



Drone acquired imagery for characterising ecological restoration areas in Northland

Tātai whenua, tātai tangata, tātai oranga

Connecting the land, the people, and their wellbeing
-Reconnecting Northland

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Environmental and Animal Sciences

Supporting Ecological Restoration and Connectivity

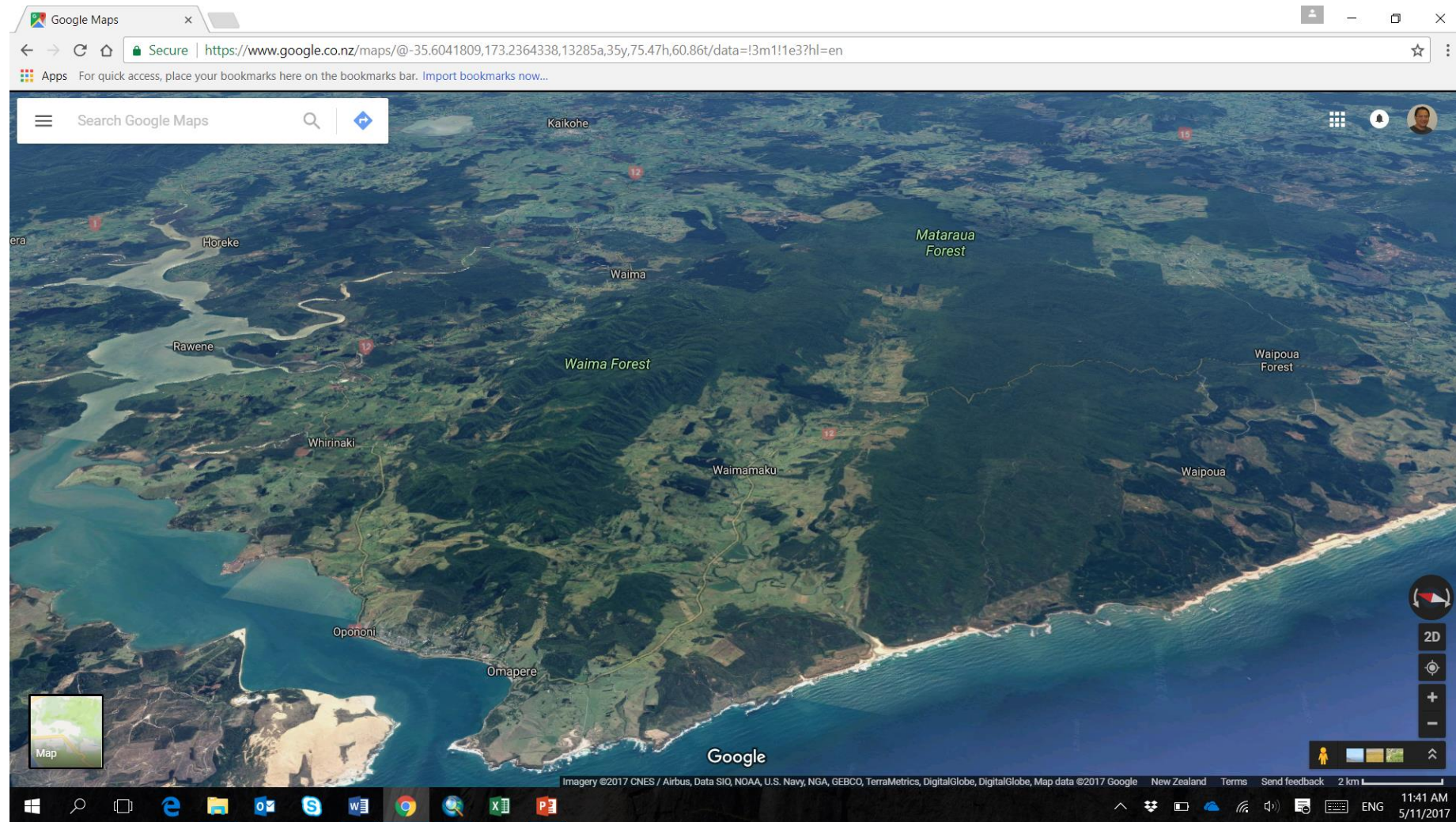
Areas of the Tutamoe,
Hokianga, and Ahipara
Ecological Districts:

River catchments:

Waipoua,
Waimamaku,
Whirinaki,
Waimā,
Mangakāhia,
The Hokianga Harbour

Forests:

Waipoua,
Waimā
Warawara
Mataraua





Aims and Objectives

Develop methodologies for effective use of drone to produce:

Baseline maps of vegetation for ecological restoration

Processes to characterise different classes of plants and or ground cover

Provide videos and photographs of the indigenous forest areas and remarkable landscapes for story telling

Background

Imagery taken by sensors on-board satellites or aircraft is currently available and commonly used

Low resolution (30 m), for global or country-wide coverage, not recent

May not meet requirements for high resolution for community based ecological restoration

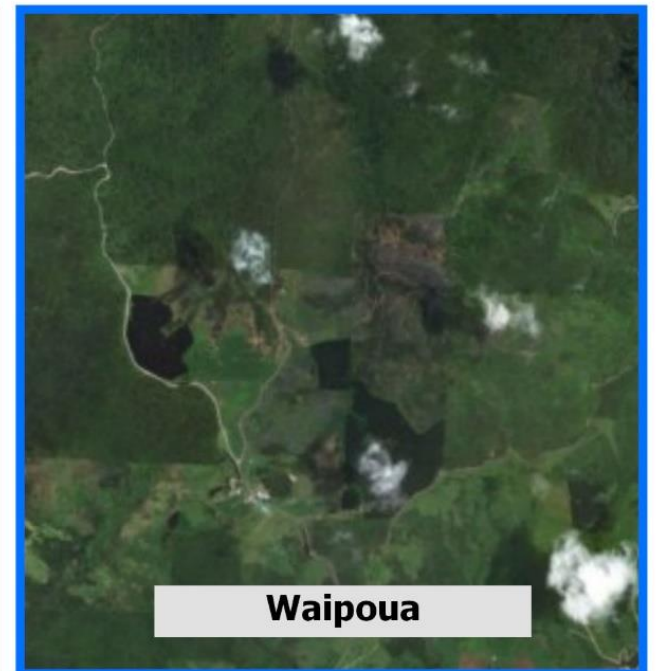
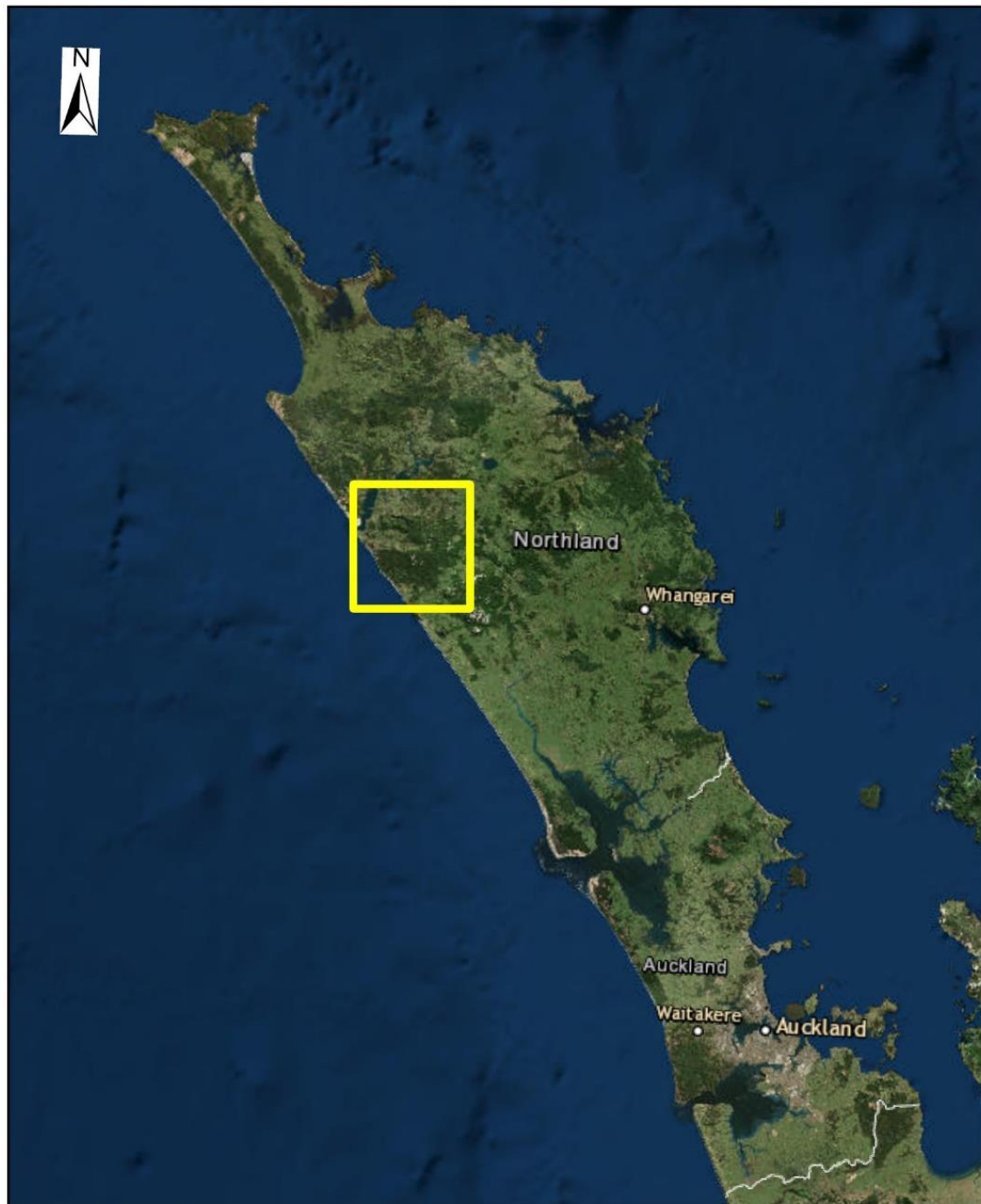
Advancement in drone technology

Low health and safety risk, convenient, low cost missions possible

Sensors now available with very high resolution (mm scale is possible)

Multi-visit/recent imagery possible

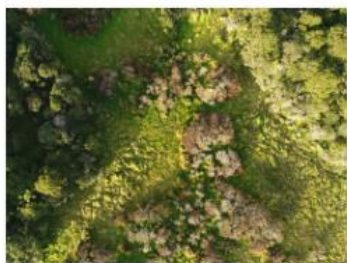
Involvement in He Ripo Kau Landscape Scale Restoration Project



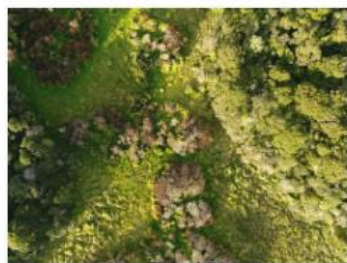
Methodology

- Image acquisition
- Processing
- Classification of imagery
- Creation of stories of the landscape





DJI_0232.JPG



DJI_0233.JPG



DJI_0234.JPG



DJI_0235.JPG



DJI_0236.JPG



DJI_0237.JPG



DJI_0238.JPG



DJI_0239.JPG



DJI_0240.JPG



DJI_0241.JPG



DJI_0242.JPG



DJI_0243.JPG



DJI_0244.JPG



DJI_0245.JPG



DJI_0246.JPG



DJI_0247.JPG



DJI_0248.JPG



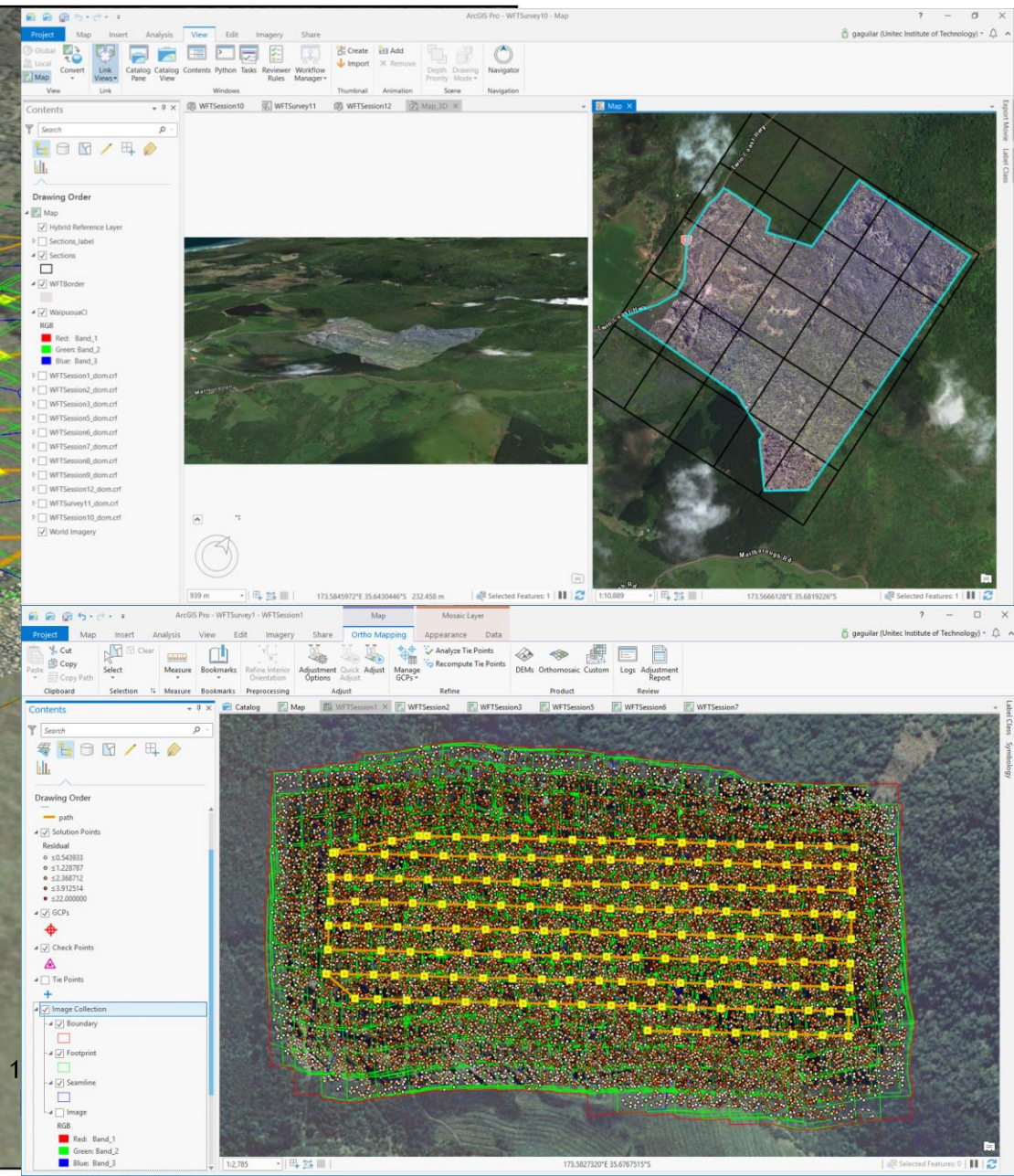
DJI_0249.JPG



57 items



Processing in ArcGIS Pro



Outputs (Spatial Artefacts)

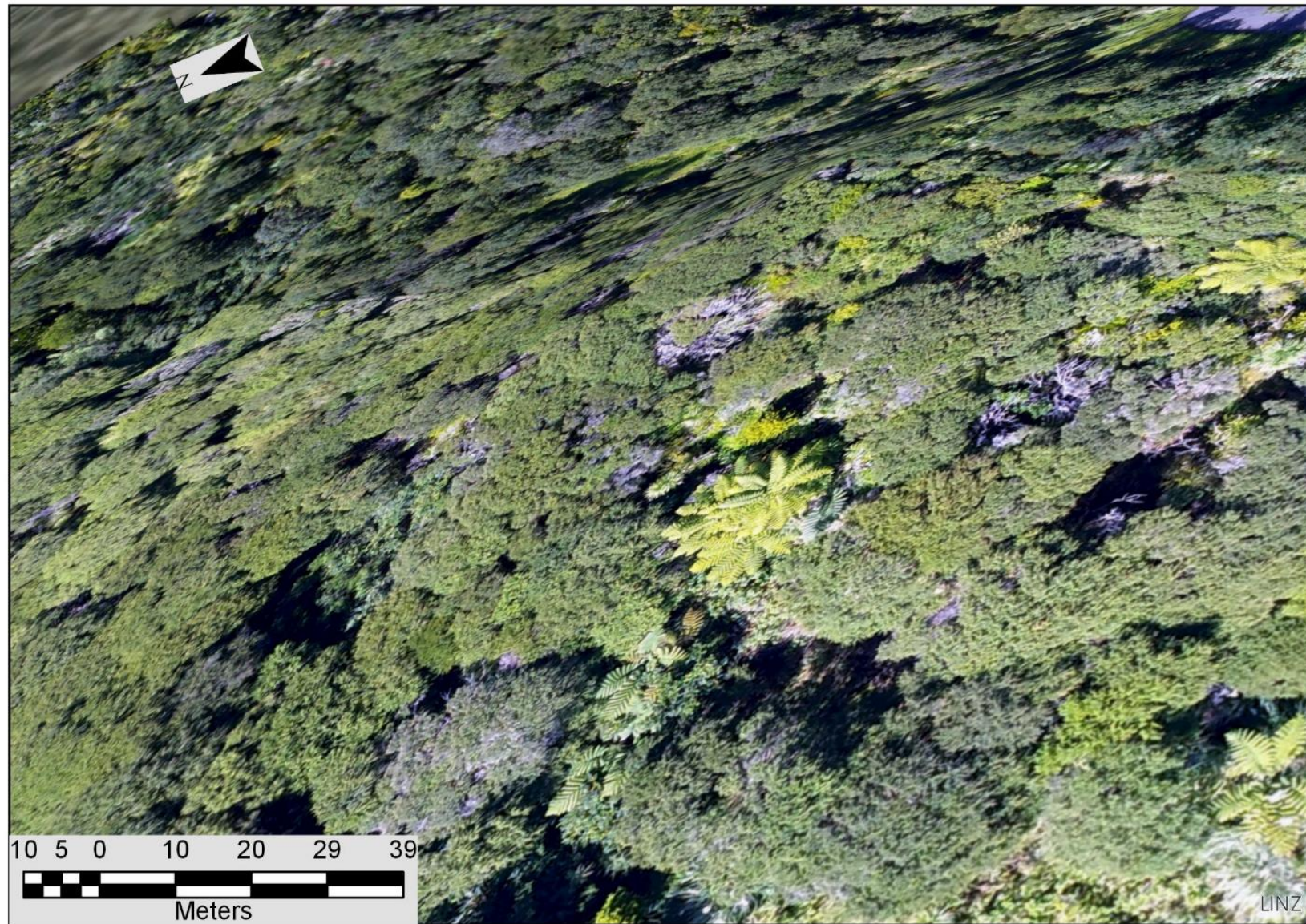
- Mosaiced and Orthomapped Imagery
- Maps of areas
- 3D models
- Movies of the landscape
- Classification of sites
- Story maps for information and education

Mosaiced and Orthomapped High Resolution Imagery





3D models and High Resolution Imagery





High Resolution Video Footage



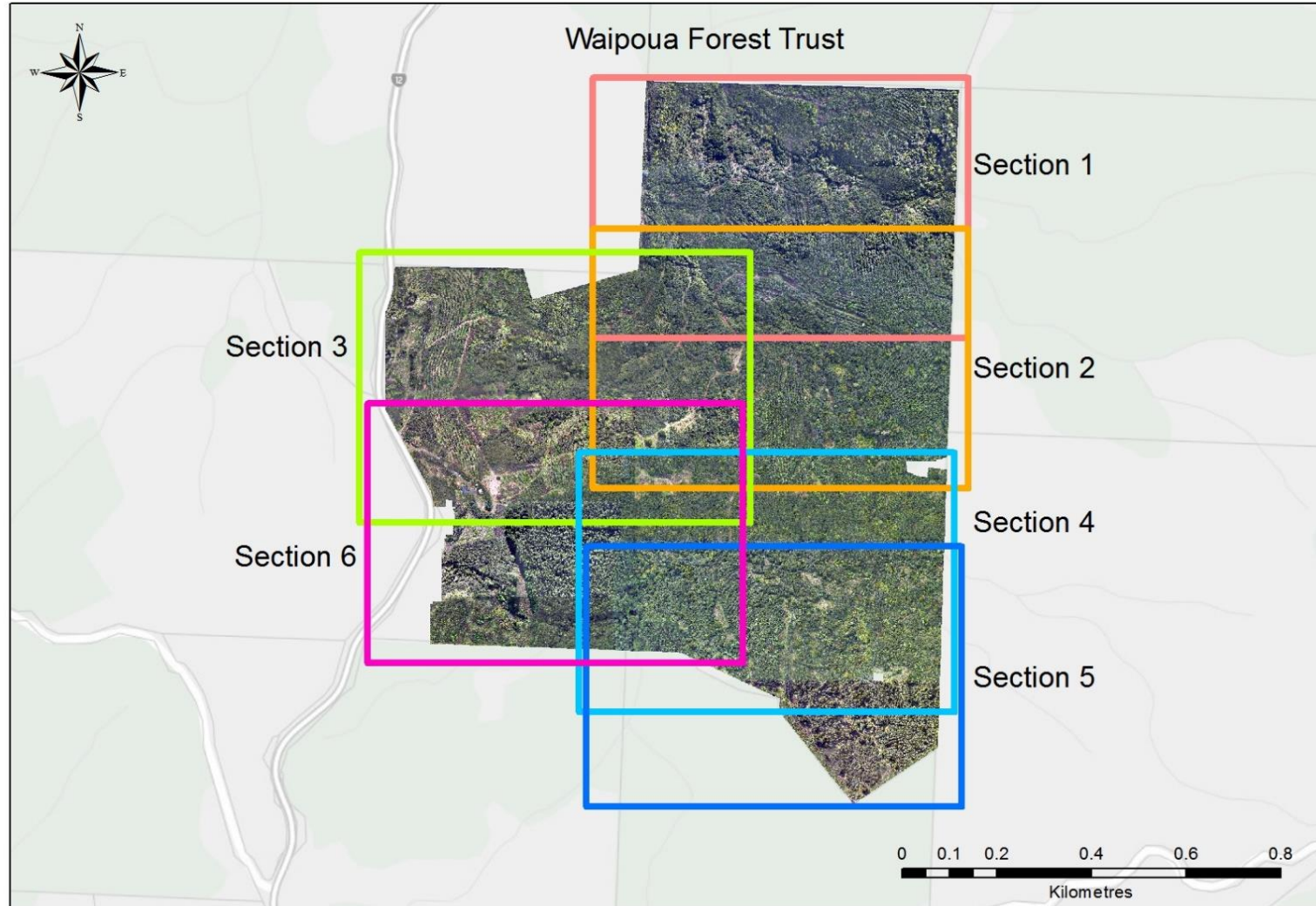
3D model: Taheke



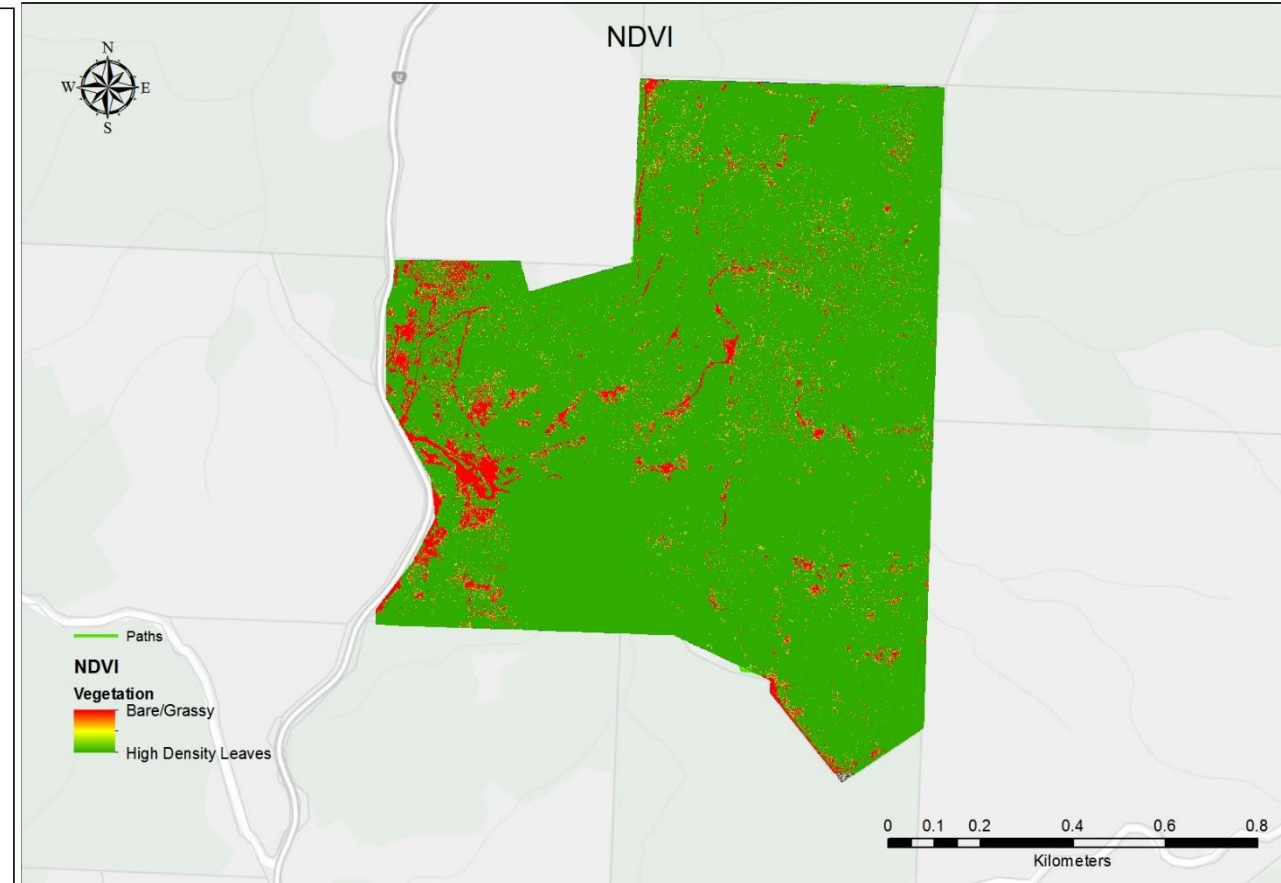
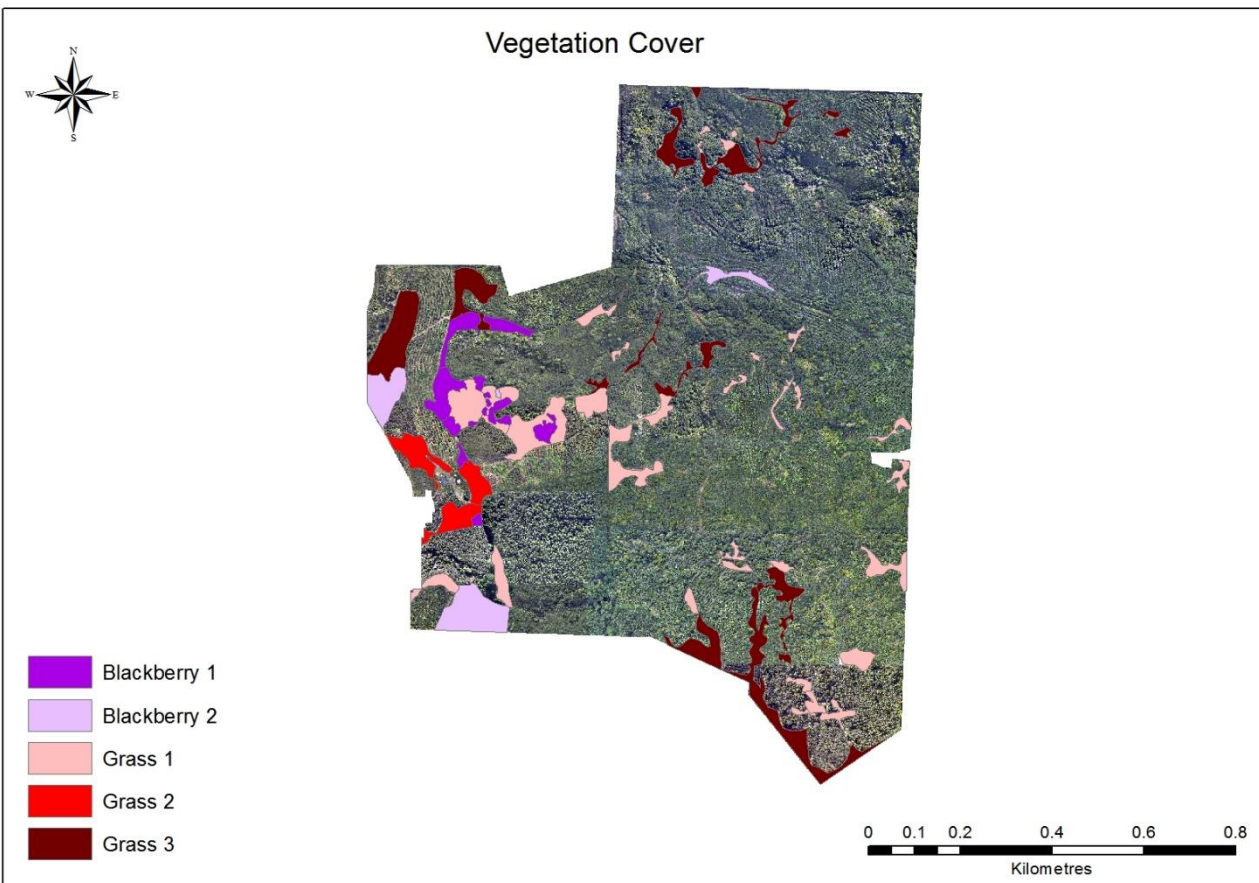
3D for Unlimited Viewing and Image Manipulation



Maps of areas



Classification of Vegetation Cover



[Back to Map](#) WFT

Field View

Document View

SHAPES

Add Import Export

☒ **Field Boundary** 177.26 hectares
Total selected: 177.26 hectares

SURVEYS

Clear

☒ **07-19-2018** DRONE ●
☐ **07-19-2018** DRONE ●

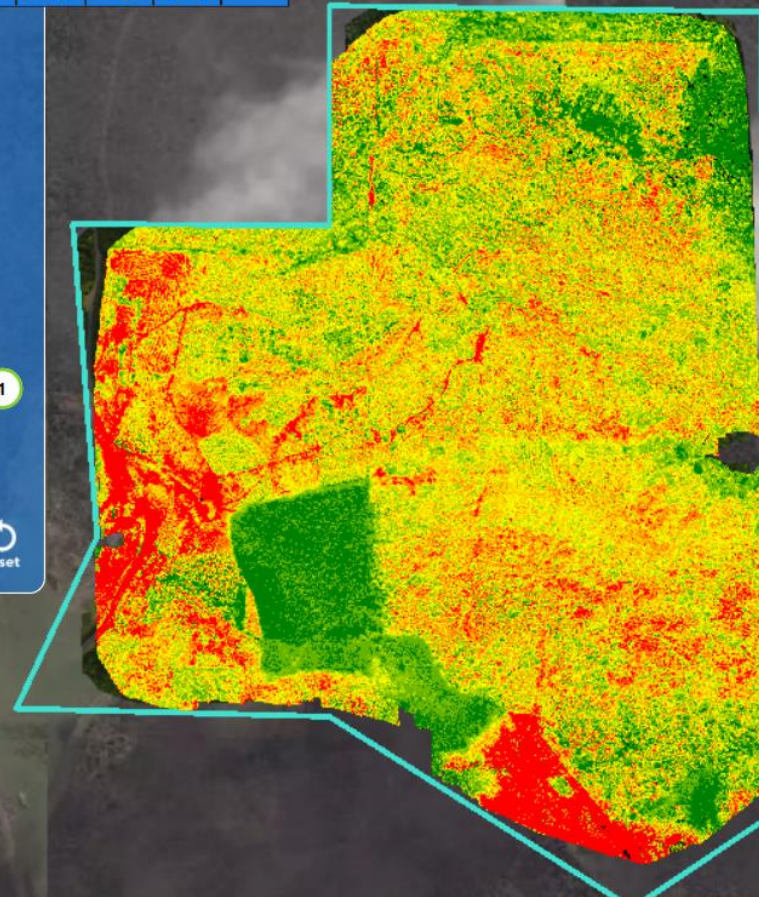
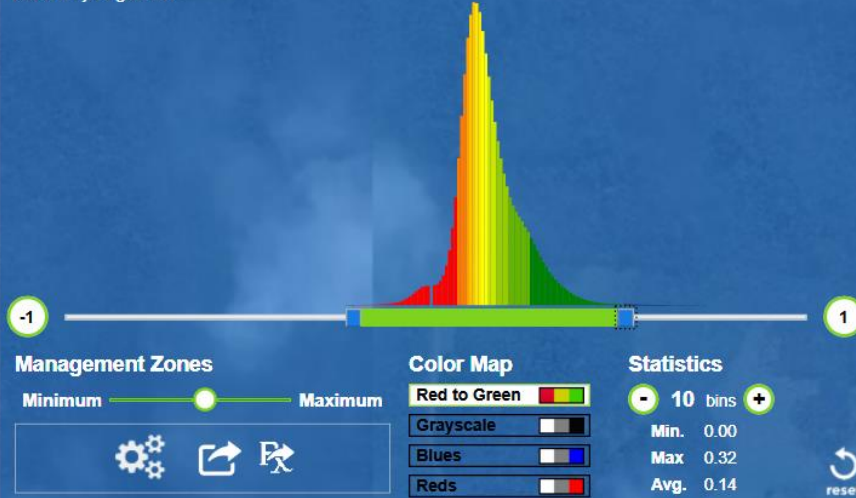
IMAGE LAYERS

Clear

- ☐ **Photo Dots**
- ☒ **Full Mosaic NDRE** 07-19-2018 100%
- ☐ **Full Mosaic NDVI** 07-19-2018 100%
- ☒ **Full Mosaic RGB** 07-19-2018 100%
- ☐ **QuickTile NIR** 07-19-2018 100%
Light Conditions: UNKNOWN
- ☐ **QuickTile NDVI** 07-19-2018 100%
Light Conditions: UNKNOWN
- ☐ **VARI Map** 07-19-2018 100%
- ☐ **QuickTile RGB** 07-19-2018 100%
- ☐ **Elevation Map**

NDVI Toolbox

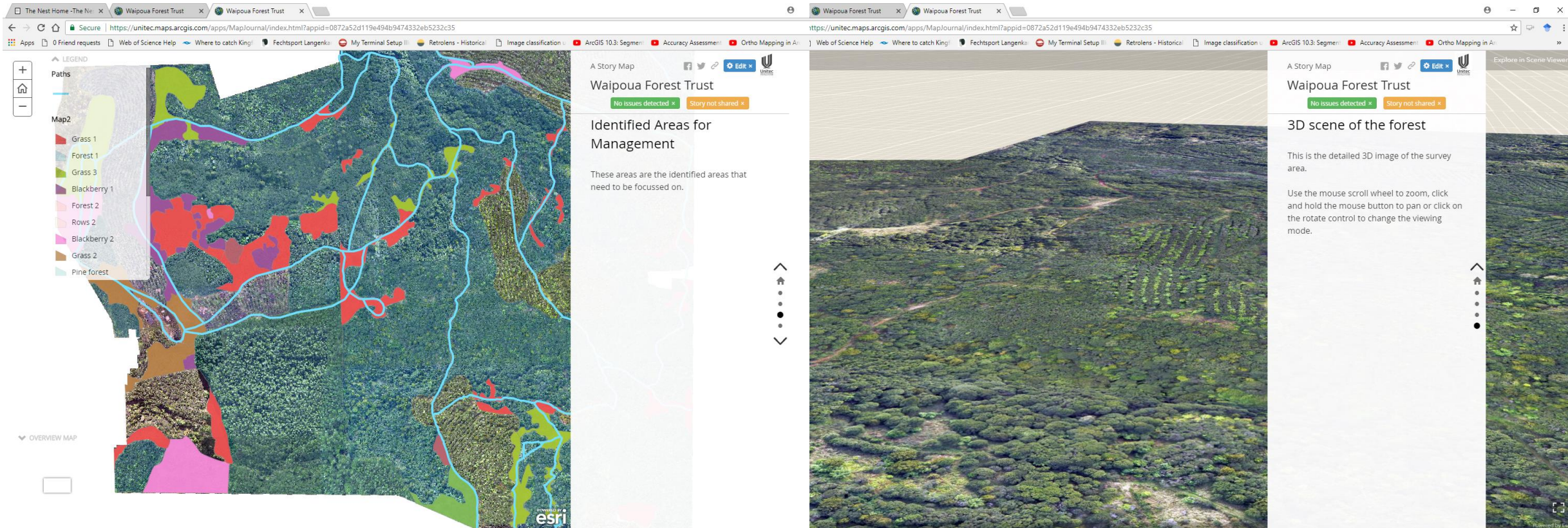
This is your place to explore your Sentera TrueNDVI® data. Experiment with different settings. Use the reset button if you get lost.



FIELD DETAILS



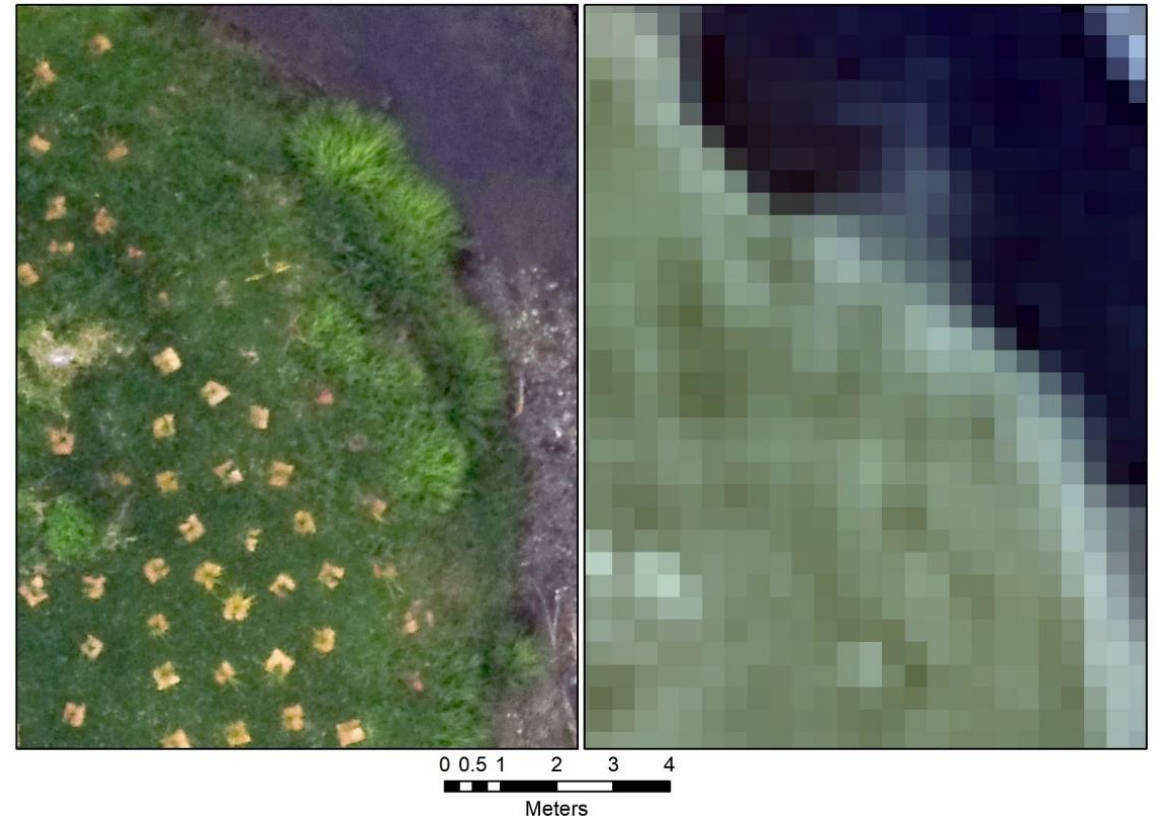
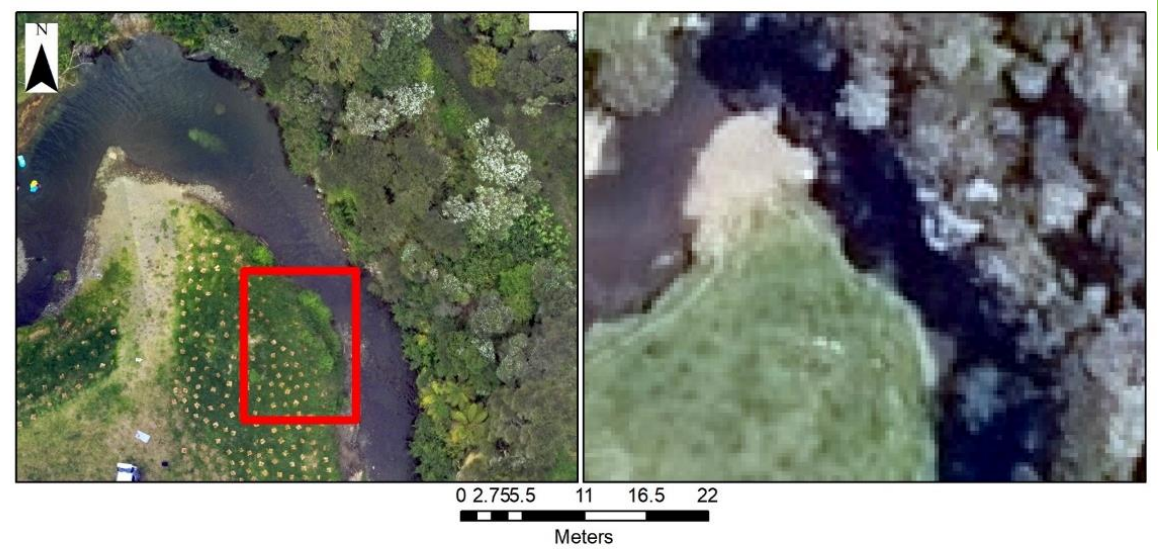
Story Map Output



<https://arcg.is/mrW8C>

Advantage of high resolution images

- Higher resolution compared to available satellite and aerial imagery
- Multiple revisit/resurvey capabilities
- Flight convenience
- Availability of technologies and off the shelf solutions



Results

1) Optimum Settings and Workflow Diagrams

Flight speed < 20 kph

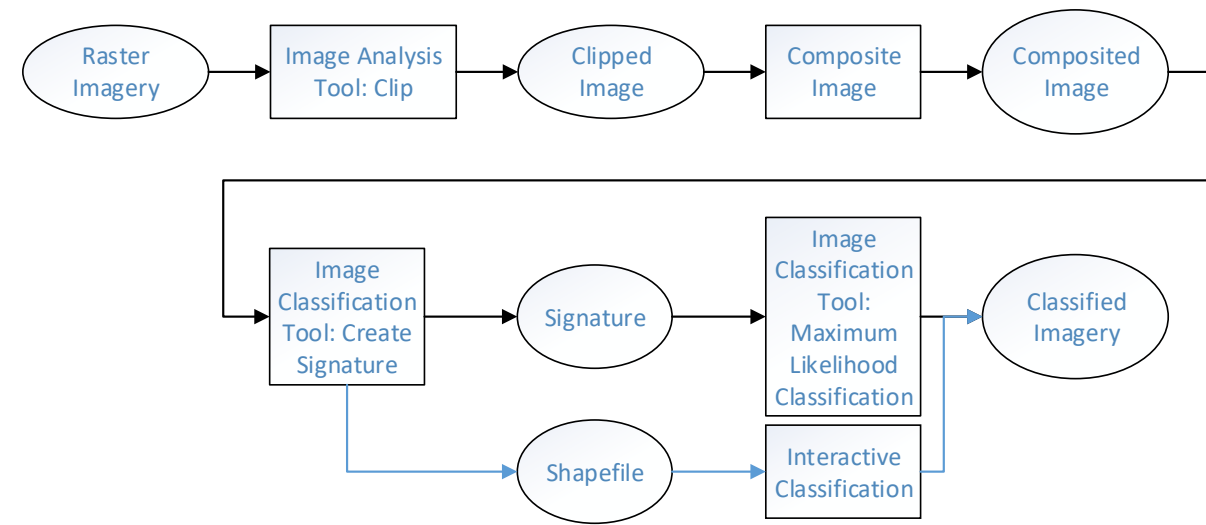
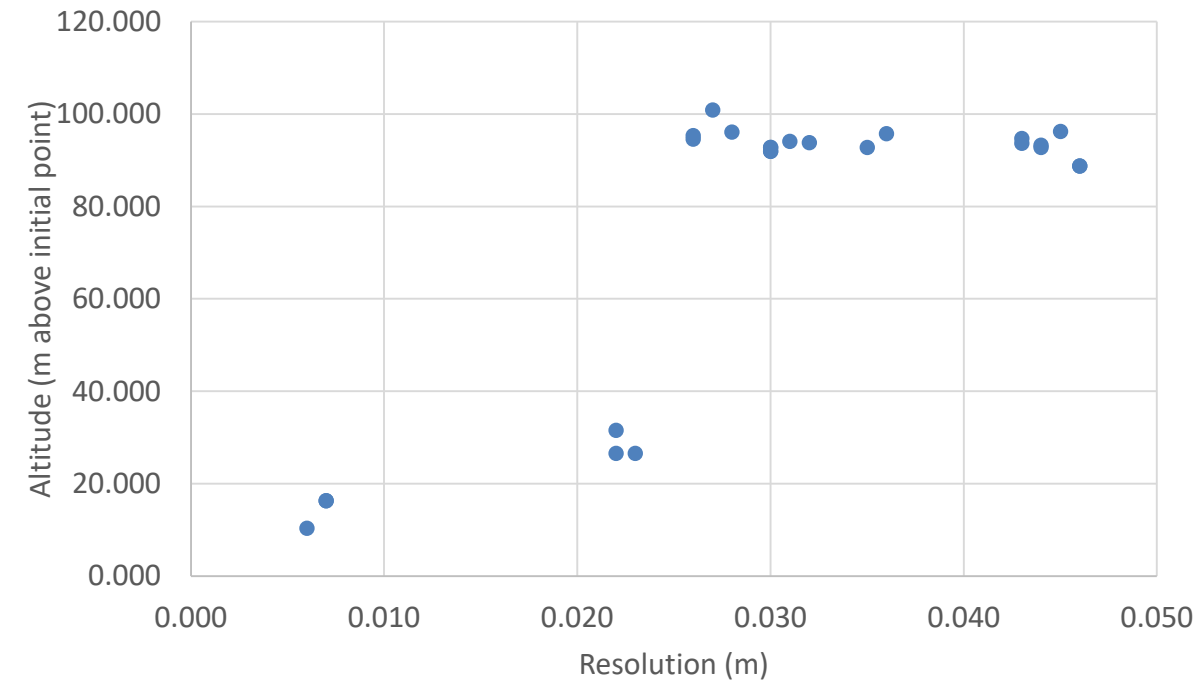
Wind Speed < 15 kph

Height < 95m (area dependent)

6 Batteries

Drone Return Height 50m

Accuracy and Height



Results

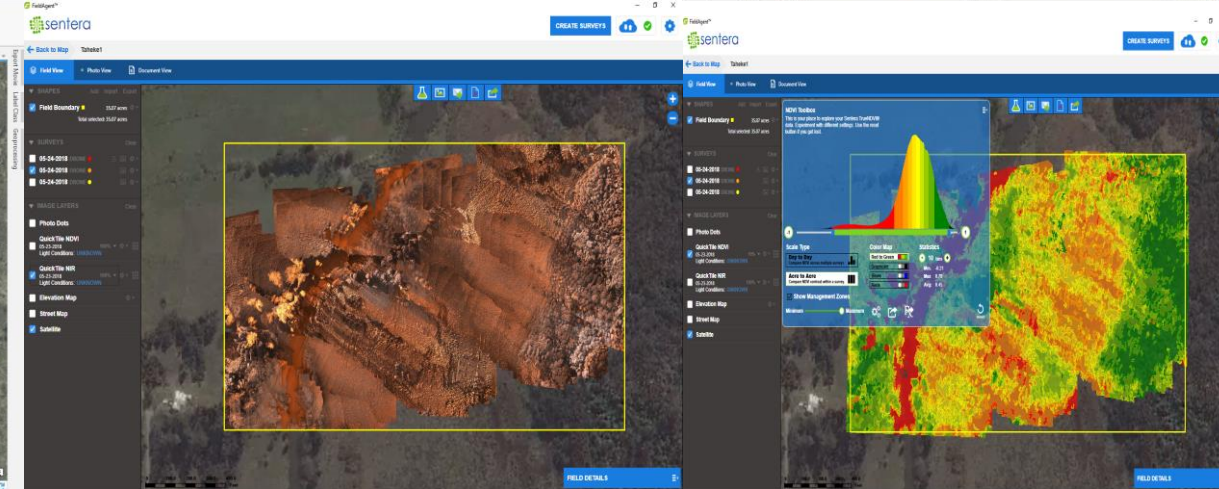
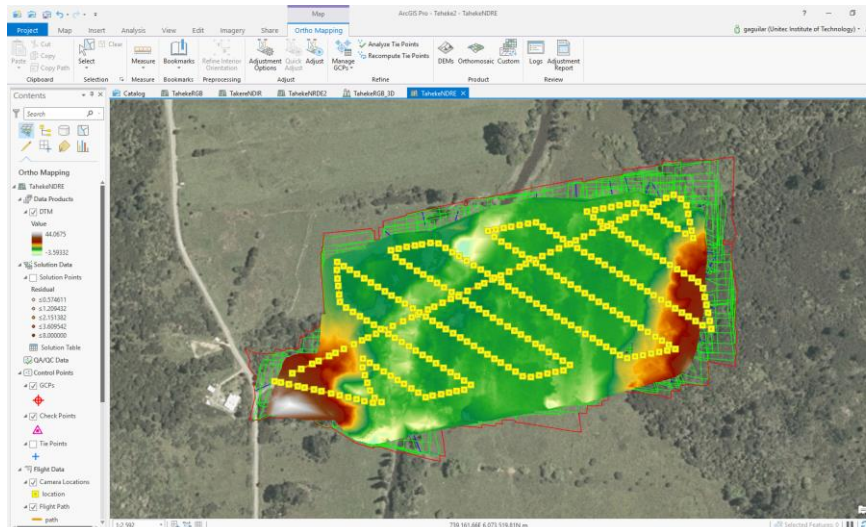
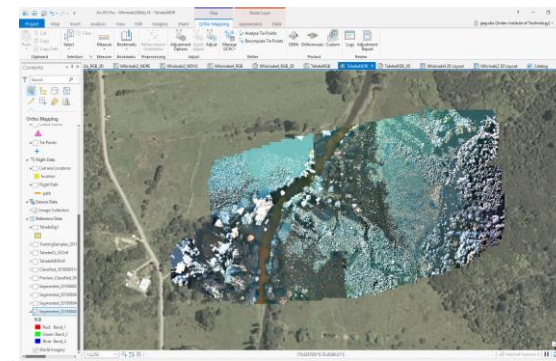
2) Trade-off between processing time: using ArcGIS Pro (lengthy) vs Online Mosaic Order (costs)

Summary	No of Images	Images with Error	Unsolvable Images	Altitude in m	Adjustment Time	Orthomosaic Time	Size of Results (GB)	Ground Resolution
Taheke RGB	57	0	9	31.58	0:20:54	0:05:18	1.09	0.022
Taheke NDRE	303	0	2	26.57	0:26:28	0:30:02	4.50	0.023
Taheke NDVI	303	0	1	26.57	1:54:32	0:08:20	2.71	0.022
Whirinaki RGB	195	0	30	94.78	1:02:18	0:19:15	4.77	0.103
Whirinaki NDRE	341	0	20	91.18	1:59:43	0:57:00	13.29	0.106
Whirinaki NDVI	341	0	4	92.60	1:09:19	0:58:48	13.40	0.121
Waipoua RGB	1311	9	38	70.77	10:30:10	61:49:01	836.05	0.035

Results

3) Classification Accuracy:

Measure of Image Accuracy	Supervised	Unsupervised (ISO Cluster-Maximum Likelihood)	Machine Learning (SVM)	Segmented (Object Based)	Manual
Overall Accuracy	0.51	0.40	0.38	0.65	0.88
Kappa Index of Agreement (should be greater than 0.60)	0.45	0.32	0.13	0.50	0.75



Further Work and Recommendations

- More drone surveys for 13 hapu and community groups
- GIS for He Ripo Kau
- High performance computer requirements
- Software for more powerful classifiers (eCognition)
- Community-based drone and mapping capability building



Taheke Marae



Whirinaki
Toiora Trust