



# Making sense of fire science

Glenda Wardle

University of Sydney

# Key messages

---

- Climate change is causing hotter and drier conditions
- Fires are larger and more intense = megafires
- Prescribed burning does not stop catastrophic fires
- Fire regimes are needed to manage for biodiversity

## Bottom line

---

Multiple stressors for biodiversity



Image: Max Uechtritz



Good news - fluorescent pink slugs have survived



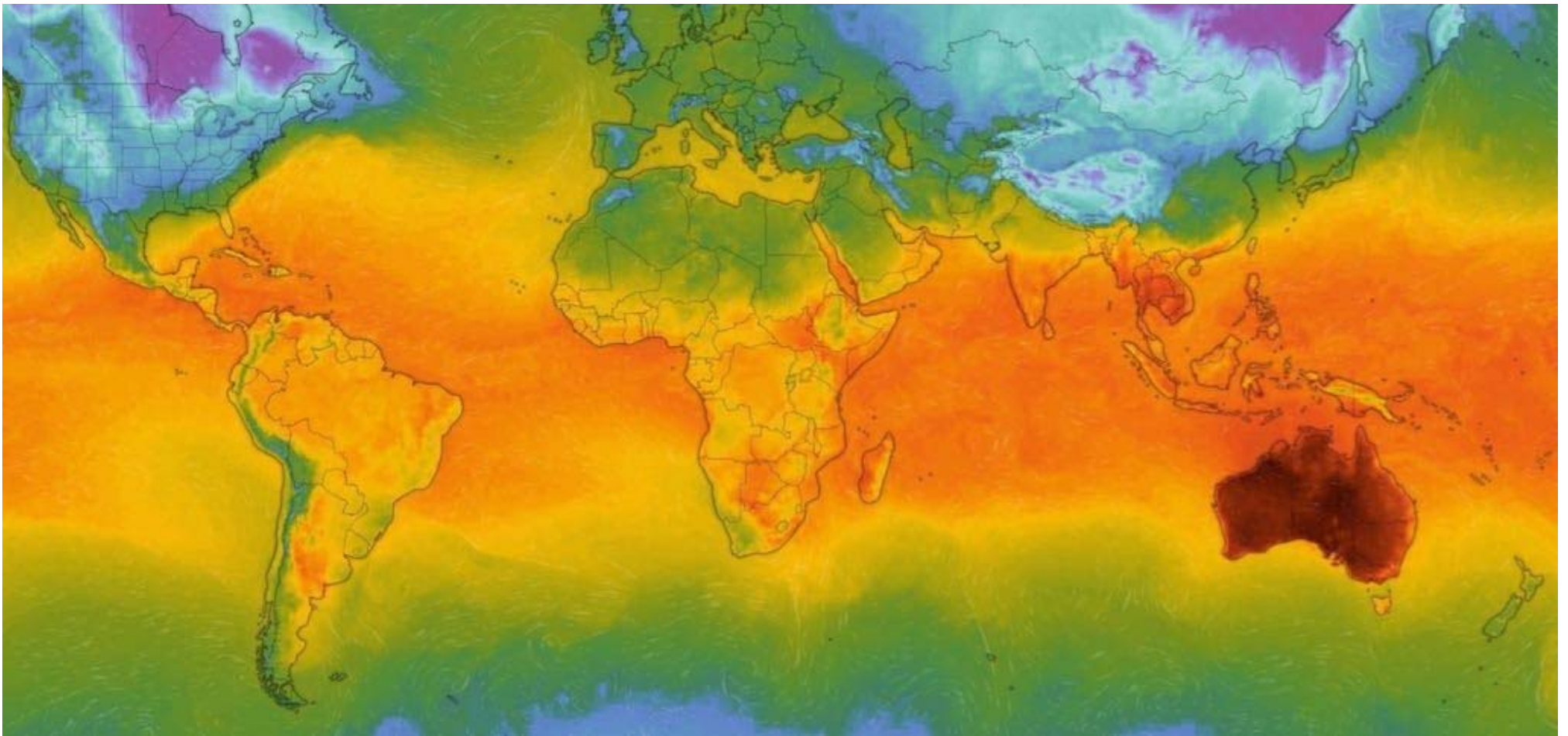
Photograph: Michael Murphy/AFP



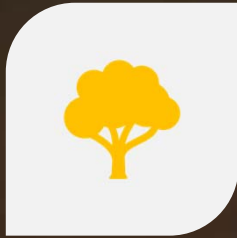




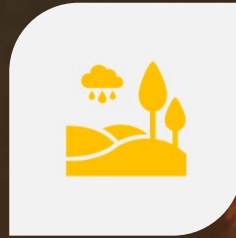
Climate change is causing hotter and drier conditions



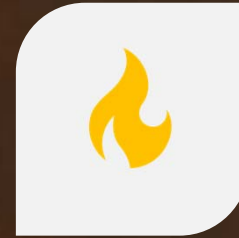




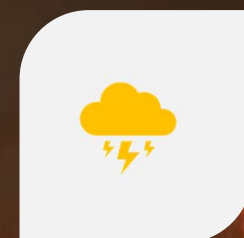
BIOMASS  
GROWTH



FUEL MOISTURE  
CONTENT



IGNITION

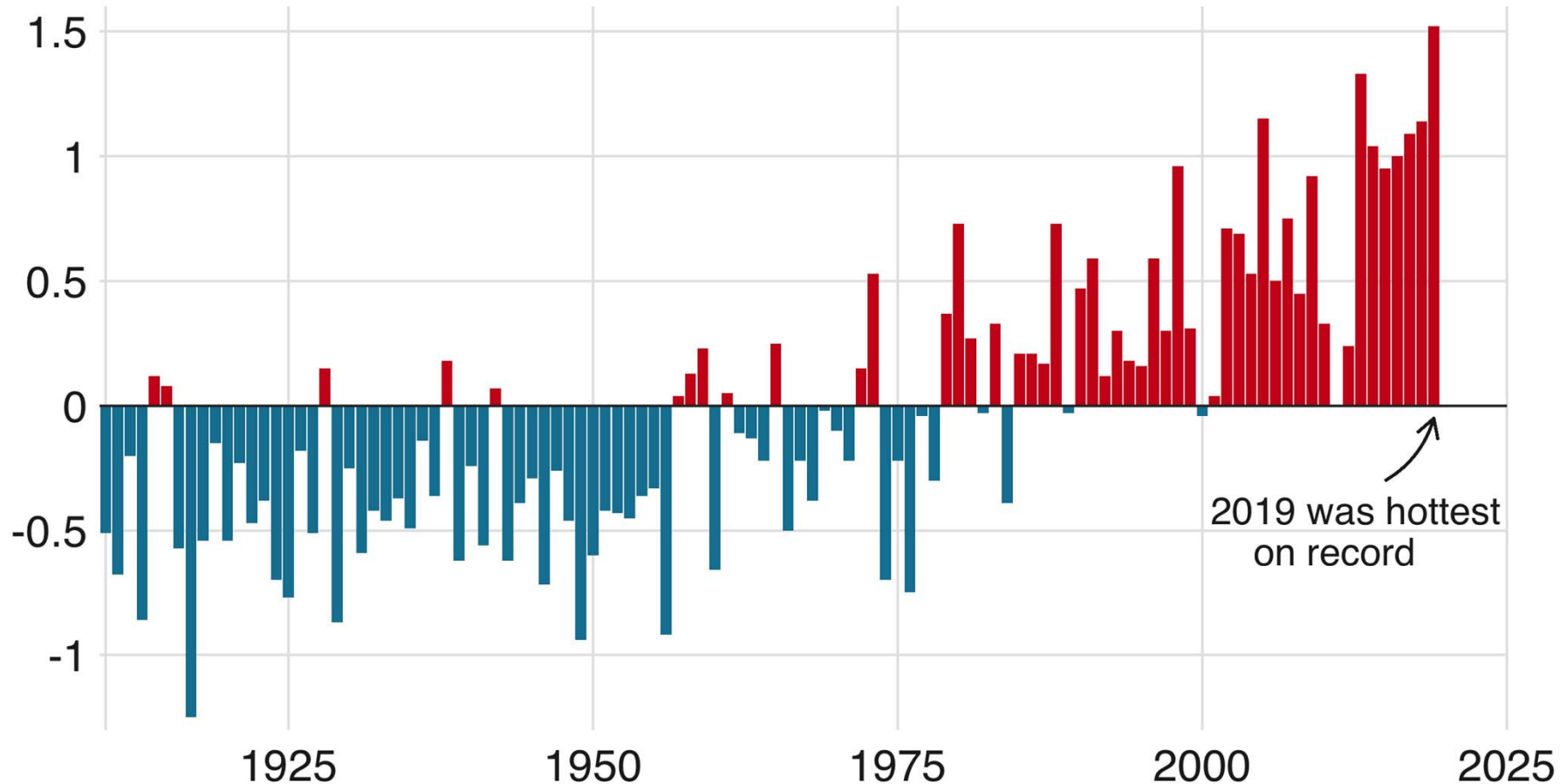


FIRE WEATHER

Image Dunns Road Fire

# Australia has been getting warmer

Annual mean temperature above or below average (°C)



2019 was hottest  
on record

Note: Average is calculated from 1961-1990 data

Australian Government Bureau of Meteorology

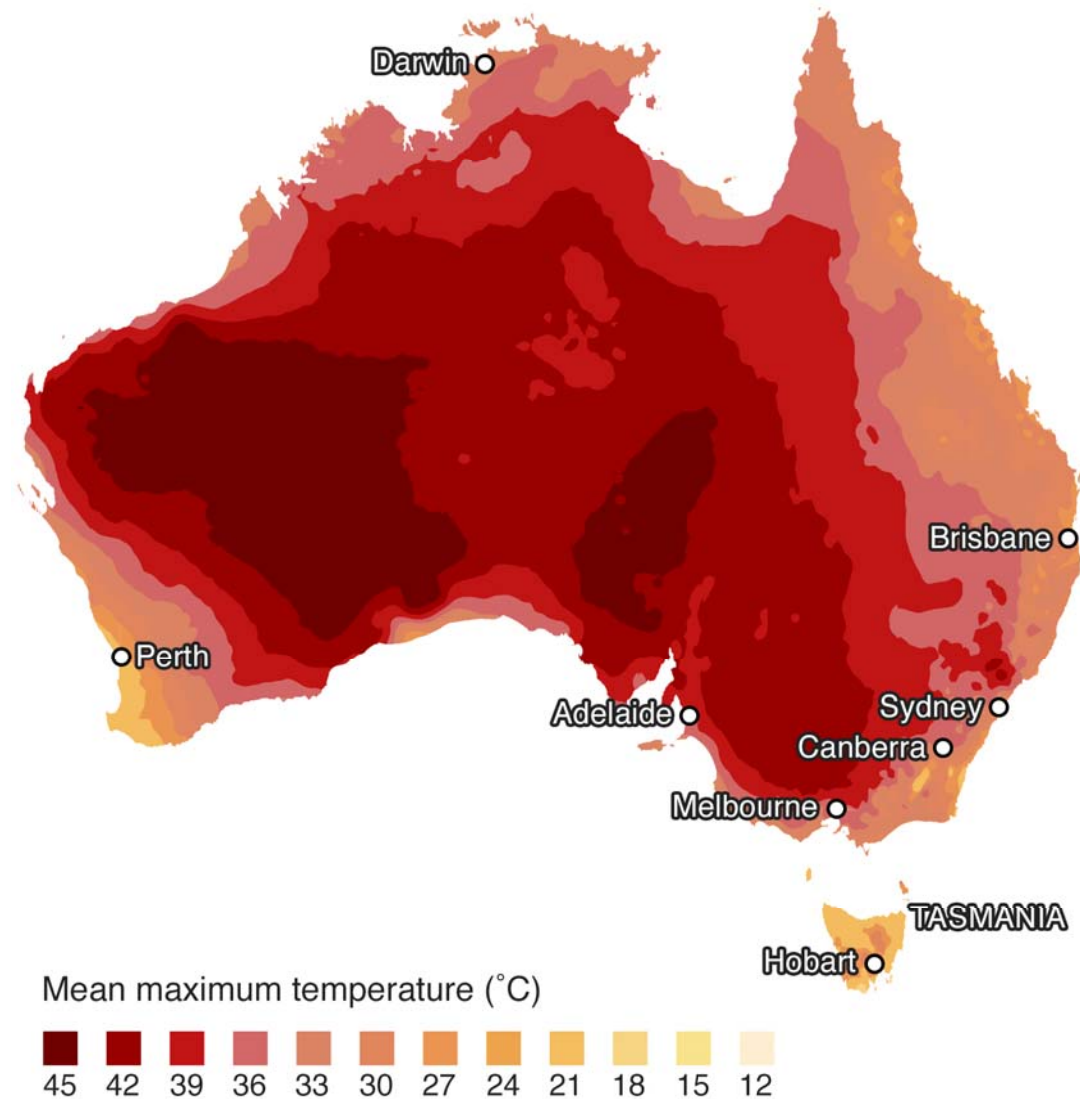


HOTTER

Temperature  
records broken

Australia average  
maximum in Dec 2019  
>40C

Mean maximum temperature, 29 Dec



Source: BOM Australia

BBC

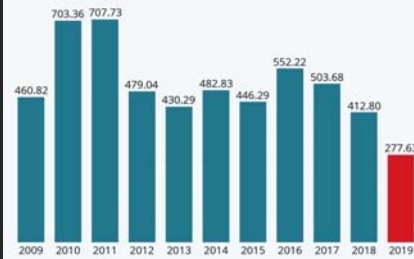




# DROUGHT DIE BACK

## Drought Down Under

The average annual rainfall in Australia from 2009 to 2019 in millimeters



Source: Bureau of Meteorology



statista

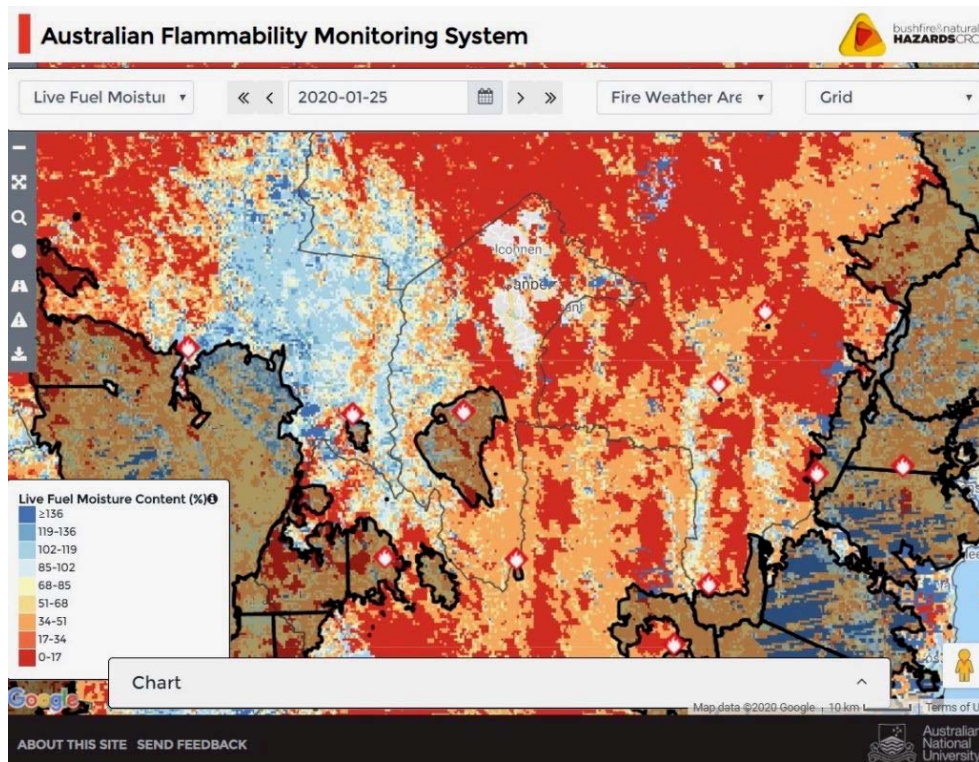
Image Belinda Medlyn



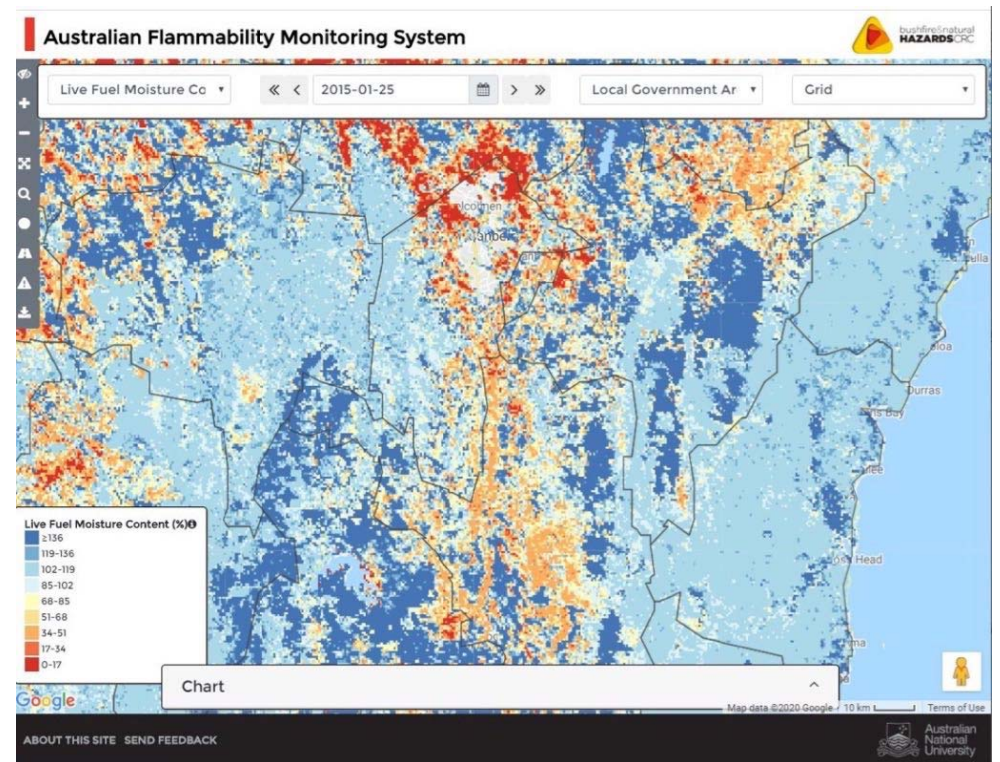


# Live Fuel Moisture Content

January 2020 < 20%

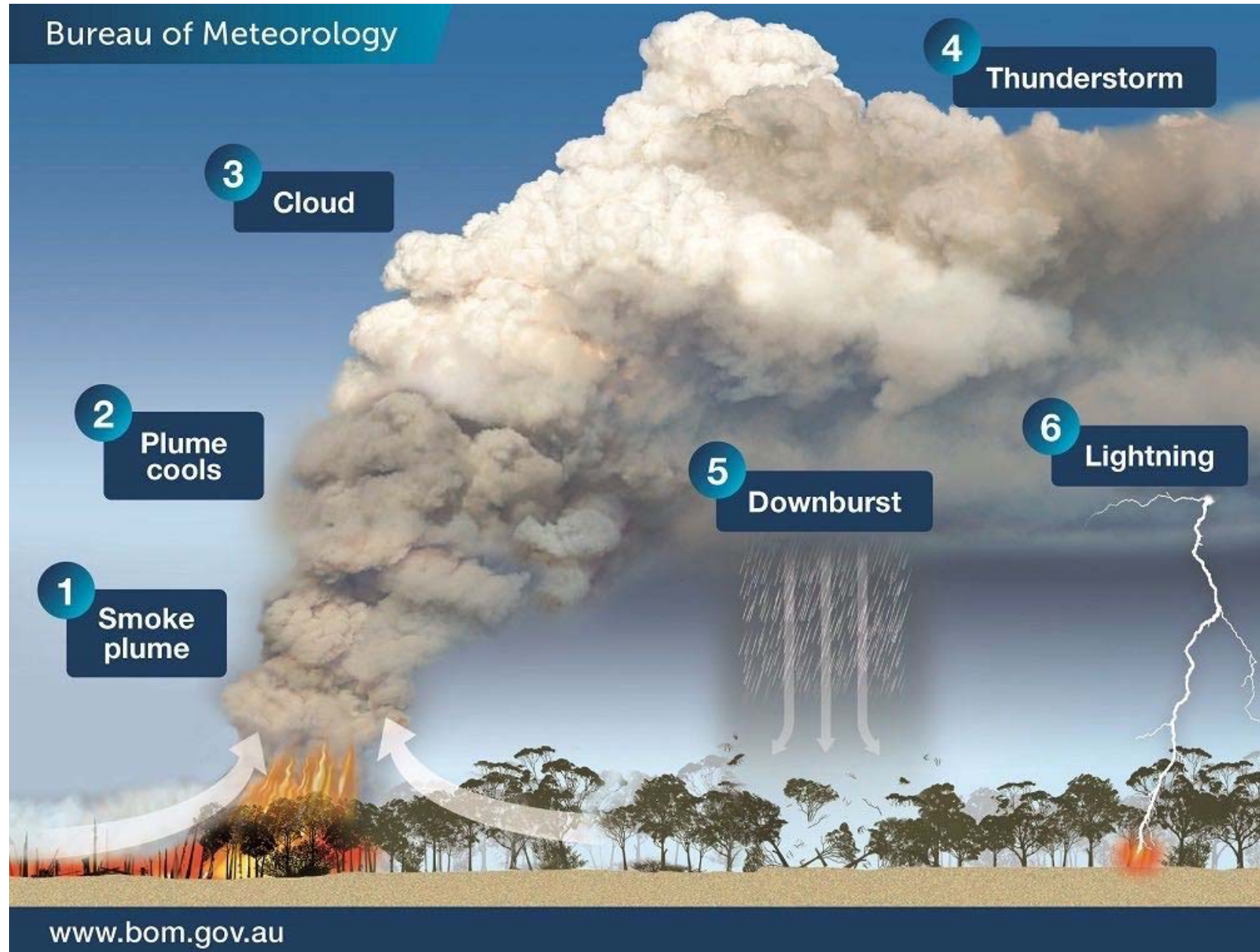


January 2015 High FMC

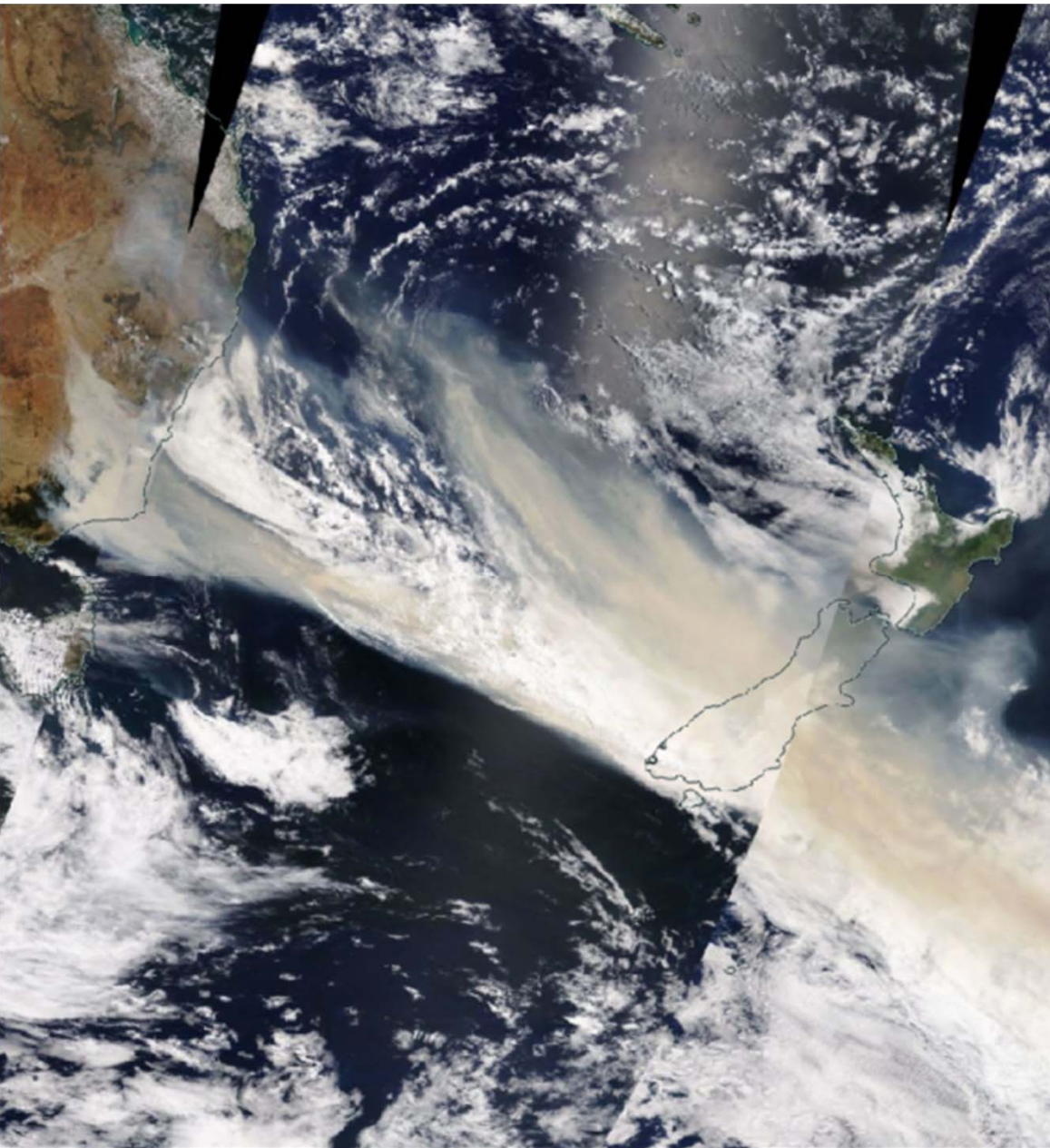




Big fires  
create their  
own weather







Smoke plumes reach NZ  
and then South America



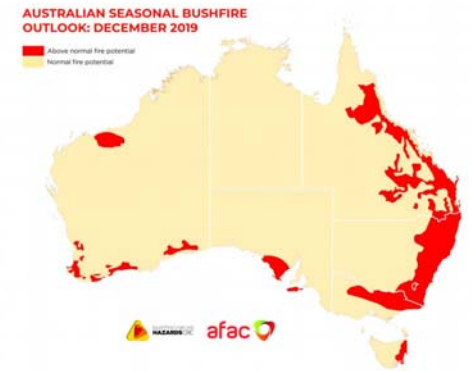
Image: Morgan Bailey Twitter 5 Jan 2020





# Science informs fire preparation and planning

NSW Rural Fire Services HQ issue daily alerts and predictions



Fire spread predictions for NSW and  
Canberra area for Saturday 1 February

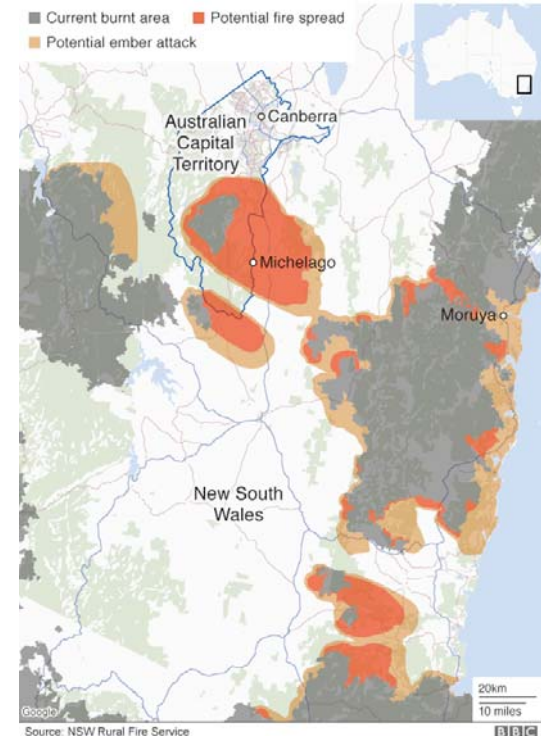


Photo: Anthony Clark, New South Wales

## Bushfires in New South Wales and Victoria



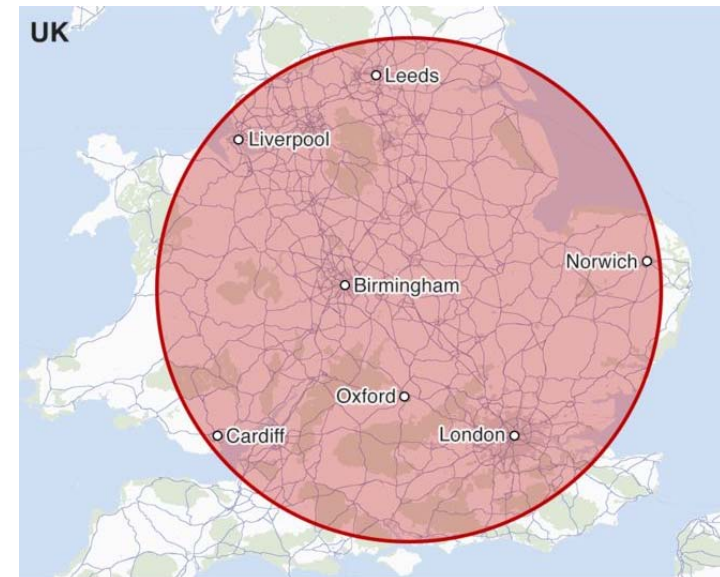
Source: DAFF and local fire services, 6 Jan

BBC

How big are the Australian fires?

10 million hectares (100,000 sq kms since 1 July 2019)

How do fires compare to Brexit?



England is 130,373 square kilometers

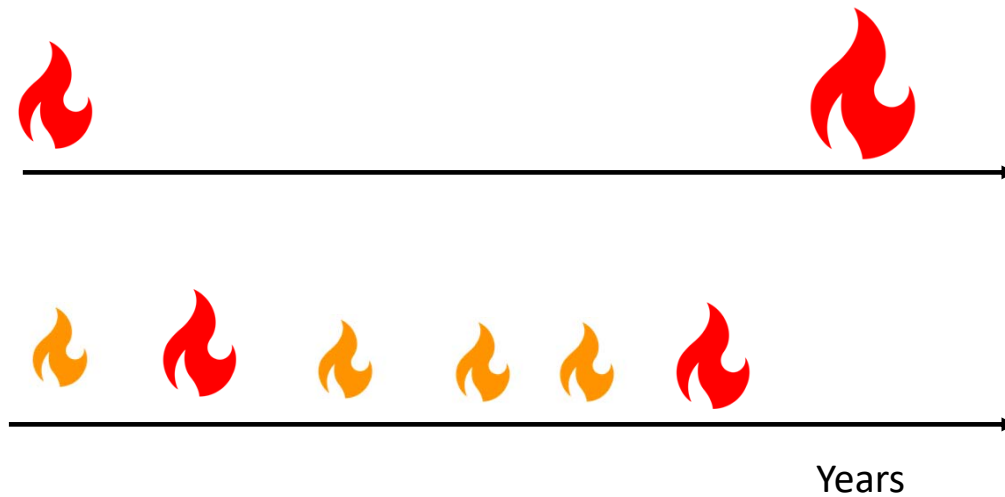




Oct. 20

# Ecological fire regimes

- Pattern, frequency and type of fire.
- Natural areas have complex fire histories
- Tolerable fire interval – different for each species









Good news – fires are patchy, some areas spared









# Kangaroo Island, SA

Satellite images show extent of damage to Kangaroo Island

12 January 2020



15 December 2019



Source: Copernicus.eu

BBC

Images AAP, Matt Johnson, The New Daily





How intense were these fires?

“Tree ghosts” are the result of very intense fire events.

These fallen trunks left pale scars after full combustion of all wood at high heat over long periods.

Image Gavin Butler, site near Bega, NSW





# Multiple stressors for biodiversity

---

---

Death of wildlife

---

Animal welfare issues for injured wildlife

---

Loss of habitat, food and shelter

---

Feral predators and weed invasions

---

Disrupted ecology for pollination, dispersal, decomposition

---

Loss of soils microbial community, and soil erosion

---

Smaller, fragmented populations





Professor Chris Dickman

Desert Ecology Research Group,  
School of Life and Environmental Sciences  
Sydney Institute of Agriculture,  
University of Sydney

## Fire impacts on fauna



Johnson et al. 2007 WWF report, updated Chris Dickman 2020

FACT CHECK

<https://www.abc.net.au/news/2020-01-31/fact-check-have-bushfires-killed-more-than-a-billion-animals/11912538>



National Environmental Science Programme



## After the catastrophe: a blueprint for a conservation response to large-scale ecological disaster

January 2020

Chris Dickman, Don Driscoll, Stephen Garnett, David Keith,  
Sarah Legge, David Lindenmayer, Martine Maron, April Reside,  
Euan Ritchie, James Watson, Brendan Wintle, John Woinarski

“The wildfires were beyond anything anticipated in conservation planning and management for Australian biodiversity.”

331 threatened species within the fire areas

13 birds, 4 fish, 14 frogs, 4 insects, 1 spider, 16 mammals,  
7 reptiles, and 272 plant species



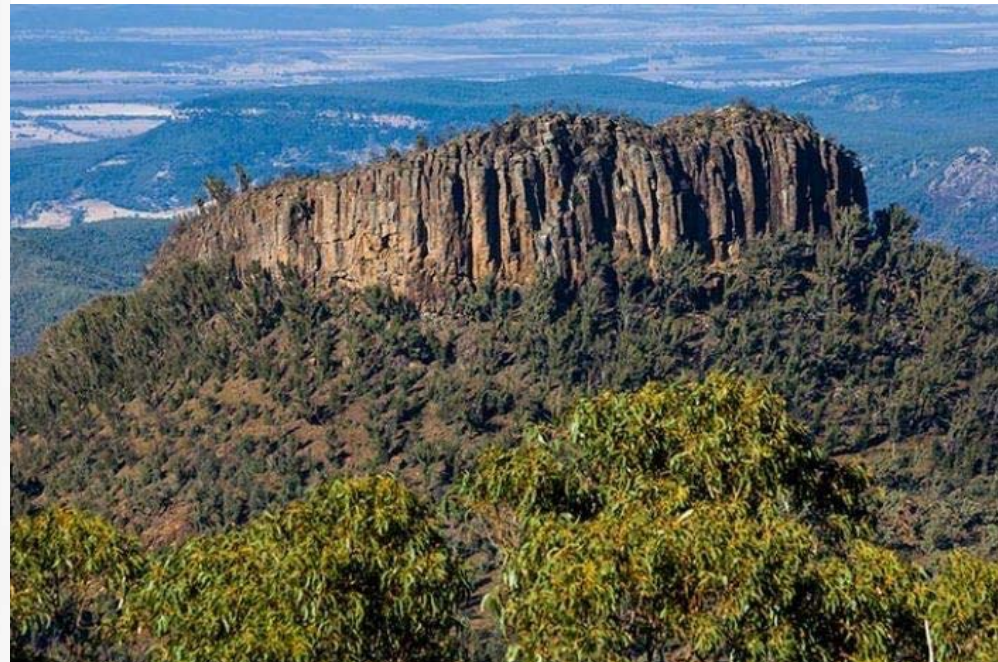




## Endangered ecological community

20 species of land snails, from high elevation and dry rainforests of the Mount Kaputar, northern NSW.

Fluorescent pink slug  
(*Triboniophorus* sp. nov. 'Kaputar')



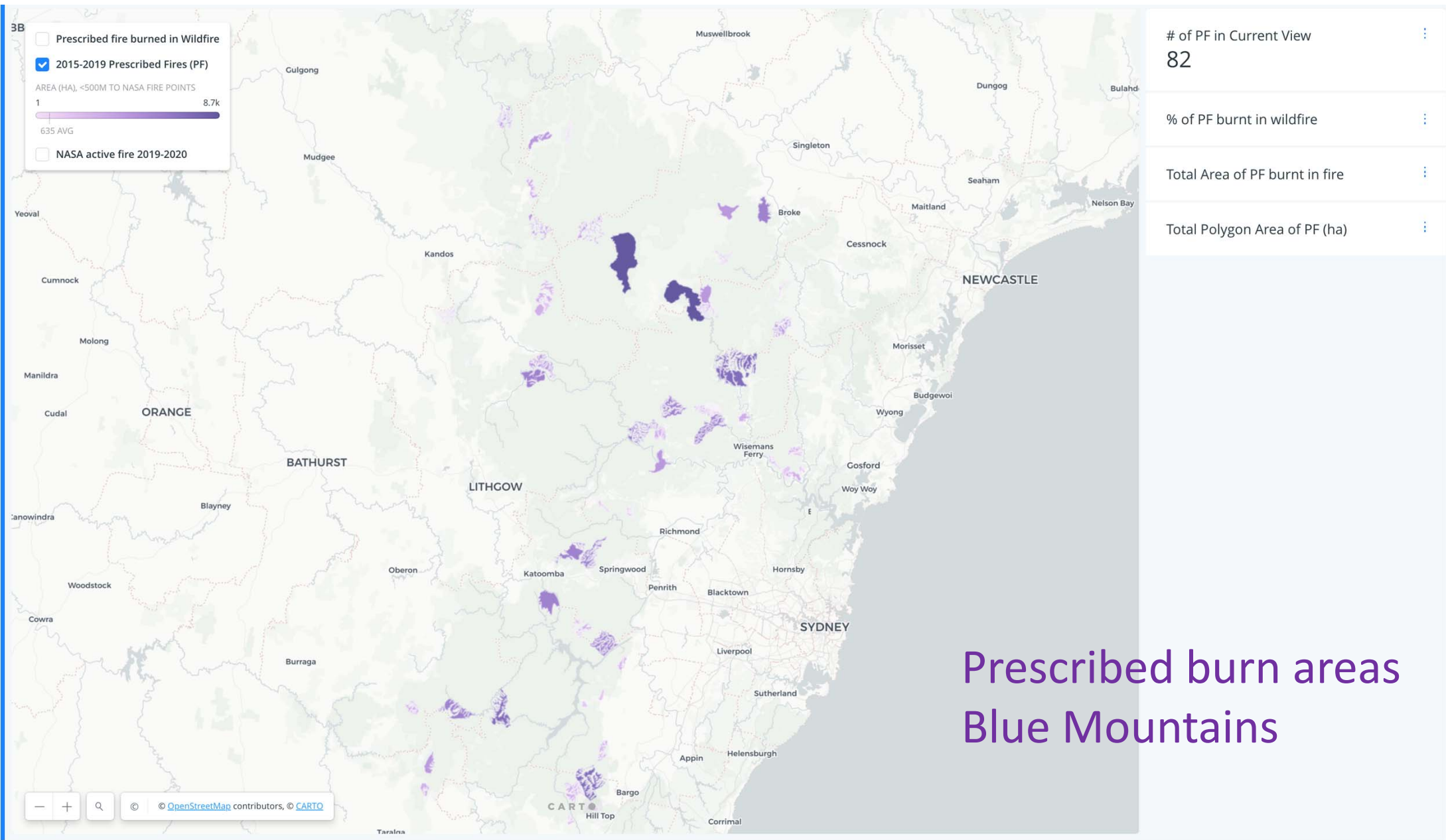


# Prescribed burning –in black & white

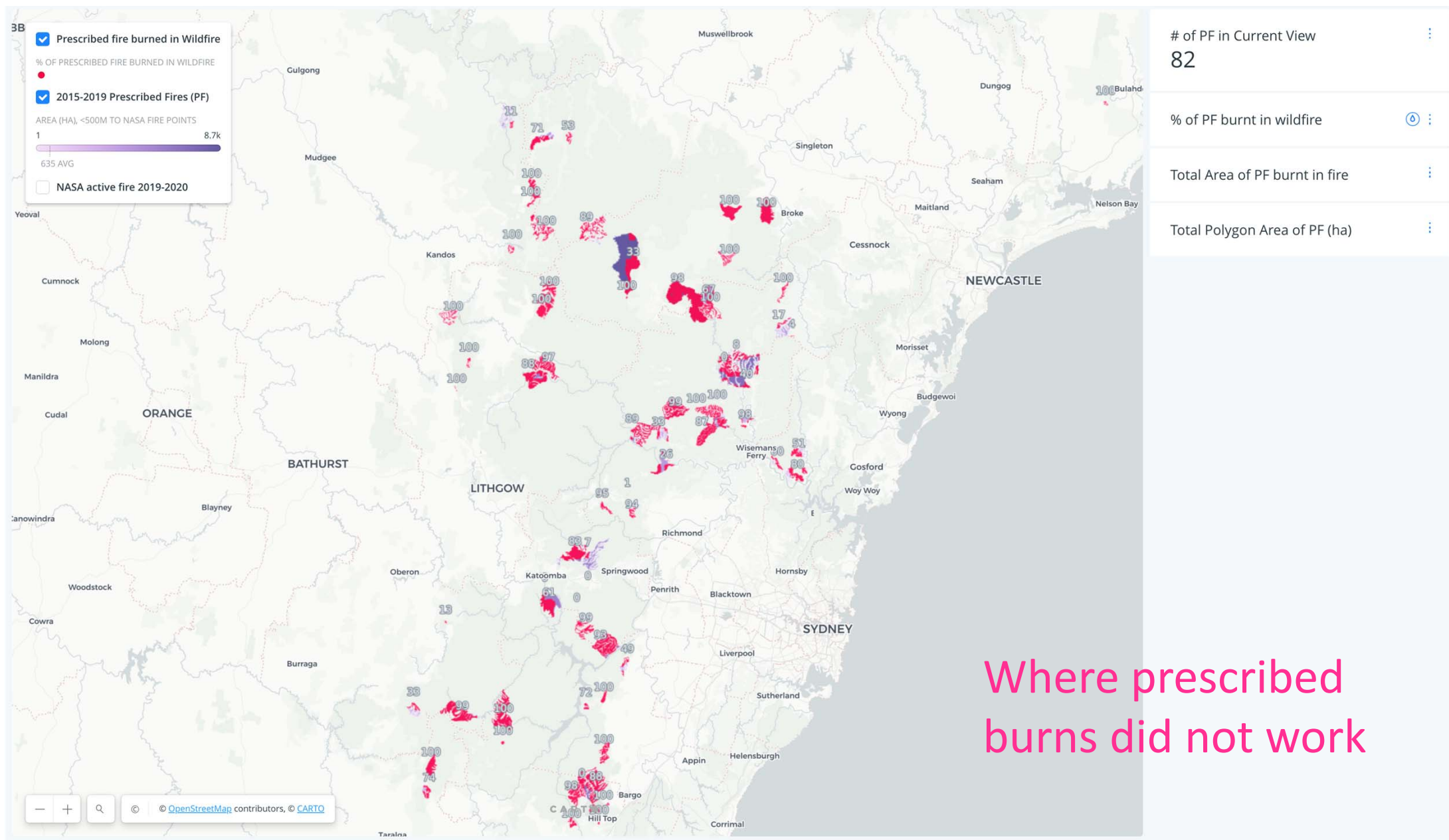
What you want - Cool season, slow burning, ground fires, less intense

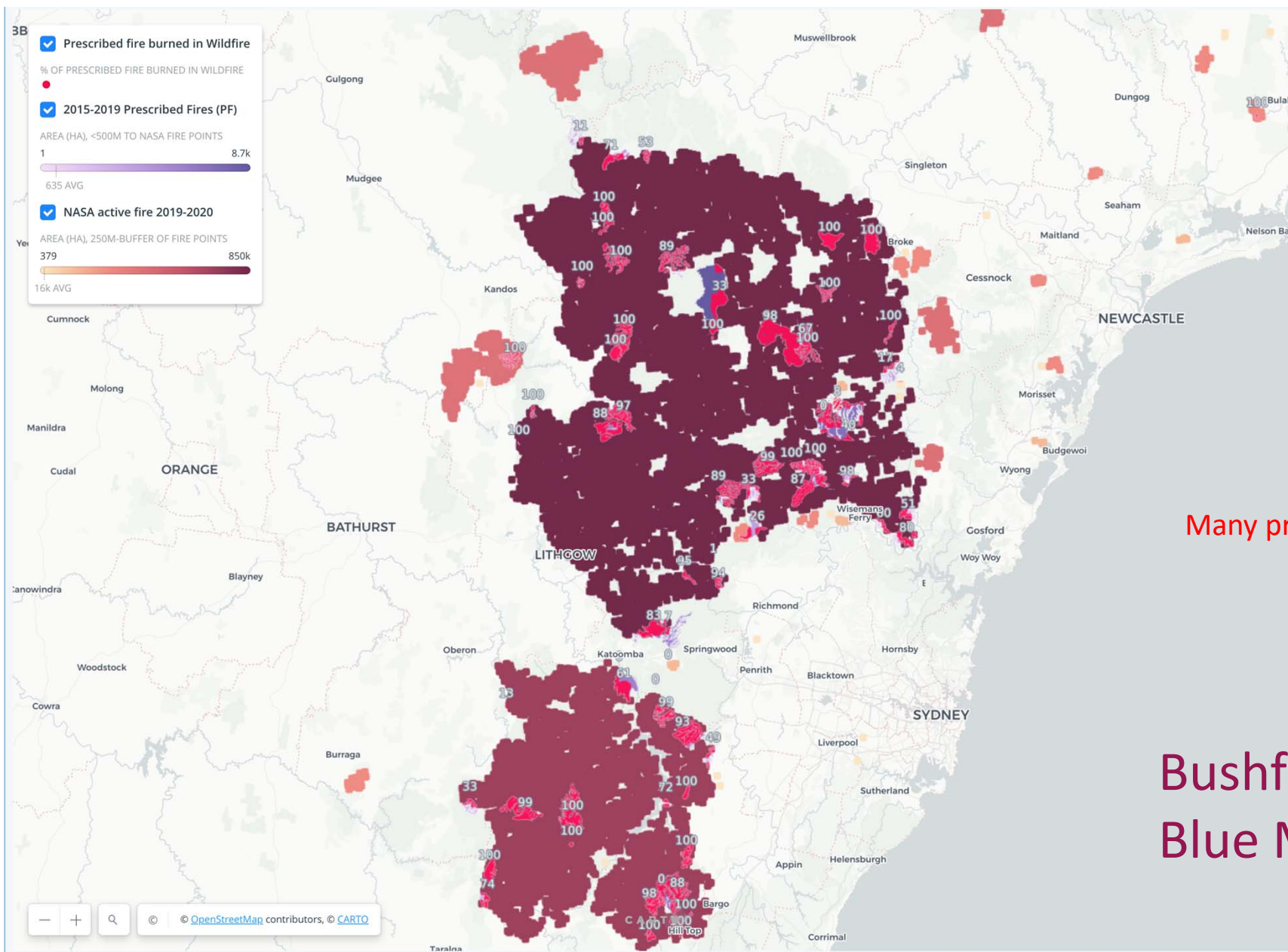
What you get -

- Prescribed burns did occur, but did not stop fires
- Catastrophic fire weather leads to crown fire and firestorms
- Safe windows have been reduced by warmer, drier, windy conditions









# of PF in Current View  
82

% of PF burnt in wildfire  
107 SELECTED



Total Area of PF burnt in fire  
64,067.62

Total Polygon Area of PF (ha)  
112,714.88

Many prescribed burns 100% burnt

Bushfire area in  
Blue Mountains

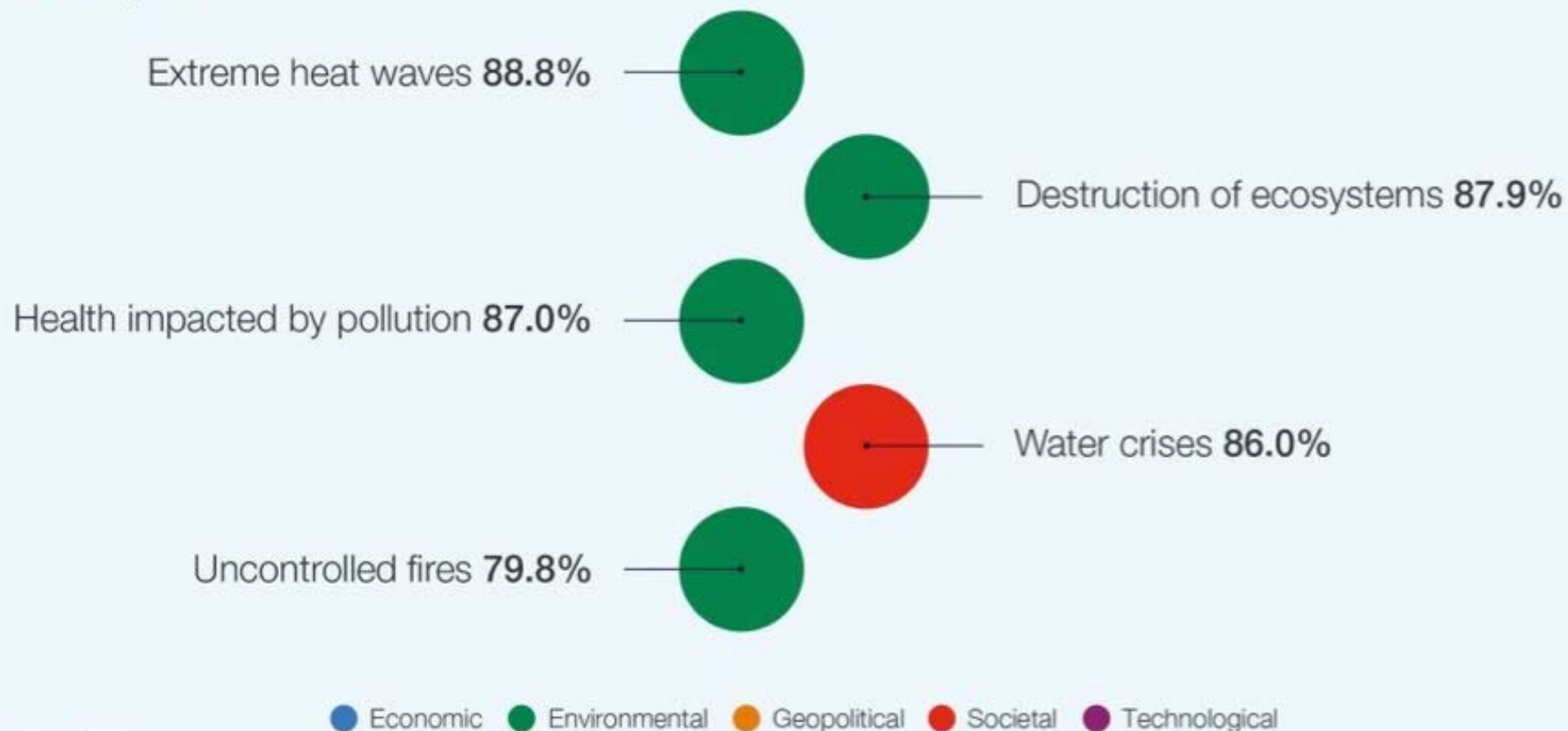


# Short-Term Risk Outlook

Percentage of respondents expecting risks to increase in 2020



## Global Shapers



Source: WEF Survey 2019

# DARE

Data Analytics for Resources and Environment

An Australian Research Council Industrial Transformation Training Center



Professor Sally Cripps, Director







## Next steps

---

- **DATA** – monitor plants, animals, soil biota over long enough time
- **LEARN** – use modern data analysis to include uncertainties
- **ACTION** – reduce threats of ferals, weeds, soil erosion
- **MANAGE RISK** – Reevaluate threatened species & ecological communities
- **WISE UP** – Fire regimes need to be managed for biodiversity, as well as people







# Thanks

---

We acknowledge the Wangkamadla people as traditional owners of the land on which we undertake our research



Desert Ecology Research Group, Simpson Desert study 30+ years