

ACT GOVERNMENT

# Advances in the use of remote sensing in Australia

GOFC GOLD Fire IT Workshop,  
Stresa, Italy, June 2022

Adam Leavesley, Marta Yebra,  
Petter Nyman, Tony Scherl





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## I'M GOING TO TALK ABOUT:

- ACT Forest Fire History
- The concept of 'Prescribed Burn Leverage'
- Learnings from the Orroral Valley Fire, 2020
- Managing Bushfire Risk in Time
- Prescribed Burn Flammability Mapping

Climate Adaptation





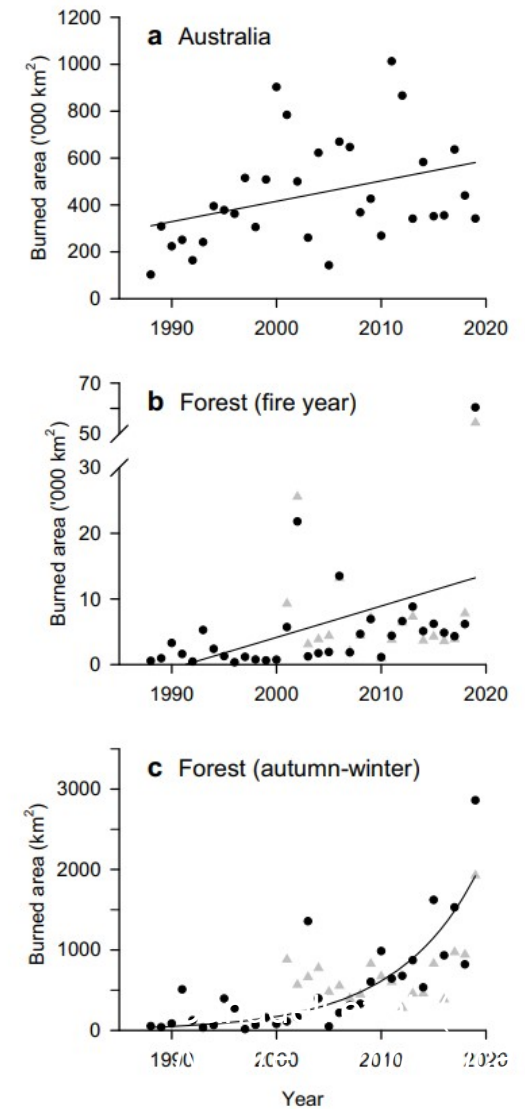
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# FOREST FIRE HISTORY

Area of forest burnt in Australia has increased every decade for the past four decades



Canadell et al. (2021)  
*Nature Communications*





# FOREST FIRE HISTORY

ACT has the shortest Year-Since-Last-Fire in forests (18 years down from 77 in 1990s). Next shortest is 34.

Canberra Fires, 2003  
Orroral Valley Fire, 2020



Decade	NSW		VIC		QLD		SA		WA		TAS		ACT	
	Mn	SD	Mn	SD	Mn	SD	Mn	SD	Mn	SD	Mn	SD	Mn	SD
1980s	69	1	56	2	112	2	58	18	73	0	81	2	73	8
1990s	66	1	61	2	113	1	48	3	57	7	80	2	77	3
2000s	49	6	47	12	94	14	53	1	46	3	69	9	25	31
2010s	44	12	34	4	47	21	45	9	36	4	44	14	18	4

Supplementary Table 2. Number of years since the last fire, YSLF (decadal mean±standard deviation) by States and Territories for the last four decades for forested areas that have burned at least once since fire records began. Data: State and Territory fire histories.

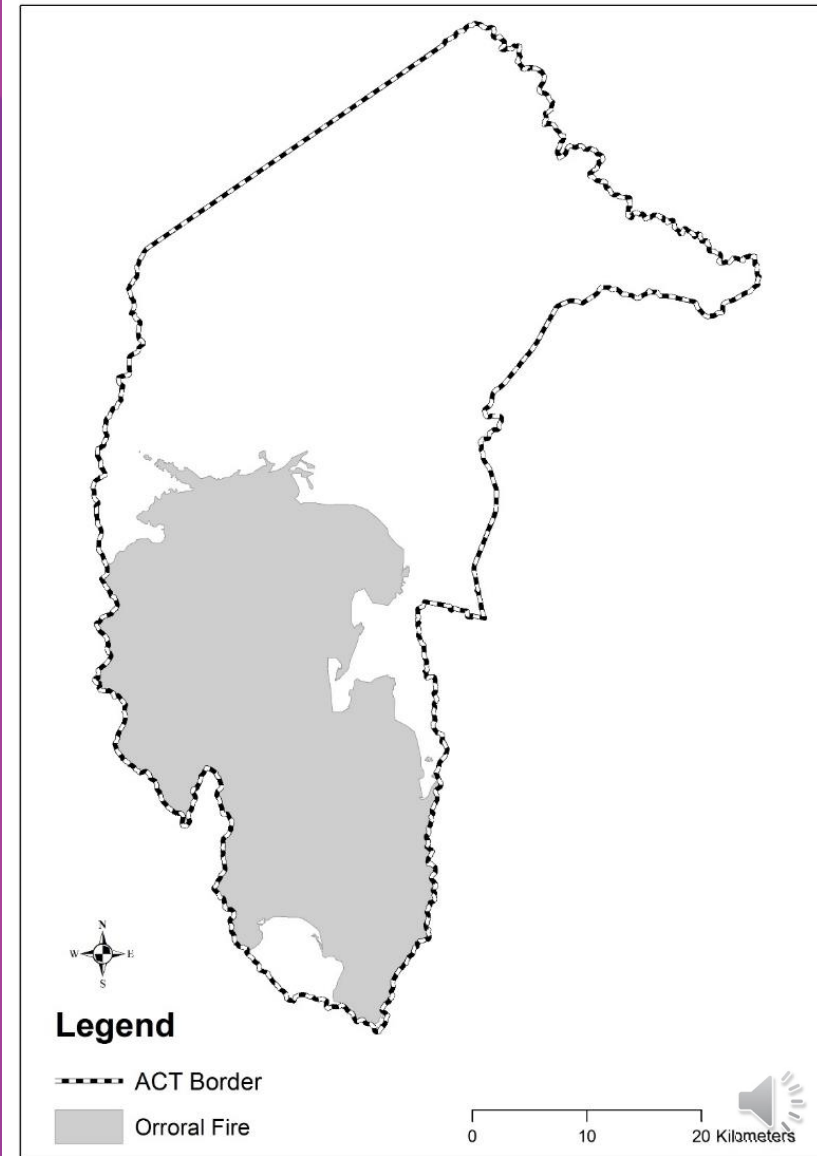
Canadell et al. (2021)  
*Nature Communications*



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## THE ORRORAL FIRE, 2020

- 27 January – 9 February 2020
- Extent ~90,000ha
- Rain assisted control
- Burnt national park and water catchment





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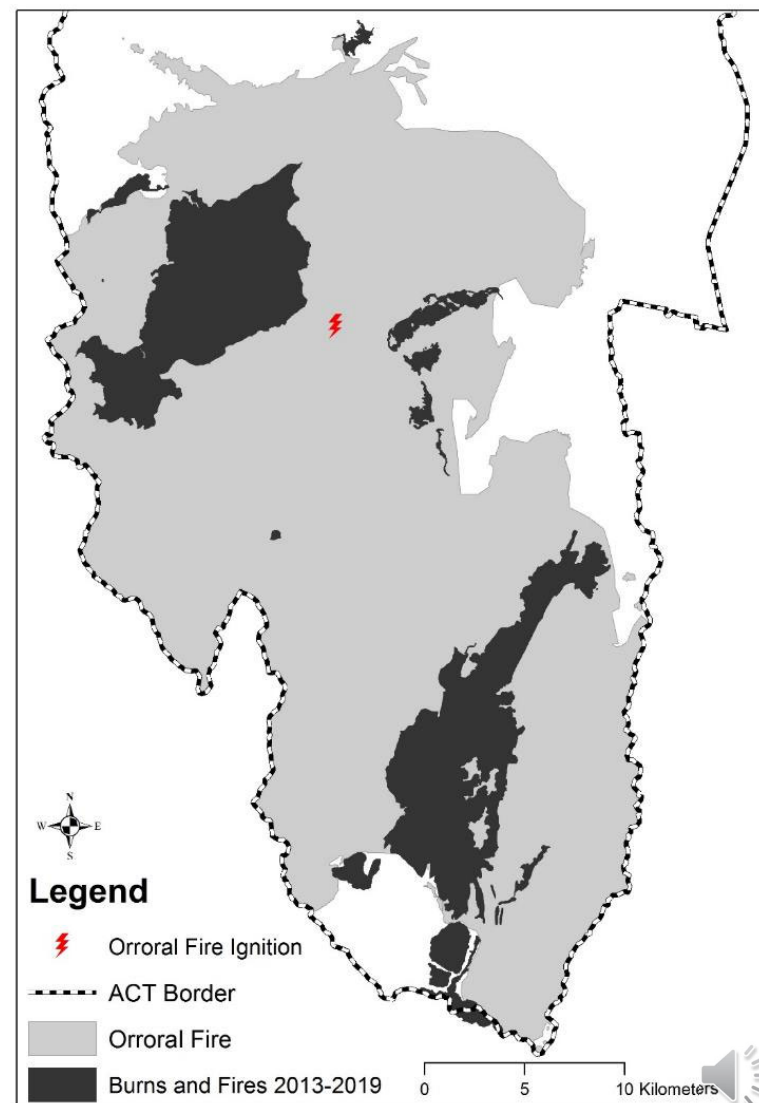
# PRESCRIBED BURNING LEVERAGE

A criticism of prescribed burning is that you have to burn more bush than you save.

In Australian forests leverage = 0.33

This means that to reduce the area burnt in bushfires from a mean of 5.0% a year to 2.5% a year, you need to burn 7 percent a year.

Price *et al.* 2013, *IJWF*; Price 2013, *The Conversation*





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# PRESCRIBED BURNING LEVERAGE

A criticism of prescribed burning is that you have to burn more than you save.

*But...*

- Takes no account of the difference between a prescribed burn and a bushfire.

Bushfire



Prescribed burn





# FIRE REGIME CONCEPT

Fire regime as proposed by Malcolm Gill has four components:

- Intensity
- Frequency
- Seasonality (eg flowering)
- Type (surface fire or peat fire)

Criticism of prescribed burning based on leverage is...

focused on FREQUENCY ignoring INTENSITY

Gill (1975) *Australian Forestry*

Bushfire



Prescribed burn





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# PREScribed BURNING LEVERAGE

A criticism of prescribed burning is that you have to burn more than you save.

*But...*

- The calculation assumes a consistent annual area burned

**(We'll come back to this)**

Bushfire



Prescribed burn





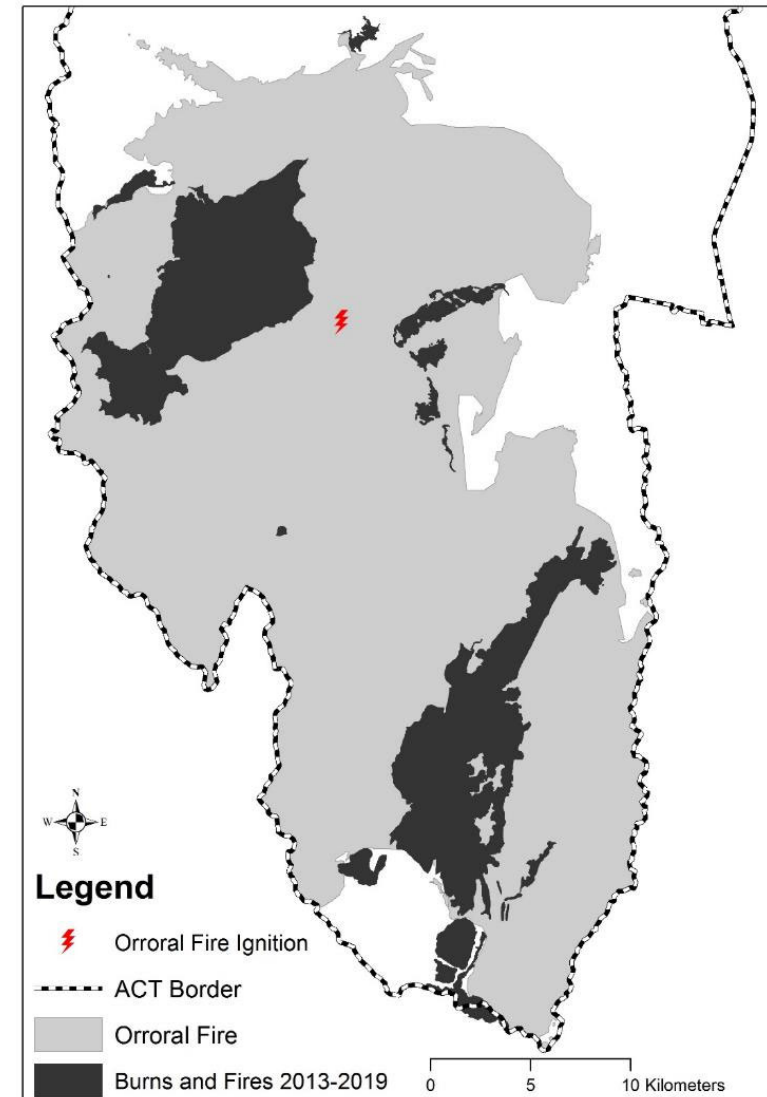
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## THE ORRORAL FIRE, 2020

- 27 January – 9 February 2020
- Extent ~90,000ha

In the period 2013-2019

- 13 prescribed burns (191-6033ha)
- 3 bushfires (3-42ha)



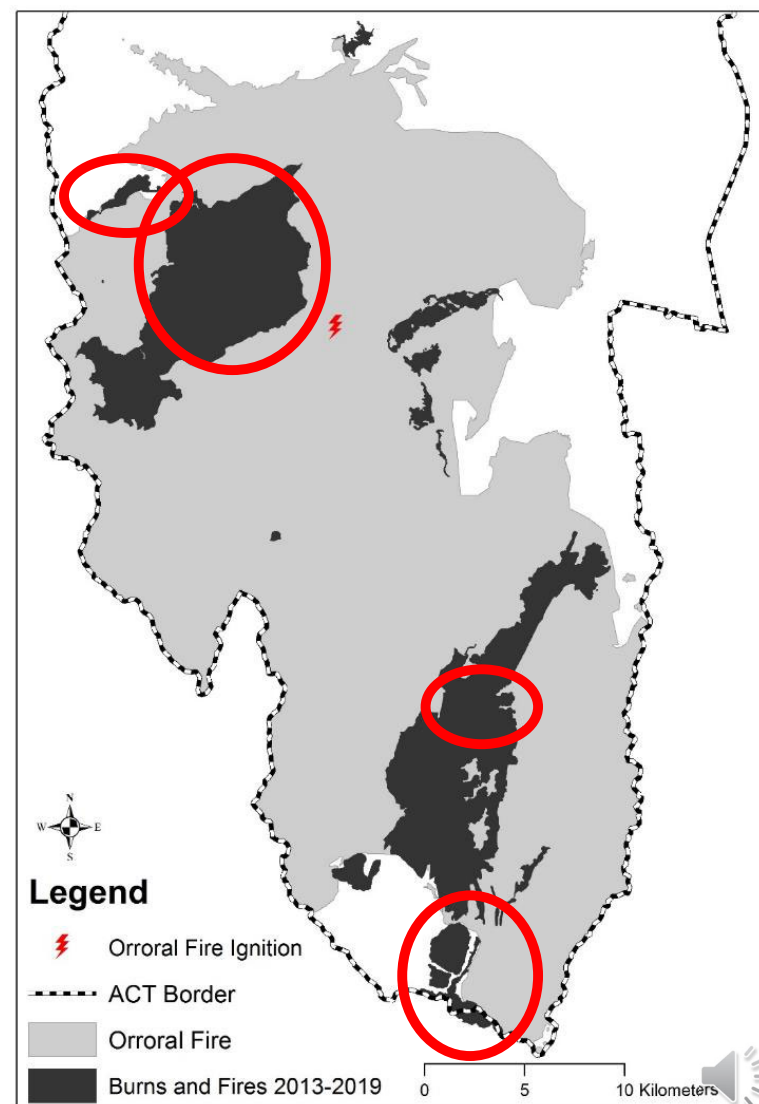


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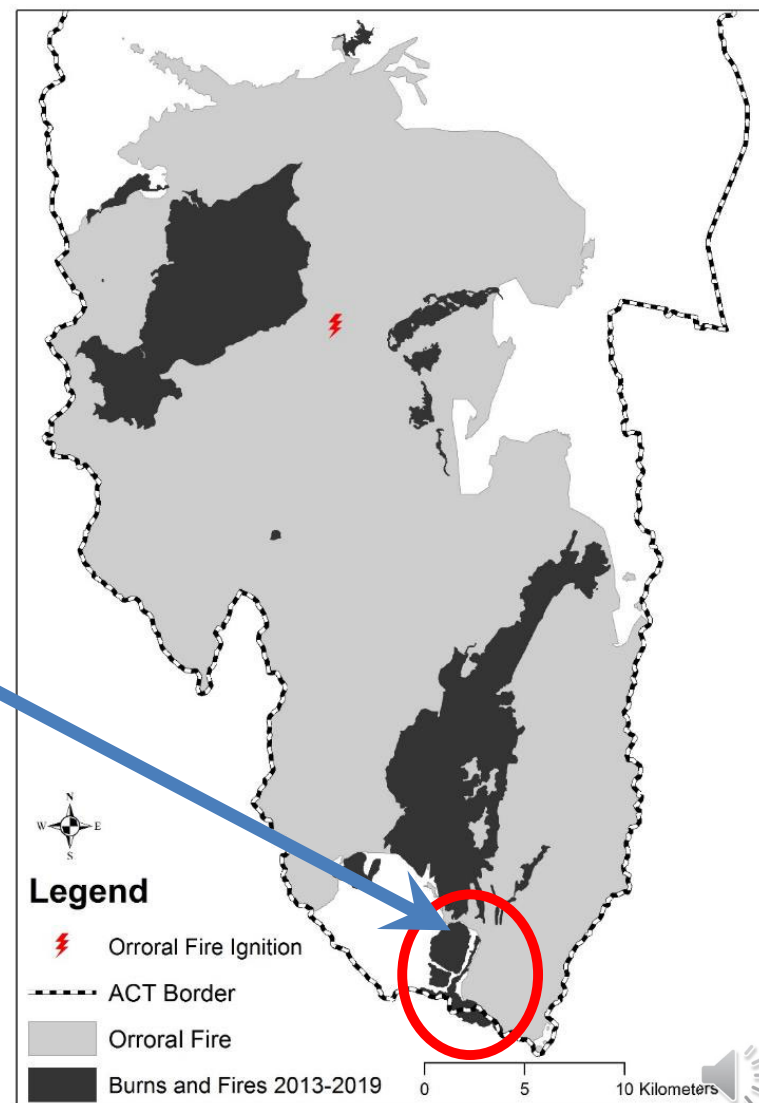
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# POTTERS HILL BURN, 2018





North side of fire trail; burnt by bushfire in 2003; consumption of the canopy.

South side of fire trail, prescribed burnt in 2018, fire self-extinguished within a few metres.



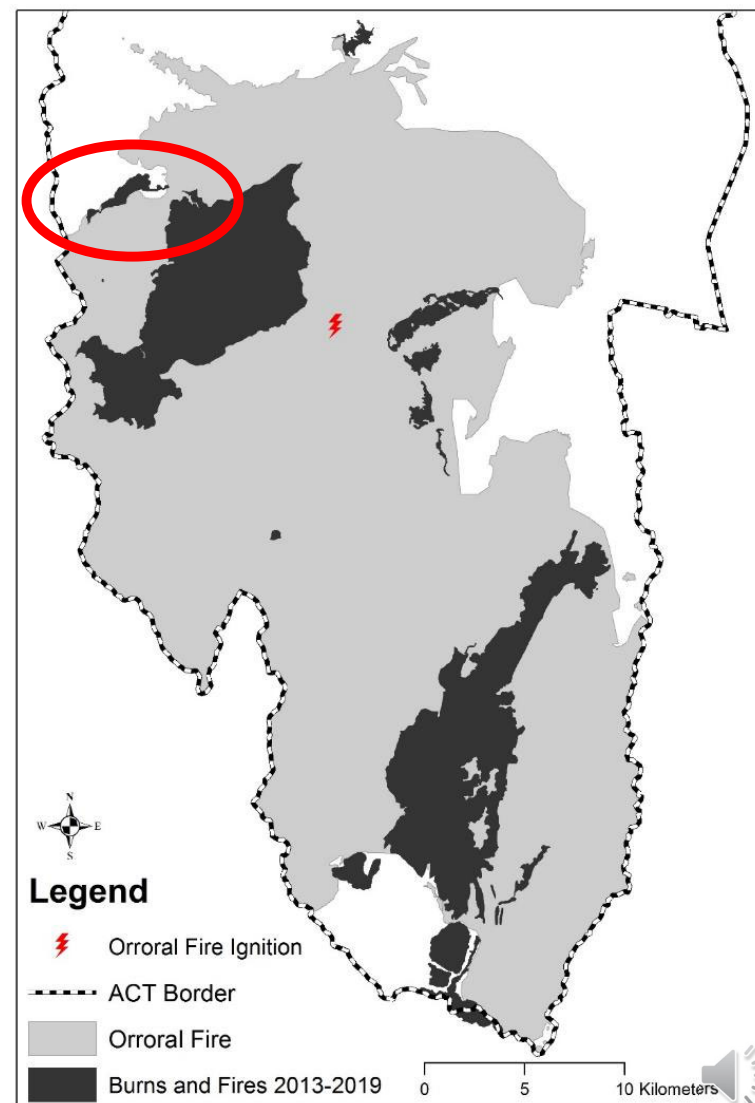


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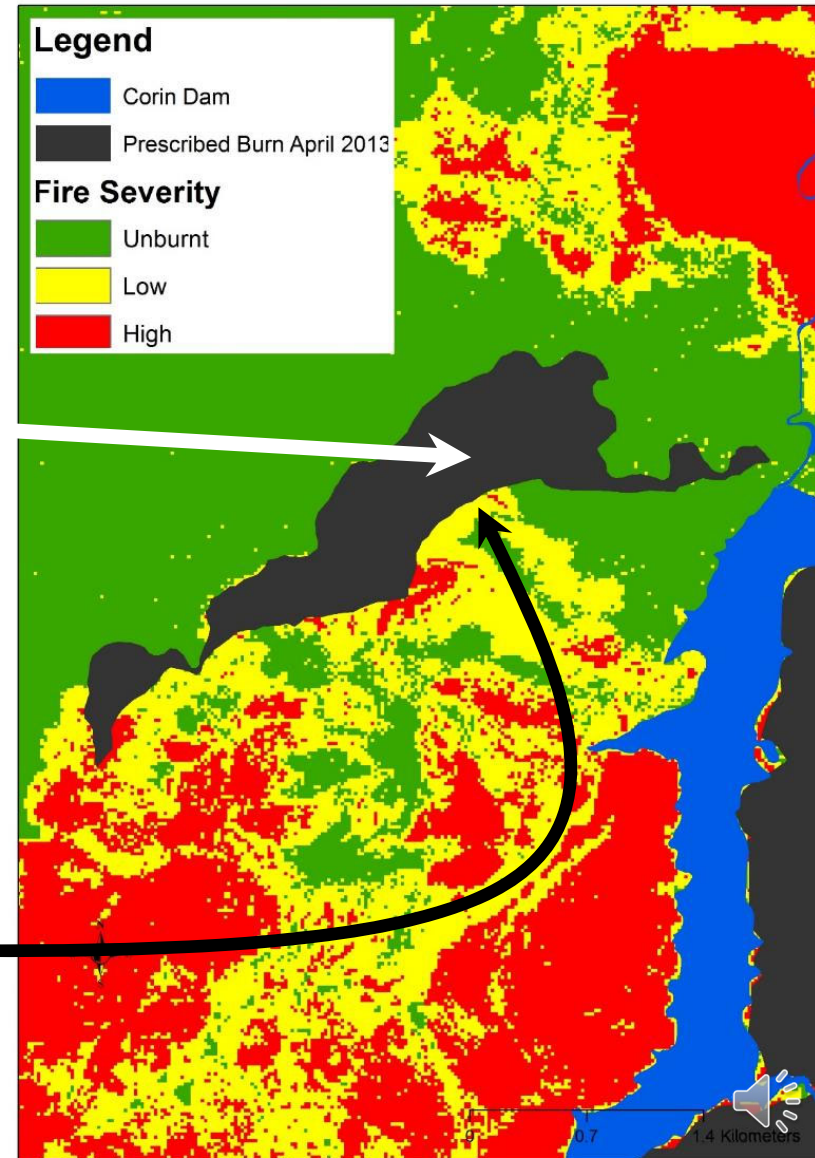




Burnt 2013



Burnt 2003





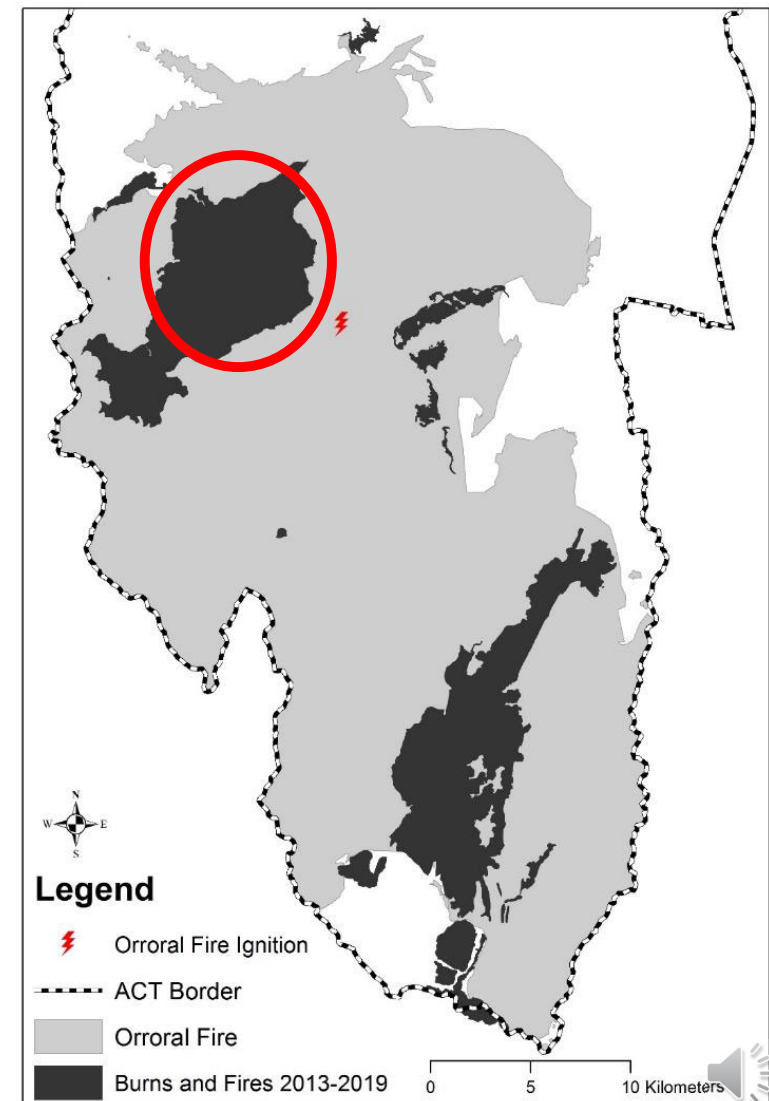
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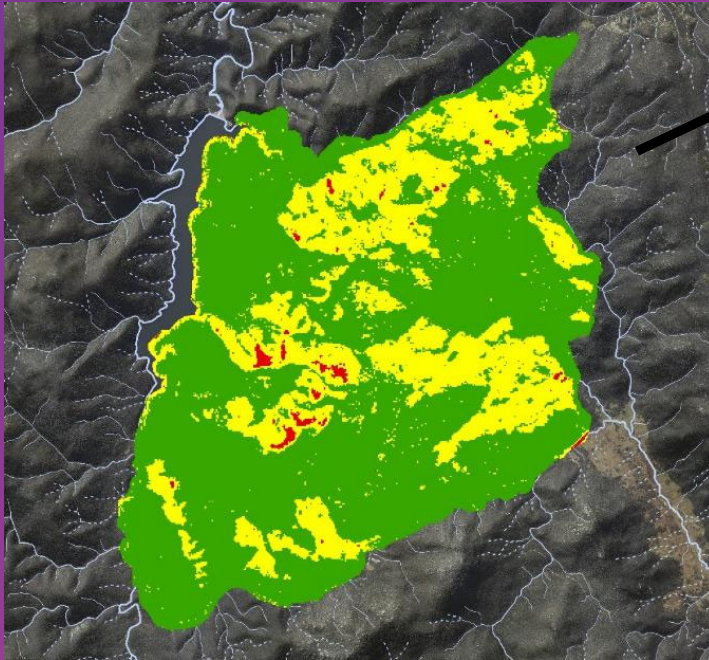
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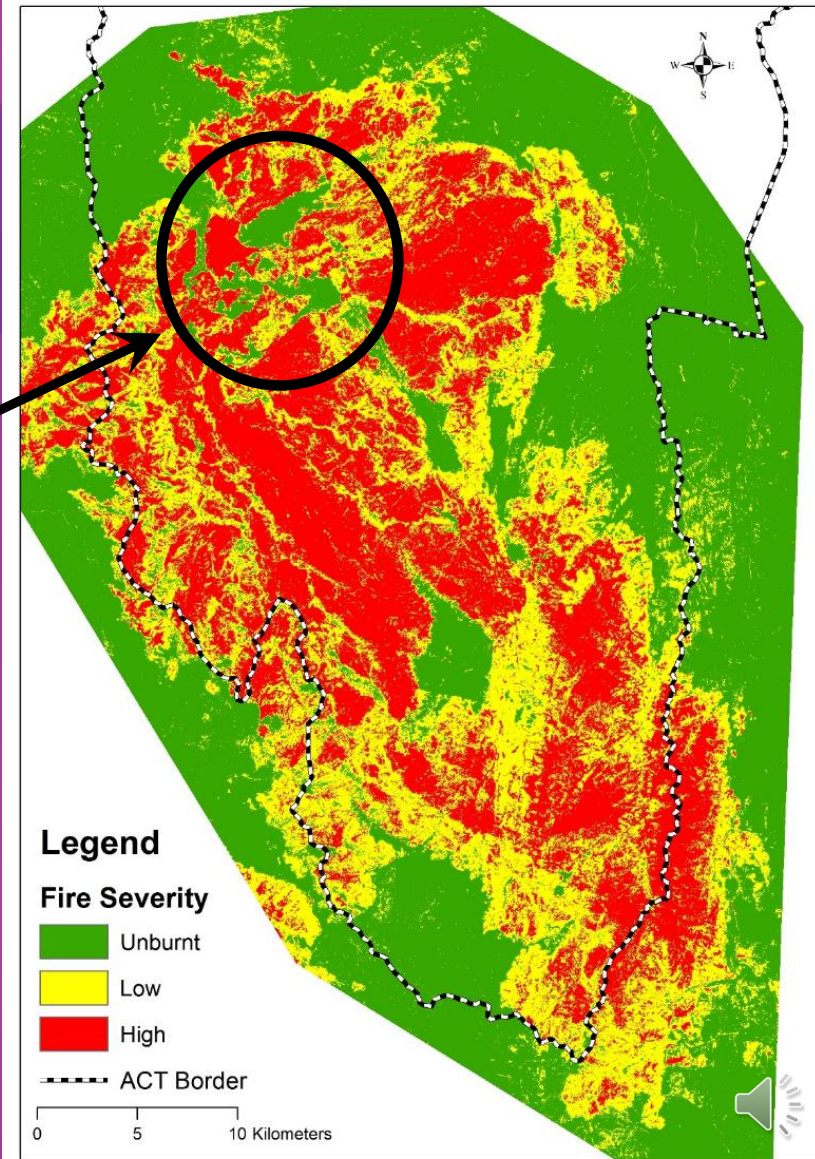


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## SMOKERS TRAIL BURN 2019



Fire severity map, Smokers Trail Burn, 2019





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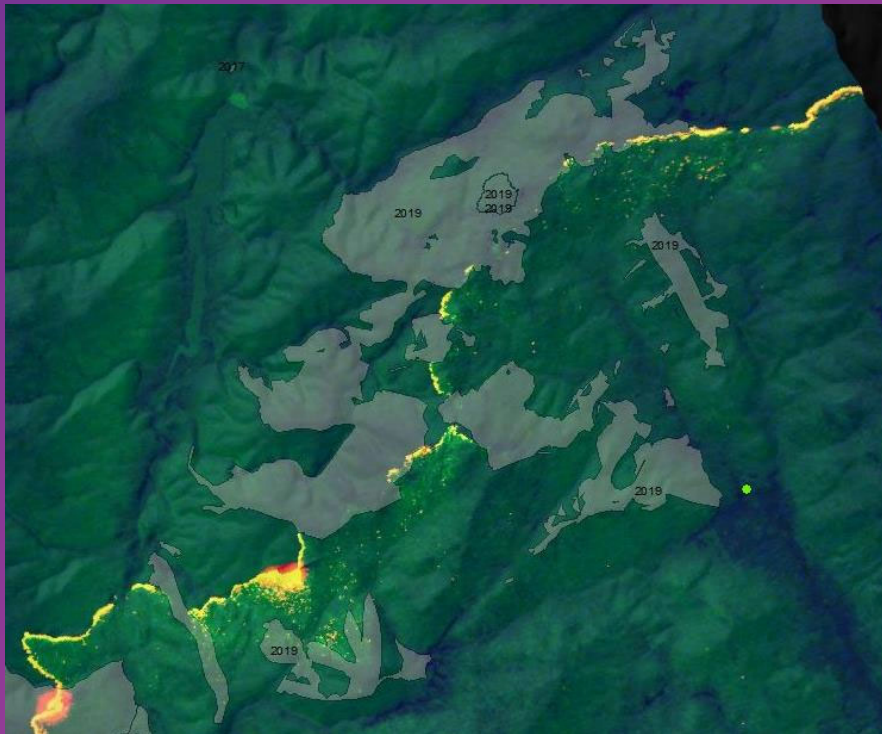
Smokers Trail  
prescribed burn,  
burnt 2019



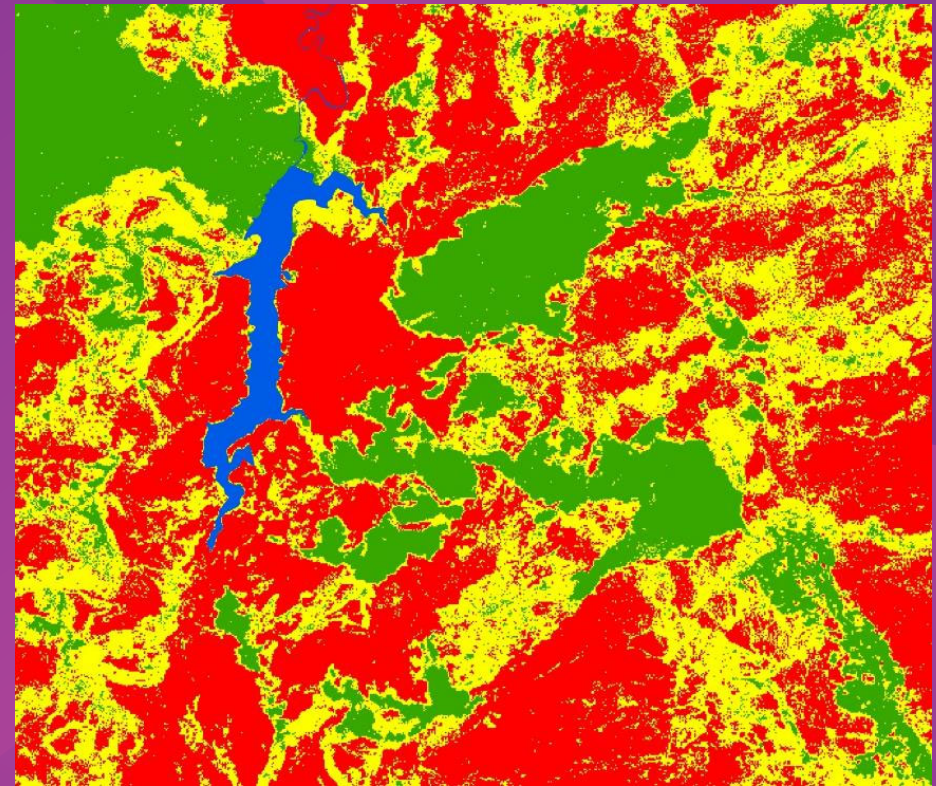


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## SMOKERS TRAIL BURN 2019



Linescan, 2 February 2020



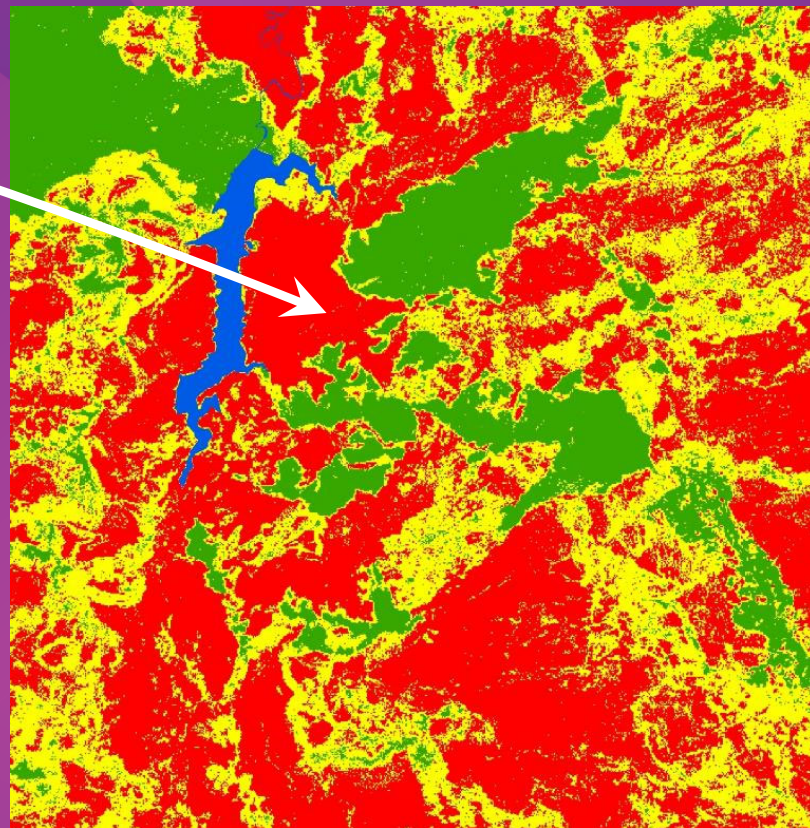
Fire severity map, 2020



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Photo of the Smokers Trail Burn



Fire severity map, 2020



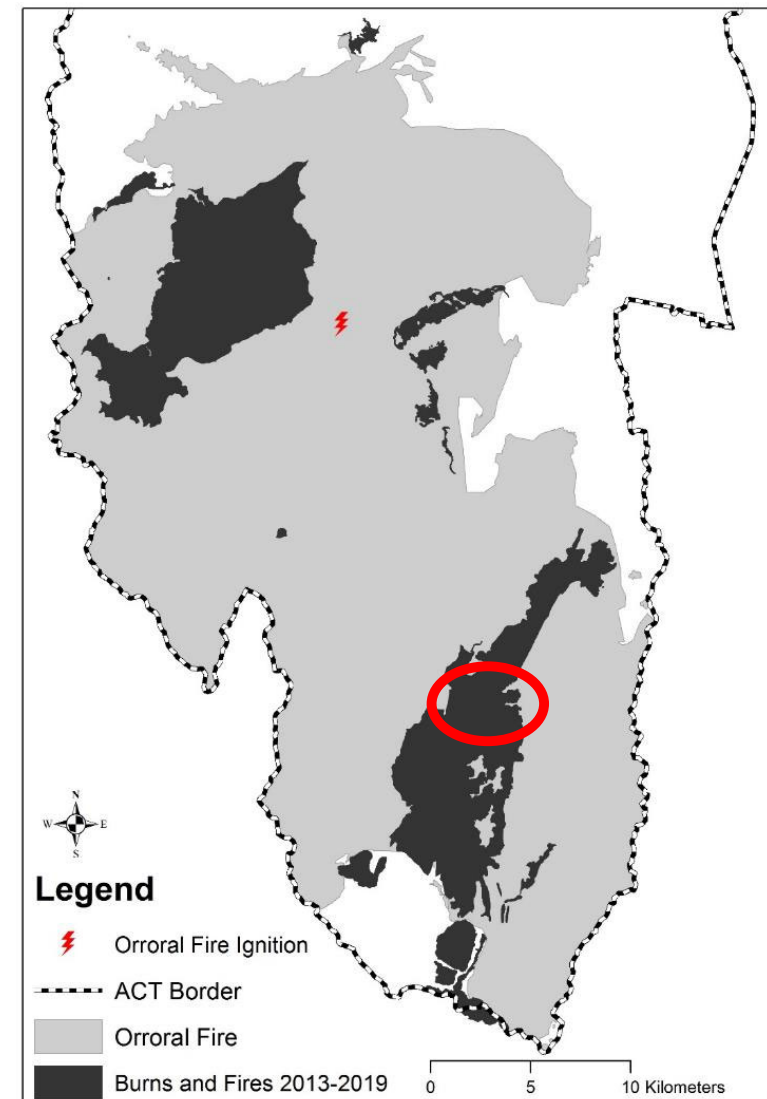
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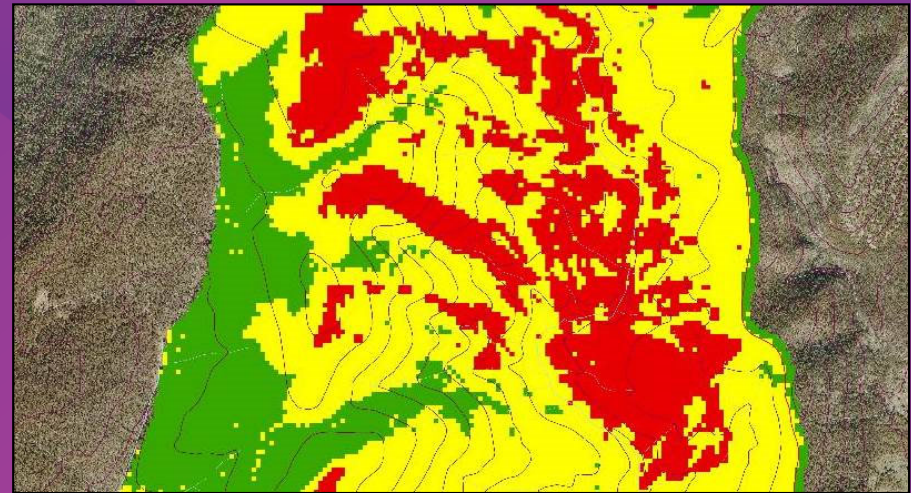


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## BRANDY FLAT BURN 2016



Booth Range from the North, 2016

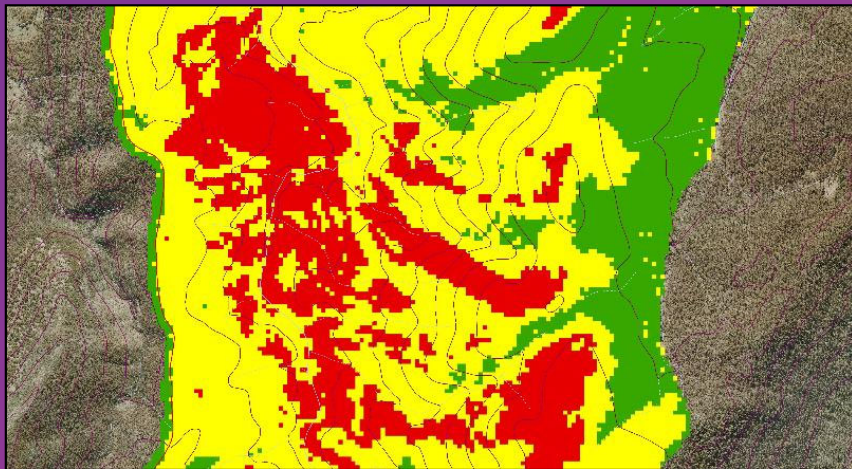


Burn severity map,  
Booth Range, 2016

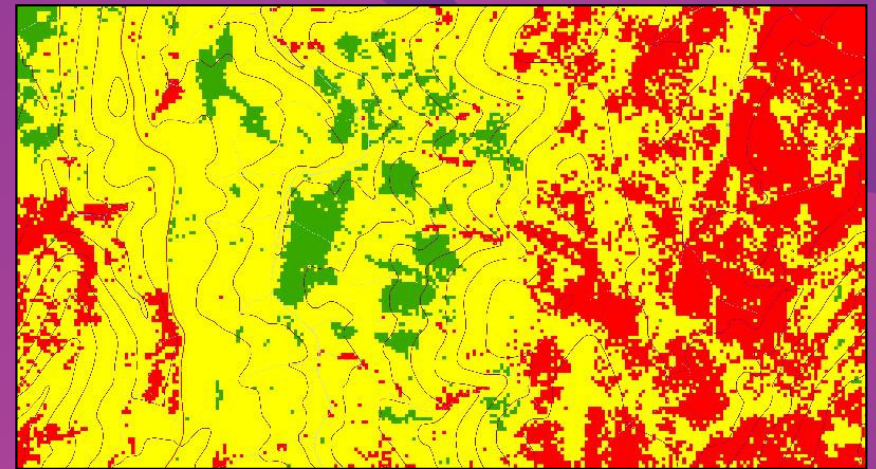


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## BRANDY FLAT BURN 2016



Fire severity map, 2016



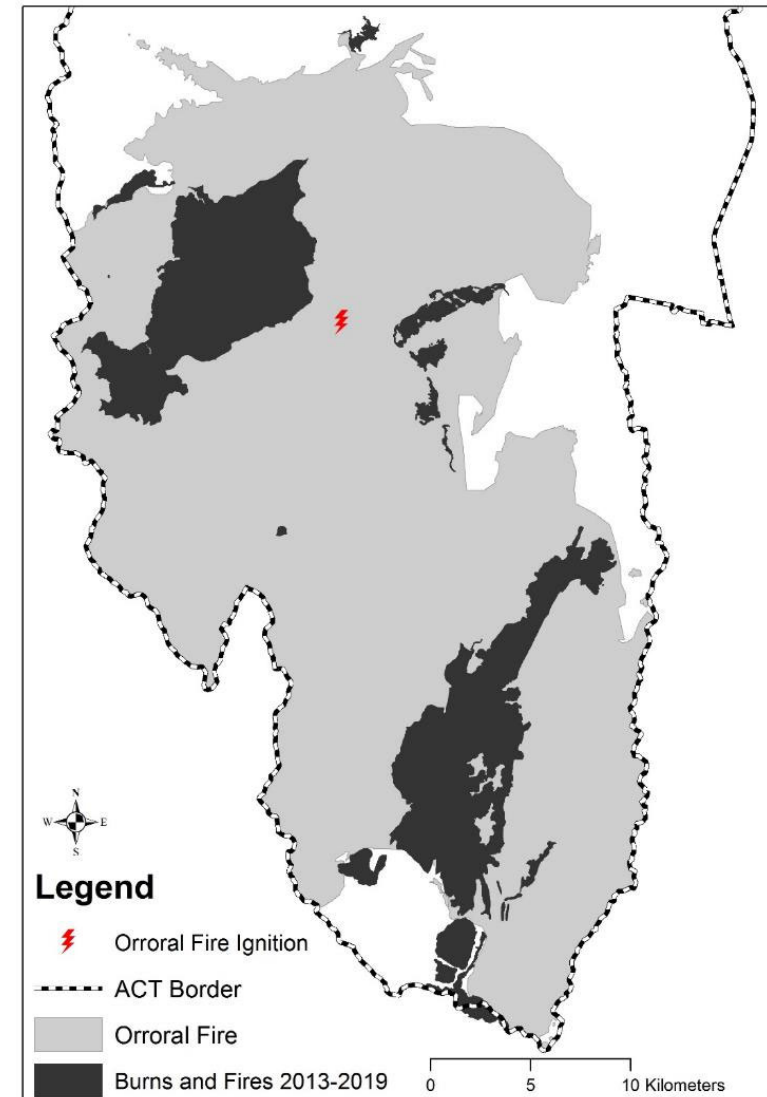
Fire severity map, 2020



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## ENVIRONMENTAL OUTCOMES OF BURNING

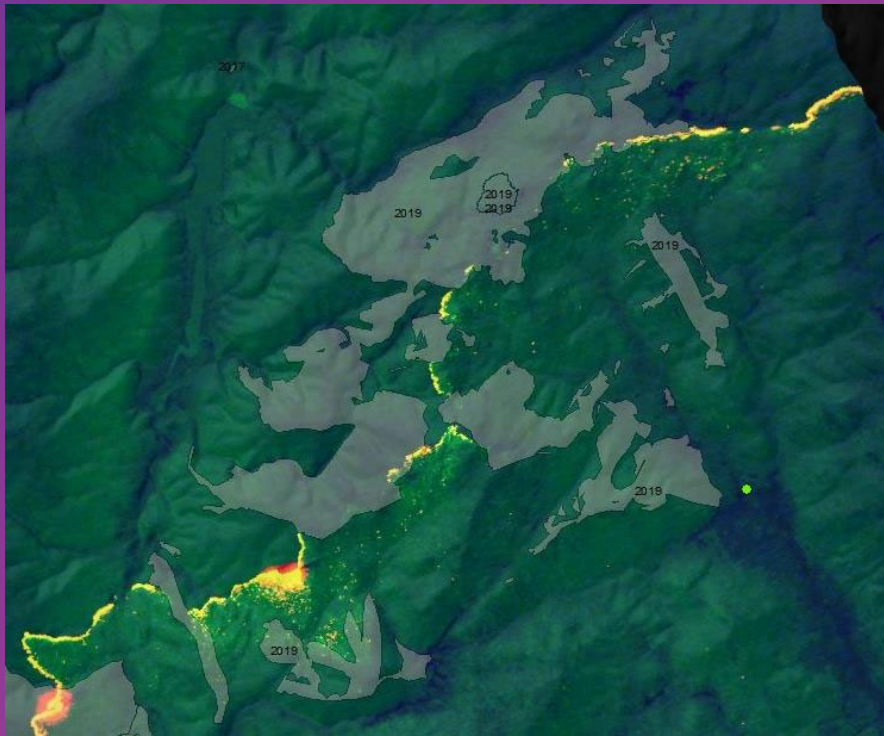
- Reduced the extent and severity of the fire
- Minimised spread into the water catchment



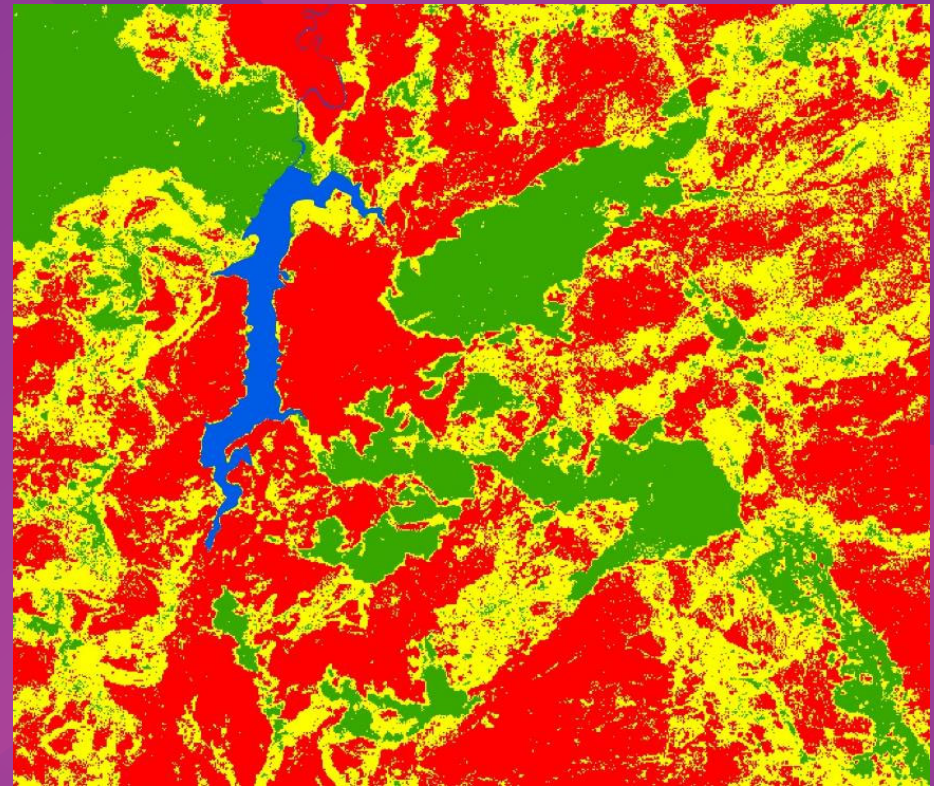


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## SMOKERS TRAIL BURN 2019



Linescan, 2 February 2020



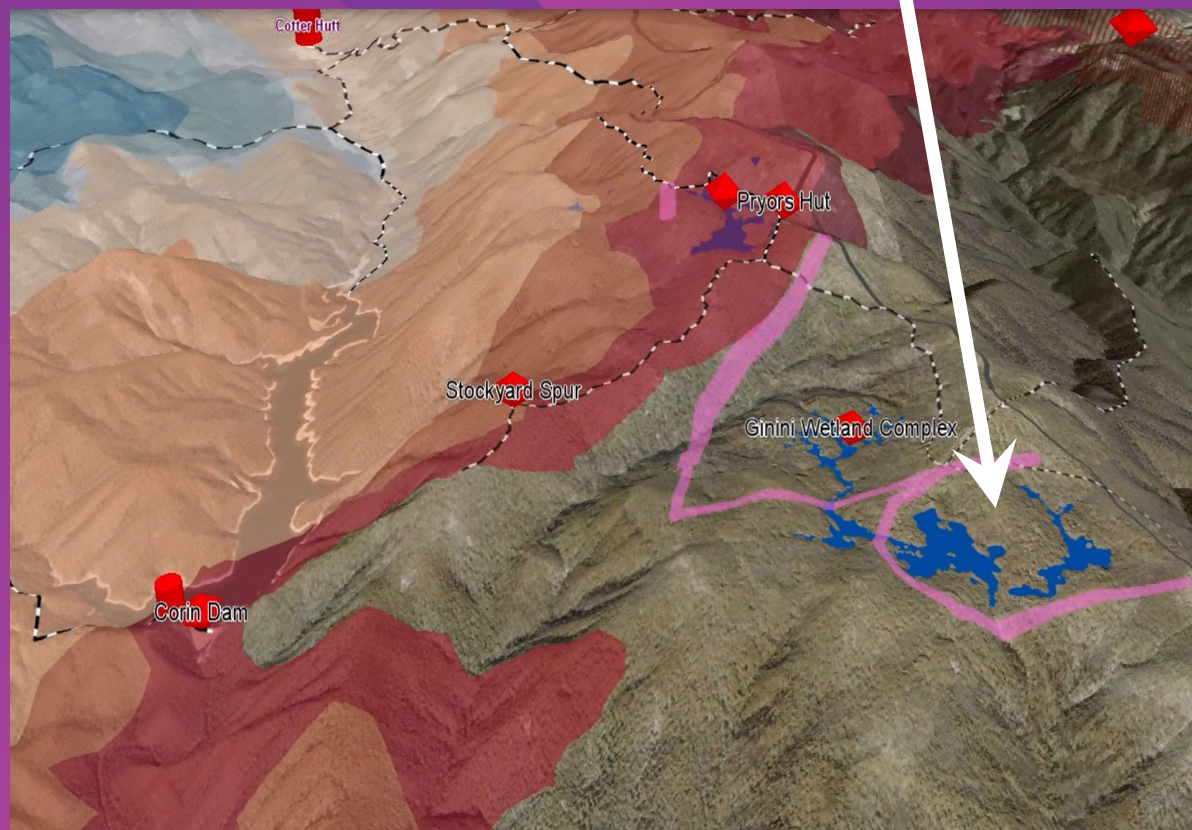
Fire severity map, 2020



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## PROTECTED THE GININI WETLAND

Plan to burn  
blocks which  
include  
alpine bogs.





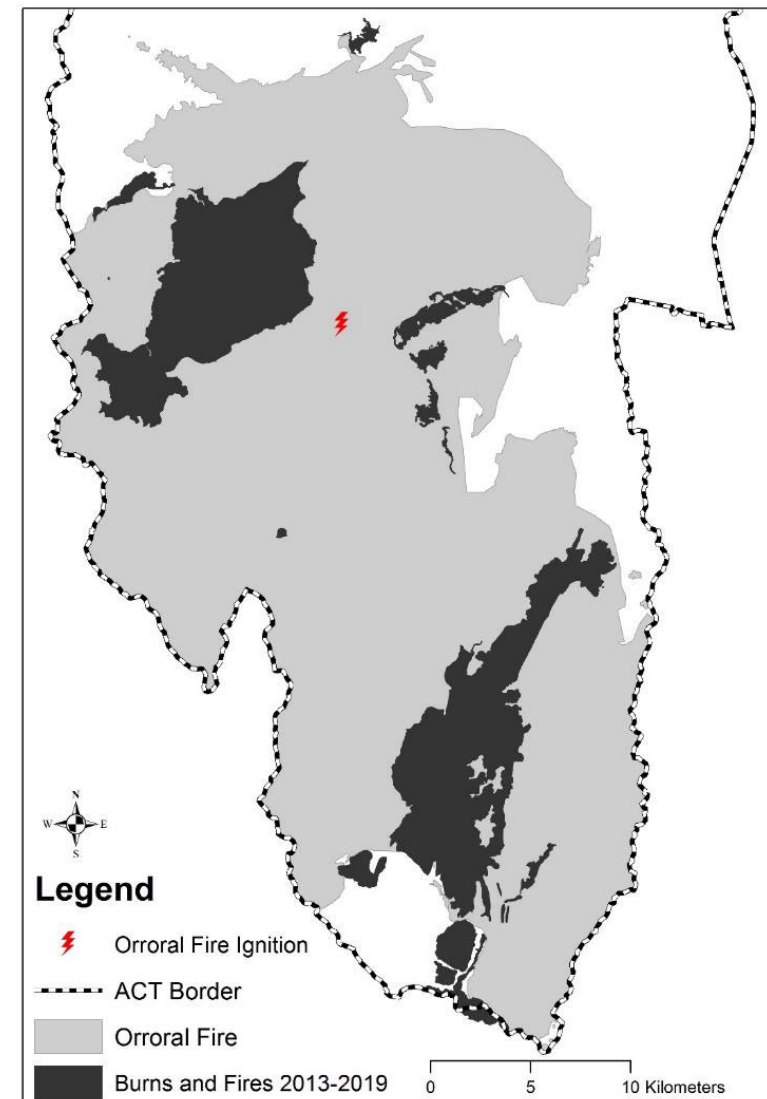
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## CLIMATE ADAPTATION

Manage bushfire risk in TIME as well as SPACE

- Deep droughts form over multiple years
- Plan to burn more country when a dryness threshold is reached

**WHEN and WHERE to burn?**

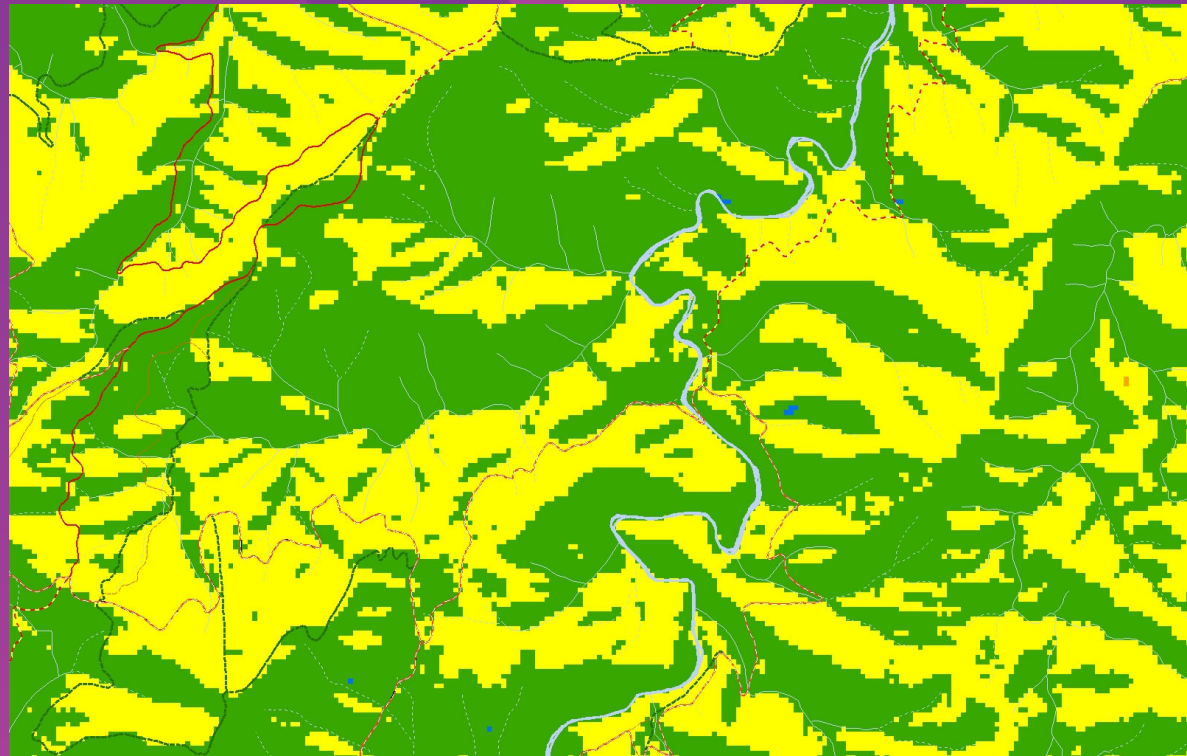




## LANDSCAPE DRYNESS PREDICTION

In mountainous, forested terrain in southern Australia, only the northerly aspects will burn when conditions are safe.

Application of a sub-canopy climate model which combines, aspect, slope, elevation and vegetation cover.





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# CLIMATE ADAPTATION



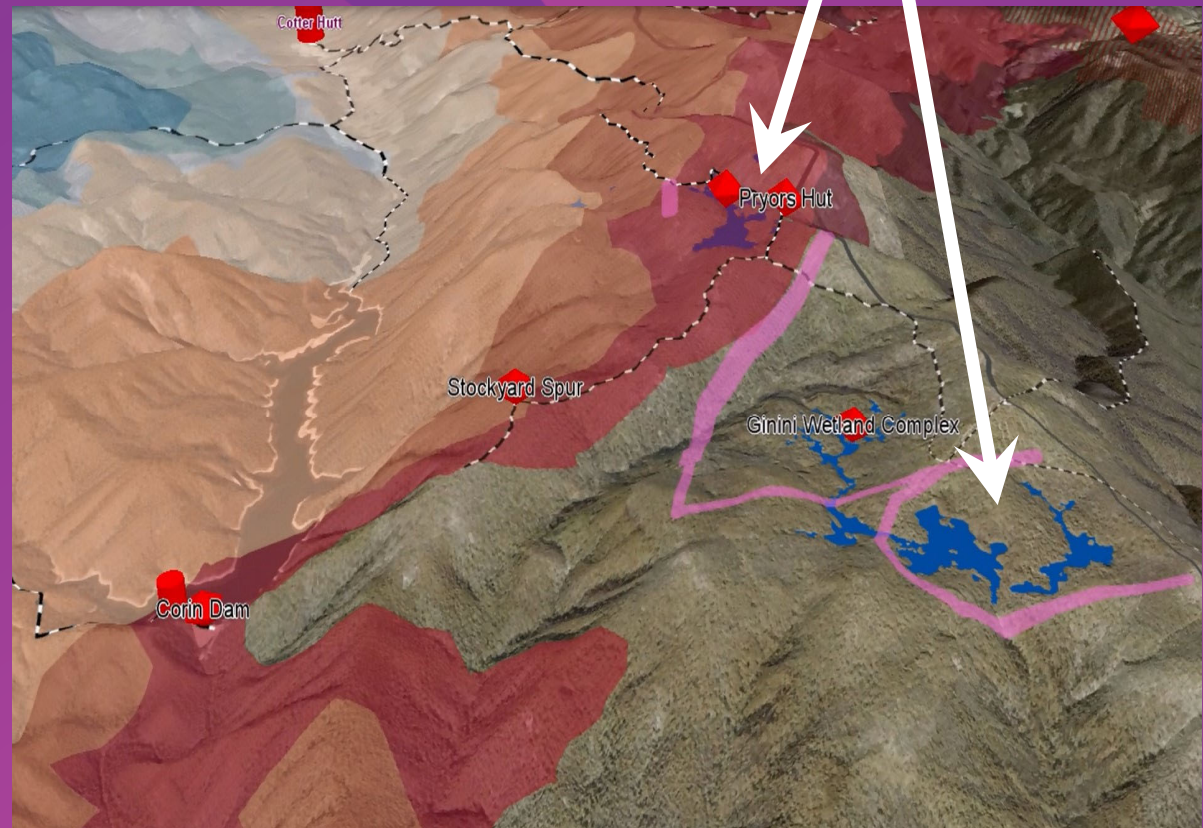
Snowy Flat alpine bog: this is what you don't want.



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# CLIMATE ADAPTATION

Plan to burn  
blocks which  
include  
alpine bogs.



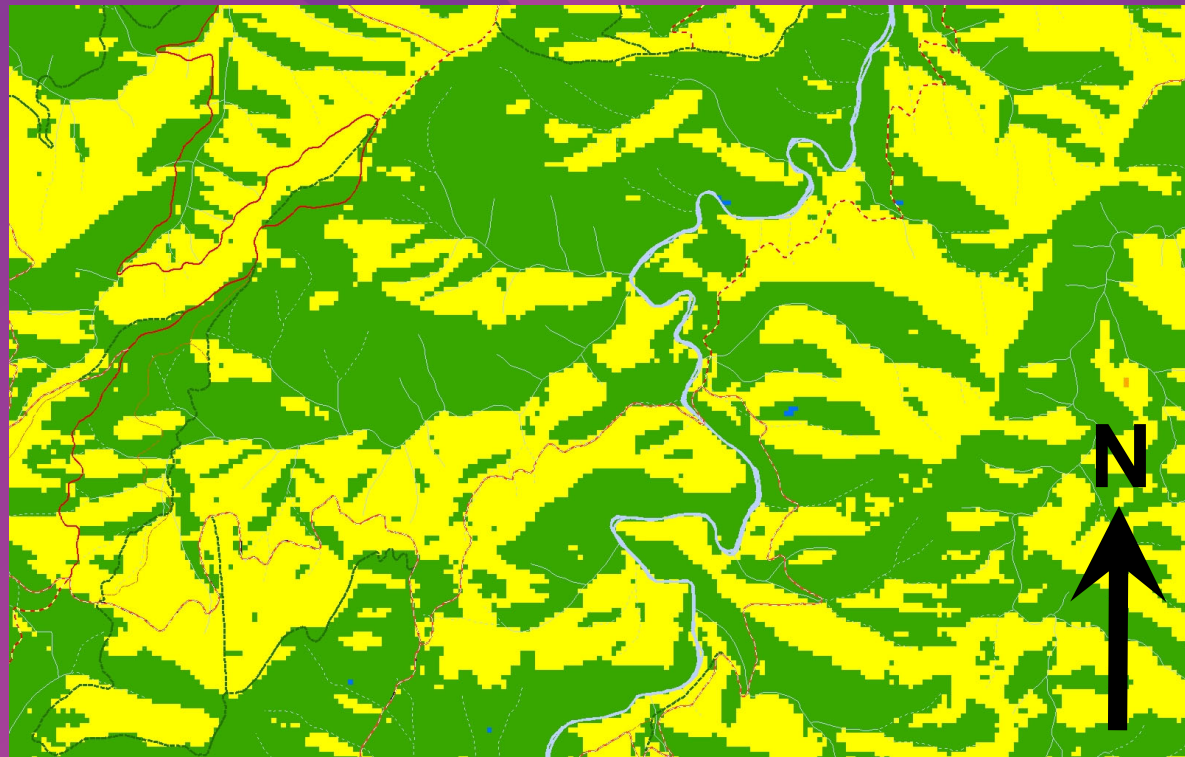


In mountainous, forested terrain in southern Australia, only the northerly aspects will burn when conditions are safe.

Application of a sub-canopy climate model which combines, aspect, slope, elevation and vegetation cover.

Nyman *et al.* (2018)  
*Agricultural and Forest Meteorology*

## FLAMMABILITY MAPPING



Application of a sub-canopy climate model to the ACT in April.  
Yellow = flammable North aspect; Green = Non-flammable South aspect

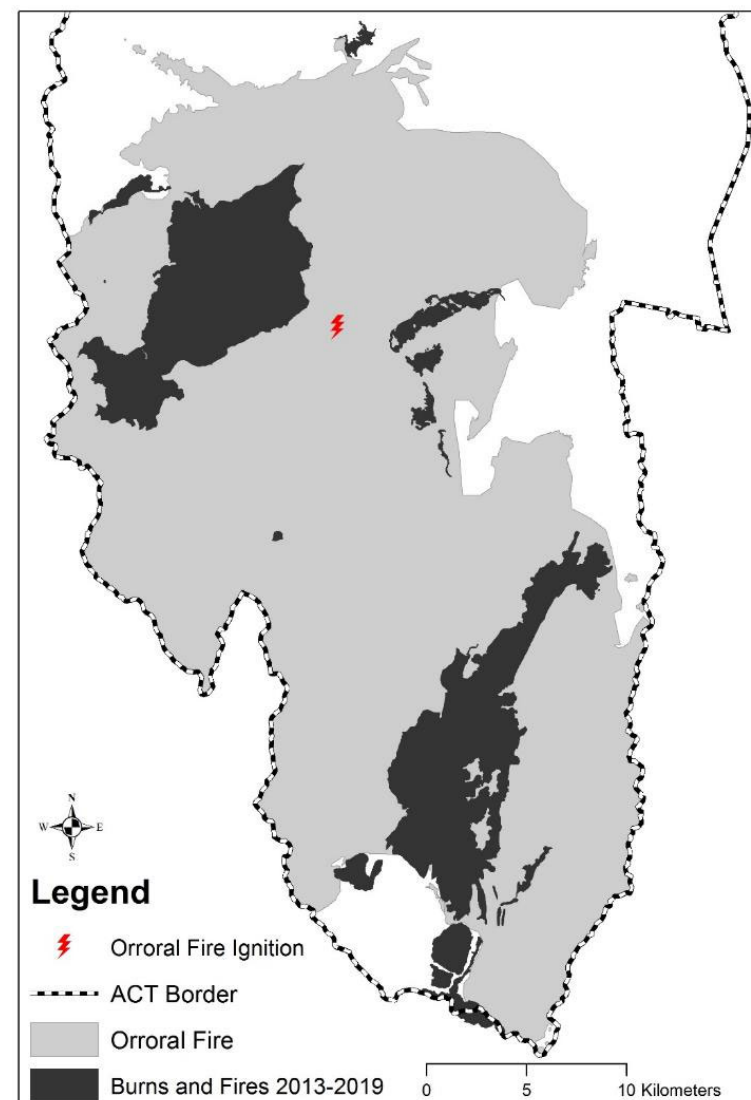


## ASSETS AT RISK IN ACT

What critical values in Namadgi National Park are threatened by bushfires?

- Water supply catchment
- Alpine bogs
- Alpine Ash (*Eucalyptus delegatensis*)
- Mountain Plum Pine (*Podocarpus lawrencei*)

Hawkins *et al.* (2022) ACT Government Report



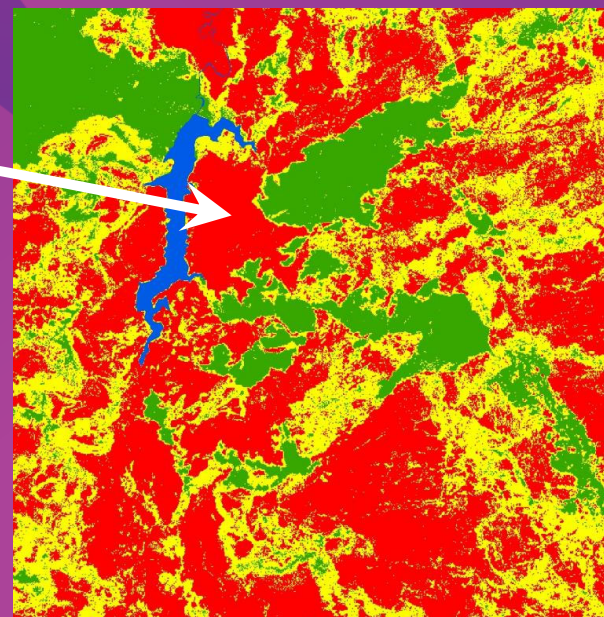


## CLIMATE ADAPTATION: CATCHMENTS

Burn critical water catchments to reduce post-bushfire hydrological risk to water supply (and threatened aquatic species).



Photo of the Smokers Trail Burn after the Orroral Fire



Fire severity map, 2020



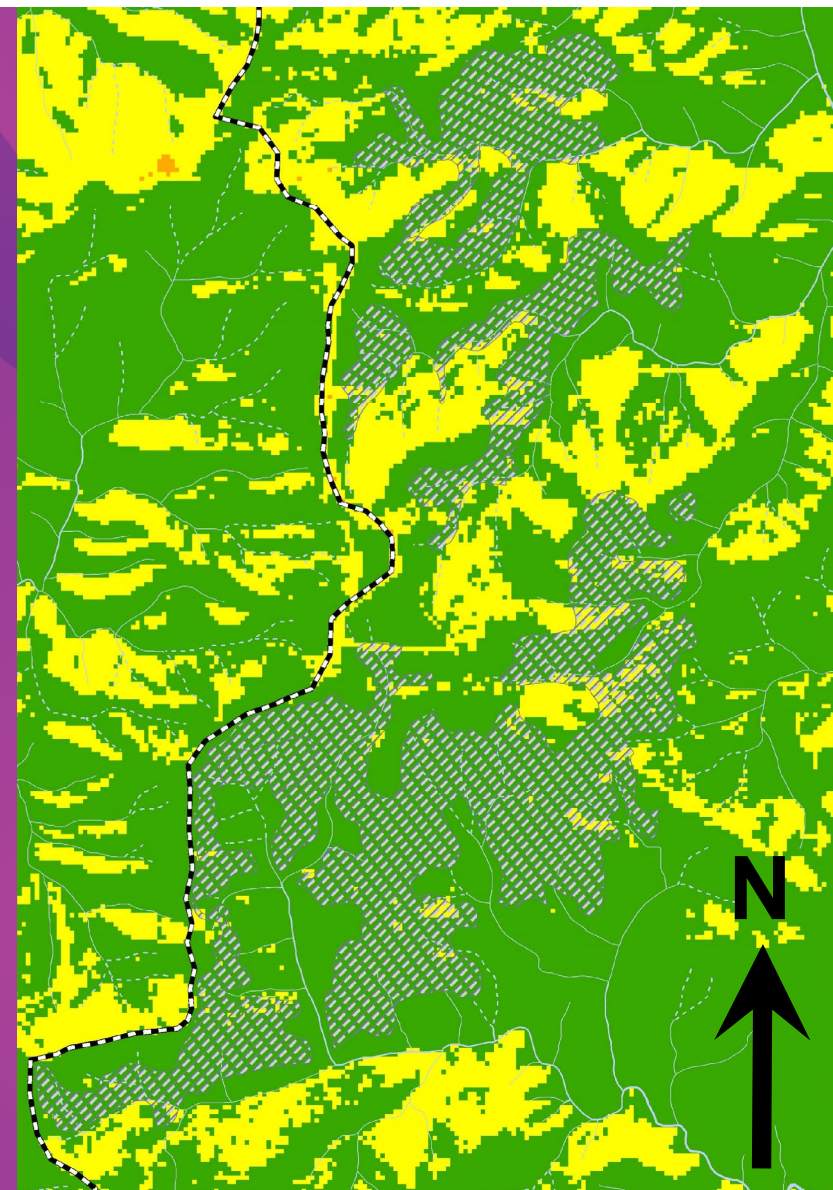
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## CLIMATE ADAPTATION: ALPINE ASH

Alpine Ash is a serotinous species which is killed by high intensity fire and vulnerable to a higher frequency of bushfires.

It mostly occurs on southerly slopes which are difficult to burn.

Flammability mapping across Alpine Ash stands (grey and white hatching) in the ACT: orange and yellow = flammable; green = non-flammable; black and white line = border





## CLIMATE ADAPTATION: ALPINE BOGS



Snowy Flat alpine bog: this is what you don't want.



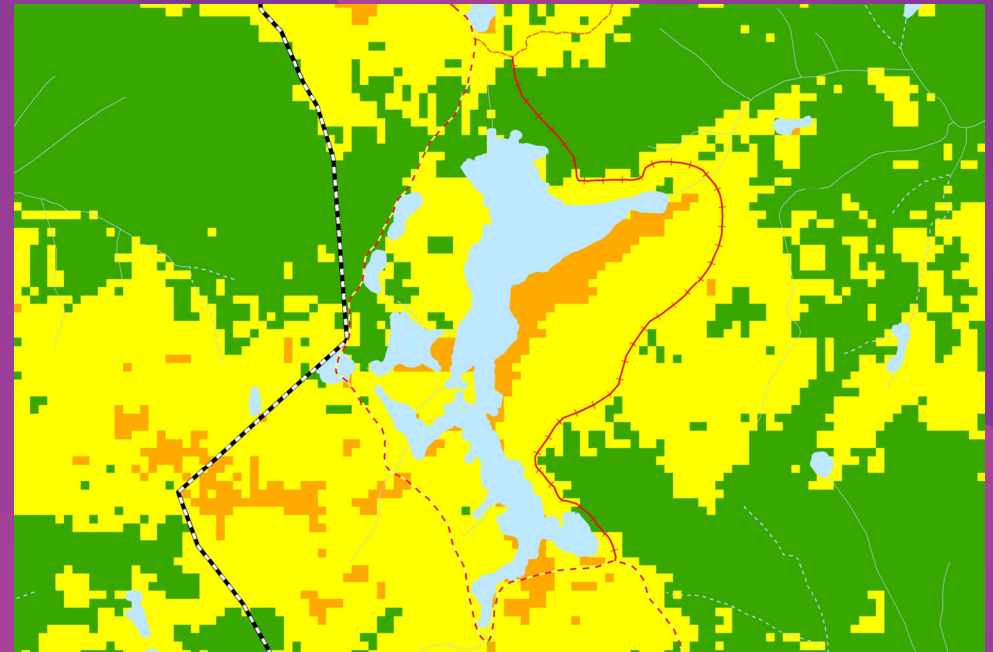
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## CLIMATE ADAPTATION: ALPINE BOGS



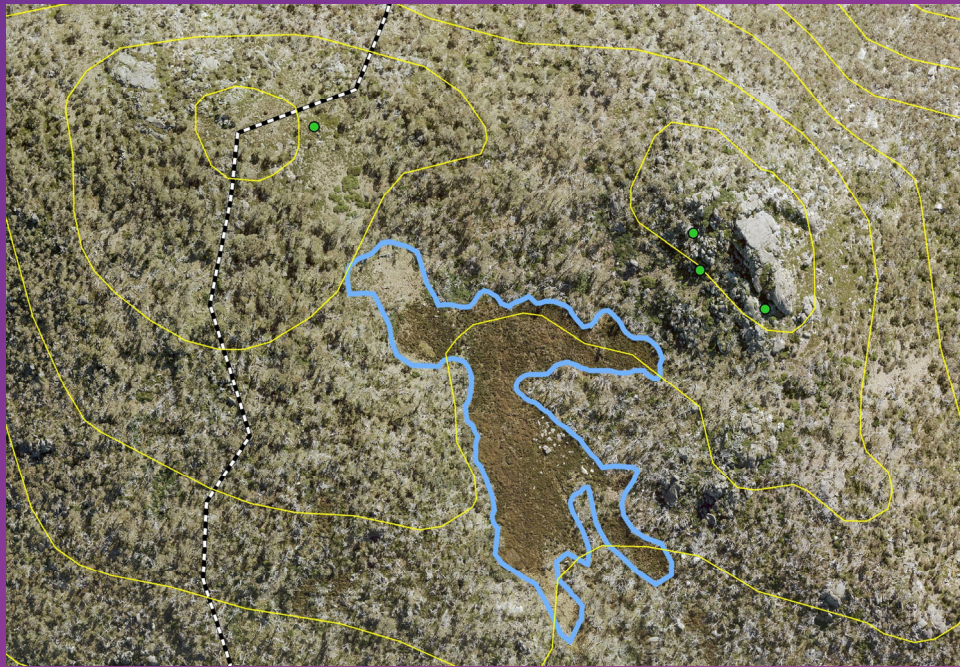
Can we burn around Snowy Flat alpine bog to create a protection zone?

Bog = blue; border = black & white line; FT = red & yellow line; proposed new containment = red line



Flammability map indicating the bush around Snowy Flat is predominantly flammable for prescribed burning (orange and yellow). Green = non-flammable; proposed new containment = red line.

# CLIMATE ADAPTATION: MOUNTAIN PLUM PINE



Aerial photo of the summit of Mt Murray in 2017, with Mountain Plum Pine (green) and an alpine bog (blue line); border = black & white line; contours = yellow line.



Aerial photo of the summit of Mt Murray in 2020 after the bushfire.

## CLIMATE ADAPTATION: MOUNTAIN PLUM PINE



Aerial photo of the summit of Mt Murray in 2020 after the bushfire.

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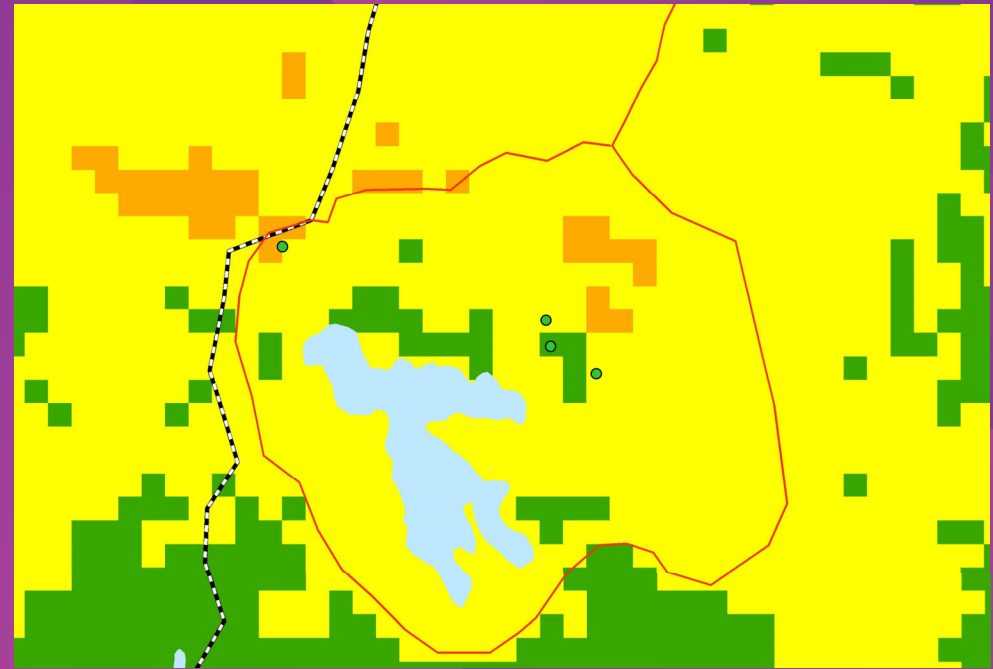


Surviving Mountain Plum Pine plants in protected locations.

## CLIMATE ADAPTATION: MOUNTAIN PLUM PINE



Aerial photo of the summit of Mt Murray in 2020 after the bushfire, with Mountain Plum Pine (green dots); border = black & white line; contours = yellow line.



Flammability mapping across the summit of Mt Murray showing the area is predominantly flammable: orange and yellow = flammable; green = non-flammable; blue = alpine bog; red line = proposed new containment.



# CLIMATE ADAPTATION

Burn Koala habitat at  
low intensity.

Reduce the likelihood of  
canopy consumption  
and scorch.



Australian Government  
Department of Agriculture, Water and the Environment

## National Recovery Plan for the Koala

*Phascolarctos cinereus*

(combined populations of Queensland,  
New South Wales and the Australian Capital  
Territory)



Draft June 2021



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# CULTURAL BURNING

Offer to partner with Traditional Owners to manage land

NB: Not something within the control of agencies

Prescribed Burning in Australasia: Science, Practice and Politics of Burning the Bush, p. 60-61.

## Fire Song

DEN BARBER

### Wiiny Nganhagu Ngurambang

Adapted Wiradjuri language

wiiny  
wiiny  
wiiny

wiiny nganhagu ngurambang  
ngurambang nganhagu wiiny

wiiny nganhagu balugan  
balugan nganhagu wiiny

wiiny nganhagu bila  
bila nganhagu wiiny

wiiny nganhagu ngurambang  
ngurambang nganhagu wiiny

wiiny  
wiiny  
wiiny



### Fire for that Country

English language translation

fire  
fire  
fire

fire for that Country  
Country for that fire

fire for that animal  
animal for that fire

fire for that river  
river for that fire

fire for that Country  
country for that fire

fire  
fire  
fire



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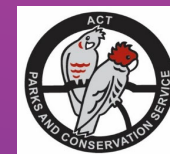
## RECENT PRESCRIBED BURNING

- Reduces the extent and severity of bushfire.
- Some critical environmental values appear to be amenable to burning.
- Can we develop a TEMPORAL burning prescription to bring the concept into operation?

A big thanks to our ACT Parks colleagues who skilfully implement the prescribed burning program and turn out when there's a fire.



Australian  
National  
University



*alluvium*



## RESEARCH NEEDED – NHRA?

- Develop a robust predictive tool nine months in advance
- Fire regime simulation modelling to:
  - a) test the concept
  - b) define the prescriptions, and
  - c) obtain the social license to operate.

A big thanks to our ACT Parks colleagues who skilfully implement the prescribed burning program and turn out when there's a fire.

