



SMERF



Darwin Centre for Bushfire Research  
Research Institute for Environment and Livelihoods

Charles Darwin University

# SMERF

## Savanna Monitoring & Evaluation Reporting Framework

A suite of reporting tools:

- some automated;
- some flexible.

# SMERF

Savanna Monitoring & Evaluation Reporting Framework

Based on the work of other Savanna Burning projects.

- Kakadu National Park, NT
- Kimberley Land Council, WA
- West Arnhem Fire Management Agreement, NT
  - Parks & Wildlife, WA

# SMERF

Savanna Monitoring & Evaluation Reporting Framework

Based on a long series of consultations with stakeholders.

# Basic Metrics

Metric	Description	Objective
Total Area Burnt	A calculation of the proportion of the project area affected by fire.	The fire affected proportion of the project area should decrease.
Area Burnt by late Dry Season (Wild) Fires	The proportion of the project area affected by late dry season fire.	The dry season (~April to October) is characterised by little or no rain. Wildfires dominate in the latter half of the dry season (typically post-July), causing massive destruction to biodiversity in most but not all habitats. The area affected by wild fires should decrease.
Fire Frequency	The calculation of the proportion of the number of times an area has been burnt in a period.	The higher the proportion of high fire frequency the worse the effect on biodiversity. Mean fire frequency should decrease.
Frequency of Late Dry Season (Wild) Fires	The calculation of the proportion of the number of late dry season fires in an area over a period.	The higher the proportion of higher frequencies of late dry season (wild) fires the worse the effect on biodiversity. Mean LDS fire frequency should decrease.
Area of longer unburnt vegetation	An overlay of the previous years of burnt area mapping, back through time, to calculate the area and age of previously burnt areas.	Fire frequency in the tropical savannas has been high in past decades. Improved fire management should mean an increase in the area of longer unburnt vegetation (> 3 years, > 5 years, etc) in most habitats.
Minimum inter-fire interval	An intersection of the fire layers to determine the minimum time (years) between fires.	If the interval between fires in an area $\leq$ the minimum interval required for obligate seeder plant species to grow from seed, mature and set seed then one can expect local extinctions.
Vegetation patchiness	Various metrics have been calculated that describe the landscape pyro-diversity: 1. Heterogeneity indices; 2. Mean distance from burnt to unburnt patches.	These mean index value should increase under improved fire management. The heterogeneity indices are averaged over five year periods to indicate the longer-term trend. The mean burnt to unburnt patch distance index should improve indicating fire patch sizes are decreasing.

# North Australian Fire Information

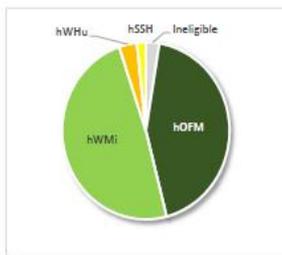
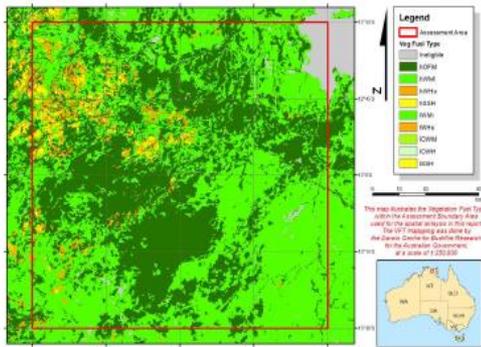
## Standard Annual Report: 2017

This report uses the North Australia Fire Information (NAFI) Burnt Area mapping to make spatial calculations based on the boundary or vegetation map illustrated below. NAFI Burnt Area mapping is derived from MODIS satellite imagery. The imagery used has 250 m pixels, this is the minimum mapping unit for these analyses.

The Assessment Area: Itsasikrat = 1,000,000 ha

### Area of Vegetation Fuel Types

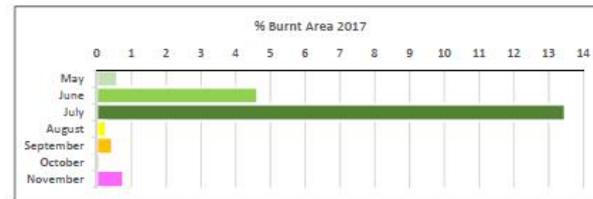
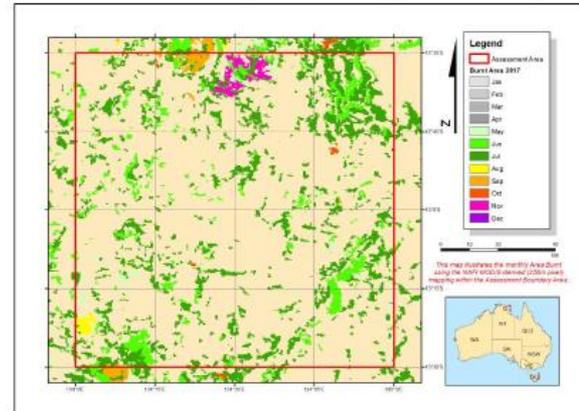
Open forest, mixed grass understorey	433,961 ha (43%)
Lowland woodland, mixed grass understorey	487,725 ha (49%)
Upland woodland, hummock grass understorey	34,506 ha (3%)
Shrubland, hummock grass understorey	17,163 ha (2%)
Other vegetation (grasslands, floodplains, <i>Melaleuca</i> dominated communities)	25,900 ha (3%)



# North Australian Fire Information

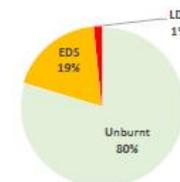
## Burnt Area Analysis

Total Burnt Area	20.3%	EDS 18.7%	LDS 1.6%
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Month	Area (ha)	%
May	6,031	0.6
June	46,325	4.6
July	134,700	13.5
August	2,806	0.3
September	4,588	0.5
October	844	0.1
November	7,706	0.8

Season	Area (ha)	%
EDS	187,056	18.7
LDS	15,944	1.6

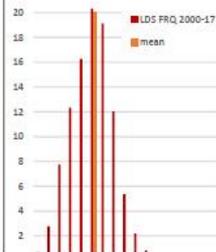
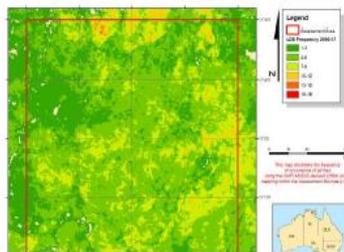
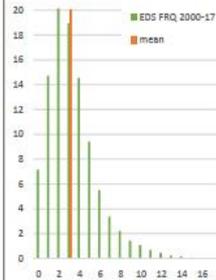
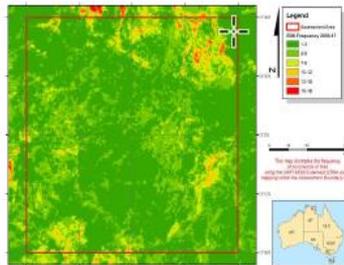
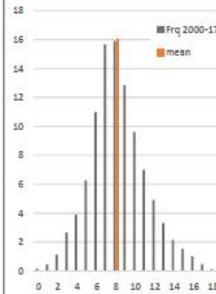
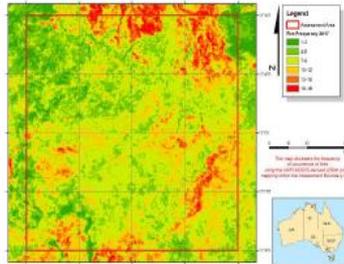


## North Australian Fire Information

### Fire Frequency Analysis

Fire frequency is a calculation at a point in time of the number of times that a point in the landscape has previously been burnt. This is calculated for whole fire years, early dry season only, and late dry season only.

Average Fire Frequency	8.3 times in 18 years = a fire return interval of 2.2 years.
Average Early Dry Season Fire Frequency	3.3 times in 18 years = a fire return interval of 5.4 years.
Average Late Dry Season Fire Frequency	5.0 times in 18 years = a fire return interval of 3.6 years.

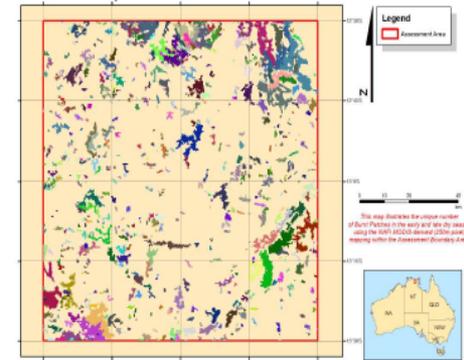
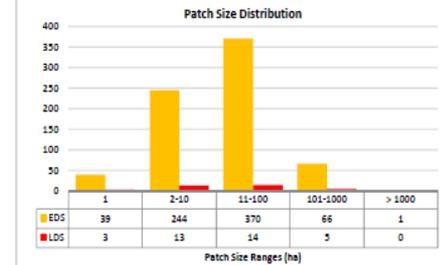


## North Australian Fire Information

### Burnt Patch Analysis

In the Burnt Patch Analysis, the number of individual burnt patches is counted and the average and median patch size is calculated, for the whole year, the early dry season and the late dry season.

Number of Burnt Patches	755	EDS	720	LDS	35
Average Patch Size	269 ha	EDS	260 ha	LDS	456 ha
Median Patch Size	94 ha	EDS	94 ha	LDS	69 ha
Number of Patches > 1,000 ha	1	EDS	1	LDS	0



### Area/Perimeter Analysis

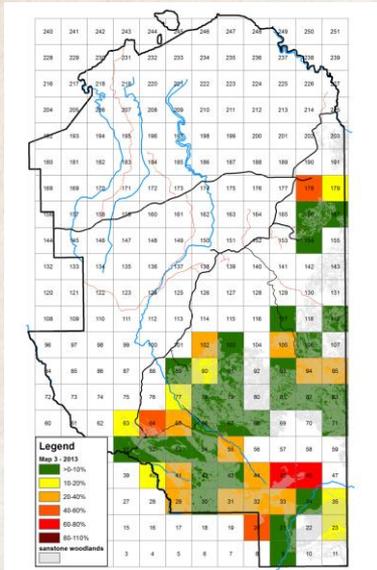
In the Area/Perimeter Analysis, the average area/perimeter ratio of individual burnt patches is calculated, for the whole year, the early dry season and the late dry season. The ratio demonstrates the difference in fire shape overall, such that a low ratio indicates longer linear burnt areas such as for fire breaks, whereas a high ratio indicates bigger rounder fires such as in the case of most wildfires.

Area/Perimeter Ratio	7	EDS	15	LDS	43
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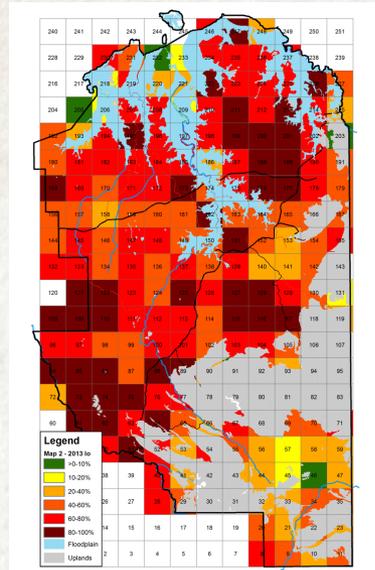
# Modelled Metrics

## Significant spatial models pertaining to fire metrics in savanna landscape units

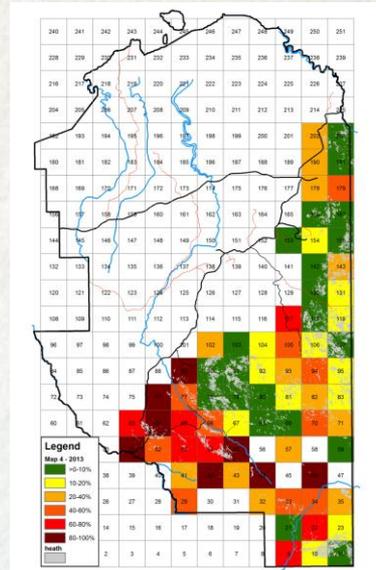
Landscape unit	Functional groups/species	Fire metrics
Savanna woodlands	Sapling density (All species) Sapling density (Non-Eucalypts) Sapling density (Callitris intratropica) Adult stem density (Callitris intratropica)	Fire frequency Frequency of low severity fires Time since burnt severely Frequency of severe and very severe fires
Savanna and Heathland	Number of shrub taxa (obligate seeders) Number of long maturing (> 3 yrs) shrub taxa (obligate seeders) Shrub density (resprouters)	Minimum inter-fire interval Frequency of early dry season fires Frequency of severe and very severe fires



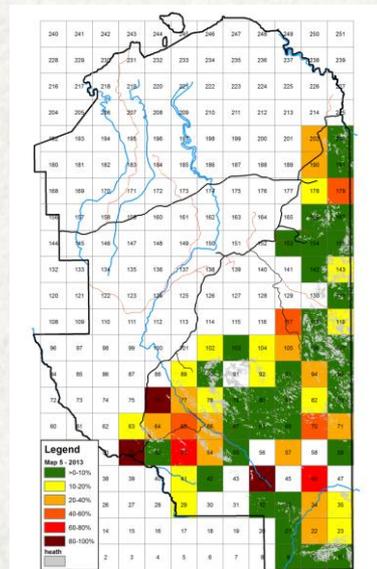
ANLARR in the stone country



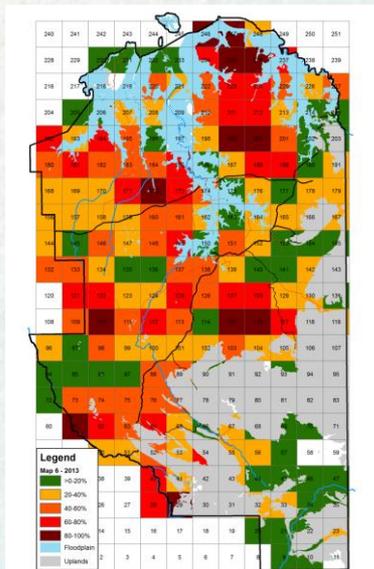
Savanna saplings in the Lowlands



The number of obligate seeder taxa in the stone country



Long maturing obligate seeders in the stone country



Re-sprouting shrub density in the Lowlands

# Time frame

## Summary

Task	Description	Start	End	Deliverables	Budget
Undertake workshops with stakeholders	DCBR have undertaken many workshops and meetings with fire management staff in north Australia over the past 18 months, through their CRC research program.	Completed		A list of appropriate metrics	Covered by current CRC project
Develop a sample report for inspection by the agencies and other fire managers	Through the CRC research program, DCBR have been and continue to develop sample reports that key agency personnel are assisting to fine tune.	July 2017	On-going	Samples	Covered by Current CRC project
Software development for web-enablement	CDU software engineer to develop web front end and programming for spatial calculations	April 2018	12 months	On-line reporting system	\$50k
On-going management of SMERF	SMERF, like the other tools in the NAFI suite will need to be archived, managed, served and supported.	On-going		NAFI Suite (including SMERF)	Incorporated by CDU through NAFI funding from Commonwealth and agency partners.

### + Detail: Software Development to web-enable the automated reporting

Task	Description	Start	End	Deliverables	Budget
Develop version 1.	A freeware python software environment will be explored to migrate the current Infonet system across to SMERF and develop the first two simple reports	20Jun18	20Aug18	1. Report A (v1): Simple single year report using basic metrics; 2. Report B (v1): Simple multi-year comparison using basic metrics; 3. Report back from interviews with users.	\$12.5k
Develop version 2.	Feedback from interviews with users will be used to refine Reports A & B. Report C development will commence.	21Aug18	20Oct18	1. Re-release of Reports A & B (v2) incorporating user feedback; 2. Report C: multi-year analytical report with built-in user selection; 3. Report back from interviews with users.	\$12.5k
Develop version 3.	Feedback from interviews with users will be used to refine Report C. Report D development will commence.	21Oct18	20Dec18	1. Re-release of Report C (v2) incorporating user feedback; 2. Report D: Report C with "thresholds" applied from the literature; 3. Report back from interviews with users.	\$12.5k
Develop final version	Feedback from interviews will be used to refine Report D. Develop support manual.	21Dec18	20Feb19	1. Re-release of Report D (v2); 2. Final release of on-line public version. 3. User manual.	\$12.5k

### Detail: On-going management of SMERF

Task	Description	Start	End	Deliverables	Budget
Merge SMERF into NAFI	The SMERF toolset will need to be integrated into the suite of NAFI tools.	1March19	29Mar19	An integrated suite of tools available to end-users to undertake monitoring and evaluation on-line through NAFI	NAFI