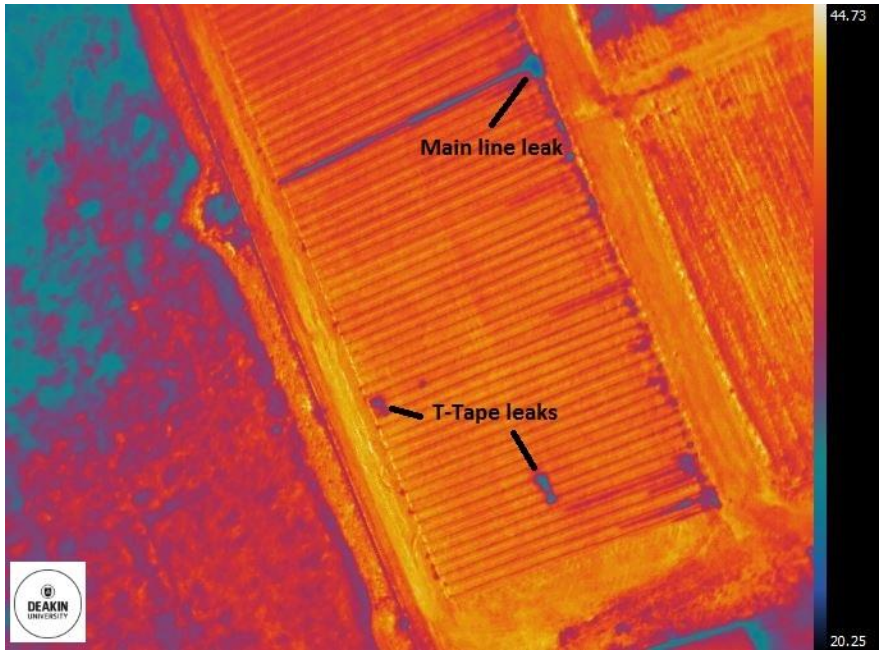

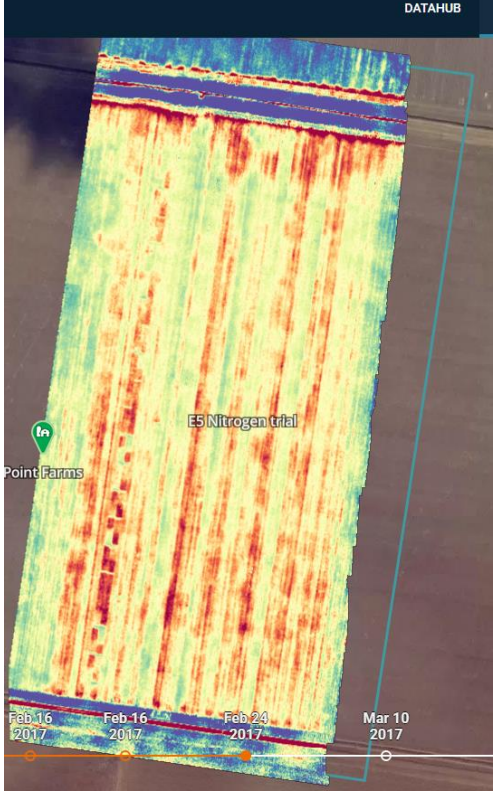

Use of drones for water and nitrogen management

John Hornbuckle, James Brinkhoff, Carlos Ballester, Oliver Delves

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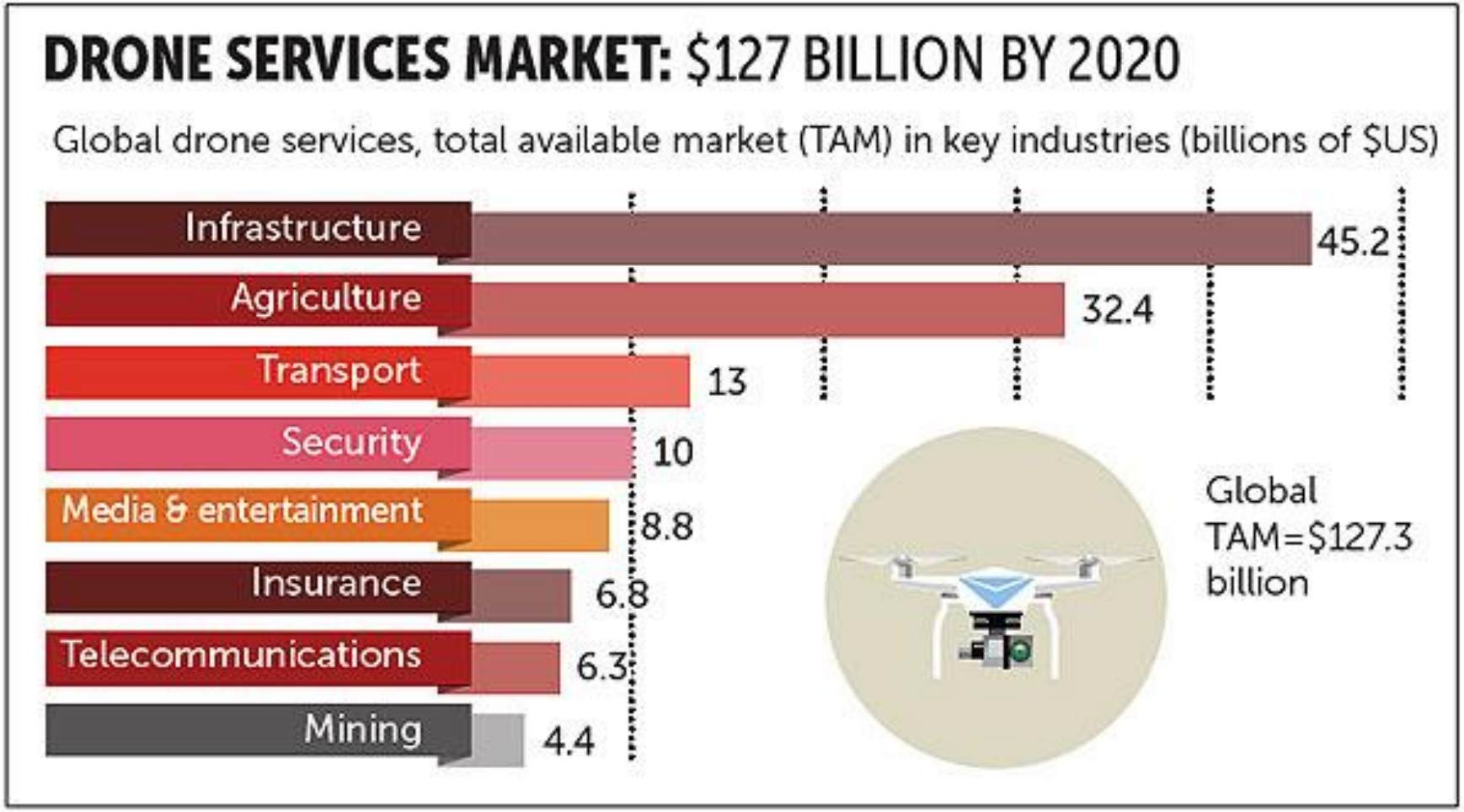
CONTENTS

- Background on drones/sensors
- Using drones
- Using drone data to make decisions
  - True colour (RGB) – variability, scouting
  - Multispectral – Nitrogen management
  - Thermal – Irrigation management

Growth in Drones



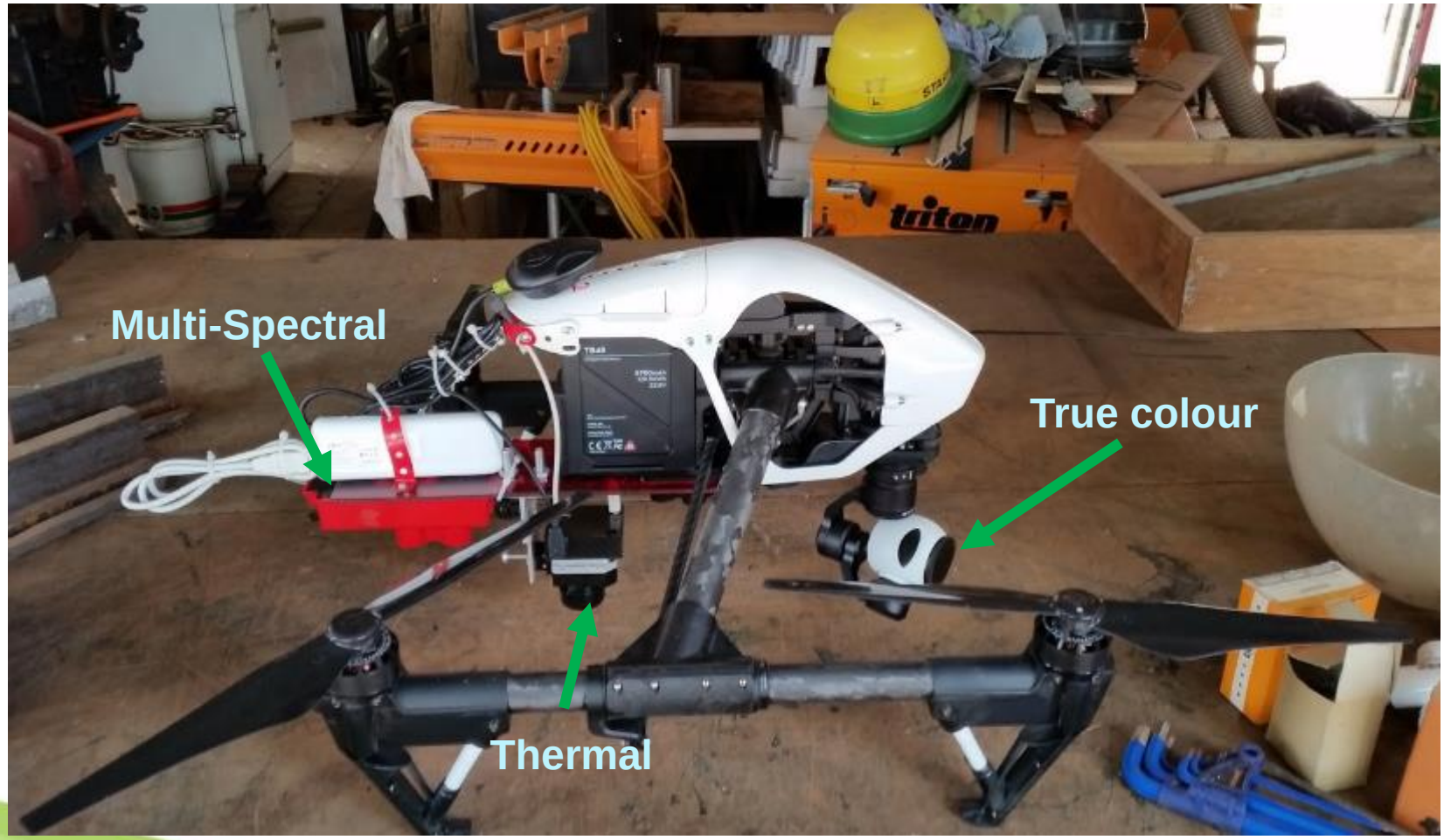
Drones/Sensors for Water + N

Standard small/medium drone $1.5-7K

+ Thermal $2-10K

+ Multispectral $3-7K

DRONE PLATFORM



Collecting the data

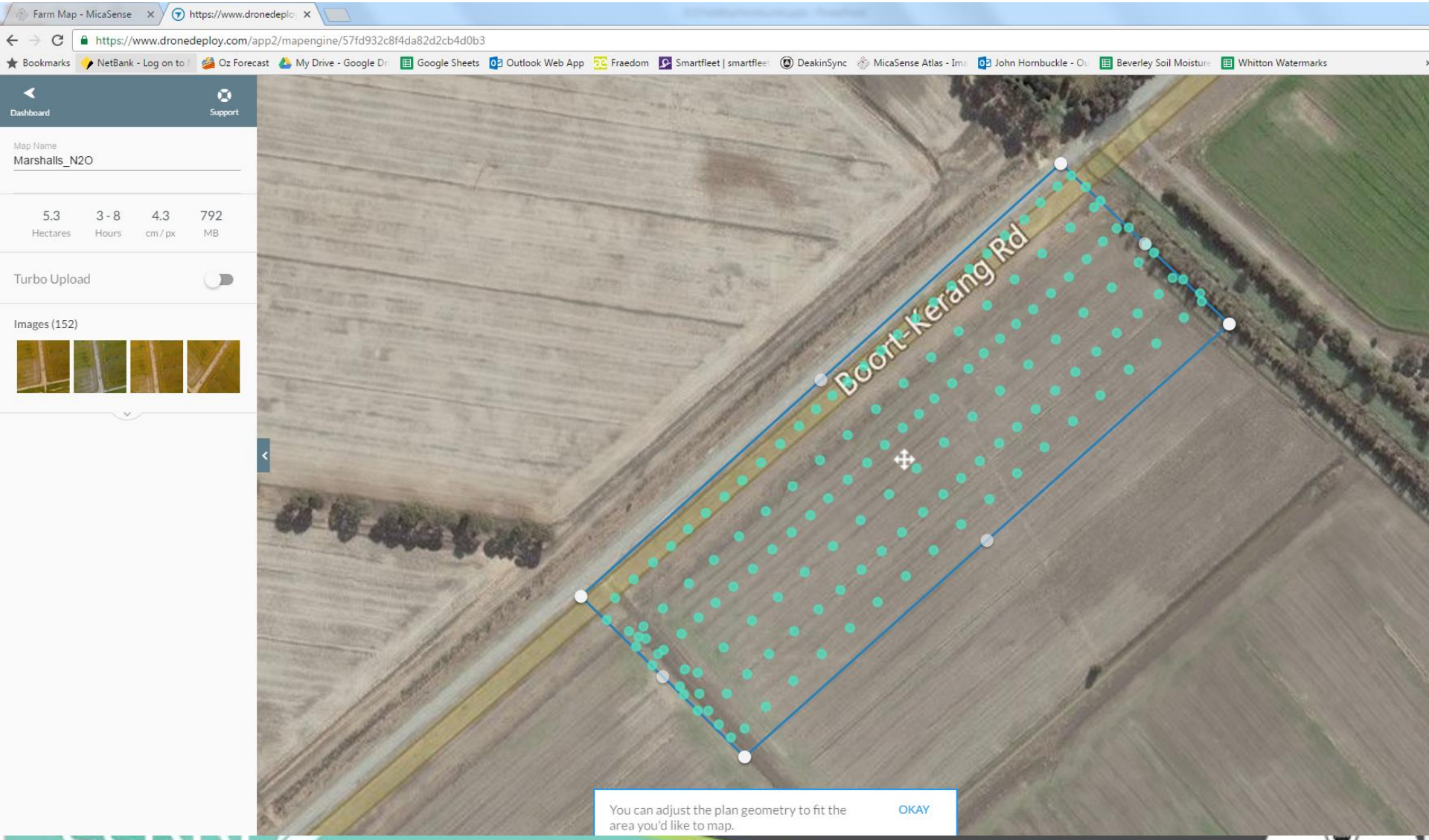
AUTOMATED FLIGHTS

-Micasense Atlas flight

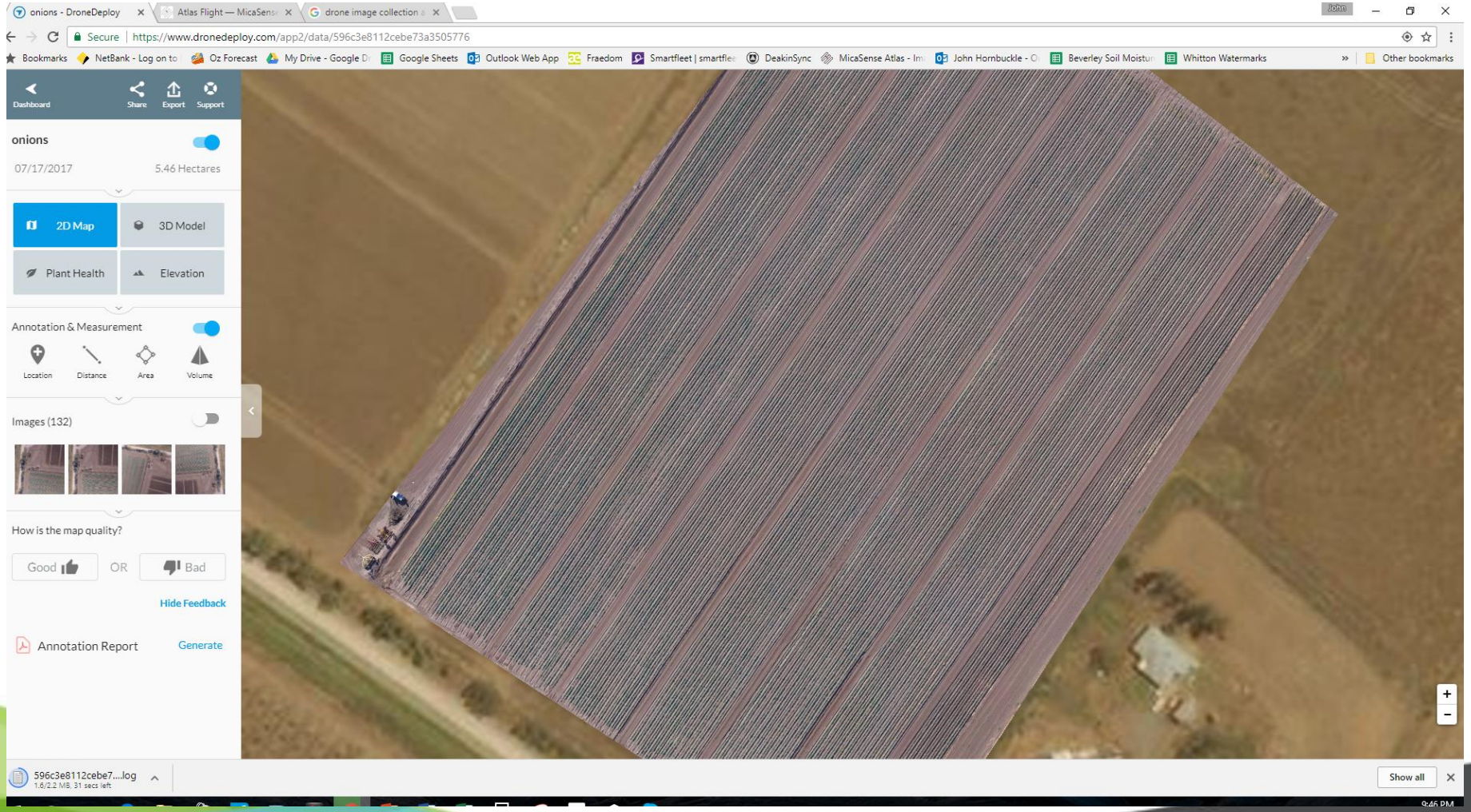
-DroneDeploy

-Pix4d

AUTOMATED DATA PROCESSING



IMAGES PROCESSED IN THE CLOUD



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USING THE DATA

TRUE COLOUR – VARIABILITY, SCOUTING

STANDARD CAMERA $1400 DRONE

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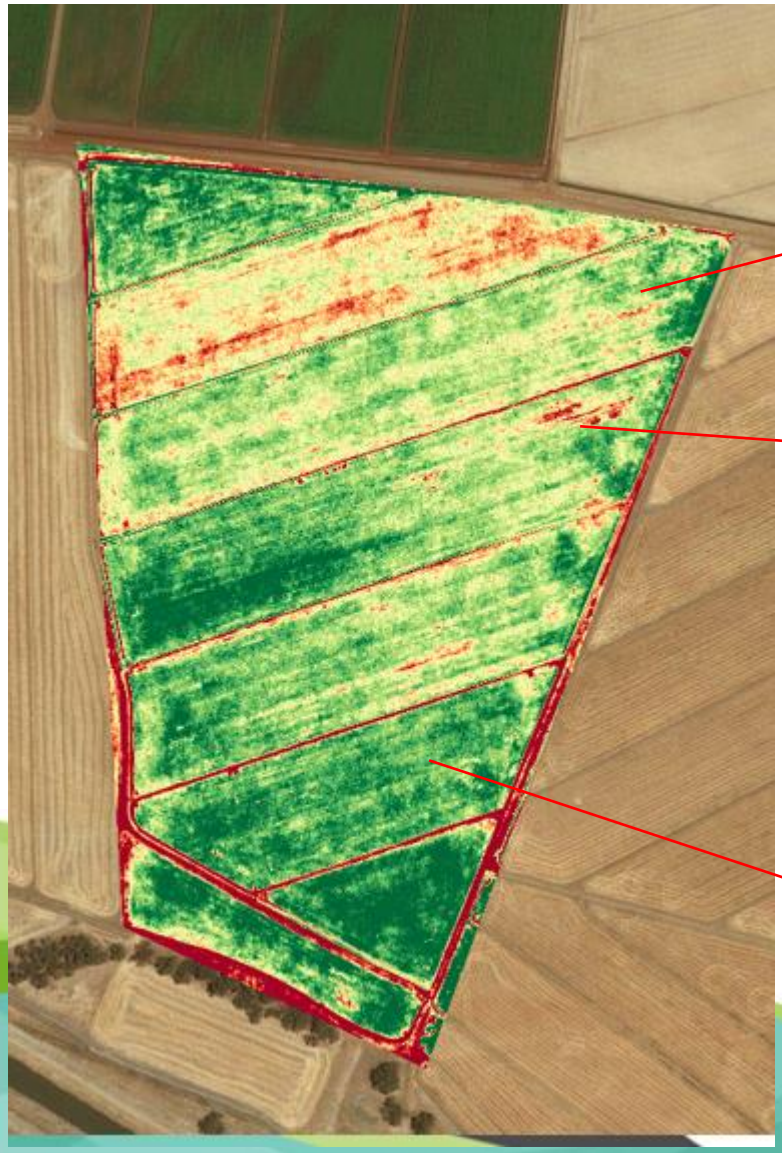
TARGETED SCOUTING AND SAMPLING

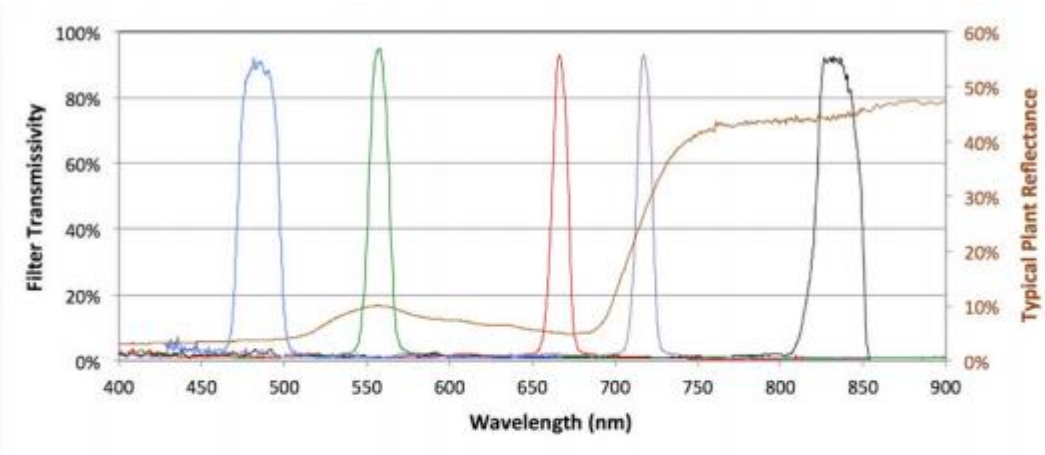


USING THE DATA

MULTISPECTRAL - N MANAGEMENT

MULTI-SPECTRAL VEGETATION INDICIES

Micasense camera bands:

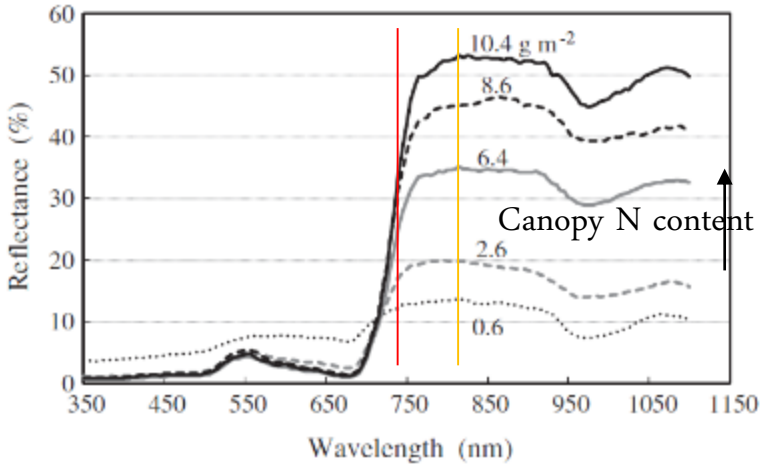


Band Number	Band Name	Center Wavelength (nm)	Bandwidth FWHM (nm)
1	Blue	475	20
2	Green	560	20
3	Red	668	10
4	Near IR	840	40
5	Red Edge	717	10

- Visible Atmospherically Resistant Index (VARI) = (G-R)/(G+R-B)
- Normalized Difference Vegetation Index (NDVI) = (NIR-R)/(NIR+R)
- Normalized Difference Red Edge (NDRE) = (NIR-RE)/(NIR+RE)
- Simplified Canopy Chlorophyll Content Index (SCCCI) = NDRE/NDVI

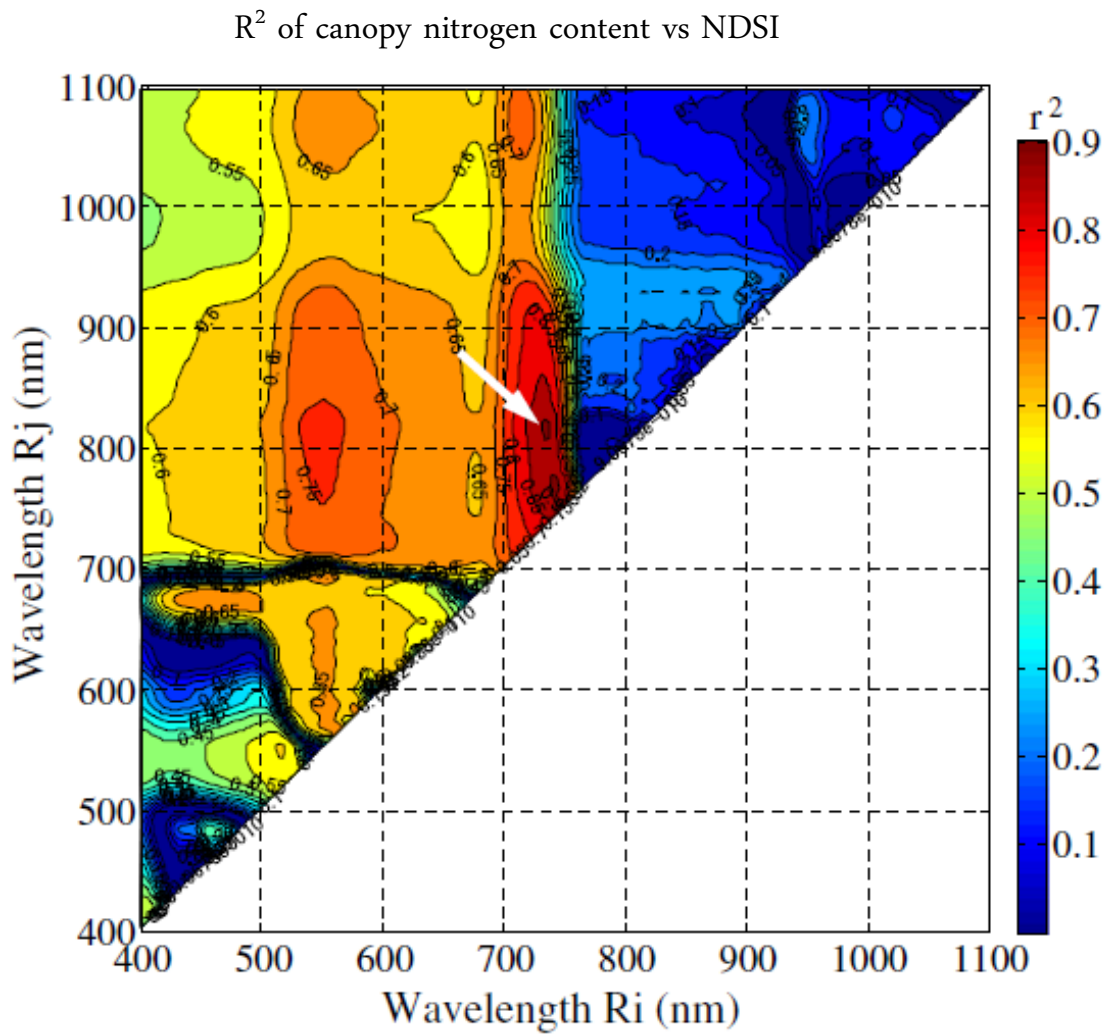
NITROGEN ASSESSMENT USING VEGETATION INDICIES -> NDRE

Inoue, Yoshio, et al. "Diagnostic mapping of canopy nitrogen content in rice based on hyperspectral measurements." Remote Sensing of Environment126 (2012)



$$NDSI(x,y) = (y-x)/(x+y)$$

Best predictor: y=R(825)=NIR, x=R(735)=RE
i.e. NDRE



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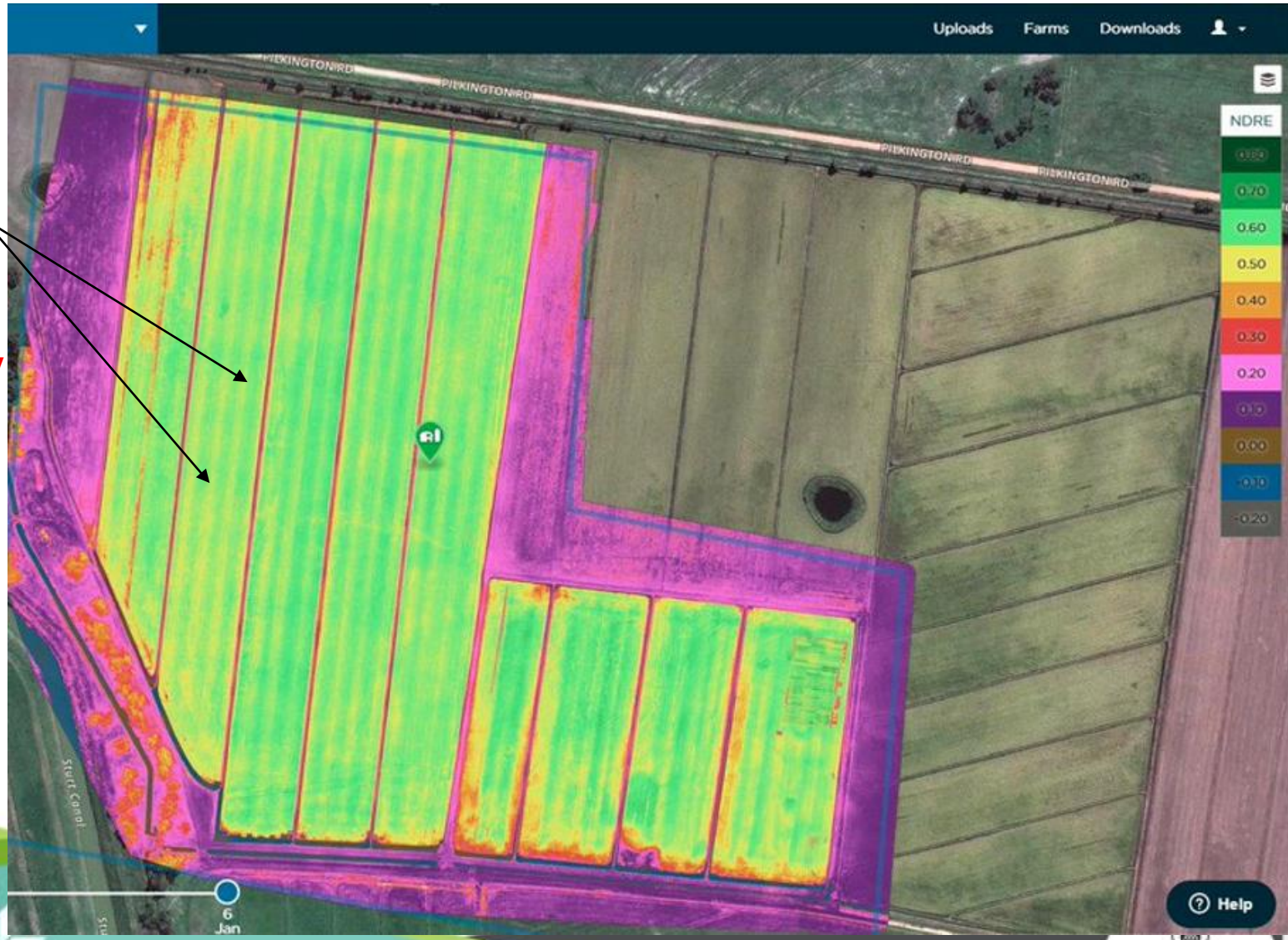
WHAT'S IT LOOK LIKE?

HI-RES IMAGERY SHOWING NEW INSIGHTS

N top dress issues – vertical lines from spreader non-uniformity



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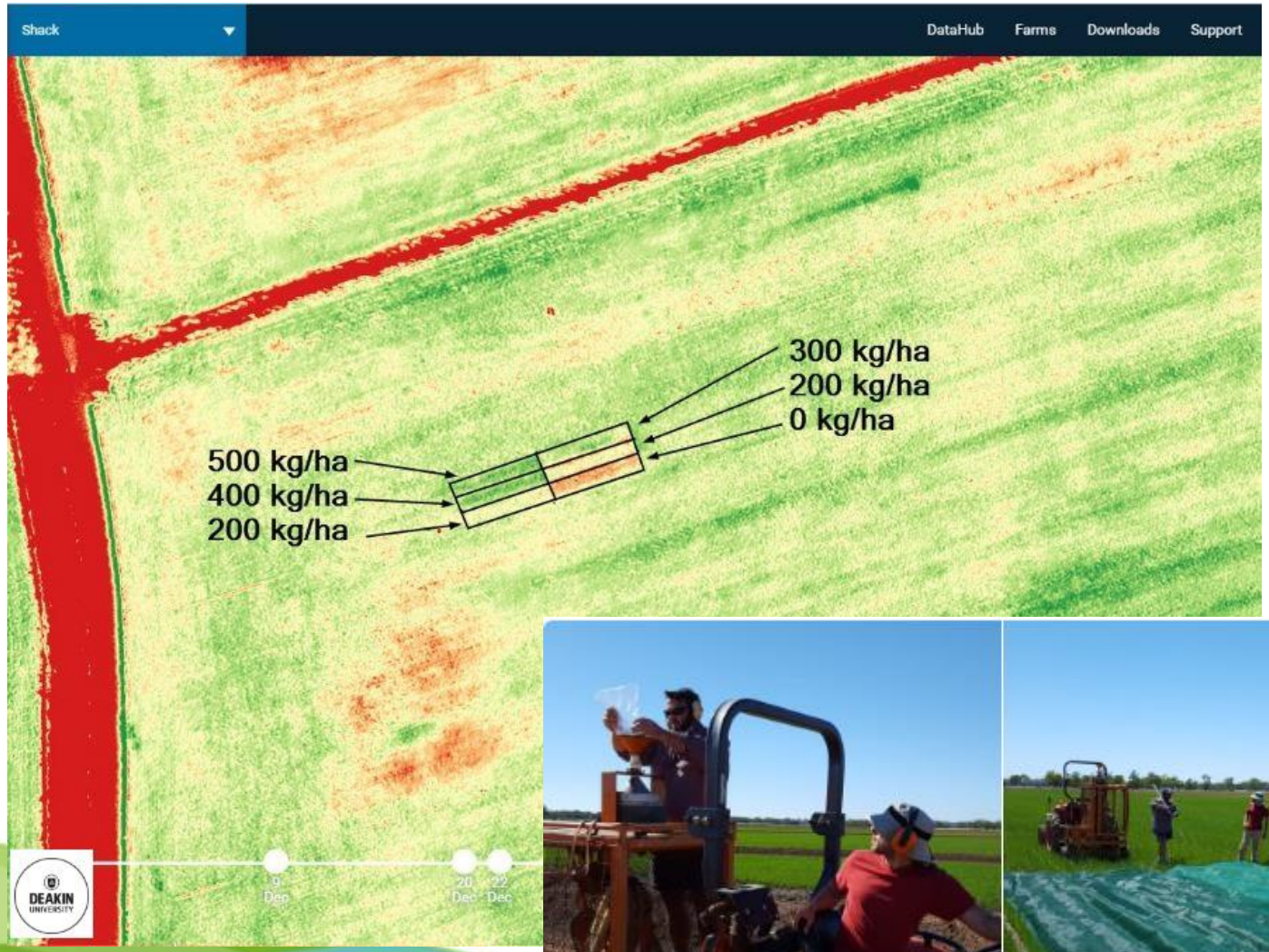
UREA RATES VS NDRE



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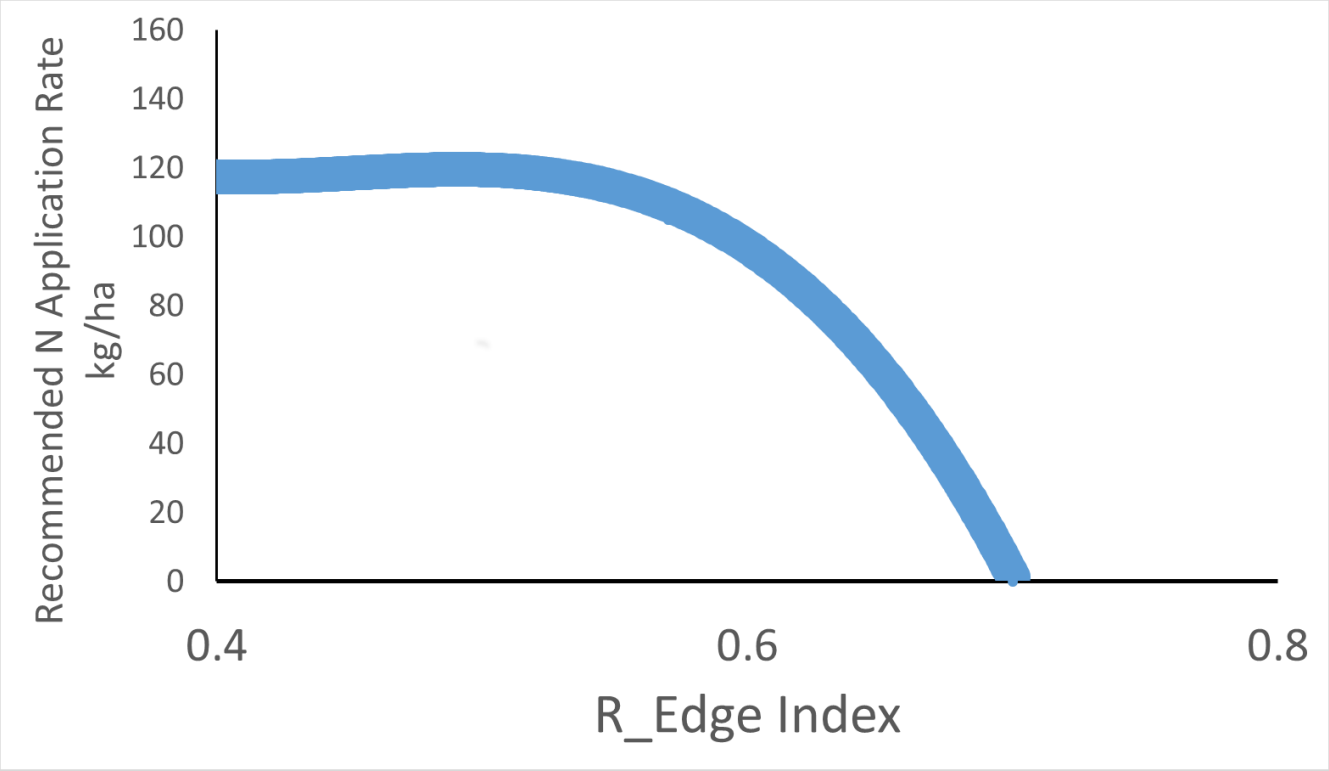
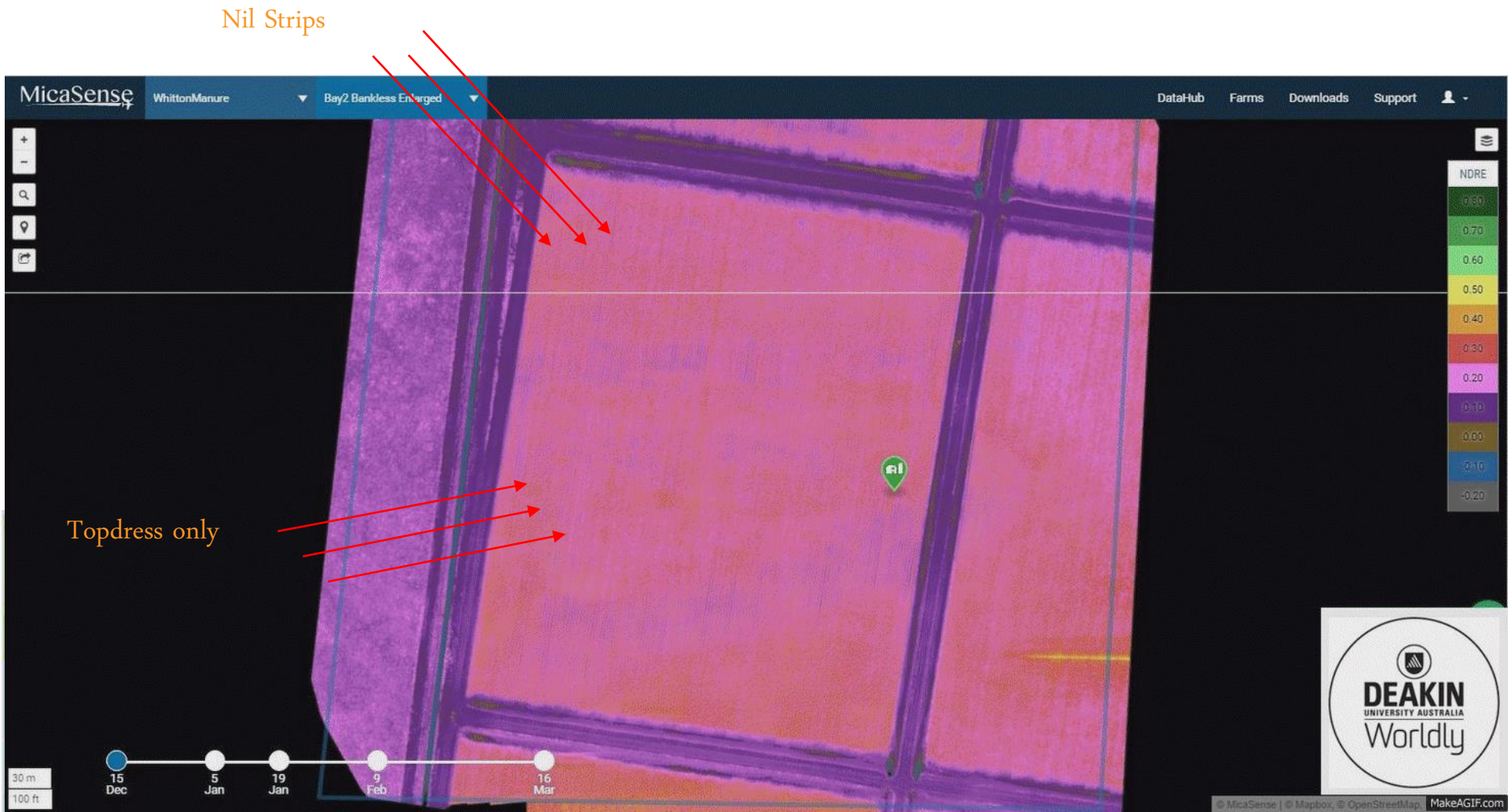
N TOPDRESSING

- Indices based on Red Edge have the potential to be used for estimating N uptake and hence make topdressing decisions



COTTON – N MANAGEMENT



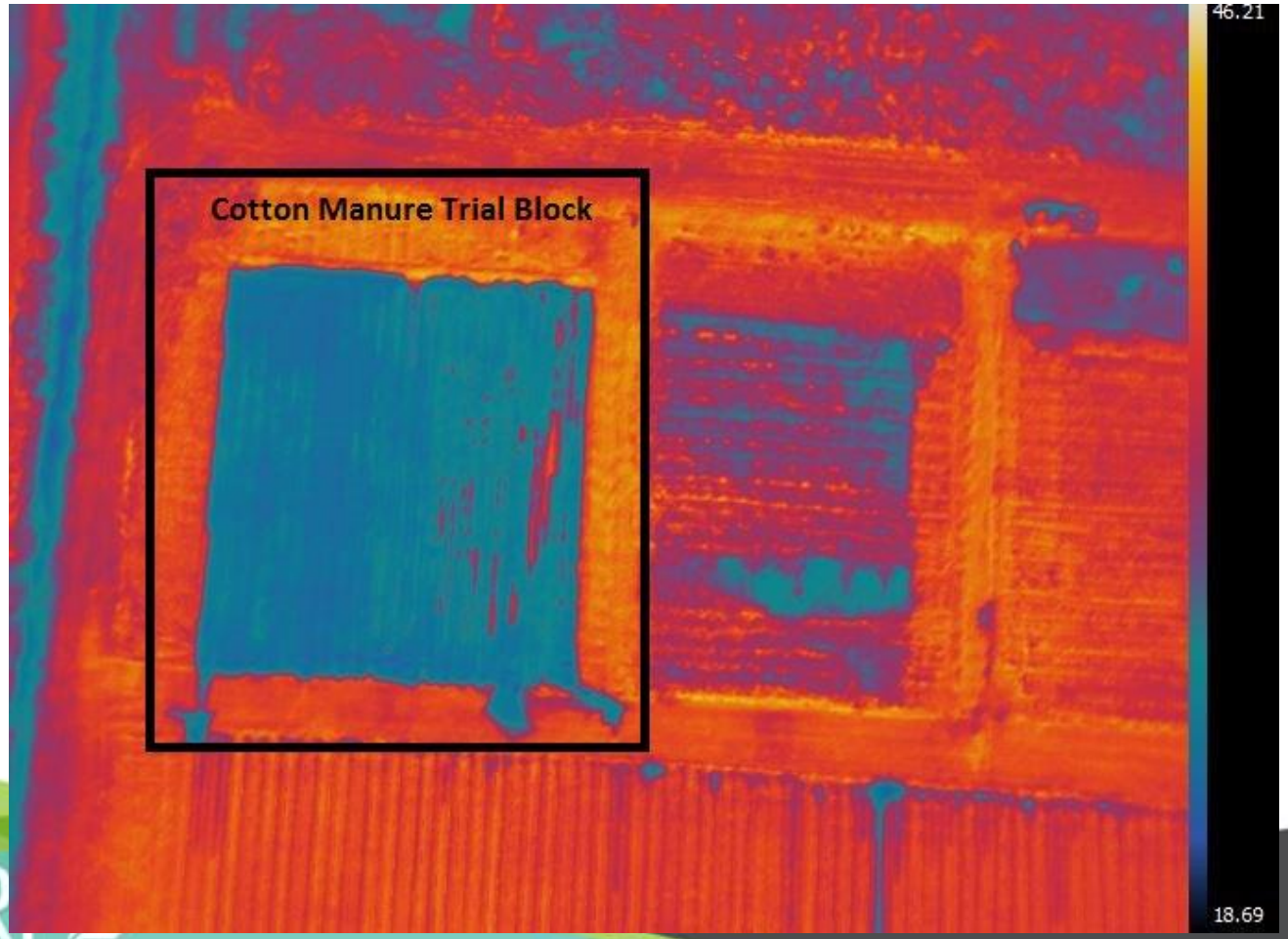
USING THE DATA

THERMAL – IRRIGATION MANAGEMENT

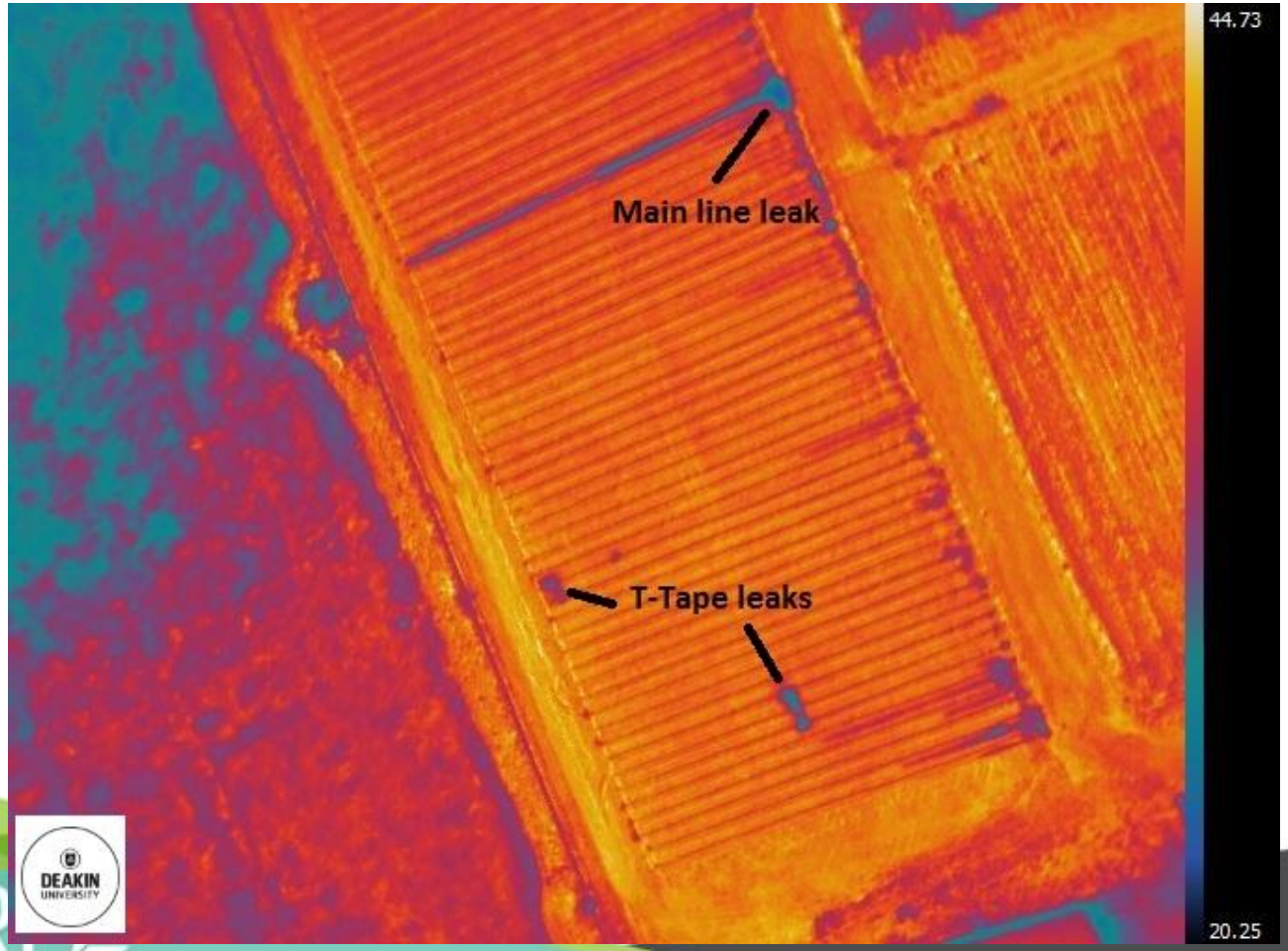
THERMAL

- Rapidly reducing in price - $2200 AUD
- Good qualitative capabilities
- Has some limitations
  - Difficult to stitch images
  - Time series data difficult to compare

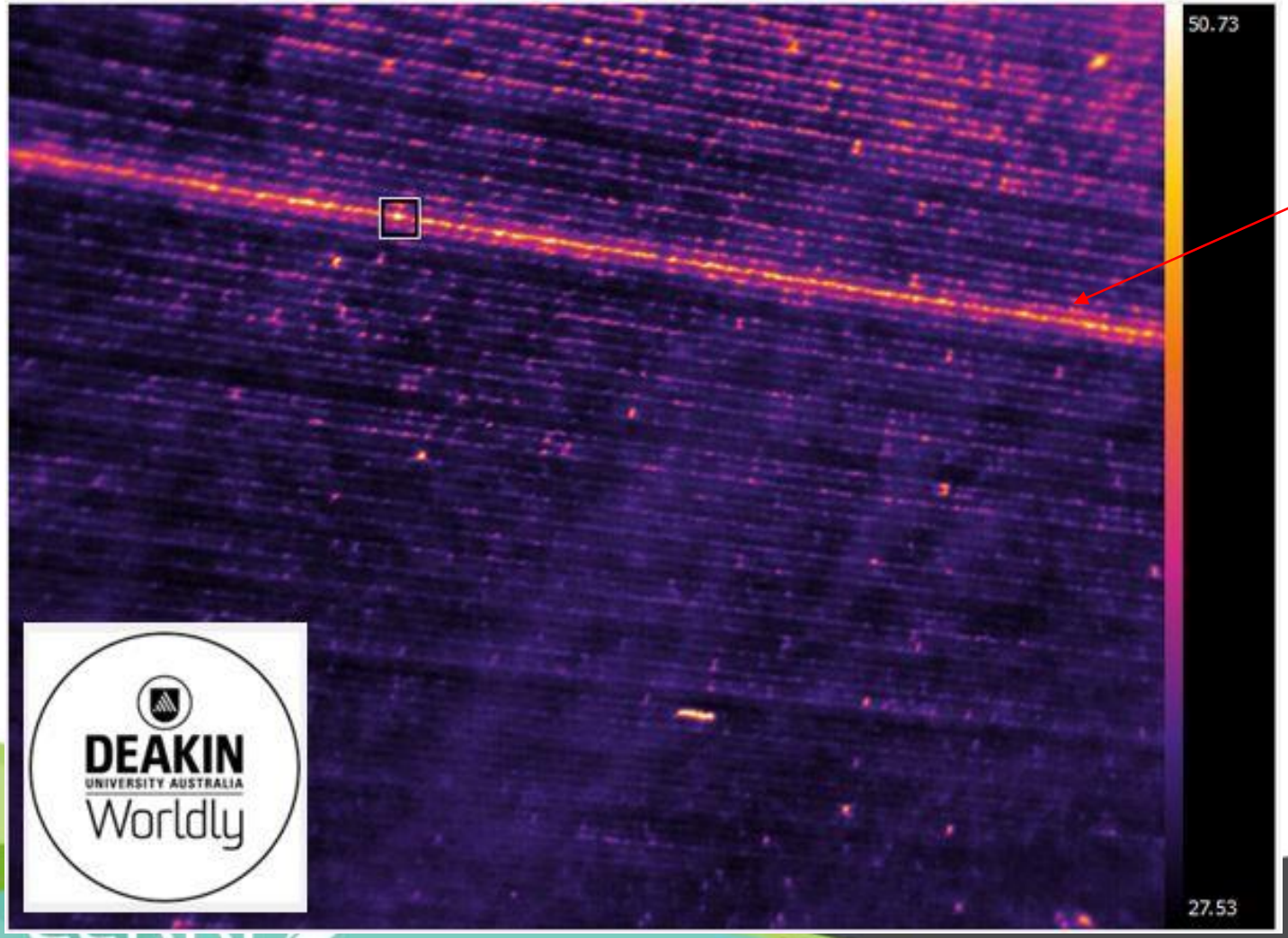
INFILTRATION ISSUES – SUBBING OF WATER ACROSS BEDS



IDENTIFYING IRRIGATION SYSTEM ISSUES



IDENTIFYING IRRIGATION SYSTEM ISSUES



Blocked Subsurface drip line

CONCLUSIONS

- A range of options with differing costs and benefits
- Learn to walk before running has merit
- Need to think about end use applications and profitability
- Real benefit comes from putting the remote sensed data into a format that makes a decision actionable - moving from Indices to suggested rates, modified practice, improved management

THANK YOU

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