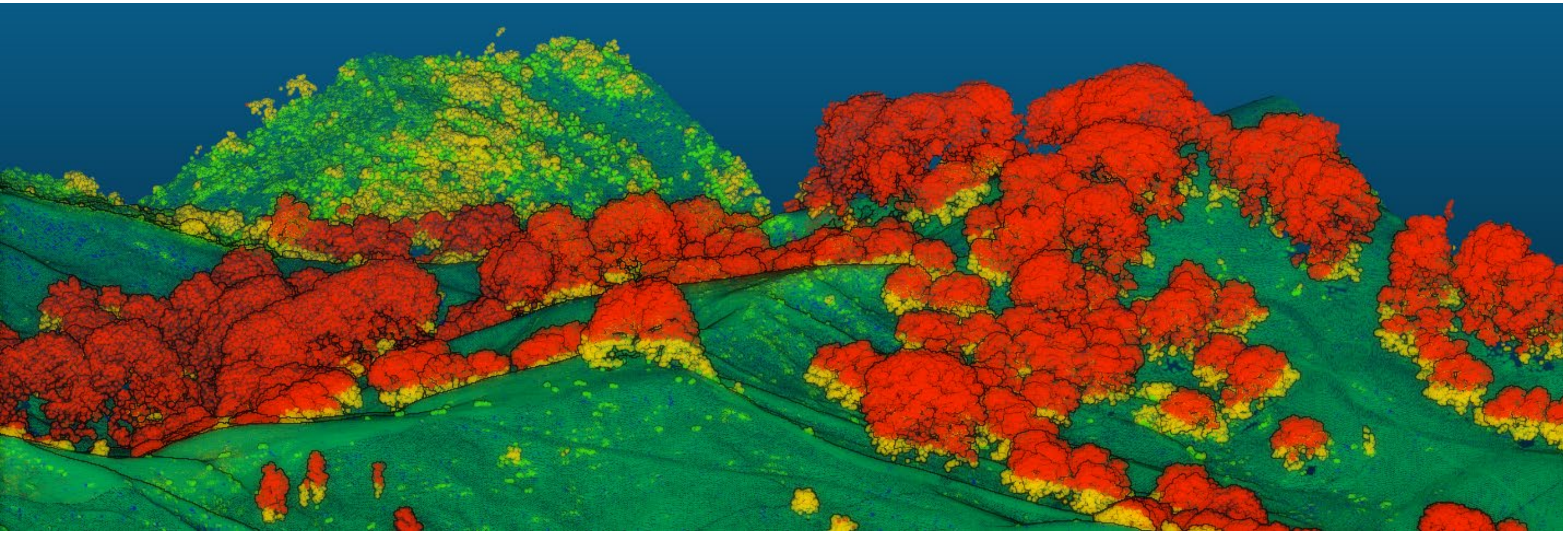
LiDAR-derived vegetation layers in Hawke's Bay

Jan Schindler

schindlerj@landcareresearch.co.nz



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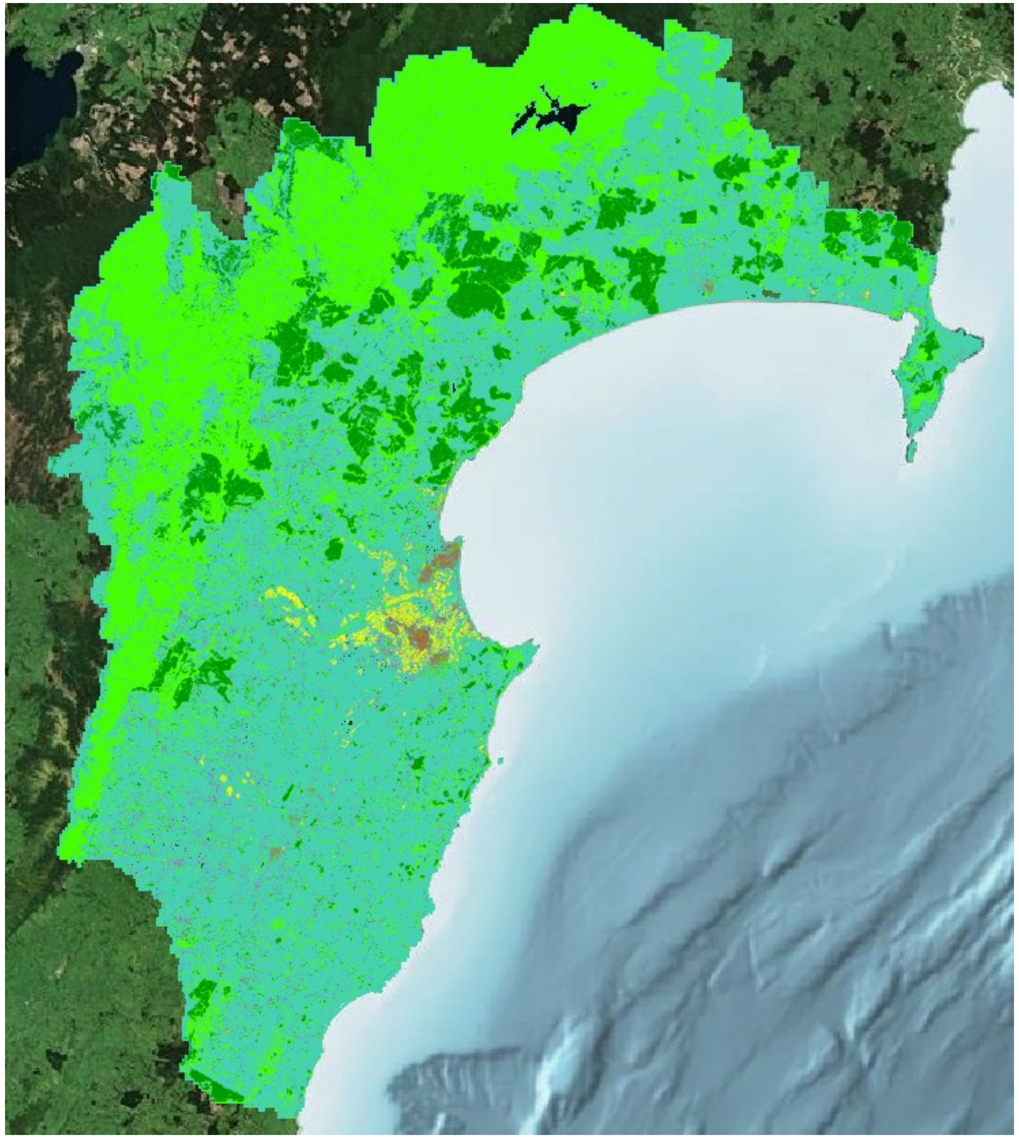
Vegetation Layer

Spatial layer vegetation classes:

- forests
- standalone trees
- shelter belts
- Pine forest

HiRes Raster products at 30cm:

- DEM, DSM, CHM, low veg, canopy
- Daylight/Shadow



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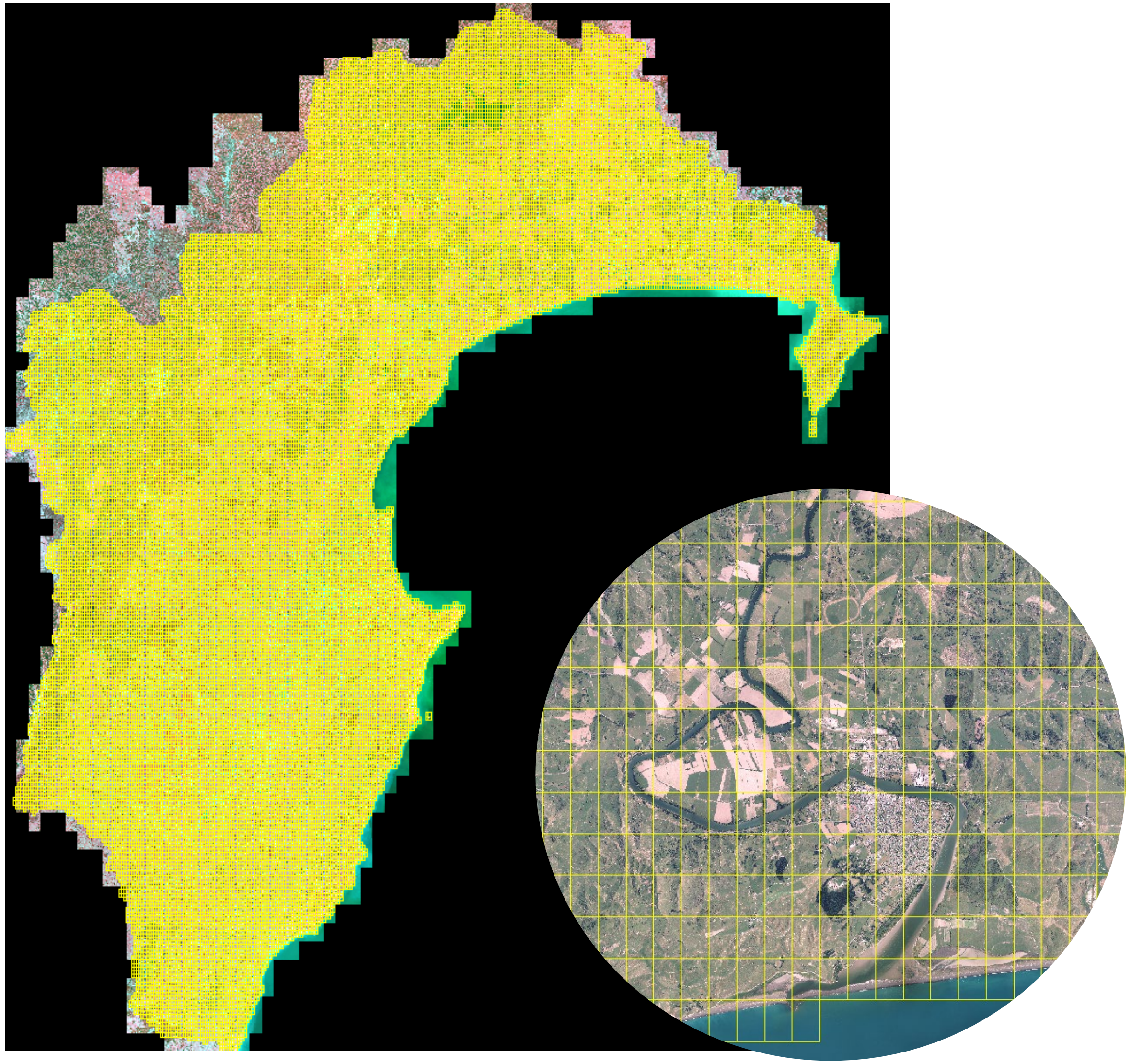
LiDAR Point Cloud 2020



>40,000 LAZ point cloud files (> 1 TB)

Tile-based processing to produce regional mosaics at 30 cm pixel resolution:

- Digital Elevation Model (DEM)
- Digital Surface Model (DSM)
- Canopy Height Model (CHM)

Mosaics are upscaled to 1 and 5 metre resolution using bilinear interpolation

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LiDAR Tile Processing

Workflow steps:

1. **Merge tiles to created buffered point cloud**
2. Create DEM + hillshade
3. Normalize Point Cloud (height above ground)
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5. Create CHM
6. Individual trees
7. Rasterize LiDAR Classification
8. Create daylight / shadow layers
9. Cut off buffer region of all raster layers

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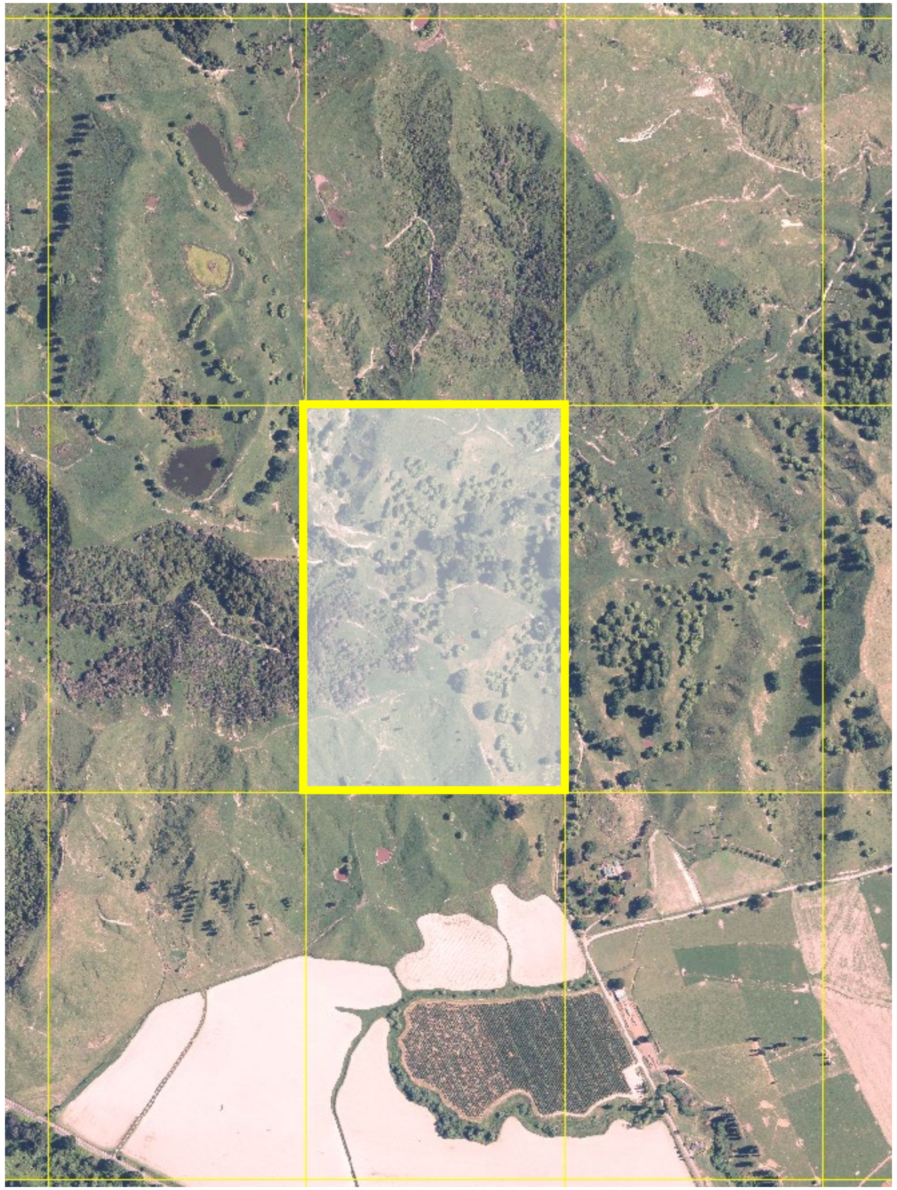

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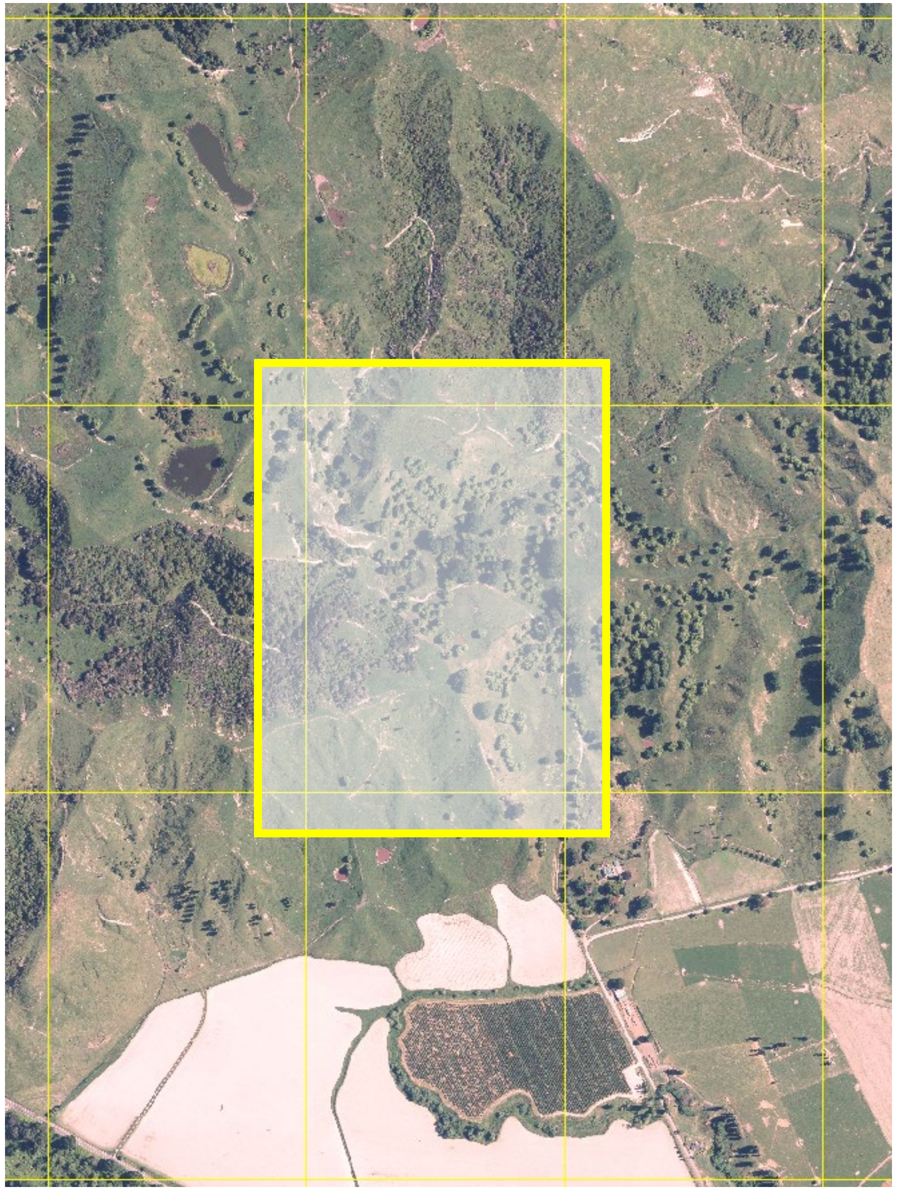

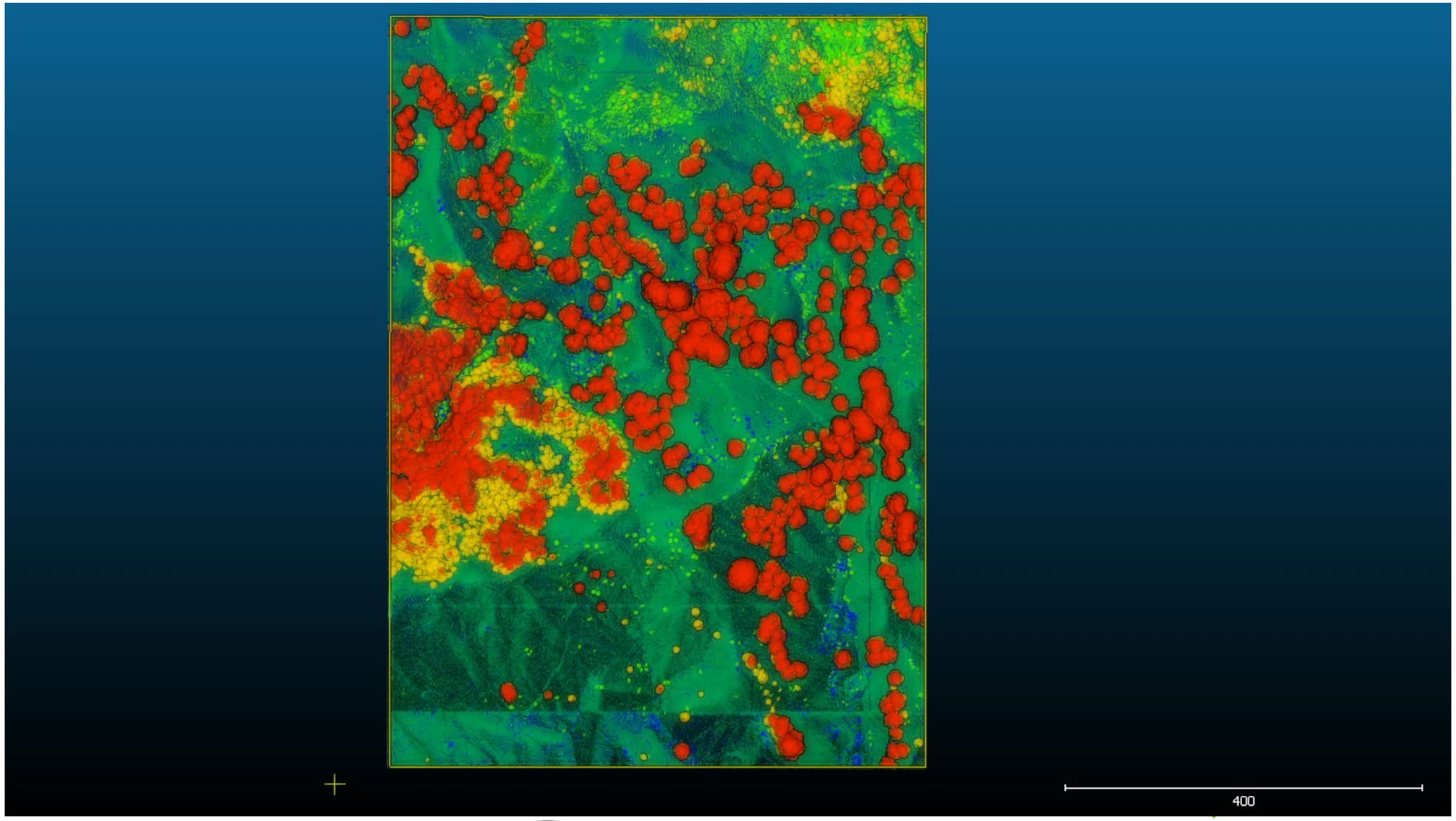

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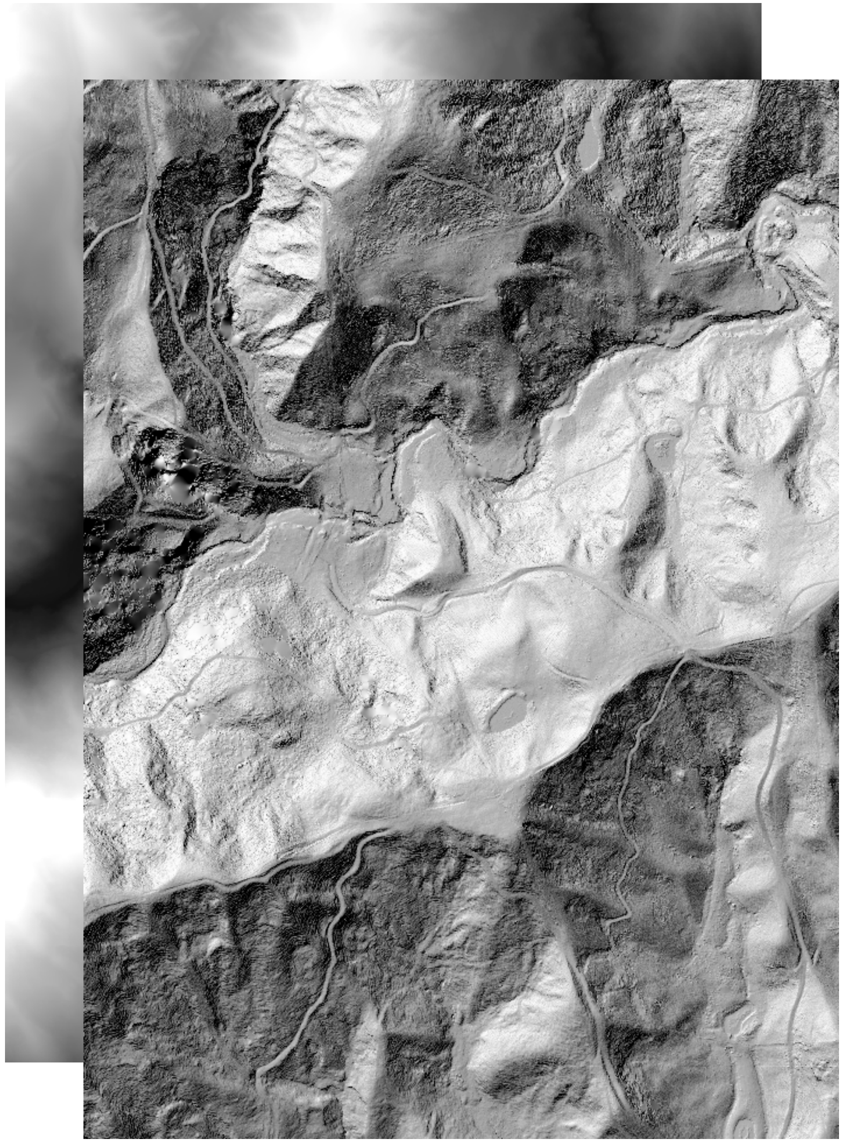

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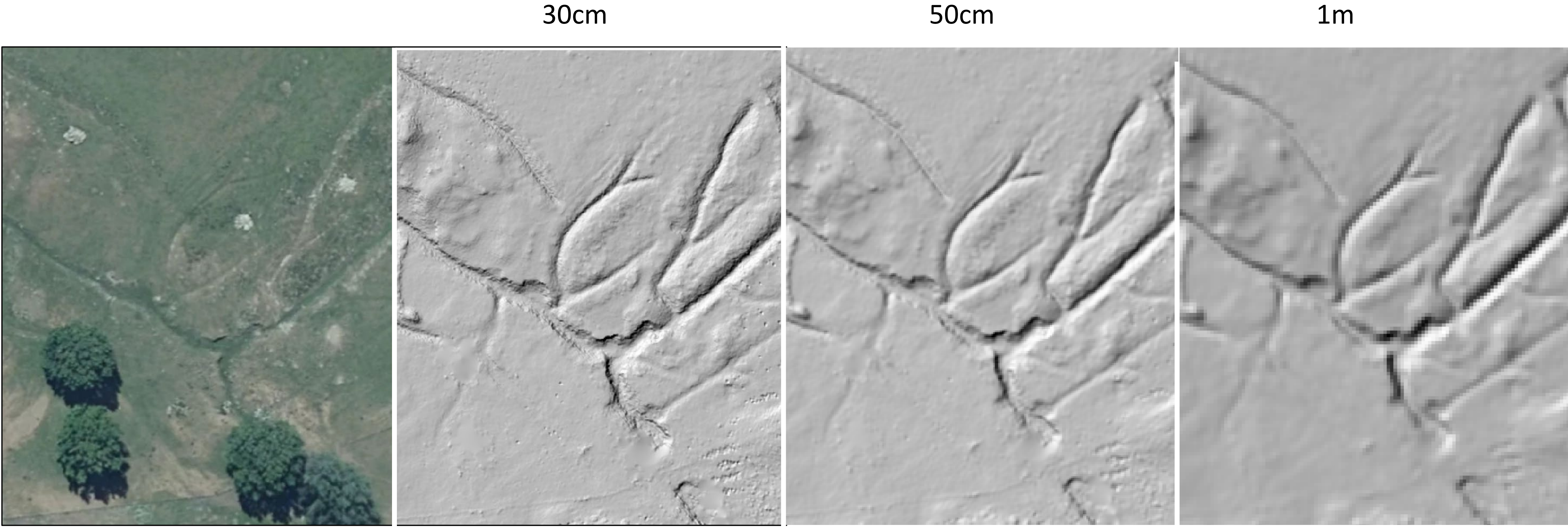

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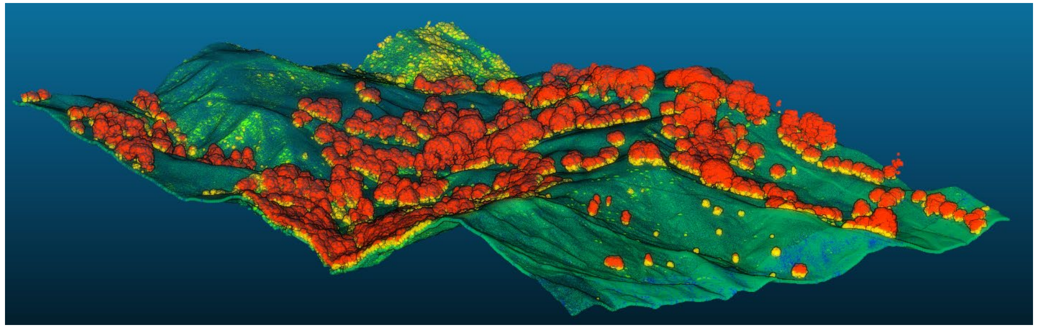

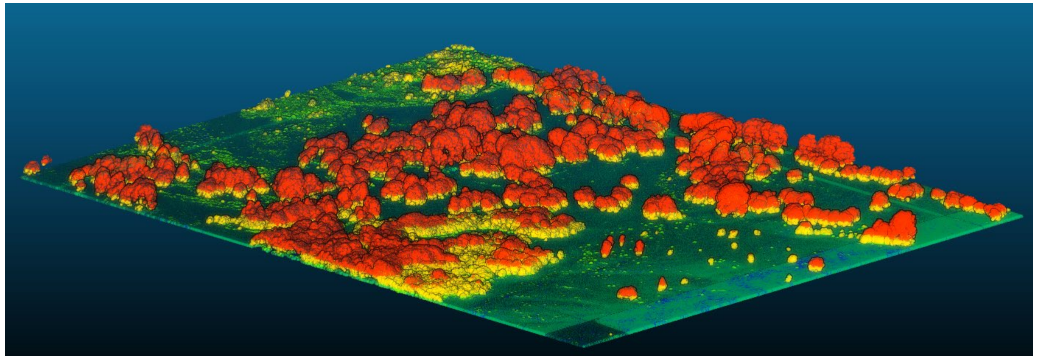

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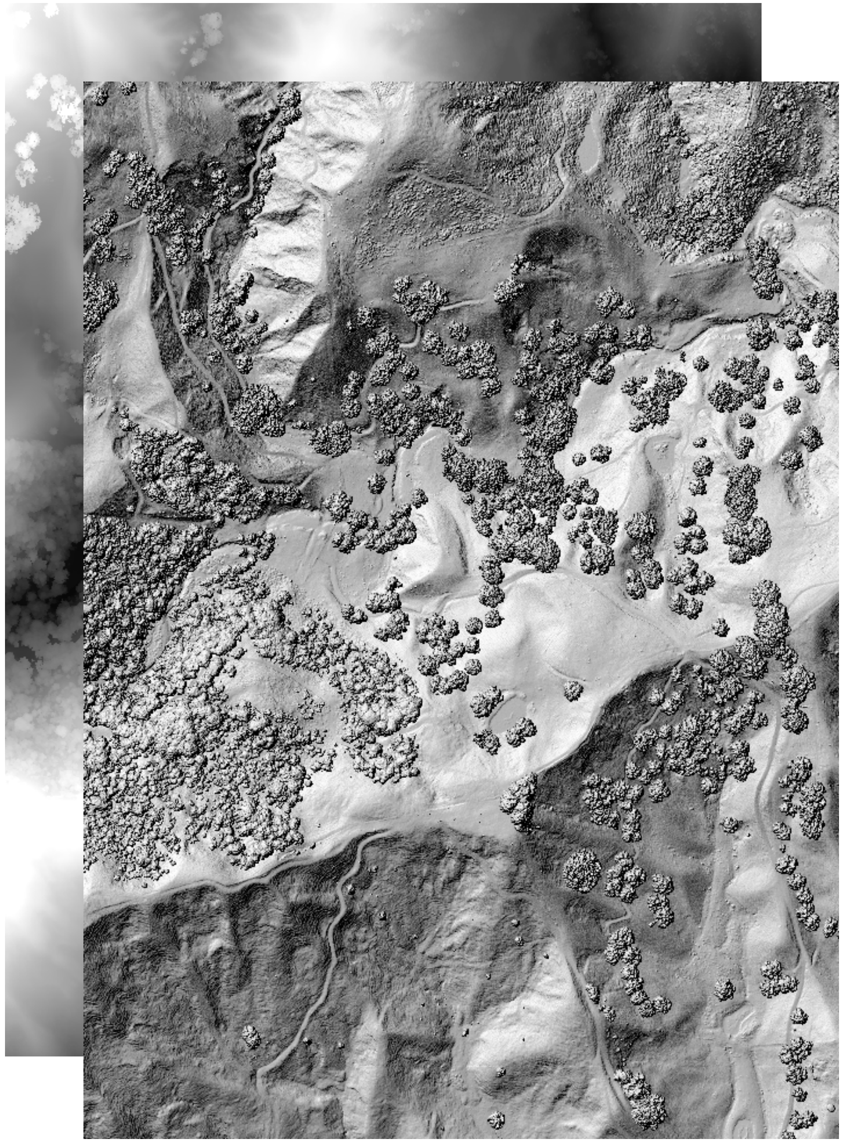

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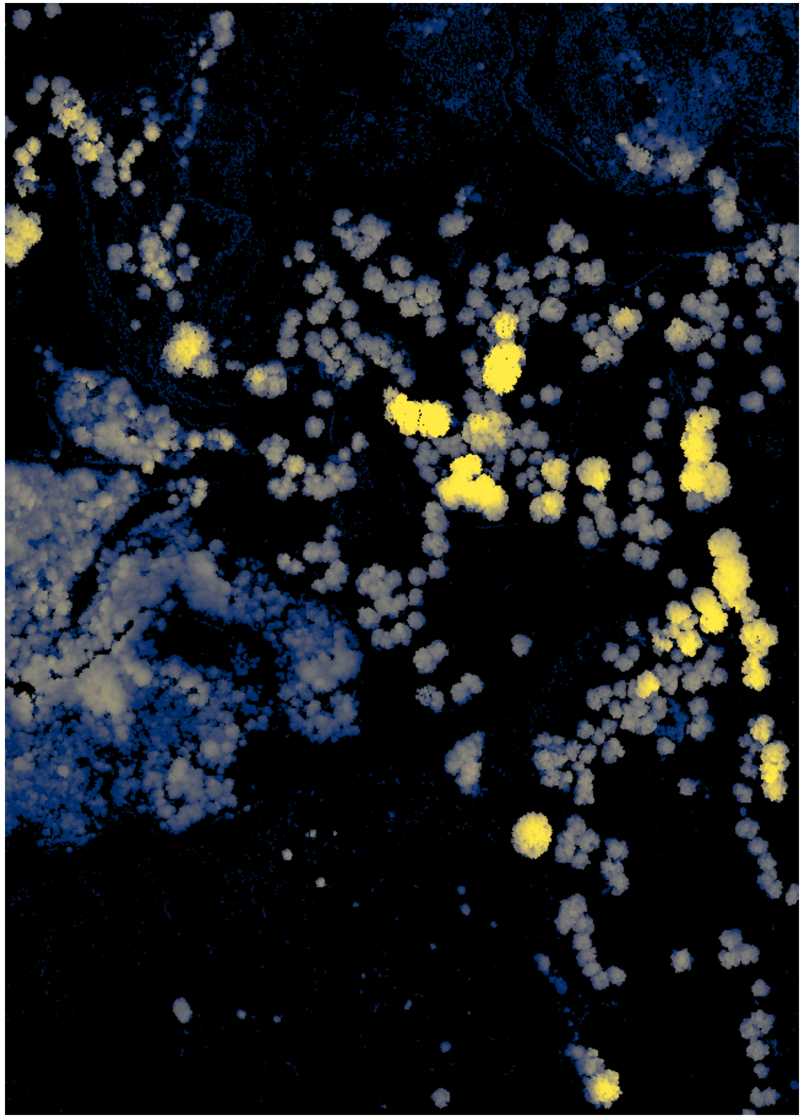

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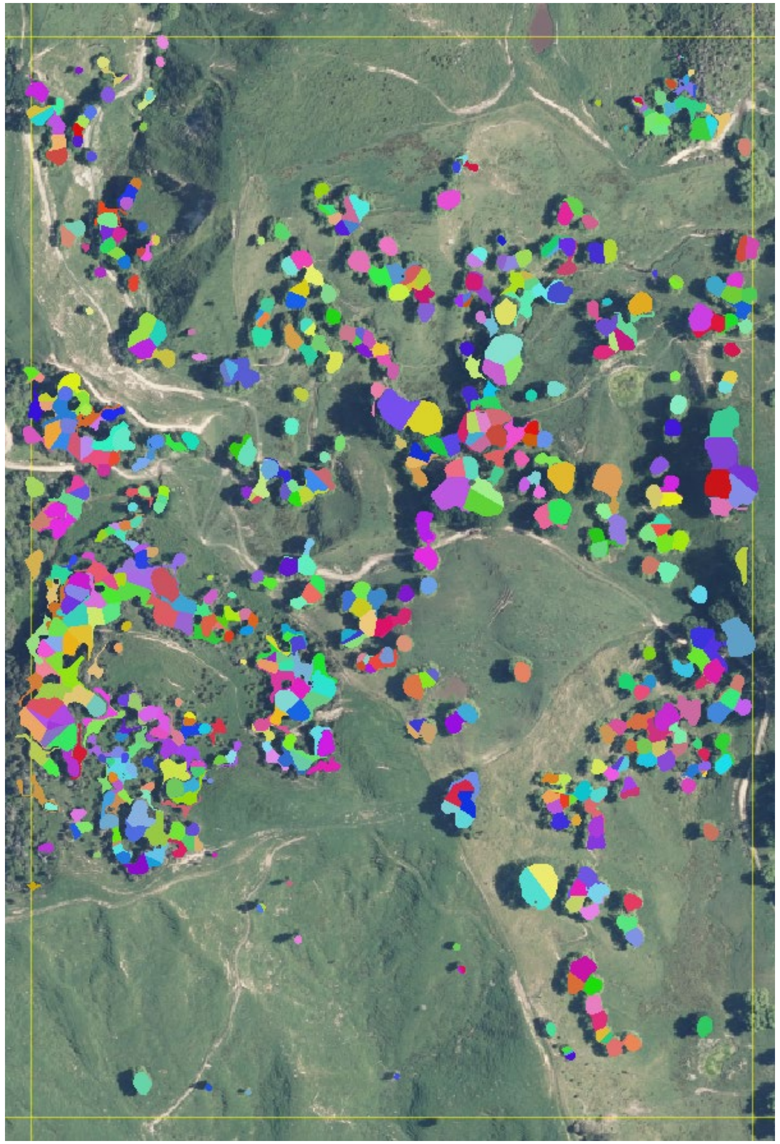

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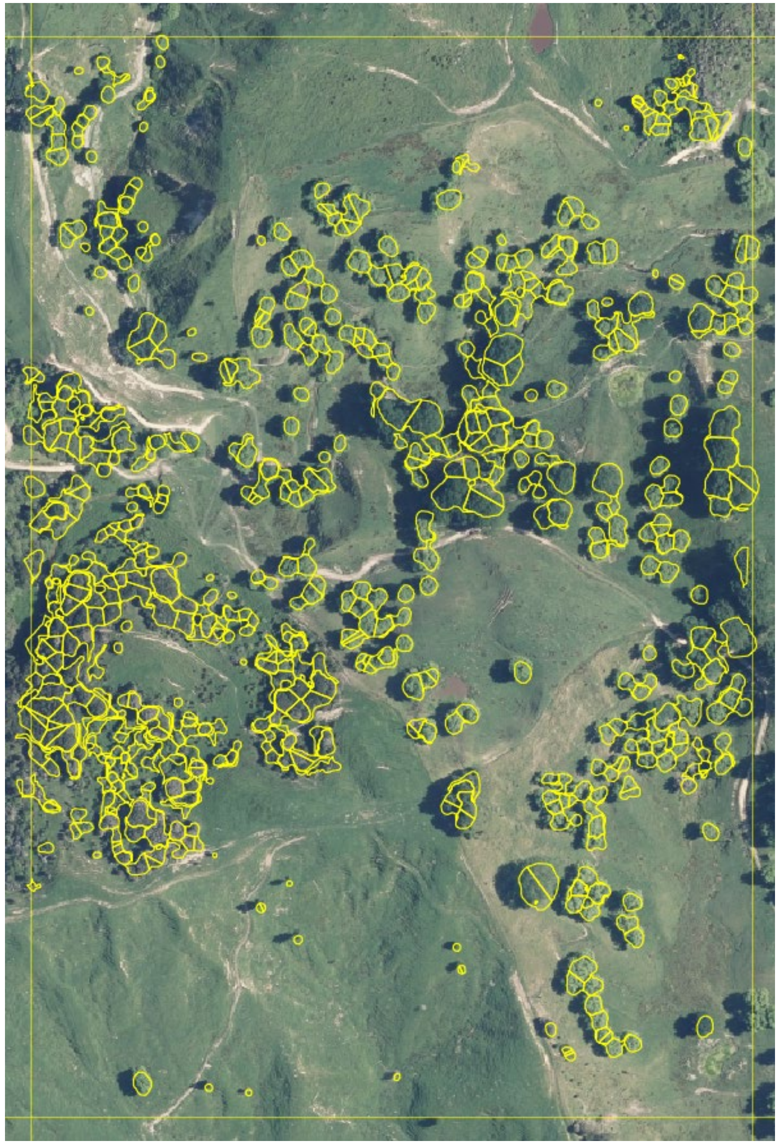

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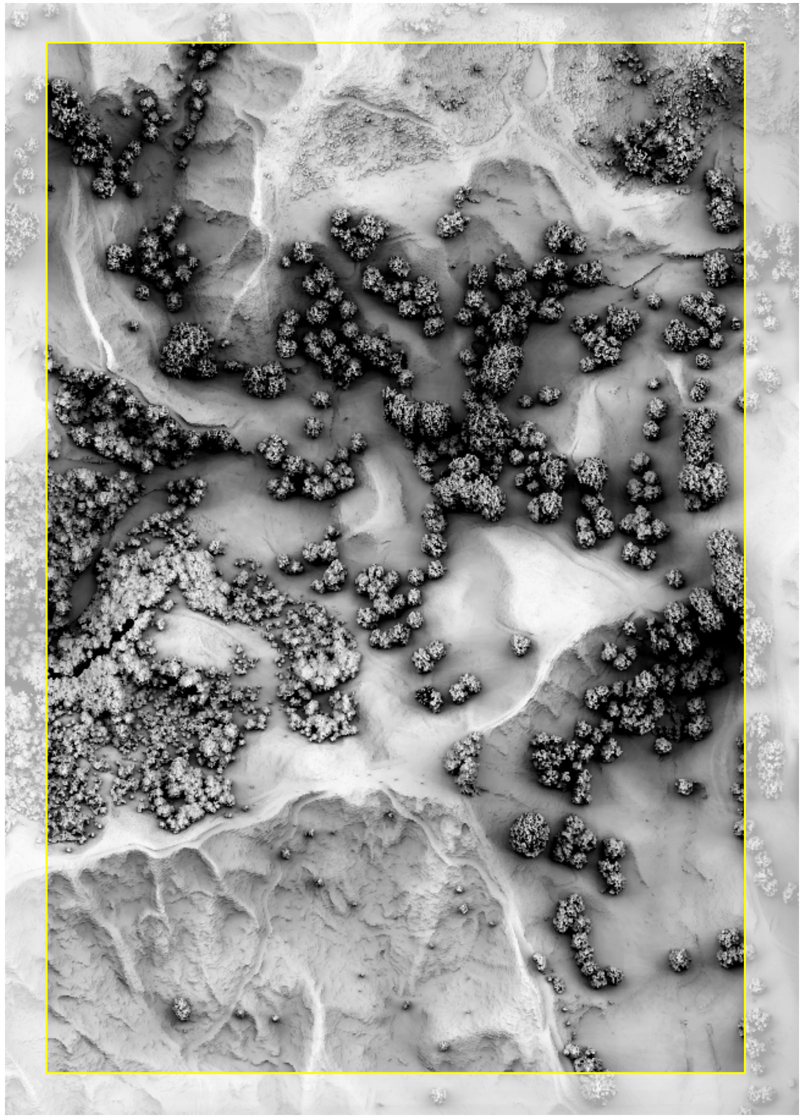

Workflow steps:

1. Merge tiles to created buffered point cloud
2. Create DEM + hillshade
3. Normalize Point Cloud (height above ground)
4. Create DSM + hillshade
5. Create nDSM
6. Create CHM
7. Individual trees
8. Create daylight / shadow layers
9. **Cut off buffer region of all raster layers**

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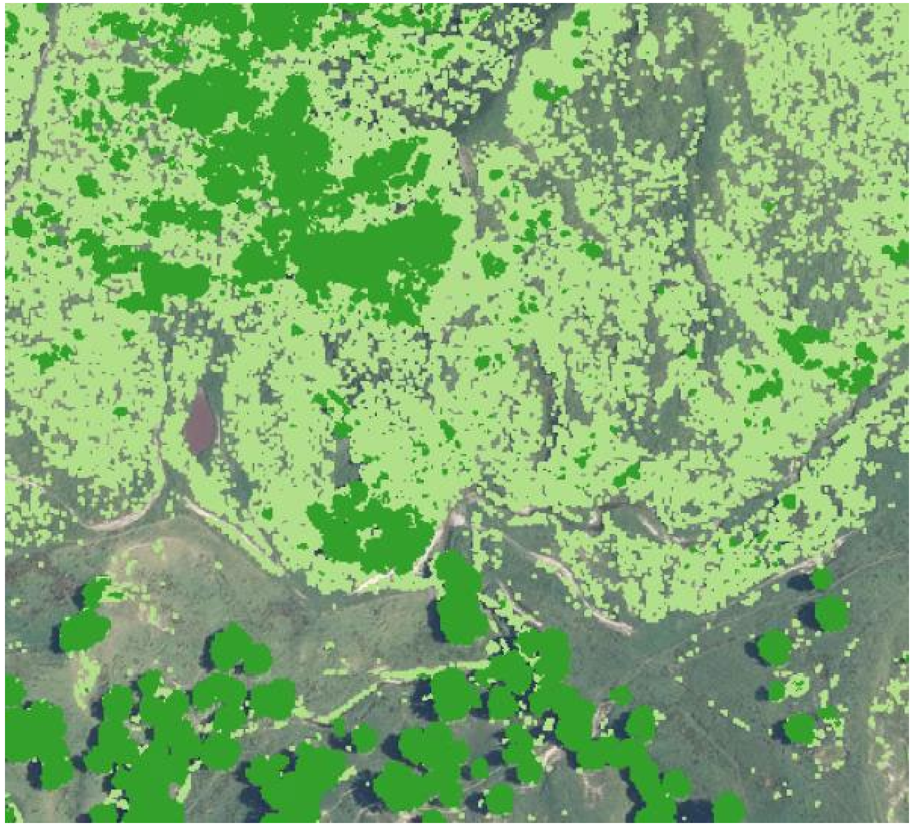
Tree canopy and short vegetation layers



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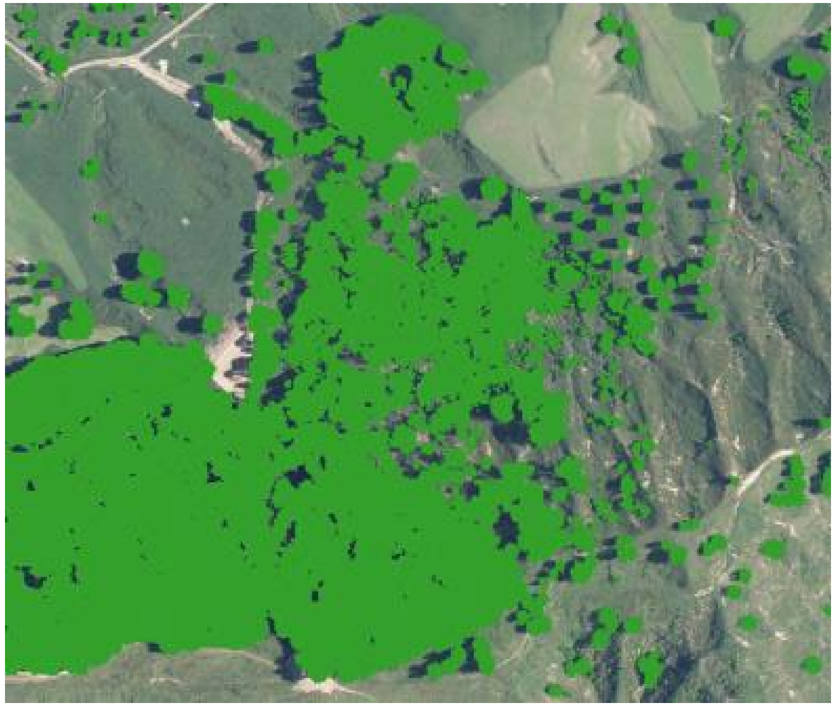
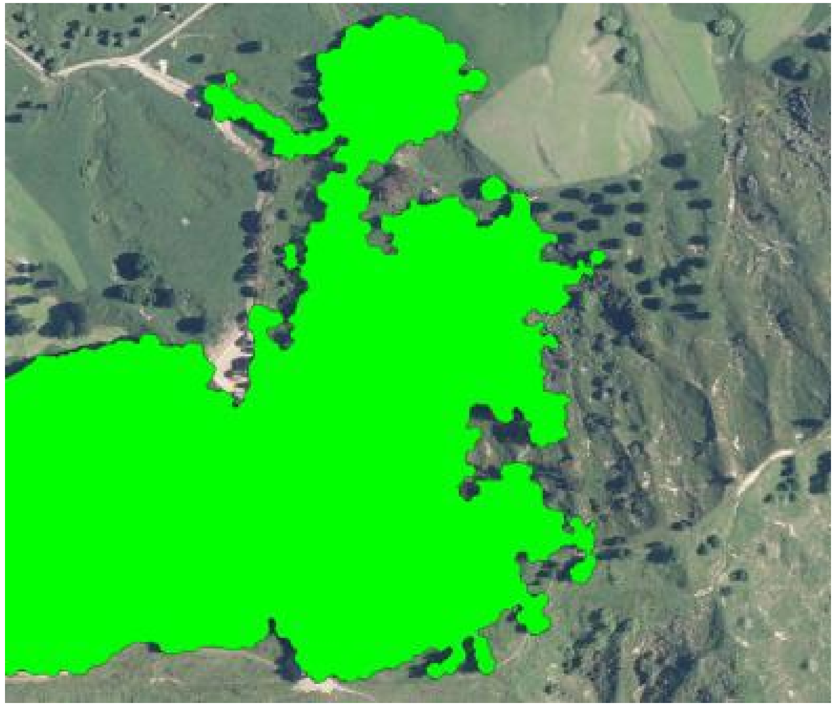
Forest layer

Tree canopy layer



Forest layer



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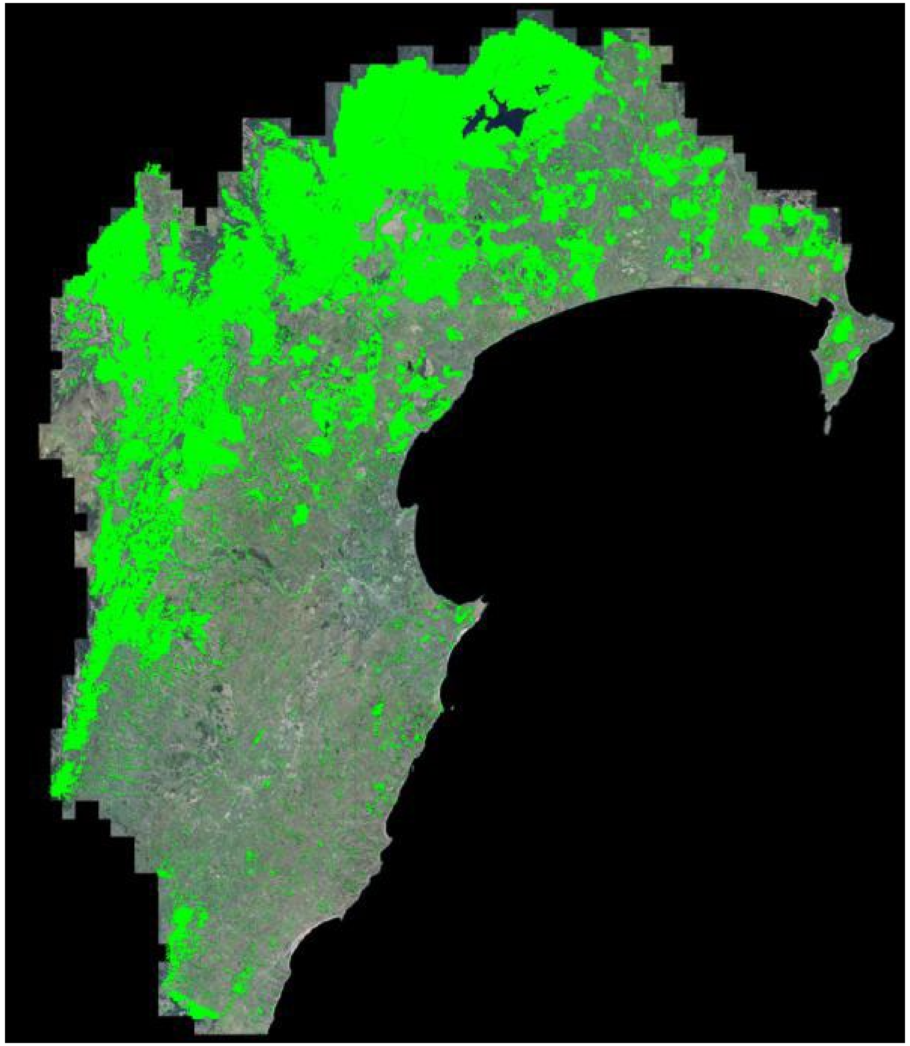
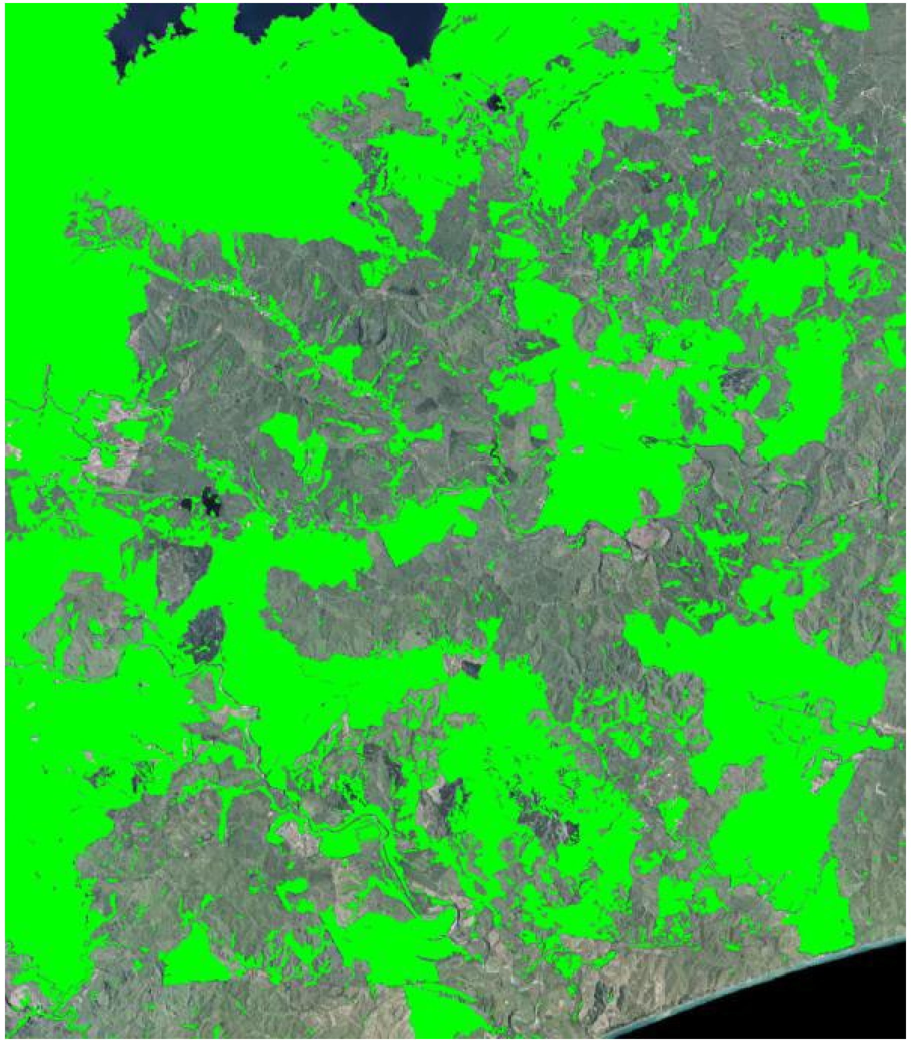
Forest layer

5,505.6 km^2; about 37.3 % of the LiDAR survey area





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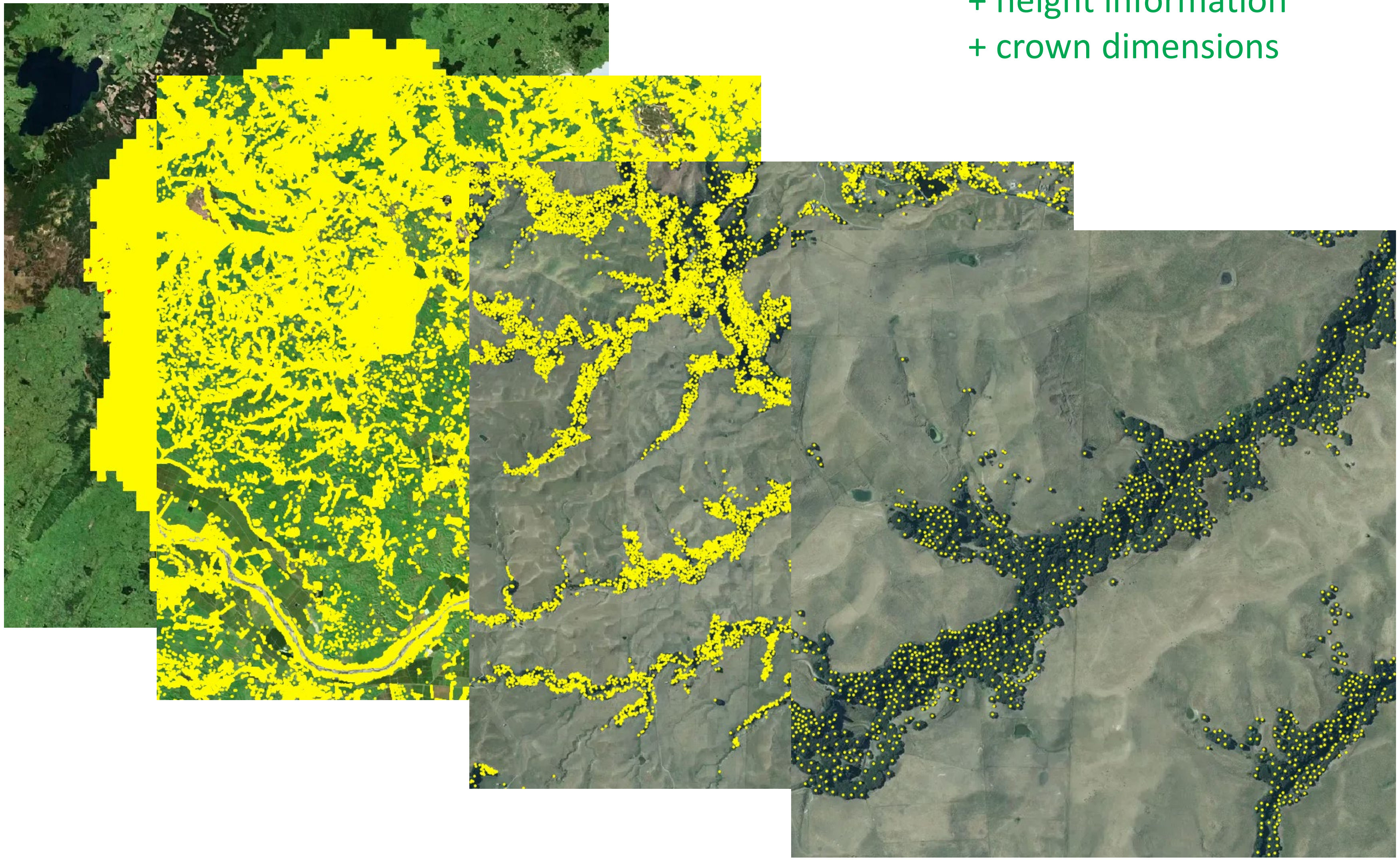
Individual tree layer



57.3 million trees
+ height information
+ crown dimensions

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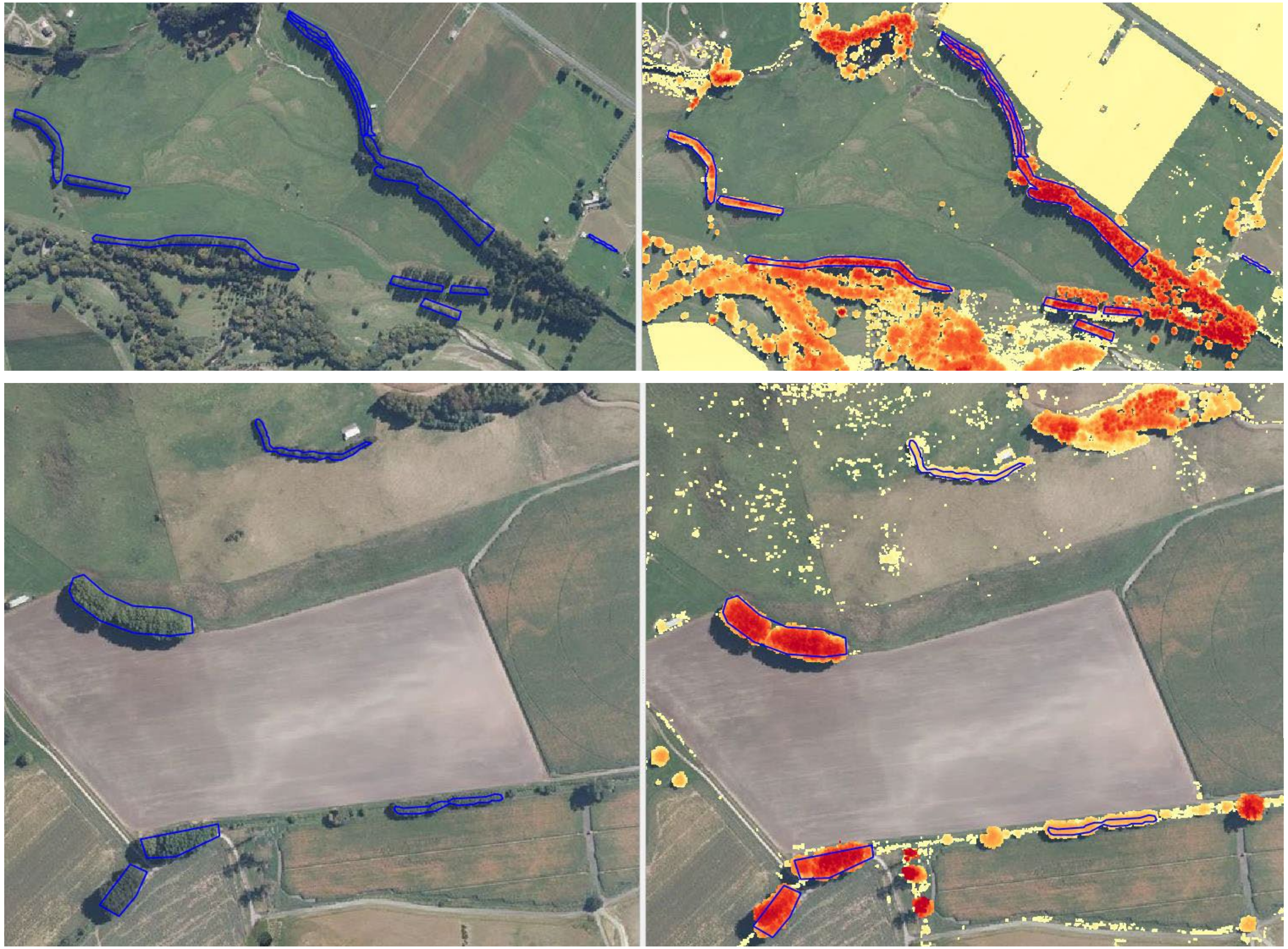
Shelter belt layer – Training data



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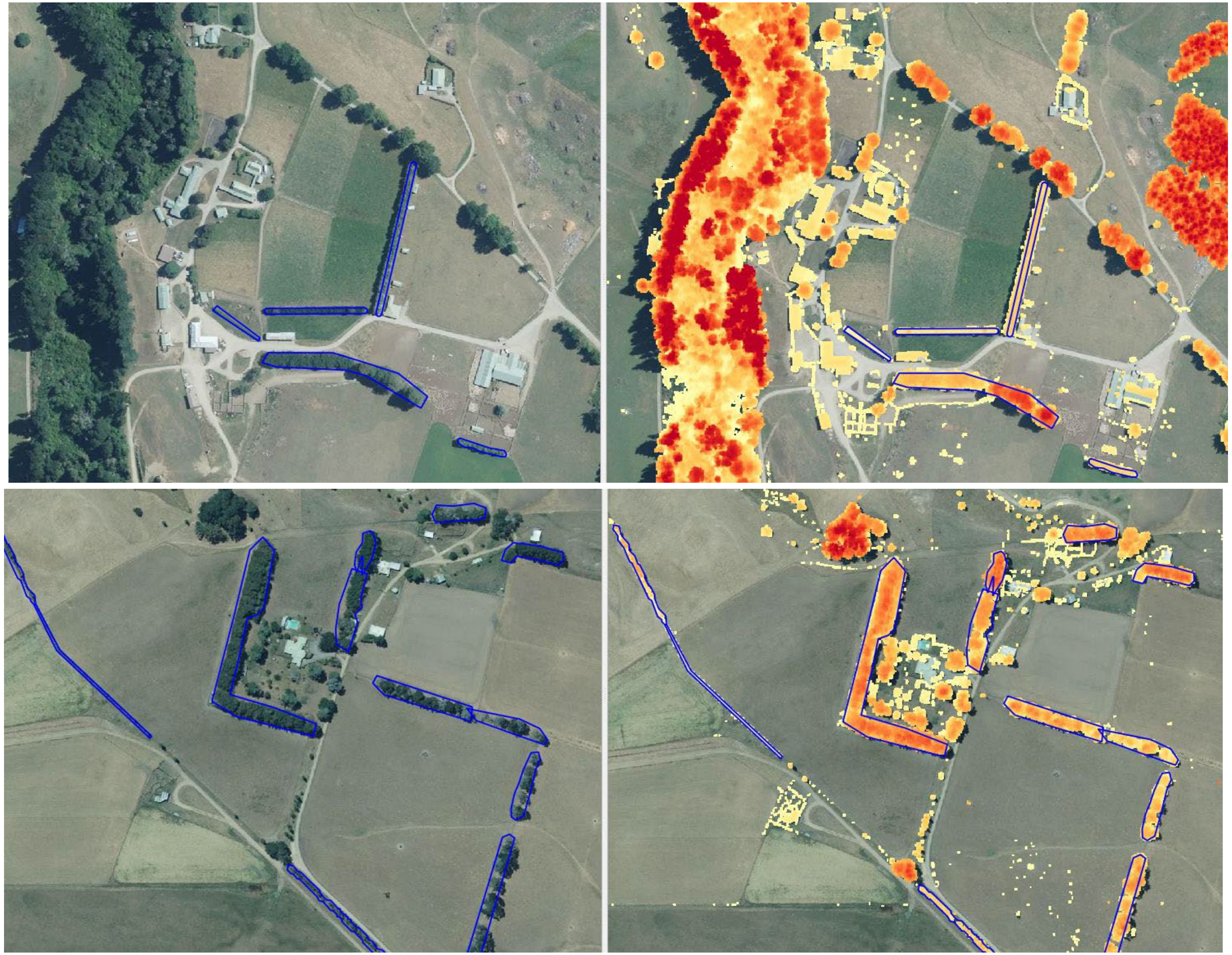

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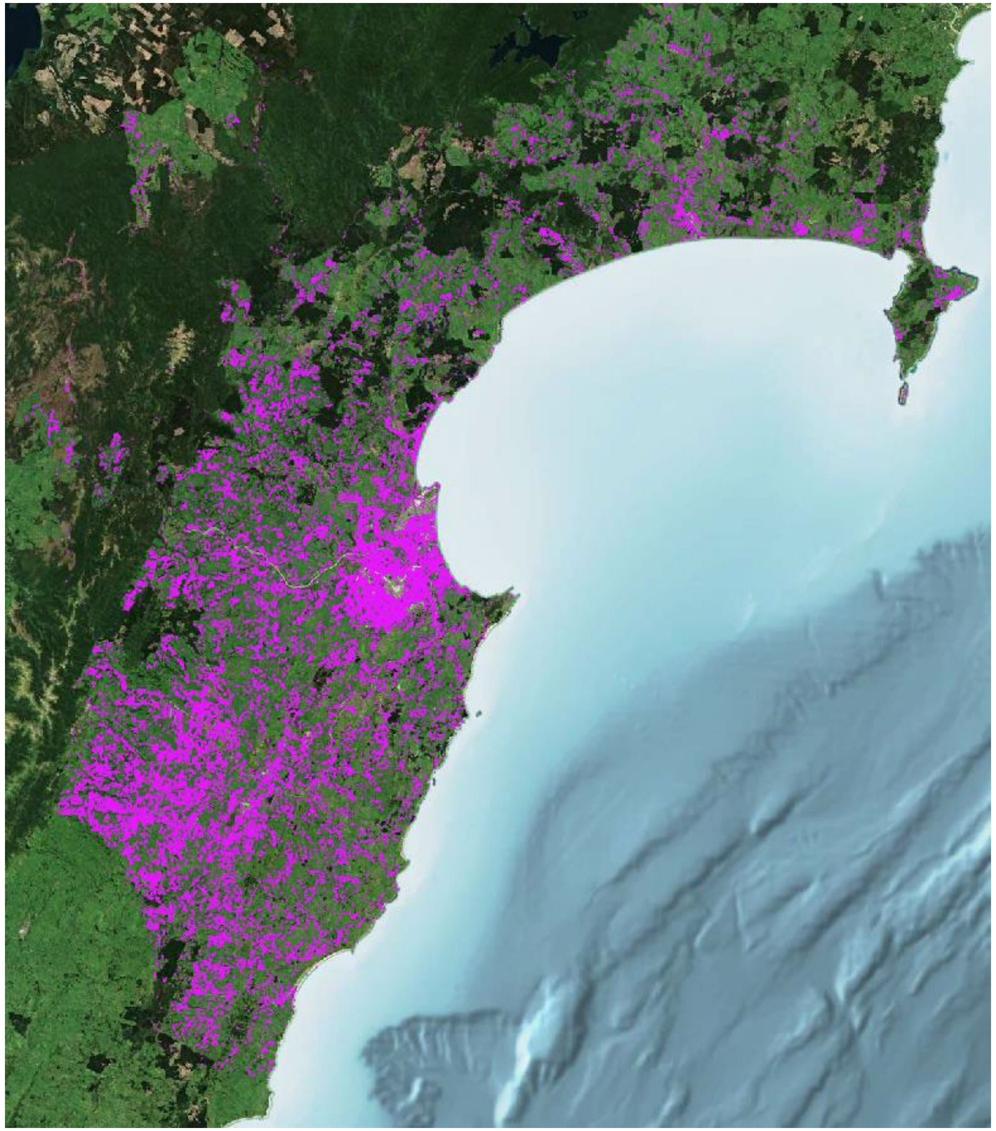
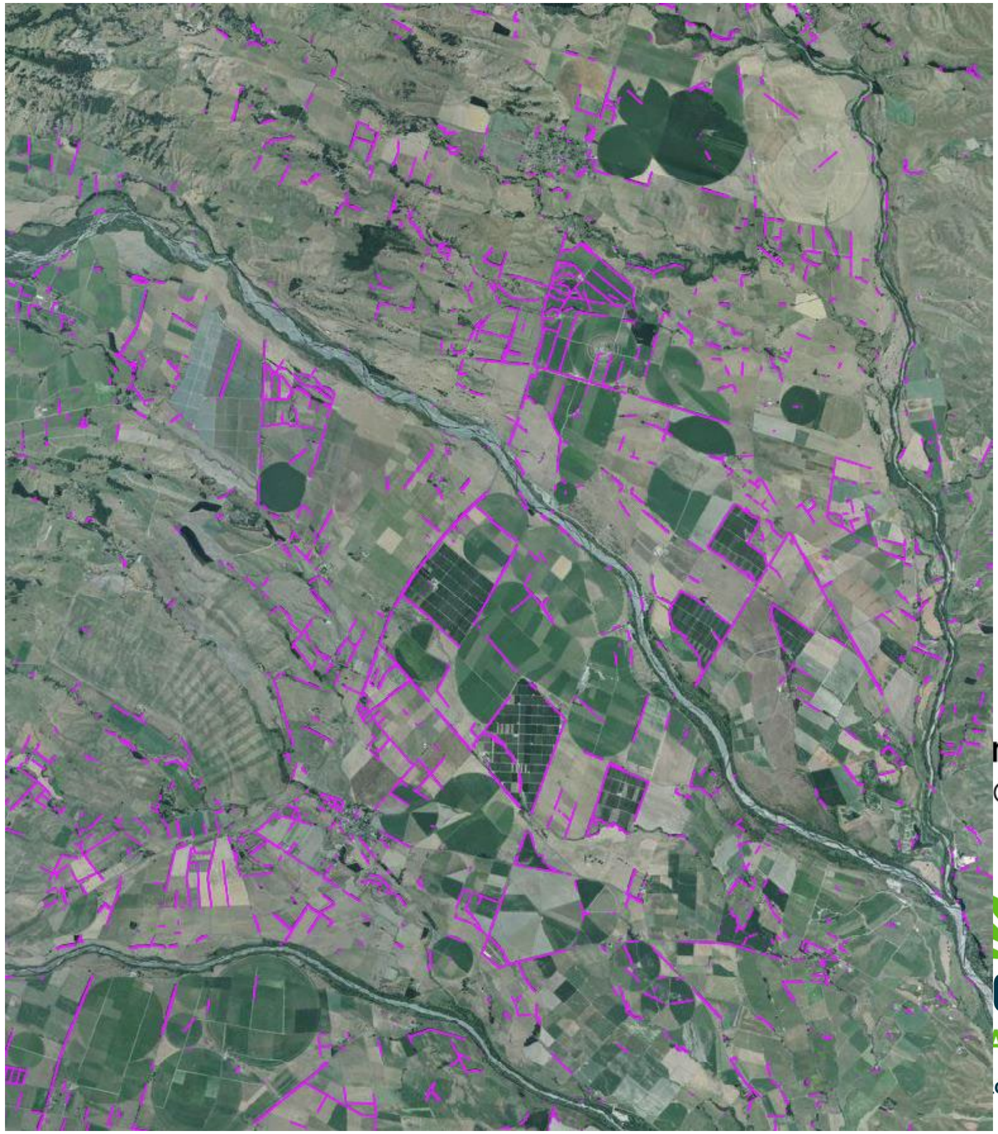
Shelter belt layer – Result

39,798 shelter belts





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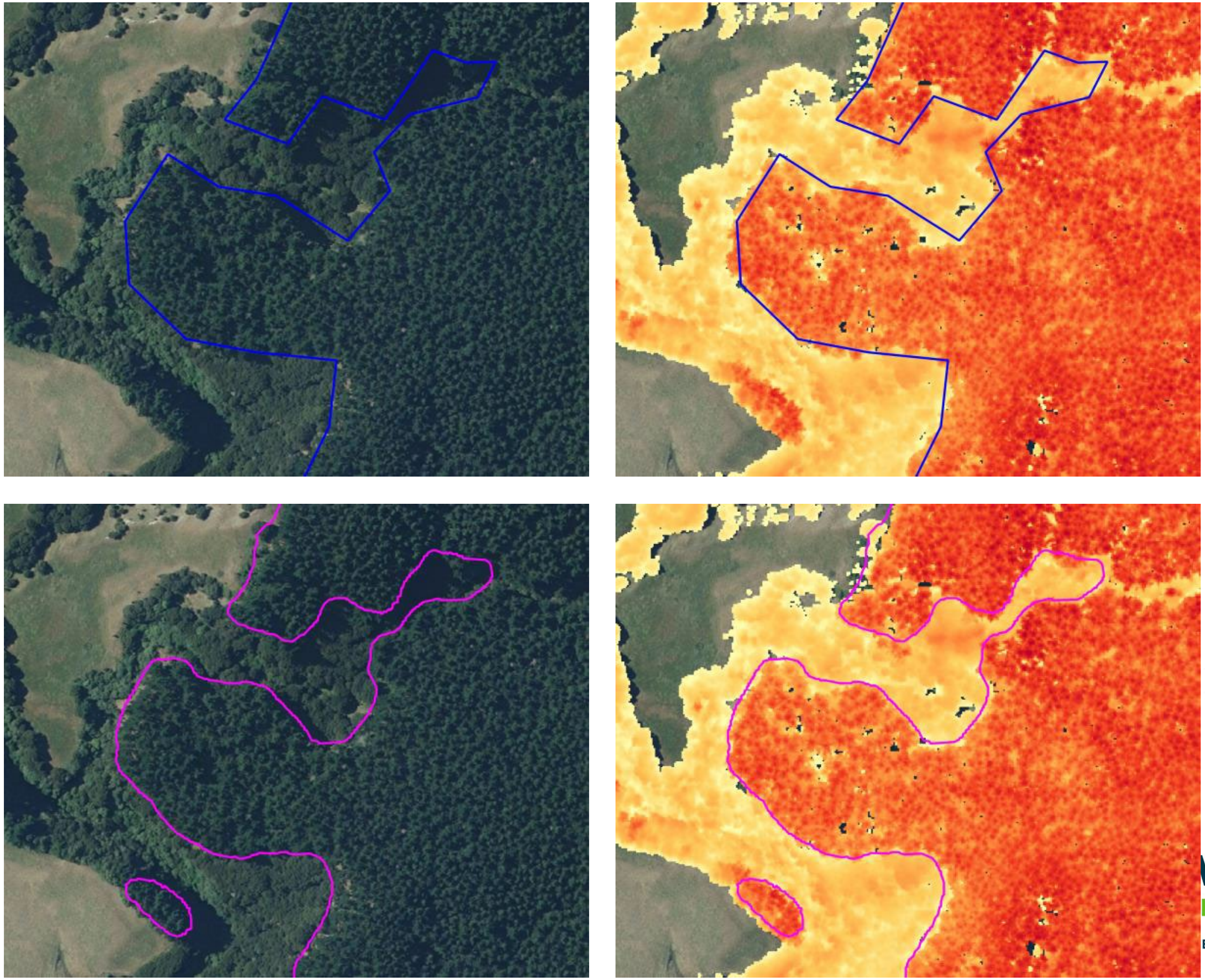
Pine forest layer

Label

Prediction



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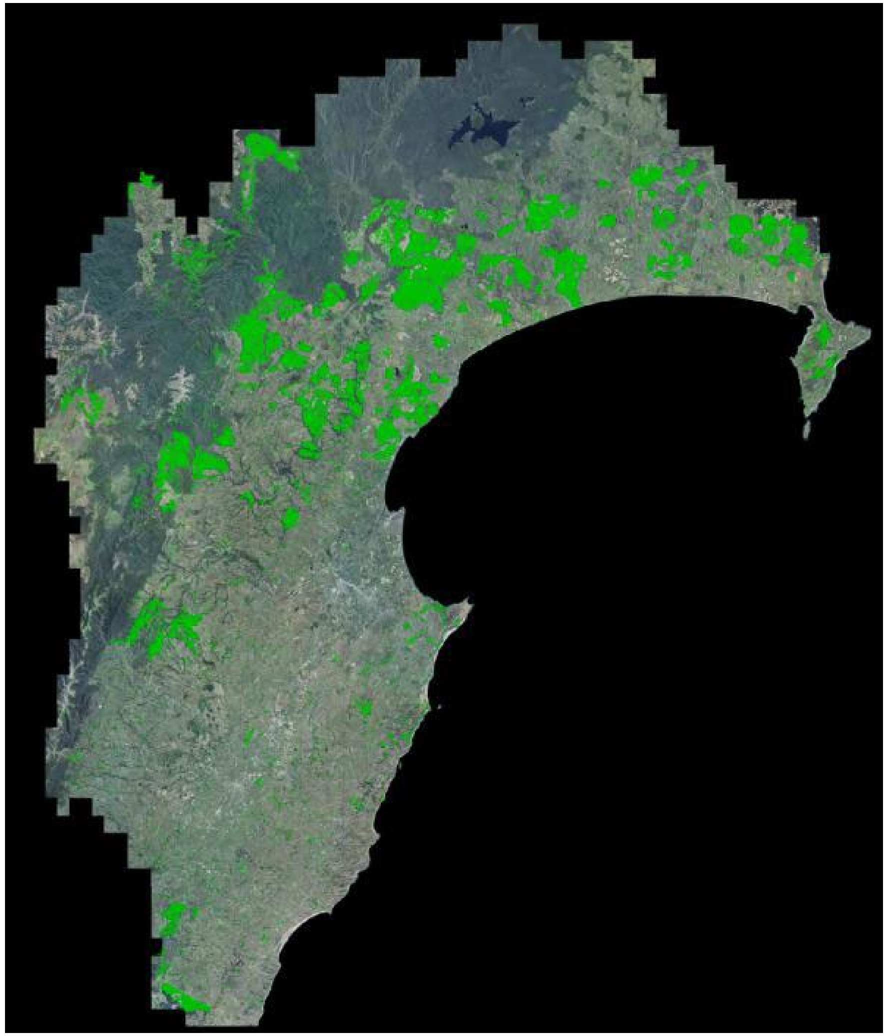
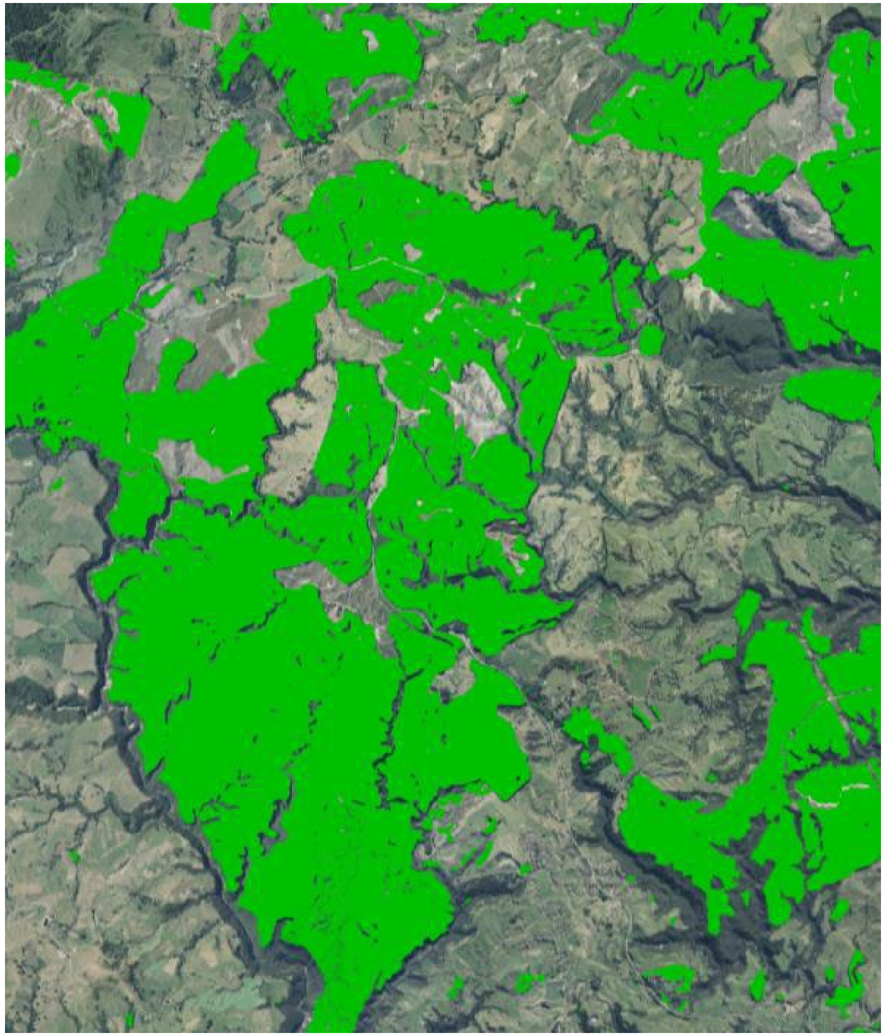
Pine forest layer

18,662 polygons; 1,511.8 km^2





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+ individual trees
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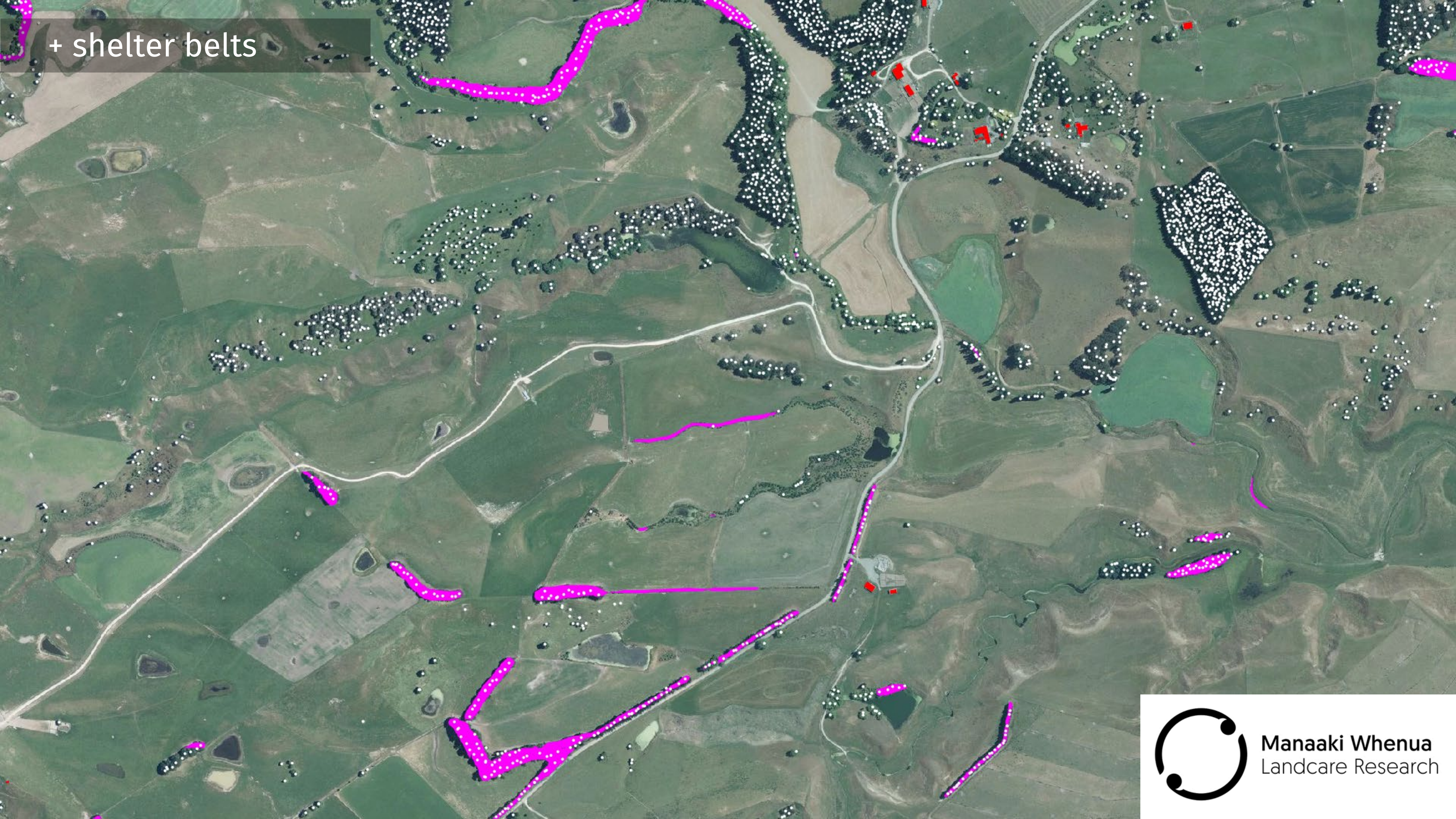
+ shelter belts
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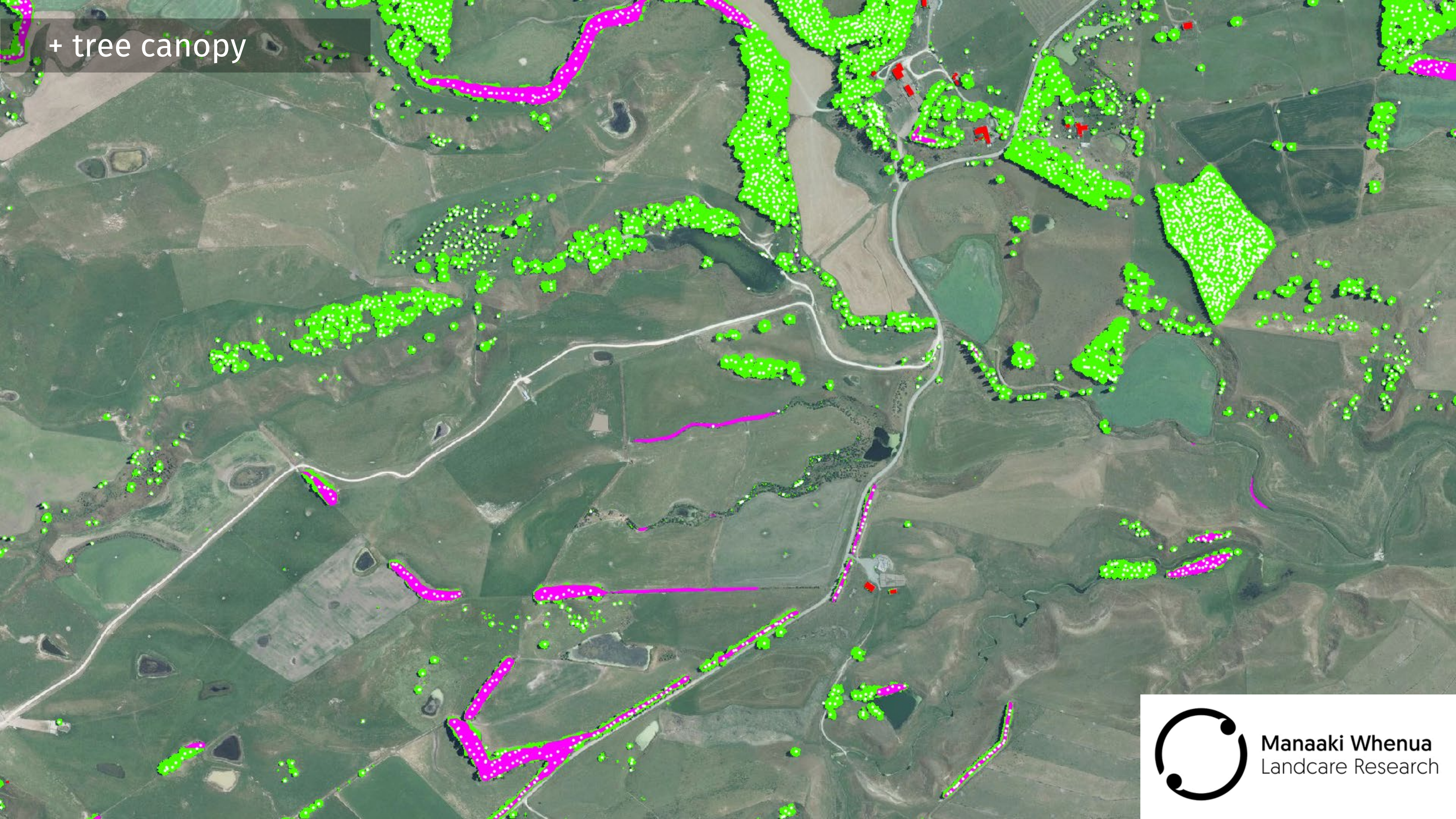
+ tree canopy
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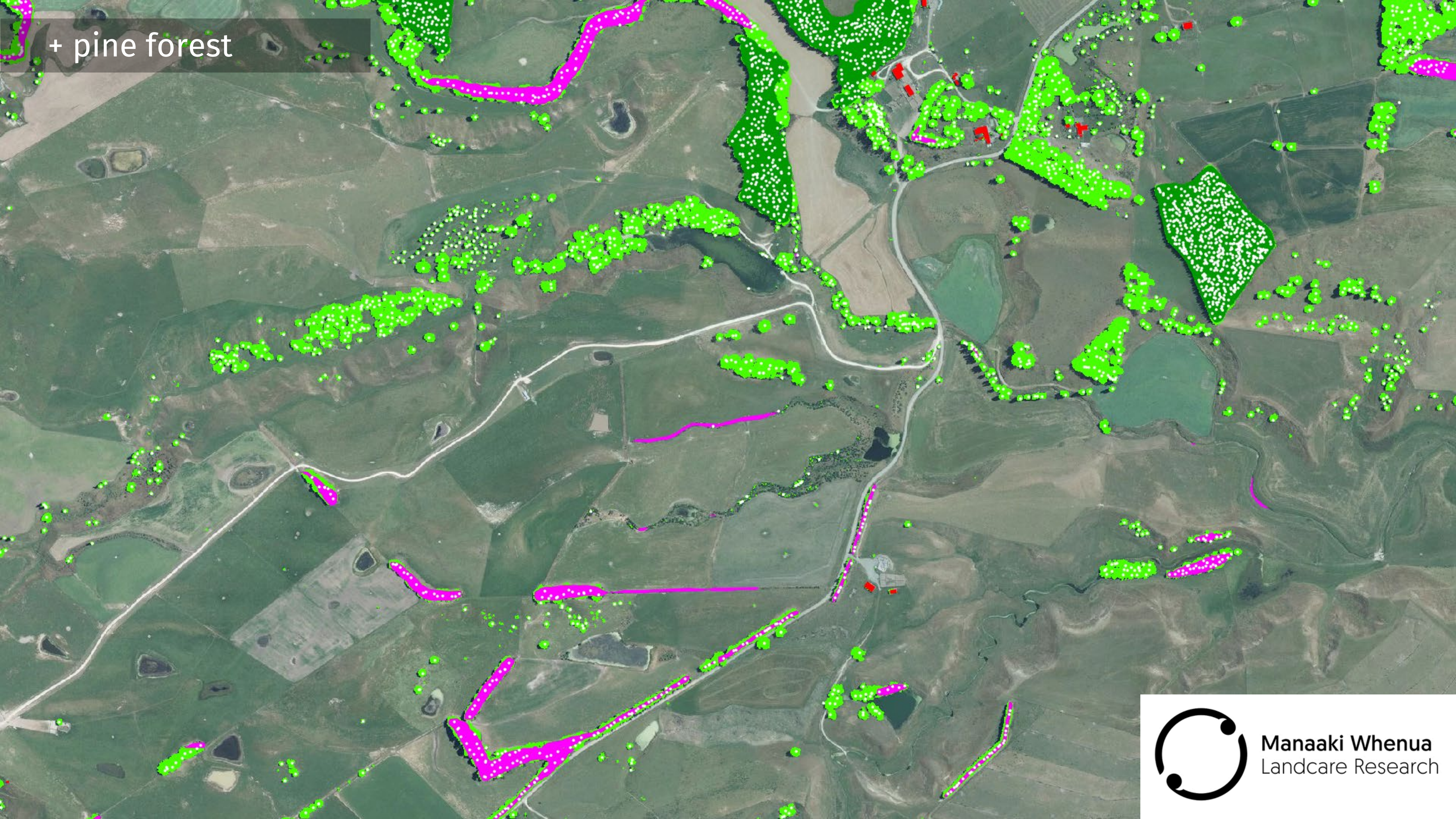
+ pine forest
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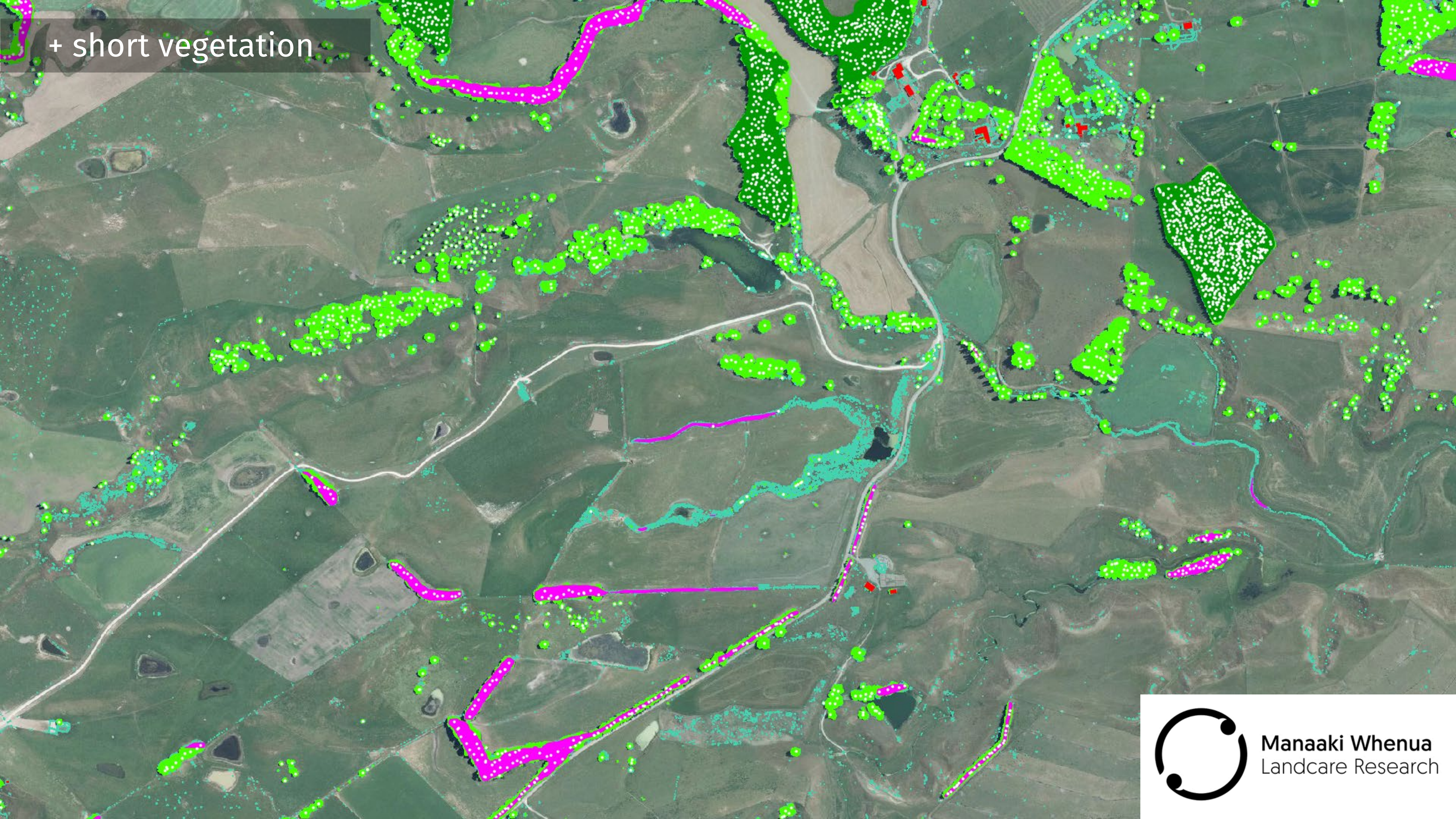

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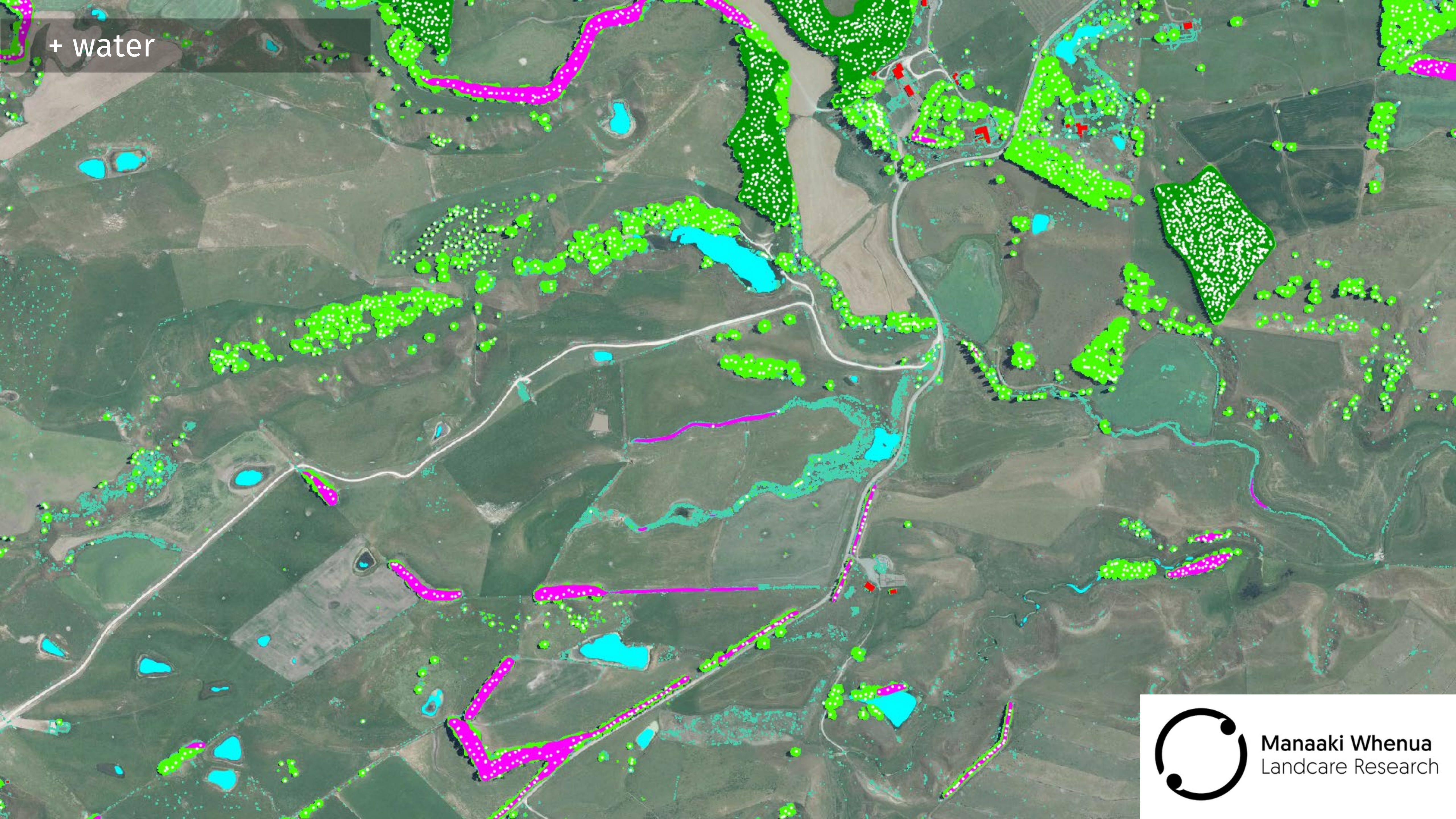
+ water
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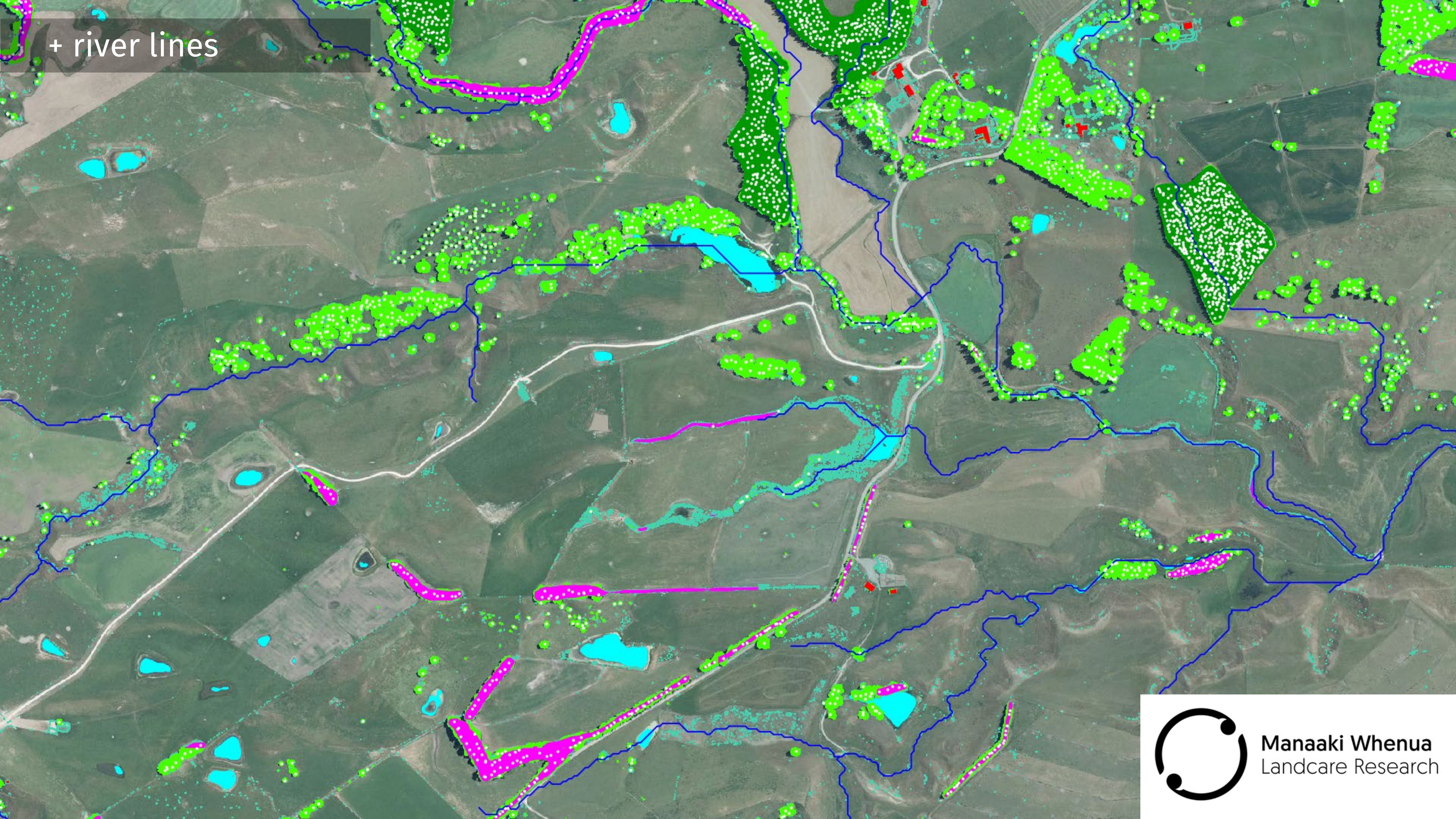
+ river lines



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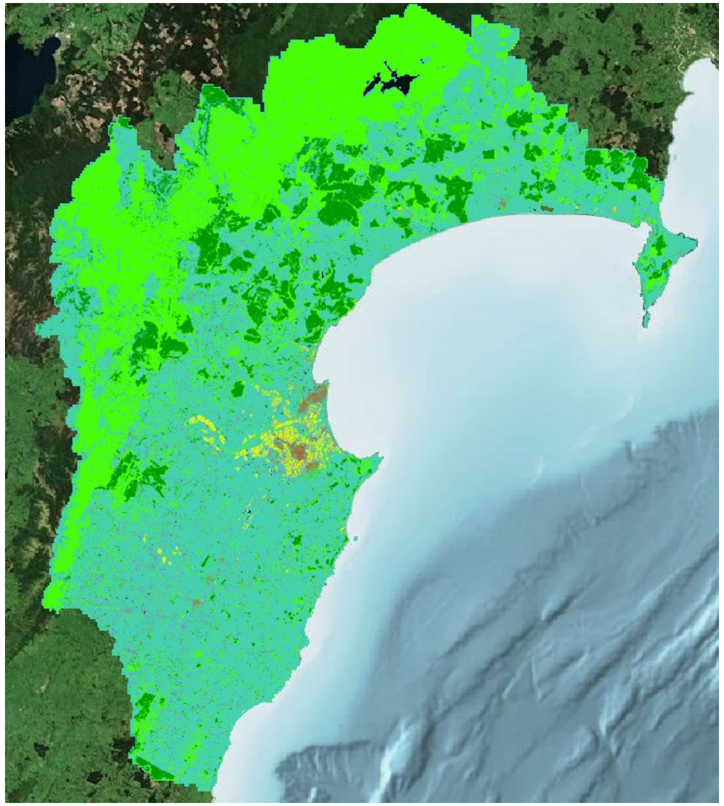
Recommendations

- Clear class definitions
- Combine existing environmental layers to derive secondary datasets and establish rule sets
- Explore different AI and more traditional algorithms for vegetation change analysis
- Simultaneous acquisitions of LiDAR and aerial photography
- Convolutional neural networks showed promise on LiDAR; use on RGB imagery
- Acquiring high-density aerial and under-canopy LiDAR data



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