HERRAMIENTAS TECNOLÓGICAS PARA OPTIMIZAR EL MANEJO DEL RIEGO EN ARROZ

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Centre for Regional and Rural Futures

RENDIMIENTO Variaciones

- Entre productores
- Entre chacras del mismo productor.
- Brecha de Rendimiento: 3.1 t/ha

DETECCIÓN DE PROBLEMAS

- Tarde – Normalmente a cosecha.

RIEGO

- UNIFORMIDAD

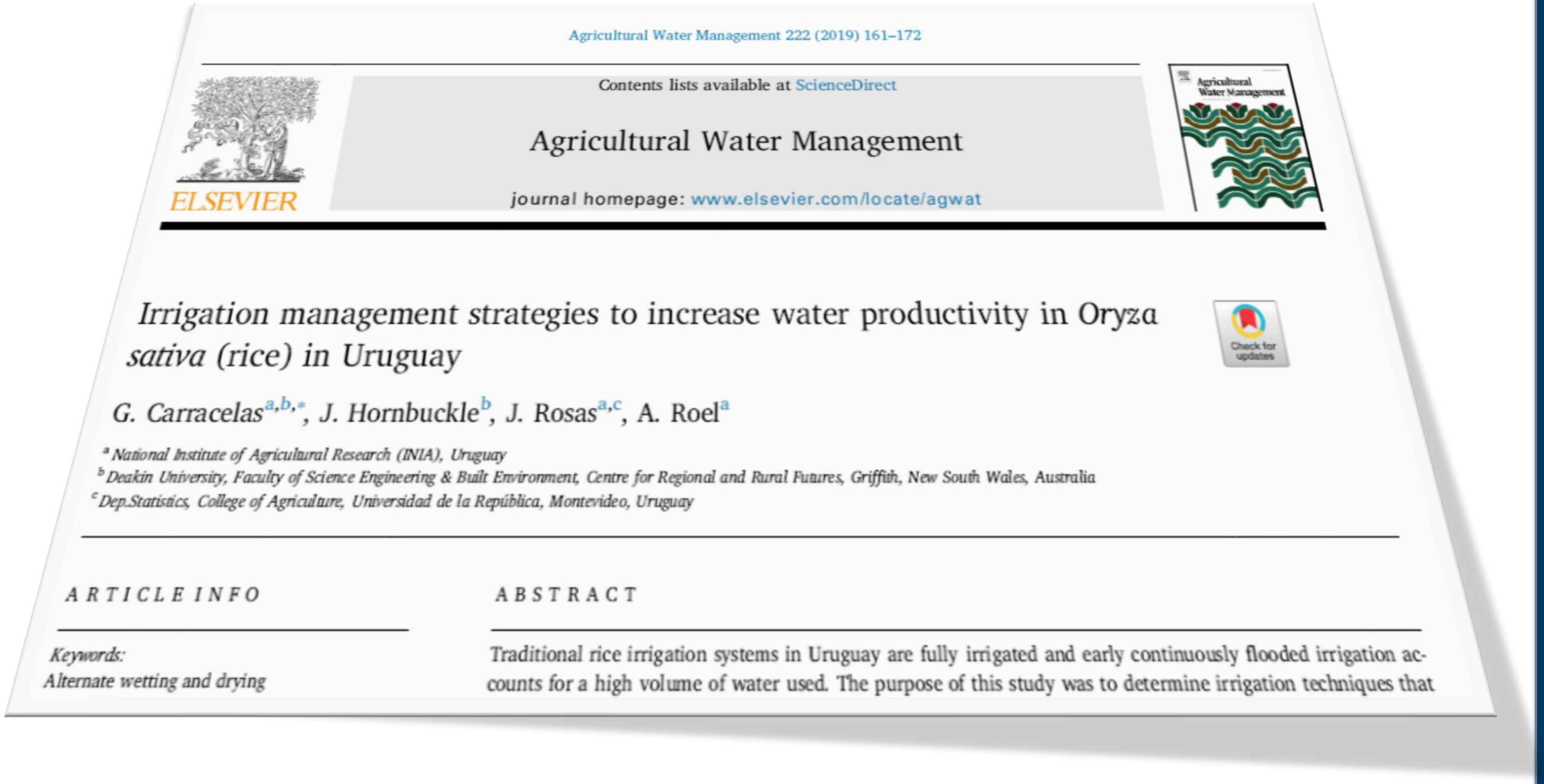
Análisis conjunto de Resultados de ensayos de riego obtenidos en tres sitios experimentales.

Periodo: 2009 – 2015

Experimentos: 10

Regiones:

Centro / Este / Norte



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ELSEVIER

Irrigation management strategies to increase water productivity in *Oryza sativa* (rice) in Uruguay

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ARTICLE INFO

Keywords:
Alternate wetting and drying

ABSTRACT

Traditional rice irrigation systems in Uruguay are fully irrigated and early continuously flooded irrigation accounts for a high volume of water used. The purpose of this study was to determine irrigation techniques that

https://doi.org/10.1016/j.agwat.2019.05.049

http://www.ainfo.inia.uy/digital/bitstream/item/12801/1/Carracelas-2019.pdf

Análisis conjunto de Resultados de ensayos de riego obtenidos en tres sitios experimentales.

- Existen **manejos alternativos** de riego que manteniendo el suelo siempre en **condiciones de saturación**, permiten **ahorrar agua sin afectar rendimiento y calidad** de grano.

Igual Rendimiento de Arroz con menos Agua

Reducción de Costos - Diversificación

Velocidad en restablecer la lámina de agua y Alta uniformidad del riego.

Existen tecnologías, que permiten optimizar el manejo del Riego, Nutrición, Malezas, Enfermedades

- Monitoreo Satelital
- Drones - Imágenes
- Manejo integrado

Información a tiempo para anticiparse al problema y corregir manejos con el fin de MAXIMIZAR RENDIMIENTOS

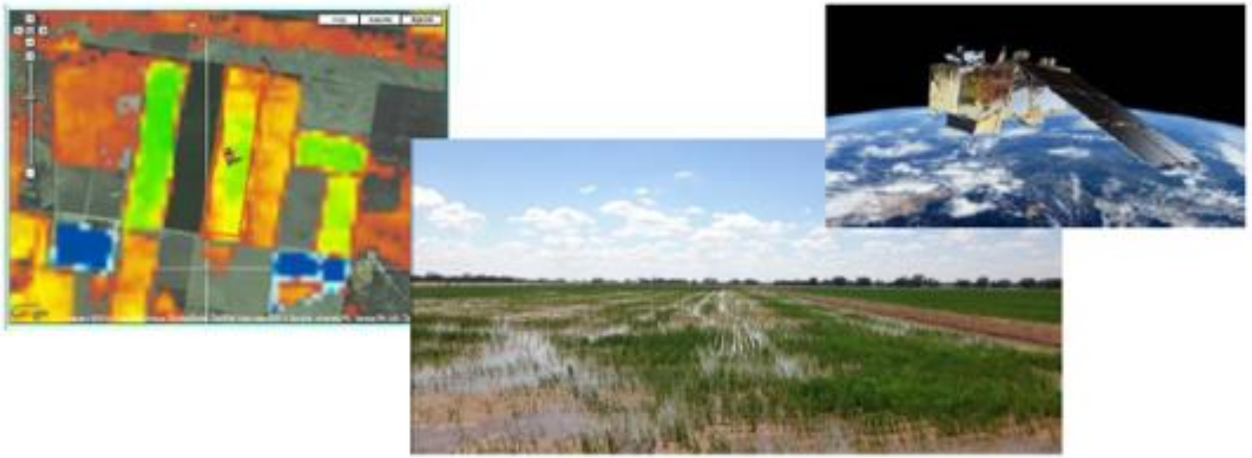
Programa

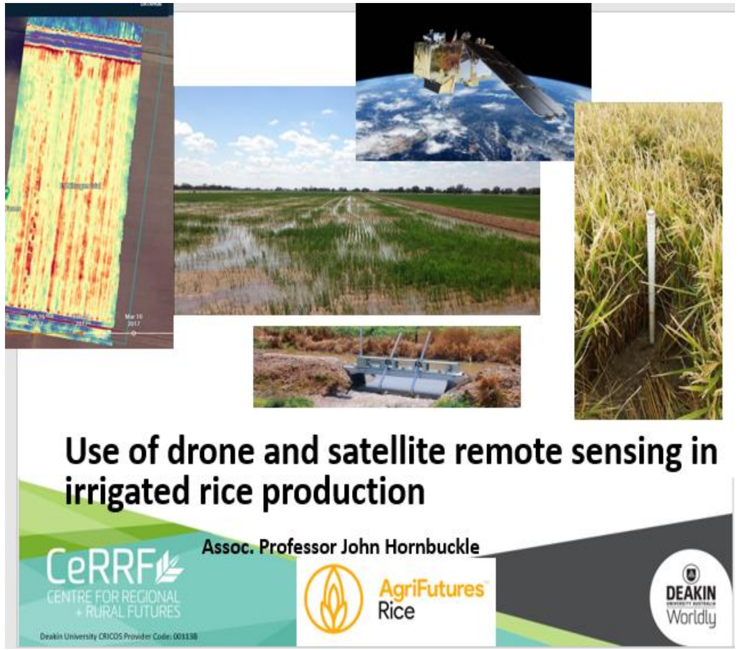
14:00 - 14:20. Uso de imágenes satelitales en chacras comerciales. Ing. Agr. Marcos Ríos

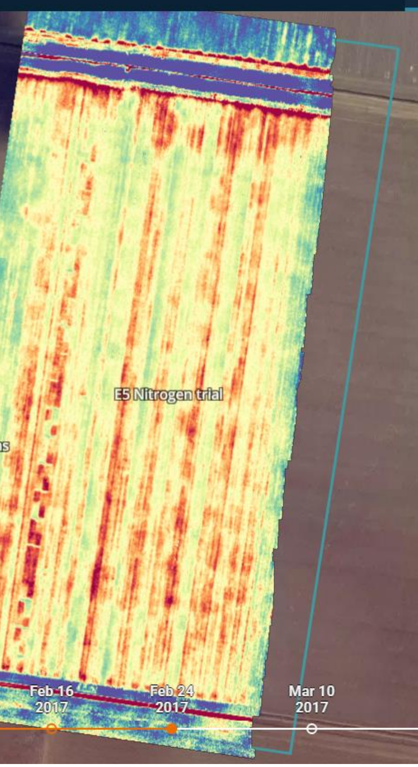
14:25 - 14: 45. Monitoreo satelital. Ing. Agr. Santiago Bandeira.

15:00 - 15:40. Sensoramiento remoto satelital y uso de drones en sistemas irrigados de arroz en Australia. Prof. PhD. John Hornbuckle (Tutor tesis Maestría: Gonzalo Carracelas)

Moderador: Ing. Agr. Gonzalo Carracelas







Use of drone and satellite remote sensing in irrigated rice production

Assoc. Professor John Hornbuckle

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TALK OUTLINE

- Snapshot of the Australian rice industry
- Satellite based Remote sensing
- Drone based remote sensing

AUSTRALIAN RICE INDUSTRY

- Capacity to produce 1 million tonnes per annum

https://www.rga.org.au/

AUSTRALIAN RICE INDUSTRY

- Better growers are achieving yields of up to 14-15 t/ha
- Water use is variable ~ 12ML/ha goal
- Water is extremely scarce and can be traded like the stock market both permanently and temporally in season
  - Permanent Water $3000-$7000/ML
  - Temporary water $80-$600/season

WATER TRADING - $$$

Order No.	Vol	Water Price ($/ML)	Authority/processing fees ($/ML)	Price ($/ML) incl fees
132140	50.00	545.00	1	546
131367	54.00	550.00	1	551
132112	24.00	550.00	2	552
132026	10.00	550.00	4	554
131945	[illegible]	[illegible]	2	[illegible]
132024	200.00	560.00	2	562
131835	20.00	570.00	2	572
131887	100.00	575.00	2	577
131829	100.[illegible]	575.00	4	579
131867	50.00	575.00	7	582

If you can save it, you can sell it !

Showing: 10 ▼

« 1 2 3 4 5 »

Buy Orders - 760.00 ML Expand

Transactions in Progress - 50.00 ML sold today Expand

WHY USE REMOTE SENSING?

- Large variations in yields across fields
- Optimising inputs to reduce costs – Urea + water
- Identifying irrigation system and irrigation management issues
- Optimising profitability $$$

Satellite – Regional and paddock level analysis using IrriSAT

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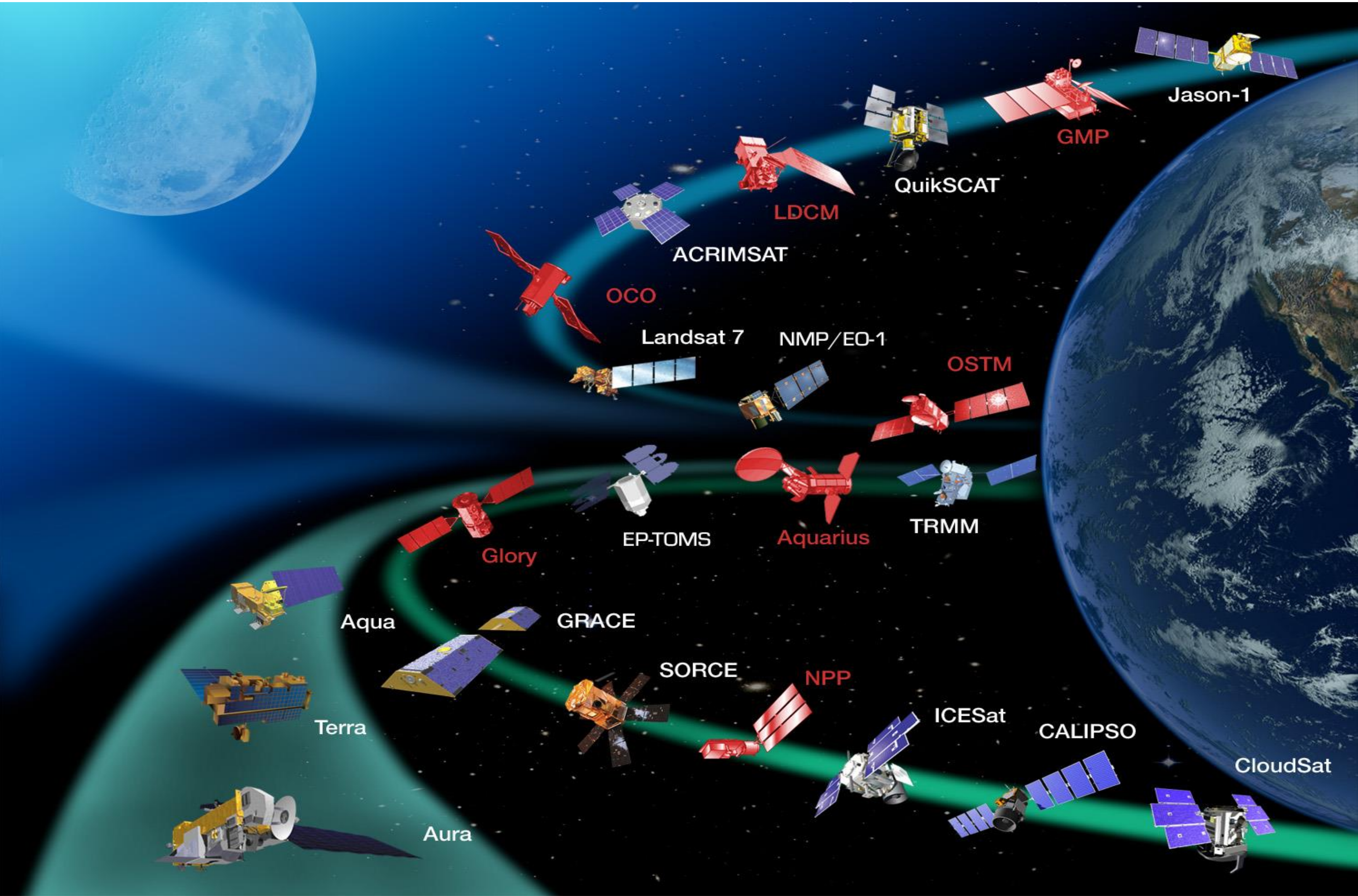
SATELLITE RS FOR WATER USE MONITORING

- Water availability and its use is a high priority in Australia due to its scarcity

- Tools developed using freely available satellite data to monitor irrigation water use and refine management

- If you can save water you can sell it (even within a season). This has driven Australia to readily adopt irrigation technologies

SATELLITE PLATFORMS



NEW SATELLITE PLATFORM – SENTINEL -2

Sentinel-2

The pair of Sentinel-2 satellites will routinely deliver high-resolution optical images globally, providing enhanced continuity of SPOT- and Landsat-type data.

Sentinel-2 will carry an optical payload with visible, near infrared and shortwave infrared sensors comprising 13 spectral bands: 4 bands at 10 m, 6 bands at 20 m and 3 bands at 60 m spatial resolution (the latter is dedicated to atmospheric corrections and cloud screening), with a swath width of 290 km.

The 13 spectral bands guarantee consistent time series, showing variability in land surface conditions and minimising any artefacts introduced by atmospheric variability.

The mission orbits at a mean altitude of approximately 800 km and, with the pair of satellites in operation, has a revisit time of five days at the equator (under cloud-free conditions) and 2–3 days at mid-latitudes. The first satellite is planned to be ready for launch between 2014 and 2015.

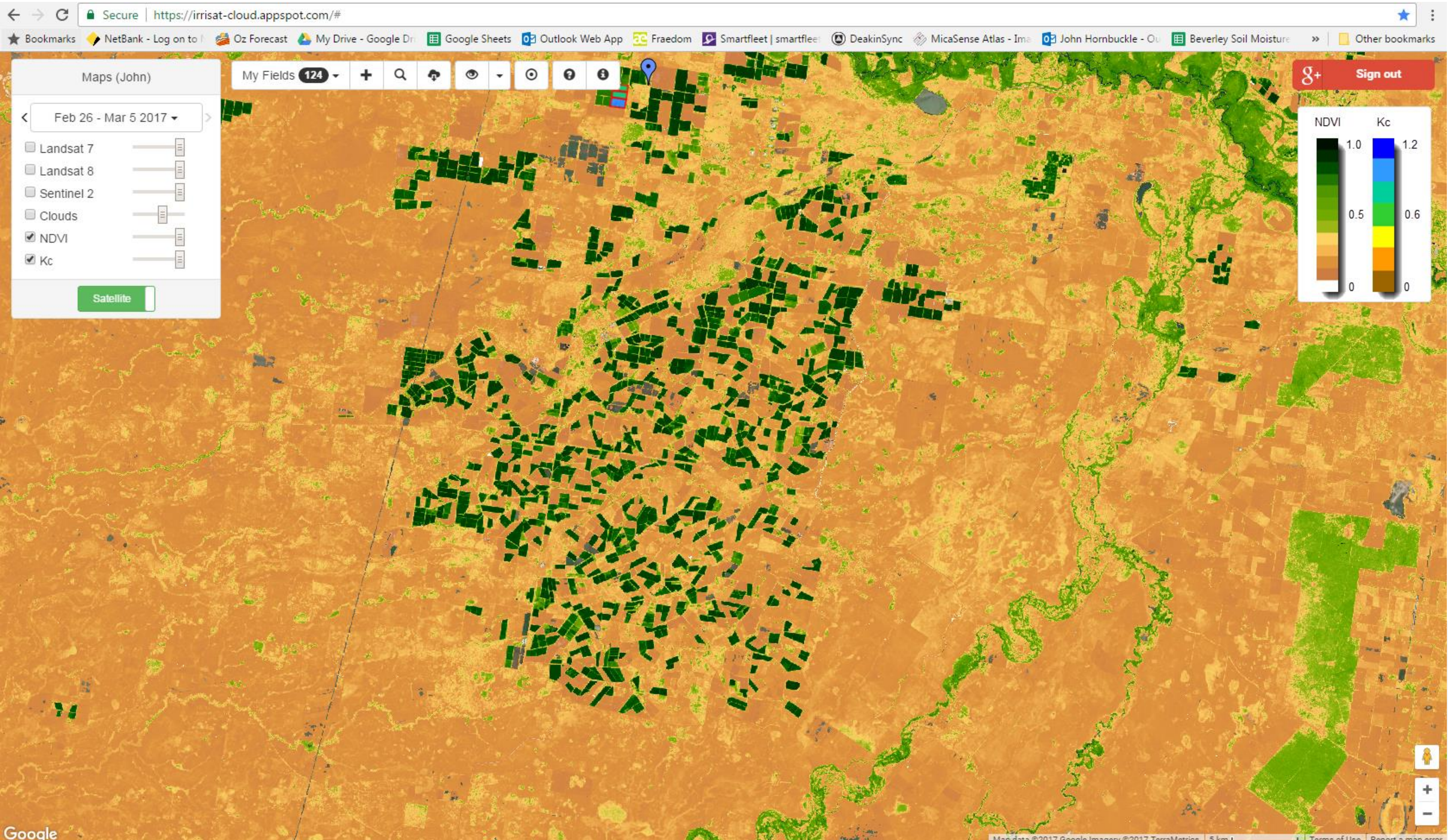
New features offered by Sentinel-2:

10-20m pixel resolution (vs 30m)

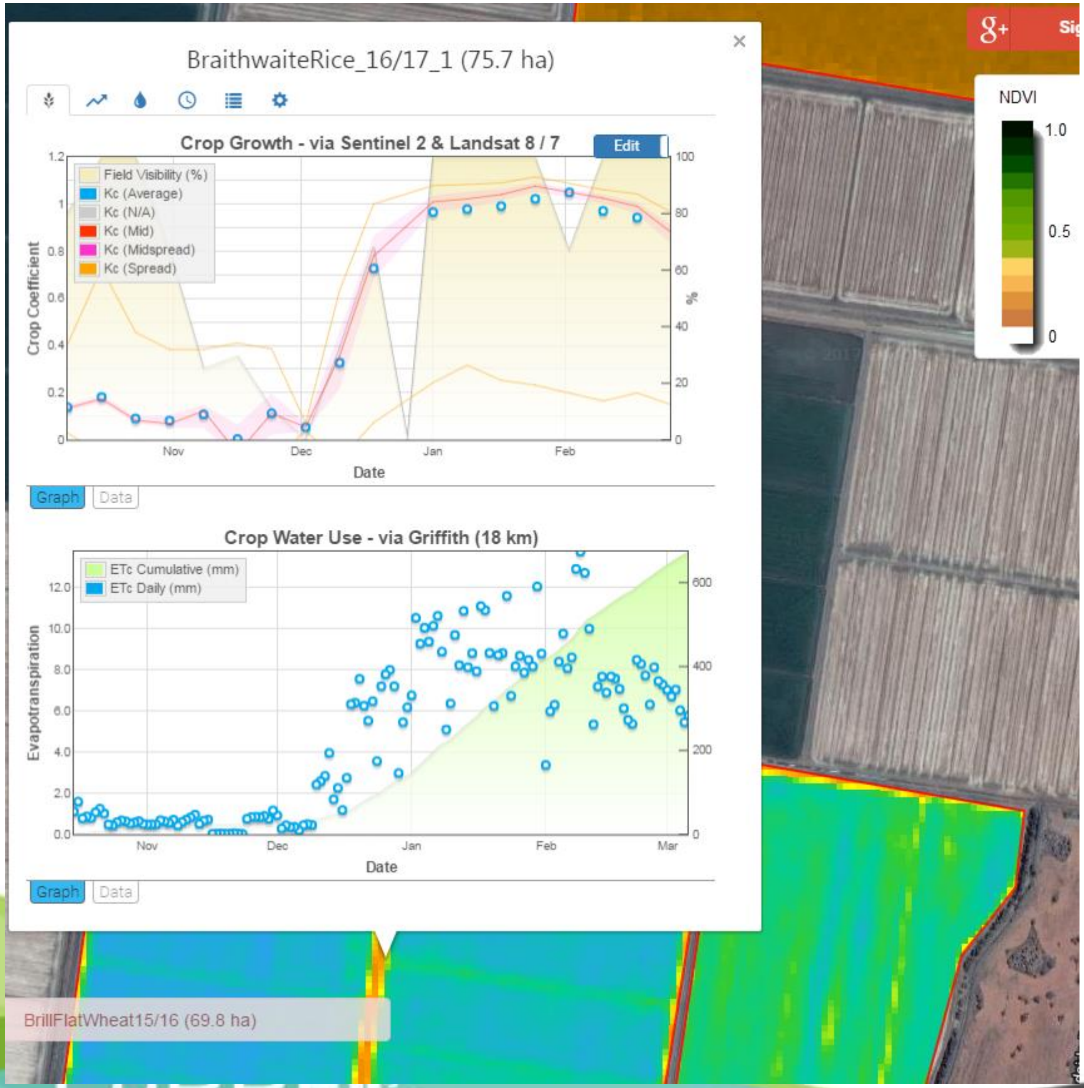
Multiple bands, including red-edge (vs visible and NIR only)

2-5 day revisit (vs 16 day)

IRRISAT – HTTPS://IRRISAT-CLOUD.APPSPOT.COM



IRRISAT – HTTPS://IRRISAT-CLOUD.APPSPOT.COM

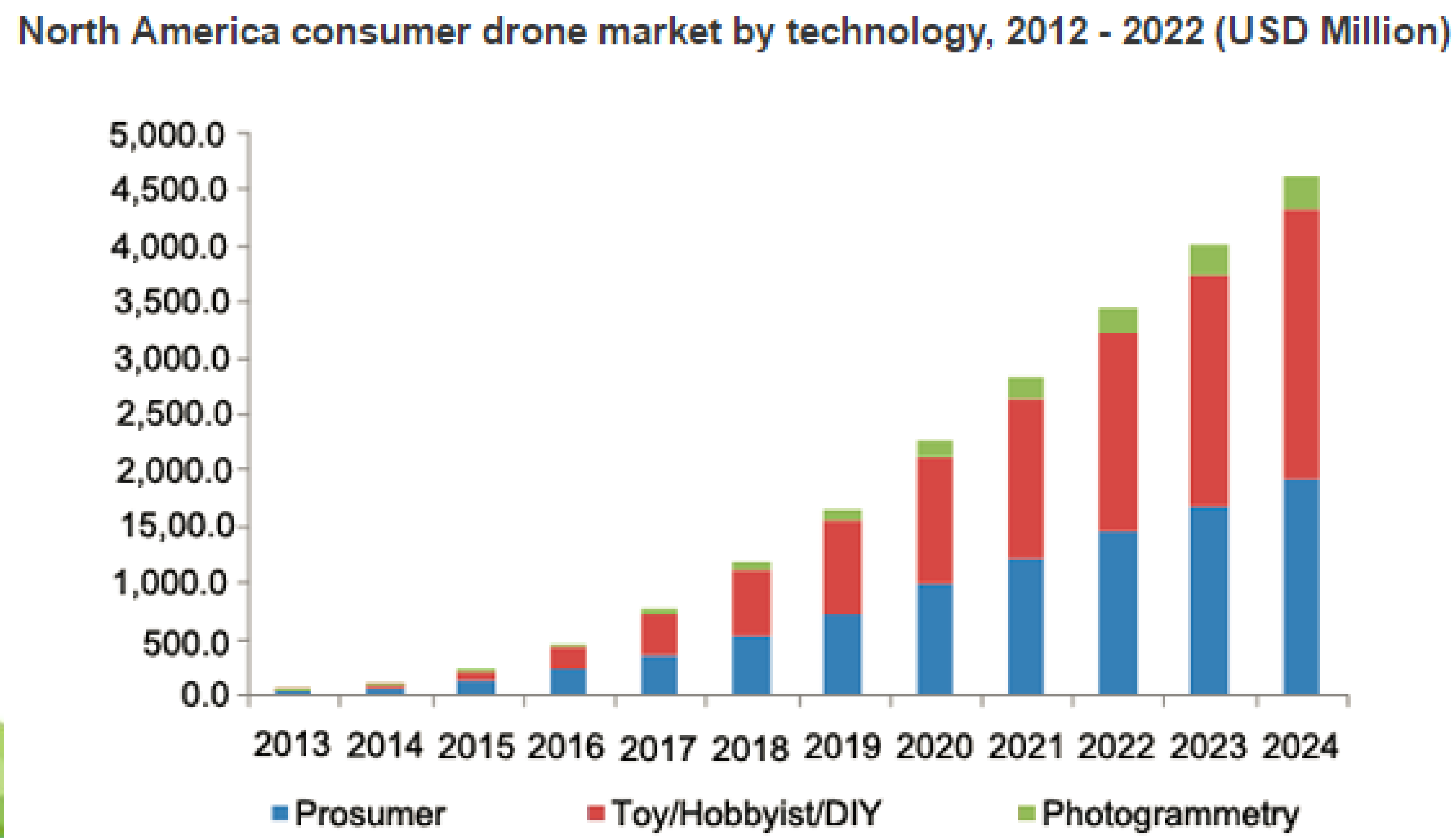


Cumulative water use across the season calculated from NDVI images, and weather station ET.

We can then compare bays and farms across the region and use this data for benchmarking performance.

Drone – Sub Paddock level analysis

INCREASING USE OF DRONES



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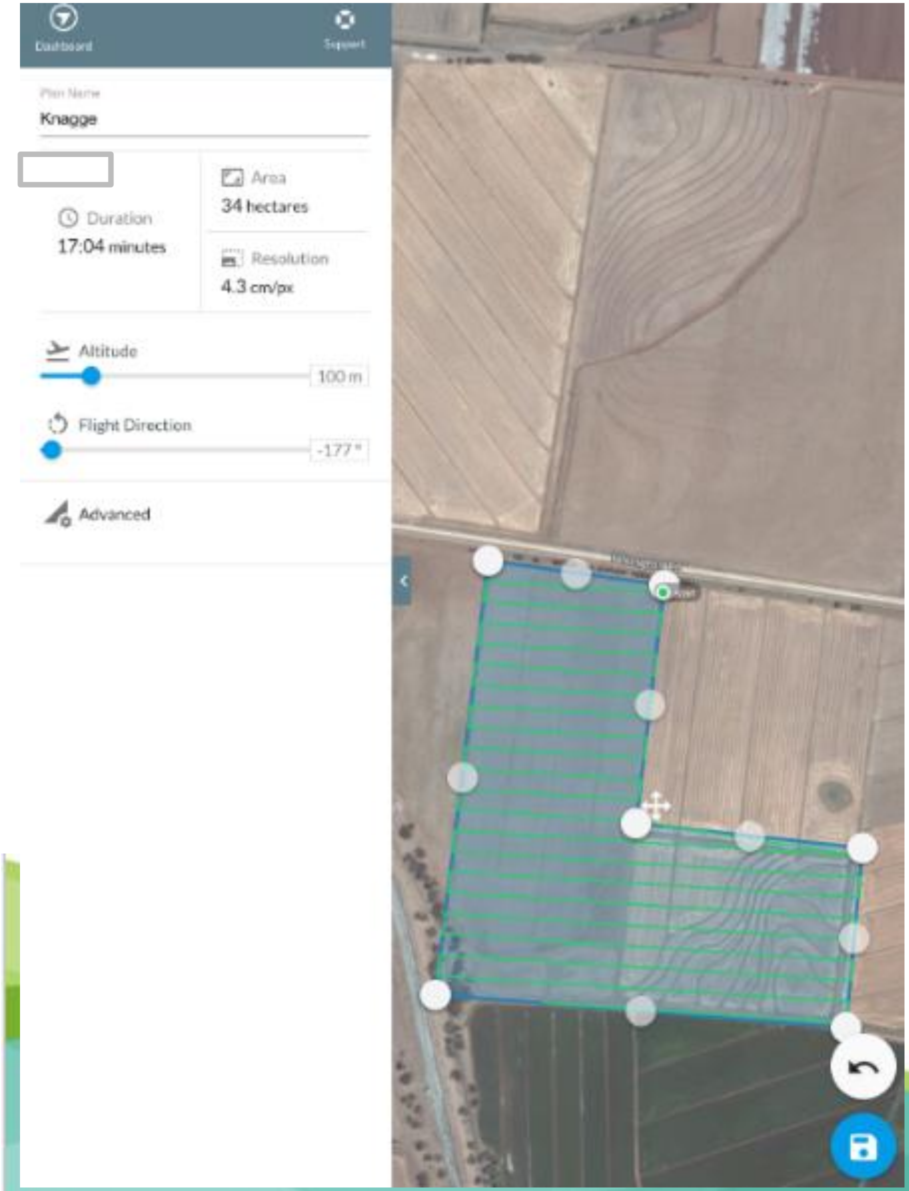
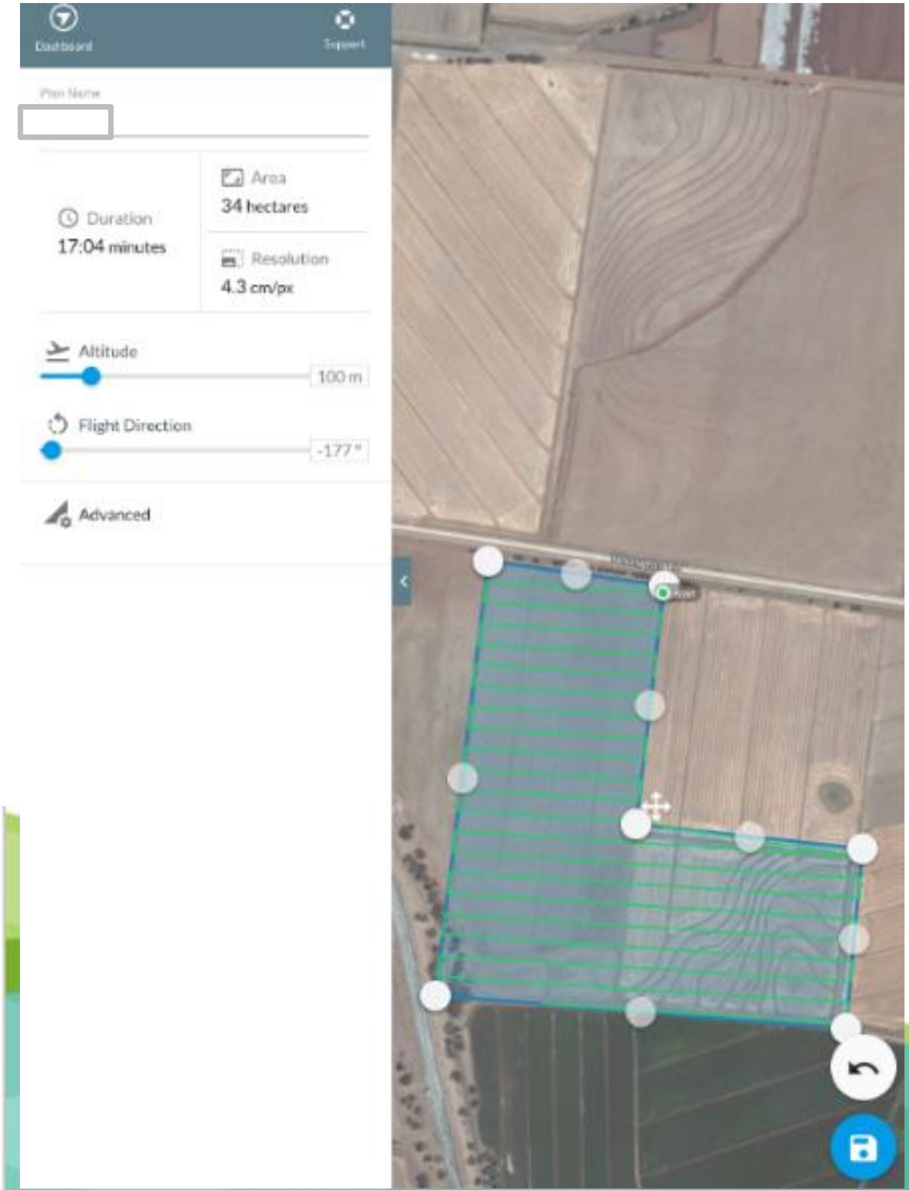
AUTOMATED FLIGHTS AND PROCESSING



- Range of programs available to automate flights – DroneDeploy, Micasense Atlas Flight
- Field boundaries defined which controls flight, automated overlap calculated
- Image taken every x metres
- Orthomosaic (stitch images to create image of whole area)

AUTOMATED FLIGHTS AND PROCESSING



- Field boundaries defined in Drone Deploy, which controls flight
- Image taken every x metres
- Orthomosaic (stitch images to create image of whole area)
- Compute vegetation indicies
  - QGIS, SNAP (free software)
  - In-house software to define treatment areas or bays, then determine variability

STANDARD CAMERA - $1400 DRONE

MULTI-SPECTRAL DRONES

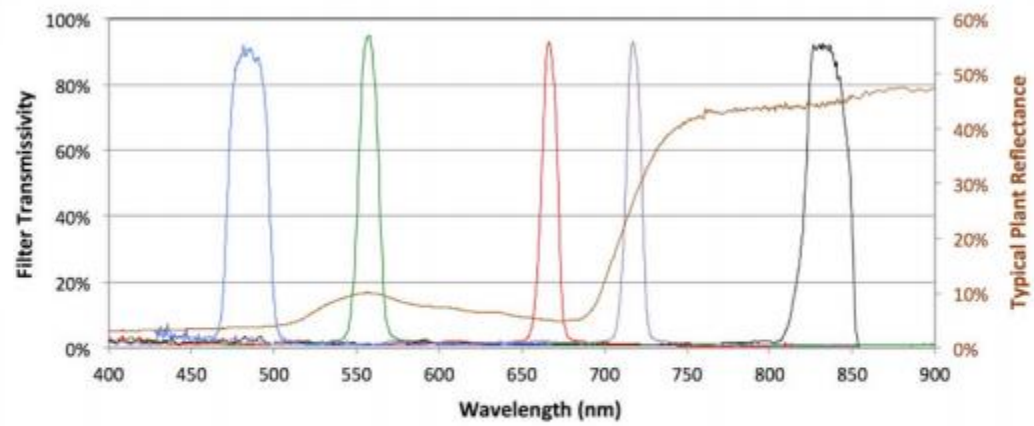
- Main focus has been on using these for nitrogen uptake monitoring in crops and nitrogen management

- More costly than stand cameras but offer repeatability

- Good for research and the bands/wavelengths used on the drones can be matched to satellite bands to allow us to upscale for real world end users

MULTI-SPECTRAL VEGETATION INDICIES

Micasense camera bands:



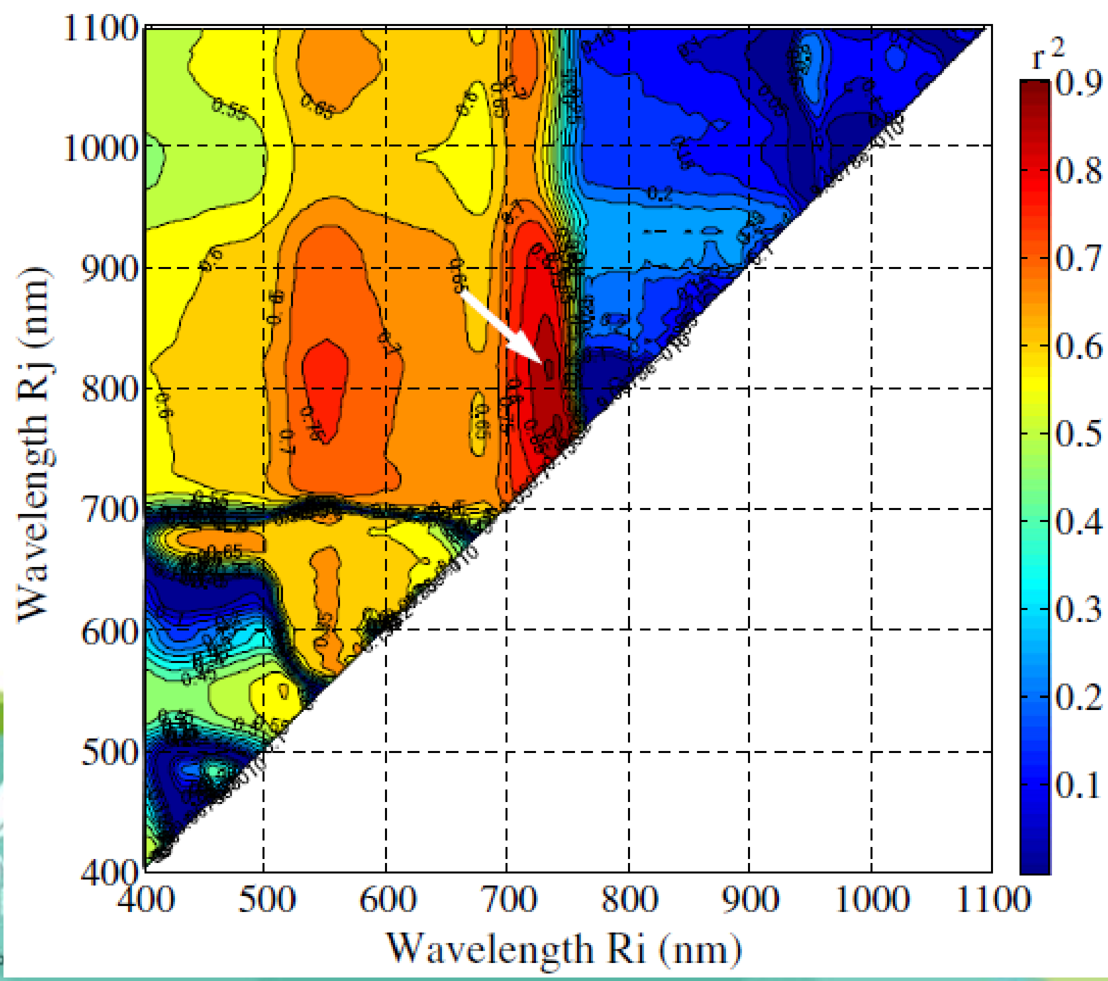
Band Number	Band Name	Center Wavelength (nm)	Bandwidth FWHM (nm)
1	Blue	475	20
2	Green	560	20
3	Red	668	10
4	Near IR	840	40
5	Red Edge	717	10

- Normalized Difference Red Edge (NDRE) = (NIR-RE)/(NIR+RE)
- Simplified Canopy Chlorophyll Content Index (SCCCI) = NDRE/NDVI

NITROGEN ASSESSMENT USING VEGETATION INDICIES -> NDRE

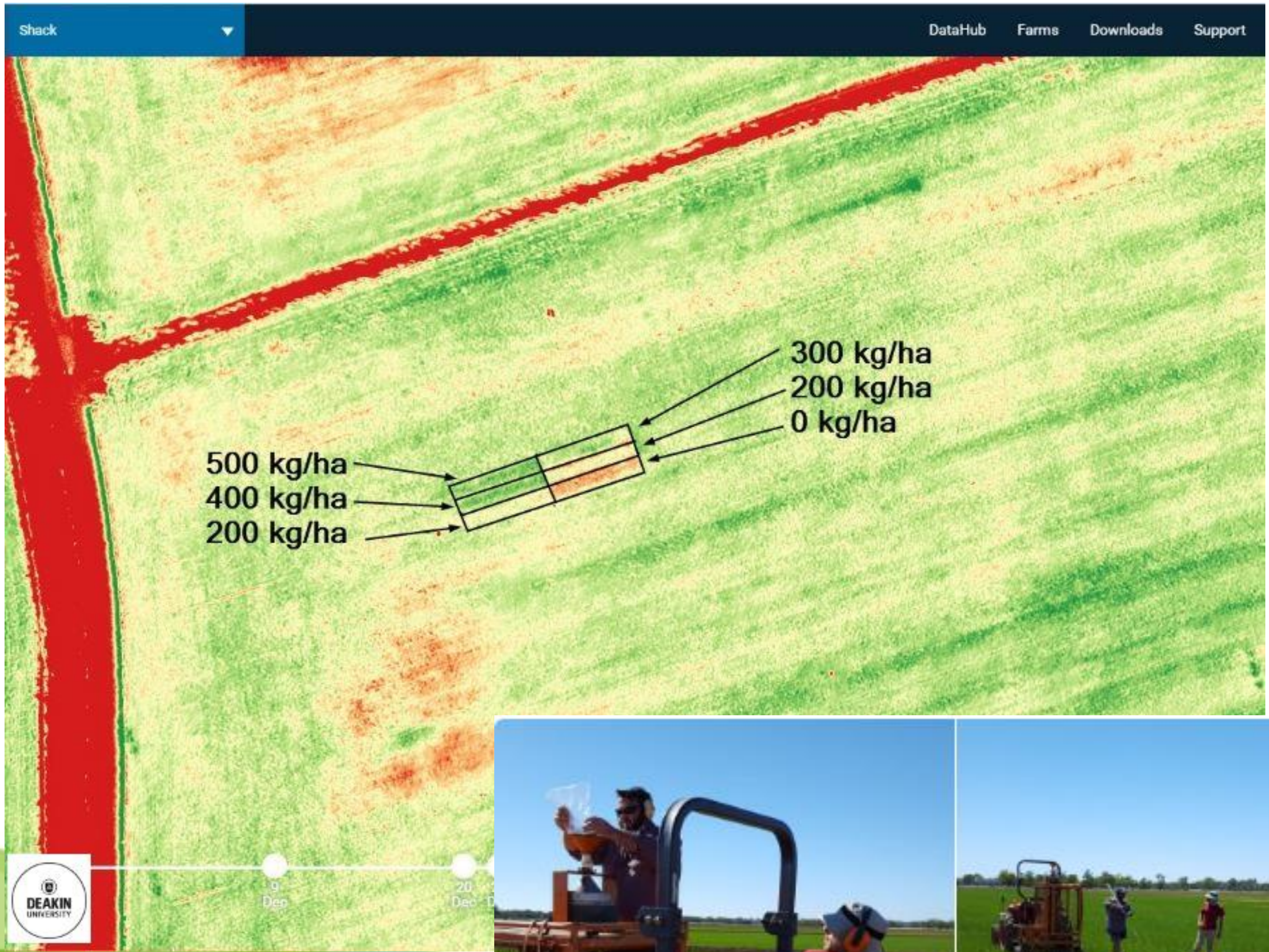
Inoue, Yoshio, et al. "Diagnostic mapping of canopy nitrogen content in rice based on hyperspectral measurements." Remote Sensing of Environment126 (2012)

R^2 of canopy nitrogen content



WHAT'S IT LOOK LIKE?

UREA RATES VS NDRE



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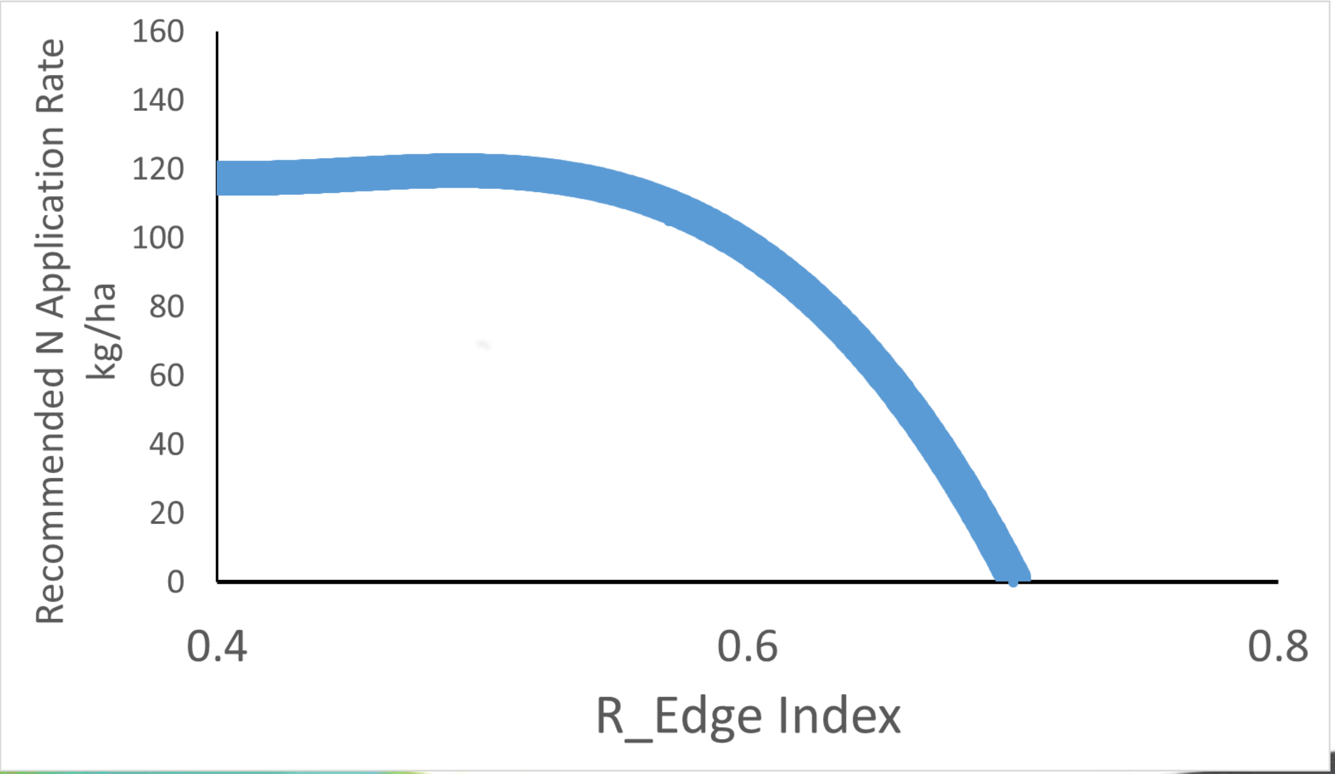
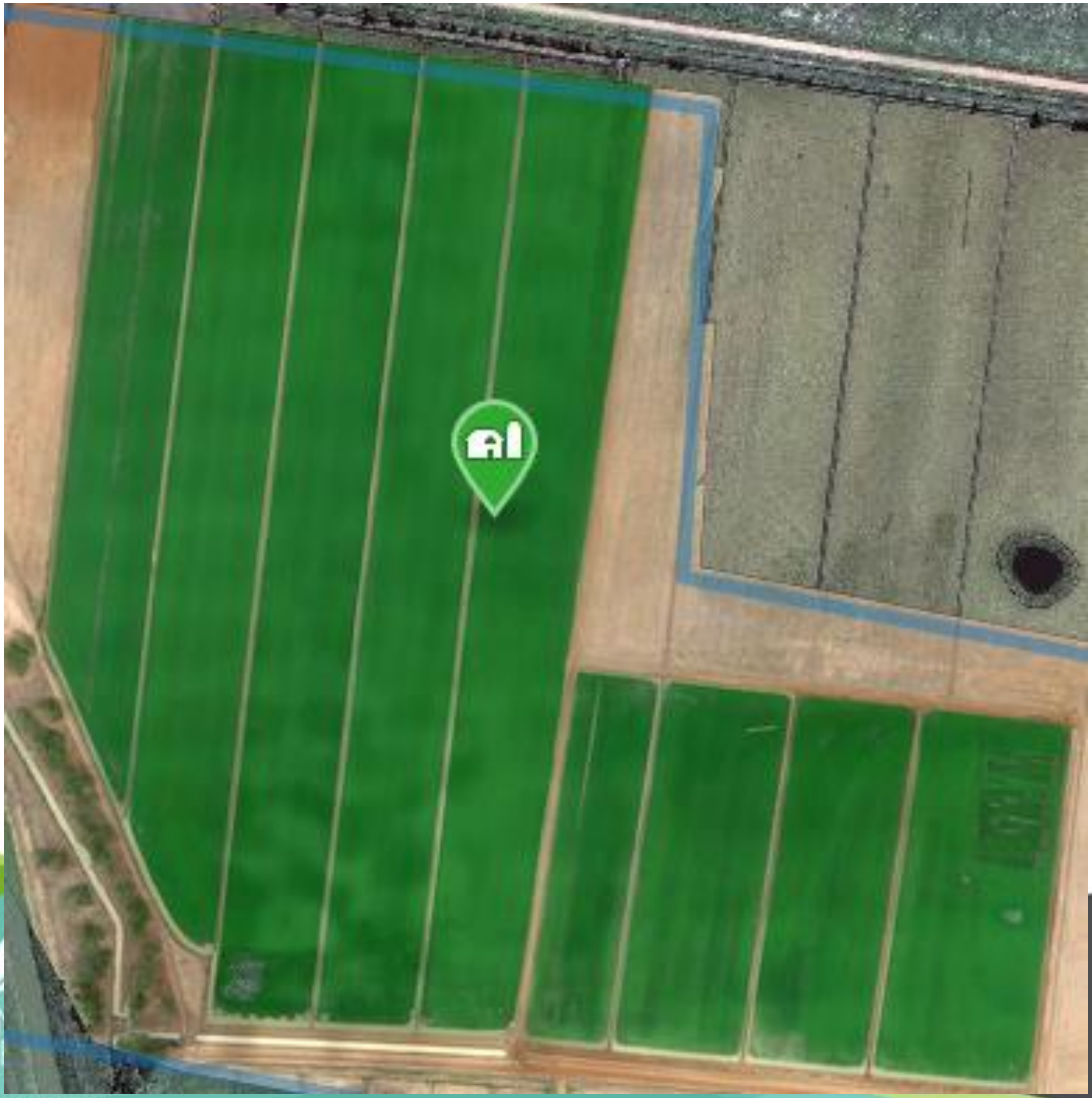
N TOPDRESSING IN RICE

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



RICE: OPTICAL AT 5TH JANUARY



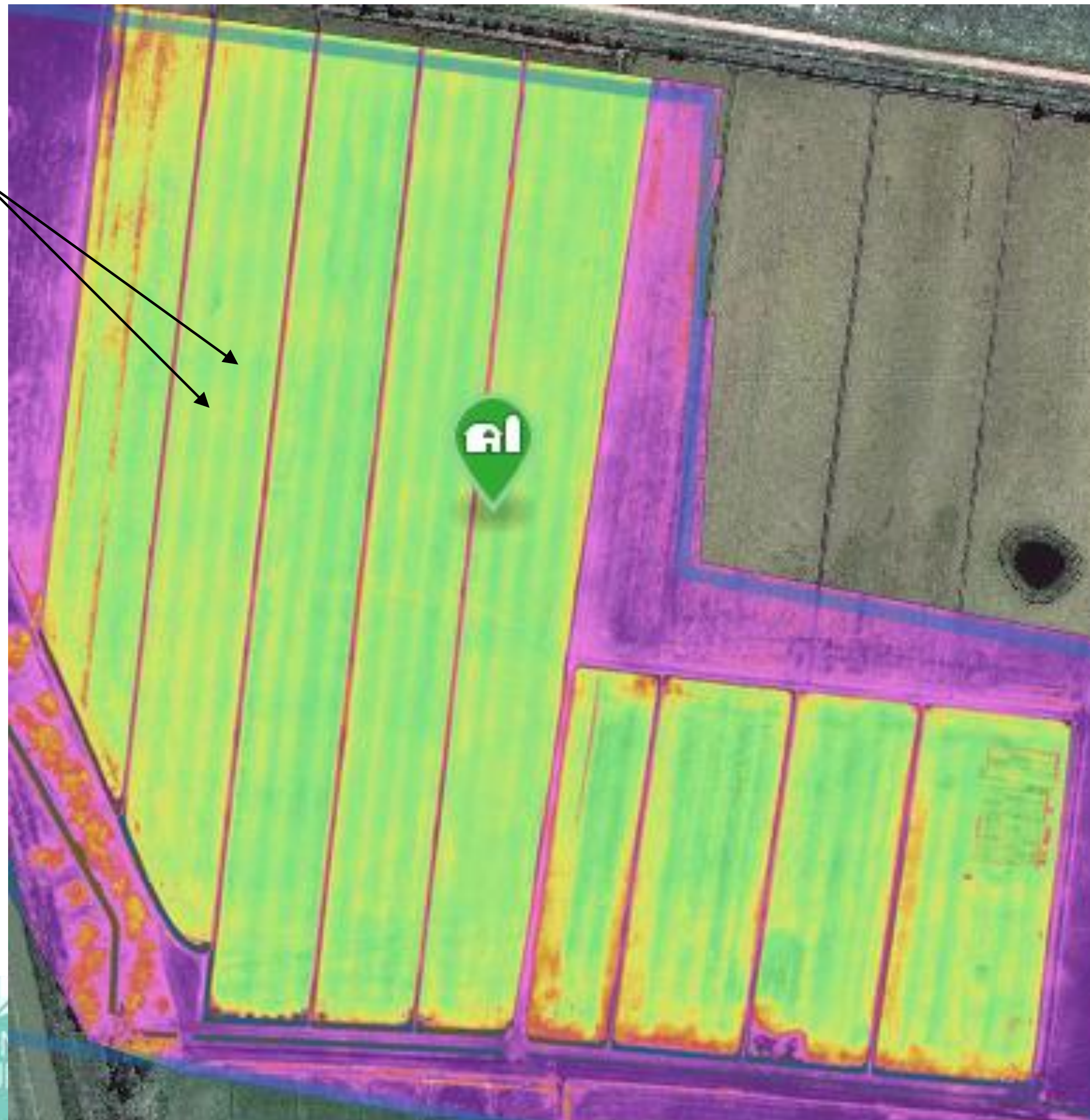
RICE: NDVI AT 5TH JANUARY

RICE: NDRE AT 5TH JANUARY

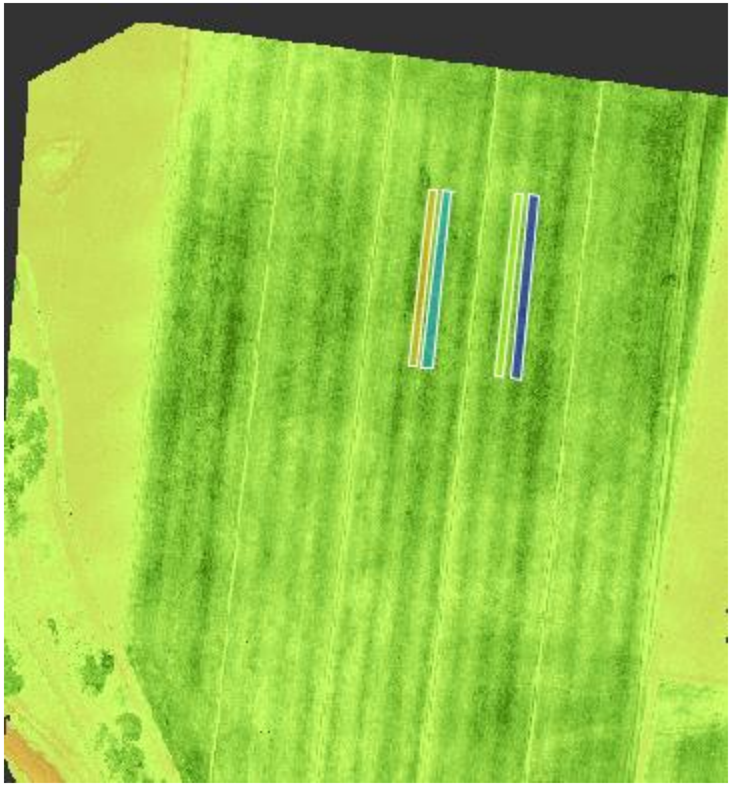
N top dress issues – vertical lines from spreader non-uniformity.

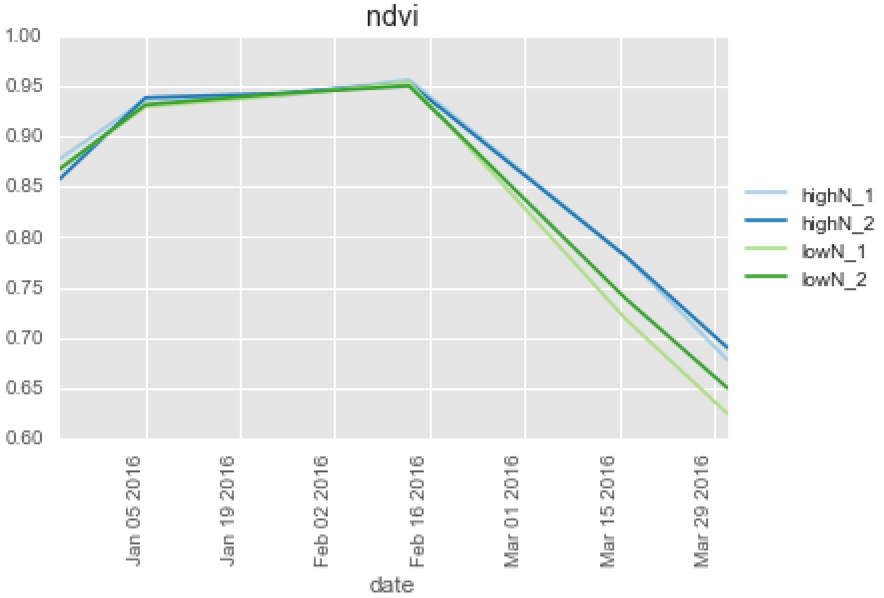
Couldn't see this with satellite – too fine resolution.

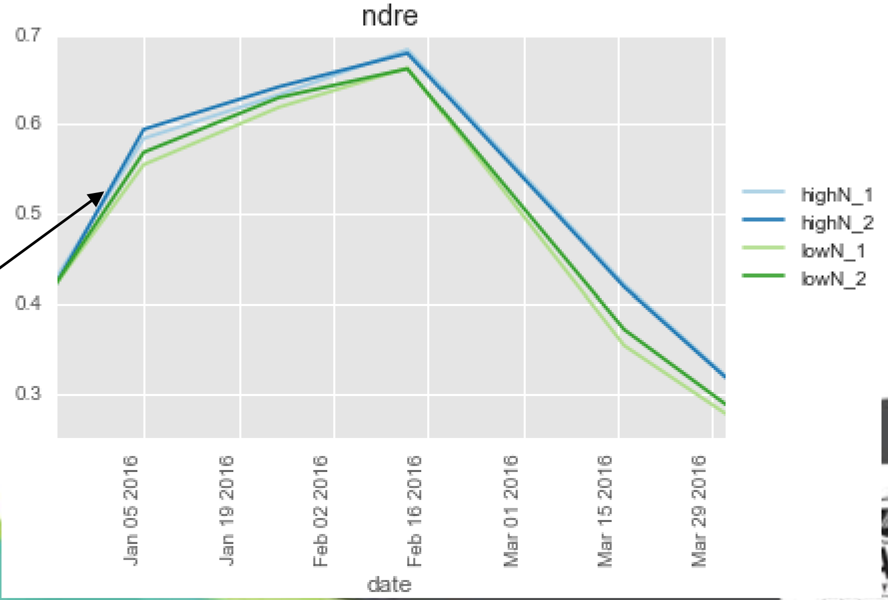
Q: How early in the season does this show up?



NITROGEN APPLICATION VARIABILITY



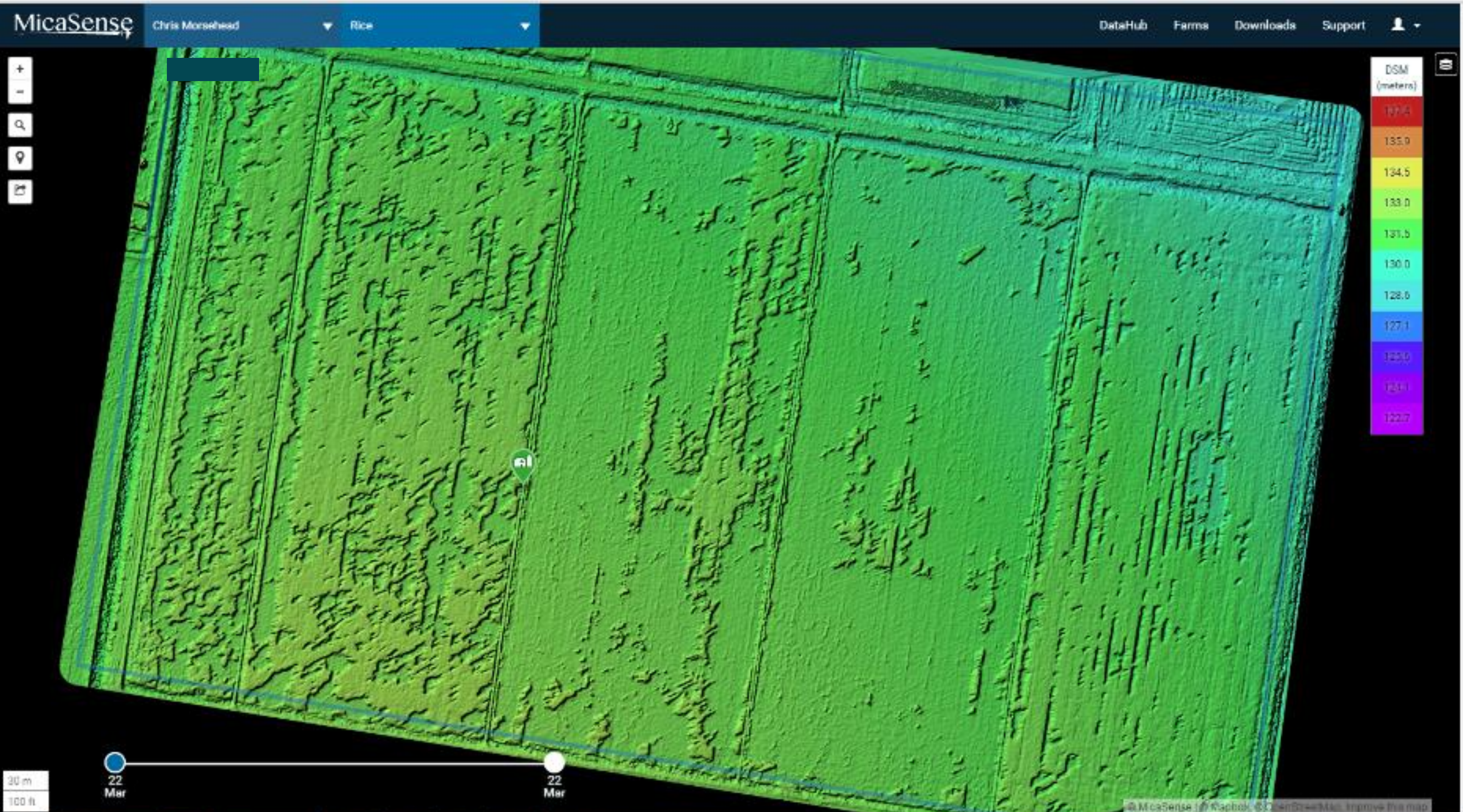




NDRE able to indicate N deficiency earlier in the season

LODGING

- Elevation profile provided by orthomosaic process
- Can indicate crop lodging, plant height



IMPACT OF LAYOUTS/FERTILISER ON MATURITY

THERMAL ON DRONES

- Previously very expensive but costs have rapidly reduced

- Low resolution thermal drones like Parrot ANAFI & DJI MAVIC 2 now available ~ $3000

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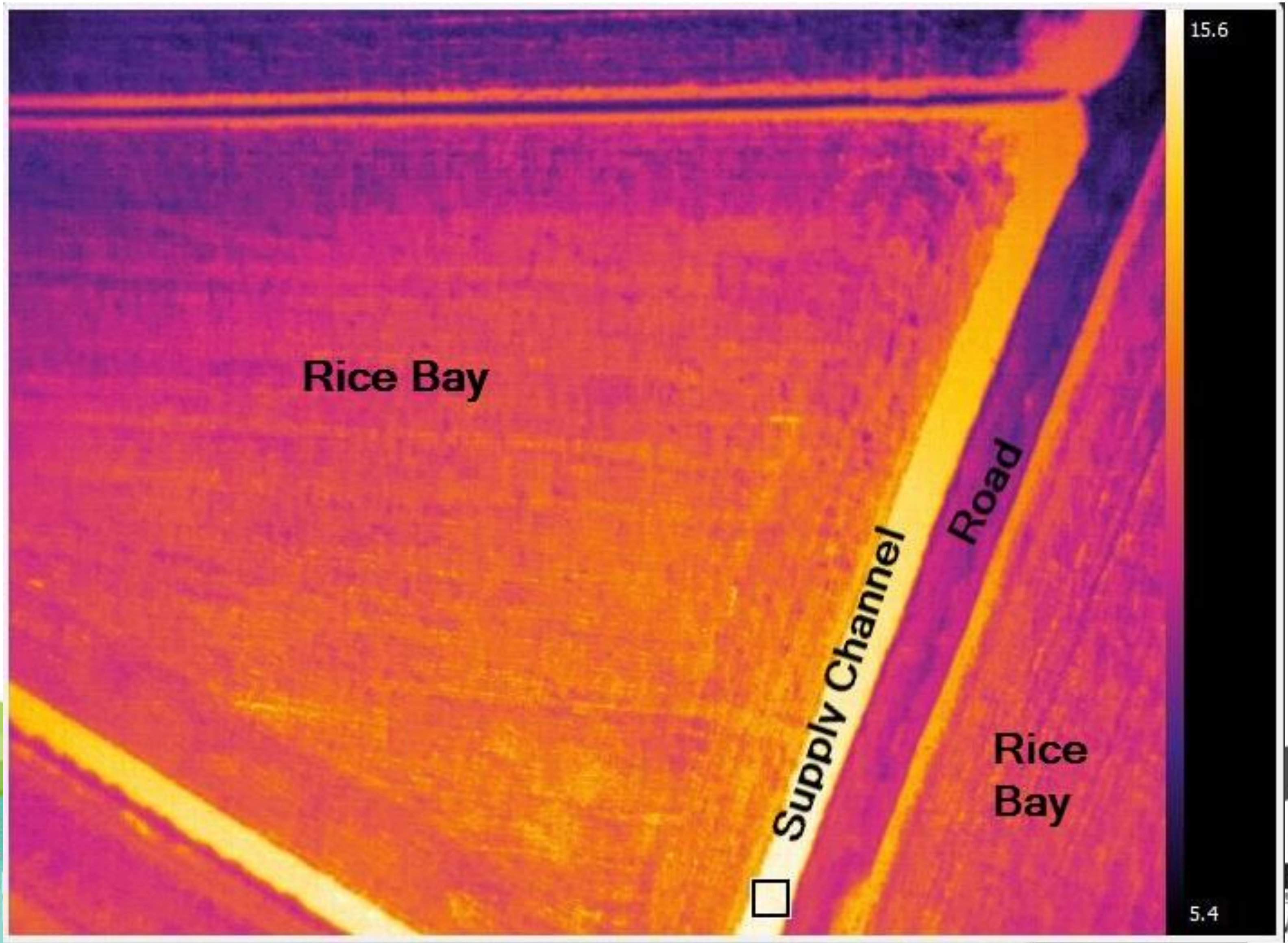
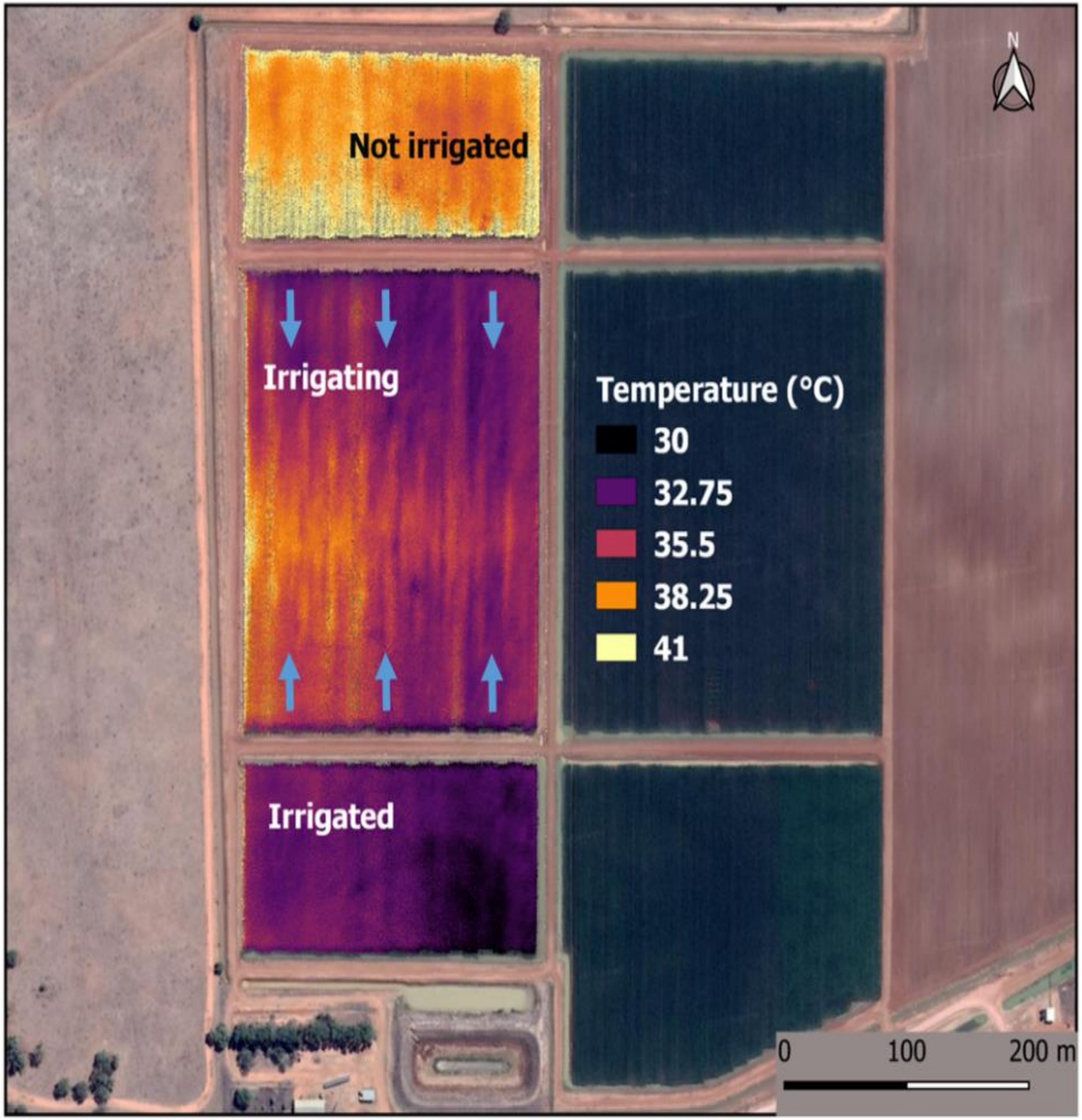
THERMAL+MULTI-SPEC - MICASENSE ALTUM

- integrates a **radiometric thermal camera** with **five high-resolution narrow bands**, producing advanced thermal, multispectral and high-resolution imagery in one flight for advanced analytics.

THERMAL – IDENTIFYING IMPACTS OF IRRIGATION LAYOUTS



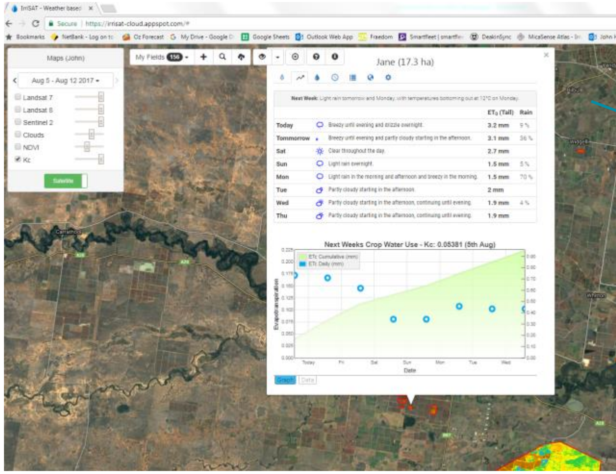
THERMAL


N
Not irrigated
Irrigating
Irrigated
Temperature (°C)
30
32.75
35.5
38.25
41
0
100
200 m

FUTURE WORK

SMART AUTOMATION

7-14 day forecasts

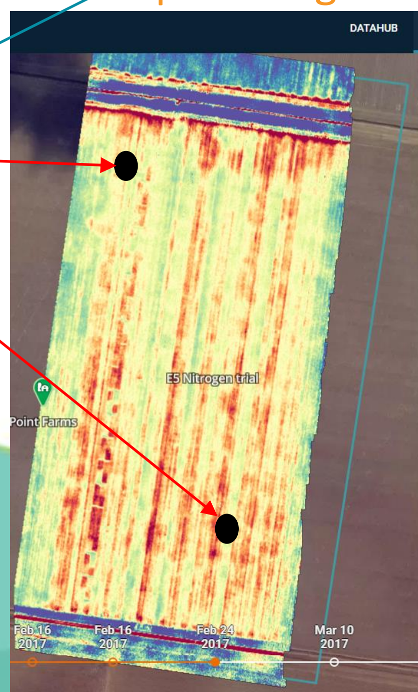


Water Infrastructure/ SCADA

Online monitoring and optimal water control algorithm

Real-time sensing of soil, crop & climate

Crop sensing



Smart control structures (IoT)

Autowinch Seasonal

/ PRODUCTS / AUTOMATION / AUTOWINCH / Autowinch Seasonal

Autowinch Seasonal

$1,580.00 Excluding

1 Add to cart

Categories: Automation, AutoWinch

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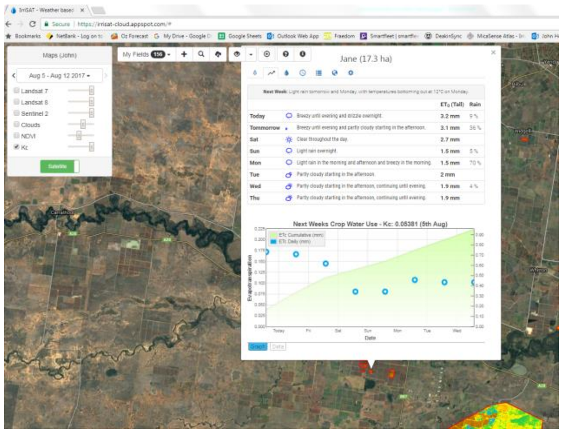
Why smart control and automation

Significant periods where cold protection is not an issue and can be forecast. Water use can be reduced during these periods.



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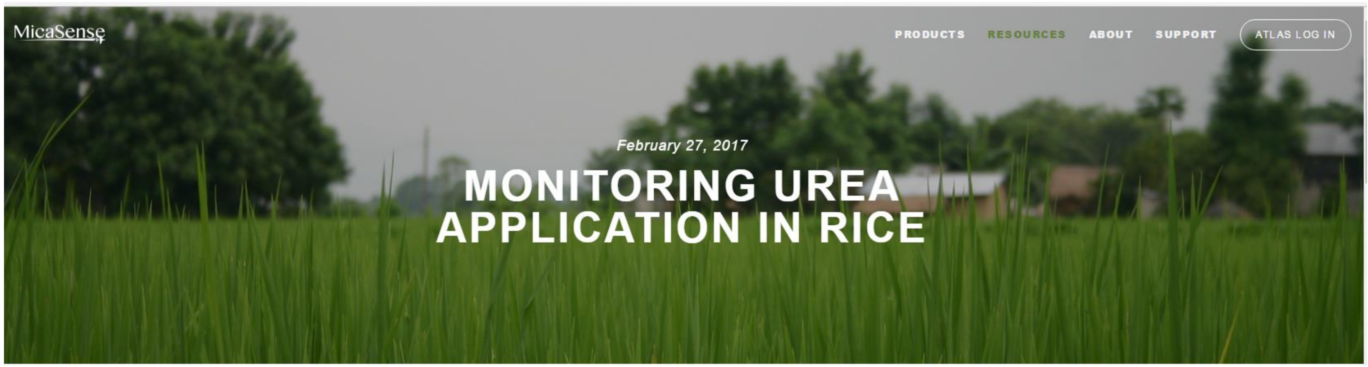
SUMMARY

- Water and labour scarcity are key issues
- Tools and systems to monitor and manage will be critical in future
- Quality data can be collected at ever-reducing cost, and without specialised training using remote sensing approaches
- Spatial and temporal data can provide quick insights to identify on-farm areas and characteristics that warrant better management
- Smart control and automation with good feedback loops will be key tools needed to ensure profitability

FURTHER INFO

https://irrisat-cloud.appspot.com

https://www.micasense.com/case-studies/2017/2/21/monitoring-urea-application-in-rice



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THANK YOU

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