



Using next generation spatial technologies to advance knowledge of grassland curing

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Grassfires are an annual risk in Australia

They are fast moving and can be very destructive

Example: On 25 Nov 2015 the Pinery fire in S.A. burnt 90,000 hectares in an afternoon



Grassland Curing

Annual grasses grow in spring and gradually senesce or wither during the summer

This process is referred to as **Grassland Curing** and is an important factor in grassfire behaviour.



Grassland Curing affects fire behaviour

The ratio of live-dead material (curing) can have a dramatic effect on fire behaviour.

These two fires differ in the amount of curing

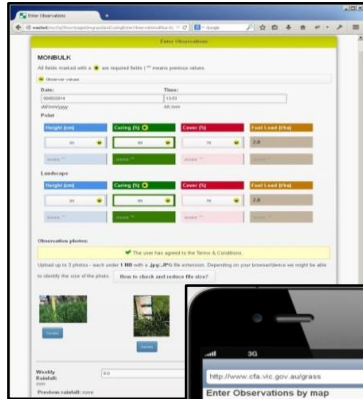


40% Cured



100% Cured

The Country Fire Authority of Victoria (CFA) create grassland curing information products.



Select Location

Select a location to enter values, you can also type in the white box below to filter this list of locations.

Observer | Validator | Administrator

Type here to filter locations...

- BENDIGO (2)**
90 | [Icons] | 90
- CARLSRUHE (2)**
90 | [Icons] | 90
- CLARKEFIELD (2)**
80 | [Icons] | 80
- DARRAWEIT GUIM (2)**
90 | [Icons] | 90
- GOORONG (2)**
90 | [Icons] | 90
- HARCOURT (2)**
90 | [Icons] | 90
- HEATHCOTE (2)**
60 | [Icons] | 60

Enter Observation Map

Back

Enter Observations by map

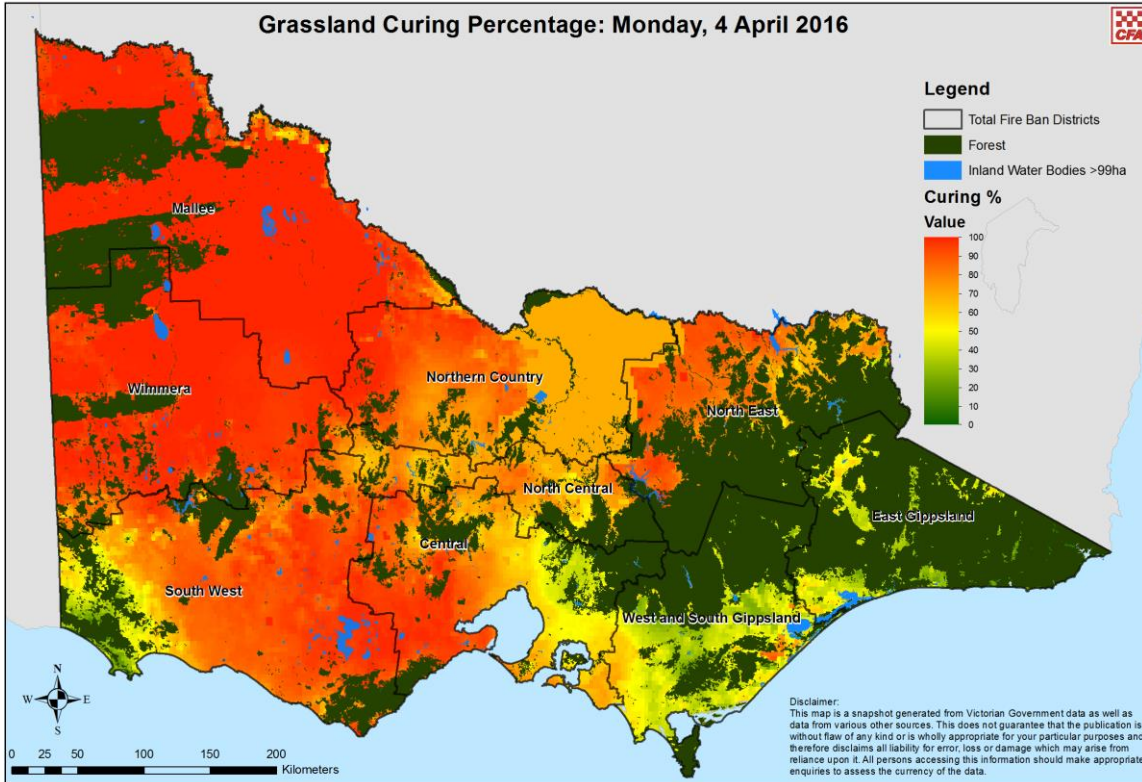
Select a location to enter the grassland height, curing and cover values.

146.85065, -36.84971

No data entered: [Red pin] | Observer data entered: [Yellow pin] | Data validated: [Green pin]

Curing estimates collected from a network of volunteers on a weekly basis

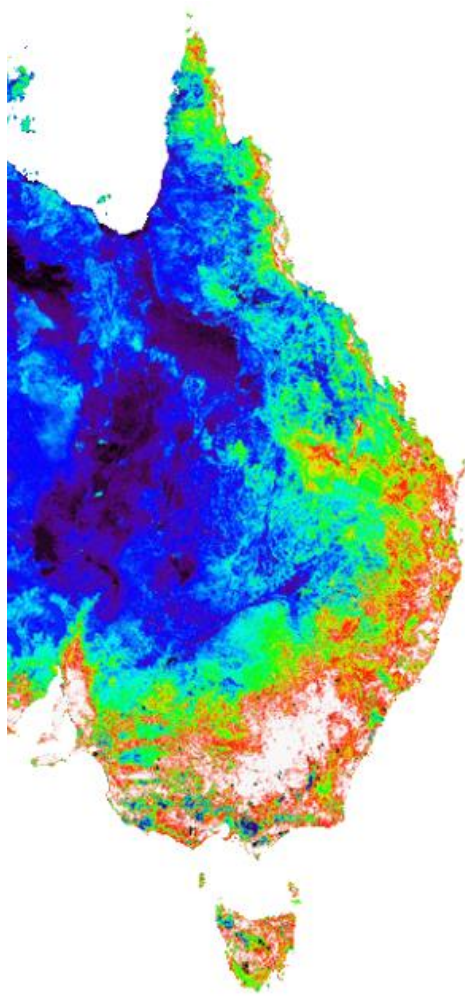
Grassland Curing Map



Observer data are combined with satellite imagery to create digital spatial curing products.

Curing is an input into:

- Fire Restrictions
- Total Fire Ban declarations
- Fire spread models



CFA expands curing product coverage

During the 2014-15 summer CFA commenced creating curing products for the eastern coast states.

With many new landscapes and ecosystems to monitor CFA looking for alternative methods to establish baseline data sets in these areas.

RISER



Resilient Information Systems for Emergency Response

- A research collaboration centred at the University of Melbourne
- RISER is developing new technologies and information systems capable of capturing, collating, and communicating timely and relevant emergency information
- Developing sensors and sensor networks

Grassland curing Needs analysis workshop



October 2014 workshop attended by CFA, CSIRO and RISER

- Assess potential of UAV to support research into estimation of grassland curing
- Supplement current CSIRO fixed sensor research at Scoresby
- Investigate practical issues of Unmanned Aerial Vehicle derived image collection



The team



Organisation	Task
RISER	Project management
	Field data collection
	Curate UAV image and field data library
Country Fire Authority	Advice, guidance
	Access to sites
	Field data collection
Think Spatial	Provide UAV and pilot
	Image processing
CSIRO	In-situ fixed cameras

The task



To capture and process a multi-date, multi-site, colour, infra-red and Normalised Difference Vegetation Index (NDVI) image collection from a UAV platform in conjunction with ground observations

The sites



Moorooduc:

- 11 paddocks
- Mixed land use

Scoresby:

- 1 paddock
- 5 fixed CSIRO Sensors

Murrayville:

- 2 sites
- Wheat/pasture and Mallee scrub



The UAV platform



“eBee” from senseFly

- Owned and flown by Think Spatial
- eBee had Colour and Infrared cameras
- Imagery processed to produce three vegetation indices including NDVI
- All flights completed in December, 2016

The imagery



Subaru

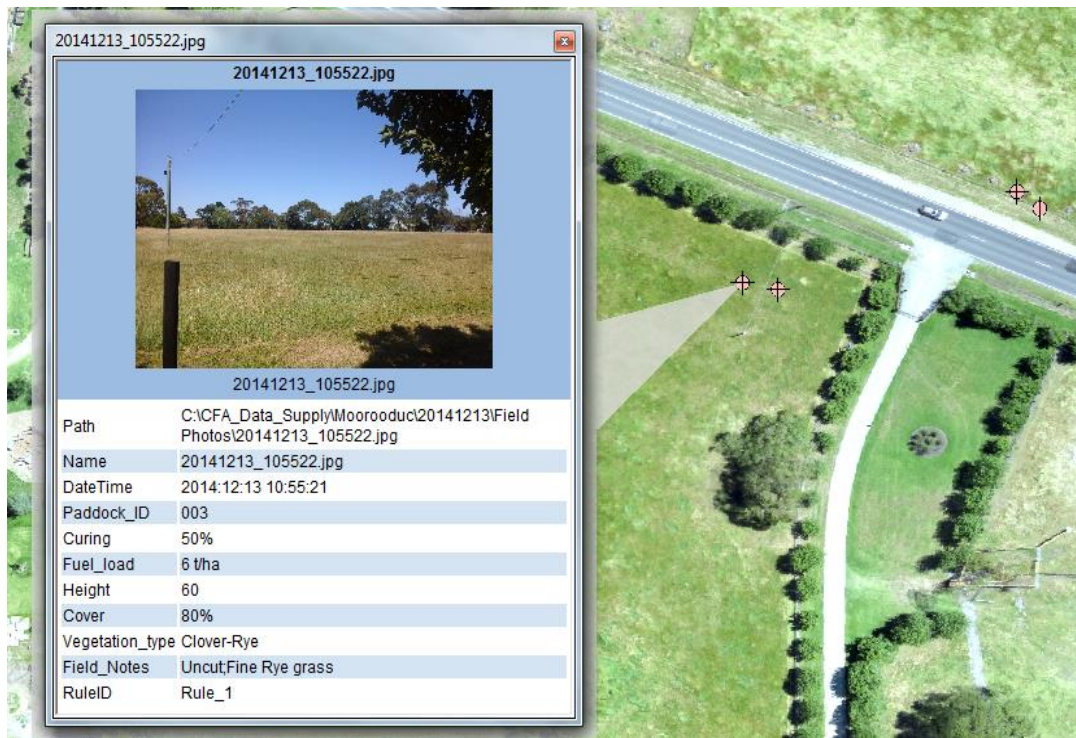
Incredible detail

Subaru
windscreen

Pixel resolution 3.5 cm

Subaru side
mirror

Field data and imagery combined

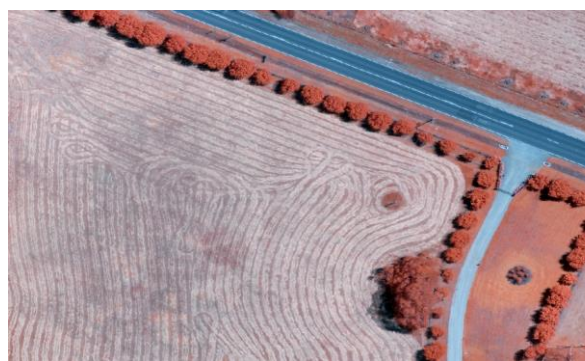


- Date and time
- Paddock ID
- Geo-referenced photos
- Curing estimate
- Fuel height estimate
- Fuel type description
- Activity comments

Results: Imagery



13th December, 2014

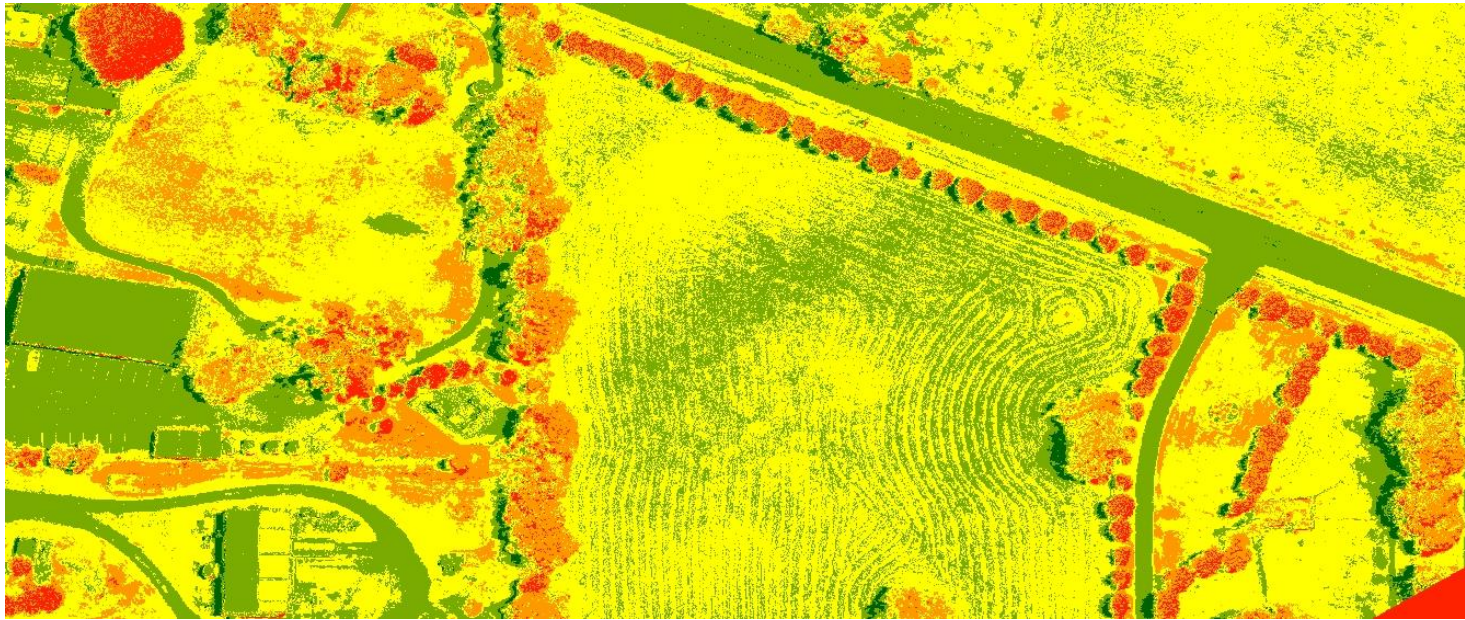


28th December, 2014
Cut for hay

Results



Processed NDVI image



Results



CSIRO sensor at Scoresby



Matching UAV image

CFA collected physical samples

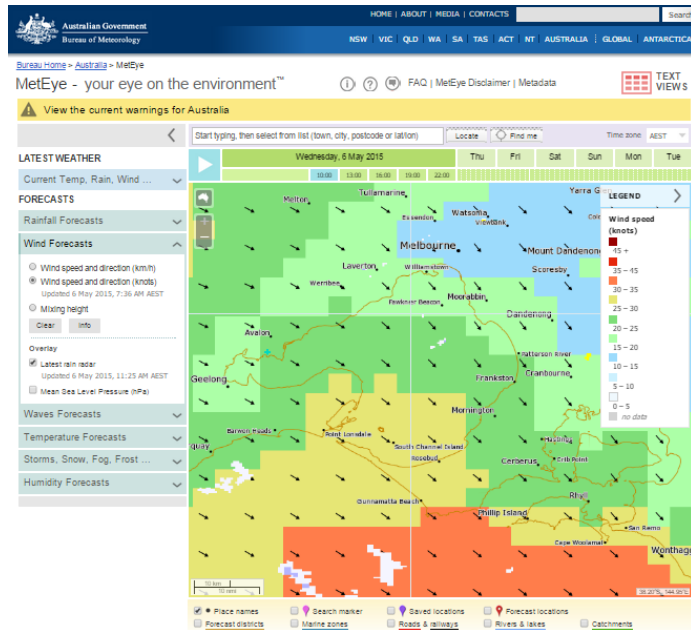
Operational Considerations



Dual cameras, dual flights

- Vegetation indices typically need red and near-infrared wavelengths
- 2014 flights required 2 cameras
- Leads to dual flights at different times – typically 45 minutes apart
- Cloud shadows
- Perhaps vegetation reflectance's are affected

Operational Considerations



Weather restrictions

- Wind operating limits about 25 km/hr
- Cloud free is best
- Obviously need to avoid rainy days
- Even in a Victorian summer this became quite restrictive as to available dates

Source: www.bom.gov.au

Operational Considerations



Batteries and backup



- As wind increased power usage increased quickly
- Needed spare batteries and a portable charging system
- Caused delays between some flights while batteries were re-charging

Operational Considerations



Pilots, accreditation, CASA

- Each company needs a Chief Pilot
- Pilots need to be trained and accredited
- If you purchase a new model .. need to be re-accredited
- Approvals required from CASA to fly within 6km of an airport
- Need approval to fly near built up areas

Operational Considerations

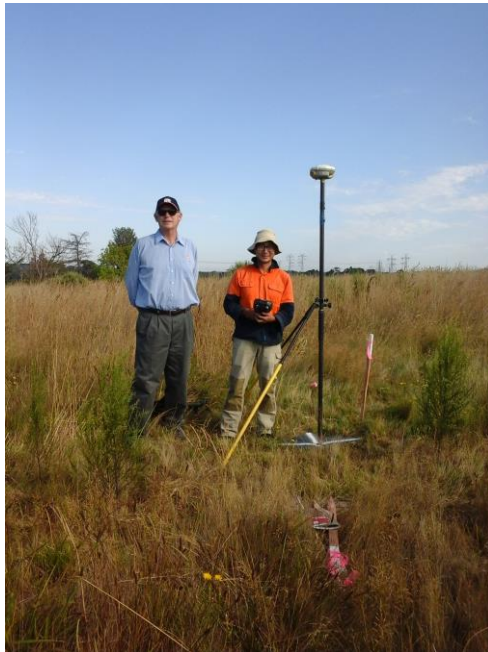


Image registration and spatial accuracy

- Need ground control points or alternative means to assist with image processing and rectification
- Absolute horizontal/vertical accuracy about 2cm
- Need spatial skills to obtain accurate results

Operational Considerations



Eagle and hawk attacks



- CASA requires that the pilot keeps visual contact with the craft
- Some estimates are that 1 in 5 flights in rural areas are affected
- Think Spatial's e-Bee taken out by an eagle during it's last Moorooduc flight and had to be repaired in Switzerland

Operational Considerations



Advantages of using a UAV



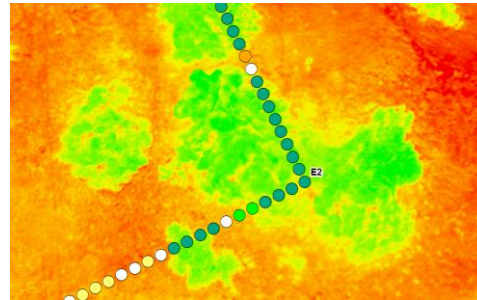
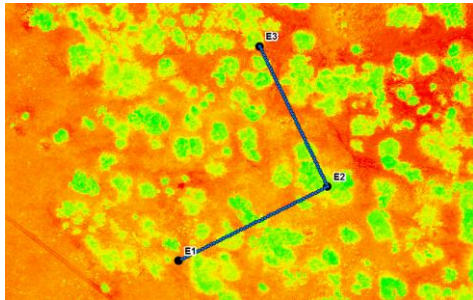
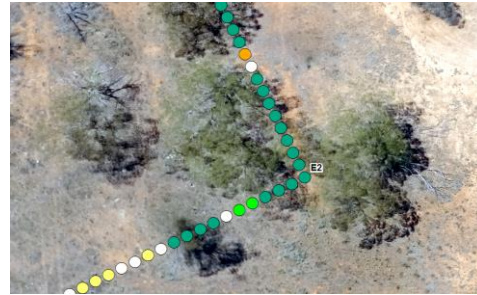
- The ability to fly small areas between weather events in order to acquire useful imagery especially when pasture conditions are changing rapidly
- When early season crops and pastures have significant soil exposure they can be masked out
- Low cost and high resolution of the system as compared to aircraft borne imaging

Second season - Murrayville



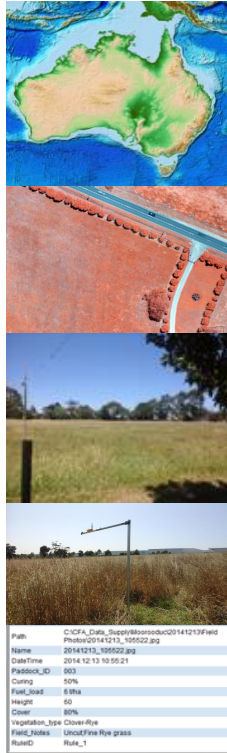
- Follow up project CFA and RISER agreed to collaborate in collecting a second series of images and field data in the Mallee region of Victoria.
- Objective: to provide greater accuracy for CFA as it expands the geographic coverage of its curing estimates across south-eastern Australia

Results



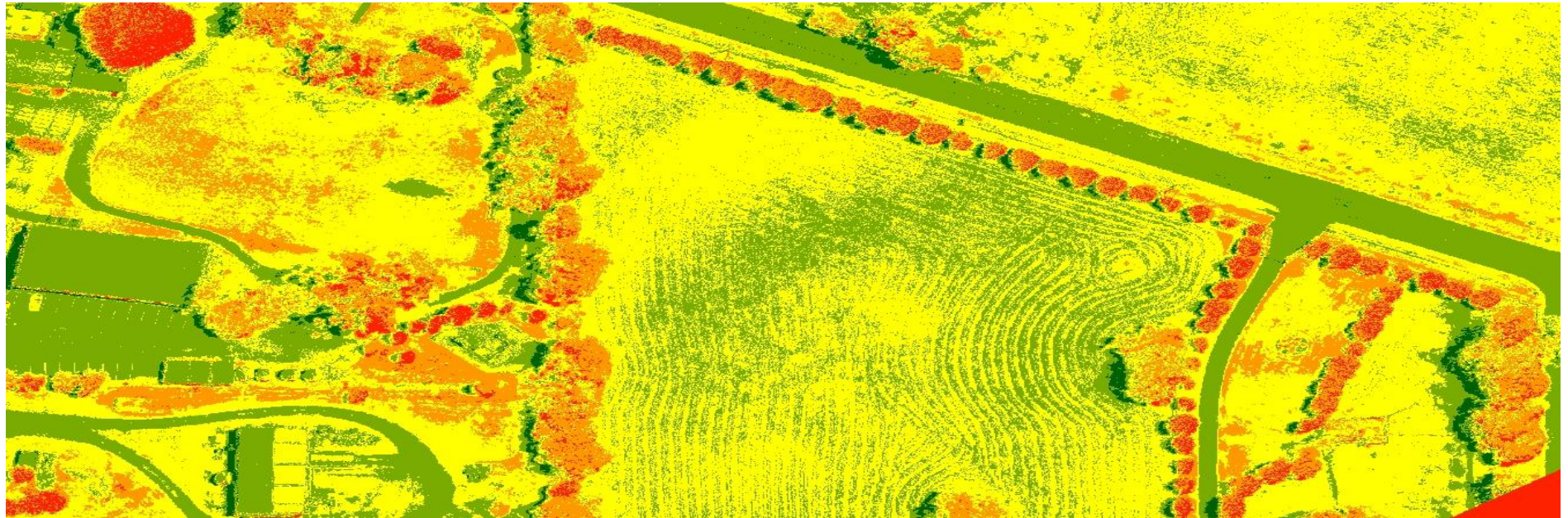
- Again, highly detailed imagery and field data supporting ongoing research by CFA
- Five tiers of data available to study grassland curing processes .. Satellite, UAV and fixed camera imagery, field photos and field observations

Results



- Five tiers of data available to study grassland curing processes .. Satellite, UAV and fixed camera imagery, field photos and field observations
- Established operational benchmarks for operating UAV to support grassland curing research

Thank you





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[Hawk attack](#)