The Challenges of

Quantifying Woody Debris

Using Machine Learning

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CTO / Director

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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**	

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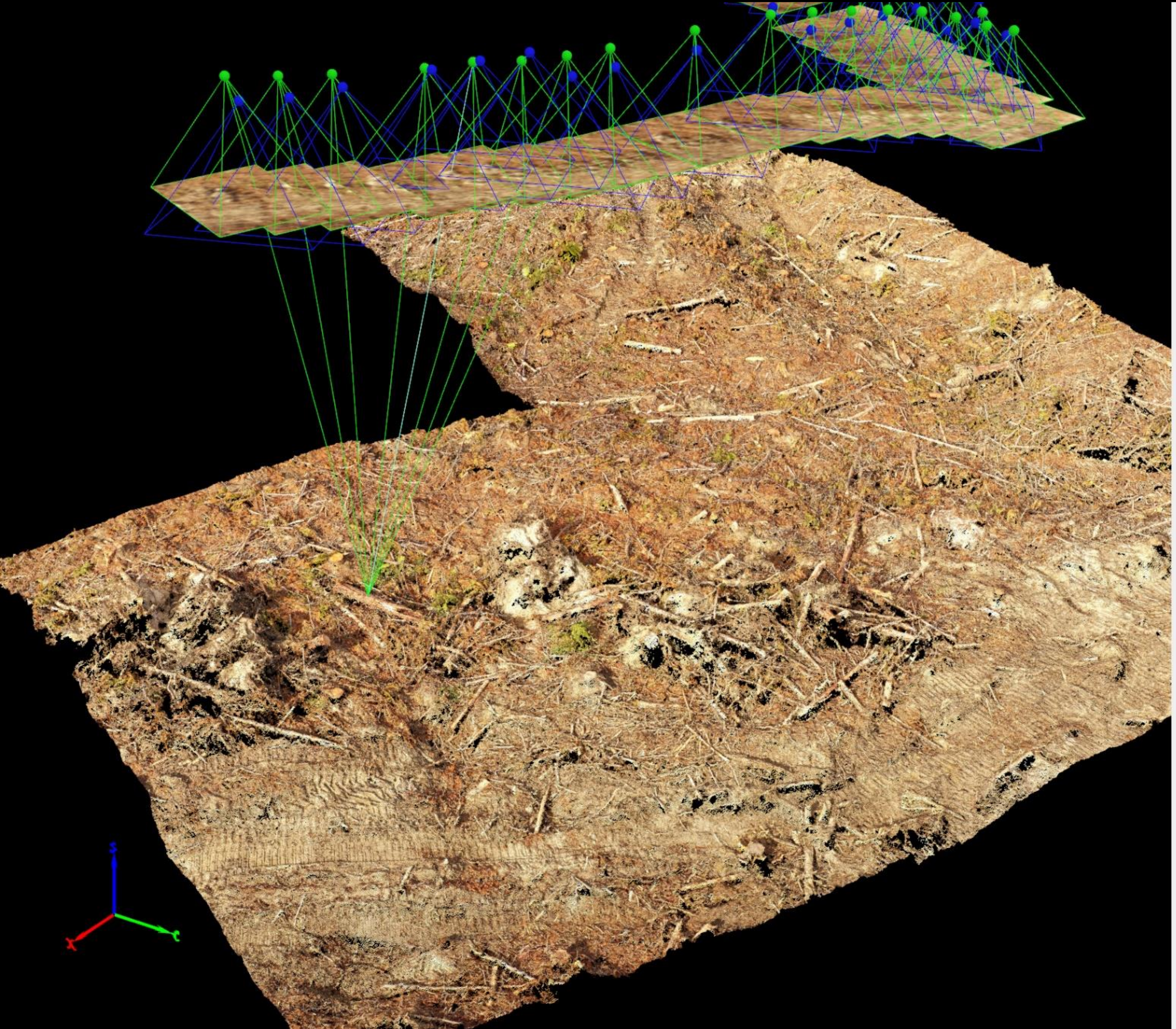
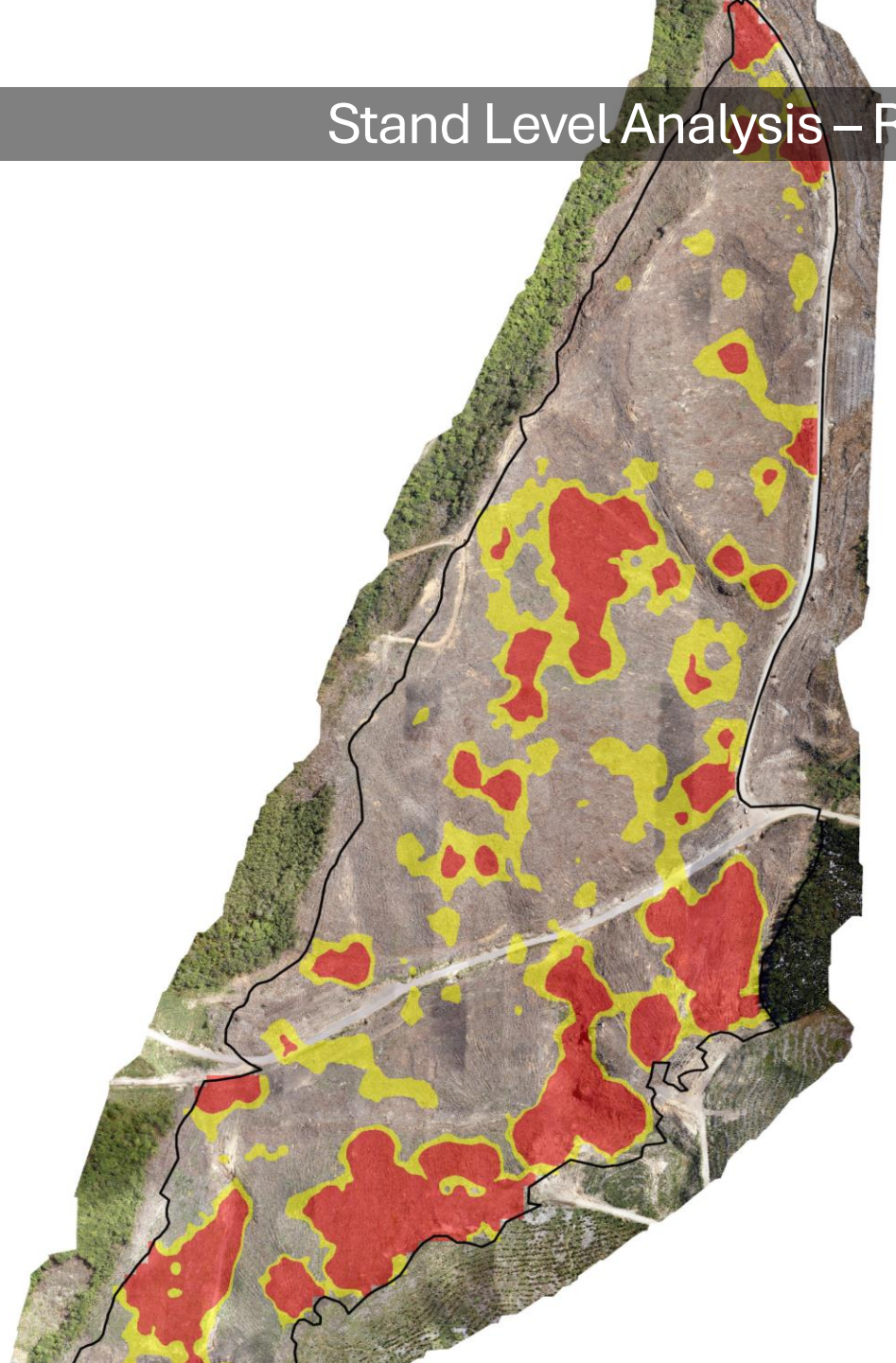
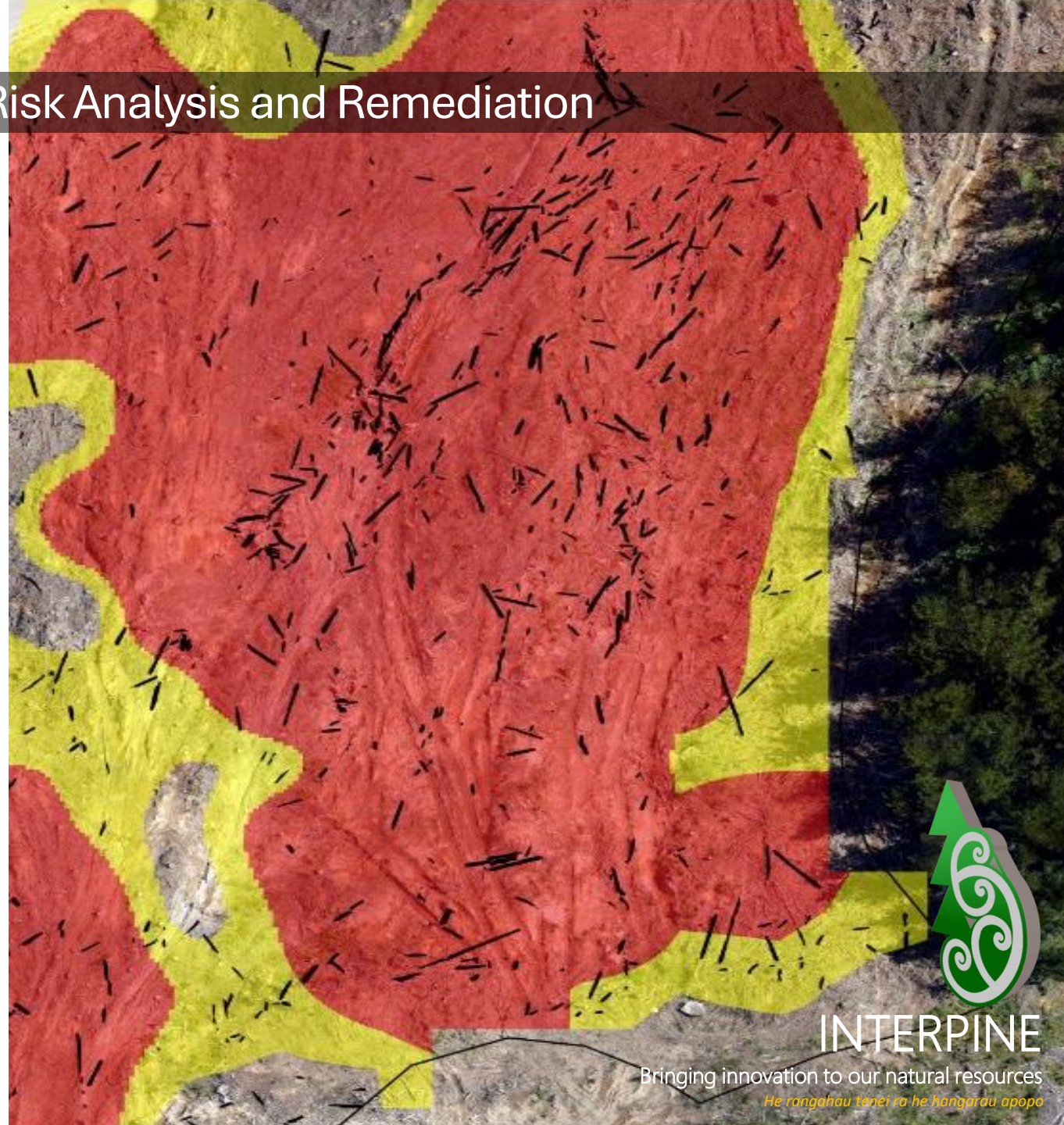
detailed piece measurement and assessment for sound / rot



Stand Level Analysis – Risk Analysis and Remediation





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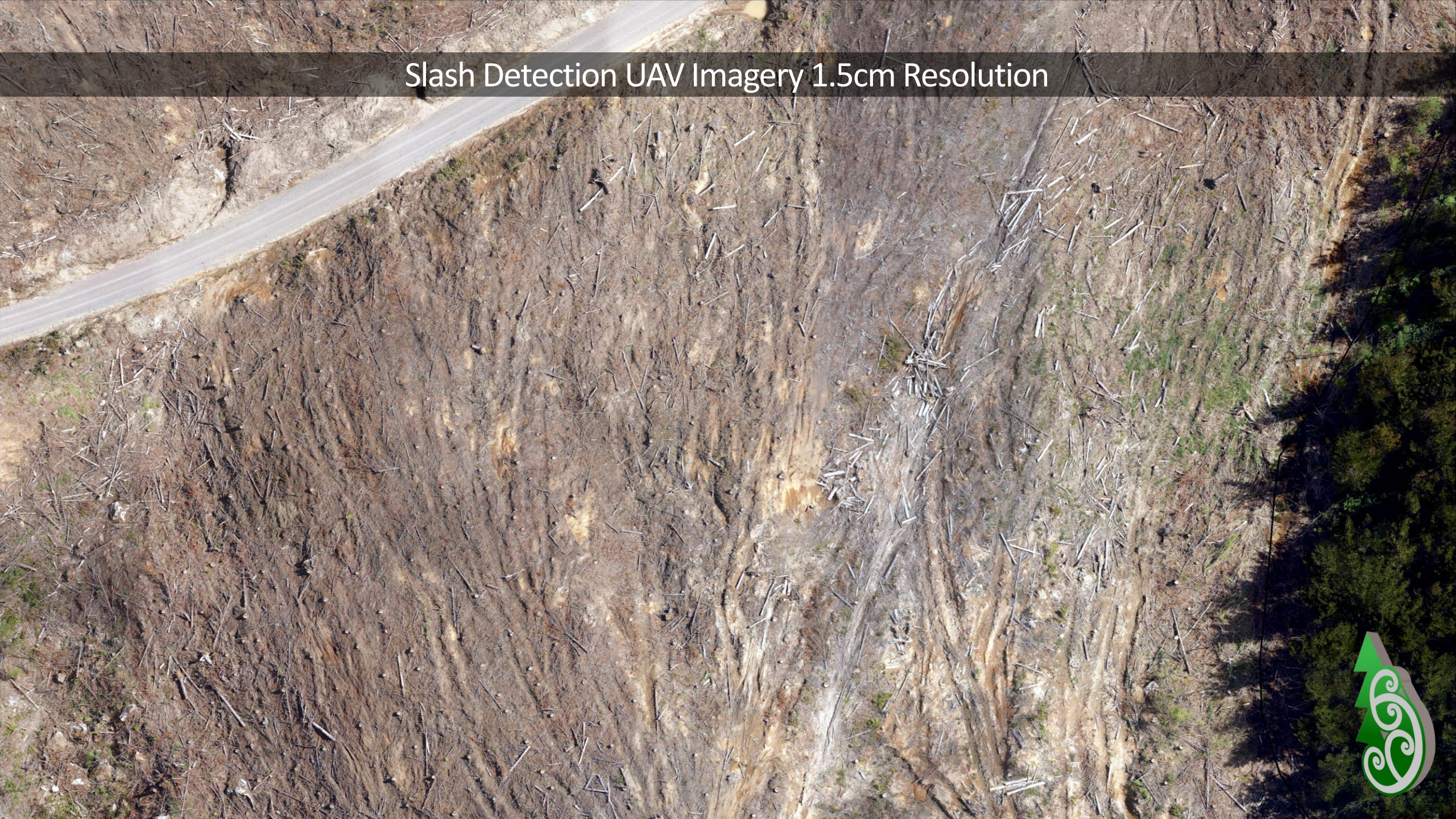
Slash Detection UAV Imagery 1.5cm Resolution



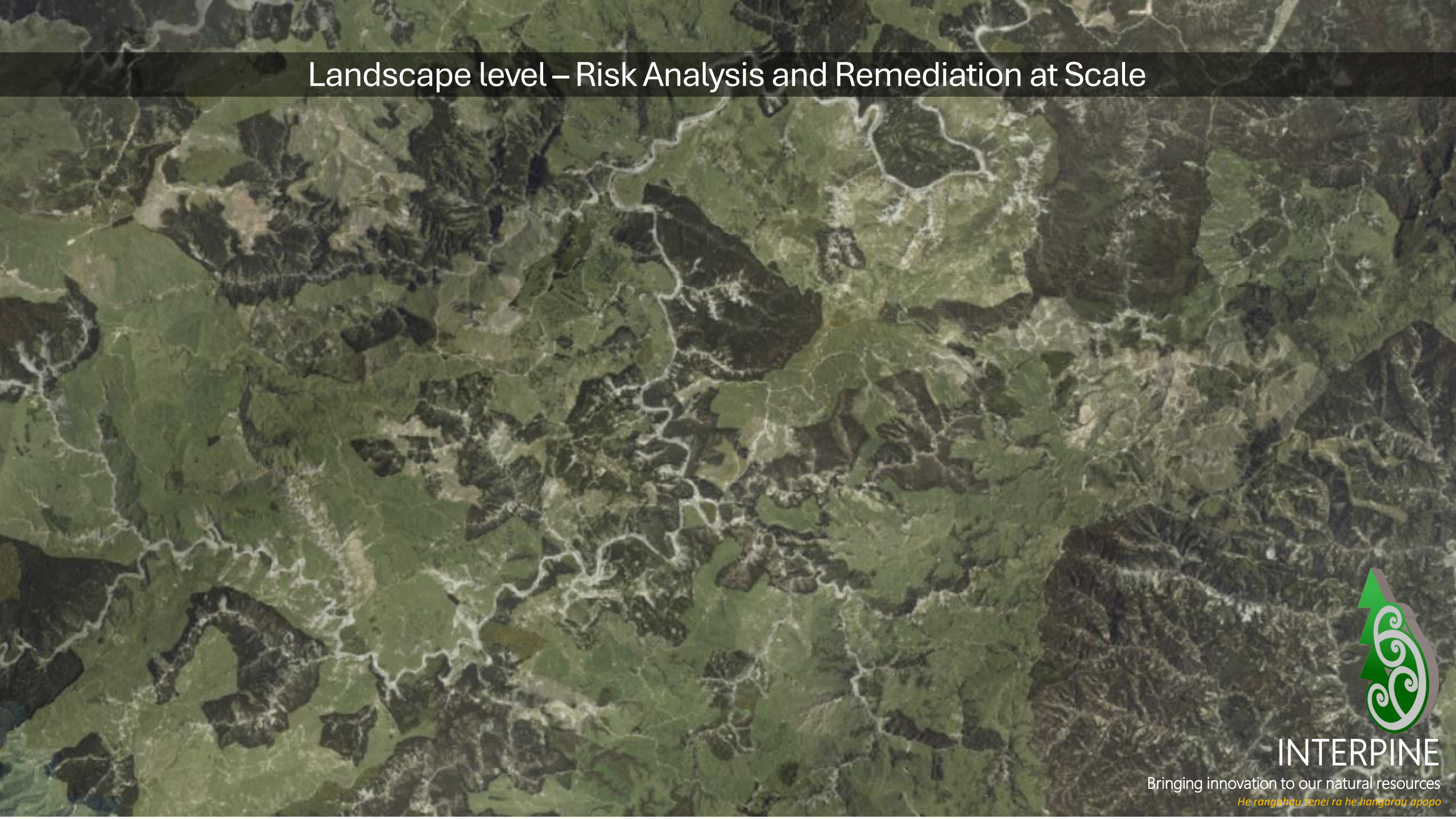

Slash Detection UAV Imagery 1.5cm Resolution

Slash Detection

Slash Detection Length

Slash Detection UAV Imagery 1.5cm Resolution

Landscape level – Risk Analysis and Remediation at Scale



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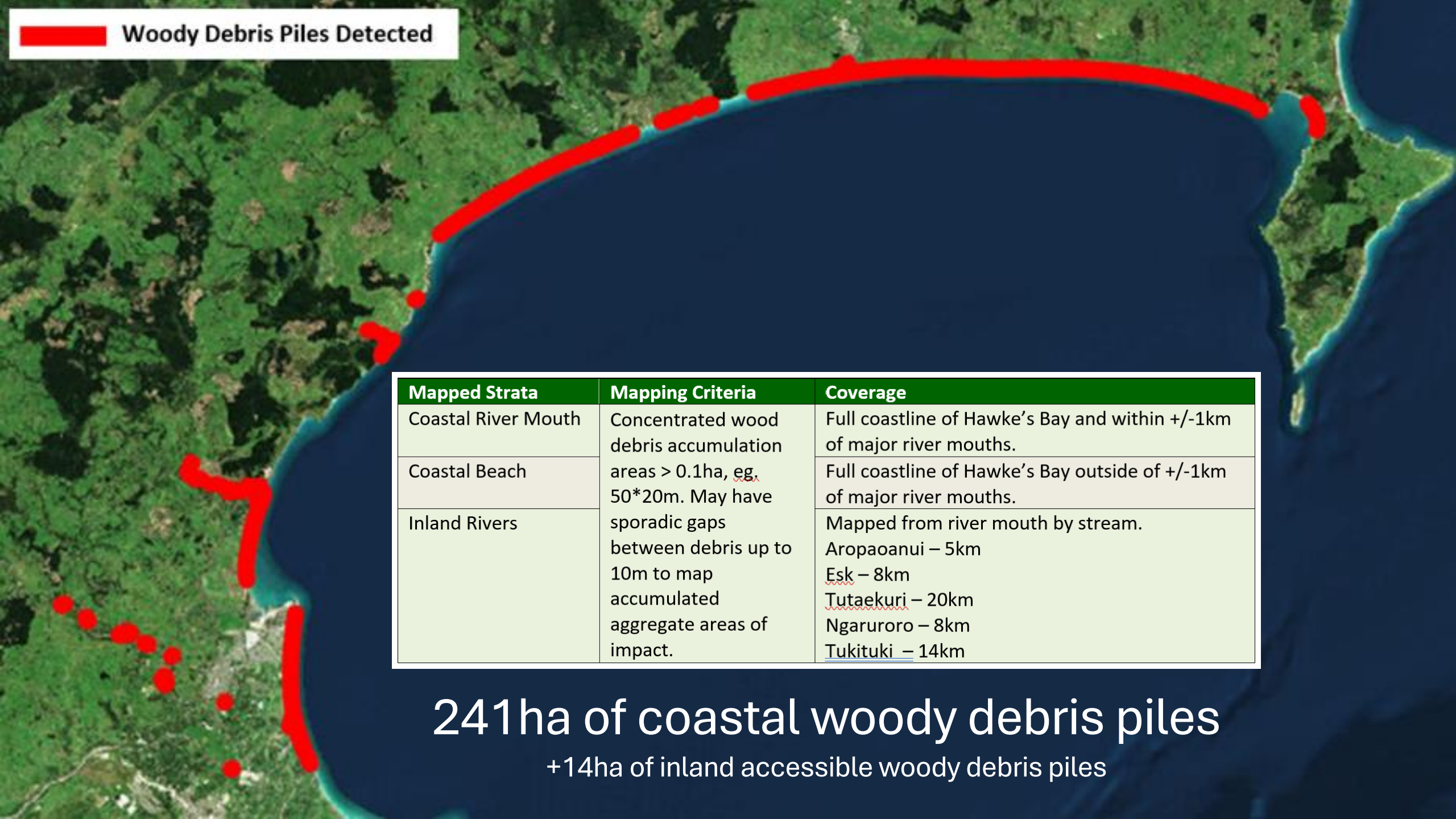
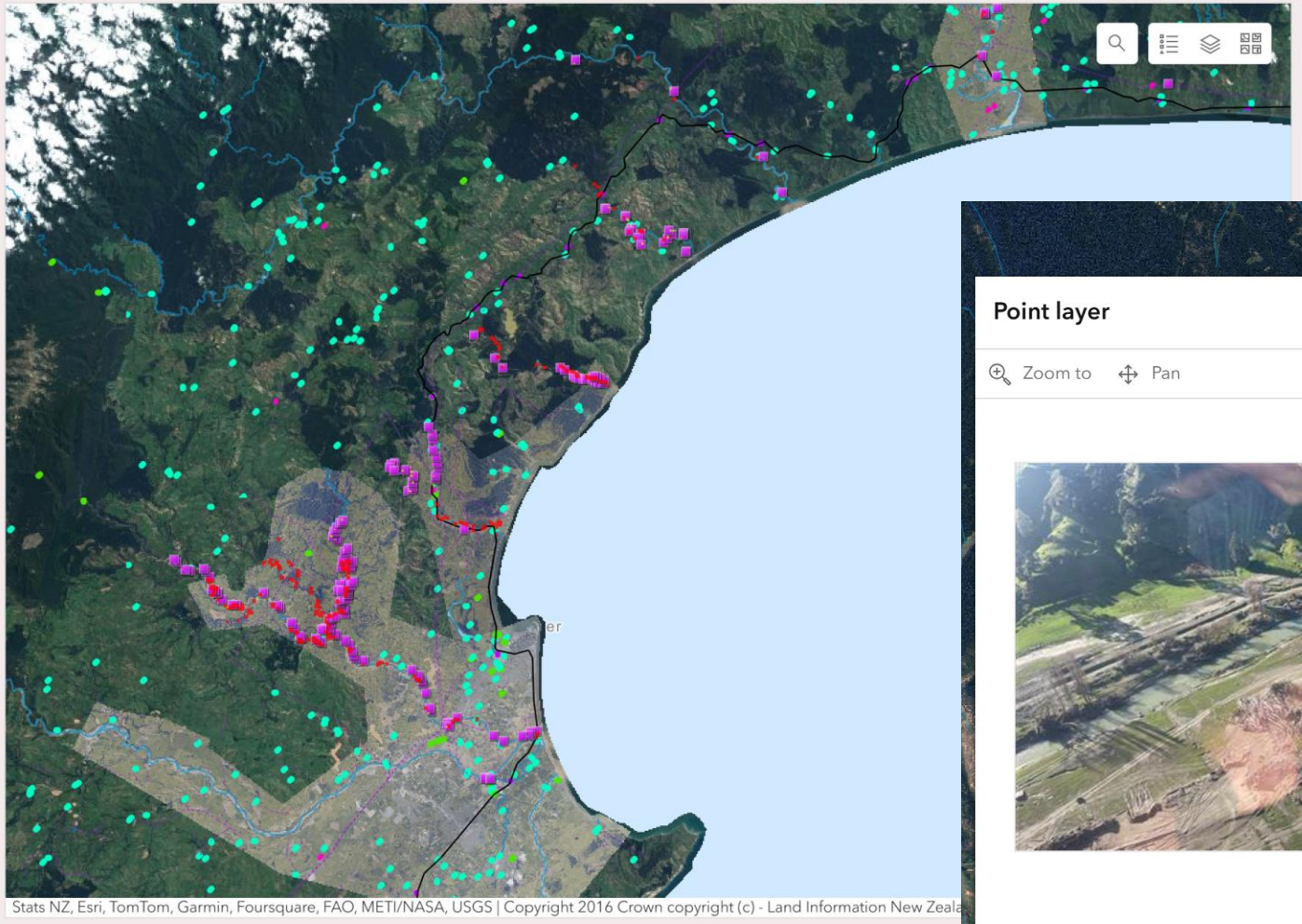


Mapped Strata	Mapping Criteria	Coverage
Coastal River Mouth	Concentrated wood debris accumulation areas > 0.1ha, eg. 50*20m. May have sporadic gaps between debris up to 10m to map accumulated aggregate areas of impact.	Full coastline of Hawke's Bay and within +/-1km of major river mouths.
Coastal Beach		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

HB Woody Debris Management Dashboard Hawke's Bay Regional Council



1 of 50

PHOTOS (Filtered by Map View)

Point layer

Area Summary by Pile Density (Exisiting = YES)

Pile_Density	Area
<10	
100	
25	
50	

Point layer

Zoom to Pan

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

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0.5m Resolution Satellite Image

0.1m Resolution Aerial Image

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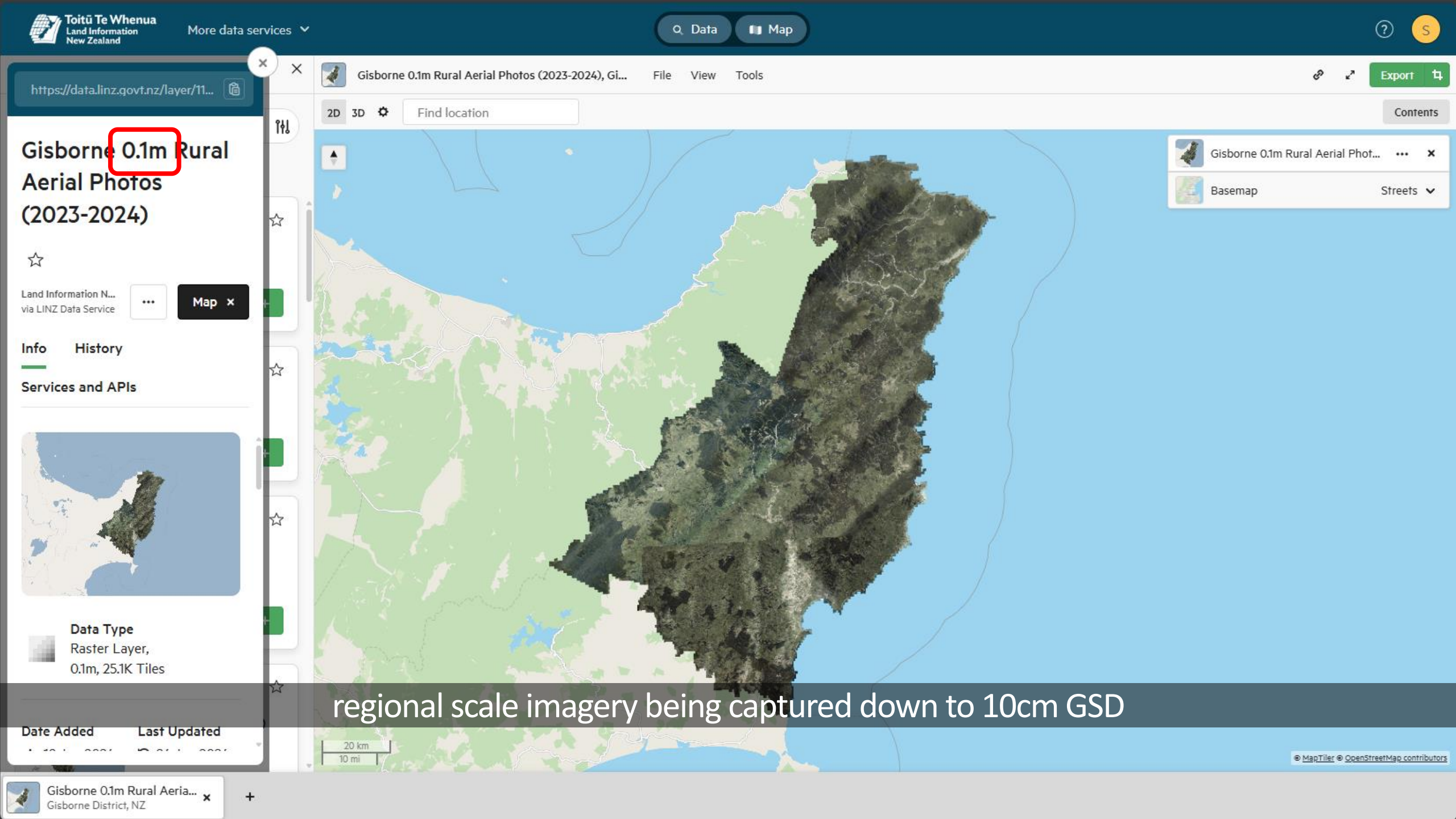
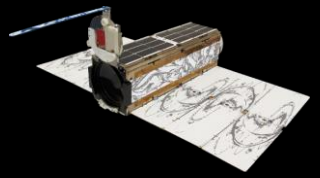

Toitū Te Whenua
Land Information New Zealand
More data services
Data
Map
https://data.linz.govt.nz/layer/11...
Gisborne 0.1m Rural Aerial Photos (2023-2024)
Land Information N...
via LINZ Data Service
Map
Info
History
Services and APIs
Data Type
Raster Layer,
0.1m, 25.1K Tiles
Date Added
Last Updated
Gisborne 0.1m Rural Aerial Photos (2023-2024), Gi...
File
View
Tools
Export
2D
3D
Find location
Contents
Gisborne 0.1m Rural Aerial Phot...
Basemap
Streets
regional scale imagery being captured down to 10cm GSD
20 km
10 mi
MapTiler
OpenStreetMap contributors
Gisborne 0.1m Rural Aeria...
Gisborne District, NZ

Agile Aerospace

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

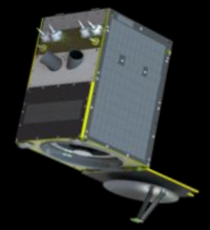
CURRENT CONSTELLATIONS



SuperDove

Always-on Monitoring

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



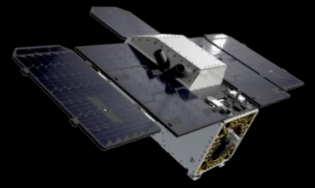
SkySat

High-Resolution Tasking

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

PLANNED HIGH RESOLUTION UPGRADE

PLANNED FUTURE CONSTELLATIONS



Tanager

Hyperspectral Tasking

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

Pelican

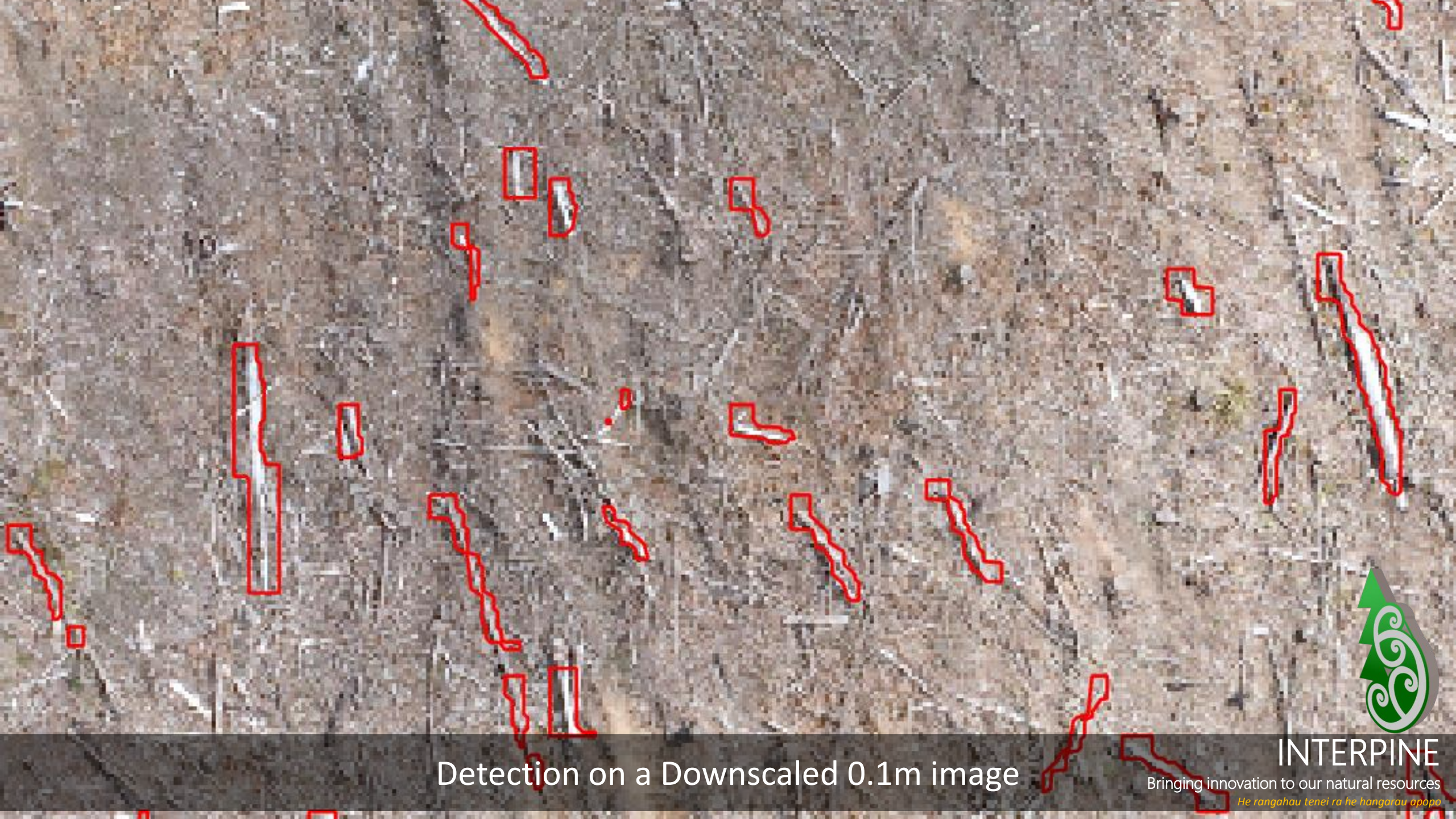
Very High Resolution Tasking

- Initial constellation of up to 30 satellites[1]
- **Up to 30cm resolution**
- Pan + 6 RGB+NIR bands
- Up to 30 revisits/day

[1] *Does not include initial 2 demonstration satellites planned.*


0.015m
Downscaled 0.1m

Detection on 0.015m UAV image



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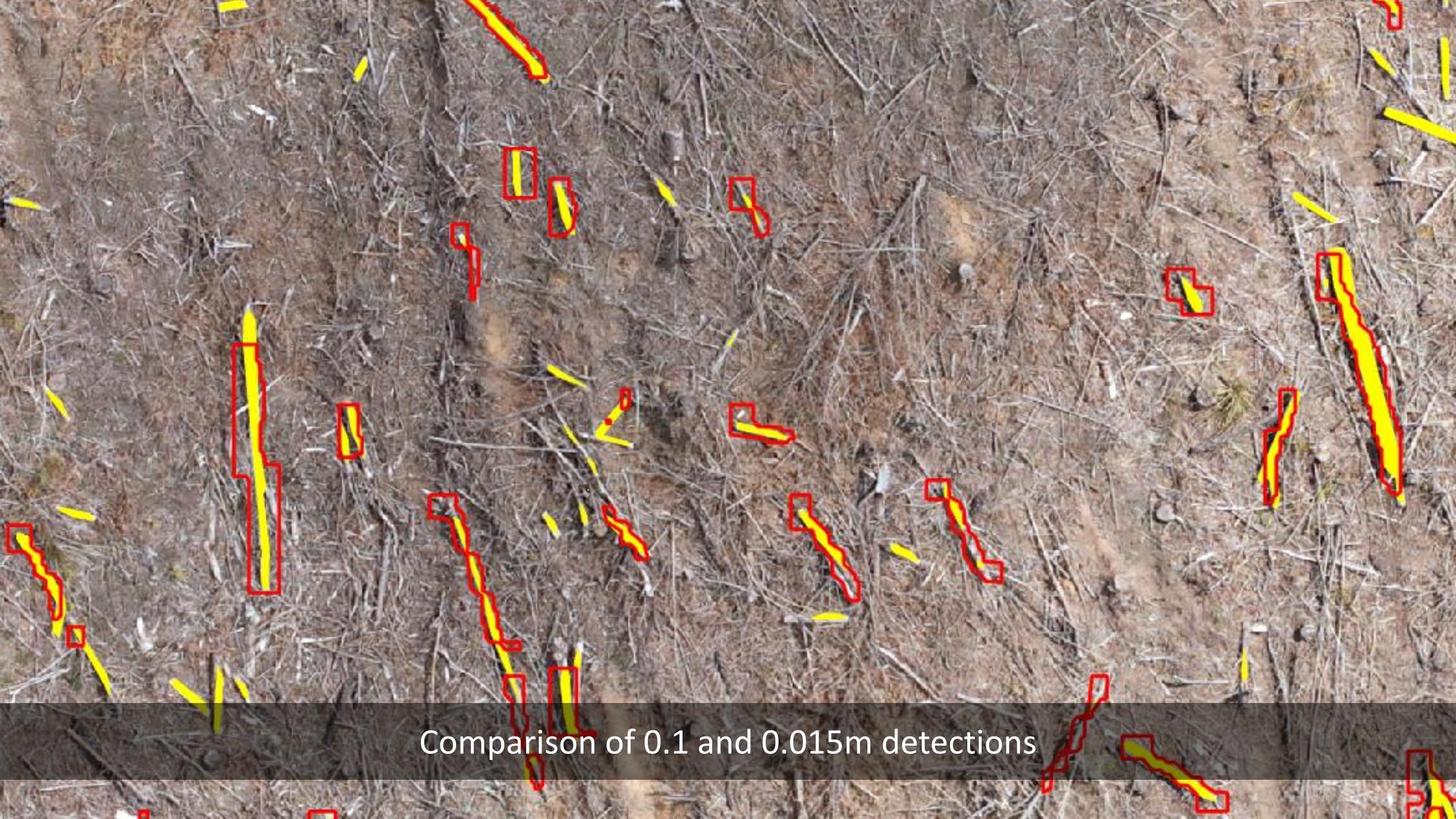
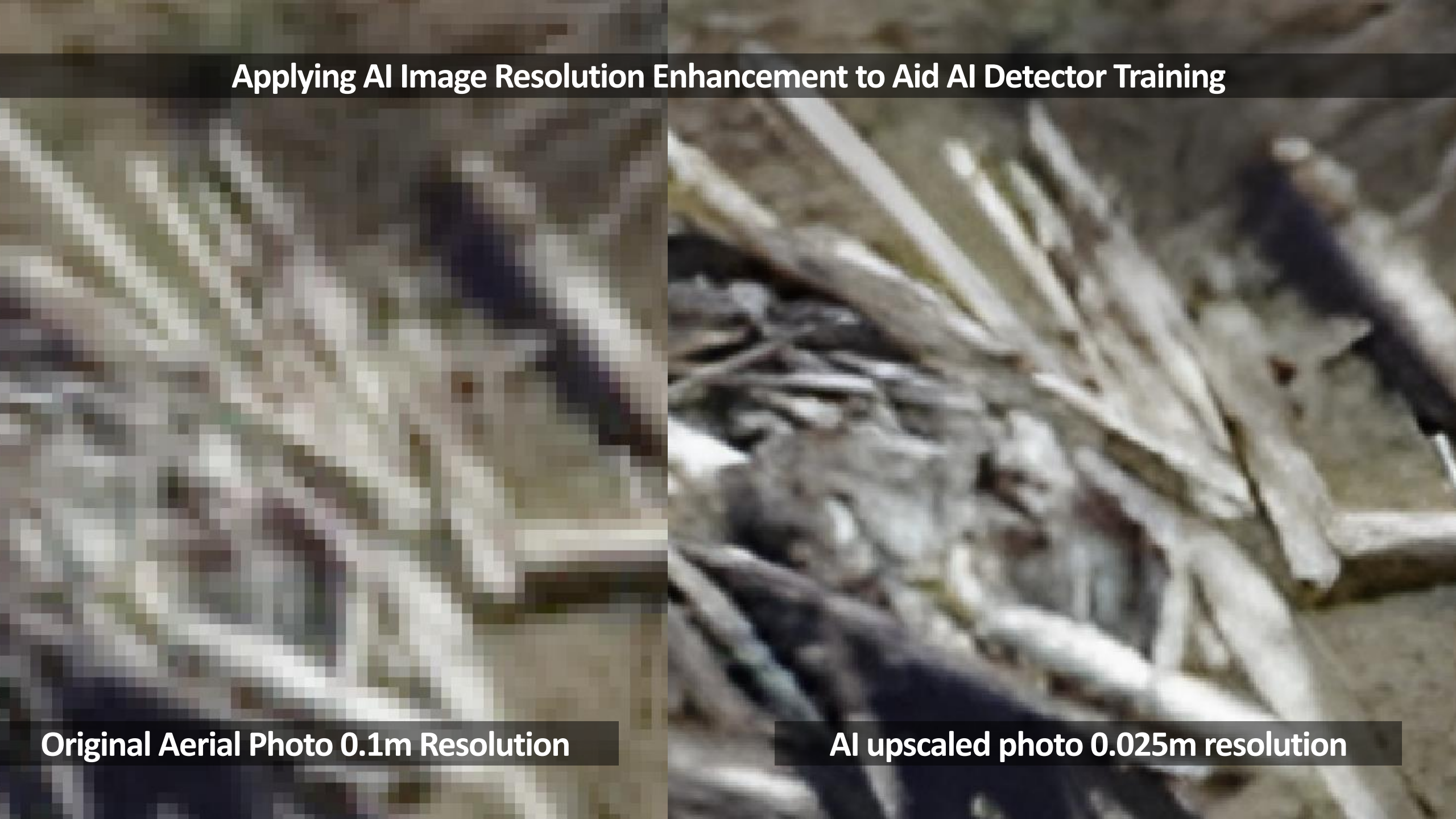


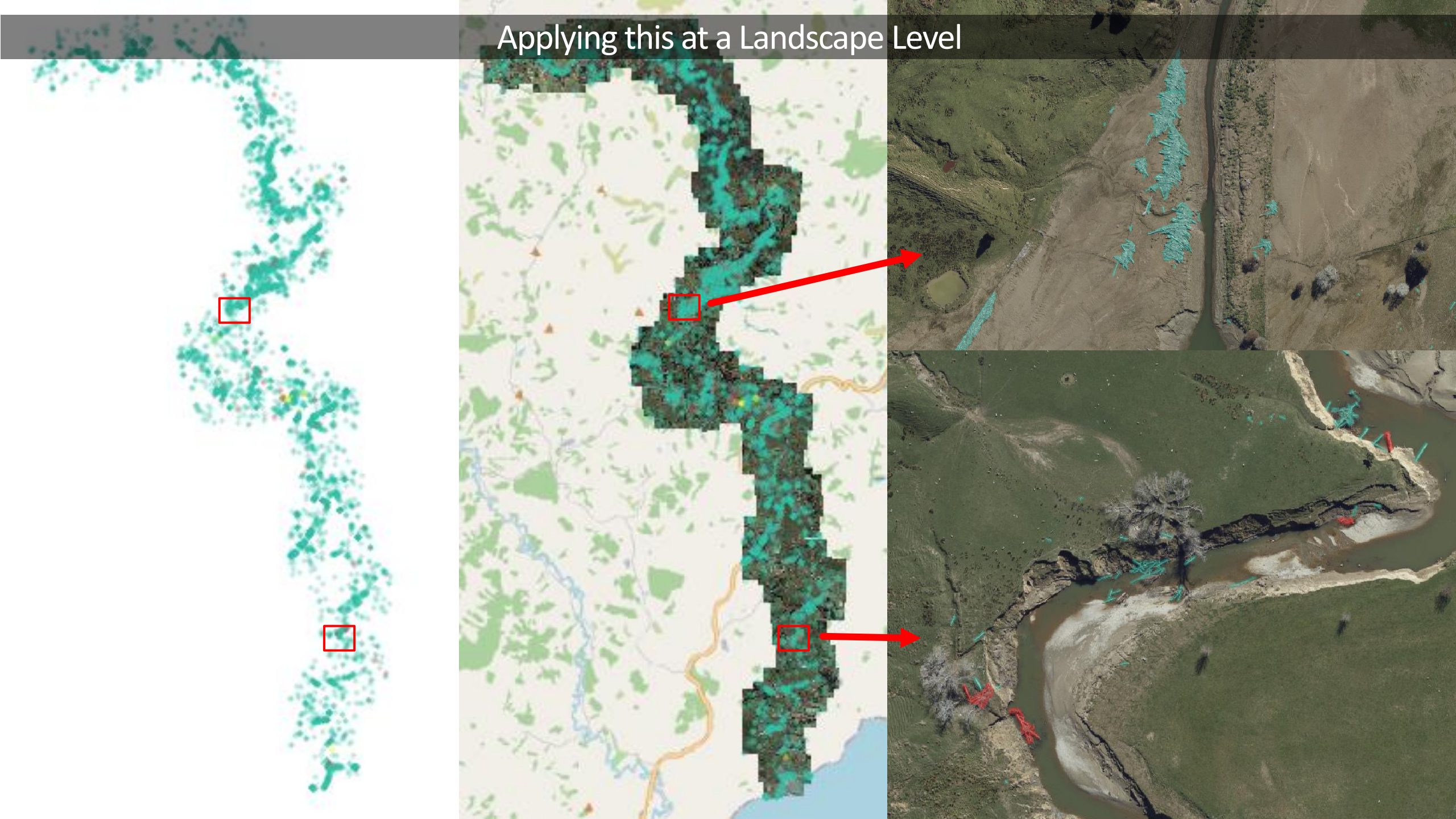
Comparison of 0.1 and 0.015m detections


0.015m
0.1m
Comparison

Applying AI Image Resolution Enhancement to Aid AI Detector Training



Applying this at a Landscape Level



Machine Learning detection using regional scale 0.1m imagery

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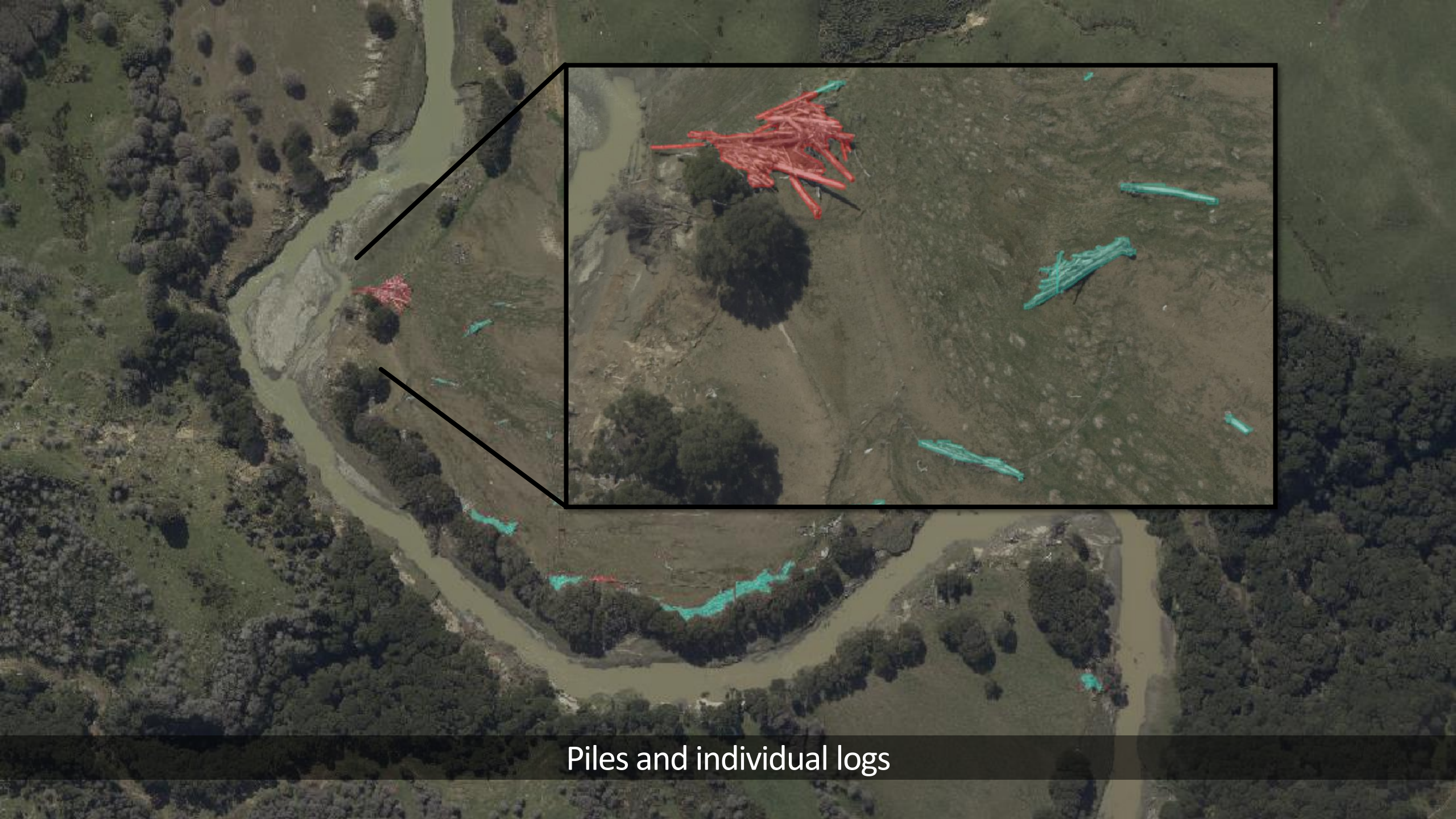
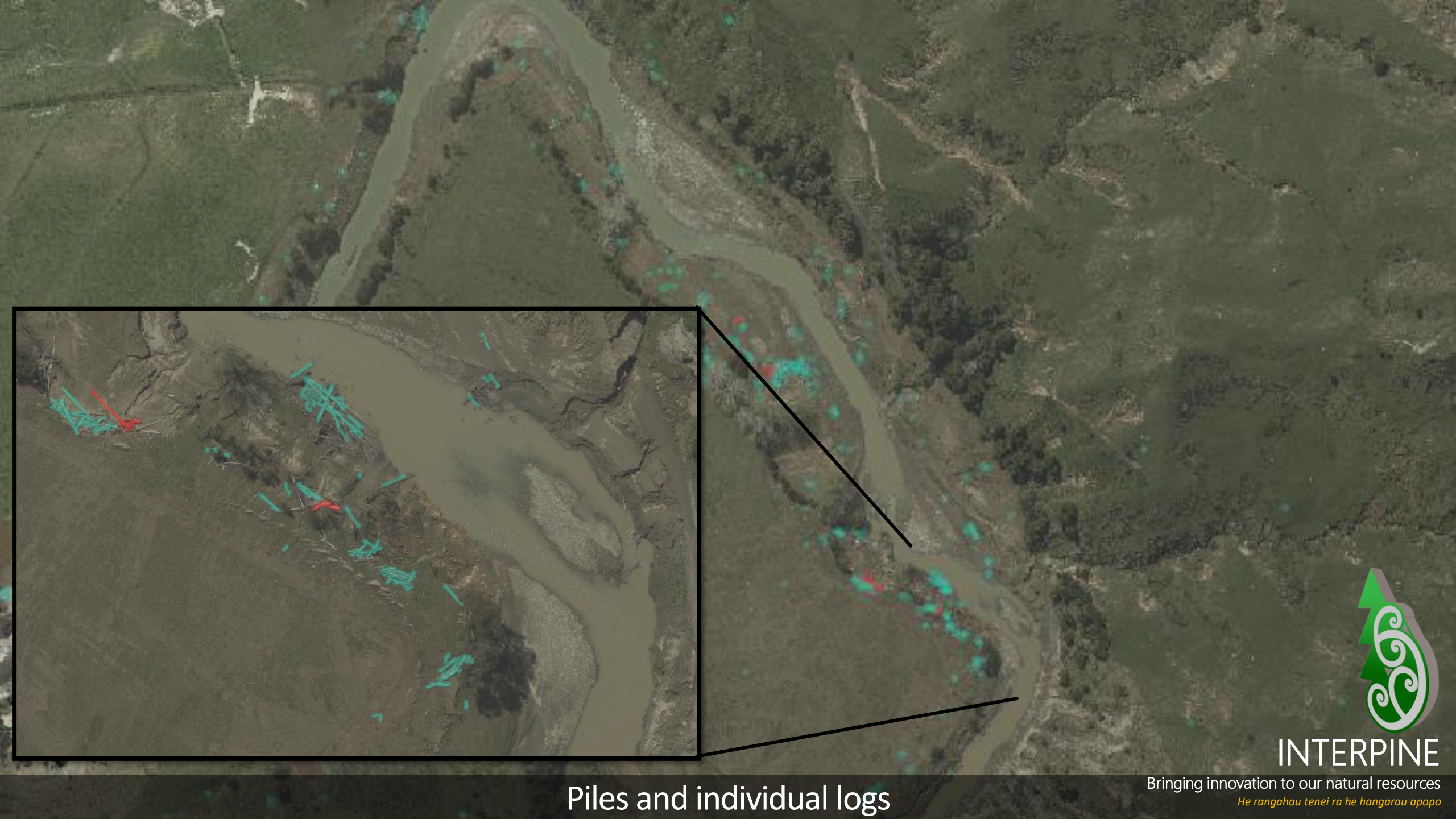
Data labelling – split into 3 classes



Piles and individual logs



Piles and individual logs

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Piles and individual logs

Slash piles

Coastal slash piles

false positives

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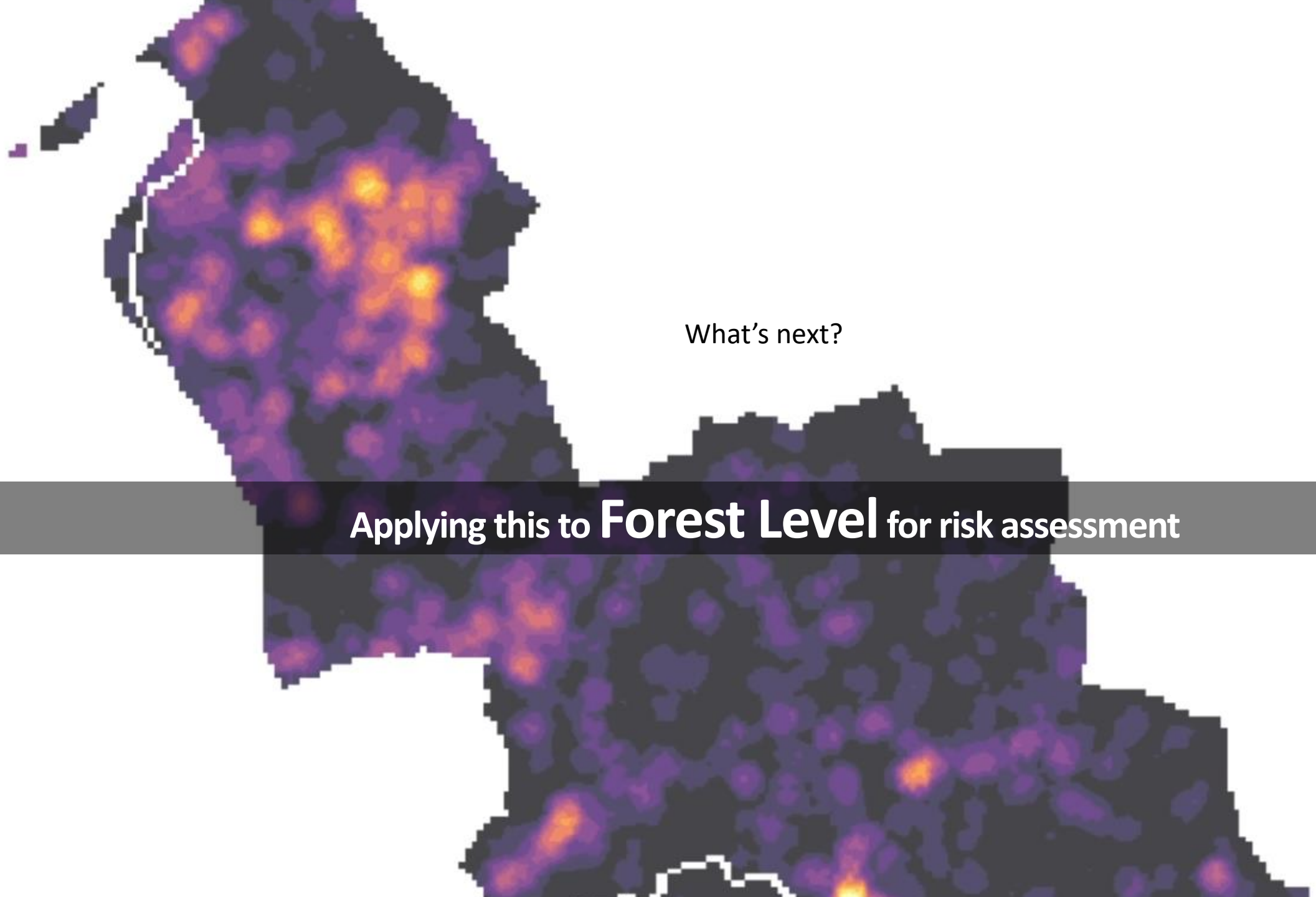

What's next?

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

Acknowledgements

Sam West, Susana Gonzalez, Joo Hynn Ahn

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