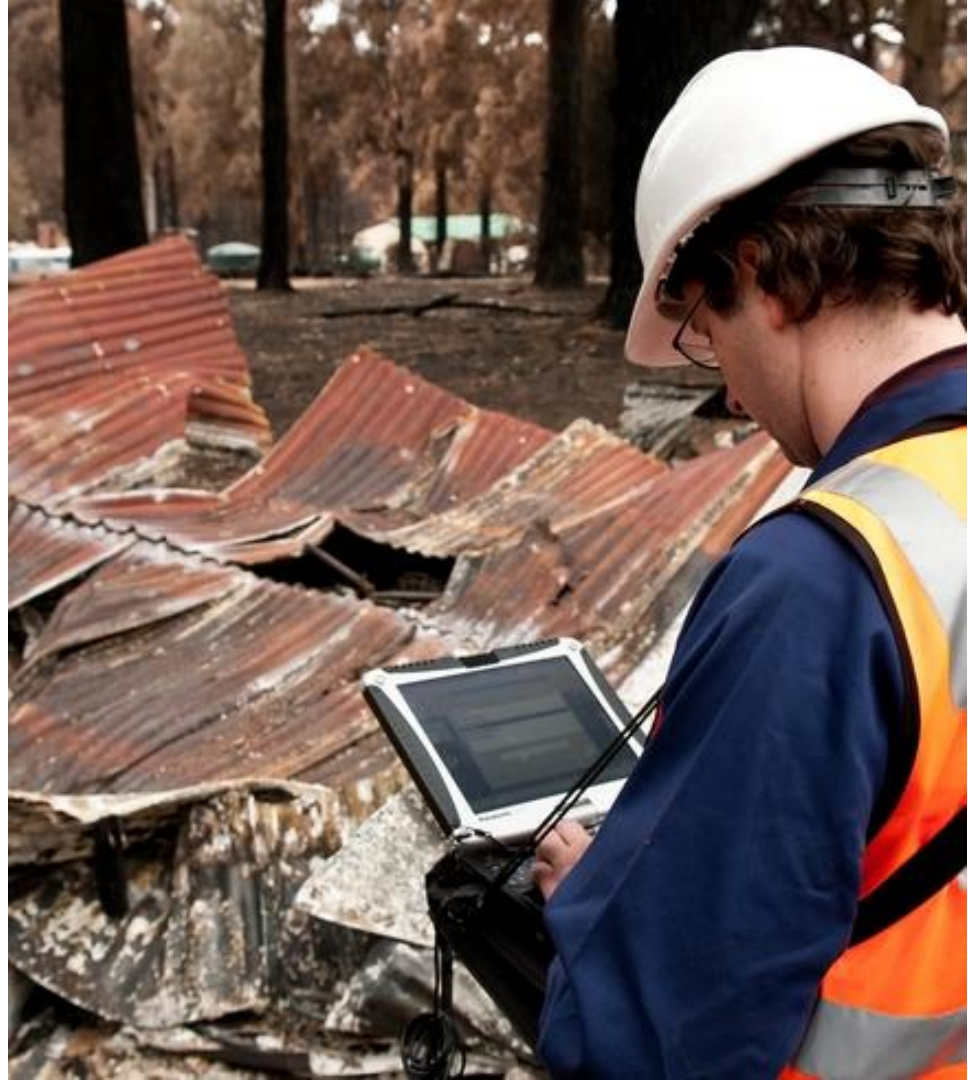




Research and Development for Bushfire Resilience

Dr Andrew Moore
CSIRO Resilience Coordinator

Australia's National Science Agency



CSIRO Innovations



Fast WiFi



Plastic Banknotes



**Equivac HeV:
Hendra virus vaccine**



**Extended wear
contact lenses**



Softly Washing Liquid



Total Wellbeing Diet



Aerogard



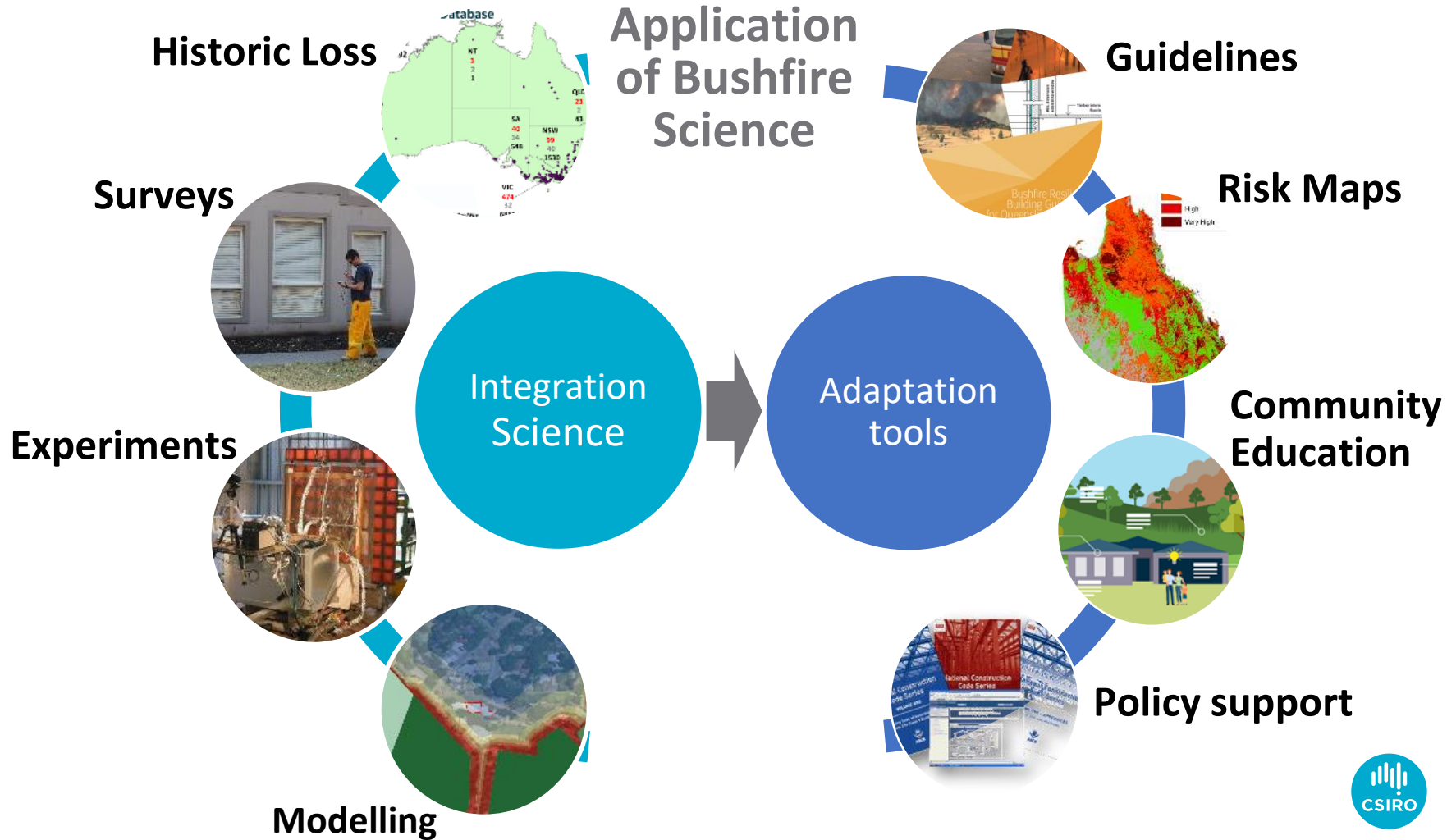
RAFT Polymerization

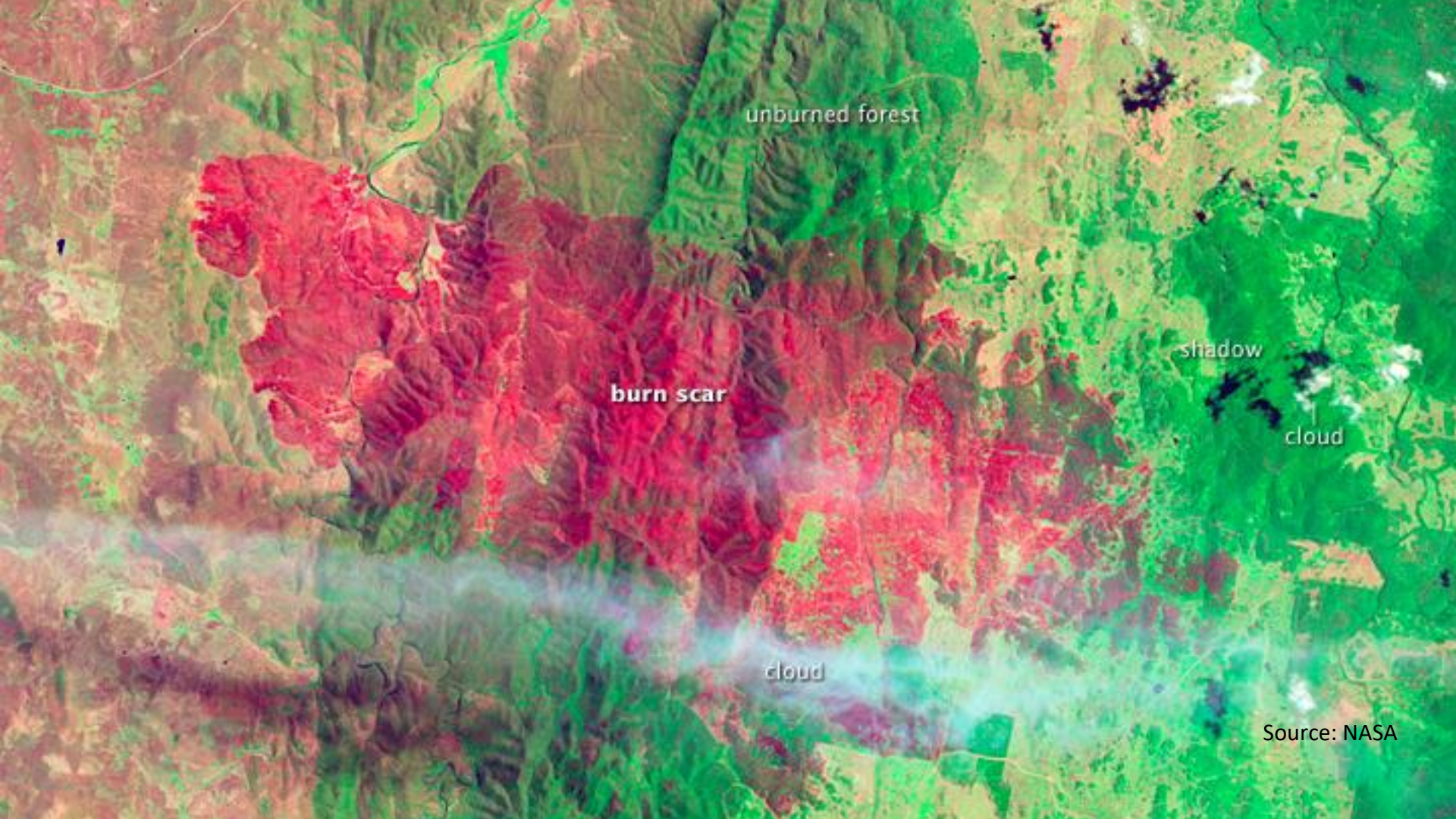
Resilience in the Face of Hazards



Understanding bushfires

Application of Bushfire Science





unburned forest

burn scar

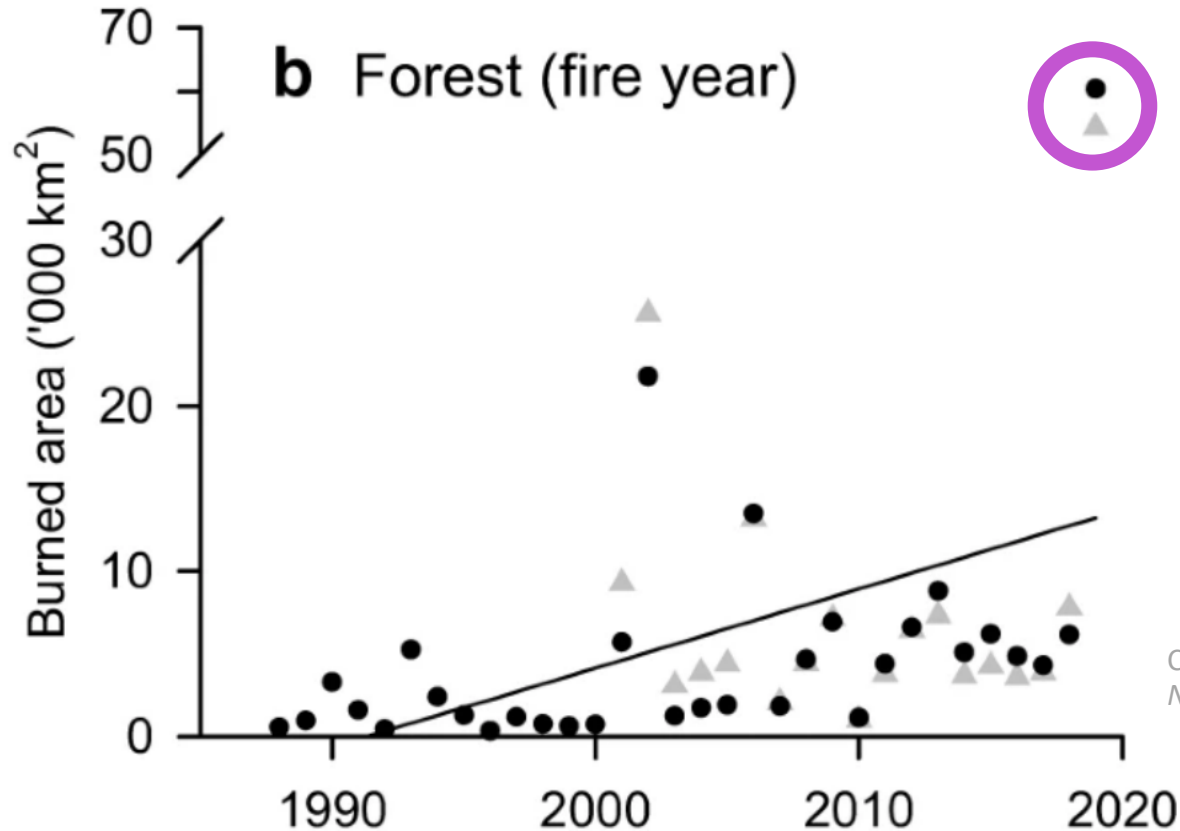
shadow

cloud

cloud

Source: NASA

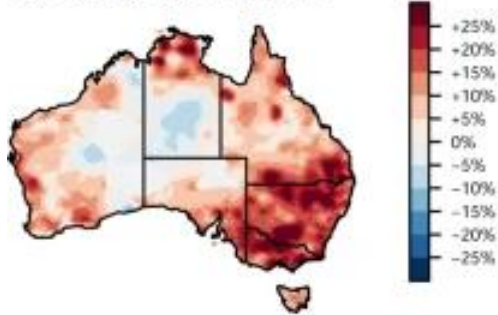
Burned areas are increasing...



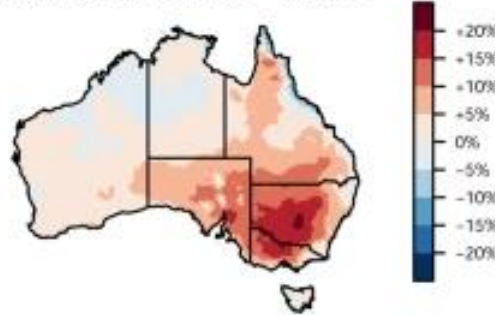
Canadell et al. (2021),
Nature Communications

...and yes, it's linked to climate change
2000-2019 vs 1980-1999

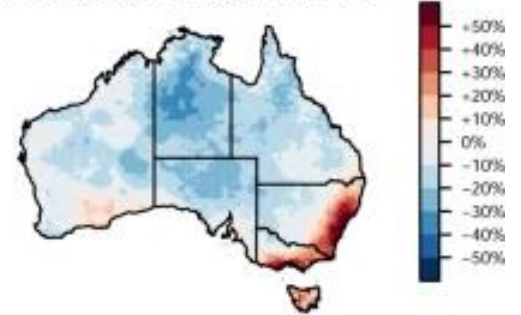
a) Change in mean FFDI



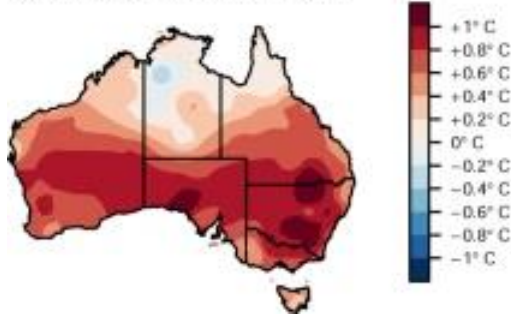
b) Change in mean C-Haines



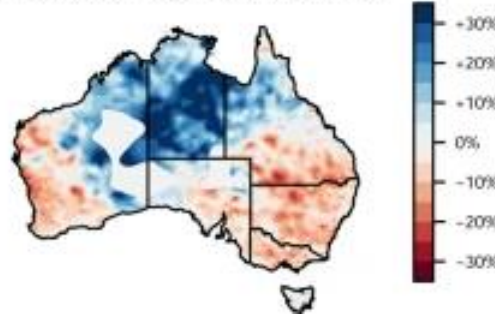
c) Change in dry lightning days



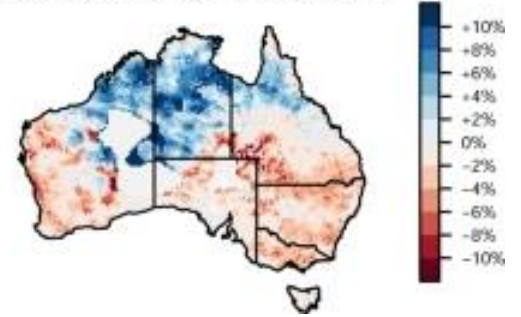
d) Change in mean Tmax



e) Change in mean precipitation



f) Change in mean soil moisture



Canadell et al. (2021), *Nature Communications*

Ever seen
inside a
bushfire
research
facility?



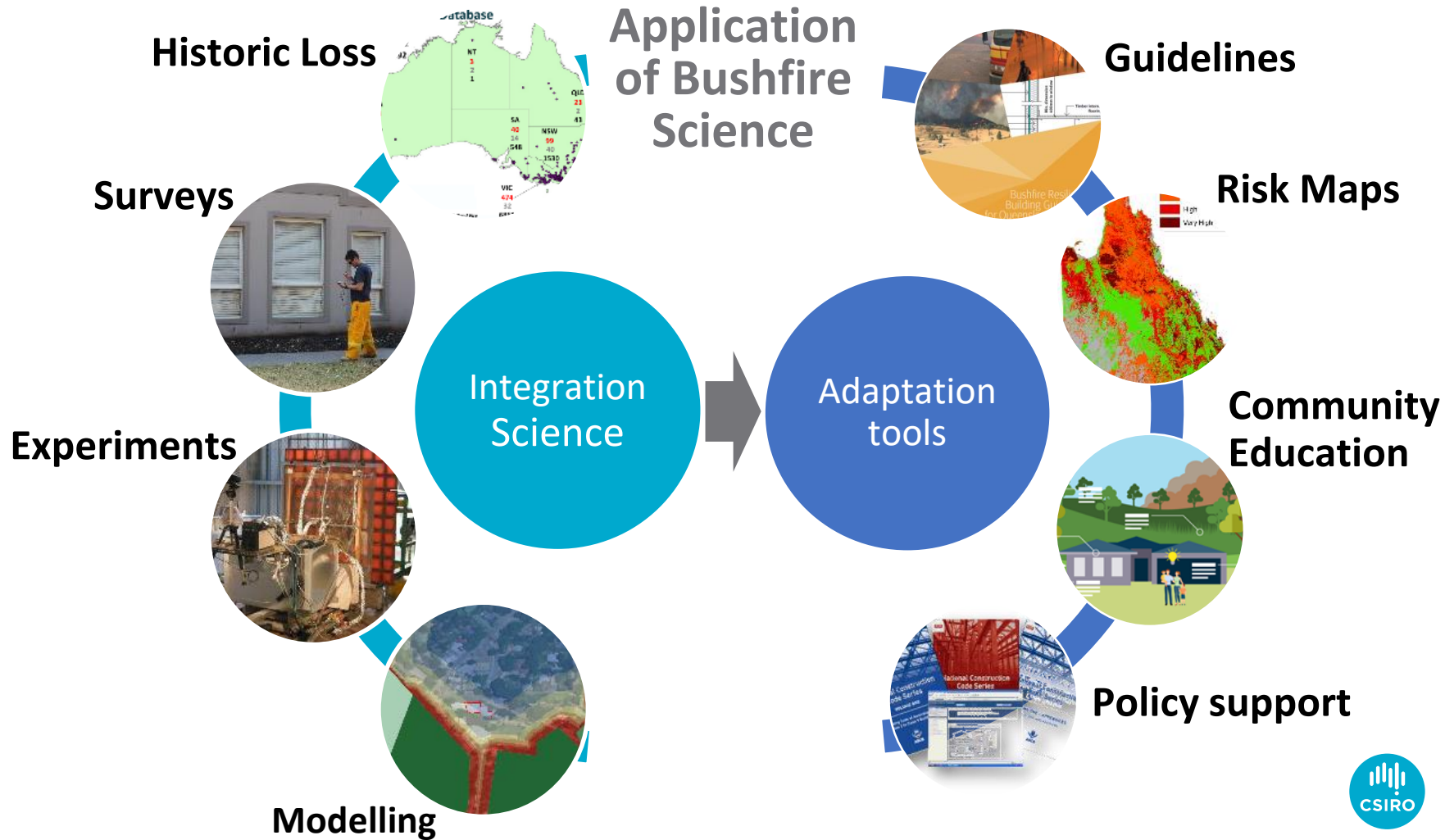
Burning down the house...





Putting bushfire research to work

Application of Bushfire Science





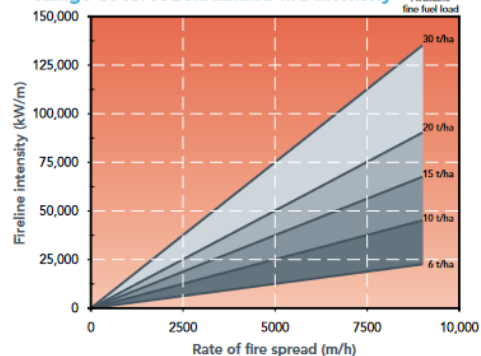
A guide to rate of FIRE SPREAD MODELS for Australian vegetation



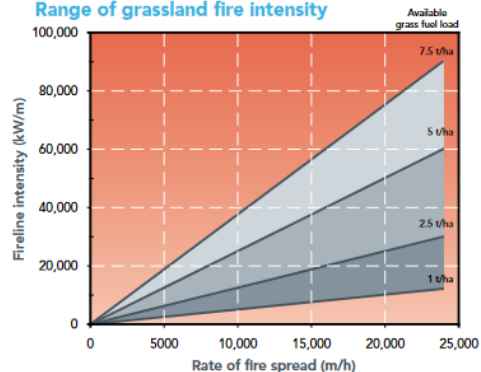
Rate of fire spread unit equivalencies

m/min	m/h
1	60
2	120
3	180
4	240
5	300
10	600
15	900
20	1200
30	1800
40	2400
50	3000
60	3600
70	4200
80	4800
90	5400
100	6000
125	7500
150	9000
175	10,500
200	12,000
250	15,000
300	18,000
350	21,000
400	24,000

Range of forest/shrubland fire intensity



Range of grassland fire intensity



Relative effect of slope steepness on rate of fire spread

	Downslope												Upslope										
Slope angle (°)	-20	-18	-16	-14	-12	-10	-8	-6	-4	-2	0	2	4	6	8	10	12	14	16	18	20		
Slope (%)	-36	-32	-29	-25	-21	-18	-14	-11	-7	-3	0	3	7	11	14	18	21	25	29	32	36		
Relative effect	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.9	1.0	1.1	1.3	1.5	1.7	2.0	2.3	2.6	3.0	3.5	4.0		



Amicus: software tool for fire managers

- Makes fire behaviour models available for practical use:
 - Assessment of fuel hazards
 - Fire danger indices
 - Bushfire behaviour predictions
 - Forecasting bushfires as they burn
- Assists with fuel-management decisions, planning prescribed burns, responding to bushfires, training
- Updated as the science improves



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Short-term planning: hazard mapping

With & for the Queensland Fire & Rescue Service

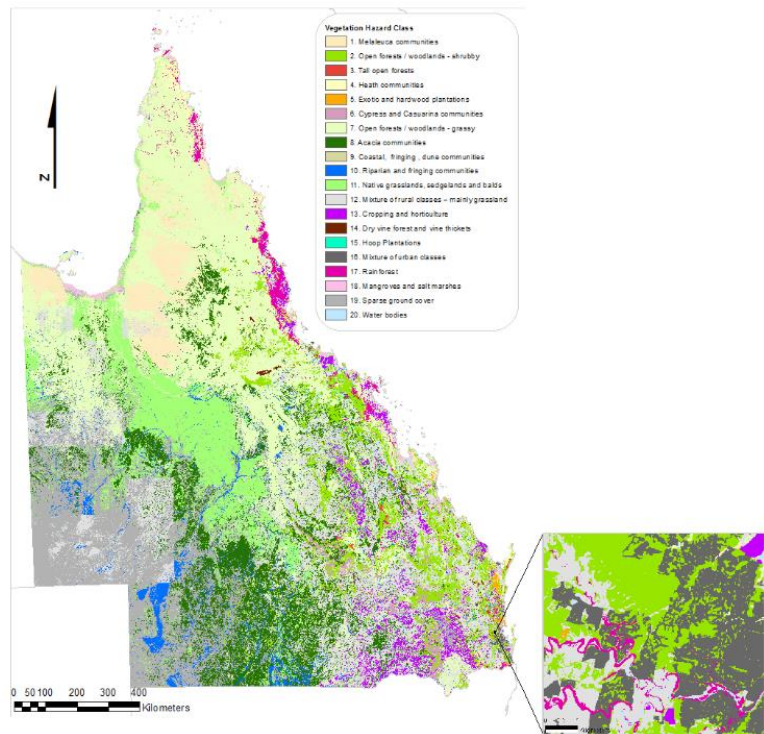


Figure 3: Vegetation Hazard Classes (VHC) for Queensland

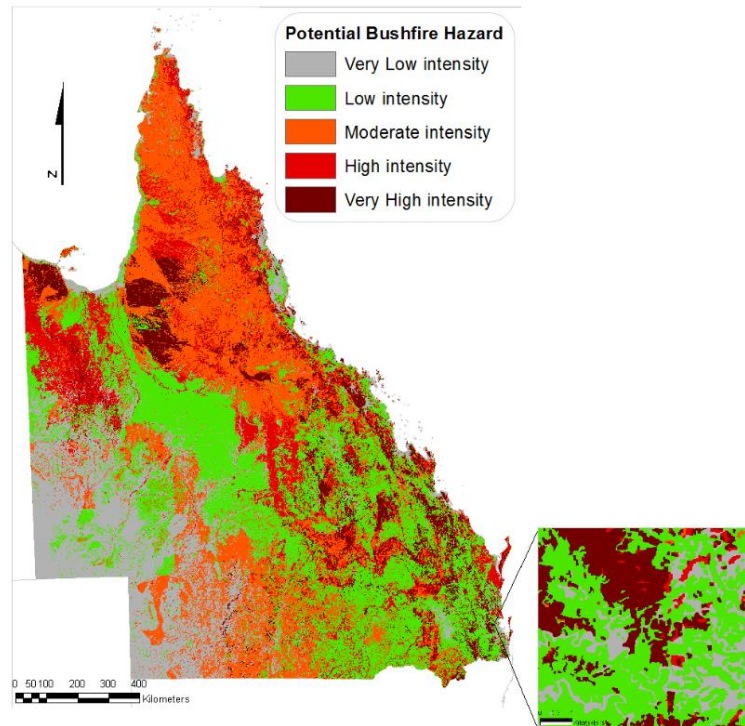
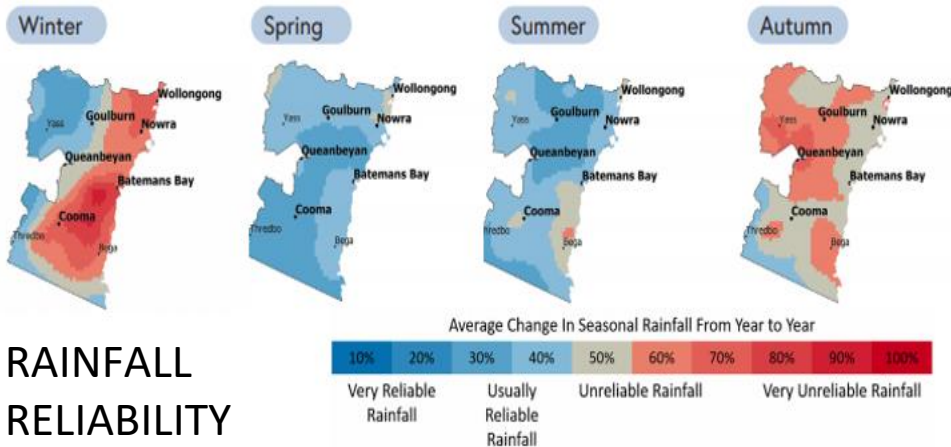
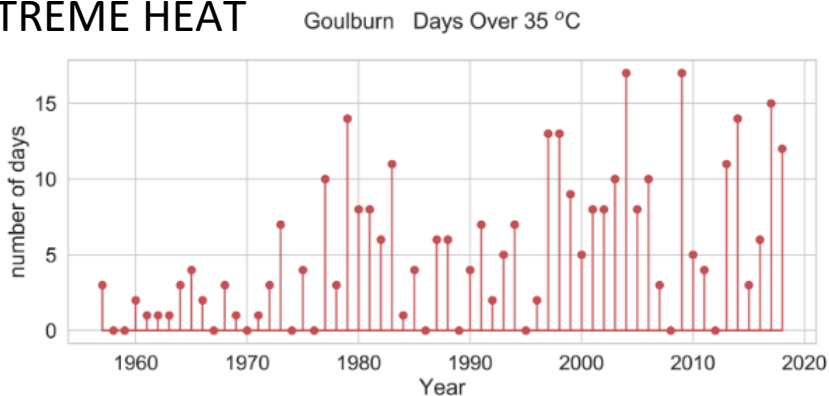


Figure 13: Potential Bushfire Hazard map for Queensland

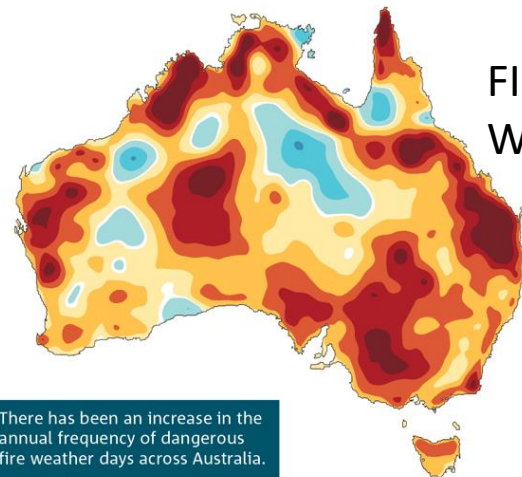
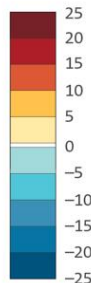
Scenarios: What will probably happen?



EXTREME HEAT



Change in number of dangerous fire weather days



www.bom.gov.au/climate/climate-guides/

Australian Climate Service

- Major Australian Government program
- Starting with support for
NRRA and EMA
- Guided by recommendations of the Bushfire Royal
Commission
- Partnership between the Bureau of Meteorology,
Geoscience Australia, CSIRO and Australian Bureau
of Statistics



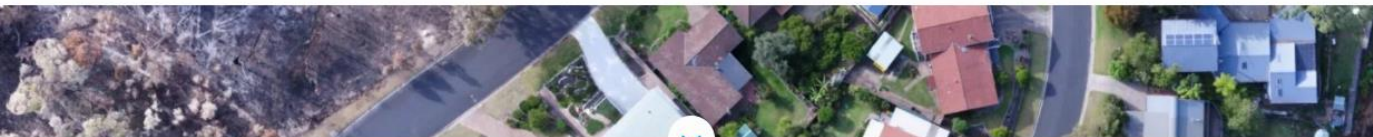
Toward best practices



Bushfire best practice guide

Bushfire basics ▾ Building regulations ▾ Assessing bushfire hazards ▾

Siting and design ▾ New builds ▾ Retrofits ▾ Landscaping ▾



Best Practice Design for Building in Bushfire Prone Areas in Victoria

This Guide will show you how to improve the bushfire resilience of your home and garden. Managing bushfire risk is essential for all Australians living in bushfire prone areas.

About this Guide

The Bushfire Best Practice Guide offers a range of advice on building and retrofitting for bushfire protection. The Guide describes the relationship between bushfire risk management and residential building and landscape design.

How to use this Guide

The Bushfire Best Practice Guide is divided into seven sections. Because bushfire risk is complex, we recommend reading the information in all seven sections to get the most complete picture. Start with [Bushfire basics](#) and move on from there.



Bushfire Resilient
Building Guidance
for Queensland Homes



Toward best practices



- Ember attack
- Radiant heat
- Bushfire flame front contact
- Surface fire
- Consequential fire
- Tree strike
- Wind
- Debris accumulation

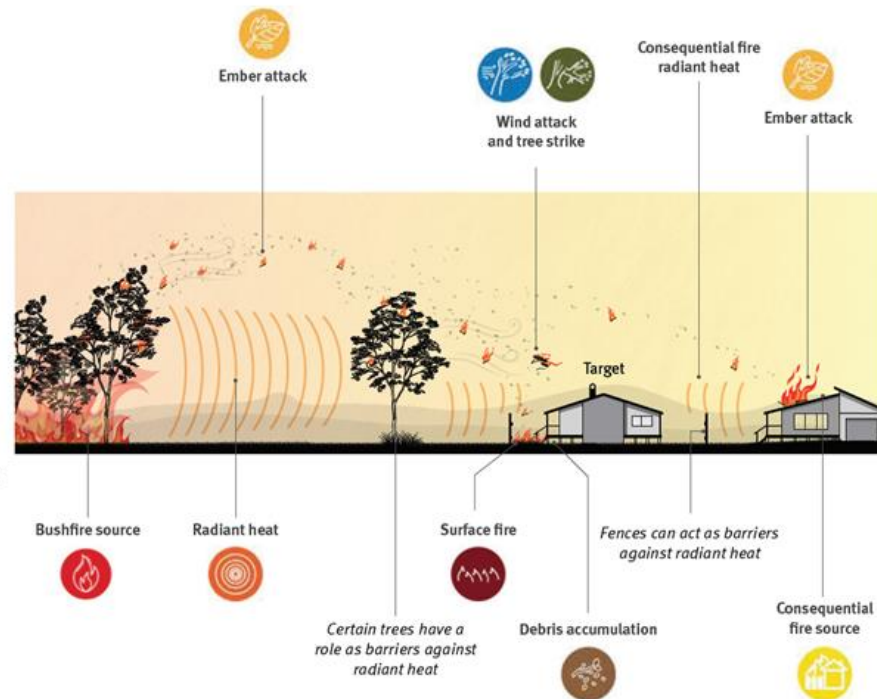


Diagram of bushfire attack mechanisms

Toward best practices

Understanding
risk

Design

Siting

Construction

Materials

Landscaping



Climbing “Mount Resilience”

Getting to Mt. Resilience

"Things are changing, how can we prepare ourselves?"

There are many future uncertainties — but a changing climate is not one of them. To ensure communities, economies and ecosystems can flourish, we need to be prepared to make the changes required for living in a different environment. We need to know how to come together, what we might do, and how we might do it.

This tool provides a hypothetical example of this, exploring how we get to a resilient future (as described by the Australian Broadcast Corporation's "Mt Resilience" project), through a detailed journey into the greenfield suburb of "Beachfront."

> INCLUSIVE FOUNDATIONS

> ABOUT THIS TOOL



PLANNING A WELL-ADAPTED
DISASTER-RESILIENT FUTURE

0. Understanding the Service Need and Existing Context

1. Catalysing Change and Seeing the Opportunity to Do Things Differently

2. Imagining New Resilience Priorities and Values

- 3. Imaging New Futures and Resilient Pathways
- 4. Expanding the Benefits and Beneficiaries Pool
- 5. Creating Value Under Climate Risk
- 6. Assessing and Prioritising Options Holistically

- 7. Identifying Additional Stakeholders, Barriers and Enablers
- 8. Stress Testing and Market Sounding

- 9. Identifying Champions, Enabling Delivery & Funding
- 10. Delivering the Investment Case

Tailor this journey to a user type:



Vishakha

Strategy



David

Policy



Tamara

Project



Generic

> ABOUT ME

Bega Valley: recovery for long-term resilience

- Regional context
- Post catastrophic fire disaster and trauma
- Multiple flood disasters
- Ongoing COVID impacts
- Recognition of need to do things differently



A final thing...



FIRE RISK



Thank you

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Economist,
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CSIRO Resilience
Coordinator
Andrew.Moore@csiro.au

More information:

www.csiro.au/en/research/natural-disasters

Burnover at Mogo:

vimeo.com/536225296

Best Practice Guides for Buildings:

research.csiro.au/bushfire/

www.qra.qld.gov.au/resilient-homes/bushfire-building-guidance-queensland-homes

Regional Weather & Climate Guides:

www.bom.gov.au/climate/climate-guides/

Enabling Resilience Investment:

www.mtresilience.com

www.enablingresilienceinvestment.com

Hazard Reduction Burning:

vimeo.com/619621941