Precision Forestry – Introducing..

Automated Seedling & Tree Detection

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www.Indufor.co.nz

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Outline

Overview

Applications - detection and analytics

Tree detection from R&D to implementation

Model considerations; data inputs, accuracy and refinement….

Future developments

- online deployment

-    DIY detection

-    new datasets

Tree Detection examples

Precision

building precision layers from
AI to improve forest
management efficiency

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Tree Detection

Our approach uses an opensource AI based framework that utilizes aerial RGBI imagery from SKYCAN @5 cm

Detection models are created, tested, and deployed across images to produce tree locations.

This data is further analysed to produced a range of analytical layers.

www.youtube.com/watch?v=Q-CLkHAIxHk

Applications

Early Detection: extract tree locations to determine establishment success and survival for each block.

Assist land managers to prioritise site inspections, provide evidence of afforestation and plan interventions.

Detection of Established Trees: prior to canopy closure extract each tree's location and crown dimensions to plan future tending, stratify stands, and track plantation performance. Link with LiDAR data (if available) to add tree heights.
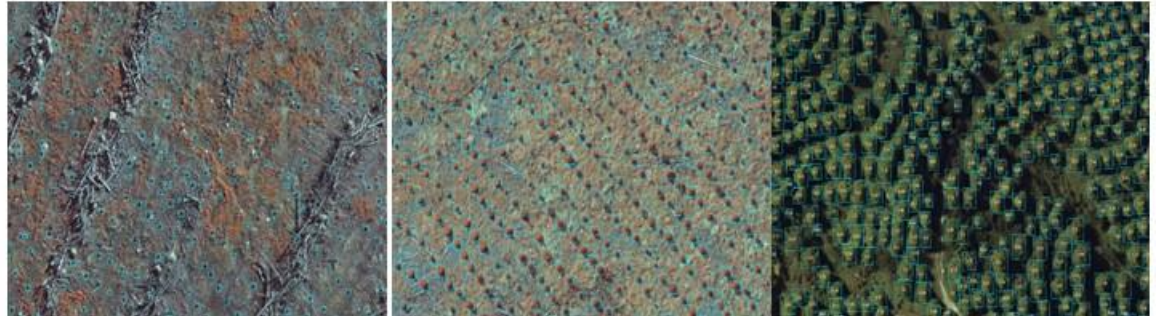
Detection of newly planted seedlings

Detection of two-year old trees   Detection of three-year old trees   Detection of ten-year old trees

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Early Age Assessment

Benchmarking productivity at age 3.

Information that support decisions and improve operational processes and achieve fully established stands with good uniformity.

Trial started in 2020

1. Quantify improvements in establishment techniques
2. Undertake remedial activities
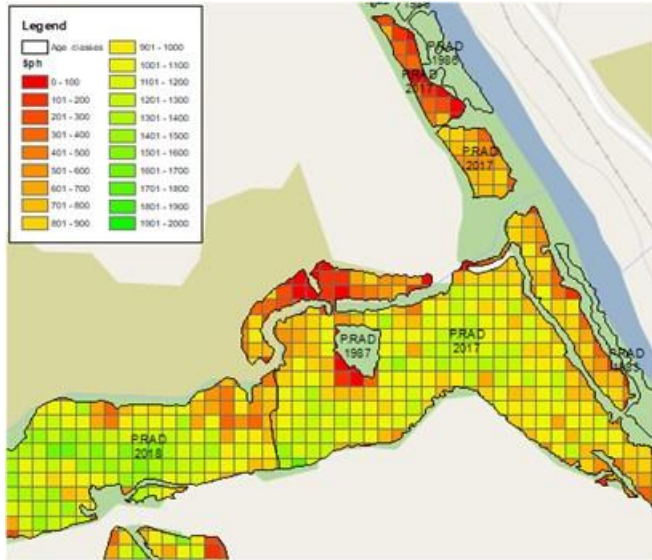3. Ensure ETS compliance

Future

Now have a baseline for updates that supports future decisions, monitoring, autonomous solutions and growth updates.
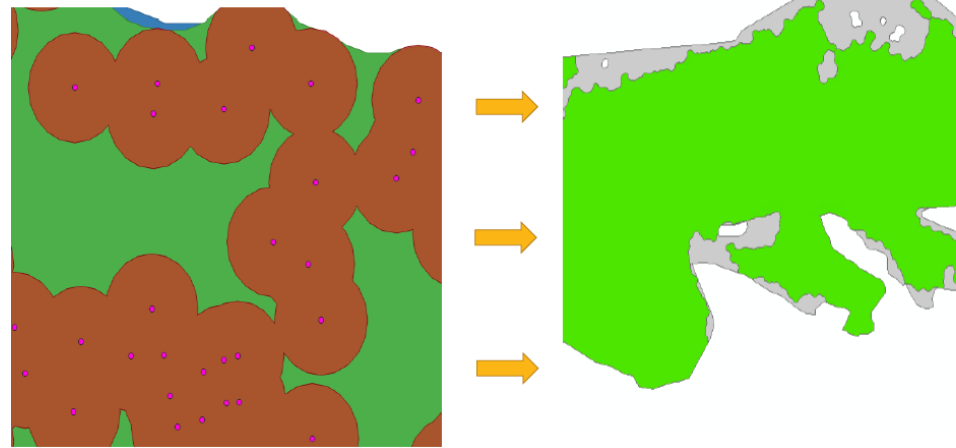
Port Blakely

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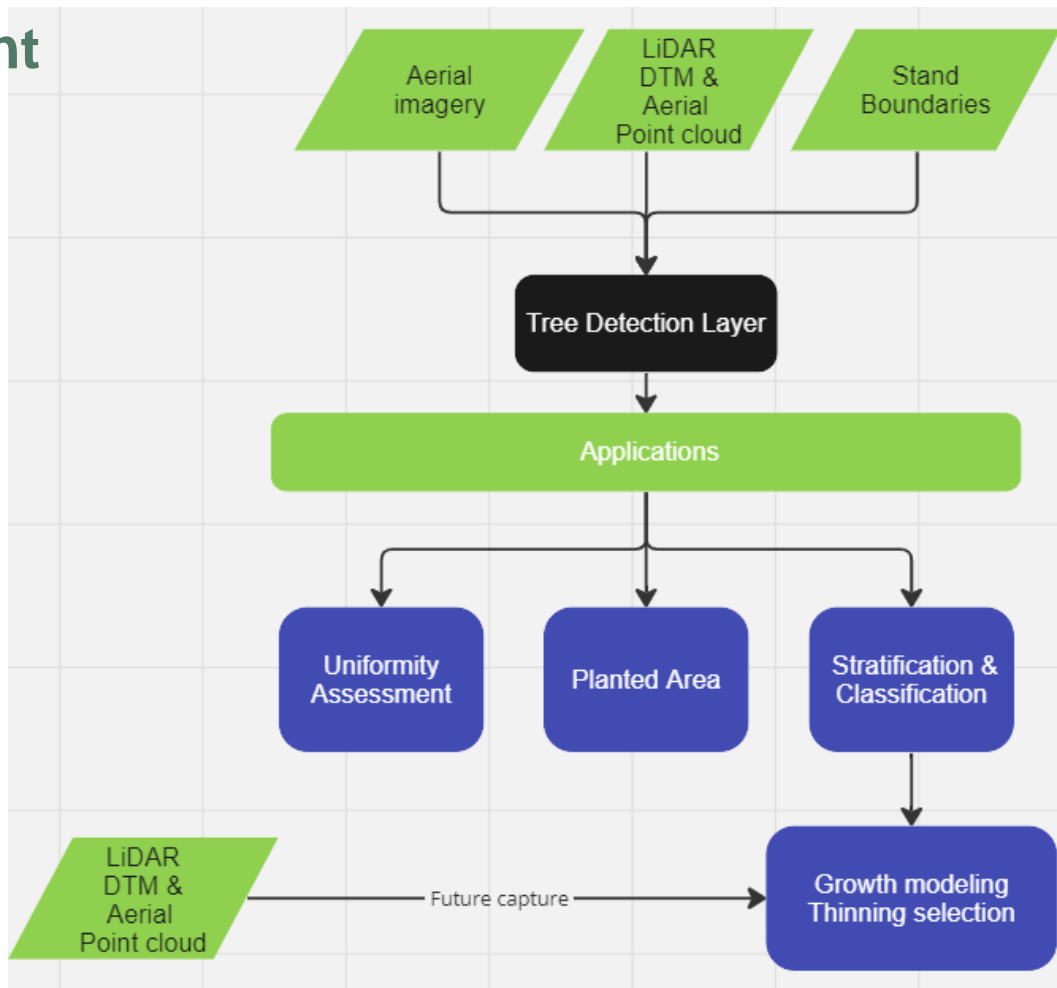
Decision Support Layers

The following examples show how Port Blakely are using tree location data to improve the area description and management of their plantations

2. Net stocked area mapping

1. Uniformity and establishment baseline assessment

3. Quantitative classification using a traffic light system to identify issues

Port Blakely

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# Outputs: Dashboard & Layers

Indufor's deep learning framework

1. Adaptability. – can be modified to detect different species

2. Scalability – built to run at scale.

3. Generalisation – models recognise different site conditions

4. Automation – automated pipeline to outputs tree locations & analytics

5. Continuous improvement – framework able to detect features or trees

6. Real time and near real time detection.

Post plant spot detection

Mapping of native forest remnants
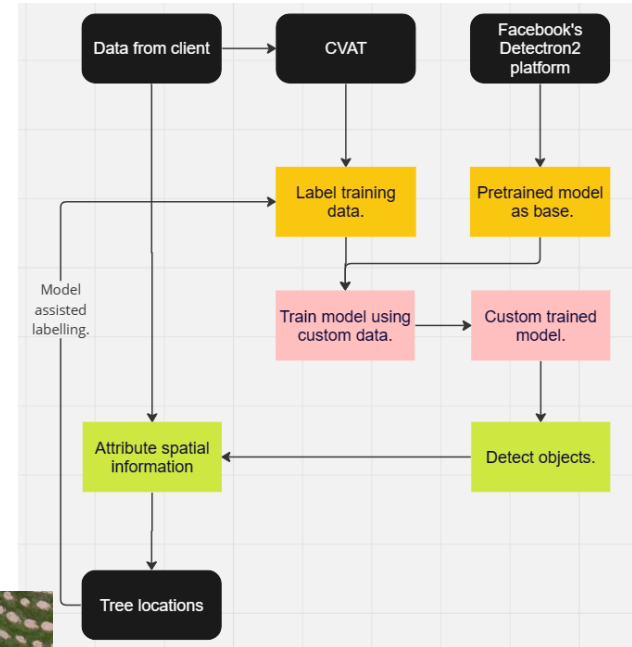
Online tree detection tool…

Presenting, a prototype online tree detection tool allowing users to generate tree detection outputs using Indufor's general tree detection models

- There are 2 tree detection models available:
  1. **induforTreeModel:** A model for detecting *P.rad* seedlings (<1 to 2 years old) from infrared imagery.
  2. **induforTreeModel2:** A model for detecting Redwoods (5 to 10 years old from aerial imagery

- Images can be uploaded or provided as a URL to the user interface. The user can choose a model to use and run the detection

- Indufor Tree Detection (click here to open tool in browser)

  Steps for using an image url:
  1. Open tool in browser.
  2. Select the URL option.
  3. Right click and copy a URL below for use in tool.
     P.rad seedlings
     Redwoods
     Drone P.rad seedlings
  4. Choose which format to have the inferences as. (Note the example images do not have a geolocation embedded in the photo so the file will be a json instead of a geojson).
  5. Click to run the inference.


Indufor Tree Detection Interface

Tree metrics from high overlap oblique imagery

Example capture from SKYCAN (www.skycan.co.nz) using two oblique cameras mounted on a Cessna.

The processed output is normalized dense photogrammetric point cloud (80 pts/m^2) overlaid with tree Indufor's tree locations.

Potential this data could be used to extract additional metrics that describe Individual tree growth and development
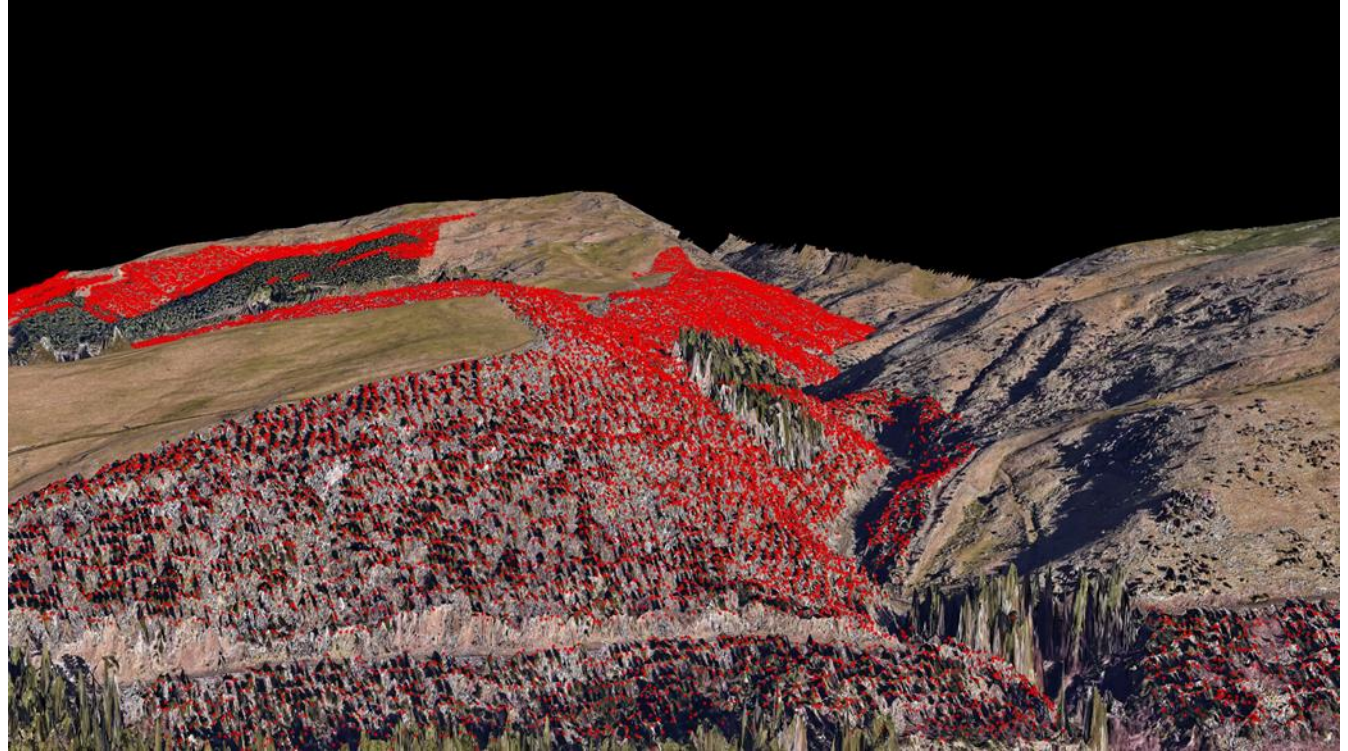
www.youtube.com/watch?v=sT4XzK0jglk

Detection Examples

Detection of newly planted seedlings

Detection example across a clean spot-sprayed grassland site.

Spray spots clearly visible and seedlings large enough to be detected. Image captured at 5 cm.

Newly planted seedlings

Detection model across a clean spot-sprayed grassland site.

Spray spots clearly visible and seedlings large enough to be detected. Image captured at 5 cm.
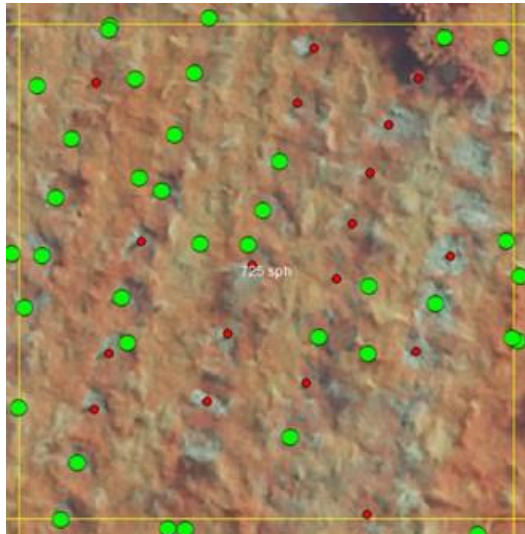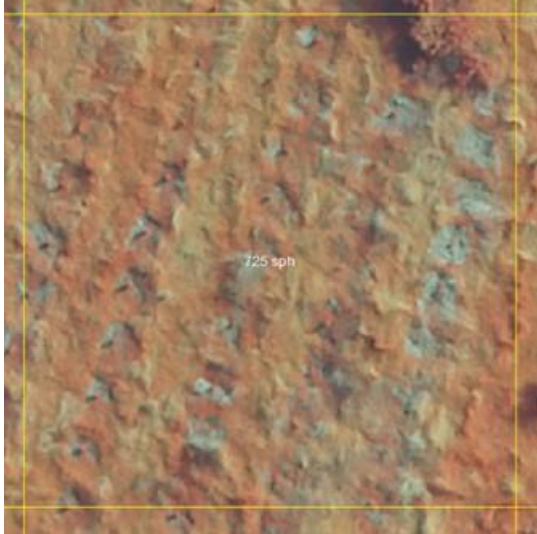
Newly planted seedlings

Detection example showing results across a cutover site.

A complex site with slash, grass and weeds. Trees with reasonable growth (though variable) are detectable.

Some benefit in waiting for trees to grow on for a further year.
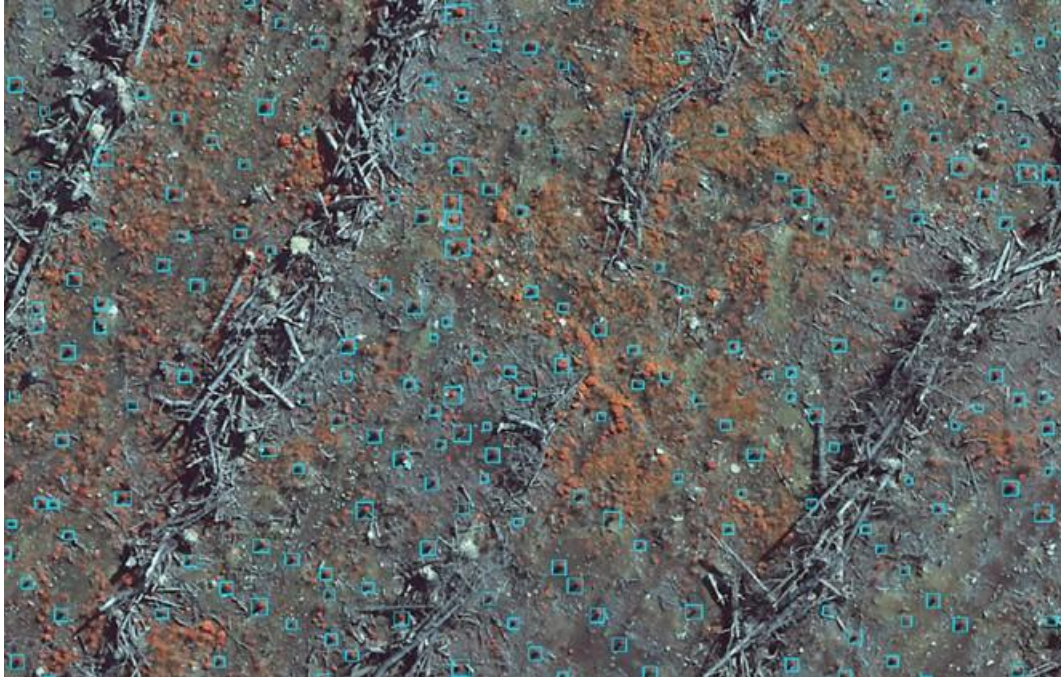
Newly planted seedlings

Detection across a grassland site

Note the base detection model has been used. The green points are Indufor detected trees, and red points undetected trees.
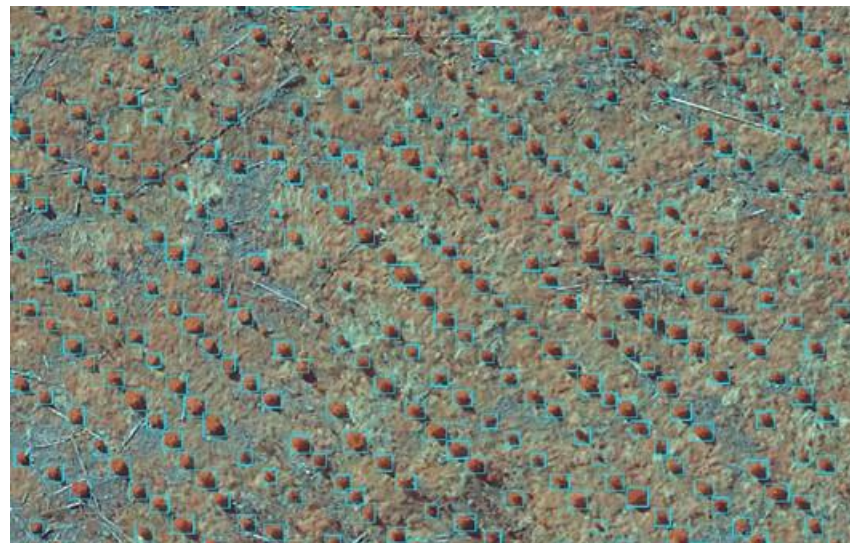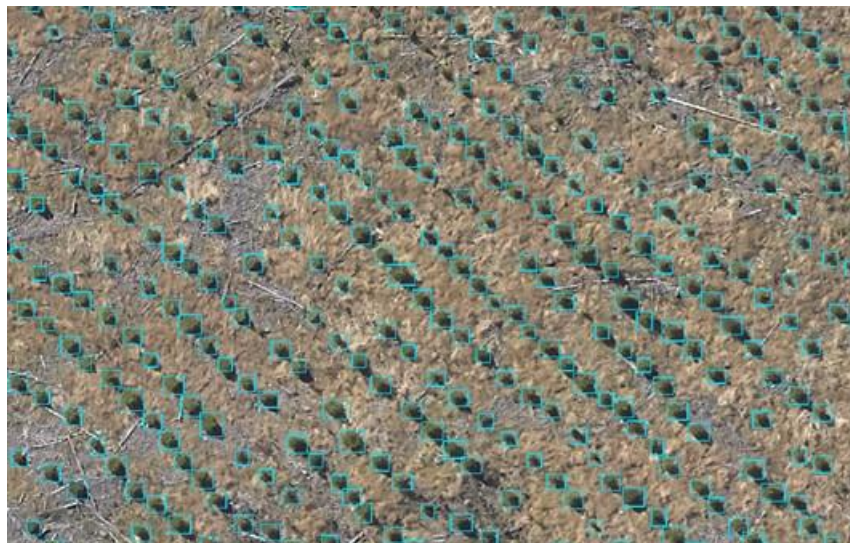
Accuracy is about 60%. With additional training model accuracy increases to 80%

Detection of two-year old pine

Detection of trees across a
cutover site that includes
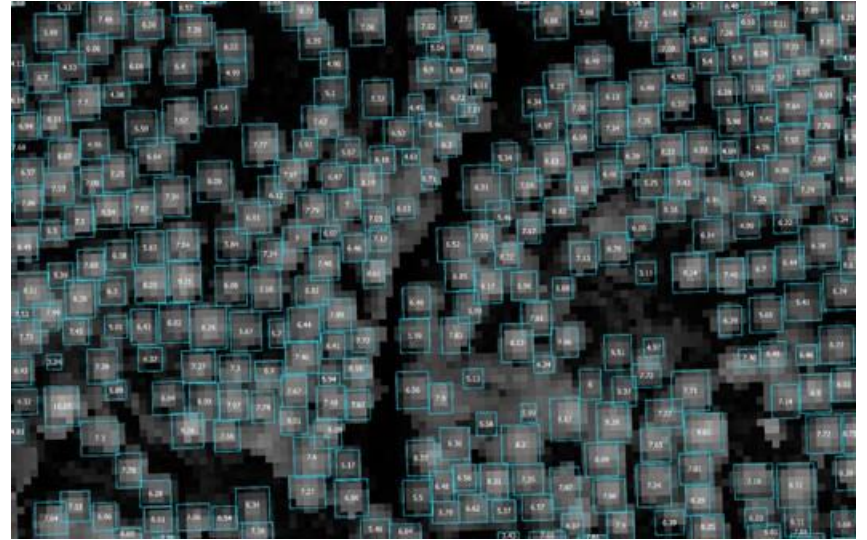scattered broom regeneration

Detection of three-year pine

South Island cutover site – site preparation is 100% sprayed.

Trees well established and easily detected using RGB and CIR detection models.

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Detection example showing results achieved using Indufor's tree detection model combined with tree heights extracted from LiDAR.

Canopy closing but still enough separation to detect individual trees using a RGB detection model.

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