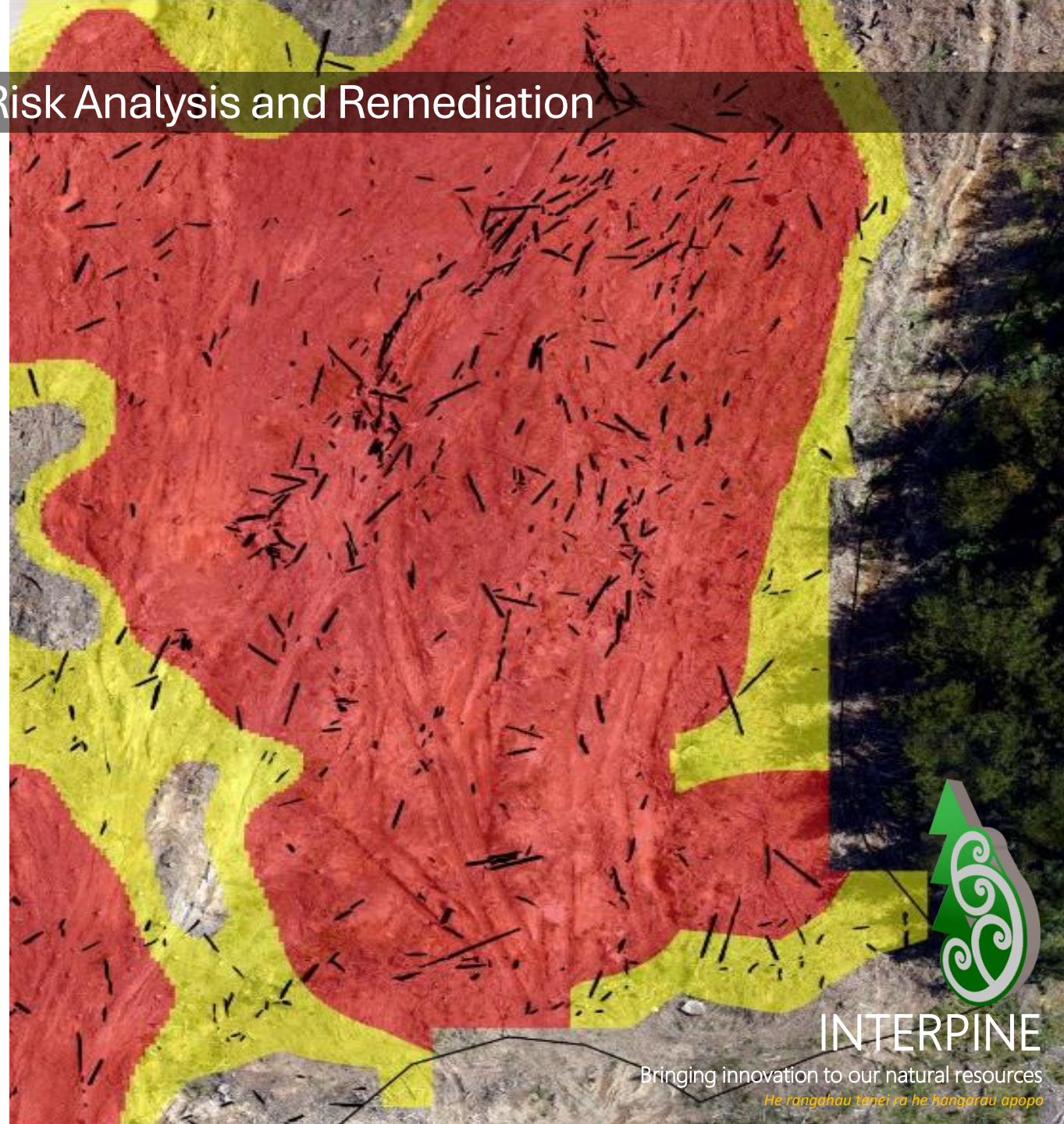
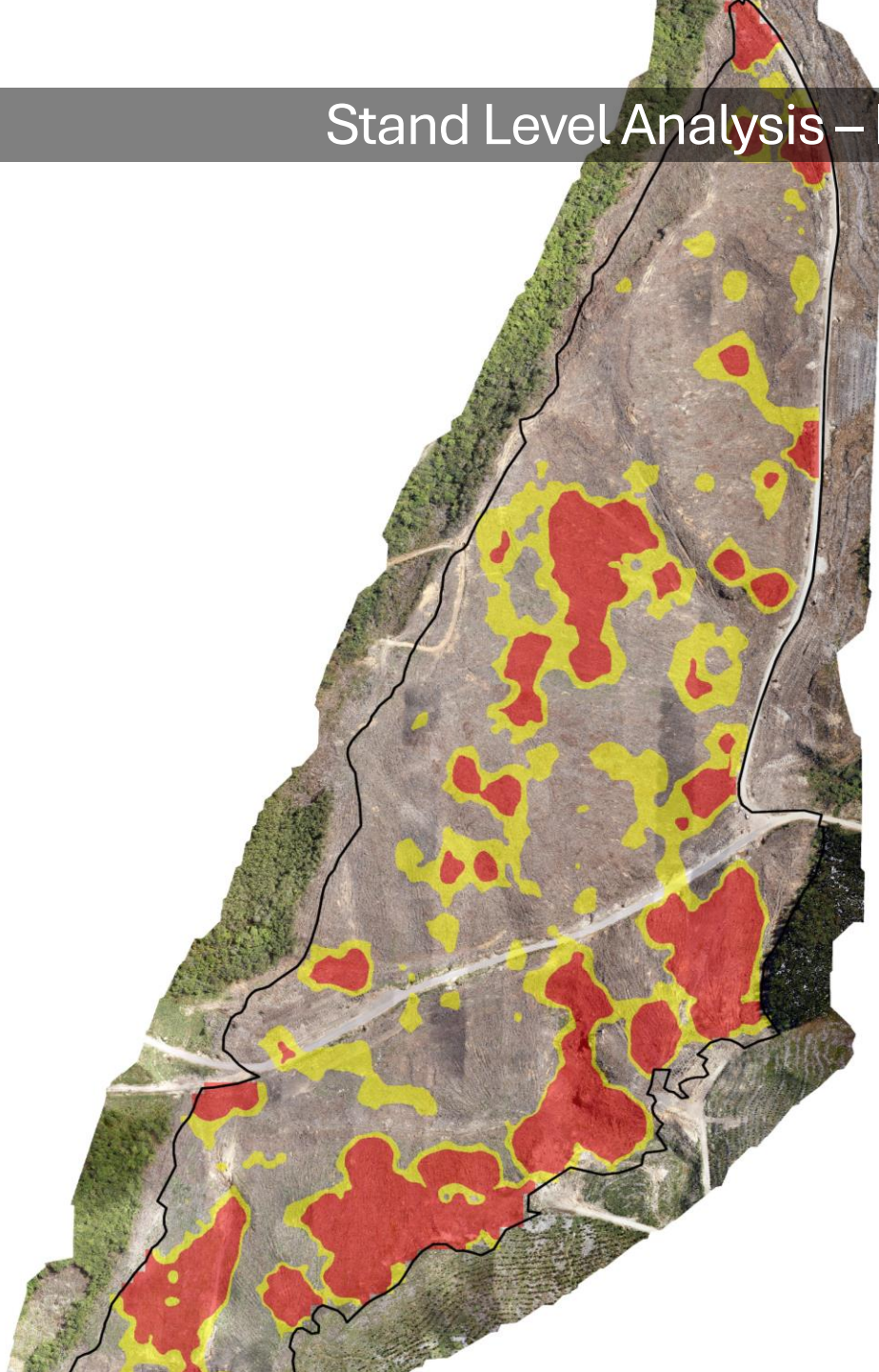
Bringing innovation to our natural resources

He rangahau tenei ra he hangarau apopo

detailed piece measurement and assessment for sound / rot



Stand Level Analysis – Risk Analysis and Remediation

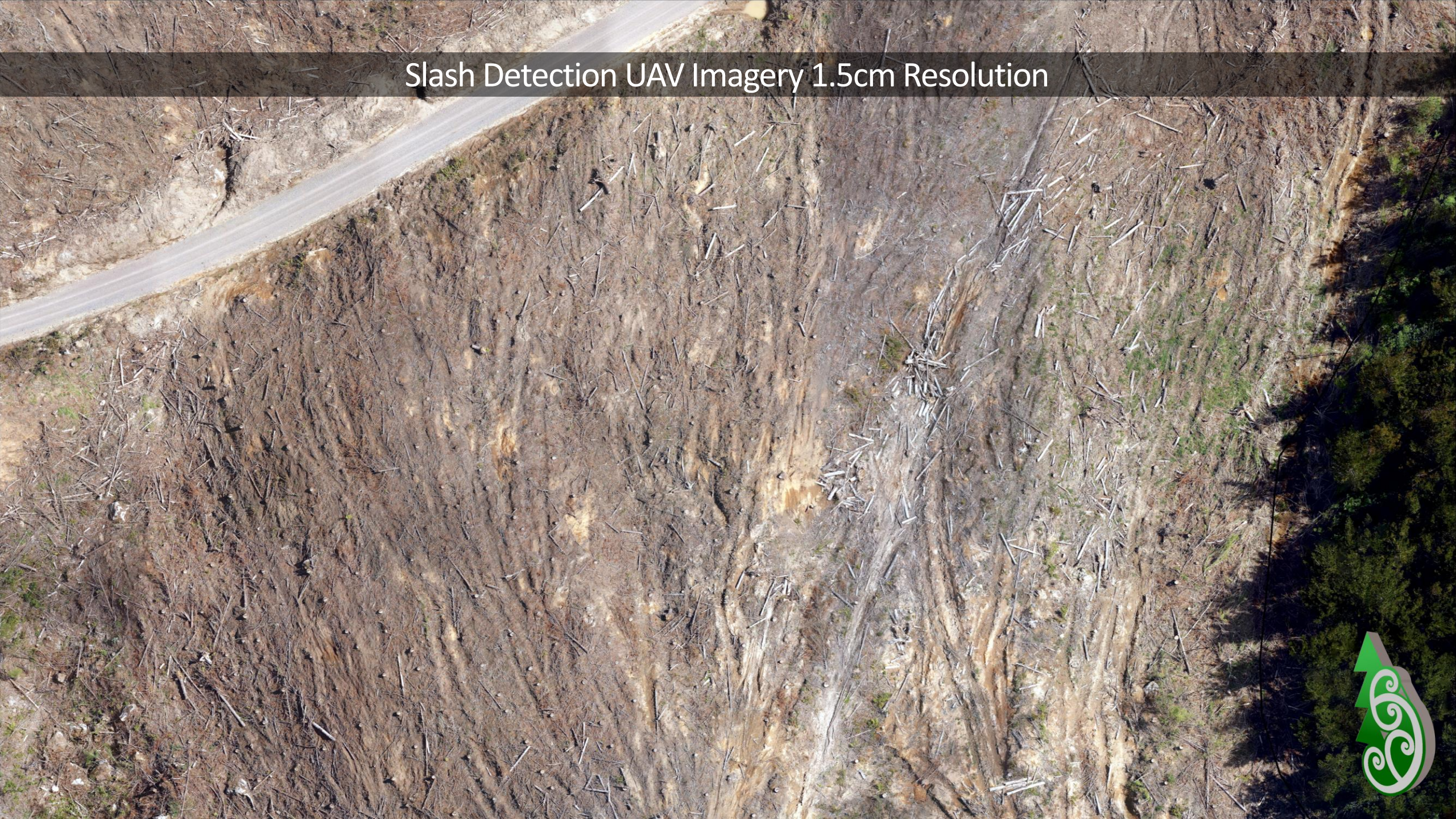


INTERPINE

Bringing innovation to our natural resources

He rangahau tenetia he hangarau aporo

Slash Detection UAV Imagery 1.5cm Resolution



Slash Detection UAV Imagery 1.5cm Resolution



Slash Detection






Slash Detection Length



Slash Detection UAV Imagery 1.5cm Resolution



Length

-  2-3m
-  3-4m
-  4m >



Landscape level – Risk Analysis and Remediation at Scale



INTERPINE

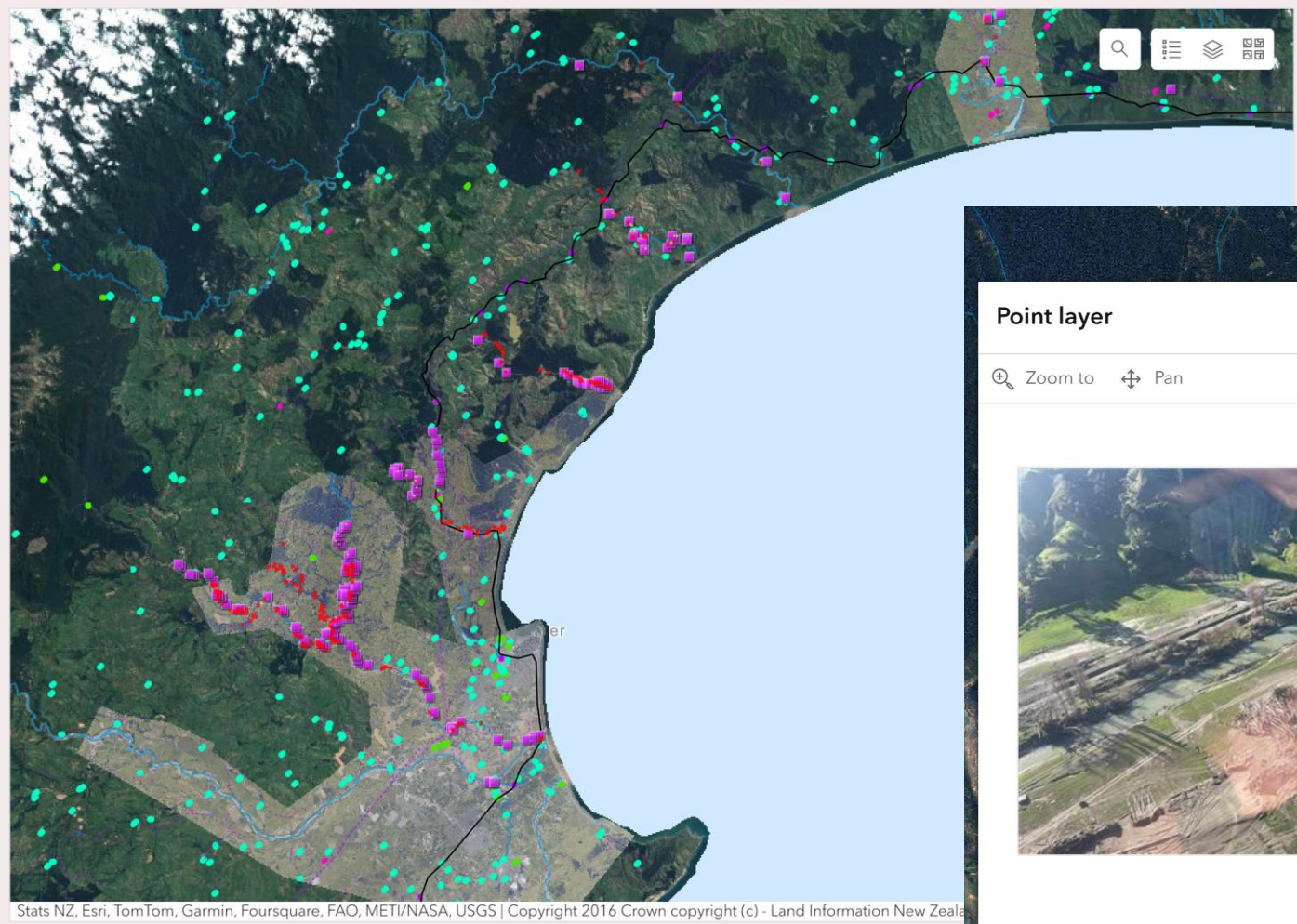
Bringing innovation to our natural resources

He rangahau tenei ra he hangarau apopo

 Woody Debris Piles Detected

Mapped Strata	Mapping Criteria	Coverage
Coastal River Mouth	Concentrated wood debris accumulation areas > 0.1ha, eg. 50*20m. May have sporadic gaps between debris up to 10m to map accumulated aggregate areas of impact.	Full coastline of Hawke's Bay and within +/-1km of major river mouths.
Coastal Beach		Full coastline of Hawke's Bay outside of +/-1km of major river mouths.
Inland Rivers		Mapped from river mouth by stream. Aropaoanui – 5km Esk – 8km Tutaekuri – 20km Ngaruroro – 8km Tukituki – 14km

241ha of coastal woody debris piles
+14ha of inland accessible woody debris piles



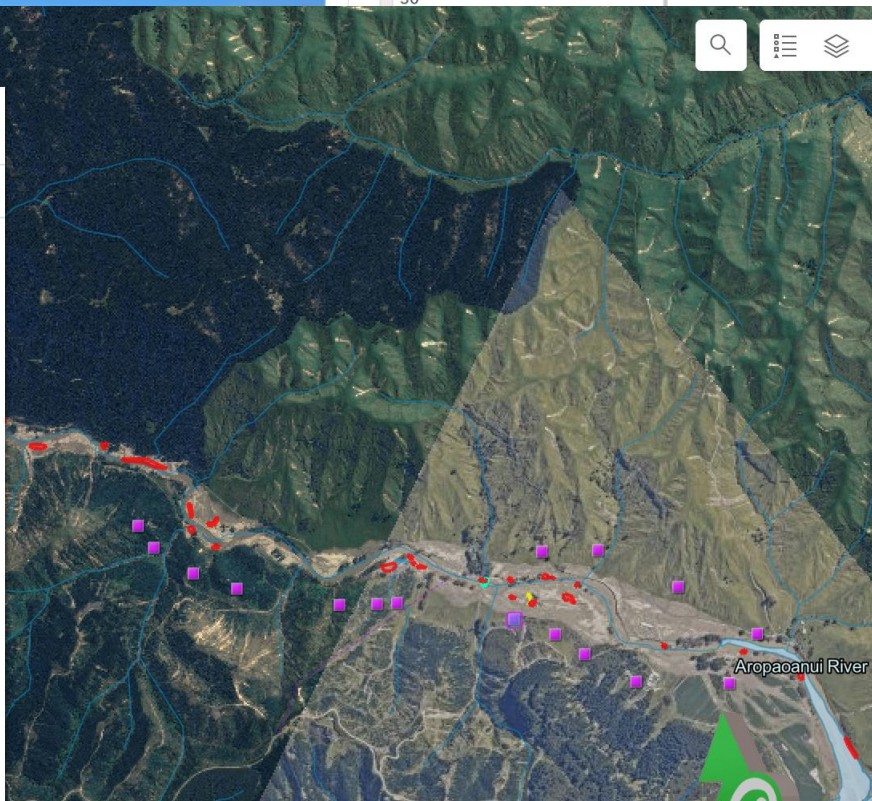
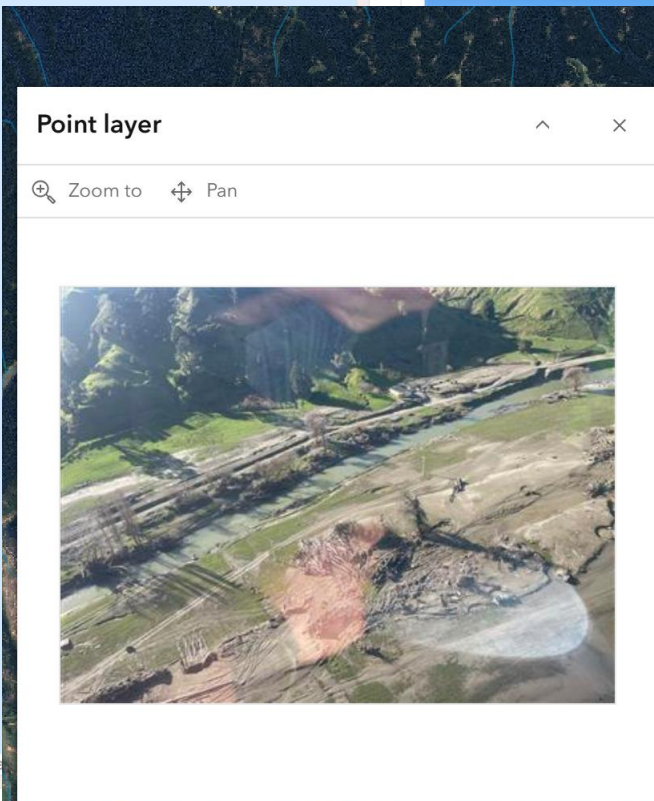
1 of 50

PHOTOS (Filtered by Map View)

Point layer

Area Summary by Pile Density (Existing = YES)

Pile_Density	Area
<10	
100	
25	
50	



Stats NZ, Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS | Copyright 2016 Crown copyright (c) - Land Information New Zealand

PILE ATTRIBUTES (Filtered by Map View)

FID	Priority	Existing	Area	Pile_c
147	None	Not Surveyed	4.953	Not Surveyed
2	Low	Yes	3.554	75
85	Medium	Yes	3.077	<10
94	Low	Yes	2.977	<10
95	Low	Yes	2.196	<10
184	None	Not Surveyed	2.127	Not Surveyed
254	None	Not Surveyed	2.073	Not Surveyed
148	None	Not Surveyed	1.962	Not Surveyed

INTERPINE

Bringing innovation to our natural resources

LinZ, Stats NZ, Esri, TomTom, Garmin, Foursquare, METI/NASA, USGS | Copyright 2016 Crown copyright (c) - Land Information New Zealand

Hastings District Ngaruroro

Powered by *he tangahau tenei ra he hangarau*

3-4m Resolution Satellite Image



INTERPINE

Bringing innovation to our natural resources

He rangahau tenei ra he hangarau apopo

0.5m Resolution Satellite Image



0.1m Resolution Aerial Image



INTERPINE

Bringing innovation to our natural resources

He rangahau tenei ra he hangarau apopo

https://data.linz.govt.nz/layer/11...

Gisborne 0.1m Rural Aerial Photos (2023-2024)



Land Information N...
via LINZ Data Service

Map x

Info History

Services and APIs



Data Type

Raster Layer,
0.1m, 25.1K Tiles

Date Added Last Updated

14 Oct 2024 21 Oct 2024

Gisborne 0.1m Rural Aerial Photos (2023-2024), Gi... File View Tools

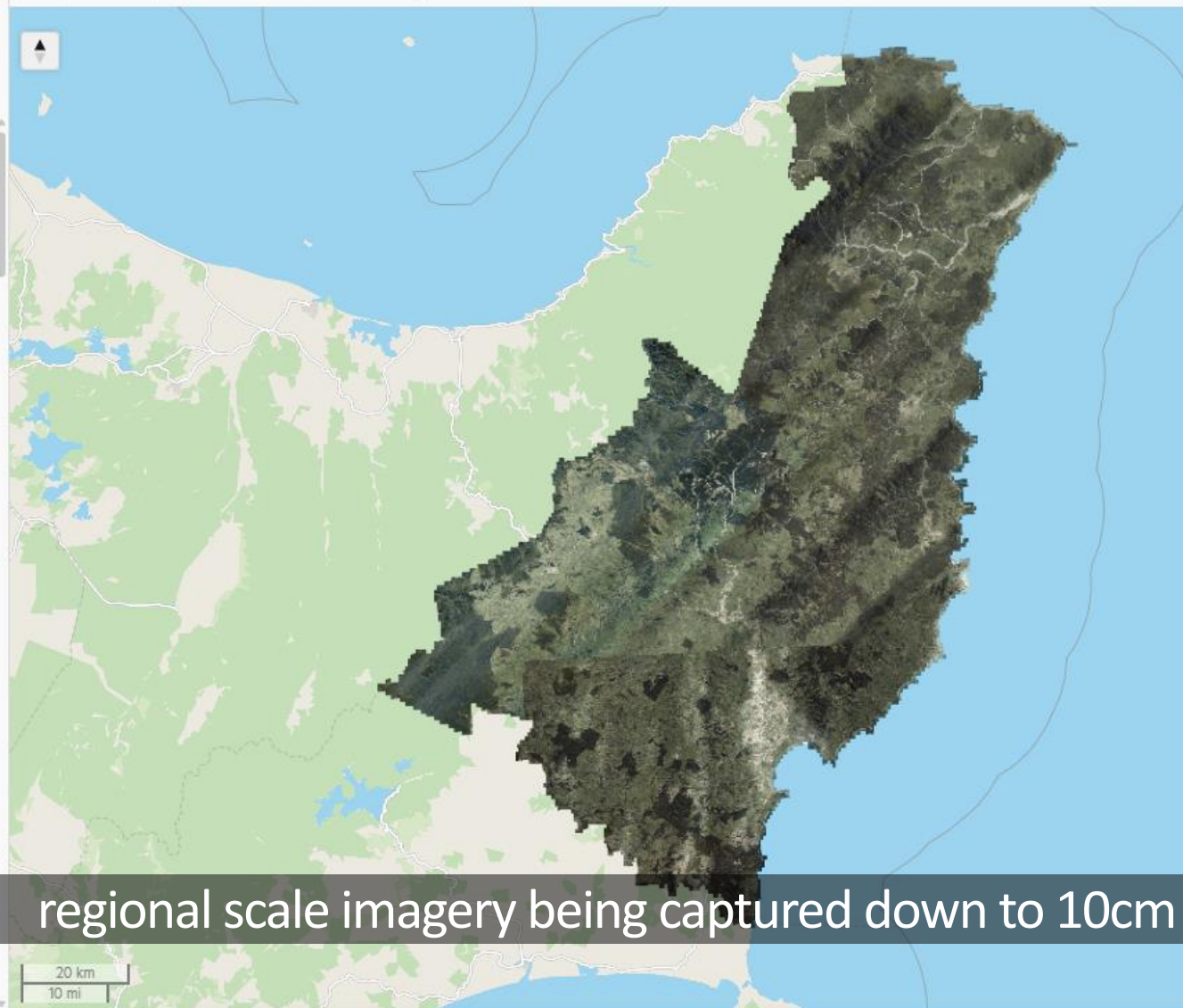
2D 3D ⚙️

Find location

Export

Contents

- Gisborne 0.1m Rural Aerial Phot... x
- Basemap Streets ▾



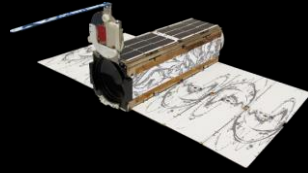
regional scale imagery being captured down to 10cm GSD



CURRENT CONSTELLATIONS

Agile Aerospace

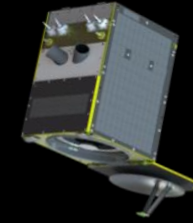
Through our agile aerospace approach, we've created a unique data set



SuperDove

Always-on Monitoring

- Hundreds of satellites
- Up to 300 million km² / day
- 8-band
- Unique scanning

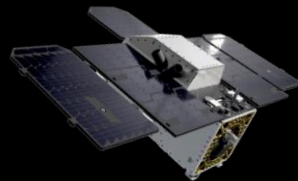


SkySat

High-Resolution Tasking

- ~15 satellites
- **50cm resolution**
- RGB, NIR, and Pan bands
- Sub-daily tasking

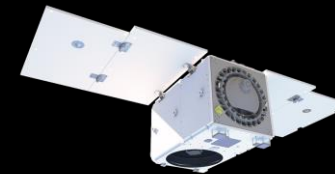
PLANNED FUTURE CONSTELLATIONS



Tanager

Hyperspectral Tasking

- Tanager-1 launched
- 400 - 2500 nm
- ~400 5nm bands



Pelican

Very High Resolution Tasking

- Initial constellation of up to 30 satellites¹
- **Up to 30cm resolution**
- Pan + 6 RGB+NIR bands
- Up to 30 revisits/day

PLANNED HIGH RESOLUTION UPGRADE

¹ Does not include initial 2 demonstration satellites planned.





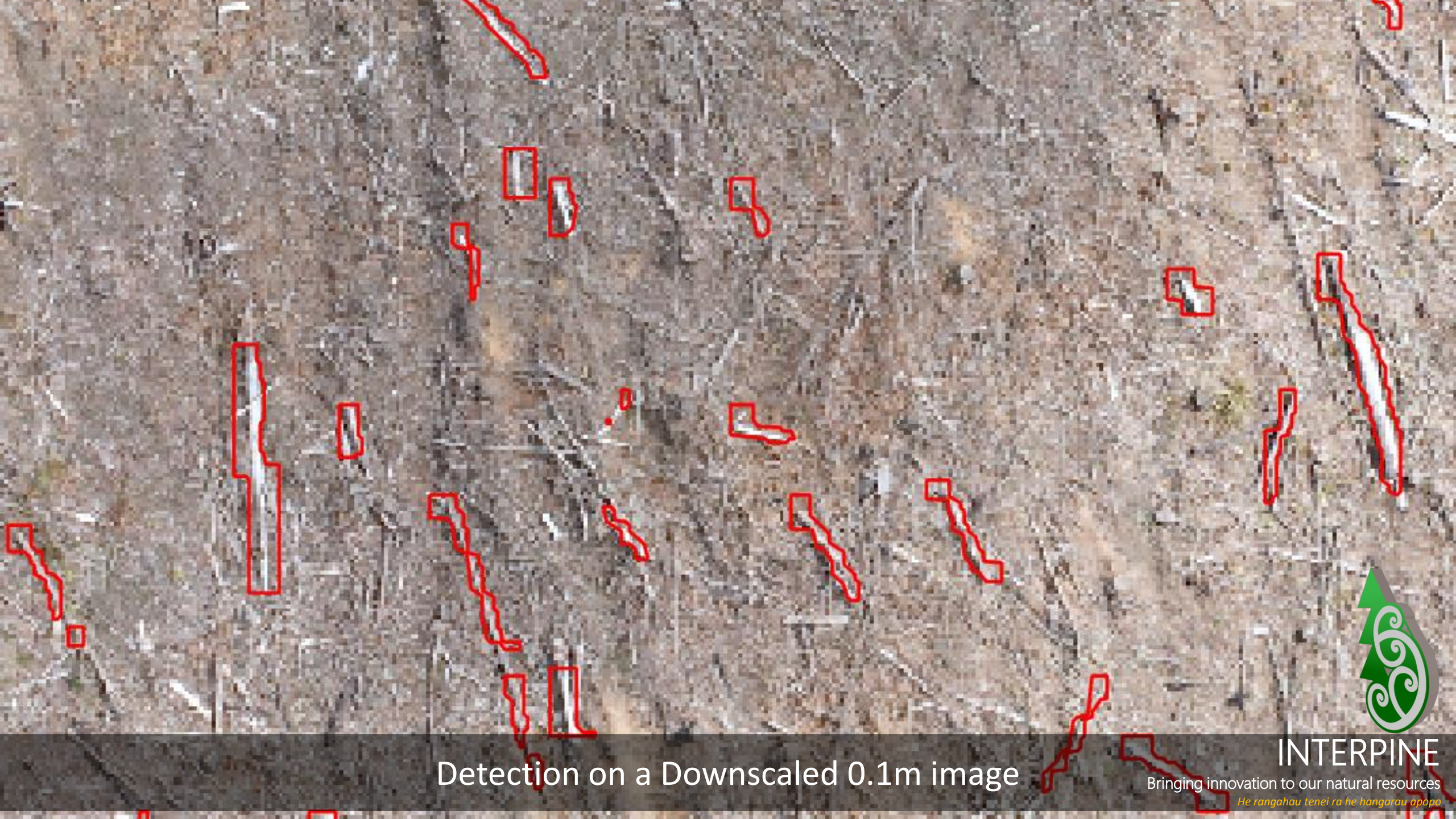
0.015m



Downscaled 0.1m



Detection on 0.015m UAV image



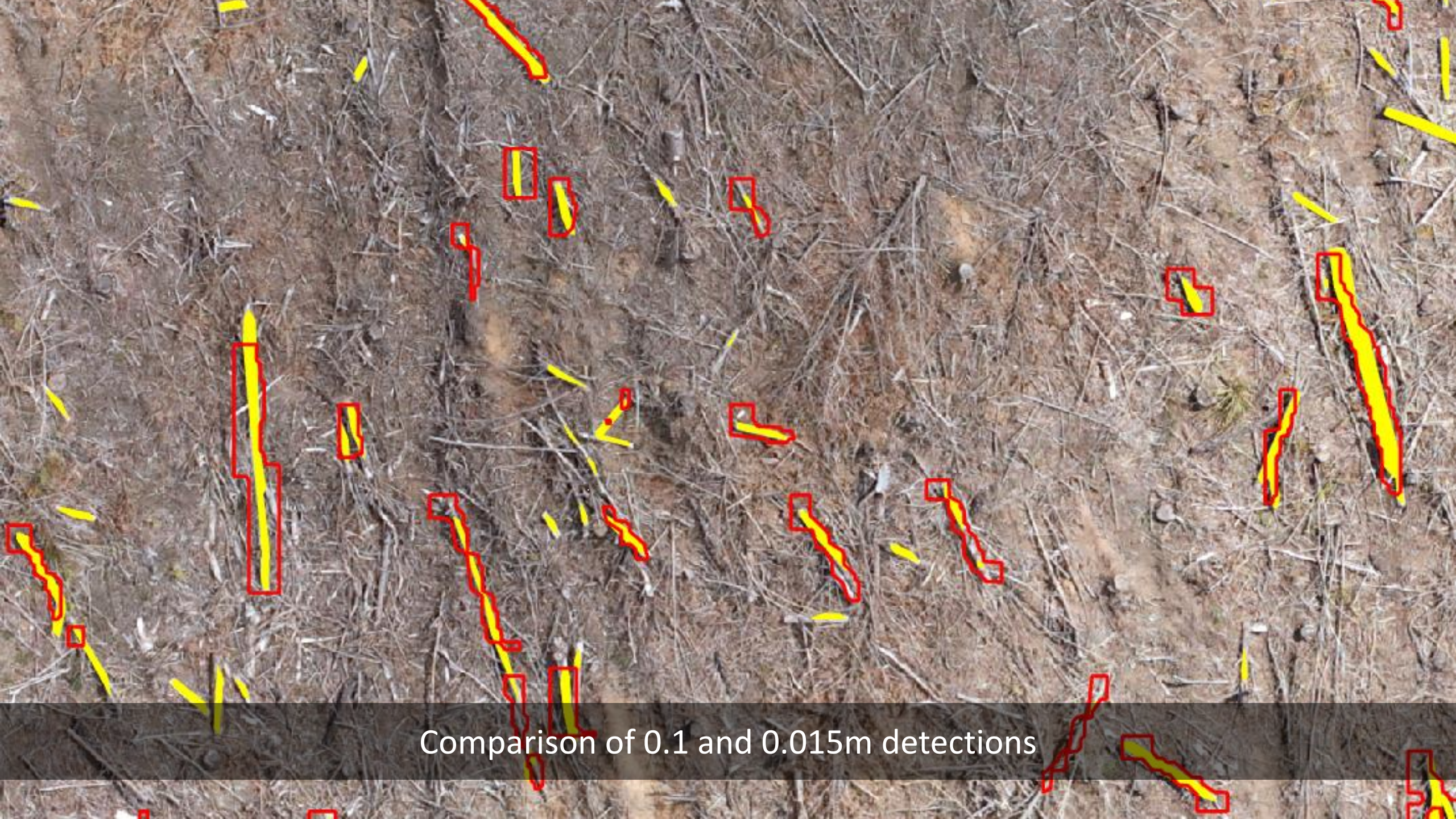
Detection on a Downscaled 0.1m image



INTERPINE

Bringing innovation to our natural resources

He rangahau tenei ra he hangarau apopo



Comparison of 0.1 and 0.015m detections



Applying AI Image Resolution Enhancement to Aid AI Detector Training

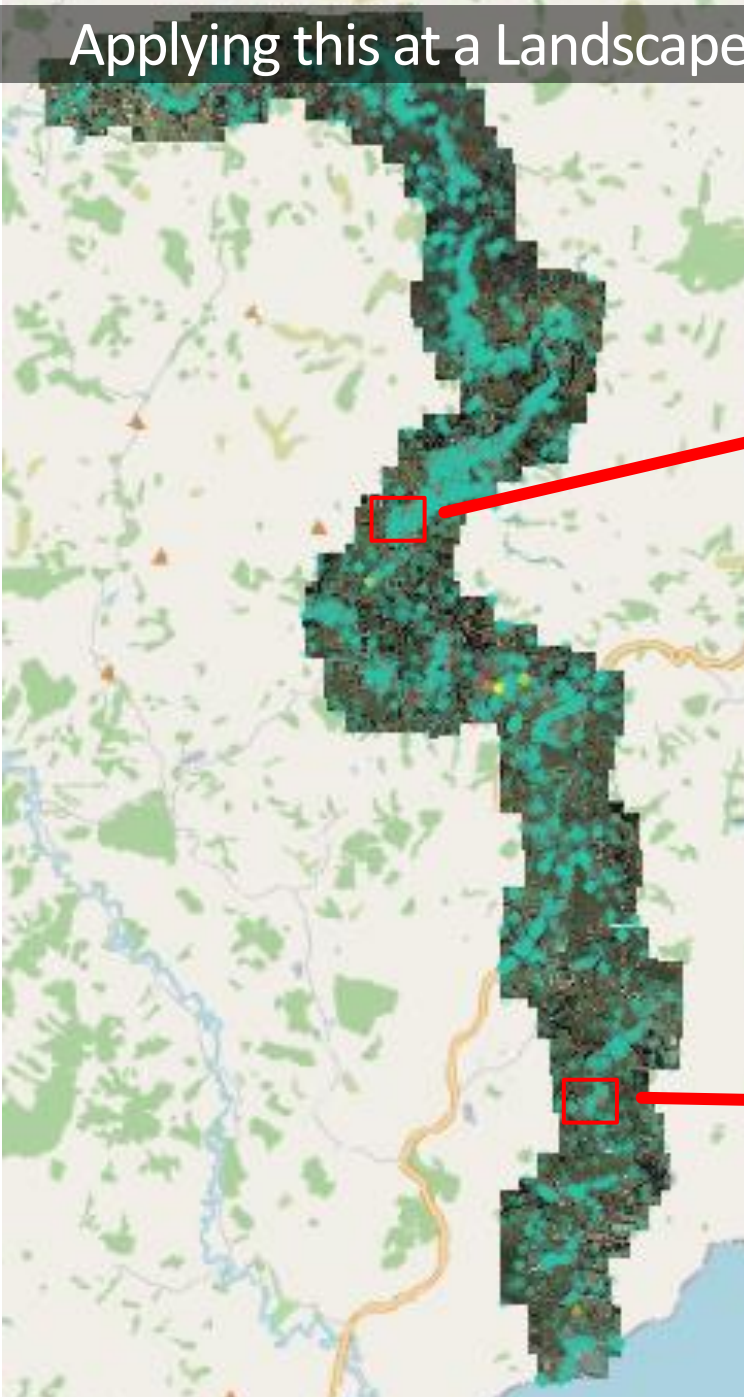
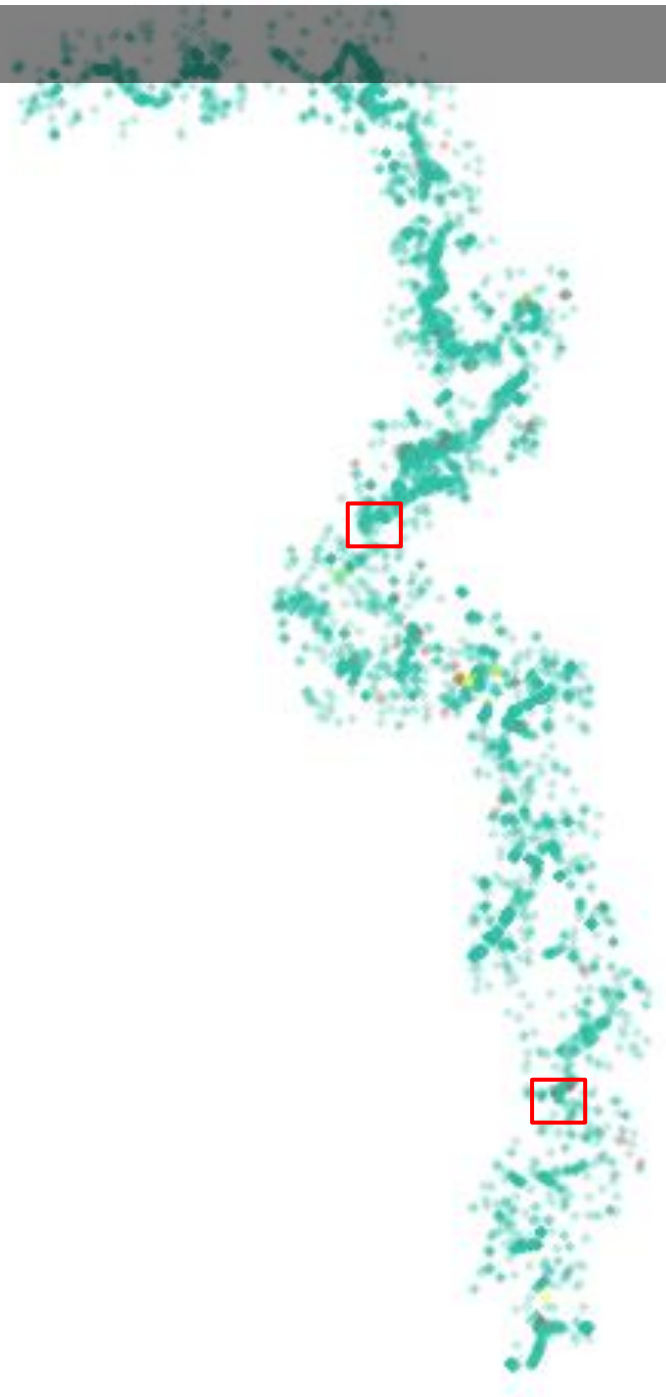


Original Aerial Photo 0.1m Resolution



AI upscaled photo 0.025m resolution

Applying this at a Landscape Level



Machine Learning detection using regional scale 0.1m imagery



INTERPINE

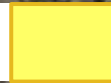
Bringing innovation to our natural resources

He rangahau tenei ra he hangarau apopo

Slash type #2: piles



Slash type #3: fallen trees

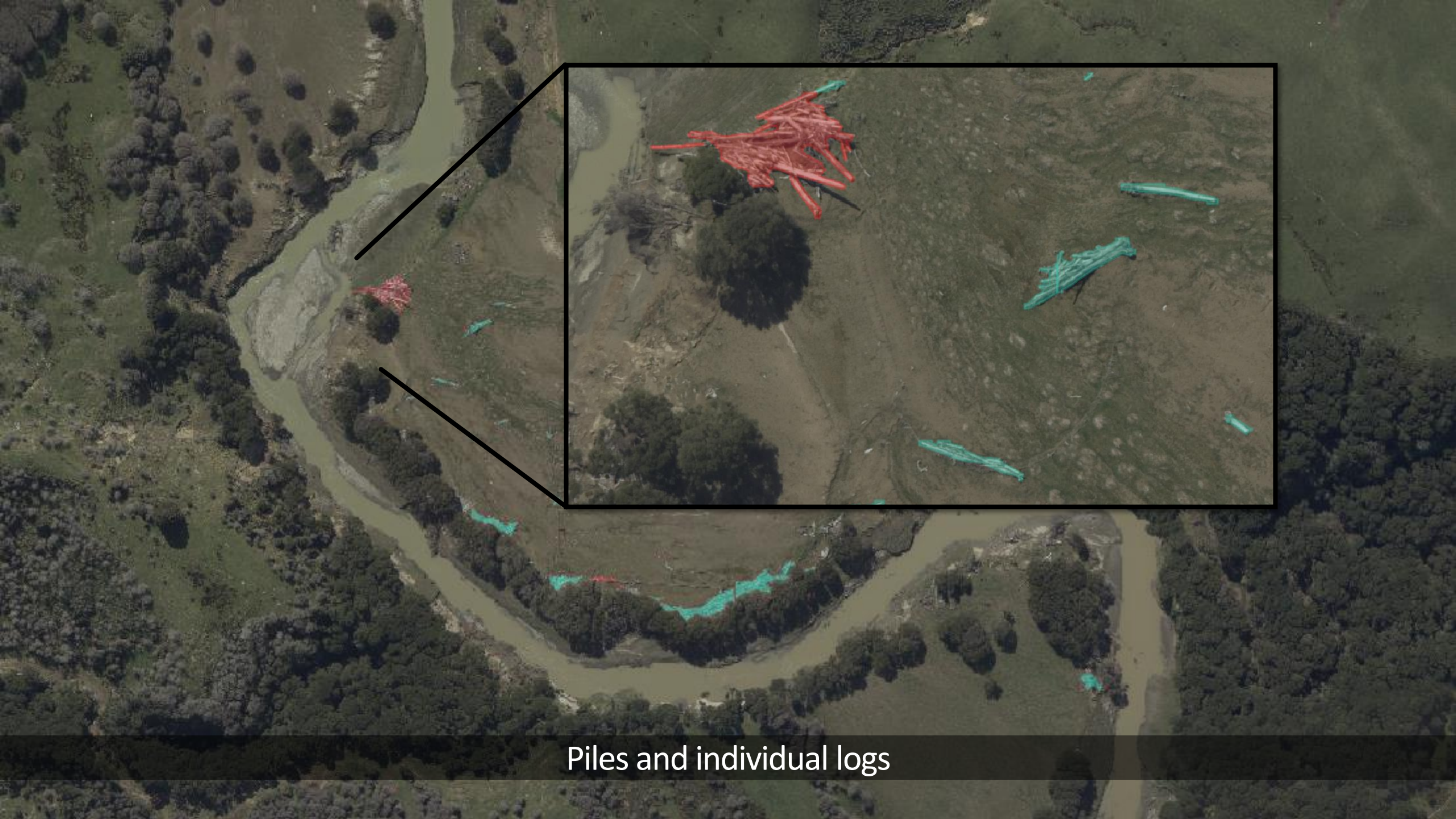


Slash type #1: single log

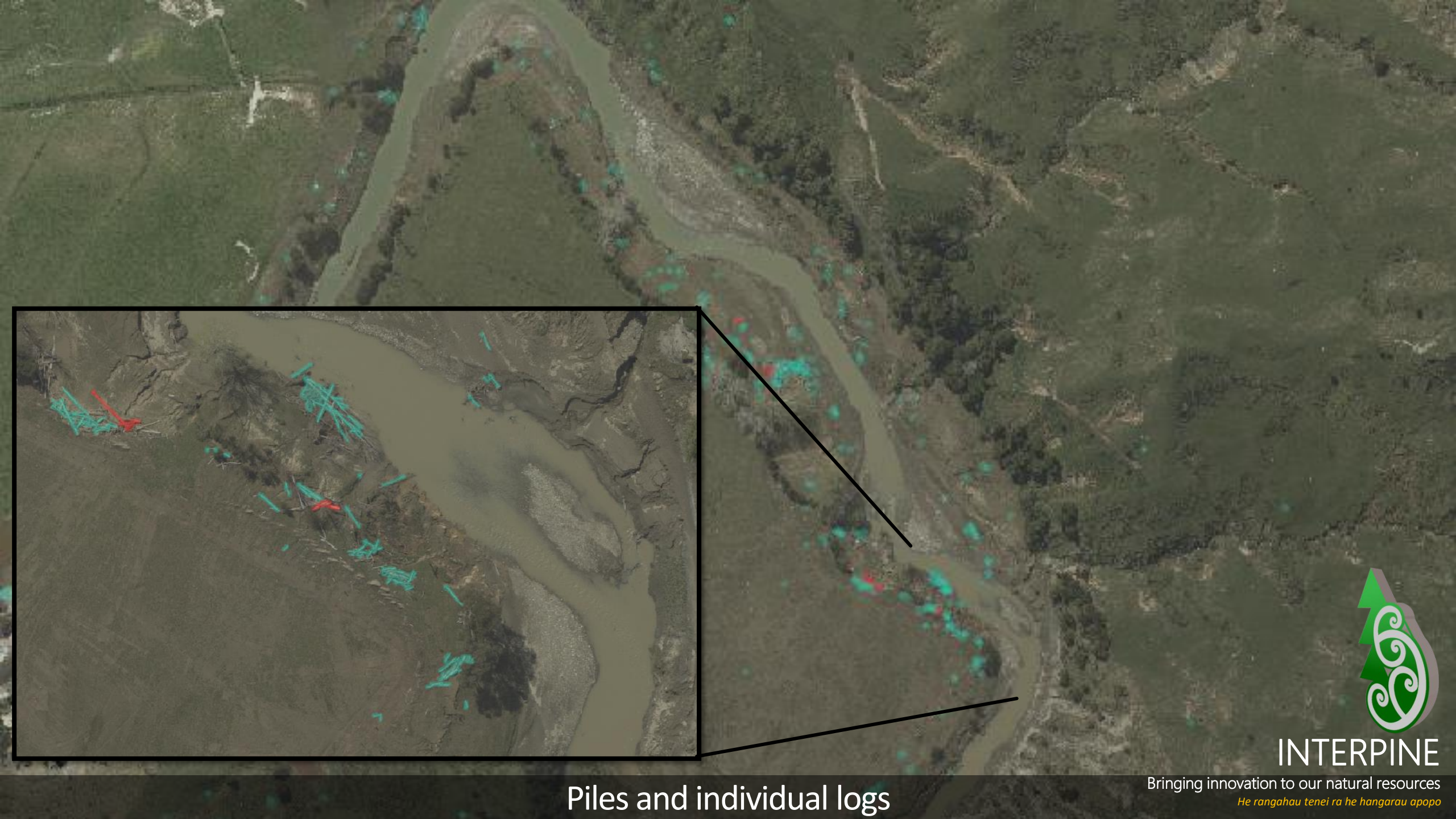


Data labelling – split into 3 classes





Piles and individual logs



Piles and individual logs



INTERPINE

Bringing innovation to our natural resources

He rangahau tenei ra he hangarau apopo



Piles and individual logs

Slash piles



Coastal slash piles



false positives



INTERPINE

Bringing innovation to our natural resources

He rangahau tenei ra he hangarau apopo



What's next?

Applying this to **Forest Level** for risk assessment

Acknowledgements

Sam West, Susana Gonzalez, Joo Hynn Ahn

Copyright / Disclaimer

The information in this document has been prepared and approved by Interpine Group Limited (Interpine). Access to the information in this document is being given by Interpine specifically to the person(s) to which it was intended. The information contained in this document remains the intellectual property of Interpine and may not be reproduced, distributed or published by any recipient for any purpose without the prior written consent of Interpine.

Although all reasonable care has been taken to ensure that the information contained in this document is accurate, neither Interpine nor its respective officers, advisers or agents makes any representation or warranty, express or implied as to the accuracy, completeness, currency or reliability of such information or any other information provided whether in writing or orally to any recipient or its officers, advisers or agents.

Interpine and its respective officers, advisers, or agents do not accept: any responsibility arising in any way for any errors in or omissions from any information contained in this document or for any lack of accuracy, completeness, currency or reliability of any information made available to any recipient, its officers, advisers, or agents; or any liability for any director or consequential loss, damage or injury suffered or incurred by the recipient, or any other person as a result of or arising out of that person placing any reliance on the information or its accuracy, completeness, currency or reliability.

Contact

W: interpine.nz

P: +64 7 350 3209

E: info@interpine.nz



INTERPINE

Bringing innovation to our natural resources

He rangahau tēnei ngā ke āngarau āpōpō