

# Mapping bushfire hazard and impacts

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*Pierces Creek Fire at sunset @ Marta Yebra*



bushfire&natural  
**HAZARDS**CRC



Australian Government  
Department of Industry,  
Innovation and Science

**Business**  
Cooperative Research  
Centres Programme

# Outline

- What our research has shown
- How our research is currently being applied or is intended to be applied.
- The broader opportunities for our research to contribute to bushfire mitigation.



# Future priorities AFMS

Order the following future developments by priority

Dry/transition/wet maps based on empirical FMC threshold values that explain fire occurrence

Almost 1st

Deciles maps

2nd Almost

Times series plumes showing max/min/median instead of 3 previous years

3rd Almost

Include information on forest cover

4th

Y

Include the uncertainty in the pop-up for a pixel

5th

Y

Download Grid as GeoTIFF

6th

Y

Distribution of values within a polygon

7th

X

Include incident feed

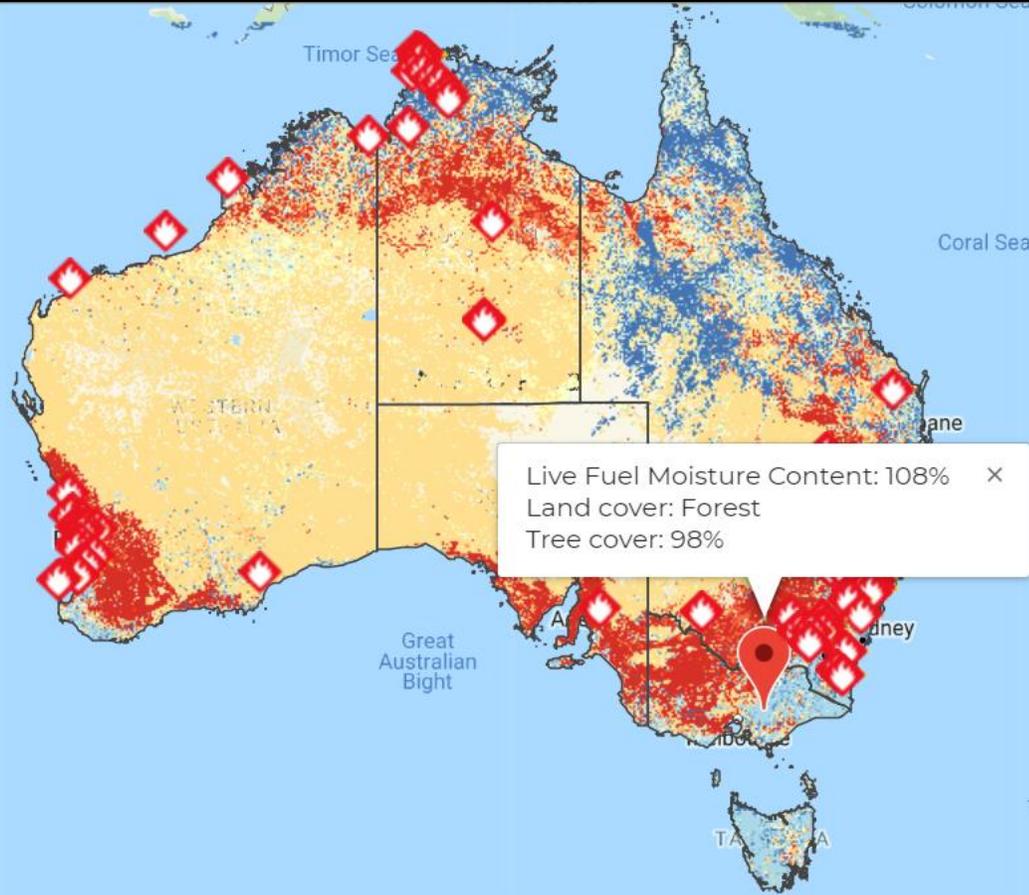
8th

Y

Live Fuel Moisture Content

2019-04-23

States and Territories



## Live Fuel Moisture Content (%)

- ≥140
- 122-140
- 105-122
- 87-105
- 70-87
- 52-70
- 35-52
- 17-35
- 0-17

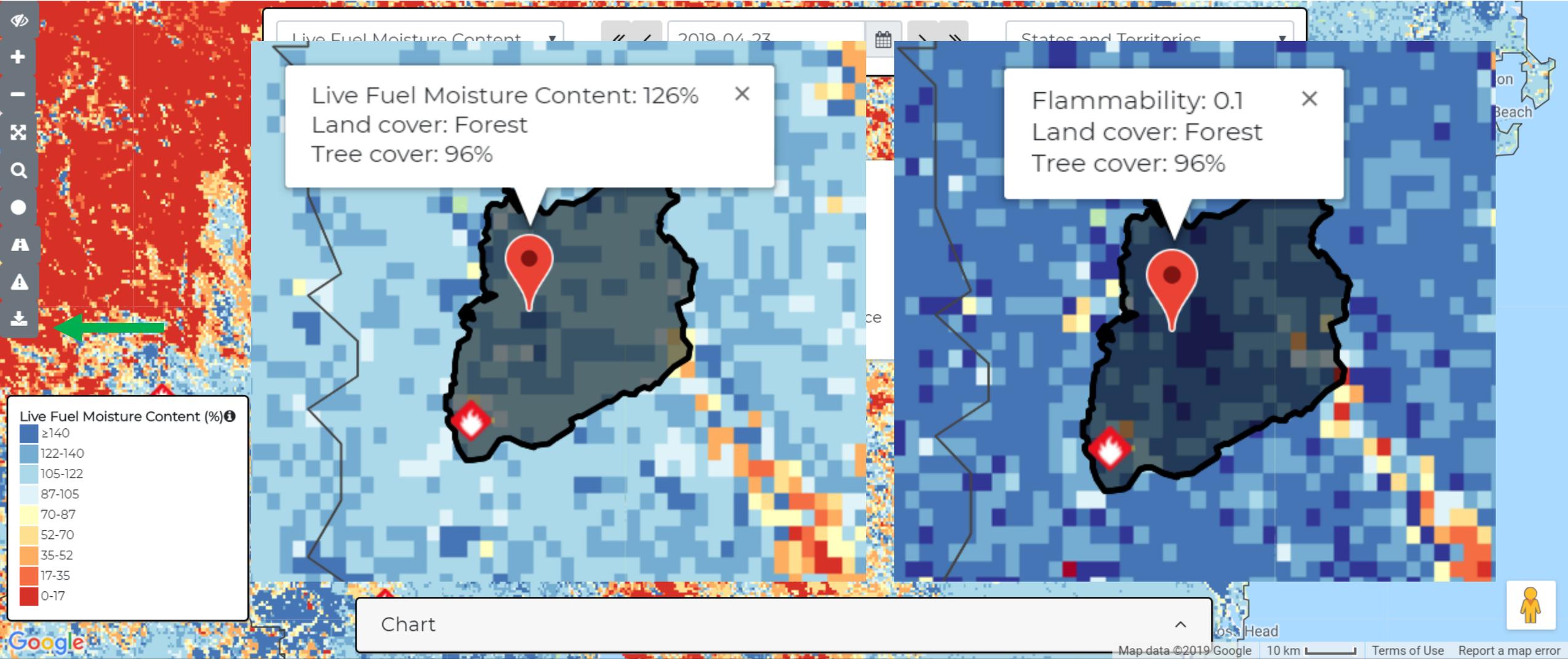
Chart

Map data ©2019 Google

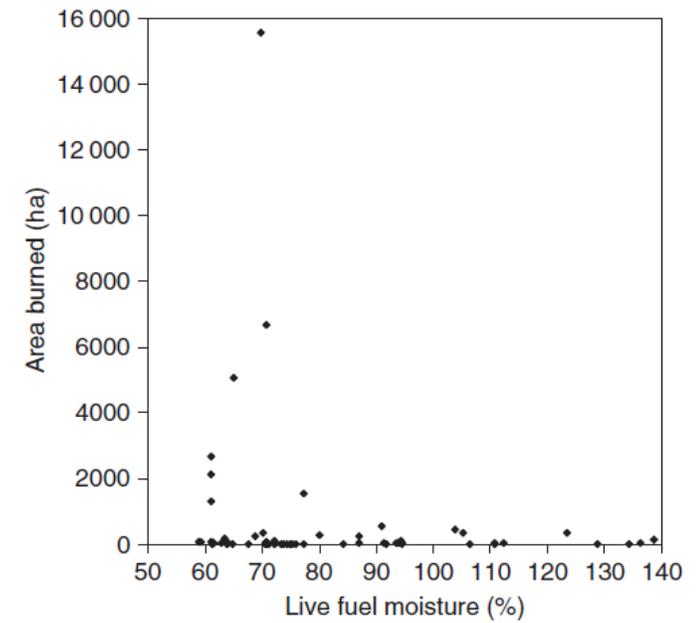
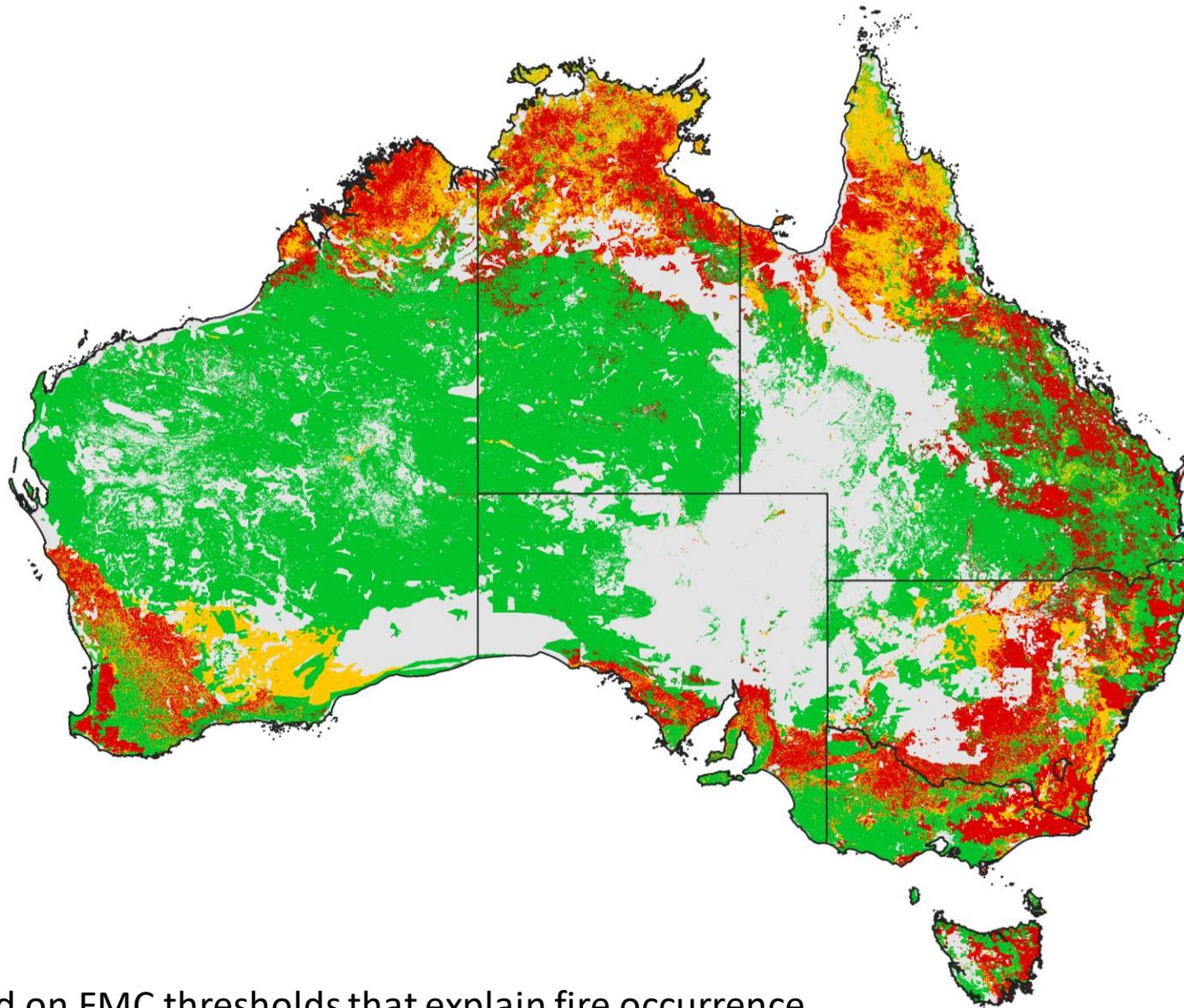
500 km

Terms of Use

# Australian Flammability Monitoring System



# FMC map for Australia

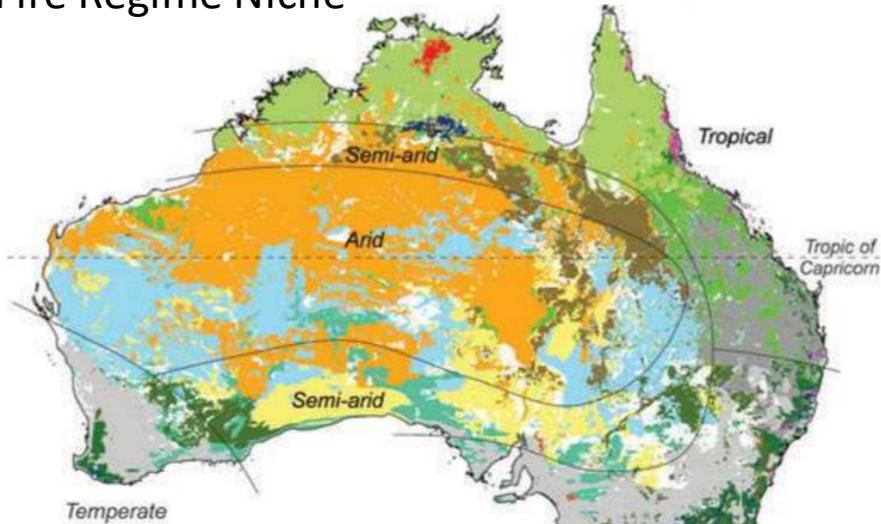


Based on FMC thresholds that explain fire occurrence

Dennison *et al.* 2008, IJWF

# FMC empirical thresholds

## Fire Regime Niche



- Rain forest (tropical): Rare low-intensity litter fires in spring
- Tall eucalypt forest (temperate): Very infrequent high-intensity crown fires in summer
- Eucalypt forest (temperate): Infrequent low-intensity litter fires in spring and medium-intensity shrub fires in spring and summer
- Rain forest (temperate): Rare low-intensity litter fires in autumn
- Heath (temperate): Infrequent medium-intensity shrub fires in spring and summer
- Pasture (tropical and subtropical): Infrequent low-intensity grass fires in spring and summer
- Pasture, cropland (temperate): Infrequent low-intensity grass fires in autumn
- Eucalypt woodland (temperate): Infrequent low-intensity litter fires in spring and medium-intensity grass fires in summer
- Eucalypt forest and woodland (tropical): Infrequent low-intensity grass fires in winter and medium-intensity shrub fires in spring
- Acacia woodland (brigalow) (tropical semi-arid): Rare medium-intensity crown fires in spring and summer
- Tussock grassland (temperate semi-arid): Very infrequent low-intensity fires in autumn or medium-intensity grass fires in spring and summer
- Heath (tropical): Infrequent medium-intensity shrub fires in winter and spring
- Eucalypt savanna woodland (monsoon tropical): Very frequent low-intensity grass fires in winter and spring
- Mallee (temperate): Infrequent medium-intensity shrub fires in spring and summer
- Acacia woodland (lancewood) (tropical semi-arid): Very infrequent medium-intensity shrub fires in spring
- Acacia shrubland (mulga) (semi-arid/arid): Rare low-intensity grass or medium-intensity shrub fires in spring and summer
- Eucalypt woodland (tropical semi-arid): Frequent to infrequent low-intensity grass fires in spring and summer
- Chenopod shrubland (semi-arid/arid): Rare low-intensity litter fires in spring and summer
- Hummock grassland (semi-arid/arid): Infrequent medium-intensity grass fires in spring
- Tussock grassland (tropical semi-arid/arid): Very infrequent low-intensity grass fires in spring and summer
- No data

**Table 1: Approximate LFMC threshold values indicating marked increases in burnt area, and the proportion of each studied niche burnt during the studied time period (2002-2014).**

Fire Regime Niche	Threshold LMFC (%)	% Area Burnt
Temperate Eucalypt forest	160, 135	1.6
Tall Temperate Eucalypt Forest	160, 130	6.5
Temperate heath	55, 20	6.4
Tropical and subtropical pasture	20	10.7
Cropland pasture	65, 20	14.49
Temperate Eucalypt woodland	130, 45	2.5
Tropical Eucalypt forest and woodland	45, 15	26.9
Tropical Heath	95, 50, 20	158.2
Eucalypt savanna woodland	90, 55, 20	19.7
Temperate mallee	45	3.1
Acacia shrubland (mulga)	45	9.2
Hummock grassland	45, 20	43.5

Gale et al., In preparation

# How your research is currently being applied or is intended to be applied

Spatially-explicit knowledge of FMC and flammability must be a key aim for fire managers

## Planning

Assist with **scheduling and plan prescribed burns:**

- drier FMC in a forest may indicate more potential to score the canopy
- fuel moisture differential can act as soft control lines
- long term fuel conditions for the PB-DST
- emissions assessment and smoke dispersion

## Preparedness

**Amend preparedness levels** in relation to Fire Danger Rating in response to lower/higher than average landscape dryness conditions or exceed set FMC or FI thresholds

## Response

**Assist in firefighting and resources allocation**

- FMC as an **input in Spinifex grass** fire behaviour
- Highlight potential for **anomalies in predicted rate of spread:** for lower FMC a fire may spread faster than predicted
- soft control lines based on fuel moisture differential

# Examples

David Taylor. Tas Parks “ tools for out Fire Duty Officer → Bushfire Operational Hazard Model(BOHM) “... if you were to drop a match how hot a fire would get, we use that in prepositioning fire crews and patrols”

Simeon Telfer “We having been using the website today to try and figure out the best time for our burning. We are planning a burn in a patch of low heath (1.5m) which is only 5 years or so since last burn, but is extremely thick. The issue we are having is that there is practically no dead fuel, so dead fuel moisture content is irrelevant. The live fuel moisture is good to know, but we have no correlation to fire behaviour! The JASMIN soil moisture profile are very interesting too, but again, **we need to correlate this to fire behaviour, or probably risk of burn escape.**”

# **The broader opportunities for your research to contribute to bushfire mitigation**

- Improving spatial resolution may open more opportunities for schedule and plan prescribed burns
- By linking to other initiatives/projects
  - Input for Extreme fire behavior prediction (Trent Penman et al.)?
  - Input for the new FDRS?
  - Inputs for fire behavior

# What's next?

Comprehensive Flammability index; probability of having a fire of  $x$  intensity (still to be define) given a ignition source

- Dependent variable: Fire ignitions (date+intensity)
- Drivers:
  - a. LFMC
  - b. Jasmin soil moisture
  - c. T, RH and wind speed
  - d. Total Biomass

# Thanks

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