

# Fine-scale prediction of yield in sugarcane: A comparison of UAV-derived LiDAR scans and multispectral imagery

AGRICULTURE AND FOOD  
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Yuri Shendryk | Drone & Satellite Workshop | 20 September 2019



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 Yuri Shendryk

 @YuriShendryk

 @yurithefury



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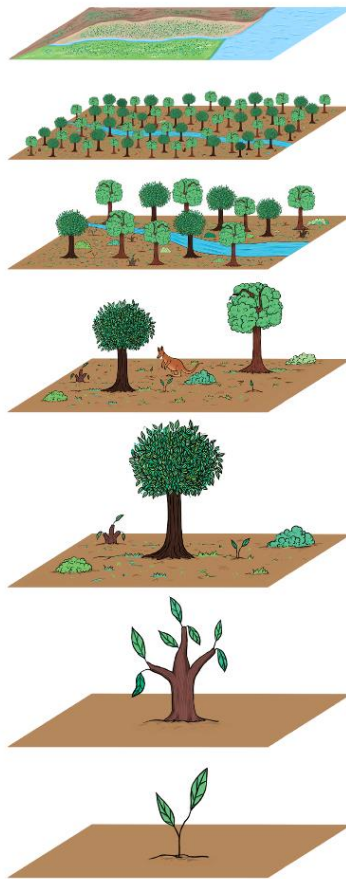


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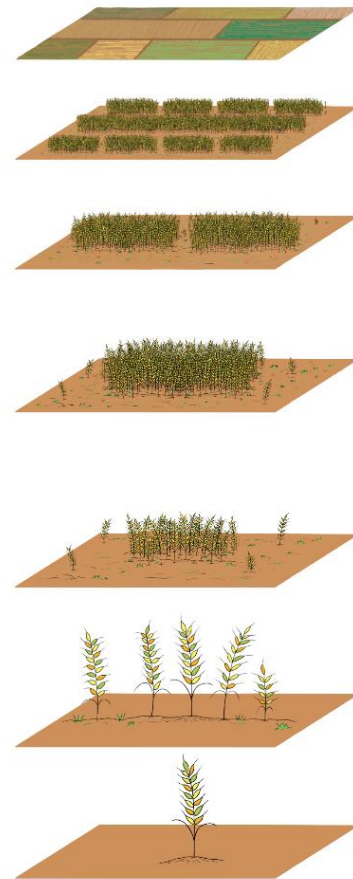


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## FOREST

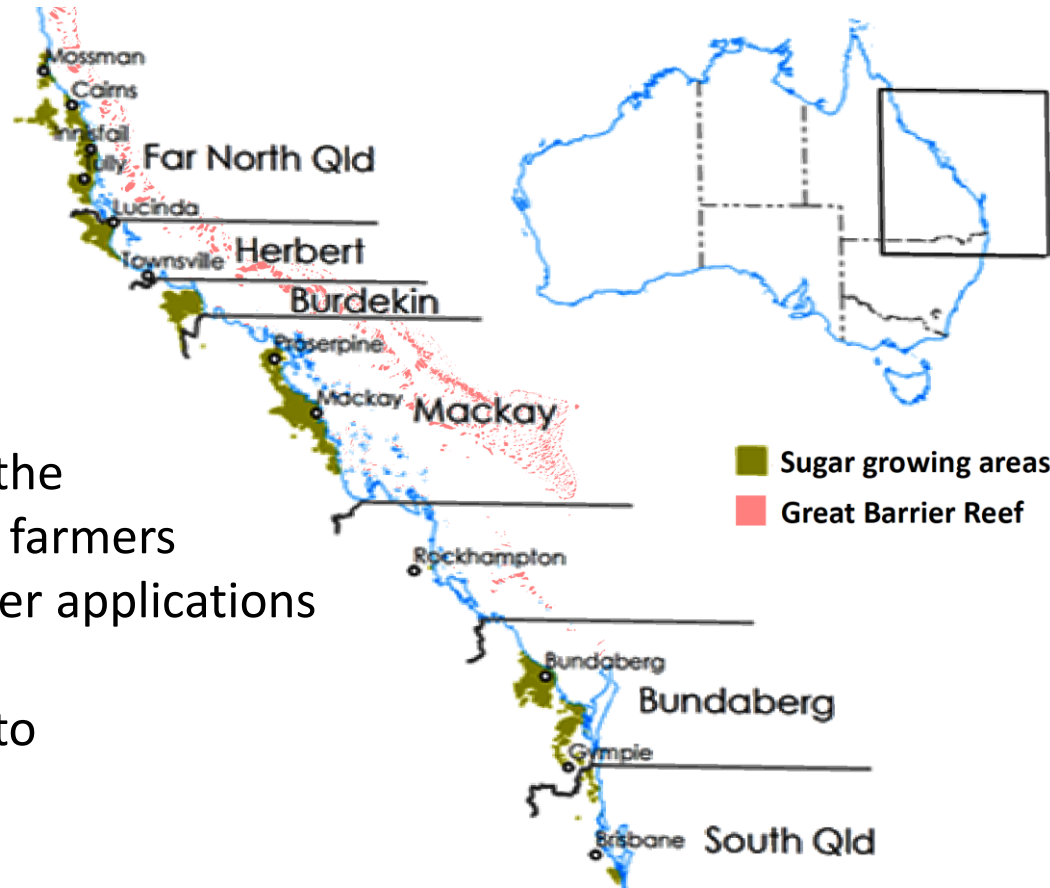


## AGRICULTURE



# Threats to the Reef

1. Great Barrier Reef is affected by agricultural pollutants due to overfertilization
2. Provision of timely information on the condition of the crop will help cane farmers make better decisions about fertiliser applications
3. Remote sensing is a promising tool to provide such information



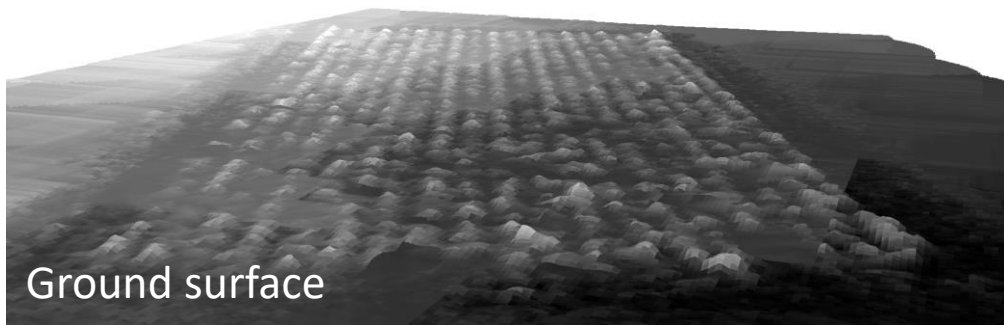
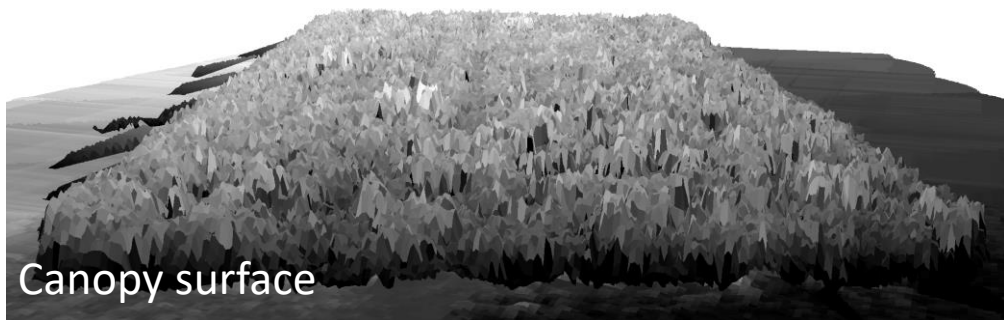
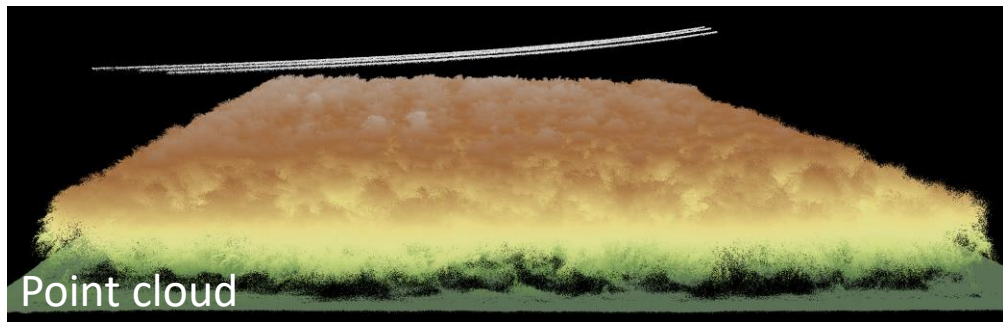
# UAV system

- **dji** Matrice 600 Pro
- **MicaSense** RedEdge/Altum
- **emesent** Hovermap



# Hovermap LiDAR

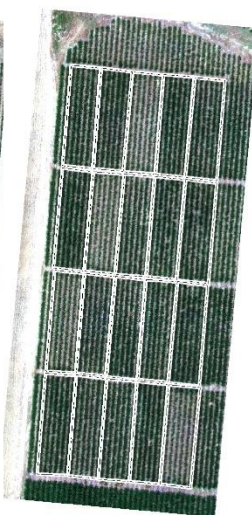
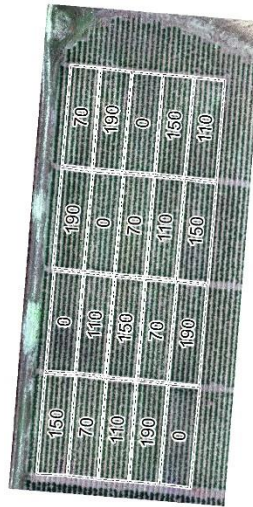
(<https://emesent.io/>)



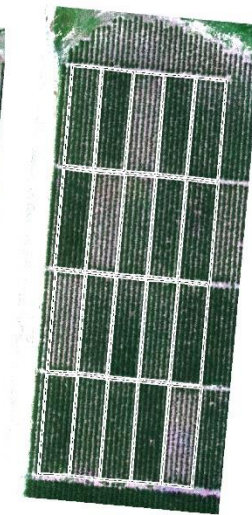
# Nitrogen Trials

- Four nitrogen (N) trials
- UAV survey every 6 weeks:

- LiDAR scans
- Multispectral imagery
- **Leaf N content**
- Stalk/leaf biomass (at harvest)



20 December 2017



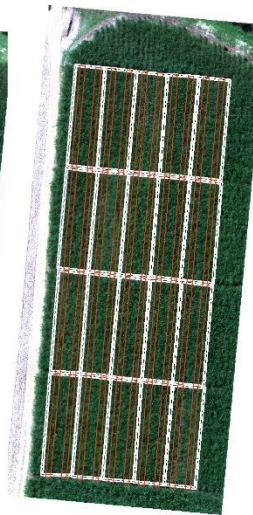
31 January 2018



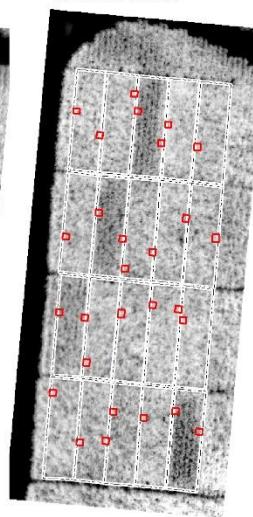
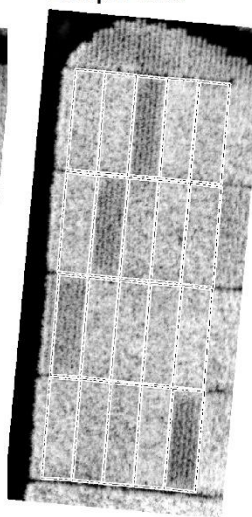
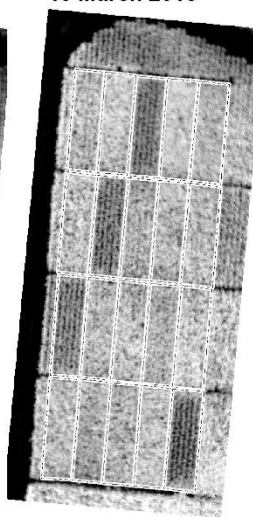
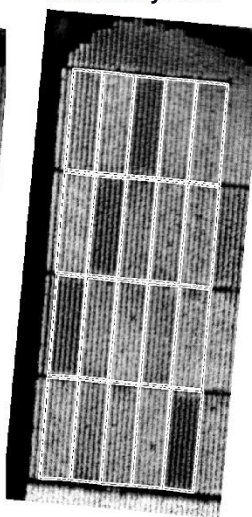
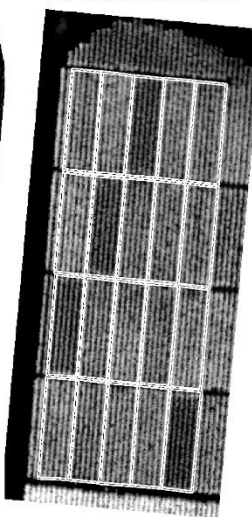
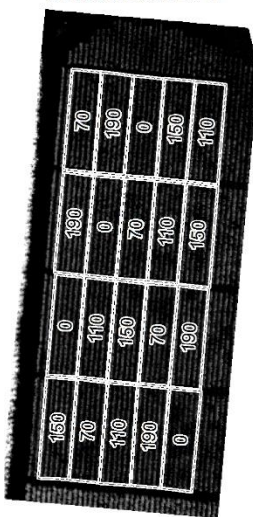
15 March 2018



26 April 2018



6 June 2018



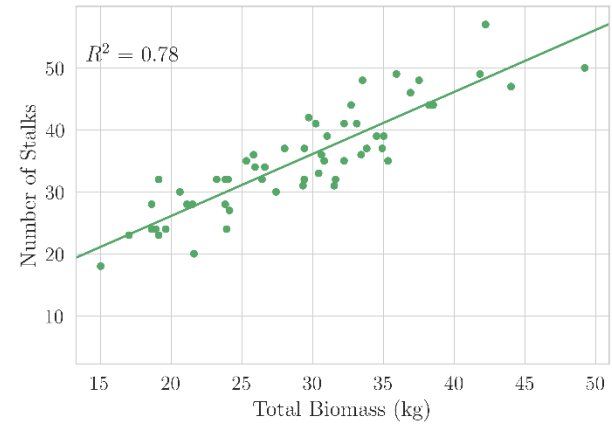
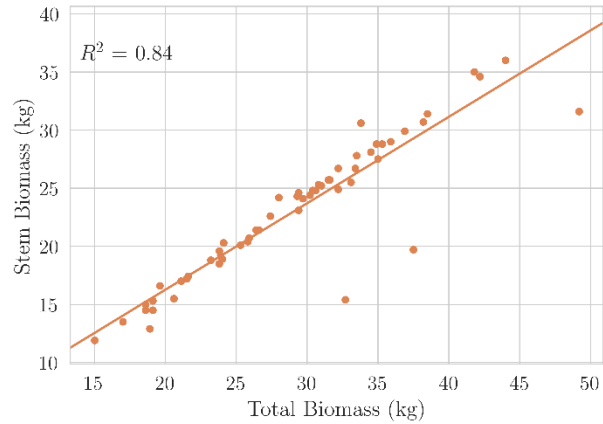
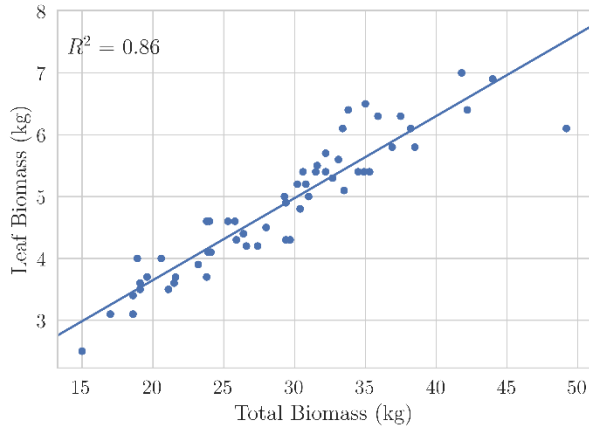
# Yield prediction

## Pre-harvest biomass:

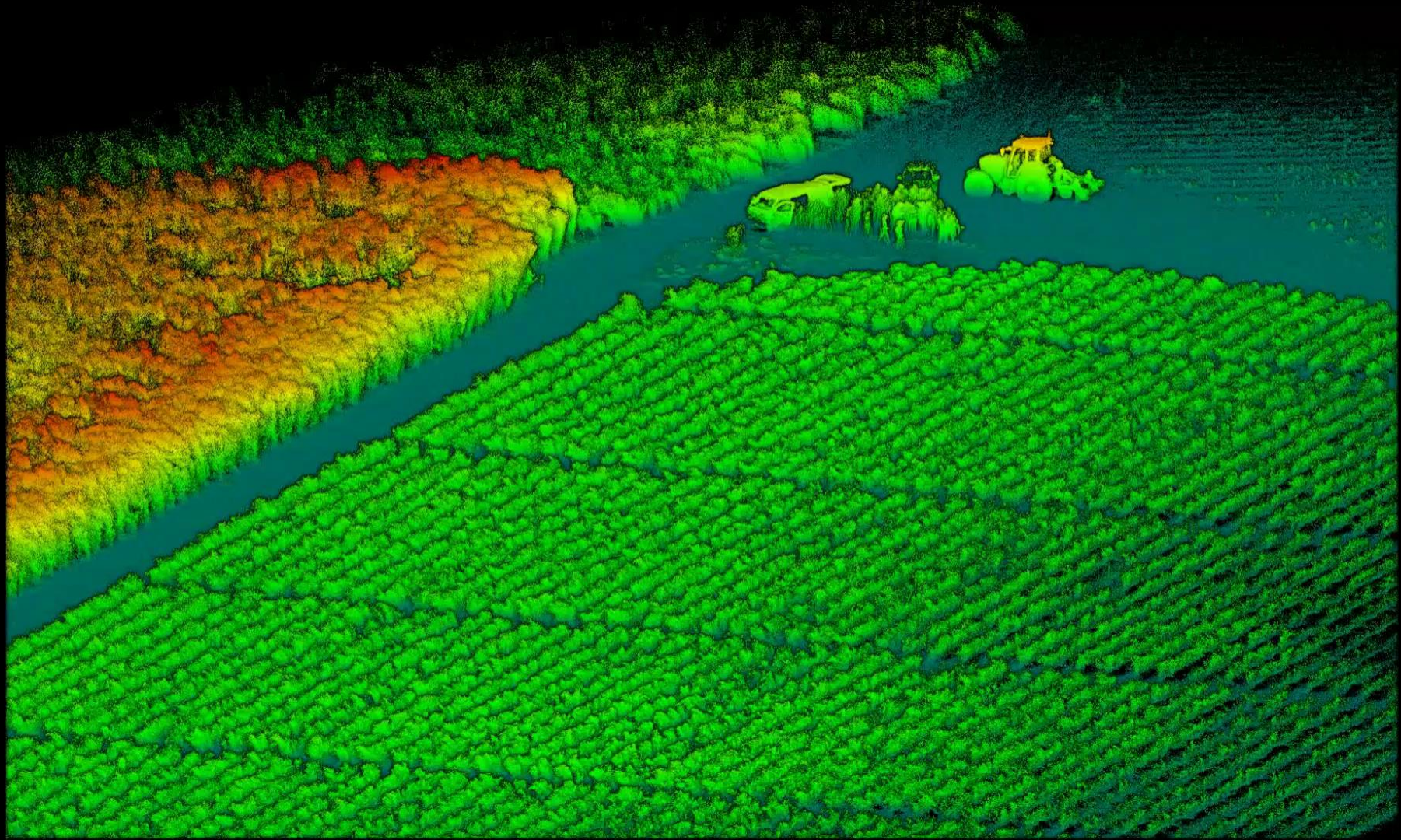
- Total
- Leaf
- Stalk (i.e. yield)
- Number of stalks



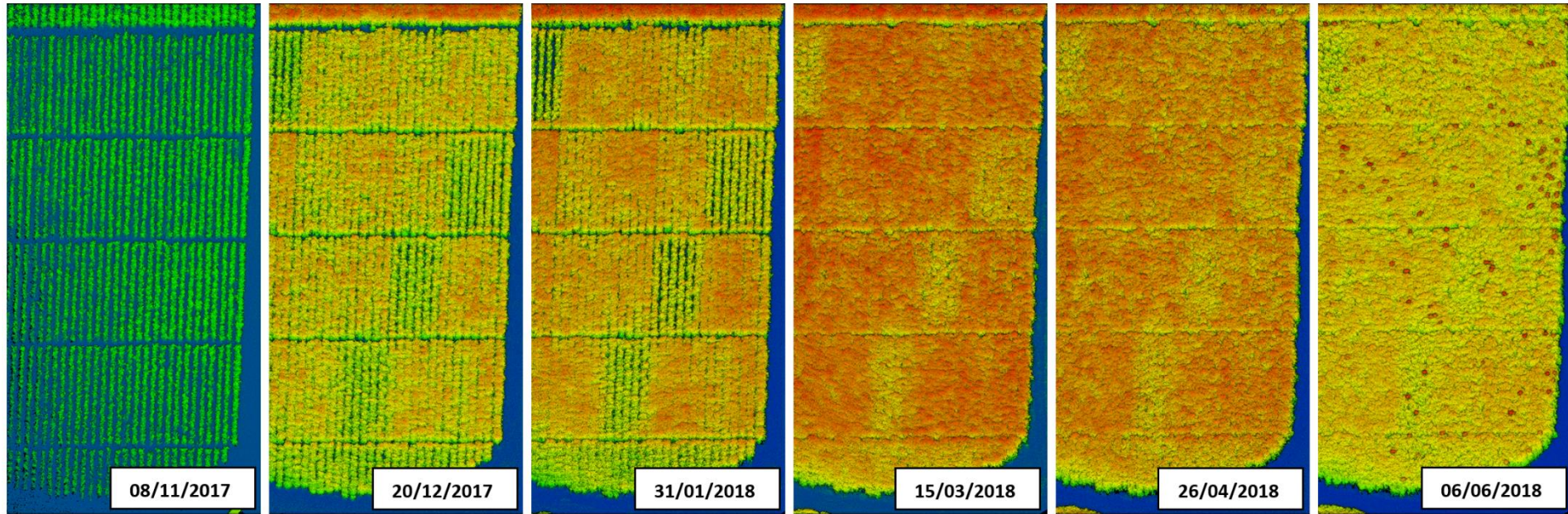
# Biomass types



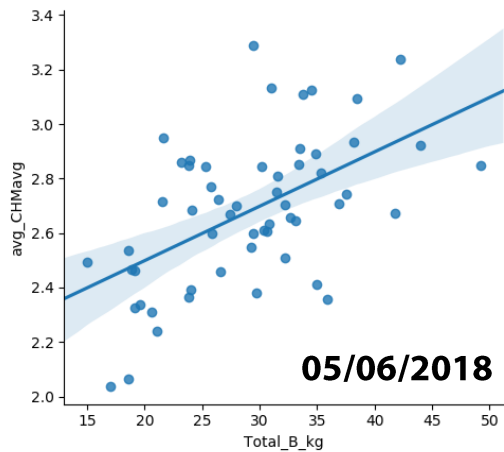
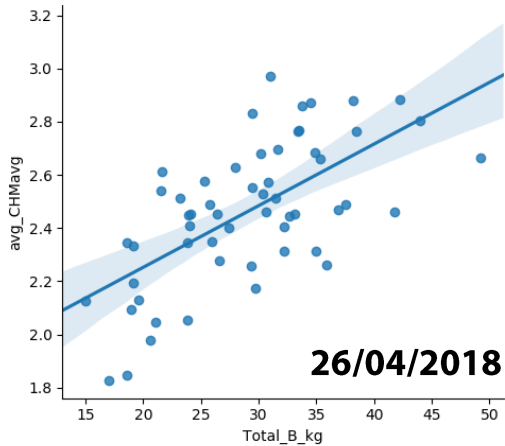
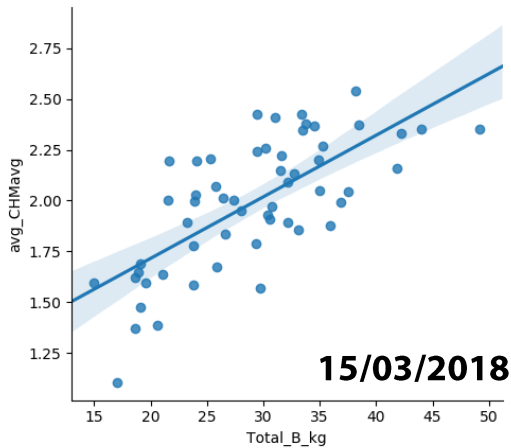
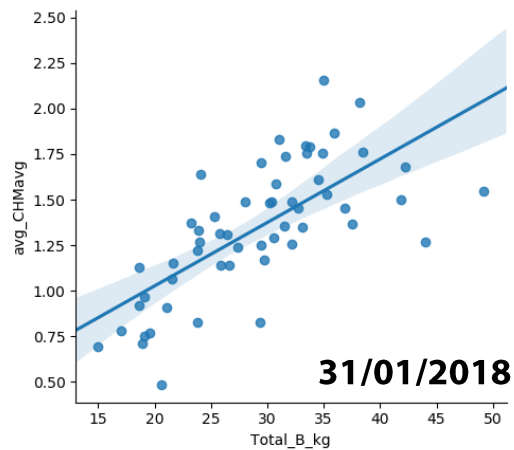
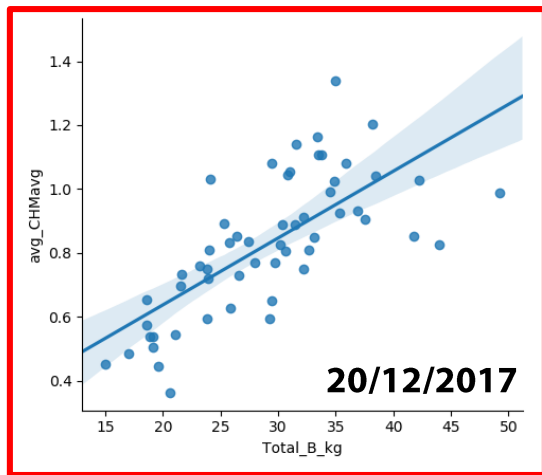
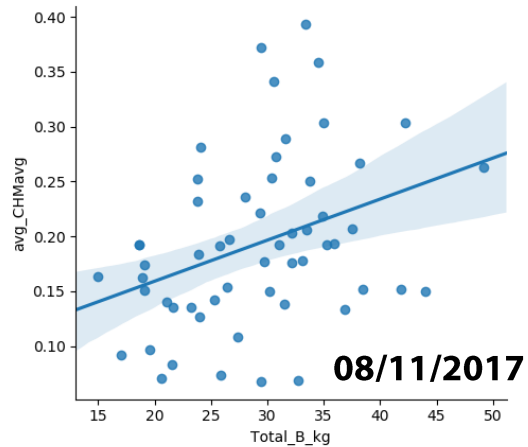




# LiDAR time-series

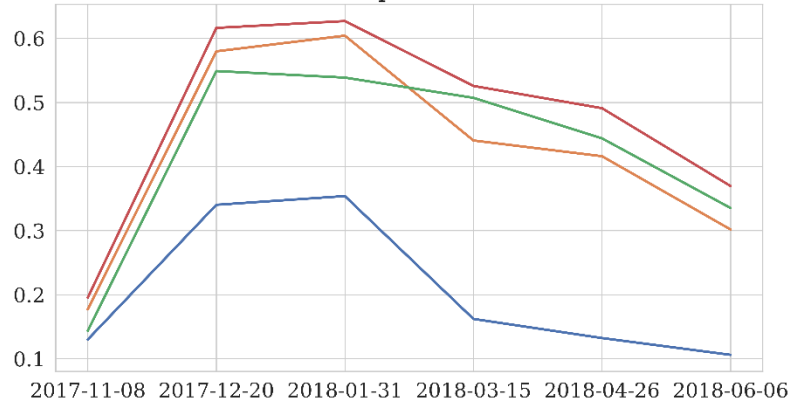


# Average height vs Biomass

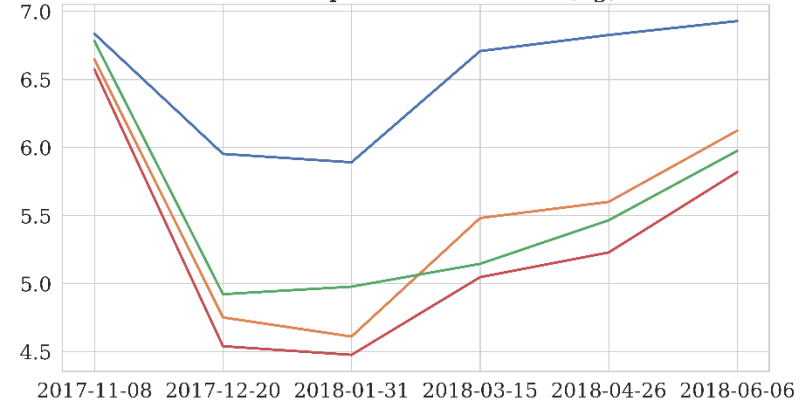


# Yield predictions

Biomass prediction:  $R^2$



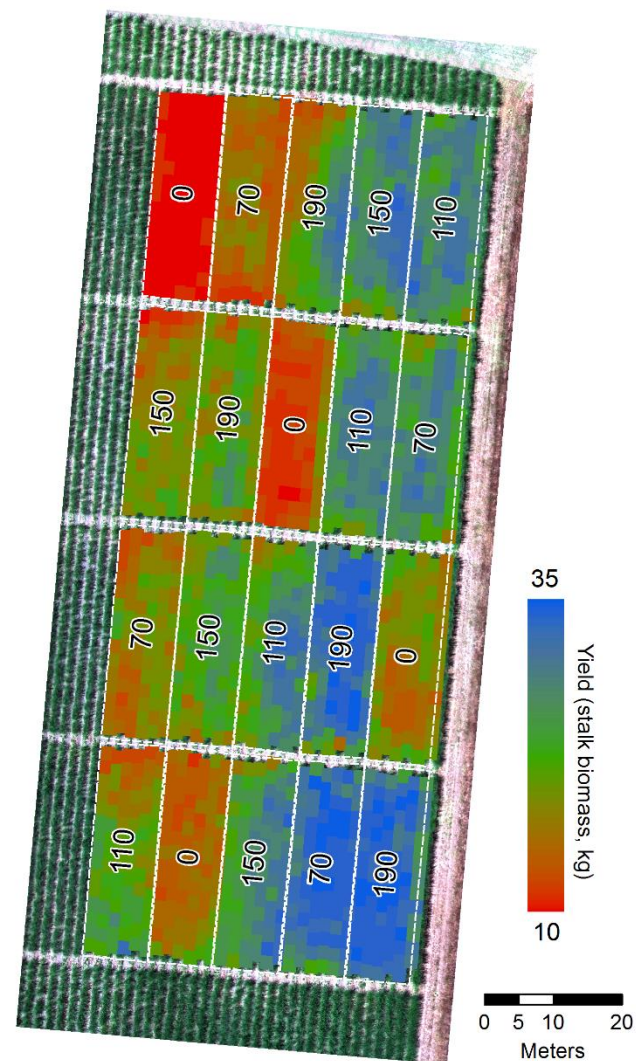
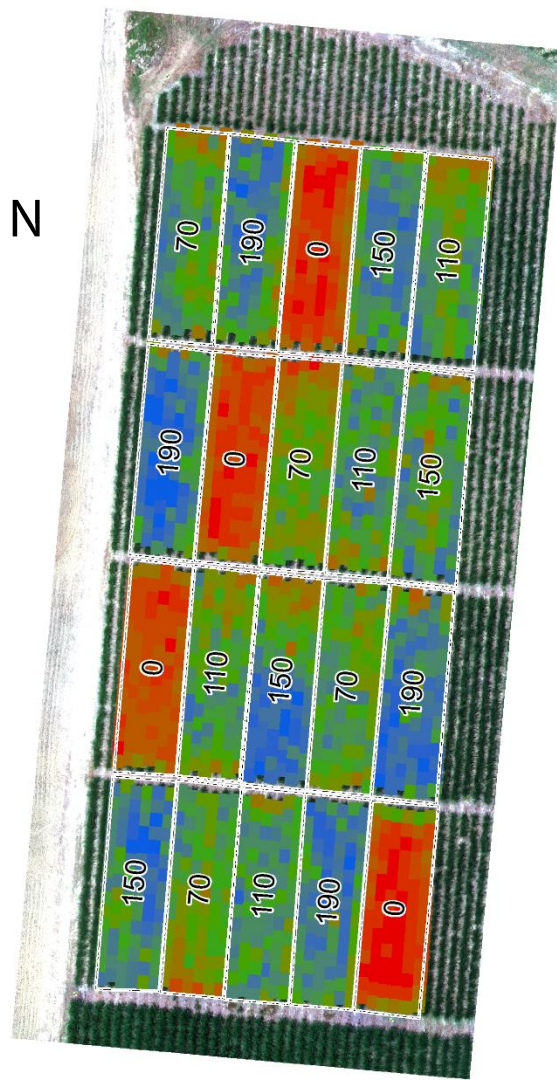
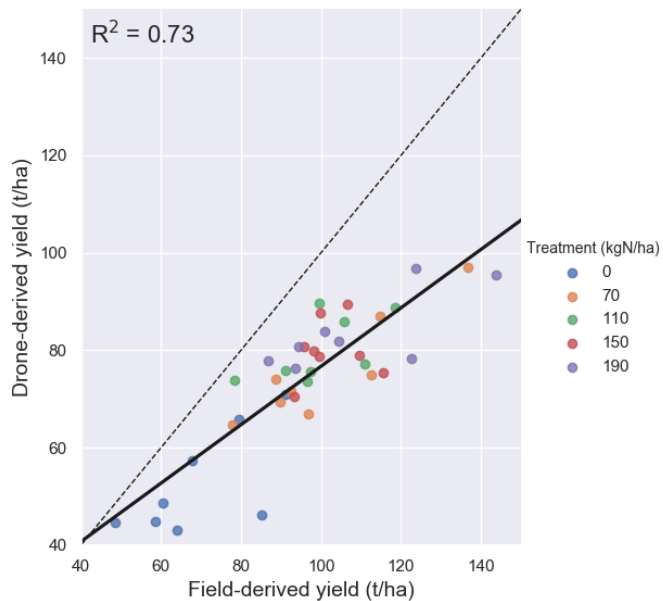
Biomass prediction: RMSE (kg)



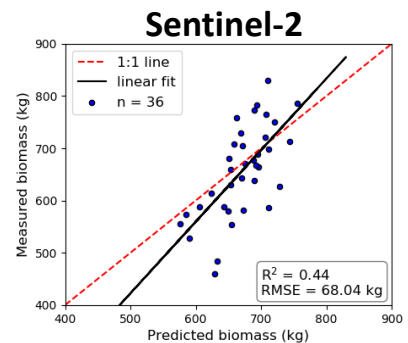
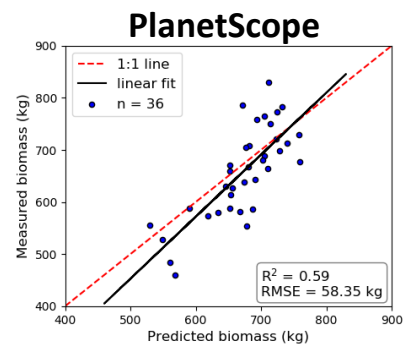
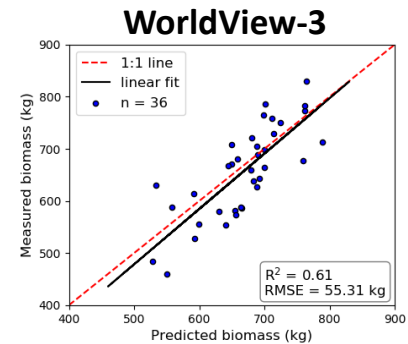
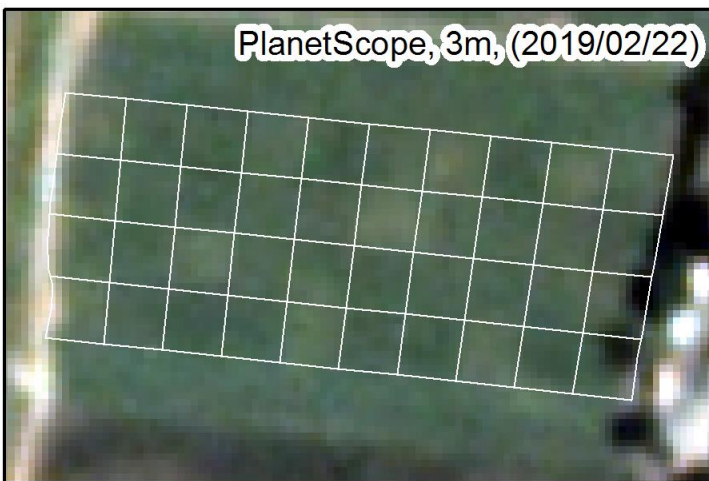
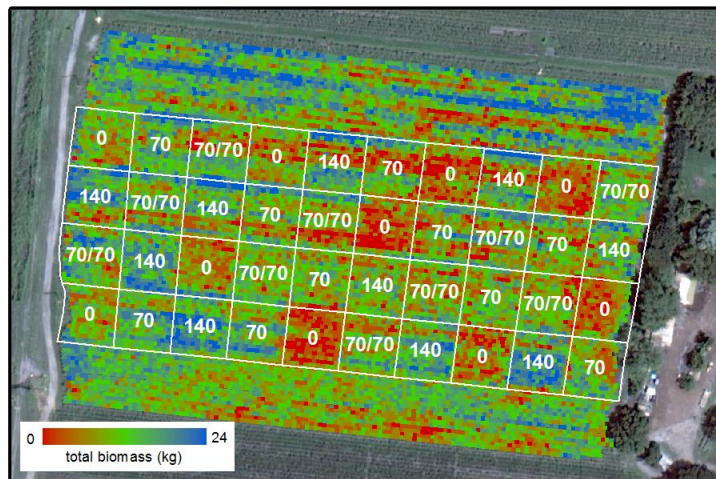
- NDVI alone is not enough
- LiDAR = multispectral
- Reliable predictions at 10 weeks from planting

# Yield predictions

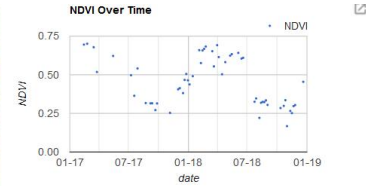
- Correspondence between N application rate and yield
- Yield over- or under-estimation?



# Upscaling yield



# Web-application



## Growing Season Comparison

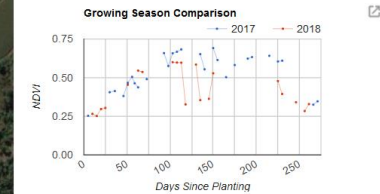
Add New Season

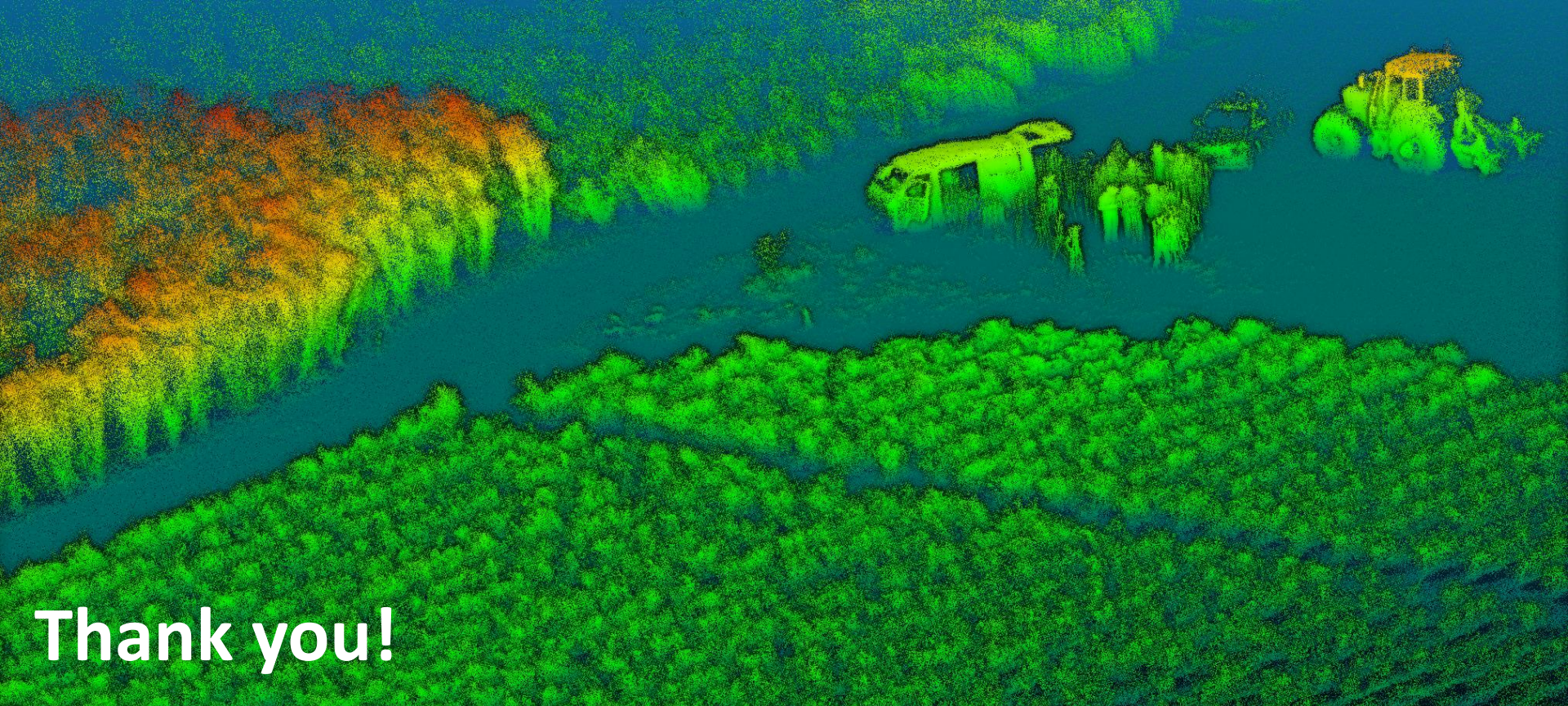
2018-11-01 2019-08-01 Add Season

2017-11-01 -> 2018-08-01 Remove

2018-11-01 -> 2019-08-01 Remove

Create/Update Comparison Chart





# Thank you!

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