Remote Sensed Mapping of Fire Severity in the Tropical Savannas of Northern Australia

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bushfire CRC

BUSHFIRES NT

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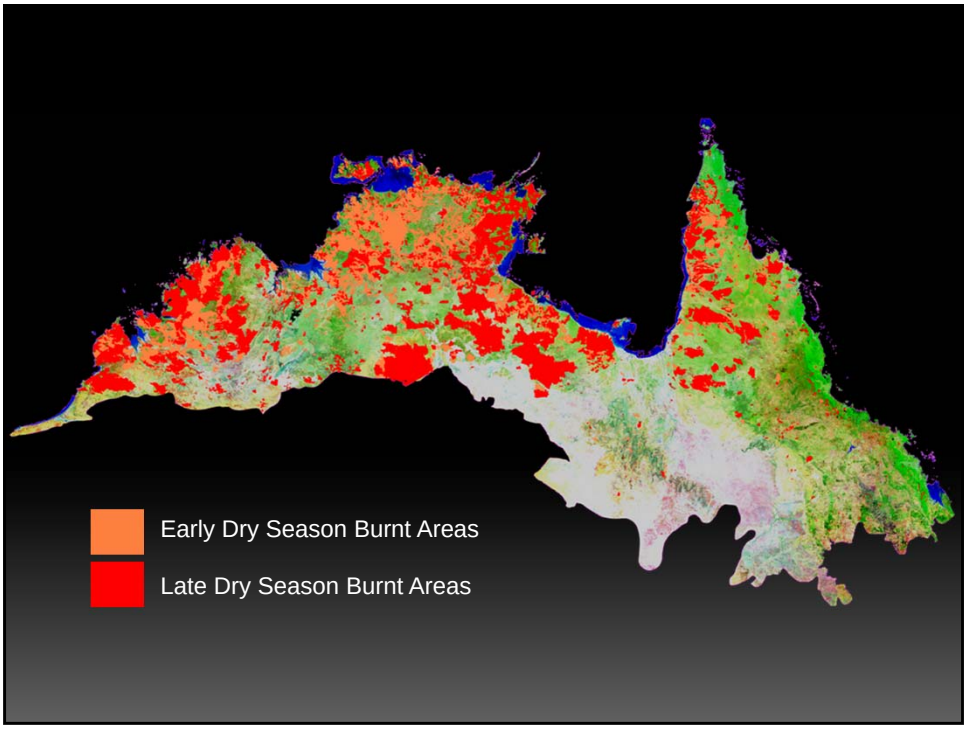
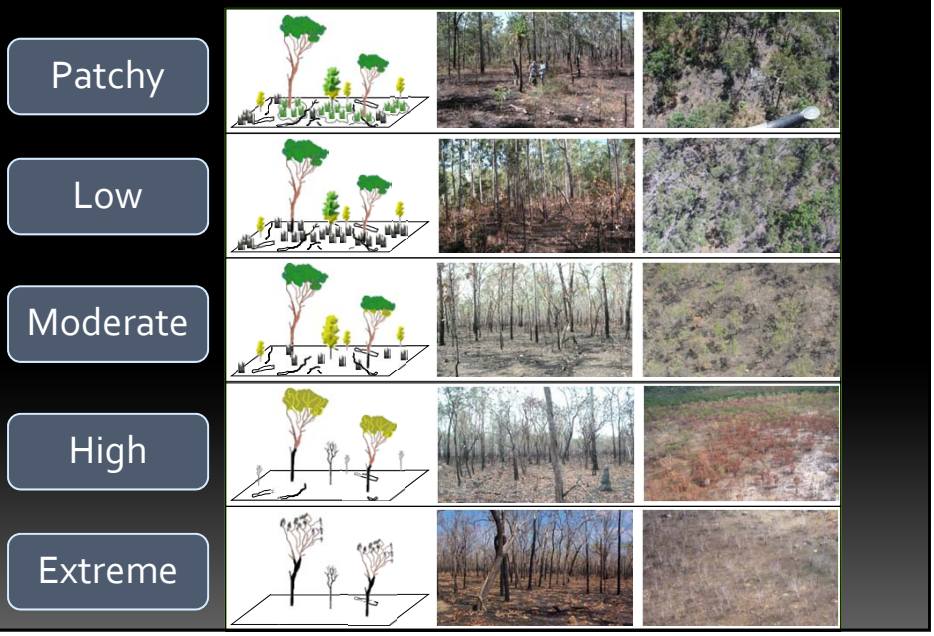


- Fire severity is a measure of the post-fire affect of fire on the vegetation.
- Fire Intensity is a measure of the energy released by a fire, usually measured in kiloWatts per linear metre.
- Burn severity is a post-fire measure of the time taken to reach a preferred state.

FIRE SEVERITY CATEGORIES FOR THE TROPICAL SAVANNA WOODLANDS OF NORTHERN AUSTRALIA

Simplified models of fire severity

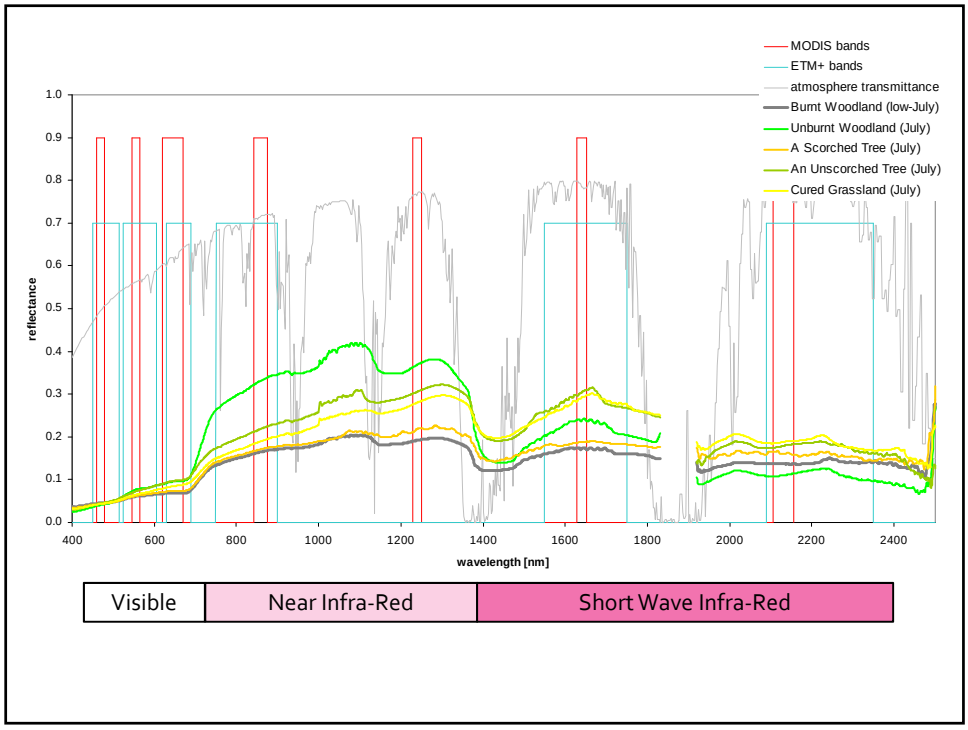


Methods:

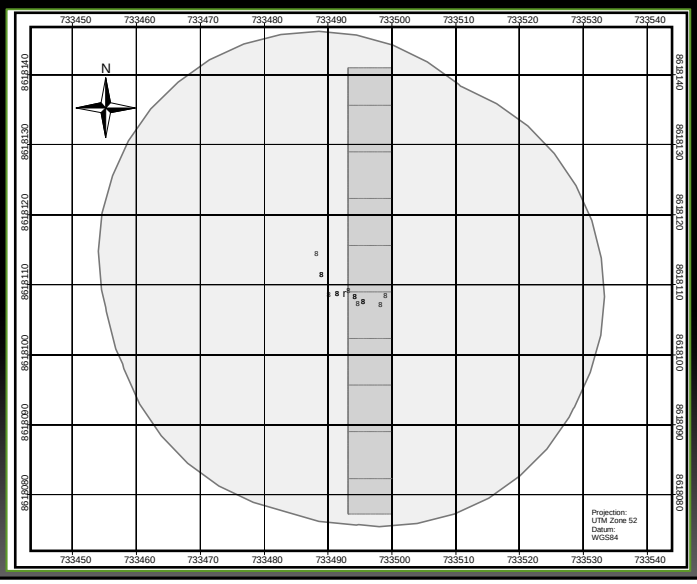
Collecting spectra†

† A remote sensing term that means EM energy or perhaps light


R44
Raven I
2000


MODIS bands
ETM+ bands
atmosphere transmittance
Burnt Woodland (low-July)
Unburnt Woodland (July)
A Scorched Tree (July)
An Unscorched Tree (July)
Cured Grassland (July)
reflectance
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
wavelength [nm]
Visible
Near Infra-Red
Short Wave Infra-Red

Site 2: 12th May 2008
Illustrates the position of the 10 GPS points,
the average waypoint at the centre of the sampled area
within the pixeloid sampled by the spectrometer.



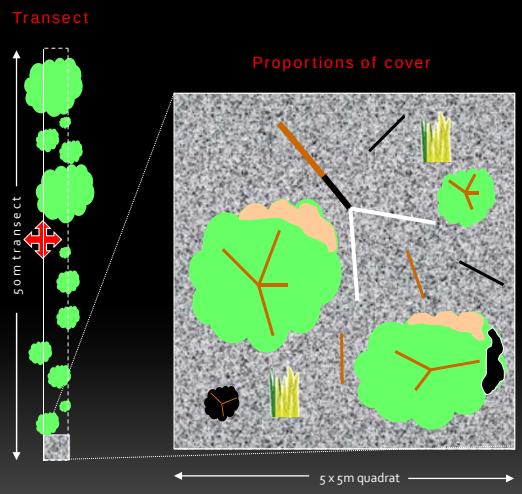
Methods:

Collecting spectra

Collecting Ground Data †

† the real stuff

Methods

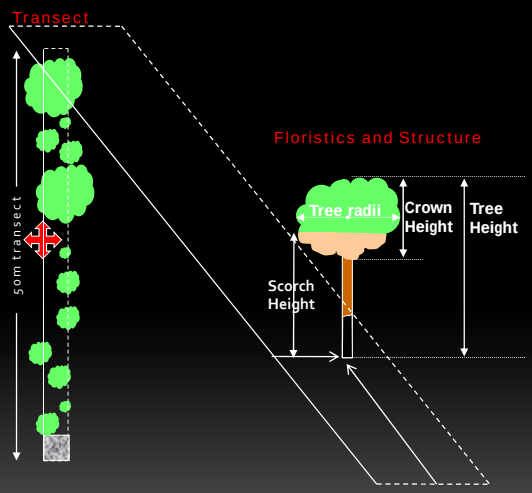


GROUND MEASUREMENTS

Collected at the same GPS point

Describing proportions of cover of the various fire affected or unaffected phenomena in various strata

Methods

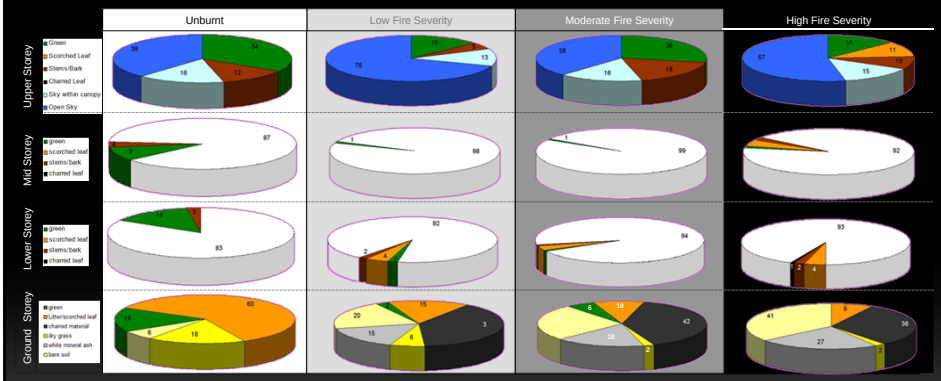


GROUND MEASUREMENTS

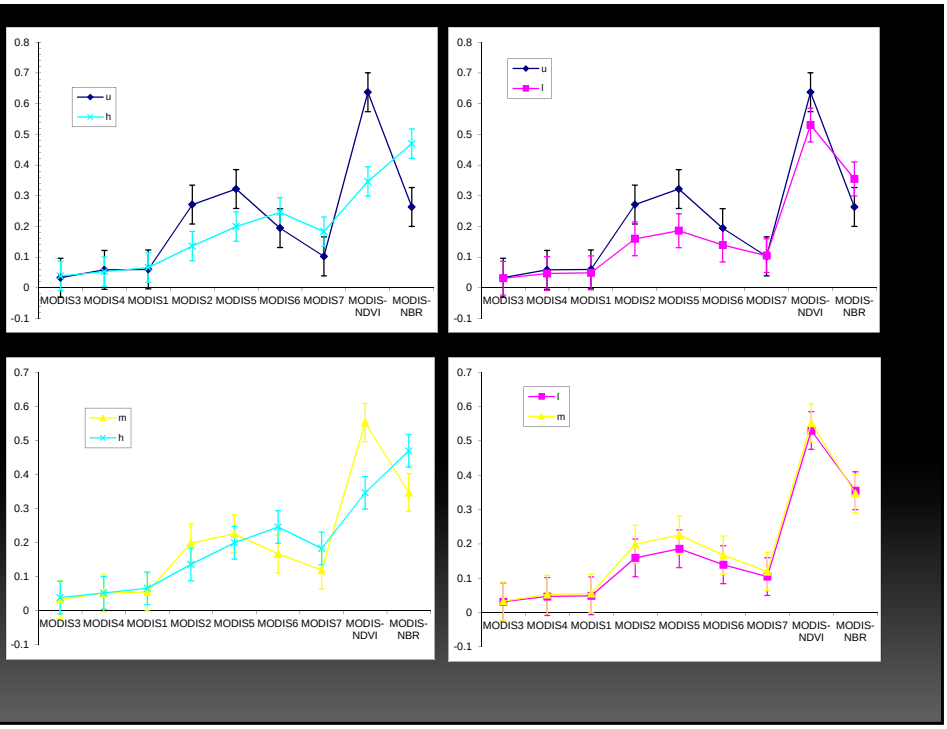
Collected at the same GPS point

Describing stand structure

The proportions of each variable within each fire severity class for each stratum



Groups of sites, H_0: samples are drawn from normally distributed populations with equal means and variances



Results

Field Spectra:

Severe *v* not-Severe	Low *v* Moderate *v* High
The Normalised Burn Ratio (NBR)	MODIS Channel 6
	MODIS Channels 2, 5 and 7

Models derived *a priori*
and assessed using AICc from 50 sites

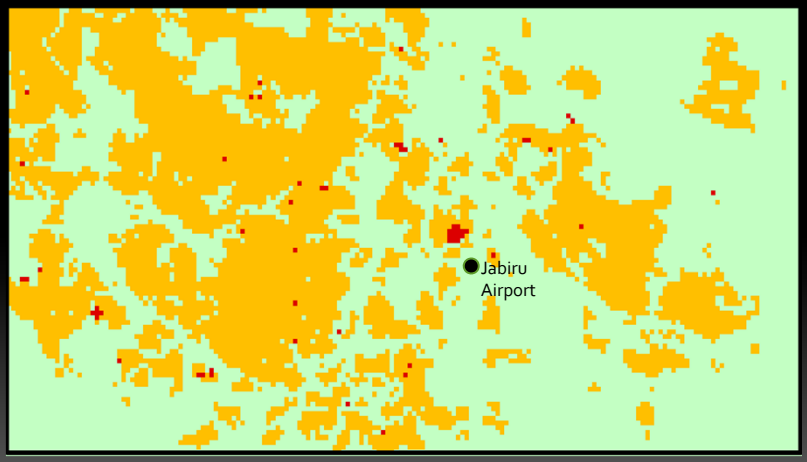
Results

on the ground:

DOES NOT indicate Fire Severity	DOES indicate Fire severity
The amount of Charred material (blackened)	The amount of Ashened material (whitened)
The amount of Green material (photosynthetic vegetation)	The amount of non-Green & Green plant material (non-photosynthetic and photosynthetic vegetation)

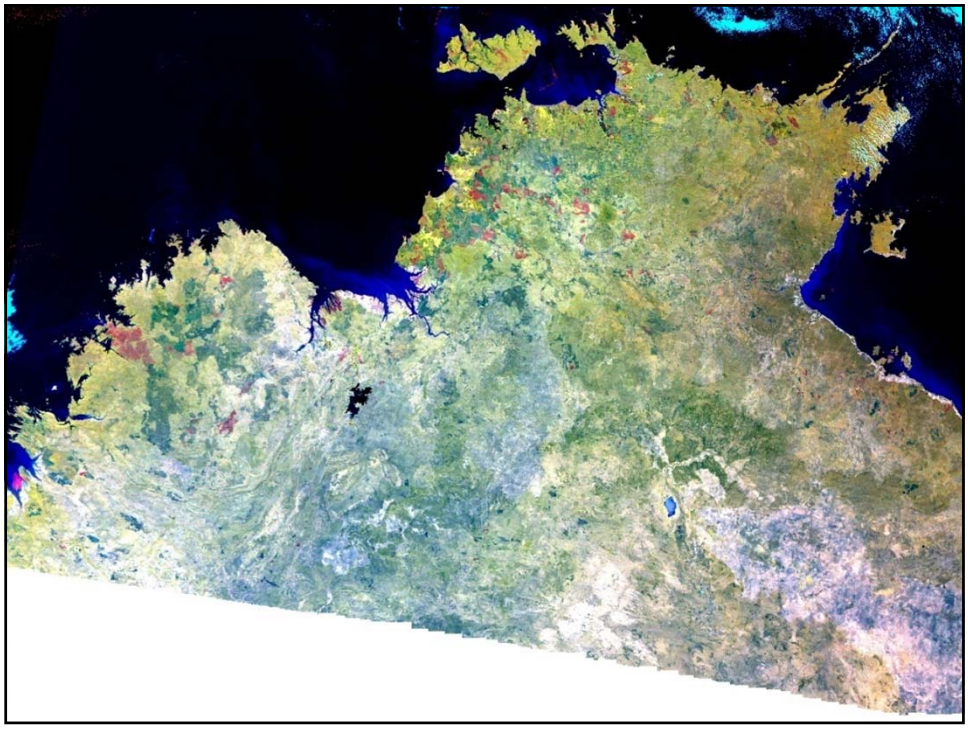
Application

Binary Fire Severity Map of subset area
in Kakadu National Park/west Arnhem Land



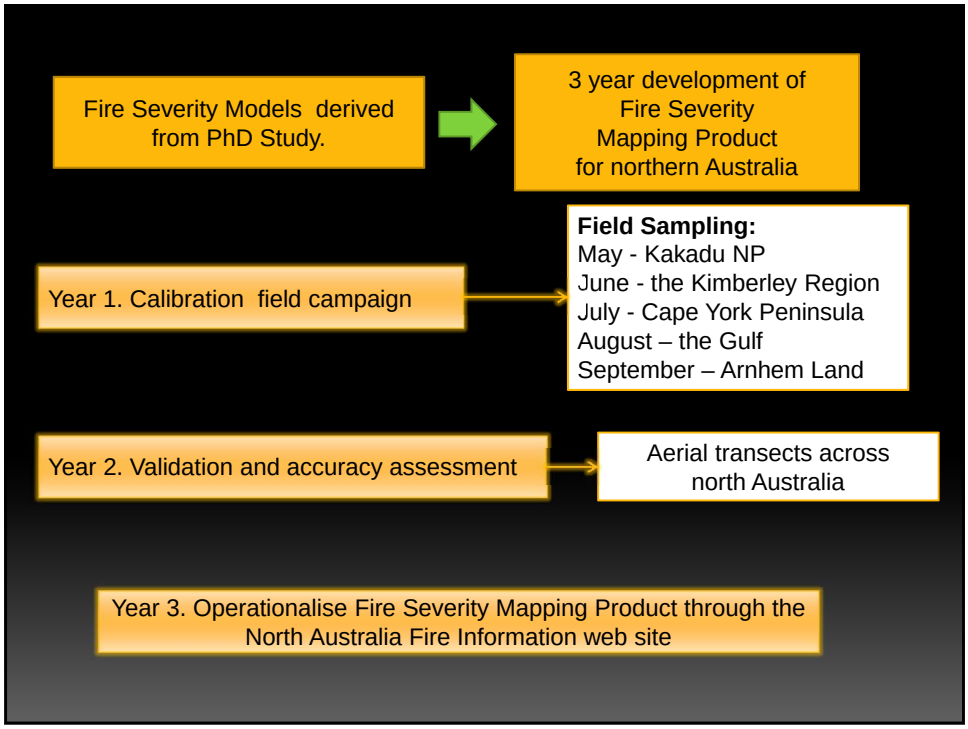
Results

Model	Accuracy assessment
Δ NBR	Distinguish between Severe and not-Severe fires accuracy = 94%
Δ Band 6	Distinguish between Low and Moderate Severity Fires, however the difference appears to vary through the fire season overall accuracy = 50%
Δ (Bands 2, 5 and 7)	Distinguish between Low and Moderate Severity Fires, however the difference appears to vary through the fire season overall accuracy = 70%



CRC Project:

- 3 year project – commenced late 2010
- Calibration a model for tropical savannas
  - various main habitats
- Ongoing validation is required including end-user feedback


Fire Severity Models derived from PhD Study.
3 year development of Fire Severity Mapping Product for northern Australia
Year 1. Calibration field campaign
Field Sampling:
May - Kakadu NP
June - the Kimberley Region
July - Cape York Peninsula
August – the Gulf
September – Arnhem Land
Year 2. Validation and accuracy assessment
Aerial transects across north Australia
Year 3. Operationalise Fire Severity Mapping Product through the North Australia Fire Information web site


The main requirements of a fire severity map:
Conservation planning

Small patchy fires are important for fauna

with small home ranges.

Rabbit Eared Rat

(Conilurus penicillatus)

Home Range < 1 ha

Quoll or Native Cat

(Dasyurus hallucatus)

Home Range: ~ 1km²

Black Footed Tree Rat

(Mesembriomys gouldii)

Home range: 1 ha to 1 km²

Intervals between fires are critical

for the preservation of

longer lived obligate seeder flora

Rock Myrtle

(*Petraeomyrtus punicea)*

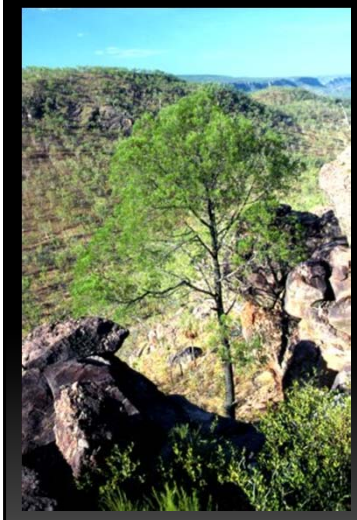
Shrub, found in rocky heaths

Time to reseed 6 years

Cypress Pine (*Callitris intratropica)*

Tree found in woodlands

Time to reseed >>10 years



The main requirements of a fire severity map:

- Conservation planning;
- Iterative fire management planning;

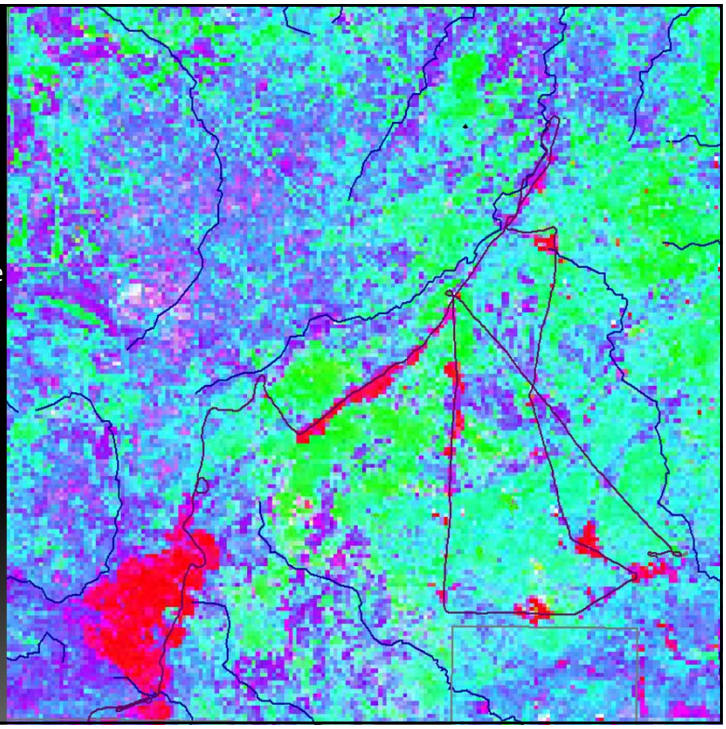
INITIAL RUN

Aerial Prescribed Burning

9th May

MODIS satellite image

12th May



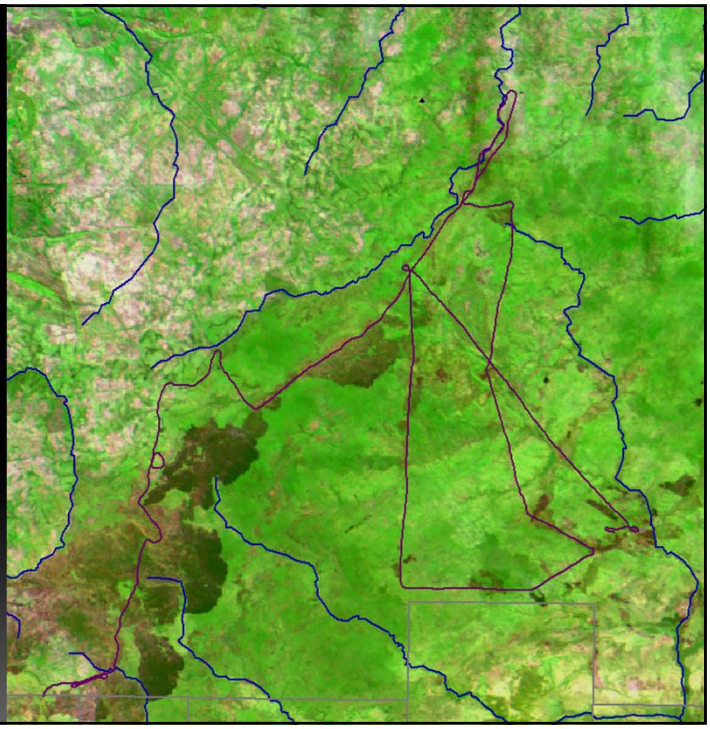
FOLLOW UP

Aerial Prescribed Burning

30th May

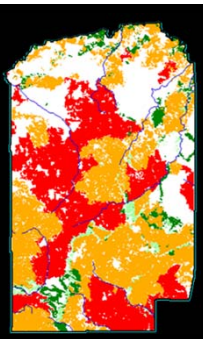
MODIS satellite image

2nd June

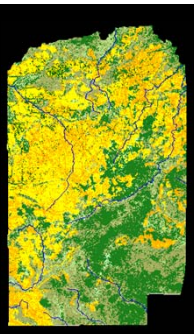


The main requirements of a fire severity map:

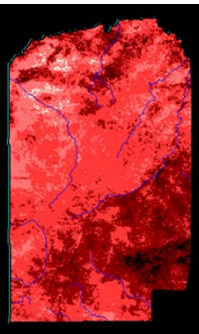
- Conservation planning;
- Iterative fire management planning;
- Greenhouse Gas Emissions Calculations.



Areas Burnt



Fuel Classes



Time Since Burnt

x Burning Efficiency Factor (per Season)
- Ground patchiness
- Proportion of material pyrolised

A rough estimate

Fire Severity

A better estimate

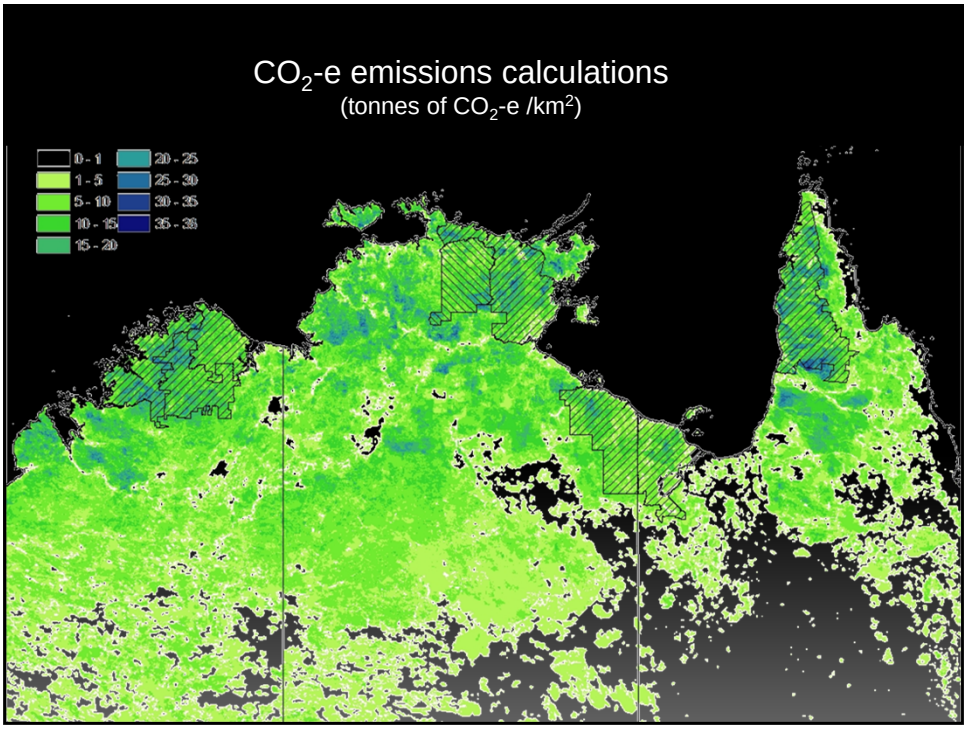
➔ Biomass Burnt ➔ Mass of CO_2-e

Result:

- Carbon Farming Initiative

-Employment
-Resources for fire management

CO_2-e emissions calculations
(tonnes of CO_2-e /km^2)



Other project components:

- A series of international peer reviewed papers;
- Extension of the fire severity mapping into the rangelands and potentially nationally;
- Assembly of relevant GIS data and the assessment of level of risk of various fire regimes to Biodiversity and the Carbon Economy.