



Prescribed burning to achieve risk reduction and biodiversity outcomes

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Acknowledgements

Our research was conducted on the traditional lands of the Gunditjmara peoples from far south-western Victoria

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- DEECA project team
 - Hamish Martin, Nicola Aylward, Mel Calwell
- Workshop participants
 - DEECA, Parks Victoria, CFA, Gundtj mirring, Glenelg Hopkins CMA, University of Melbourne, Nature Glenelg, Glenelg shire council



Climate change is altering fire risk

Global increase in wildfire risk due to climate-driven declines in fuel moisture

Todd M. Ellis^{1,2} | David M. J. S. Bowman^{1,2} | Piyush Jain³ | Mike D. Flannigan⁴ | Grant J. Williamson^{1,2}

Pyroconvection Risk in Australia: Climatological Changes in Atmospheric Stability and Surface Fire Weather Conditions

Andrew J. Dowdy¹ and Acacia Pepler¹

Climate Change Increases the Potential for Extreme Wildfires

Giovanni Di Virgilio¹, Jason P. Evans^{1,2}, Stephanie A. P. Blake¹, Matthew Armstrong³, Andrew J. Dowdy⁴, Jason Sharples⁵, and Rick McRae⁶

Climate Change Significantly Alters Future Wildfire Mitigation Opportunities in Southeastern Australia

Giovanni Di Virgilio¹, Jason P. Evans^{1,2}, Hamish Clarke^{3,4,5}, Jason Sharples^{6,7}, Annette L. Hirsch^{1,2}, and Melissa Anne Hart^{1,2}

npj | climate and atmospheric science www.nature.com/npjclimatsci

BRIEF COMMUNICATION OPEN Check for updates

Health costs of wildfire smoke to rise under climate change

Hamish Clarke^{1,2,3,4}, Brett Cirulis¹, Nicolas Borchers-Arriagada^{3,5}, Ross Bradstock^{2,3,6}, Owen Price^{2,3} and Trent Penman¹

ARTICLE Check for updates

<https://doi.org/10.1038/s41467-021-27225-4> OPEN

Multi-decadal increase of forest burned area in Australia is linked to climate change

Josep G. Canadell¹, C. P. (Mick) Meyer², Garry D. Cook³, Andrew Dowdy⁴, Peter R. Briggs⁵, Jürgen Knauer¹, Acacia Pepler⁴ & Vanessa Haverd¹

Article

Warming weakens the night-time barrier to global fire

<https://doi.org/10.1038/s41586-021-04325-1> Received: 3 July 2020

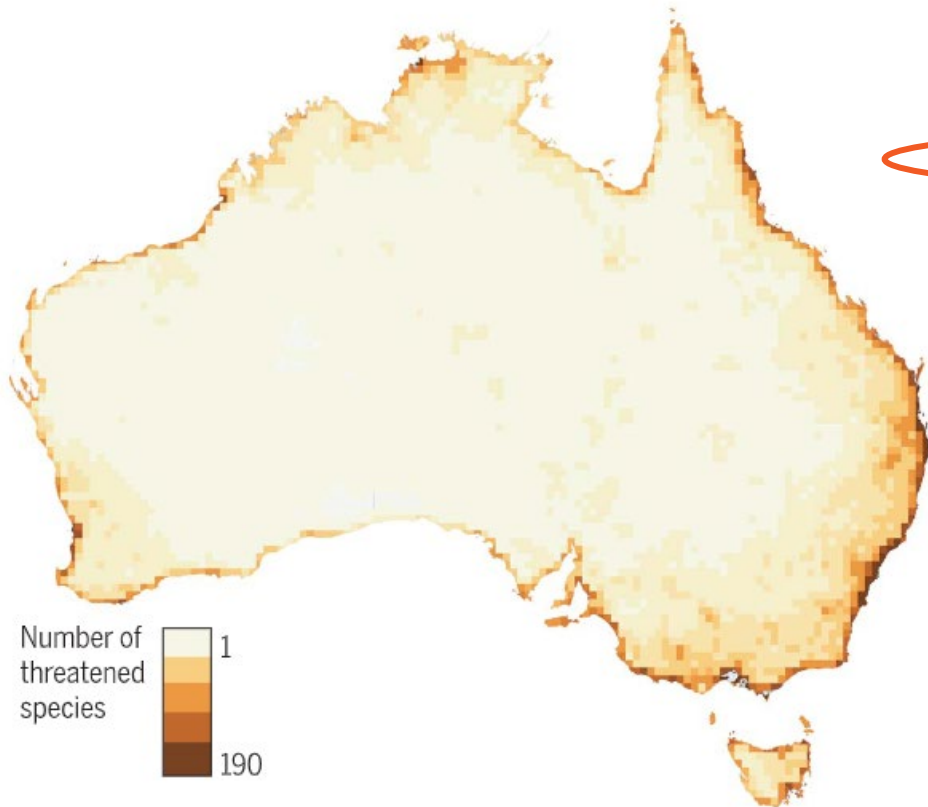
Jennifer K. Balch^{1,2}, John T. Abatzoglou^{3,4}, Maxwell B. Joseph^{1,4,5}, Michael J. Koontz^{3,6}, Adam L. Mahood^{1,2}, Joseph McGlinchy^{1,3,5}, Megan E. Cattau⁶ & A. Park Williams^{1,3,6}

Warmer and drier conditions have increased the potential for large and severe fire seasons across south-eastern Australia

Luke Collins^{1,2} | Hamish Clarke^{3,4,5} | Michael F. Clarke² | Sarah C. McColl Gausden⁶ | Rachael H. Nolan^{4,5} | Trent Penman⁶ | Ross Bradstock^{3,4}

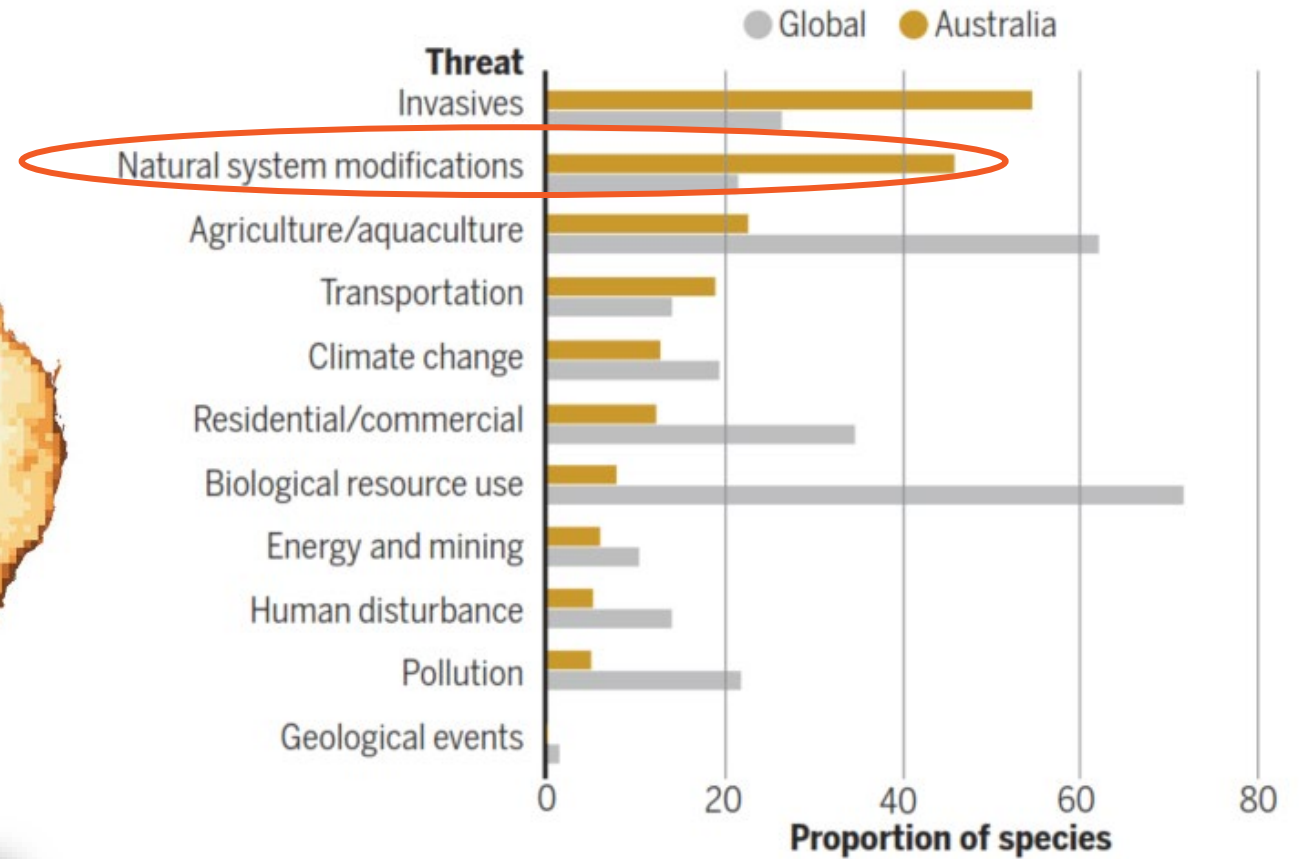
Photo credit: John Costenaro

We are in a biodiversity crisis



Loss of terrestrial biodiversity in Australia: Magnitude, causation, and response

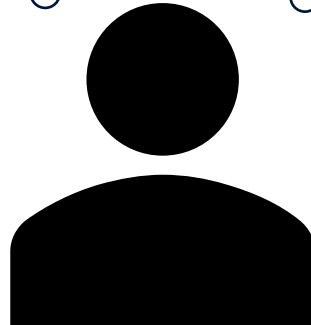
Sarah Legge^{1,2*}†, Libby Rumpff³†, Stephen T. Garnett¹†, John C. Z. Woinarski¹†



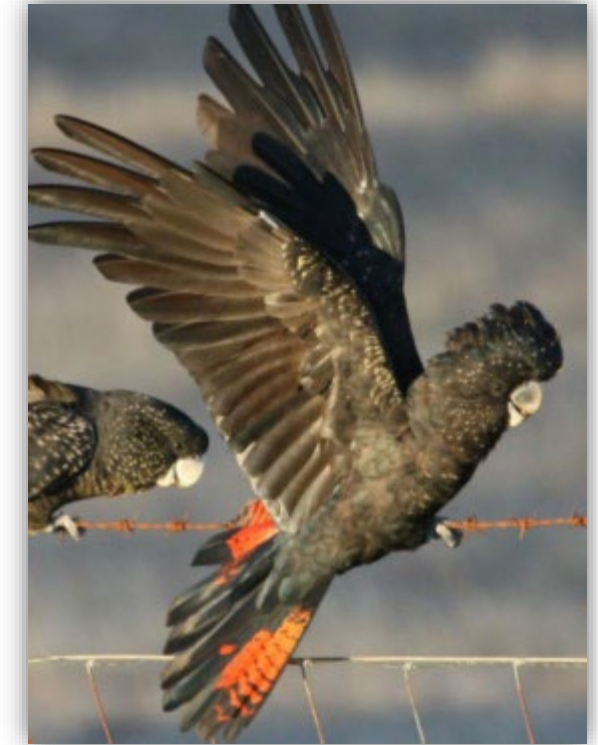
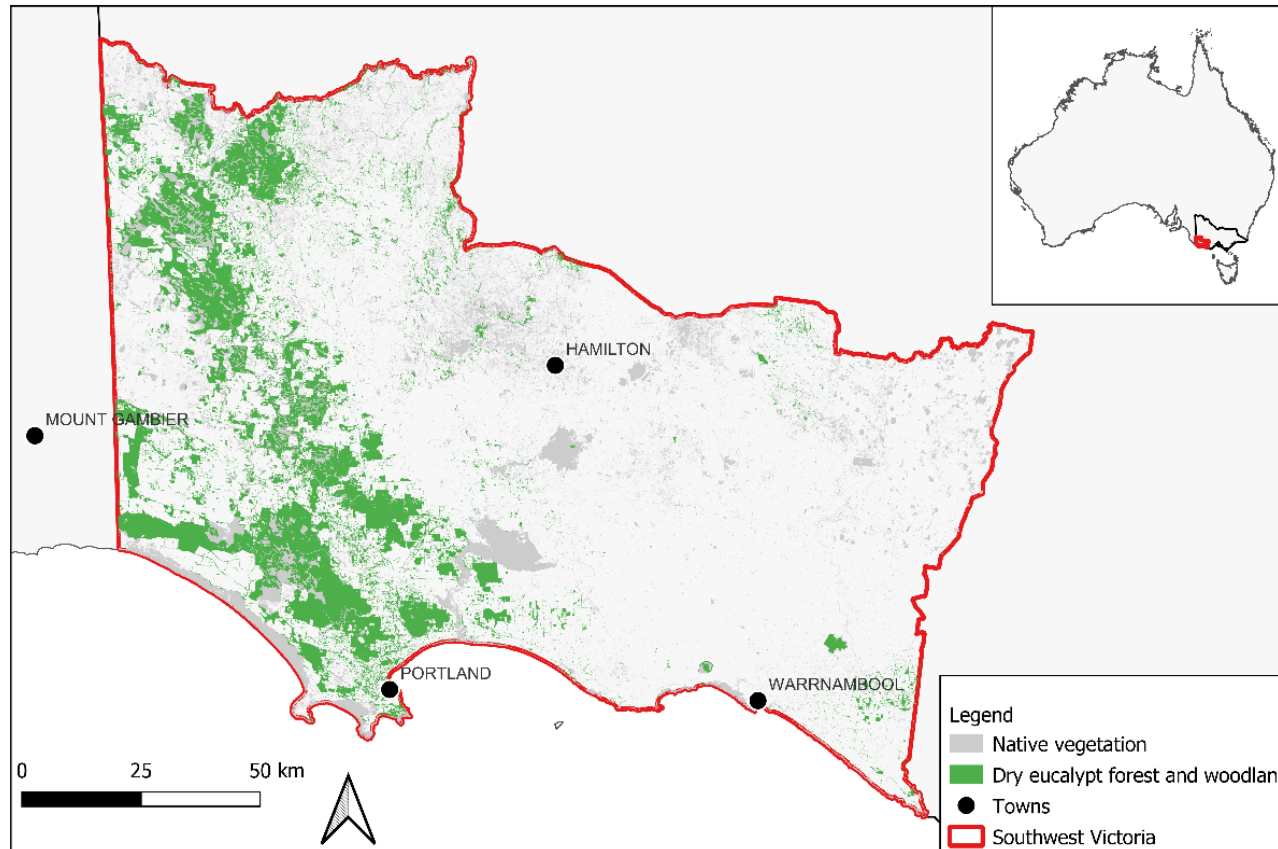
How do we want
our forests to look
in the future?

What management
actions could be used to
shift vegetation towards a
desirable state?

Do we need
objective-specific
burn prescriptions?



Far south-western Victoria

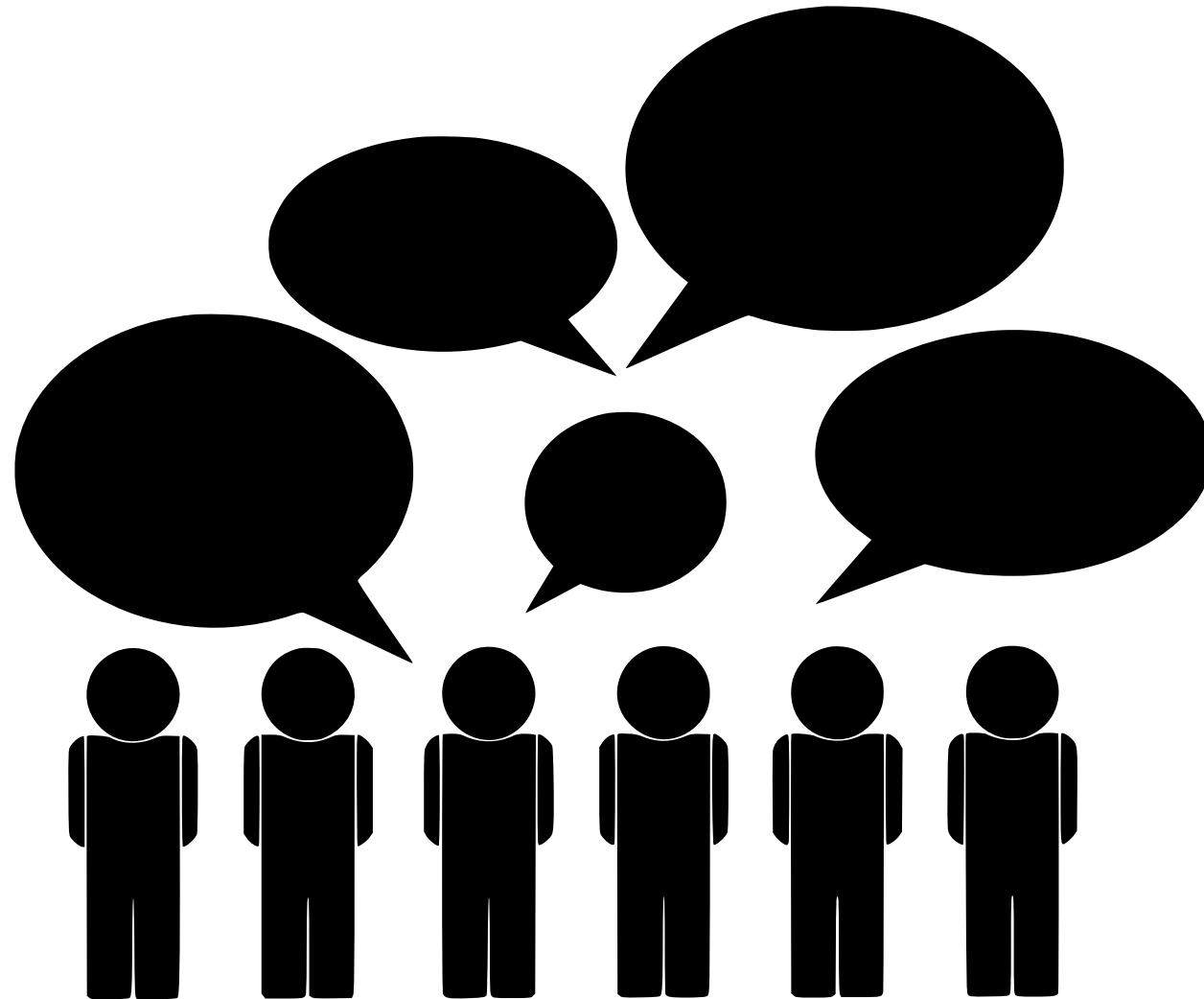


Southeastern red tailed black cockatoo



Heath Mouse

Expert elicitation: Structured decision making & Quantitative Expert Judgement





Expert elicitation: Structured decision making & Quantitative Expert Judgement

- Lack of existing data but plenty of experiential knowledge
- Considers a broad range of perspectives, which may help with social license
- Different perspectives promote creative thinking
- Group estimates outperform individual estimates
- Structured approach allows estimates to be treated as data

How do we want our forests to look in the future?





Increasing desirability from fire risk and biodiversity perspectives

TREES	No char, bark long unburnt	High stem density	Low stem density	Charred bark
	Total canopy death	Poor canopy health	Healthy, open canopy	Multi-cohort, hollows
UNDERSTOREY	Low floristic diversity	Increasing floristic diversity	High floristic diversity	Gaps between vegetation strata
	Dense shrub layer	More open patches	Monocultures of desirable species	Structural diversity
	Monocultures of undesirable species	High proportion dead	Green, no dieback	Absence of weeds
	Extensive dieback			
	High abundance of weeds			

Compatibility between objectives

Vegetation attributes desirable or undesirable from both perspectives

- ✓ Lower stem density
- ✓ High live to dead ratio

- x Abundant woody weeds
- x Extensive dieback

Vegetation attributes desirable from one perspective and unimportant to the other

- ✓ Charred bark
- ✓ High floristic diversity
- ✓ Multi-cohort of trees
- ✓ Hollow bearing trees

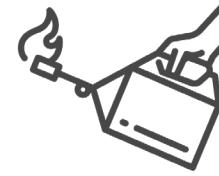
Vegetation attributes could be compatible

- ✓ Sparser vegetation closer to human assets
- ✓ Mixed density vegetation across the wider landscape

What management actions could shift vegetation towards a desirable state?



Burning: high severity, high coverage



Burning: candling



Burning: mixed-severity, patching



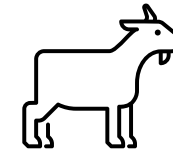
Slashing



Herbicide



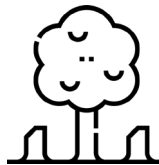
Hand removal



Grazing



Mulching



Thinning



Predator control



Revegetation

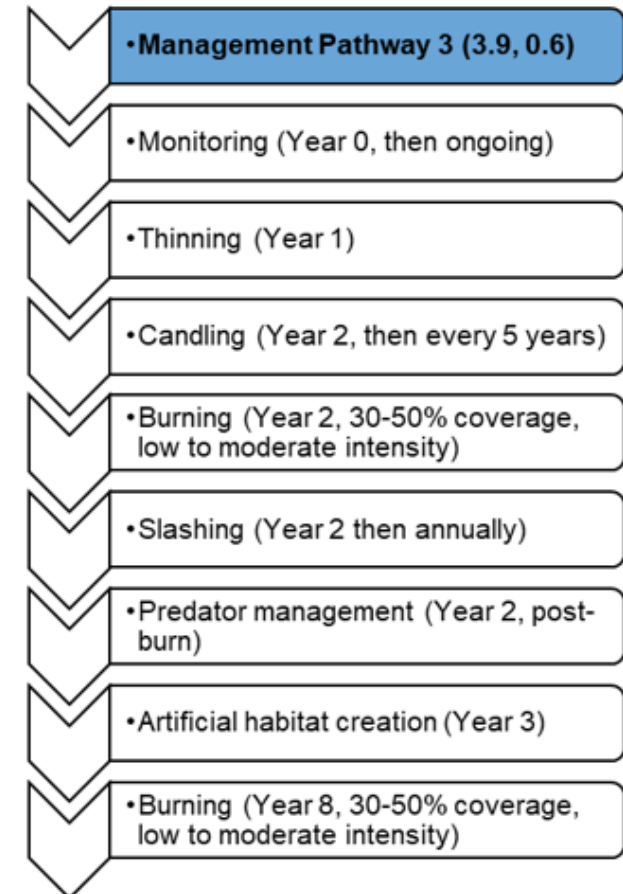
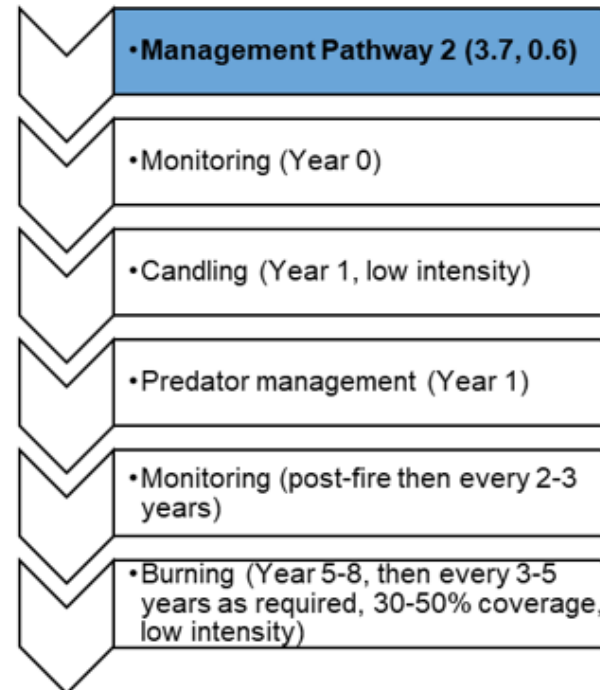
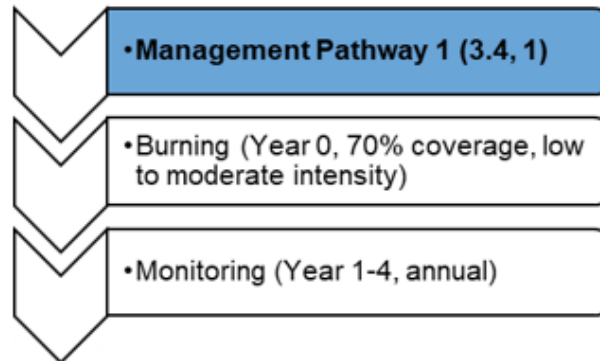


Artificial habitat creation



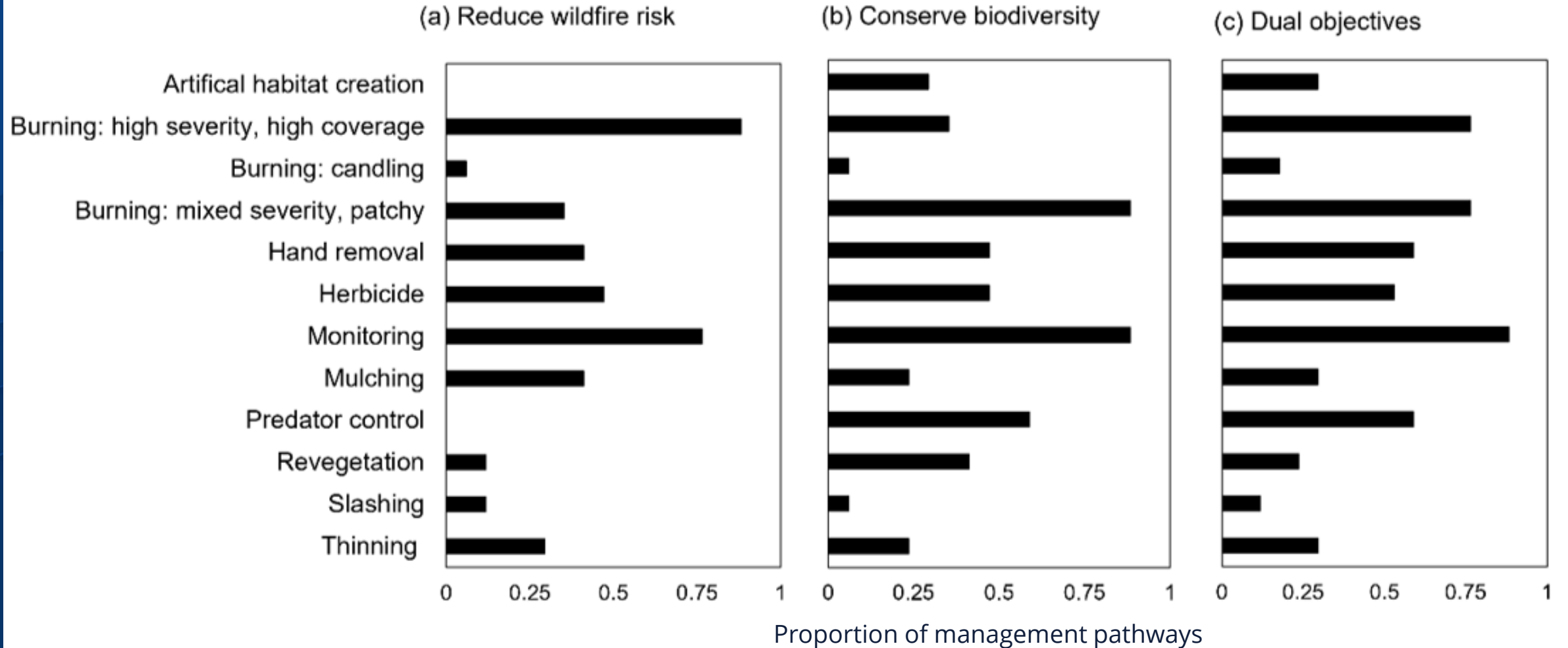
Monitoring

Management pathways





What management actions are needed to transition vegetation to a desirable state?



Prescribed burning

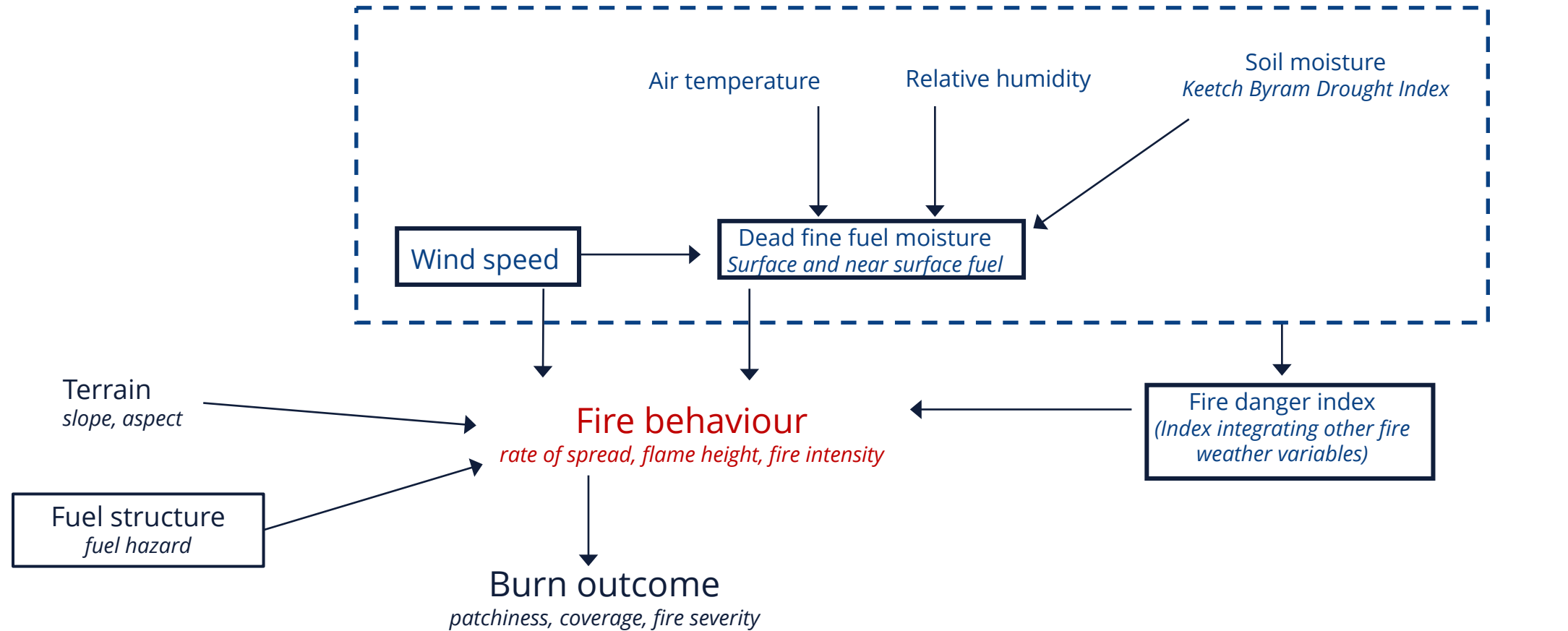


- Broadscale management tool
- Different severities & patchiness needed to achieve specific objectives
- Do we need objective-specific burn prescriptions?

Burn Class	FDI (max)	Temperature (°C)	RH (%)	Wind (km/h @ 10 m in open)*	KBDI	FFMC (%)
Dry sclerophyll forest (mature, without wiregrass)	10 Day 2 <12	18-27	35-70	<20 (Beaufort = leaves and twigs (only) in constant motion)	<50, or <120 (if fallen ≥30 from summer	FRB: surface 9-16 Slash: inside<14 outside>16



Do we need objective-specific burn prescriptions?



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Scenario 1

Bark moderate to high hazard; Understorey very high to extreme hazard

In your opinion, what are the range of conditions when you could you safely achieve a **high intensity, high coverage burn** with low risk of escape.

	Ideal	Lower	Upper	Not sure	Not relevant
Temperature (deg C)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relative humidity (%)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wind speed (km/h)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>
Surface dead fine fuel moisture (%)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>
Profile dead fine fuel moisture (%)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>
Suspended dead fine fuel moisture (%)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>
Grass curing (%)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>
FFDI	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>
CHaines	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cloud coverage (%)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>

Scenario



1
VH-E
understorey;
VH-E bark



2
VH-E
understorey;
M-H bark



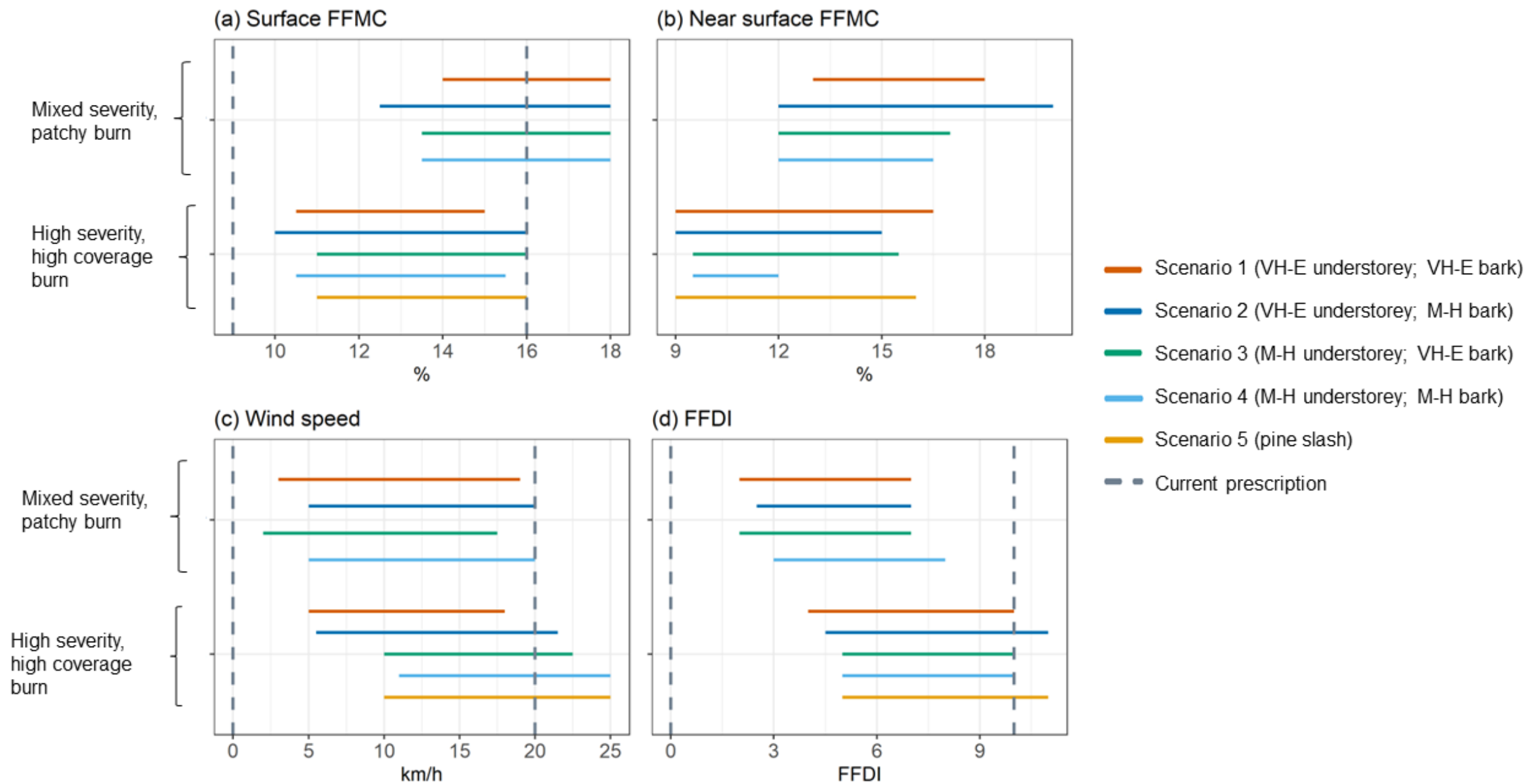
3
M-H
understorey;
VH-E bark



4
M-H
understorey;
M-H bark

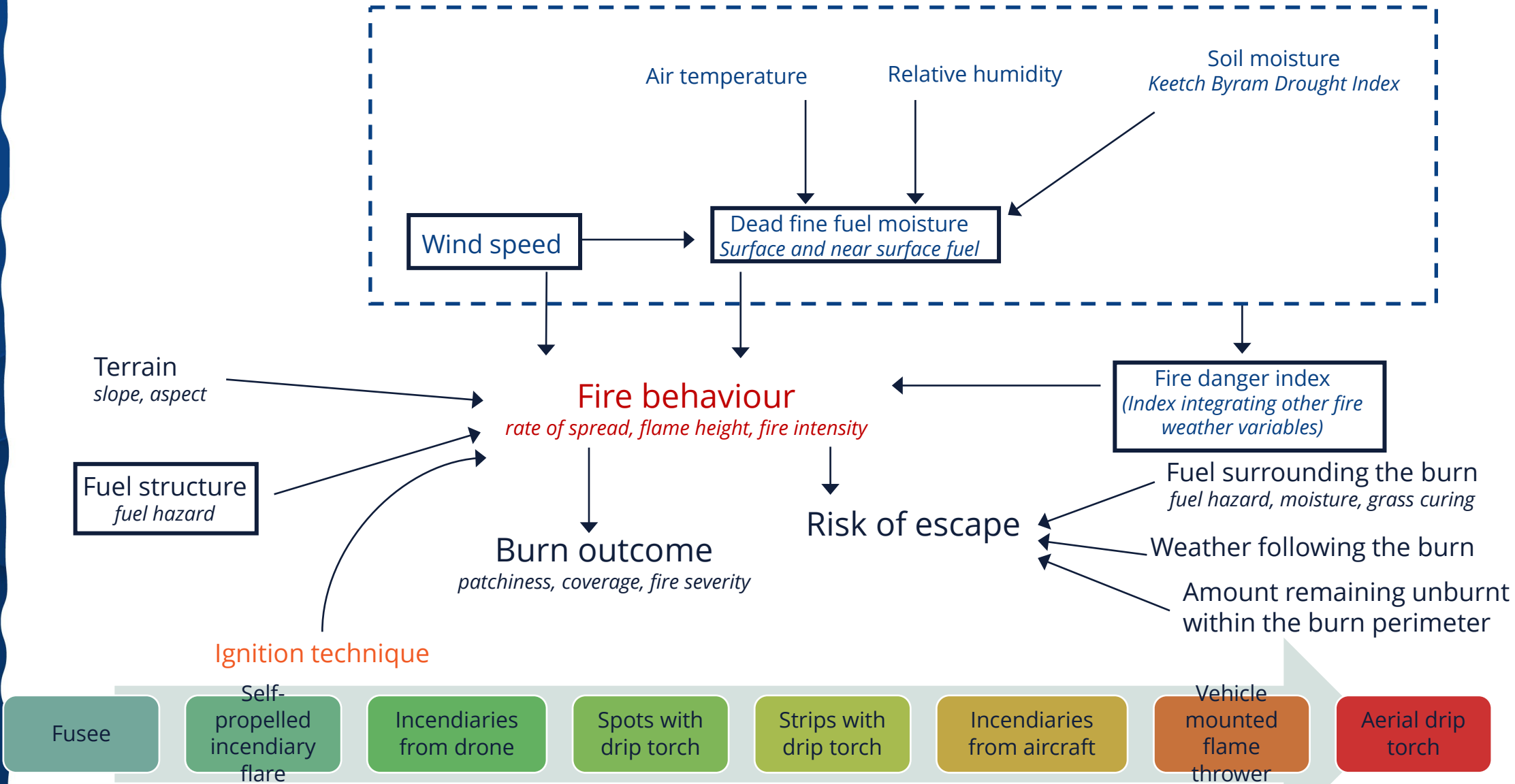


5
Pine slash





Do we need objective-specific burn prescriptions?





In summary

How do we want our forests to look in the future?

- Fire risk and biodiversity conservation compatible to a large extent

Which combinations of management actions could be used to achieve these desired forest states?

- Fuel management could be tailored to achieve both objectives in many parts of the landscape, particularly if there is an appetite to include additional steps to increase ecosystem resilience

Do we need objective-specific burn prescriptions?

- Prescriptions differed for patchy vs. high coverage burning
- But differences in fuel structure could be accommodated by adjusting the lighting technique
- Objective-specific burn prescriptions may be useful, but will not negate the need for highly experienced burn operators



Thank you

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