

UAV Based LiDAR for Forest Inventory

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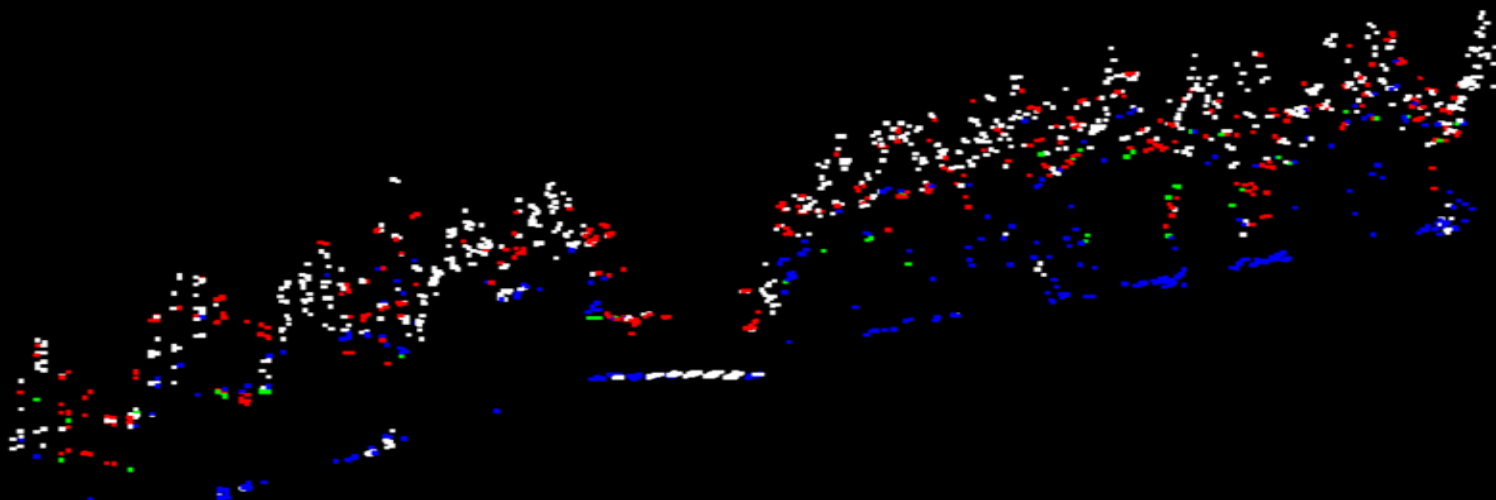
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Aerial LIDAR?

From our perspective, the jury is still out...

- clear benefit is seeing through 90%+ veg cover rather than 50% with photogrammetry
- very expensive (\$300-\$400k), so need high-utilization
- no question about distance accuracy measurement, but, with an airborne mount the lack of precision in positional and angular measurements means it is at best on par with photogrammetry
- cheaper LIDAR alternatives on the horizon, and also alternative technology which doesn't depend on precision positional+angular sensors



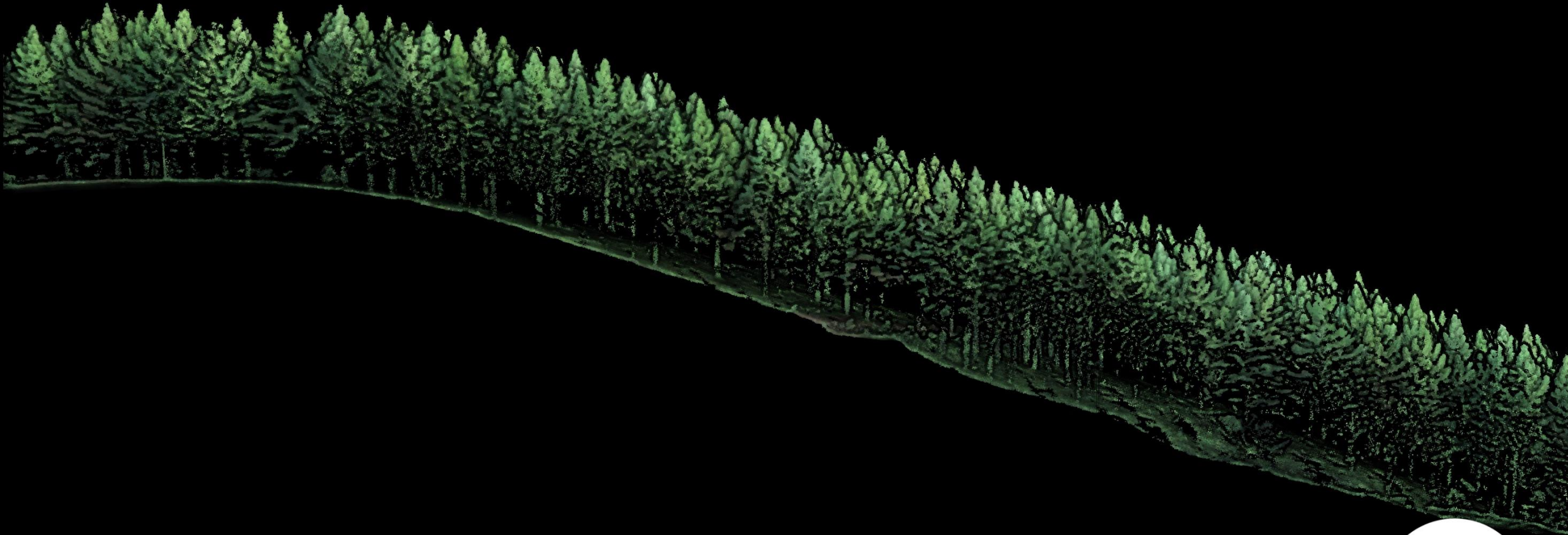


DJI L1 Sensor

- RGB camera
- Live point cloud feed
- Number of advantages over photogrammetry

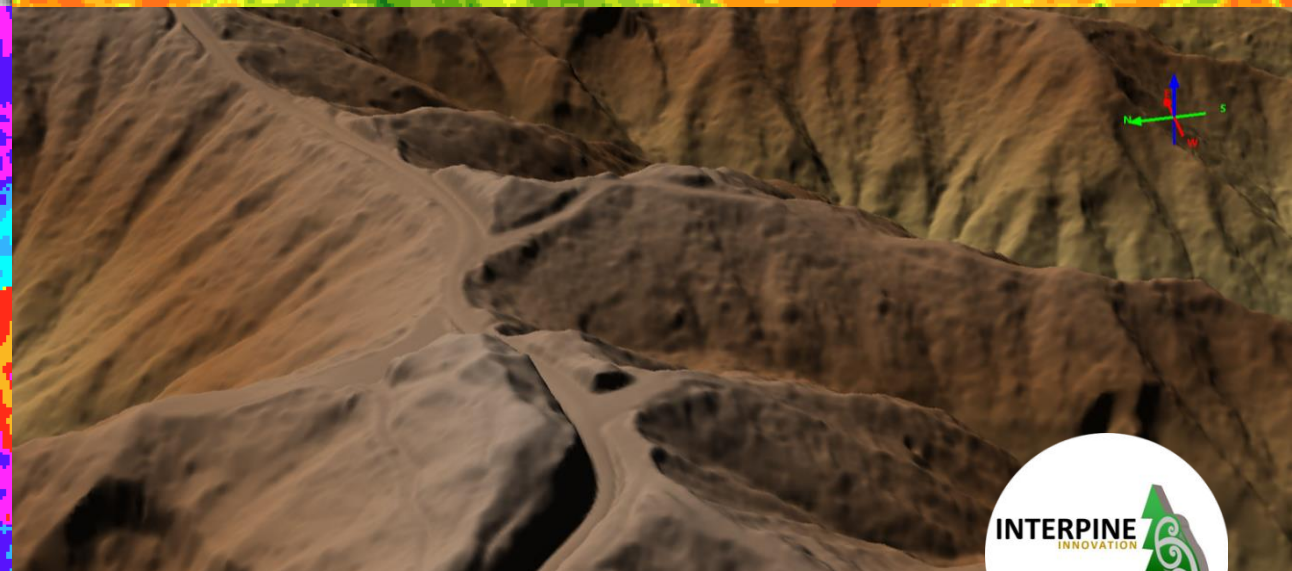
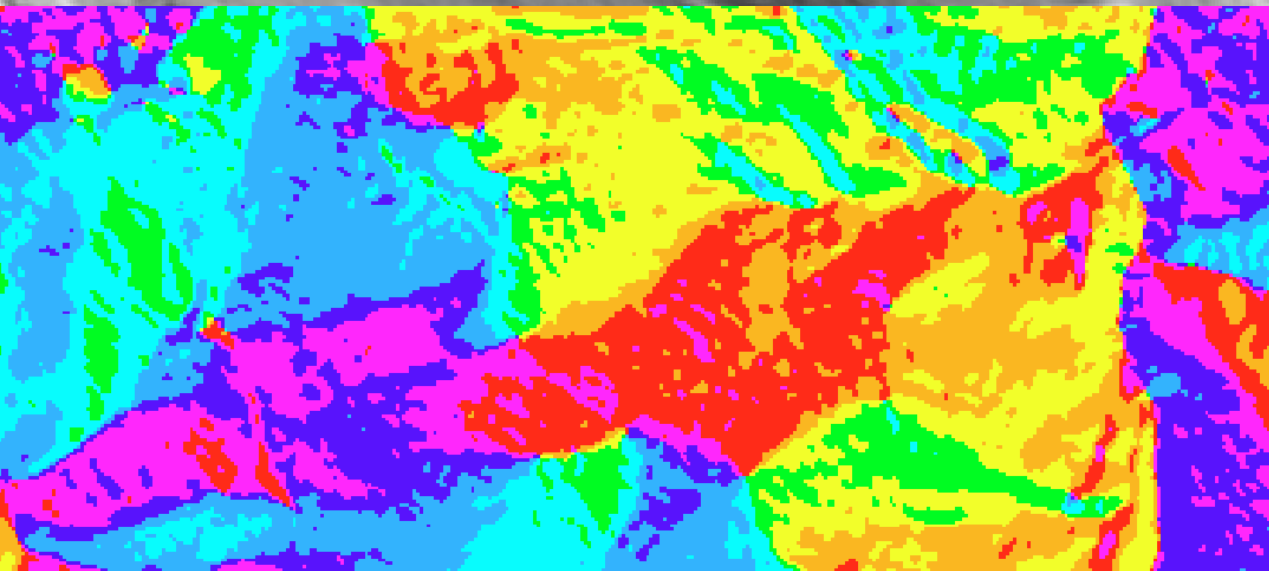
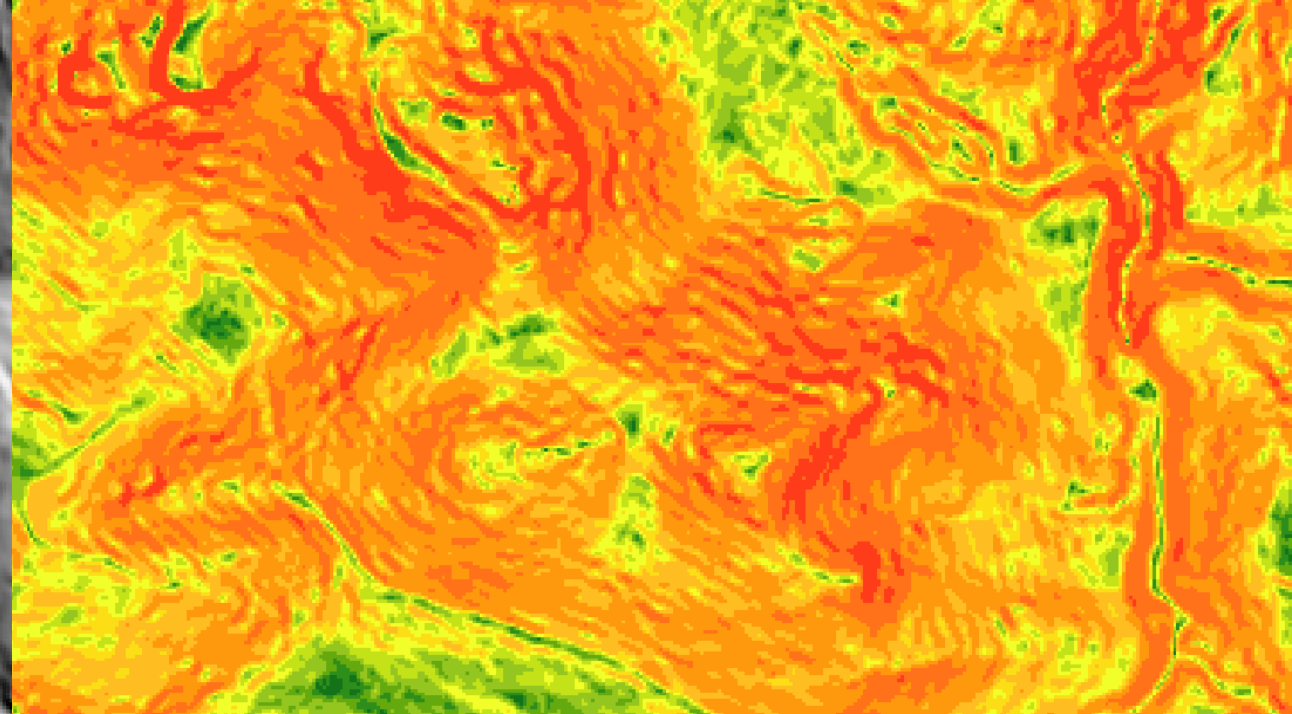
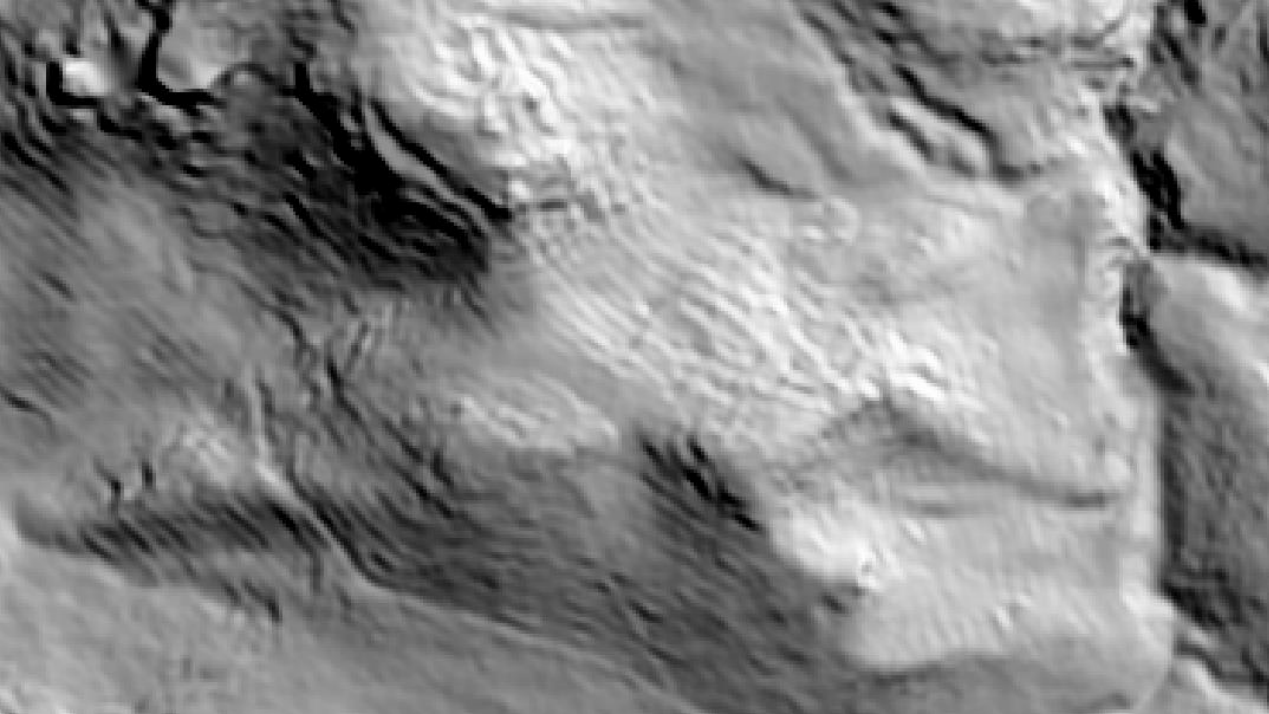






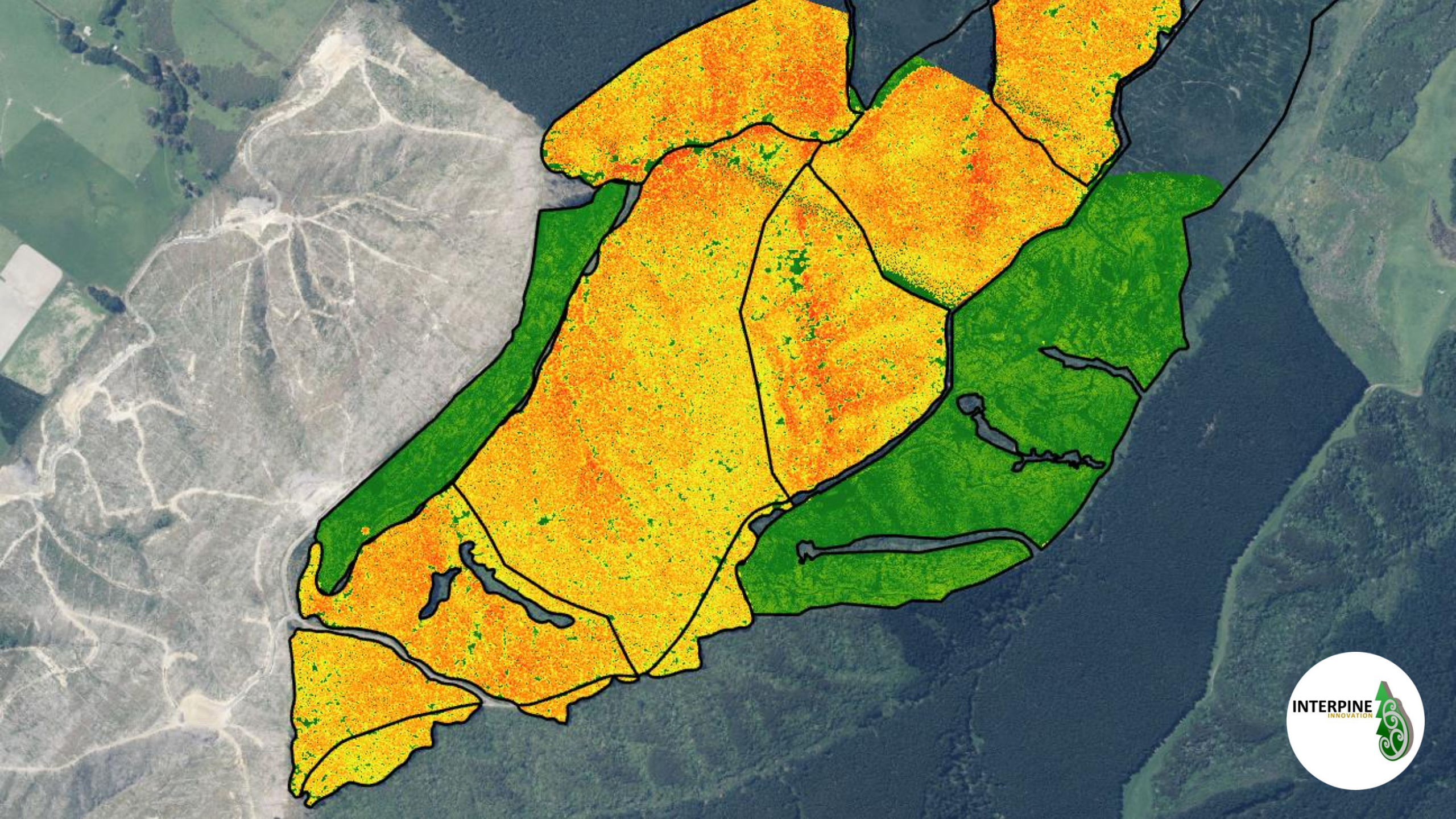


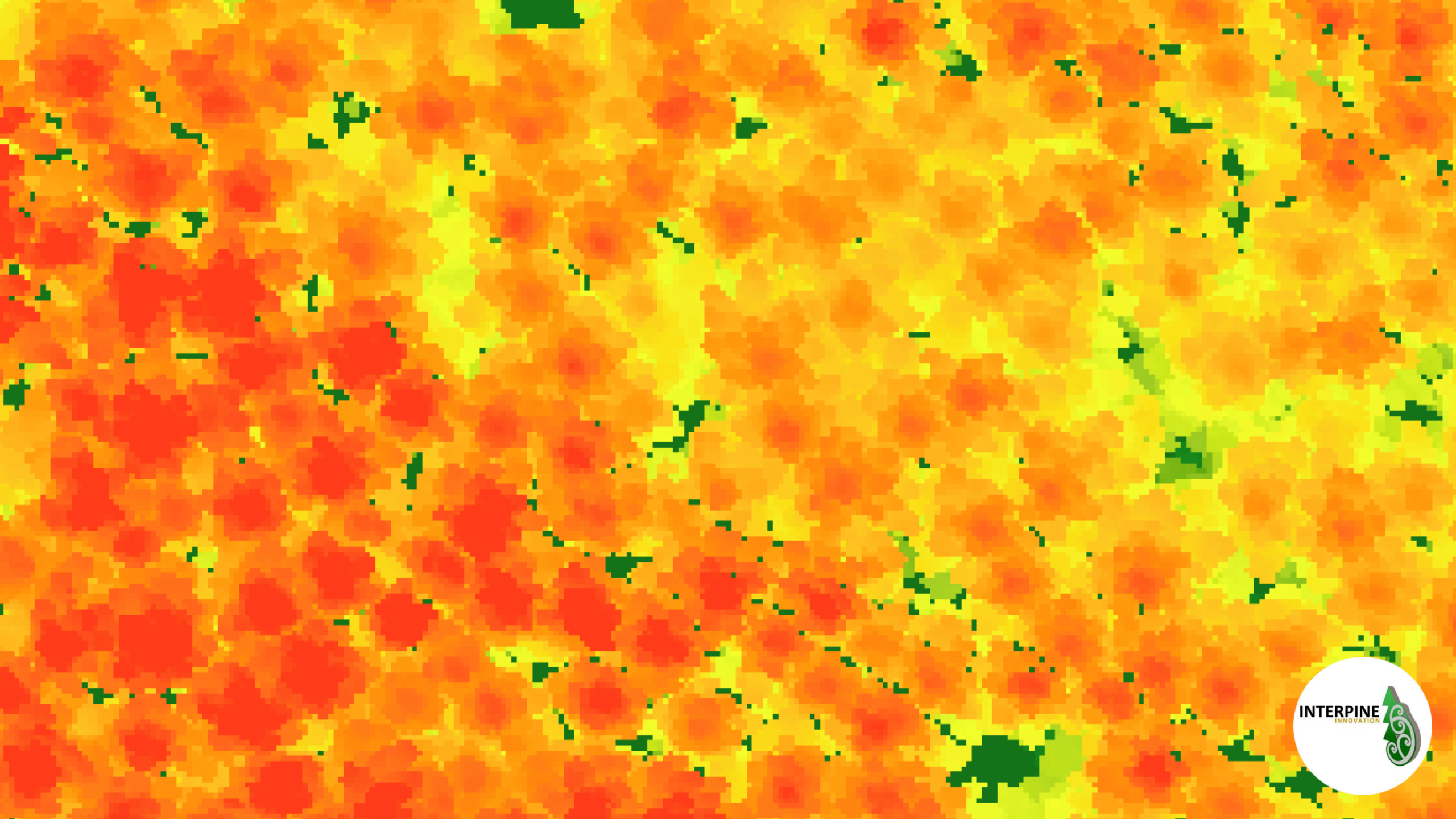


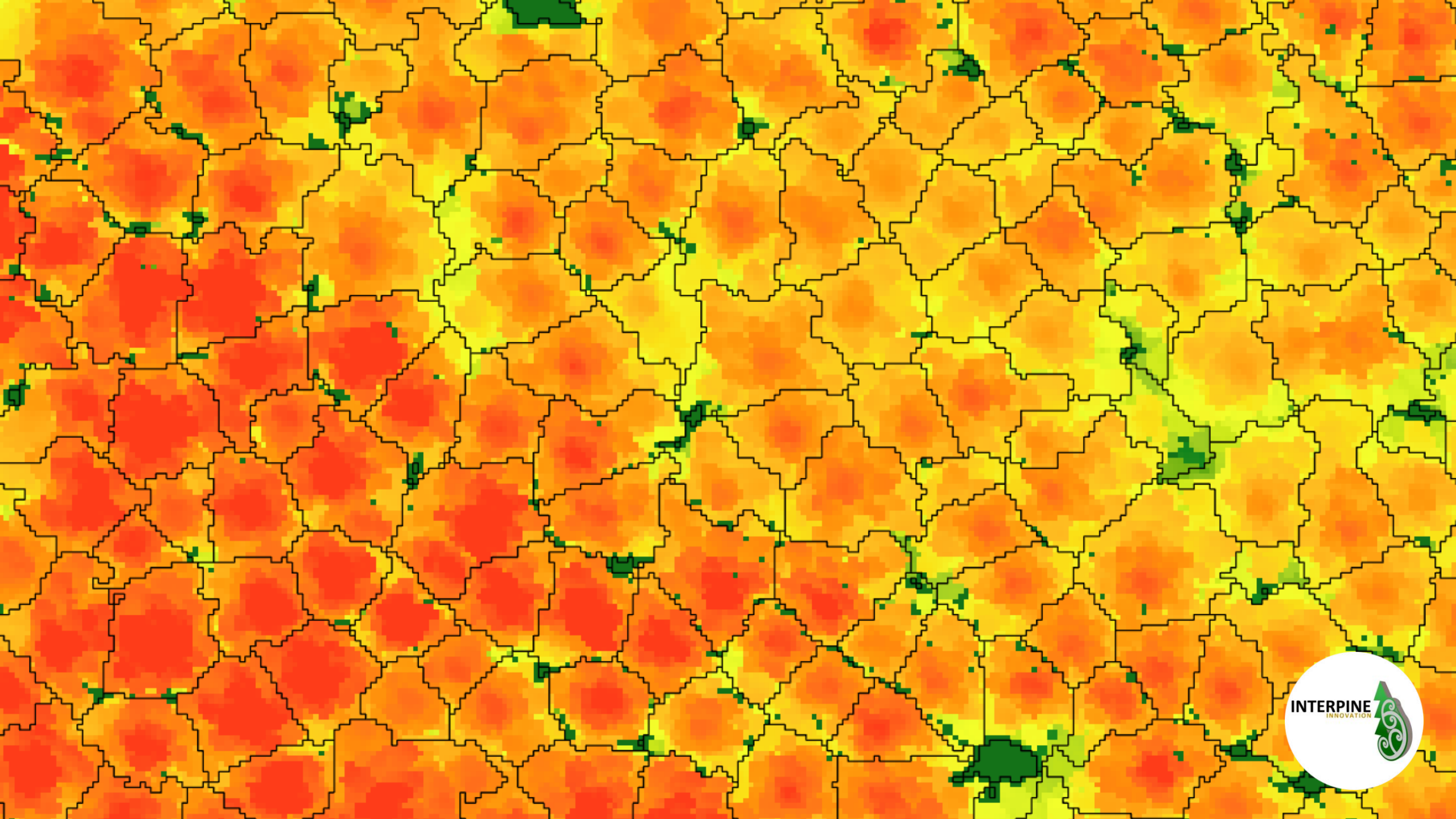


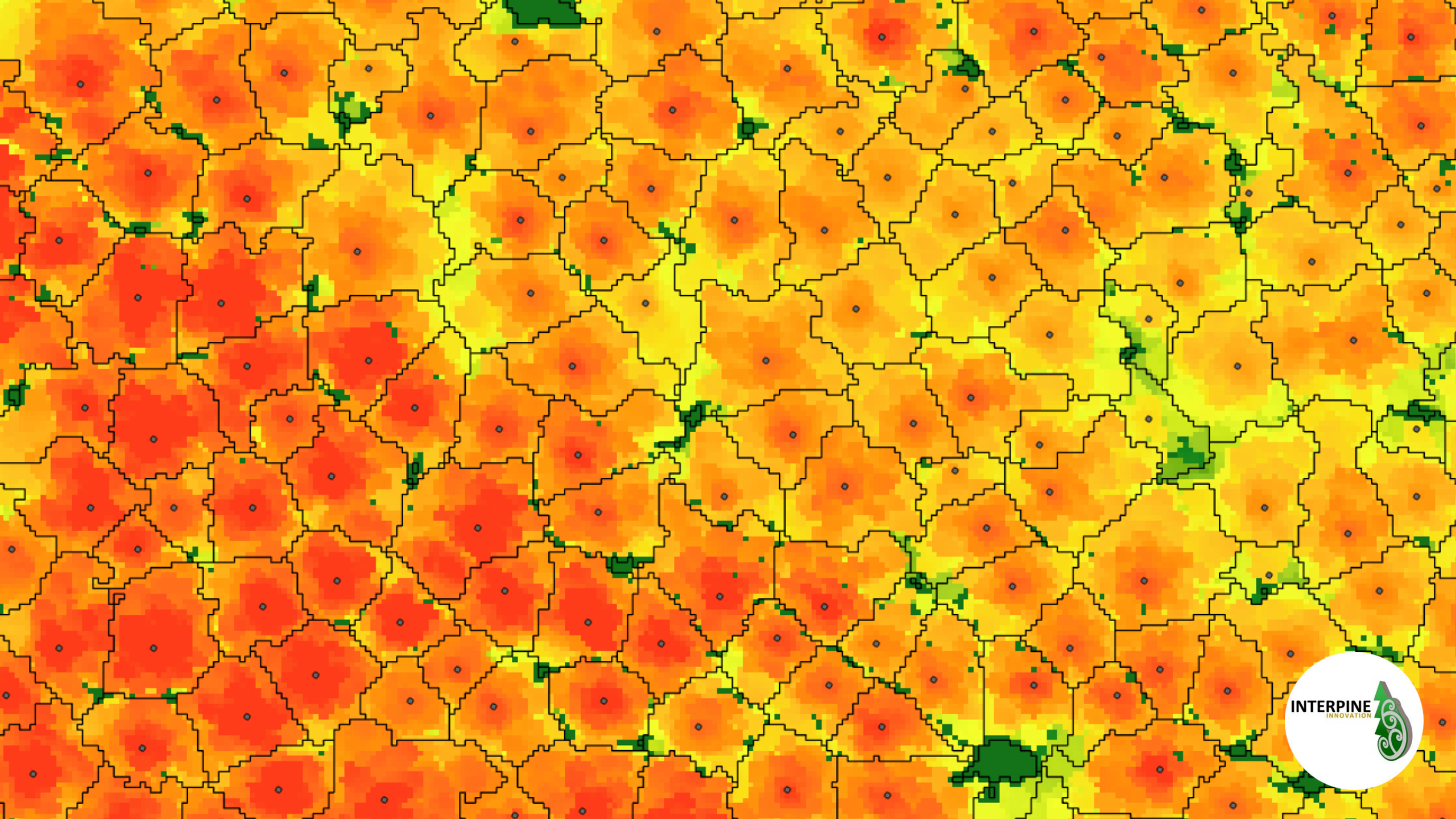
Outputs

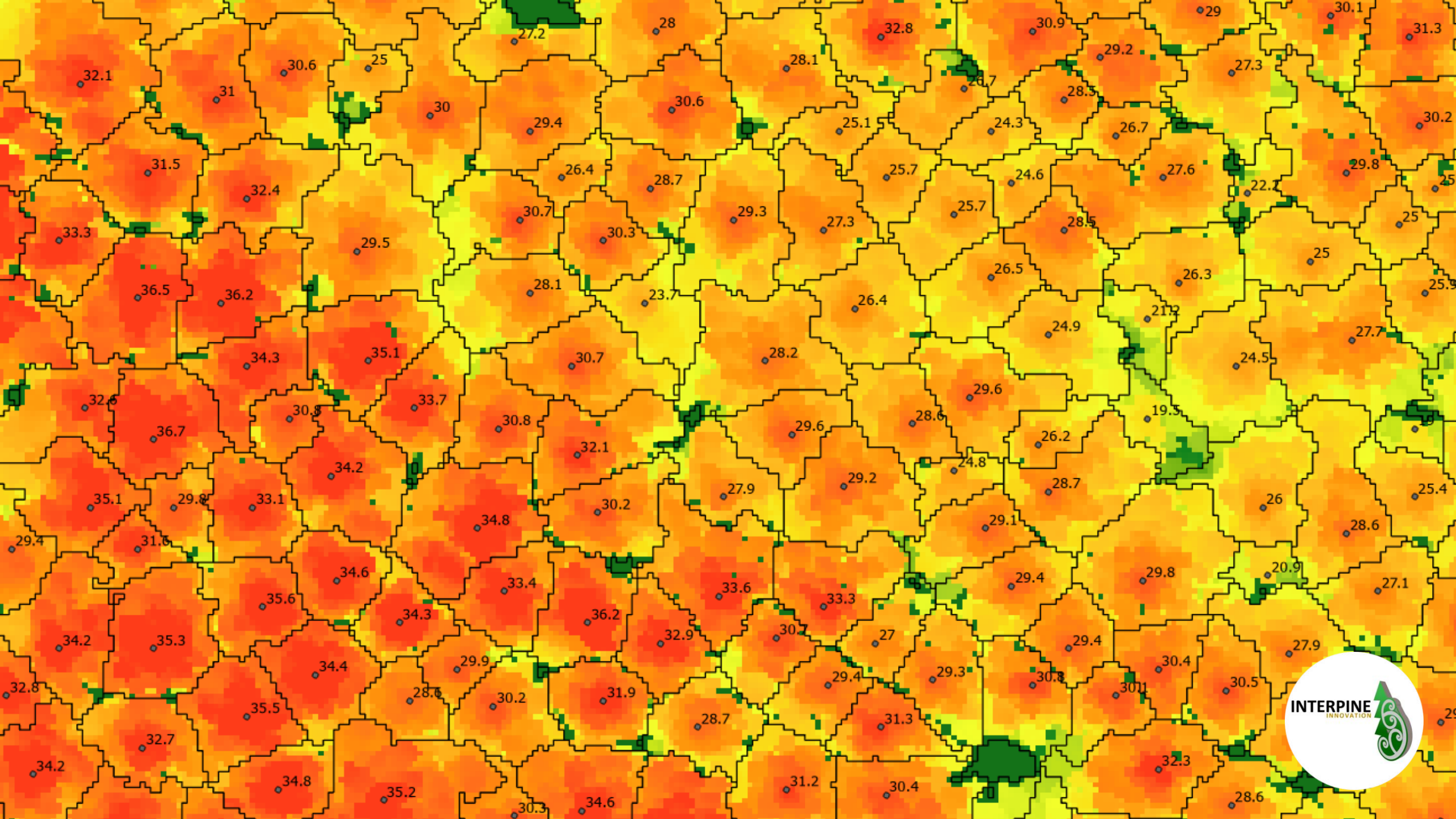


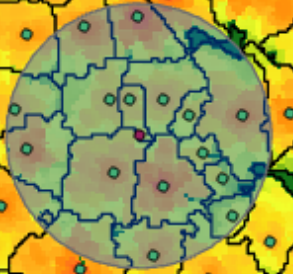
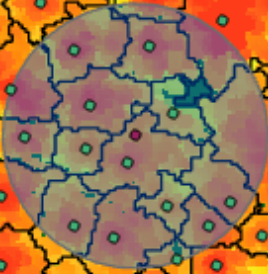
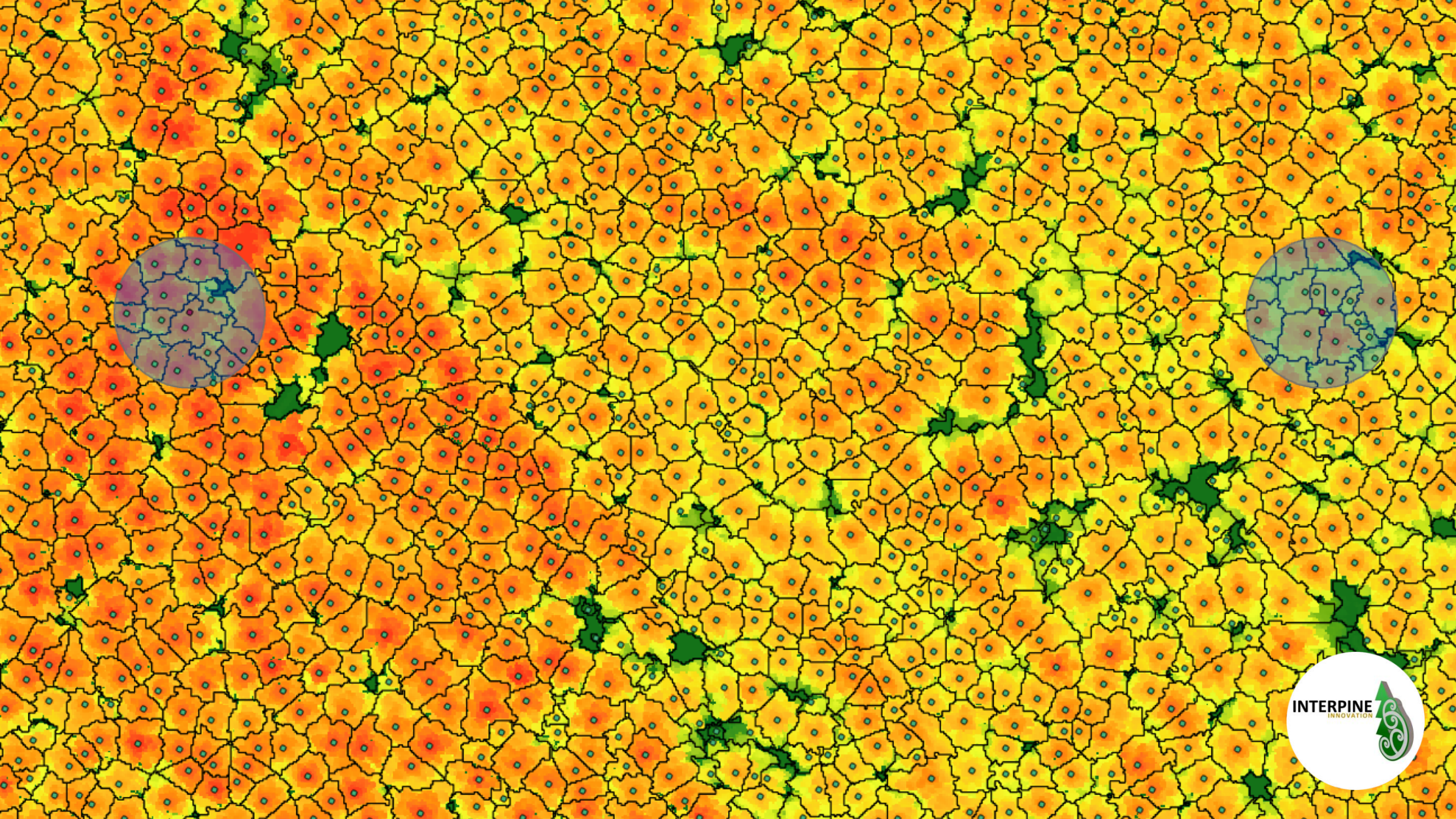




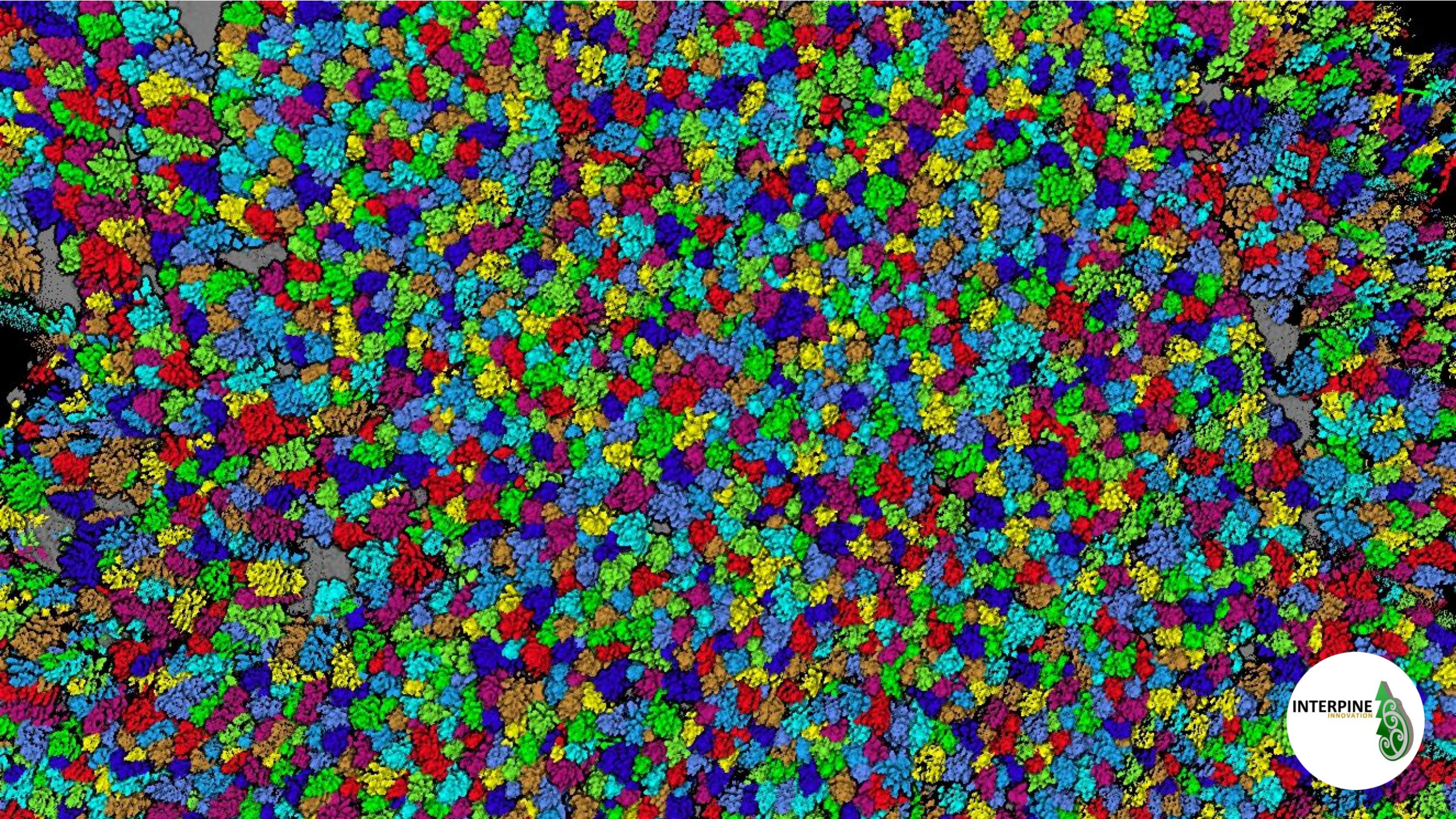


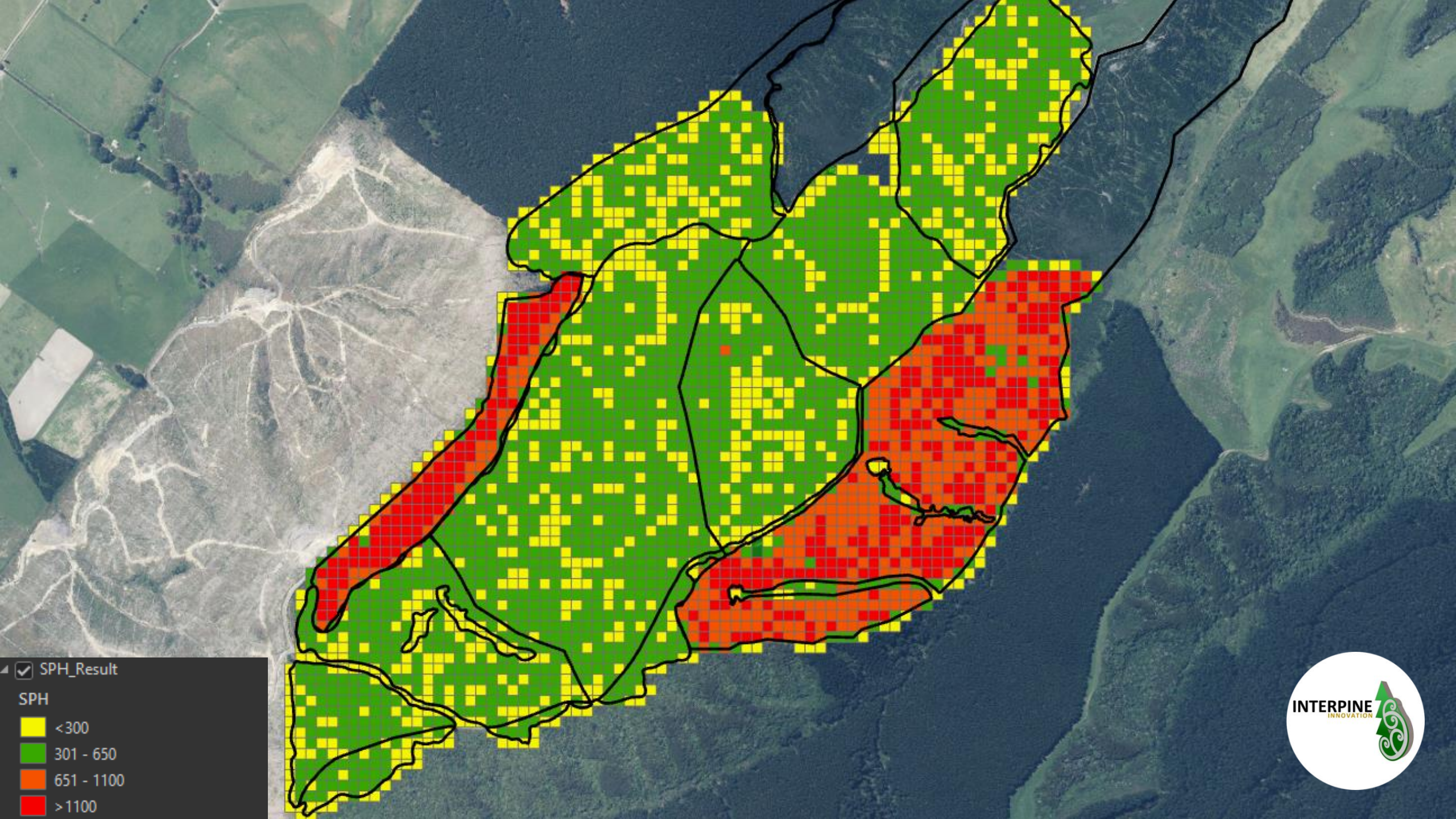












SPH_Result

SPH

- < 300
- 301 - 650
- 651 - 1100
- > 1100





Challenges & Limitations?

UAV Assisted Inventory – Techniques and Applicability

Advantages

- Full stand measure rather than sampling, improved accuracy
- Mapping of individual tree locations, accurate stocking and distribution
- Reduced plotting effort

Disadvantages

- Scale
- Additional complexity, data management
- Hardware/software entry barrier

UAV sensing techniques

Photogrammetry

- UAVs now standard equipment
- Processing software required to stitch images to produce orthophoto
- Processing software also produces point cloud – Structure from motion (SfM)

LiDAR

- Much higher cost entry barrier
- Steep learning curve
- Very rich point cloud compared to ALS
- Suitable for deep canopy, mature stands

Inventories where UAVs might assist

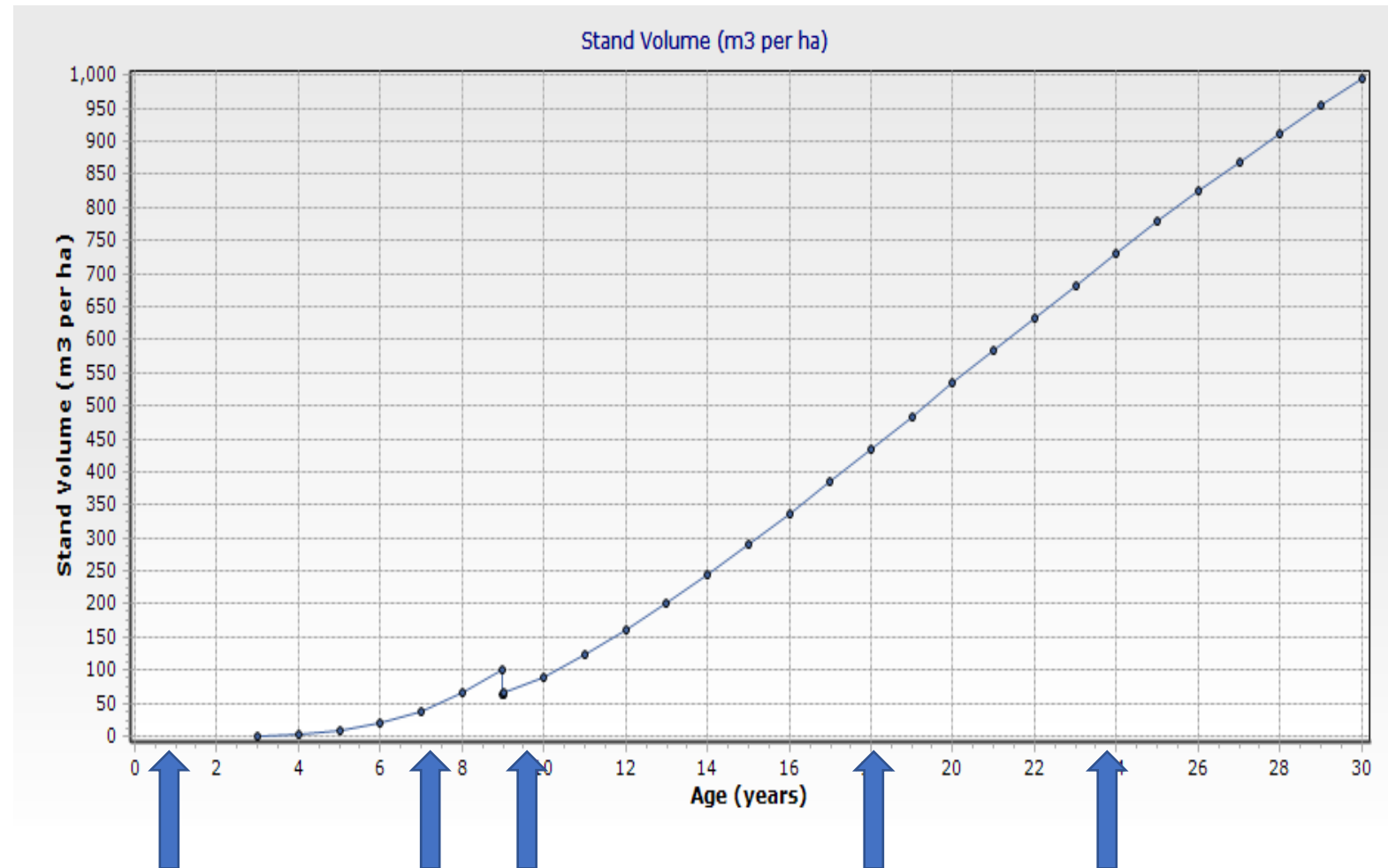
Survival/Mortality survey (9 months)
Orthophoto/ deep learning tree detection

Silvi scheduling? LiDAR, CHM

Silvi QC (after thinning, 9-12 years)

Photogrammetry, SfM, point cloud analysis

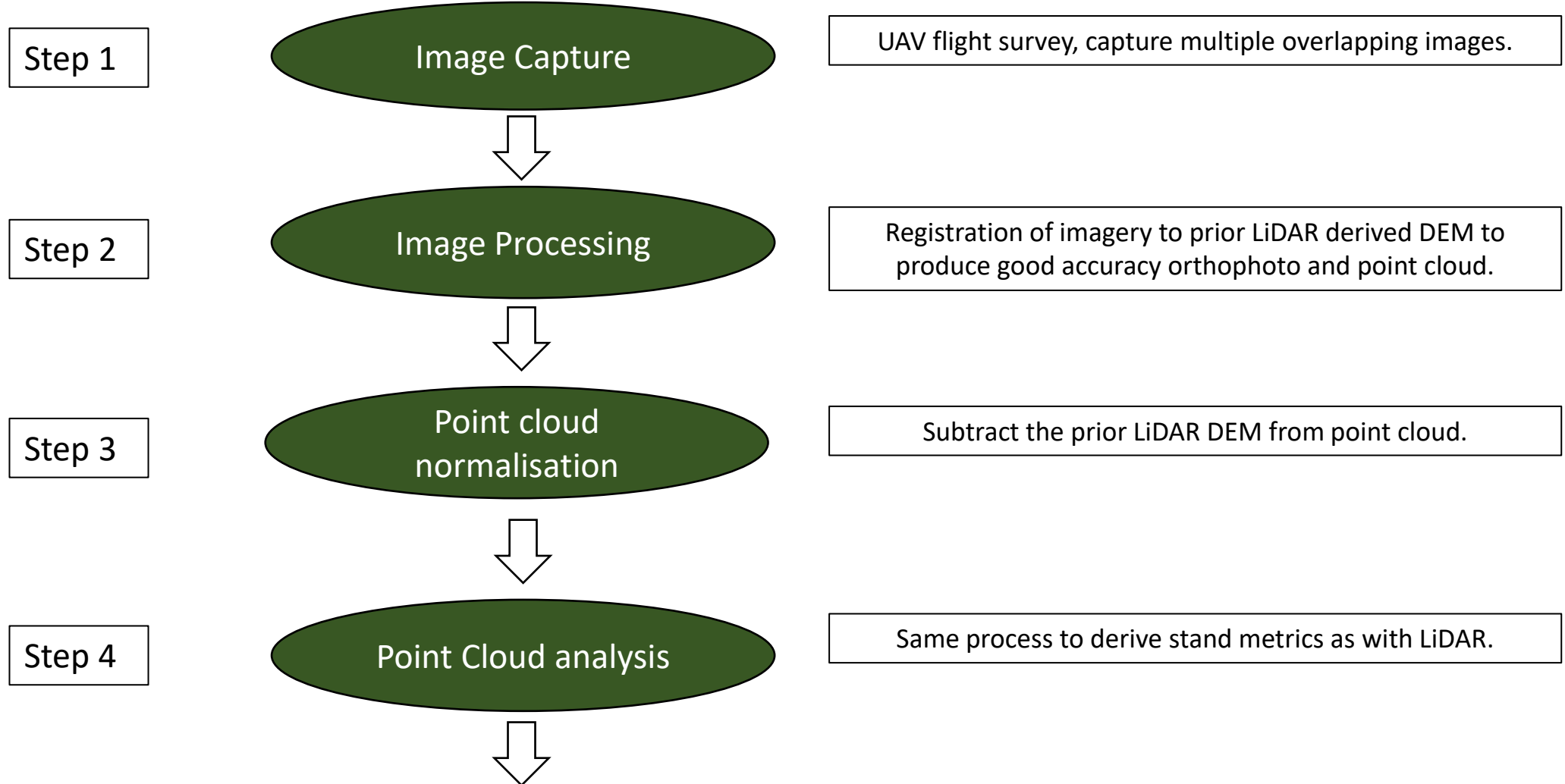
Mid rotation, Pre harvest inventory
(18,24 years) LiDAR point cloud analysis



Post Silvi QC Photogrammetry

- Flight/Image capture considerations
- Lighting, sun angle, altitude, forward/side overlap, flight speed, image blur, terrain awareness etc
- Prior LiDAR derived DEM availability
- Registration of images to ALS LiDAR survey imagery
- Point cloud DEM derivation, check against LiDAR DEM

Photogrammetric (SfM) Process



Photogrammetric (SfM) Process

