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Darwin Centre for Bushfire Research

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Main Programs

- Savanna Monitoring & Evaluation Reporting Framework (SMERF)
  - Savanna wide
  - High-Resolution, Fire Community-based Assessments
- Ecological Thresholds Analysis
  - High Resolution Habitat Mapping
  - High Resolution Fire Mapping
  - GIS Analysis and Reporting
- Emissions Analysis (Smoke over Darwin)
  - High Resolution fuels mapping (including Gamba)
  - CSIRO/BoM Ventilation Index Forecasting tool
  - Sensor Array

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NAFI NORTH AUSTRALIA & RANGELANDS FIRE INFORMATION

Kimberley Land Council

KAKADU NATIONAL PARK

bushfire&natural HAZARDSCRC

DCBR Darwin Centre for Bushfire Research

GOVERNMENT OF WESTERN AUSTRALIA

PARKS AND WILDLIFE SERVICE

QUEENSLAND PARKS AND WILDLIFE SERVICE

FNQ Spatial Data Services

West Arnhem Land Fire Abatement

PARKS AND WILDLIFE COMMISSION NORTHERN TERRITORY

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BUSHFIRES NT

Savanna Monitoring & Evaluation Reporting Framework

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SMERF

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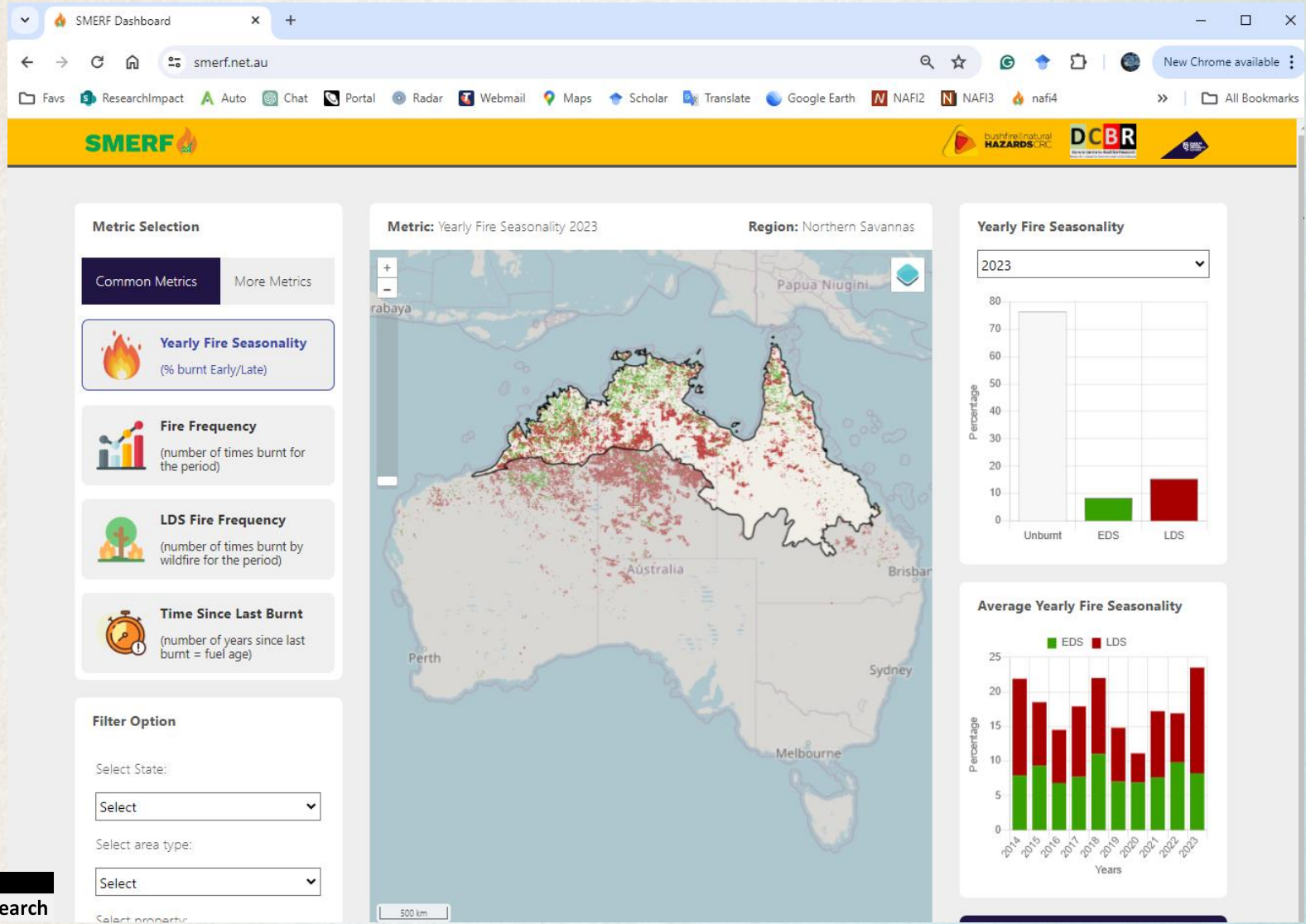

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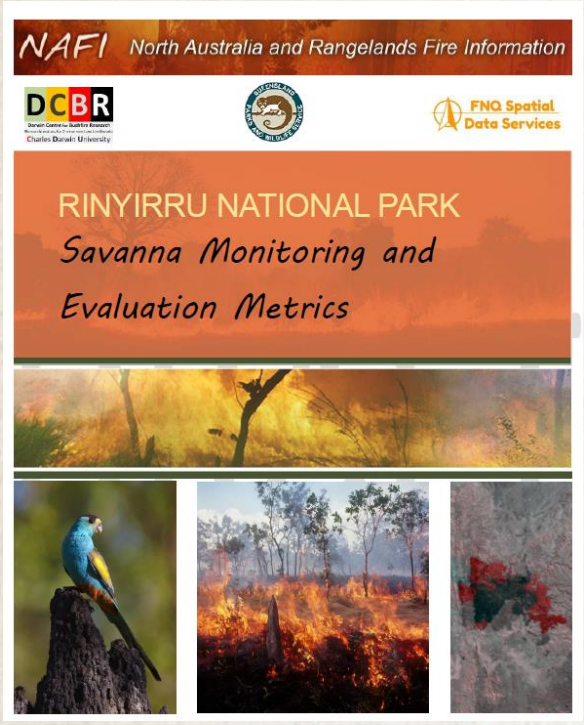

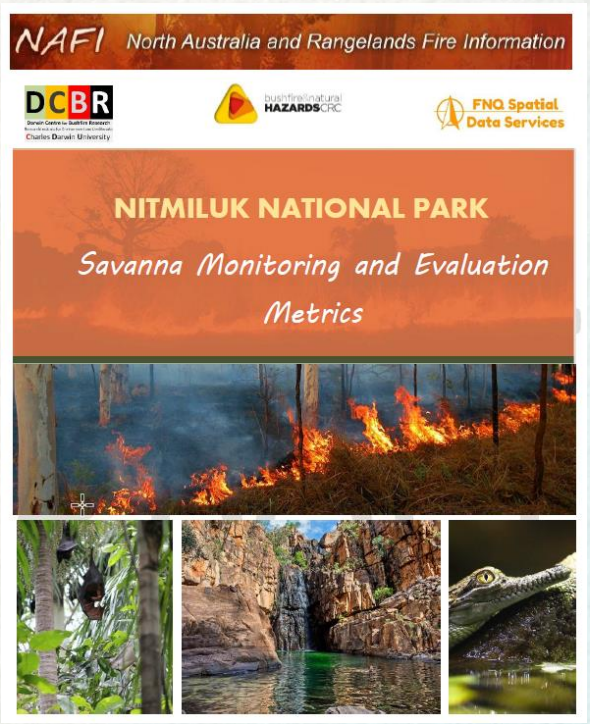

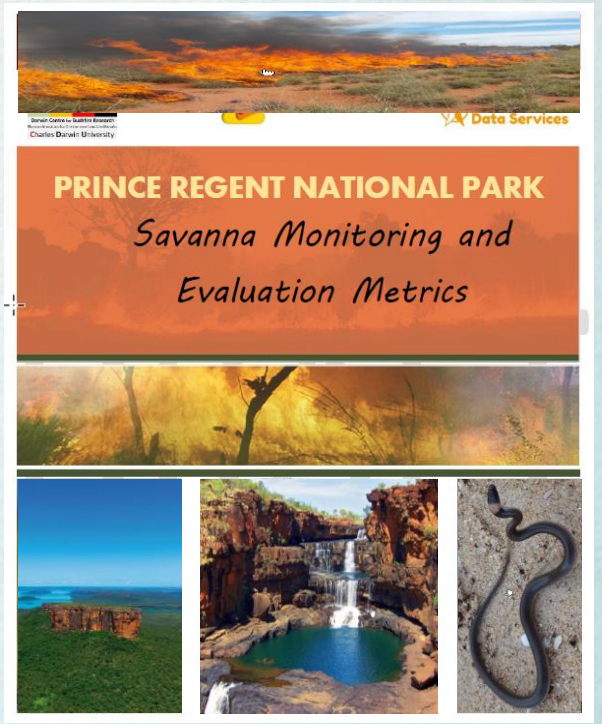

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bushfire&natural HAZARDS CRC DCBR

Metric Selection

Common Metrics | More Metrics

Yearly Fire Seasonality
(% burnt Early/Late)

Fire Frequency
(number of times burnt for the period)

LDS Fire Frequency
(number of times burnt by wildfire for the period)

Time Since Last Burnt
(number of years since last burnt = fuel age)

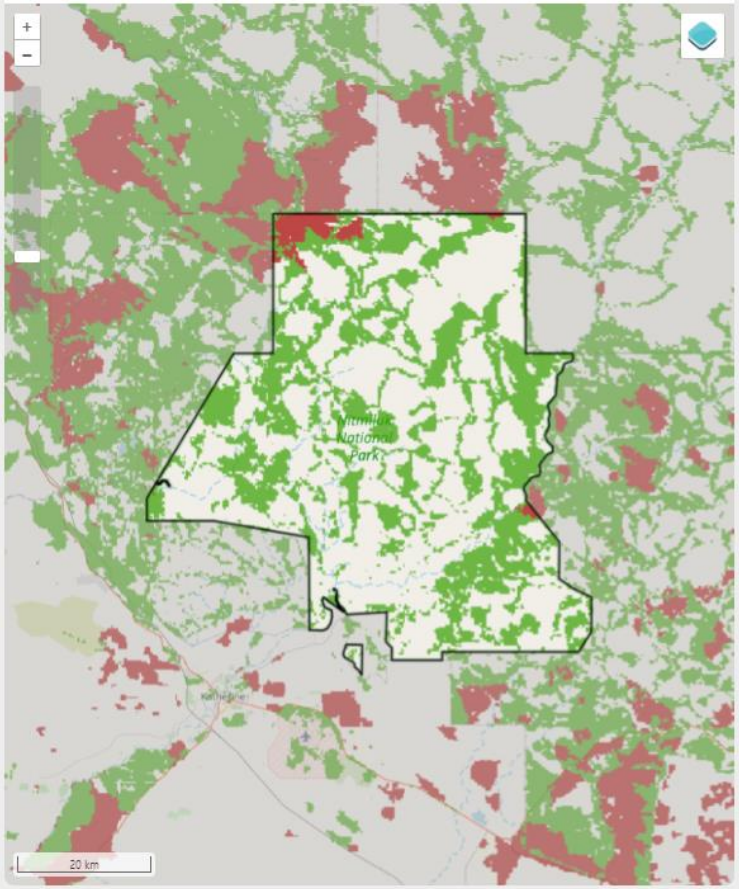
Filter Option

Select State:
Northern Territory

Select area type:
Parks and Reserves

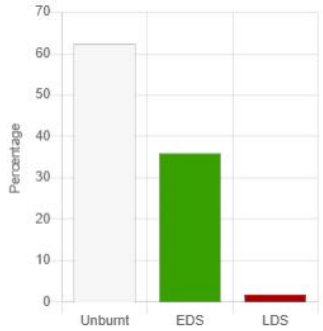
Select property:
Nitmiluk National Park

Metric: Yearly Fire Seasonality 2023 **Region:** Nitmiluk National Park (NT)

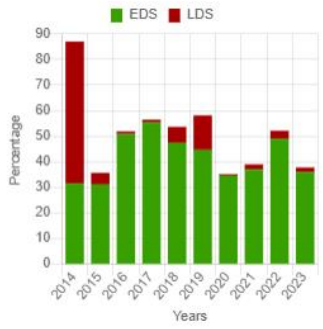


Yearly Fire Seasonality

2023



Average



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Metric Selection

Common Metrics | More Metrics

Yearly Fire Seasonality
(% burnt Early/Late)

Fire Frequency
(number of times burnt for the period)

LDS Fire Frequency
(number of times burnt by wildfire for the period)

Time Since Last Burnt
(number of years since last burnt = fuel age)

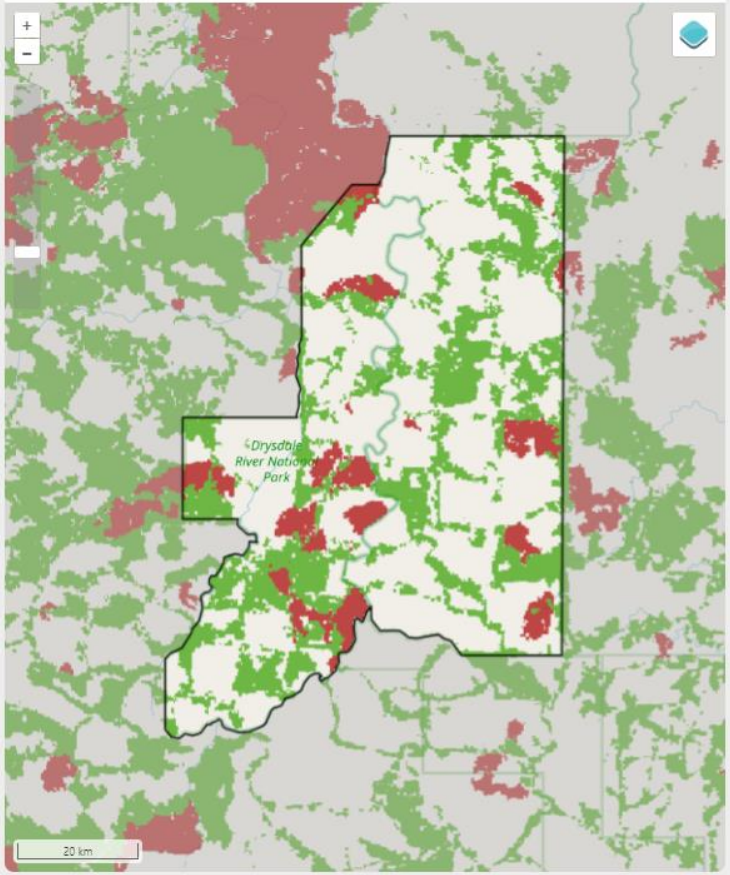
Filter Option

Select State:
Western Australia

Select area type:
Parks and Reserves

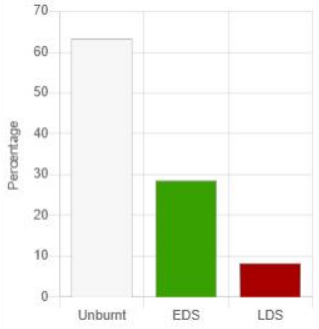
Select property:
Drysdale River National Park

Metric: Yearly Fire Seasonality 2023 **Region:** Drysdale River National Park (WA)

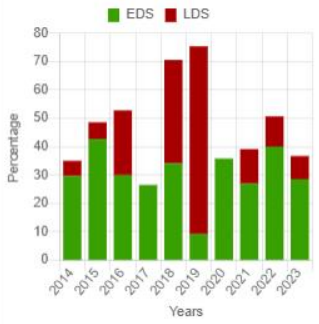


Yearly Fire Seasonality

2023



Average Yearly Fire Seasonality



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Metric Selection

Common Metrics | More Metrics

Yearly Fire Seasonality
(% burnt Early/Late)

Fire Frequency
(number of times burnt for the period)

LDS Fire Frequency
(number of times burnt by wildfire for the period)

Time Since Last Burnt
(number of years since last burnt = fuel age)

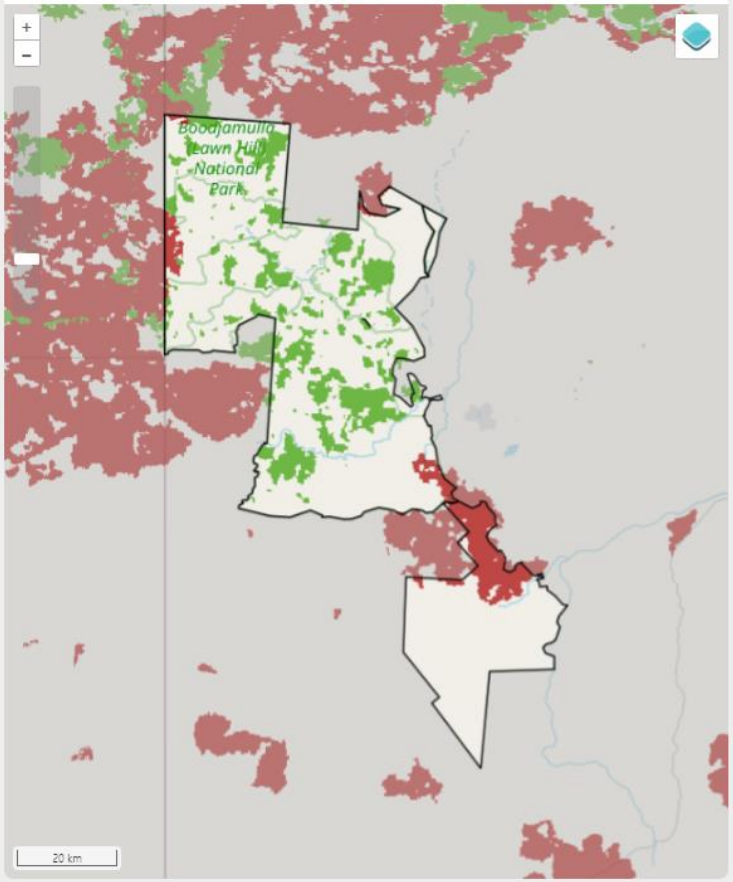
Filter Option

Select State: Queensland

Select area type: Parks and Reserves

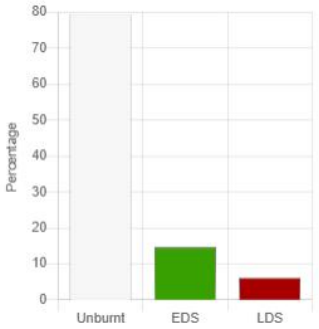
Select property: Boodjamulla

Metric: Yearly Fire Seasonality 2023 **Region:** Boodjamulla (QLD)

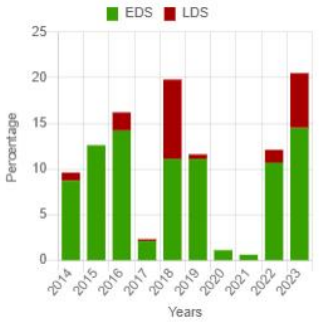


Yearly Fire Seasonality

2023



Average



Print Report

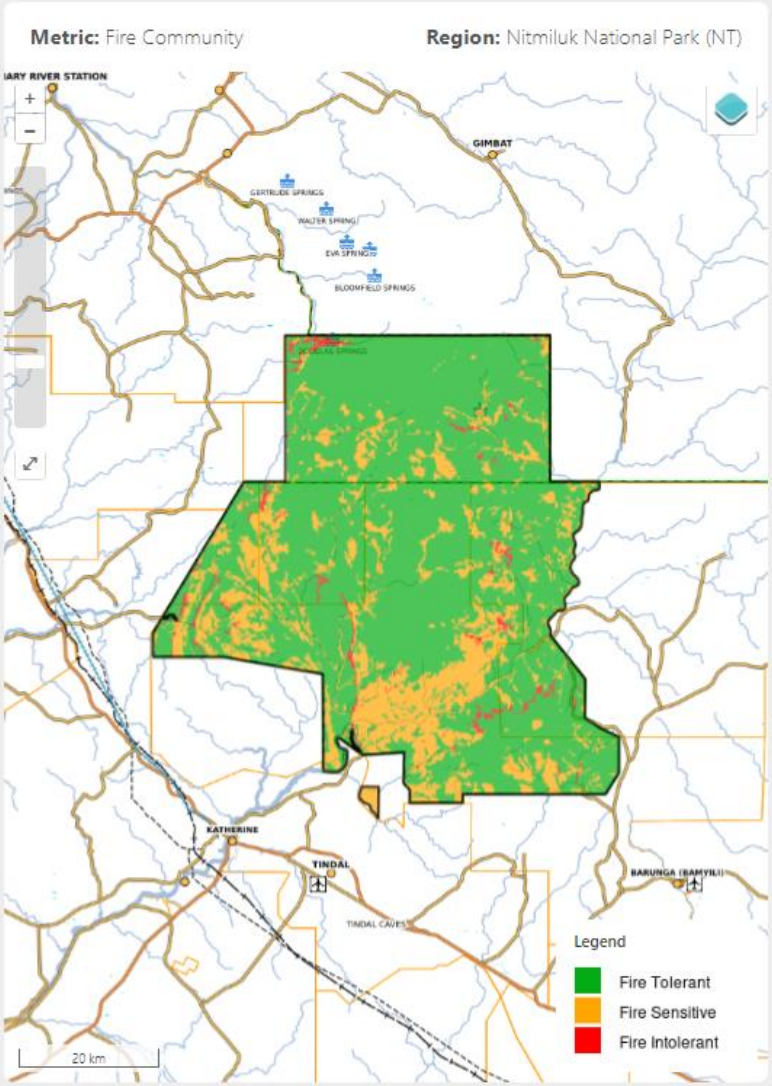
NT Parks-wide, High Resolution, Vegetation Community Level, Analysis

Filter Option

State: Northern Territory

Property type: Parks and Reserves

Select property: Nitmiluk National Pa



Nitmiluk National Park ICS Score Card 2023

Communities	NAFI Fire Metric	GOOD	FAIR	POOR	VERY POOR	2023 Score
PARK-WIDE INTEGRITY	% Burnt/Year by EDS Fires	> 40%	> 30%	> 20%	< 20%	GOOD
PARK-WIDE INTEGRITY	% Burnt/Year by LDS Fires (> July)	< 10%	< 20%	< 30%	> 30%	GOOD
FIRE TOLERANT	% Burnt EDS	> 40%	> 30%	> 20%	< 20%	FAIR
FIRE TOLERANT	% Burnt by LDS Fires	< 5%	< 15%	< 20%	> 20%	GOOD
FIRE TOLERANT	% Unburnt > 3 years	> 25%	> 10%	> 5%	< 5%	POOR
FIRE SENSITIVE	% Burnt/Year	< 20%	< 40%	< 60%	> 60%	GOOD
FIRE SENSITIVE	% Unburnt > 5 years	>= 80%	> 70%	> 60%	< 60%	VERY POOR
FIRE INTOLERANT	% Burnt/Year	< 3%	< 5%	< 10%	> 10%	GOOD
FIRE INTOLERANT	% Unburnt > 10 years	> 25%	> 15%	> 5%	< 5%	VERY POOR

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Ecological Thresholds Analysis

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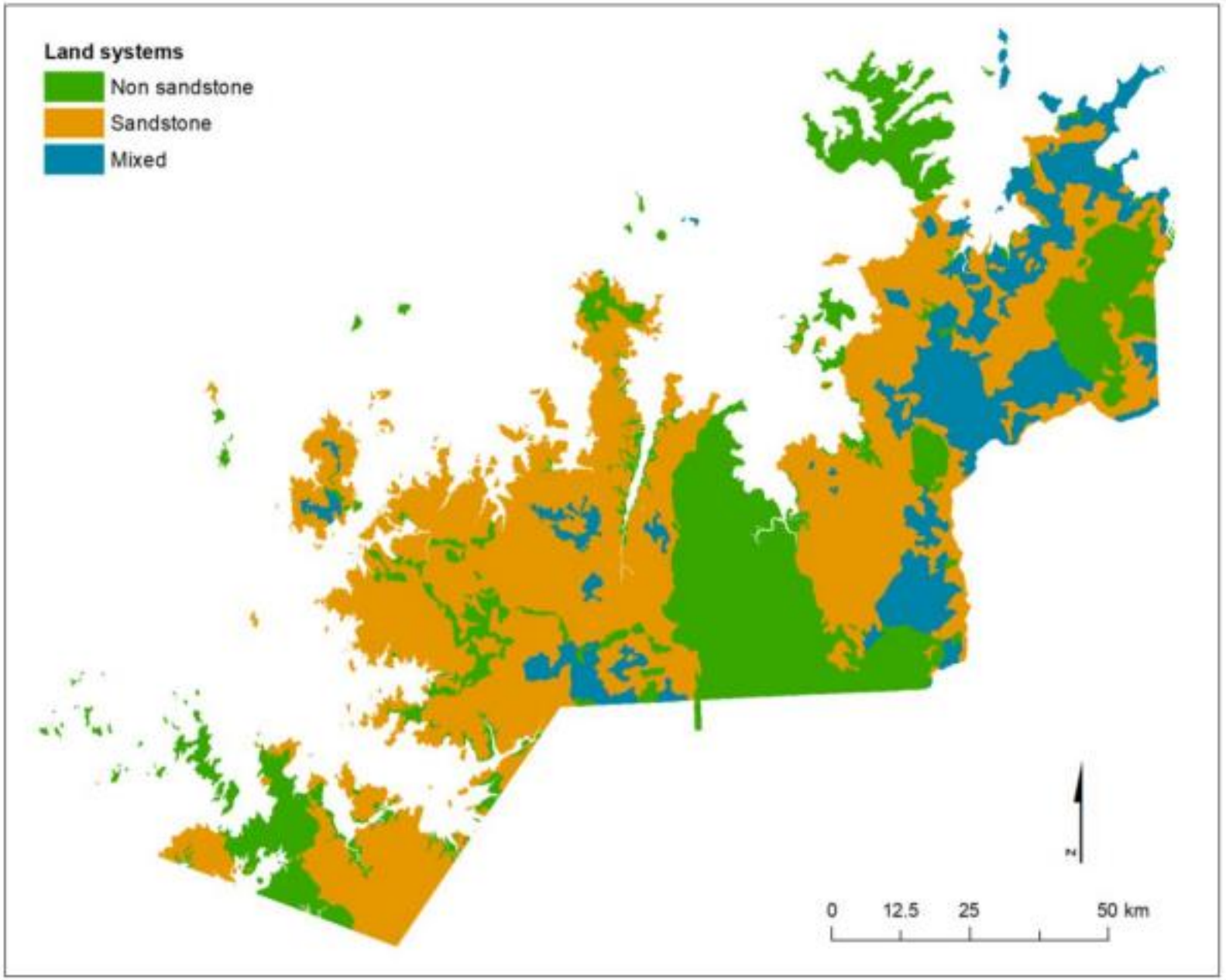

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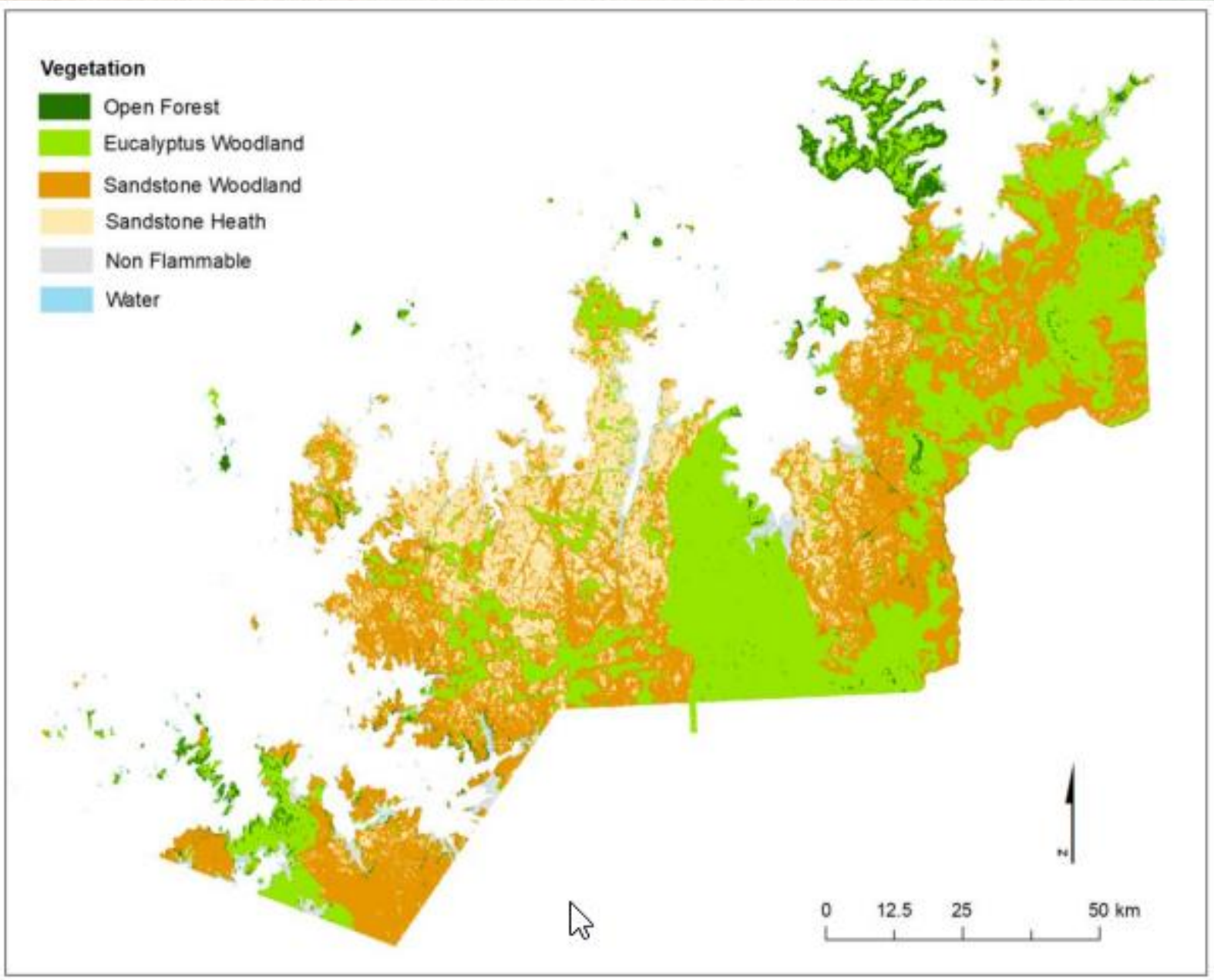

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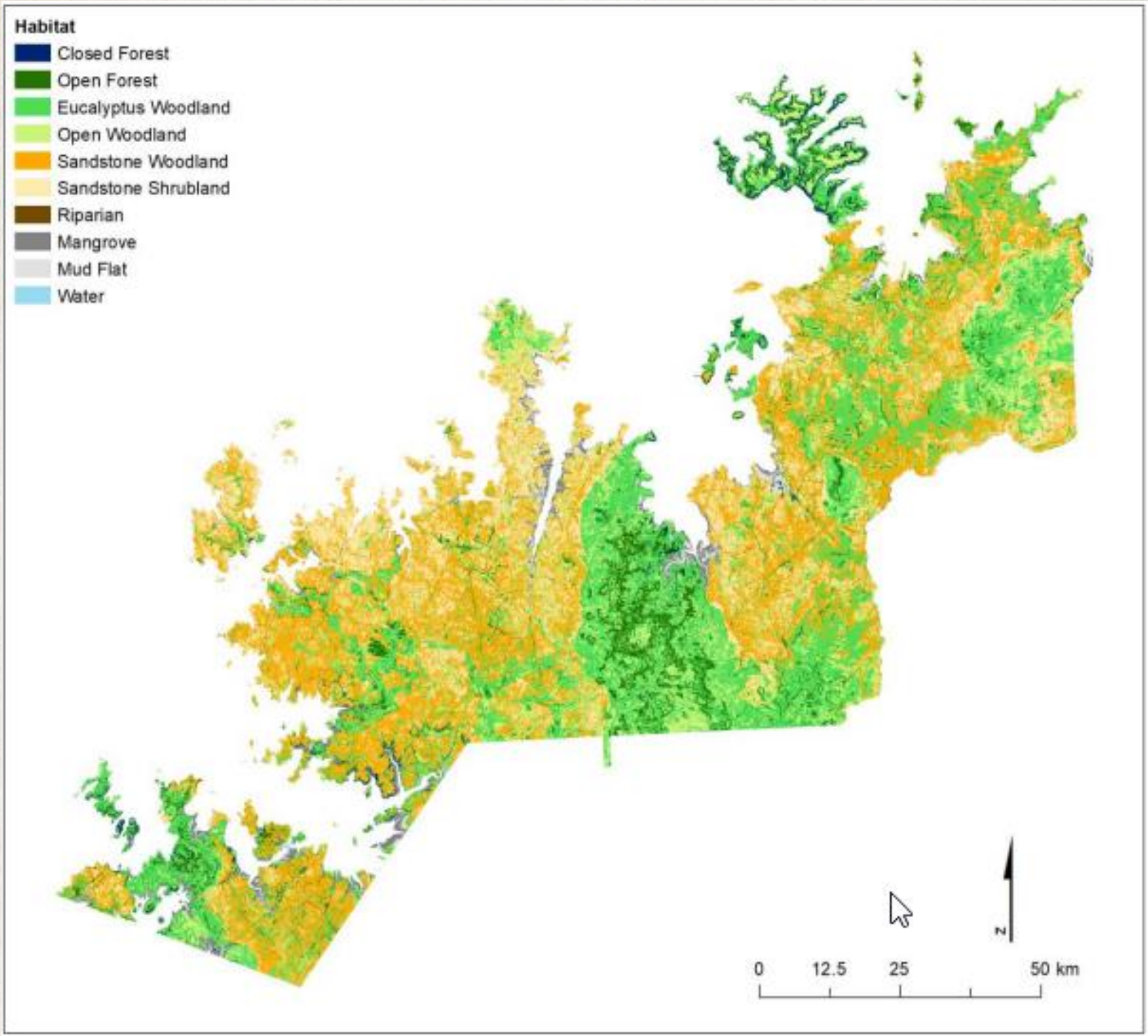

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Table 2. Observed responses vs. performance threshold criteria.

Response variable	Performance threshold	Observed response 2015†	Observed response 2006–2015
1. Severe fire impacting monsoon rain forest boundary			
1.1 Lowland monsoon rain forest	<10% should be affected by one severe fire in 5 yr	57%	Consistently >40%
1.2 Upland monsoon rain forest	<10% should be affected by one severe fire in 5 yr	40%	Consistently >15%
2. Severe fire affecting fire-prone woodland habitat			
2.1 Lowland woodland	<10% should be affected by two or more severe fires in 5 yr	37%	Consistently >20%
2.2 Upland woodland	<10% should be affected by two or more severe fires in 5 yr	24%	Consistently >10%
3. Frequent fire affecting fire interval-sensitive sandstone heath	<10% should be affected by more than one fire in five years	75%	Consistently >40%
4. Long-unburnt habitat for fire-vulnerable small mammals and birds			
4.1 Floodplain	At least 25% should remain unburnt for 3 yr	Achieved 41%	Achieved: consistently >40%
	At least 5% should remain unburnt for 10 yr	Achieved 15%	Achieved: consistently ≥15%
4.2 Lowland woodland	At least 25% should remain unburnt for 3 yr	6%	Consistently <25%
	At least 5% should remain unburnt for 10 yr	1%	Consistently <5%
4.3 Upland woodland	At least 40% should remain unburnt for 3 yr	23%	Achieved for 6 yr
	At least 10% should remain unburnt for 10 yr	7%	Consistently <10%
5. Small fire sizes for fauna with restricted home ranges, and narrowly dispersed obligate seeder plants			
5.1 Floodplain	<10% should be burnt by fires >1 km^2 in extent within a 5-yr period	67%	Consistently >50%
5.2 Lowlands	<10% should be burnt by fires >1 km^2 in extent within a 5-yr period	98%	Consistently >95%
5.3 Uplands	<10% should be burnt by fires >1 km^2 in extent within a 5-yr period	87%	Consistently >65%

† At end of 5-yr assessment period.

Russell-Smith *et al.* 2021)

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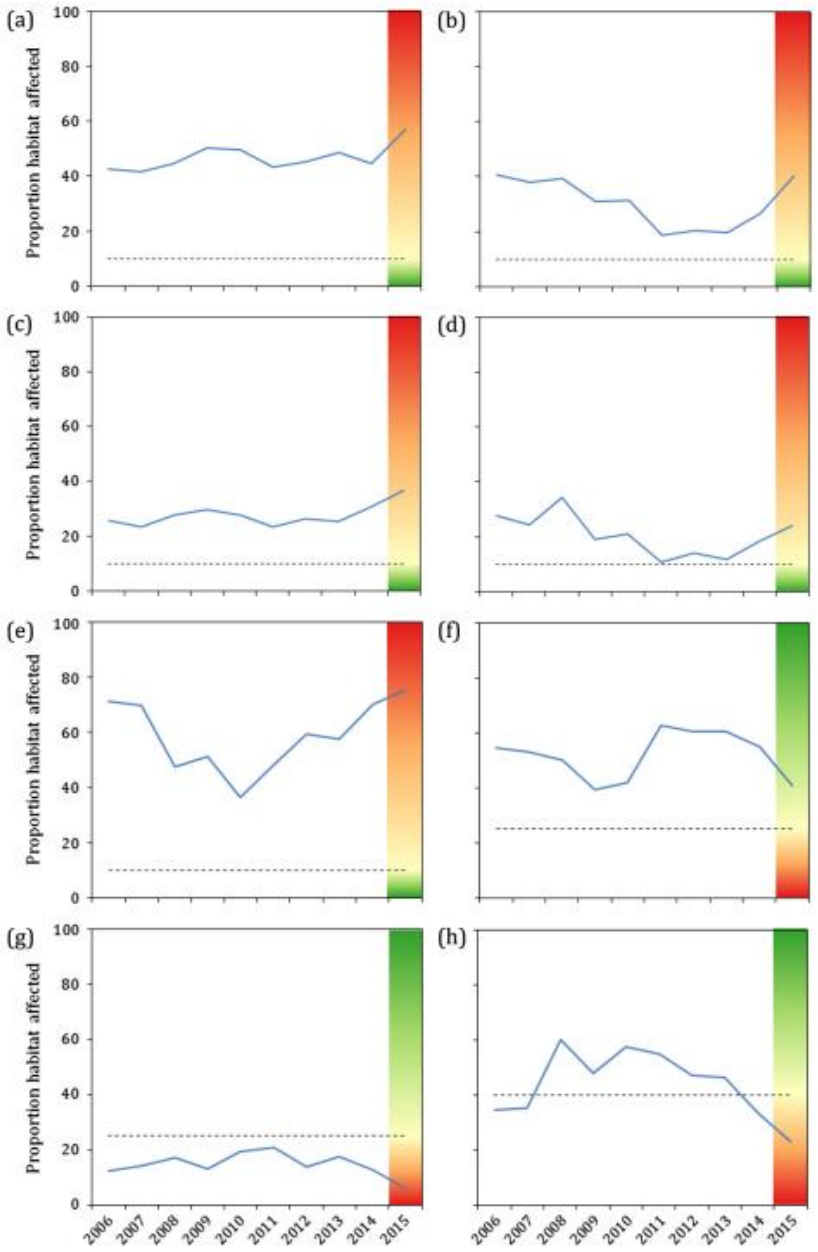

Fig. 3. Ten-year trends for respective ecological performance threshold metrics, for (a) severe fires affecting lowland monsoon rain forest, (b) severe fires affecting upland monsoon rain forest, (c) severe fires affecting lowland woodland, (d) severe fires affecting upland woodland, (e) frequent fires affecting sandstone heath, (f) floodplain habitat unburnt for at least 3 yr, (g) lowland woodland unburnt for at least 3 yr, (h) upland woodland unburnt for at least 3 yr,

Russell-Smith *et al.* 2021)

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Fire and smoke impacts in northern Australia

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Problem

Bushfire smoke emissions are increasing in the Darwin Region with an impact on human health

August 5, 2013 (Source: https://earthobservatory.nasa.gov/)

Impacts of smoke on health

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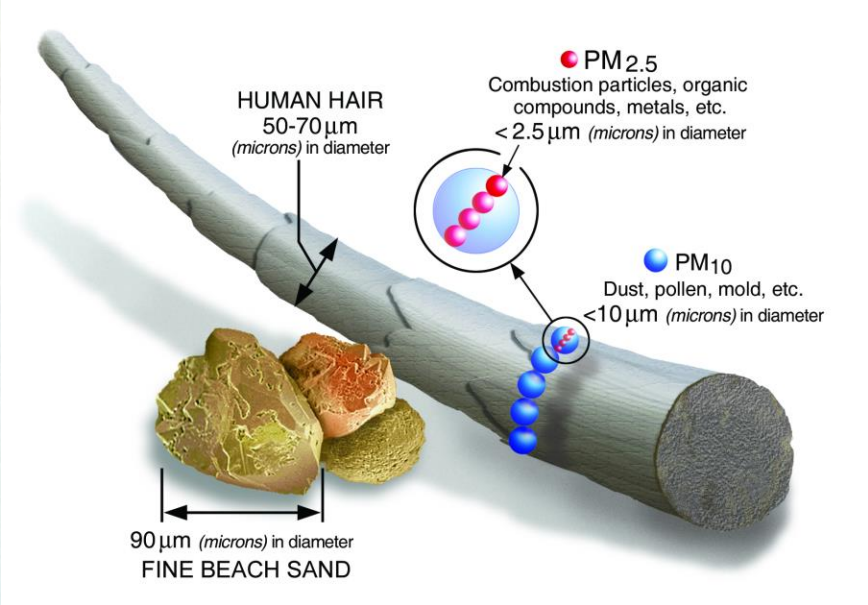
Bushfire smoke pollution, and especially $PM_{2.5}$, has been associated with a wide range of health effects:

- exacerbations of respiratory symptoms
- declines in lung function
- asthma attacks
- emergency department presentations
- hospital admissions
- premature mortality



Background

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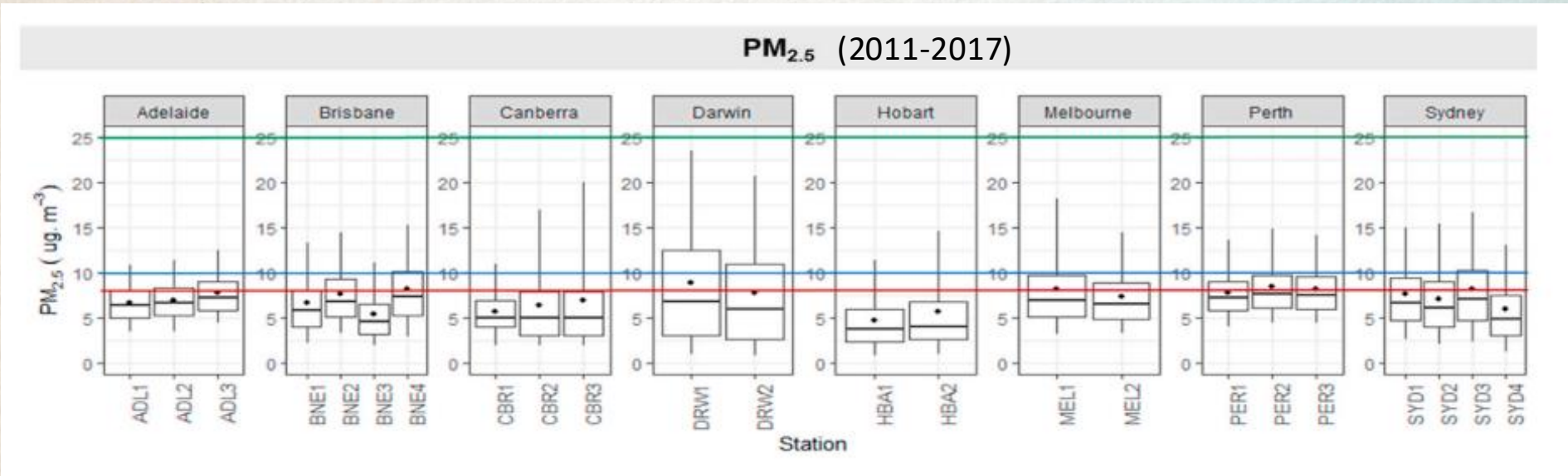
Darwin has the highest mean $PM_{2.5}$ concentrations



Boxplot for the daily $PM_{2.5}$ concentrations in Australia (de Jesus et al. 2020)

- Daily average NEPM and WHO
- Annual average NEPM
- Annual average WHO

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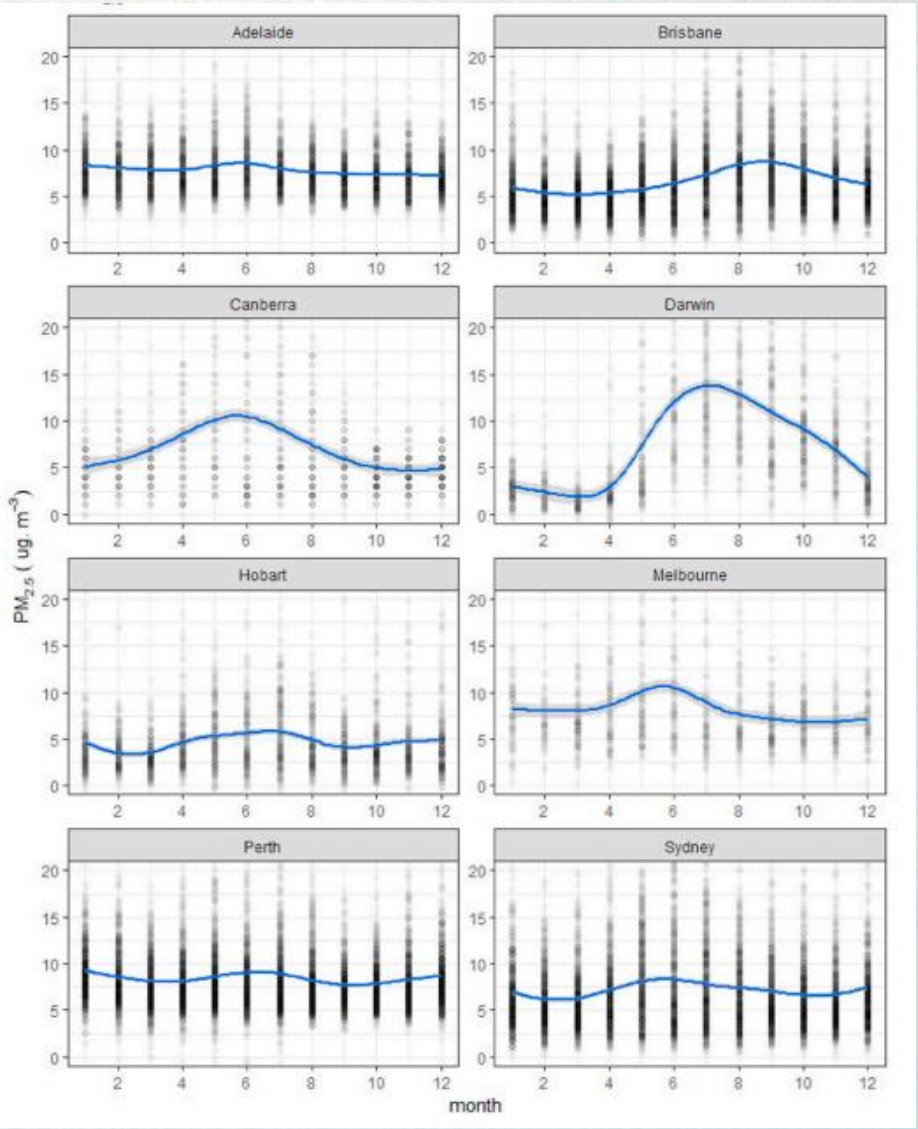
$PM_{2.5}$ concentrations start increasing in April and peak in July



Seasonal trends of PM2.5 (de Jesus et al. 2020)

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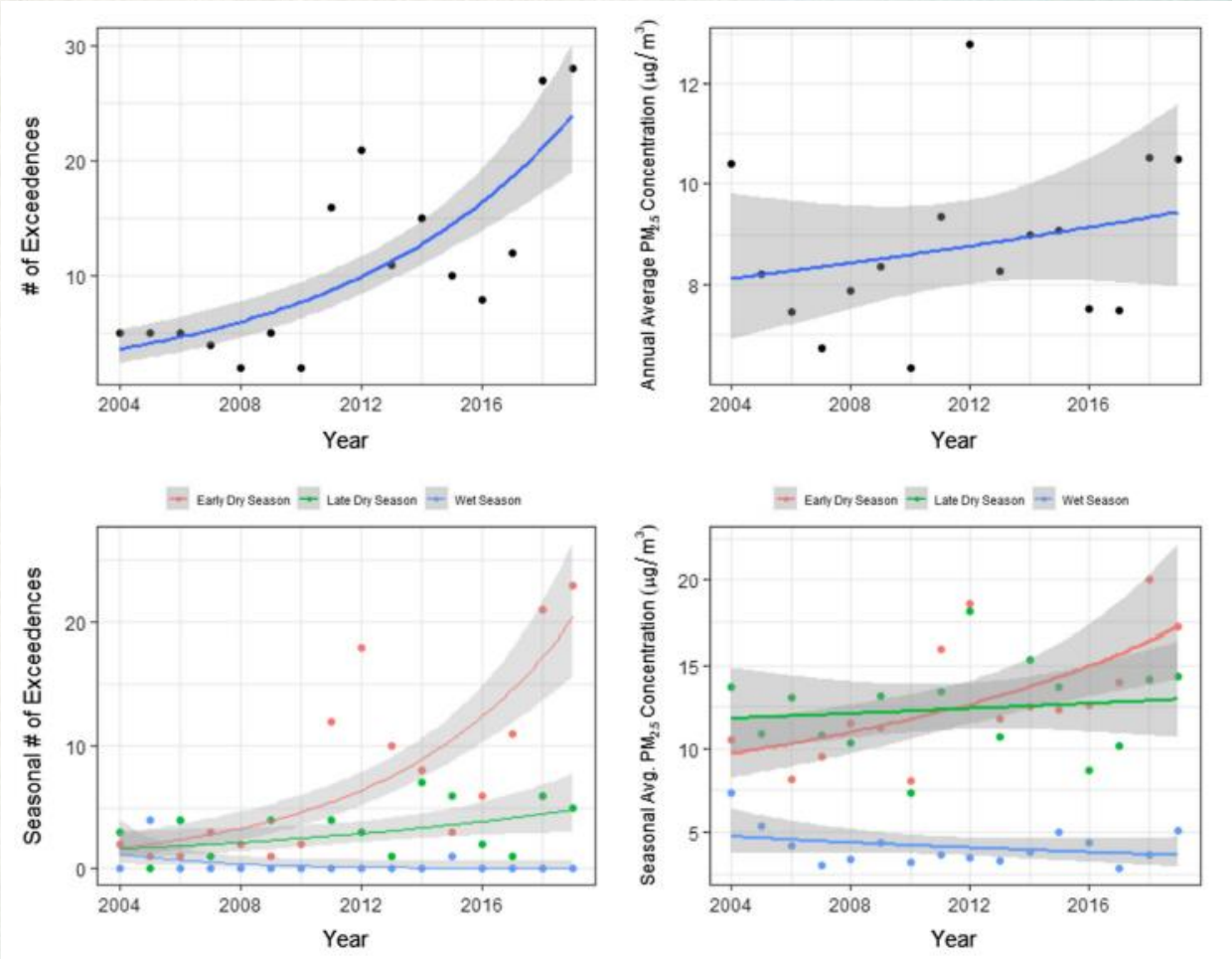
Smoke pollution is increasing in Darwin in the EDS



Annual number of $PM_{2.5}$ exceedances and annual average $PM_{2.5}$ concentrations (Jones et al. 2022)

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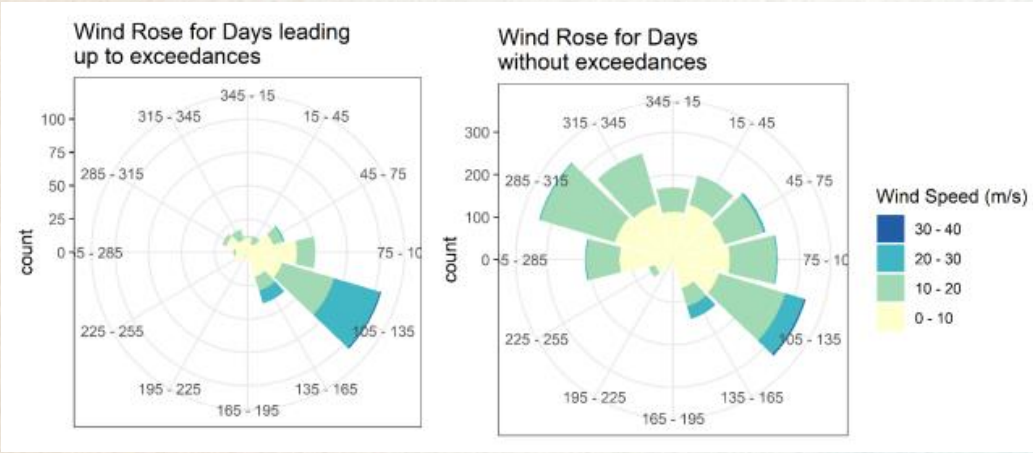
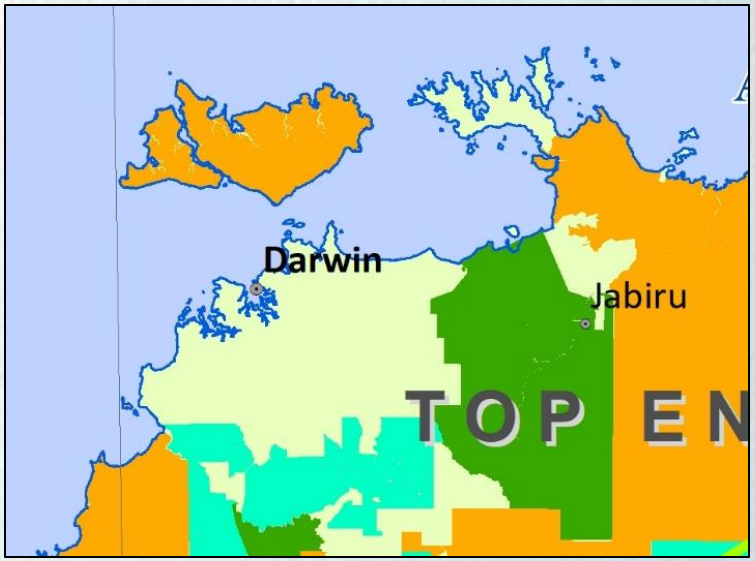
Increase in smoke pollution is related to an increased in EDS burning in carbon abatement project areas in southeast of Darwin (Jones et al. 2022)



Wind speed and direction on exceedance days vs non-exceedance days (Jones et al. 2022)



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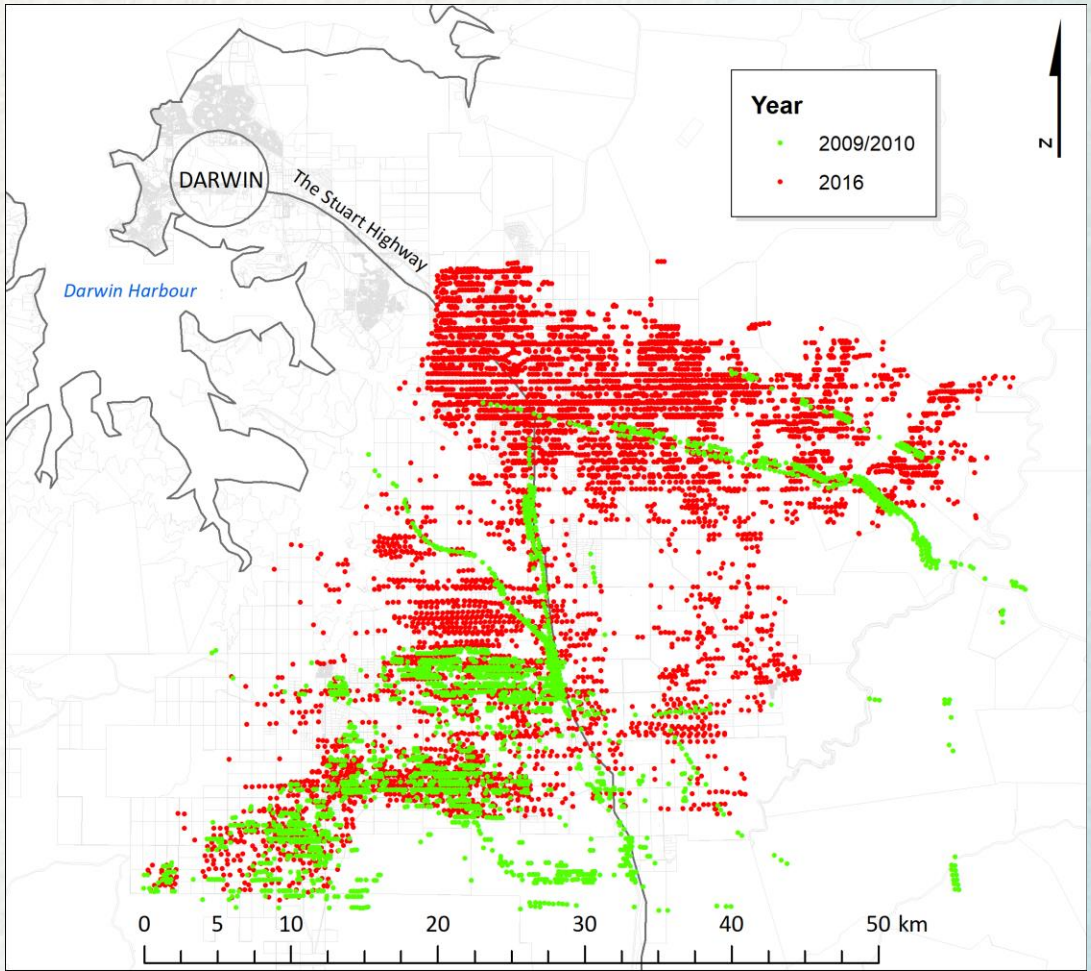
Background



Darwin Centre for Bushfire Research

Fuels Project Aims

- Collaboration of CDU, NTG (Health Environment, Bushfires NT, NTFRS), CSIRO, Territory NRM.
- Develop a detailed fuels map
  - including remnant native vegetation, Gamba, Humidicola, Mission Grass etc
- Create a fuels mapping methodology to annually re-create the fuels map
  - to hand over to NTG

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Other Aims

- Use Territory NRM networks and communication skills to develop a community-based program to reduce arson, with a focus on public health.
- Expand sensor network to ascertain the extent of the smoke problem
- Work with public health experts to characterise the location of people presenting with cardio-respiratory illness.