The 2024 Die-off: what's happened and going forward

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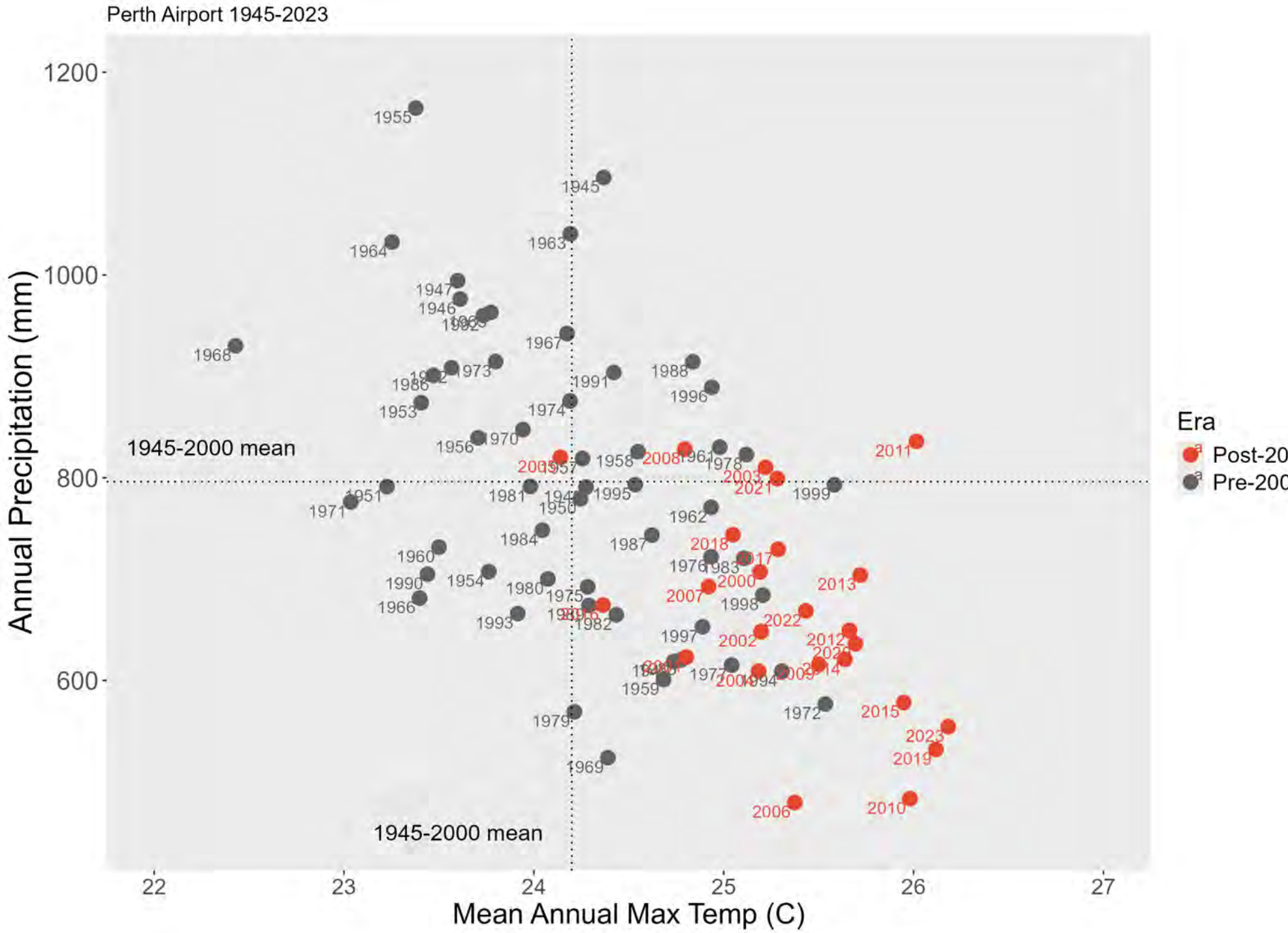
GOVERNMENT OF WESTERN AUSTRALIA

Biodiversity and Conservation Science

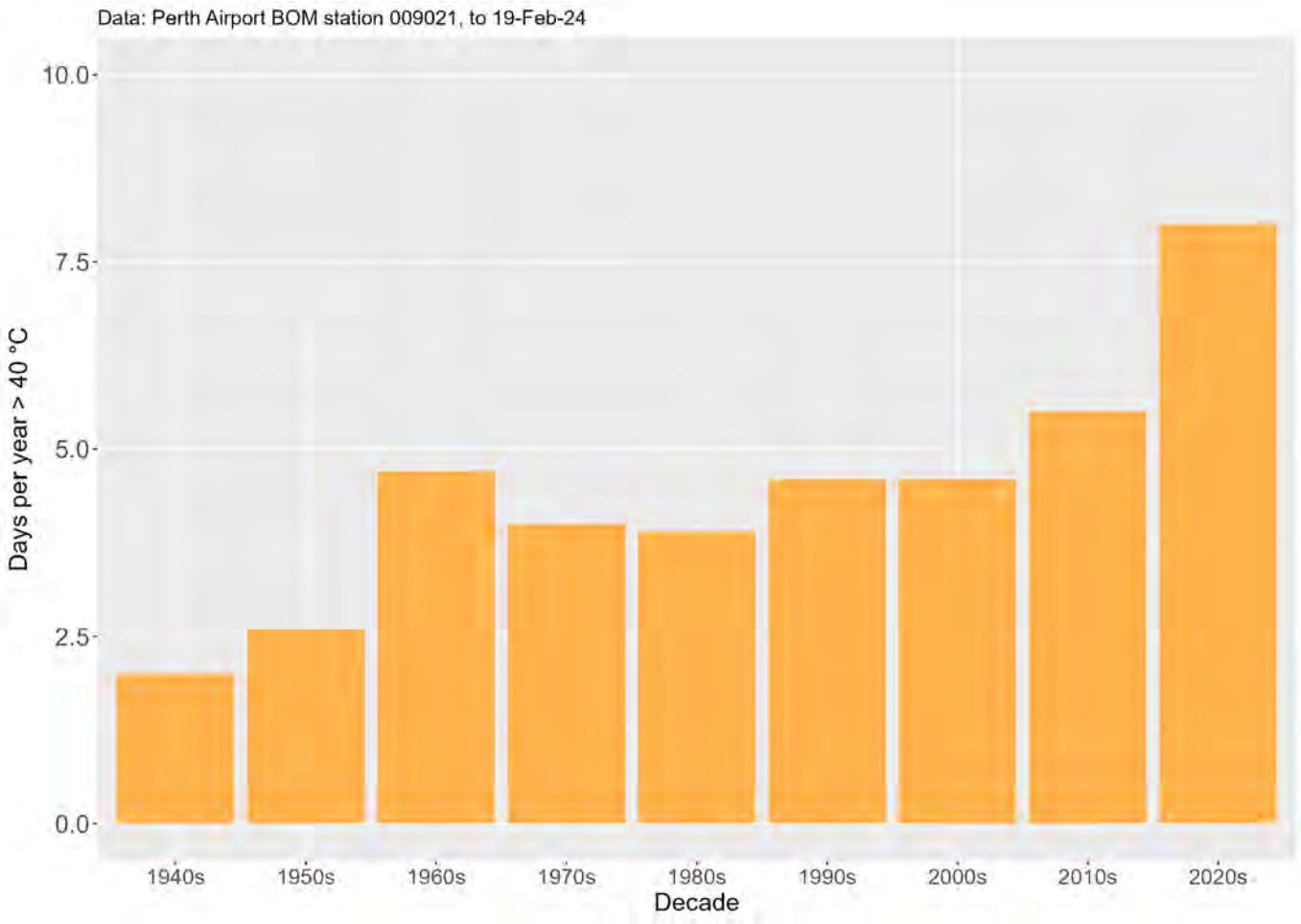
Topics

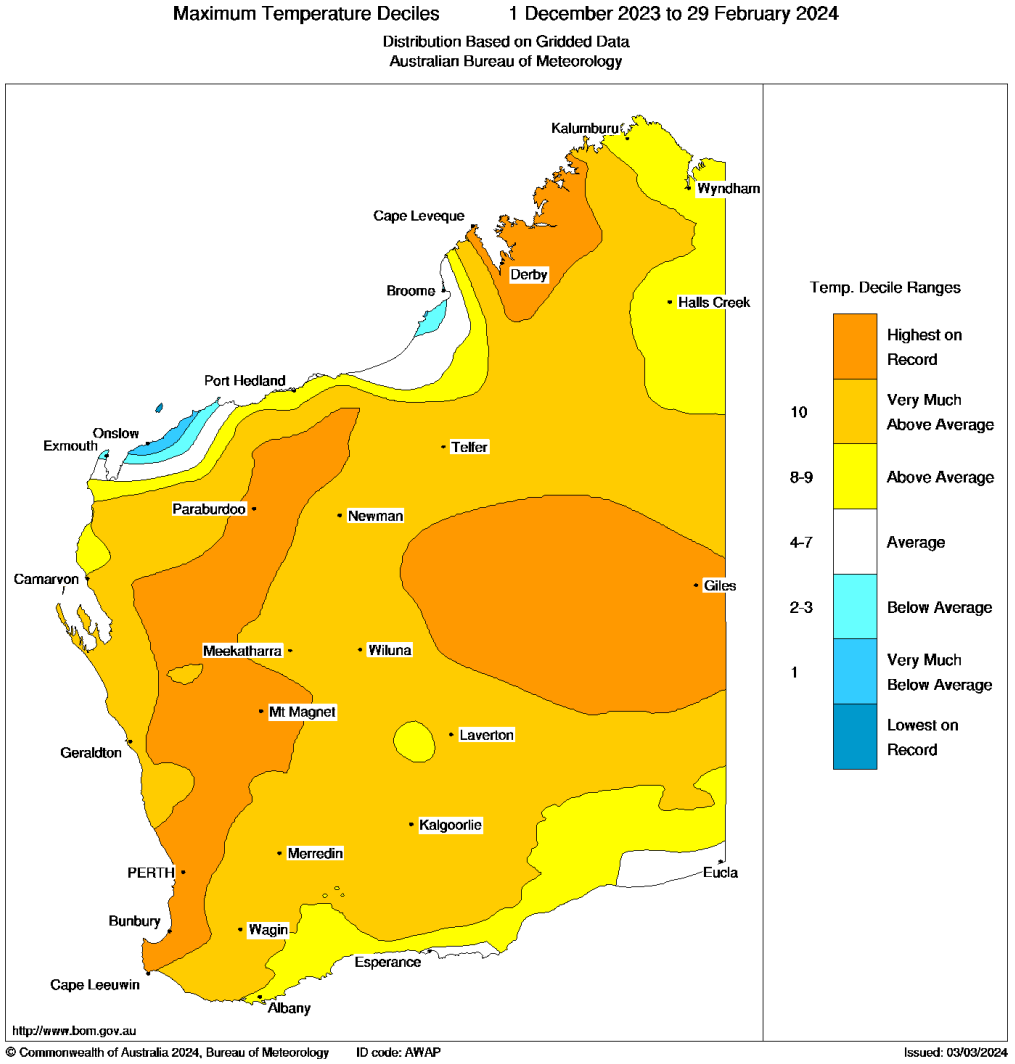
- What happened
- This happened before
- Mapping impacts
- Conservation implications
- Fire management implications
- Questions

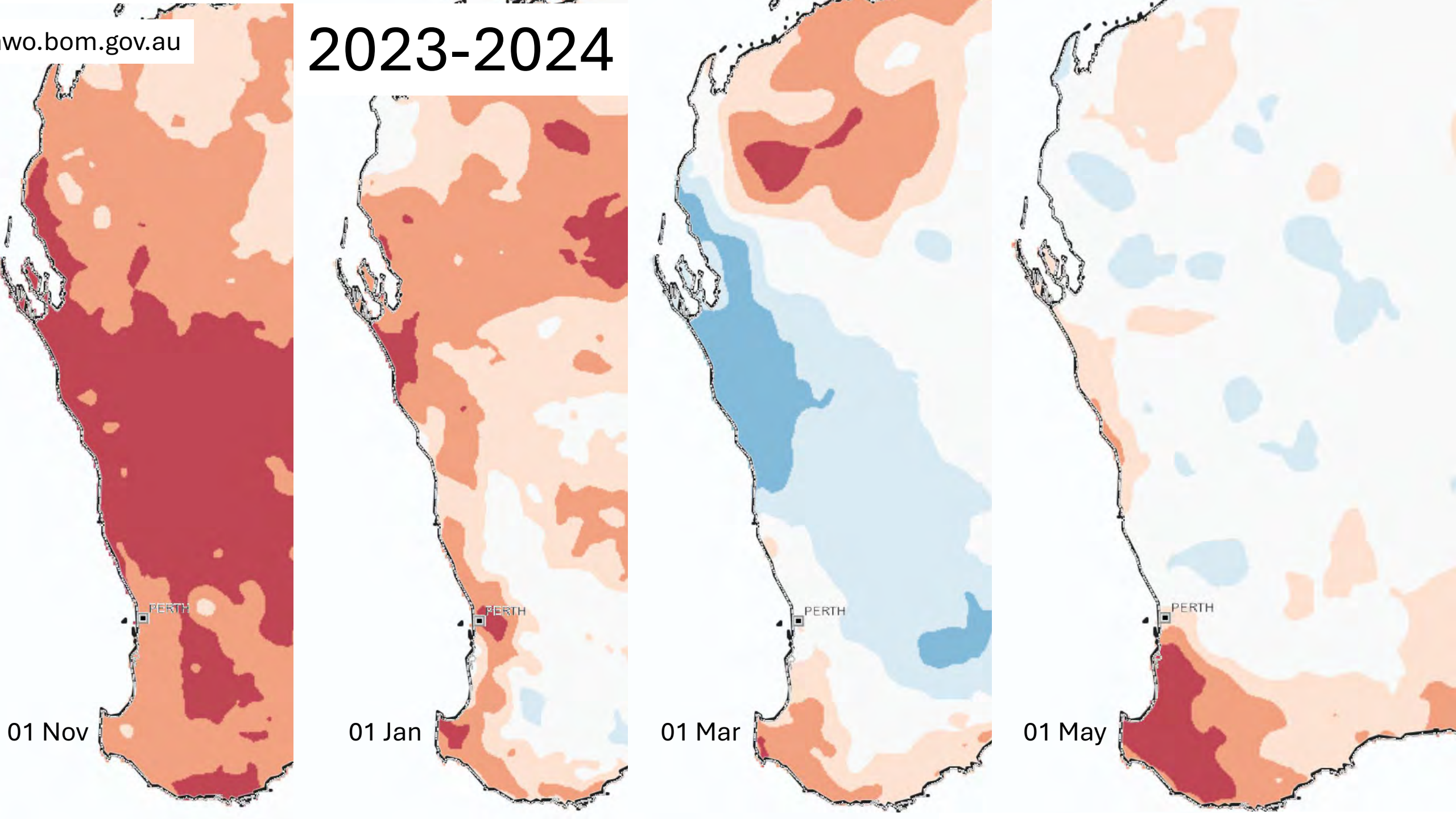
Climate


Perth Airport 1945-2023
Annual Precipitation (mm)
Mean Annual Max Temp (C)
1945-2000 mean
1945-2000 mean
Era
Post-20
Pre-200
1200
1000
800
600
22
23
24
25
26
27

Weather: Temperature






wo.bom.gov.au
2023-2024
PERTH
PERTH
PERTH
PERTH
01 Nov
01 Jan
01 Mar
01 May

Southwest canopy dieoff

<u>Major Factors</u>

Duration of dry

Heat waves

Rainfall

Beedelup Falls


Prevelly


Jarrahdale


Thomsons Lake


Manning Park


SW of Gingin

Lesueur NP


Kalbarri NP

So what do we know?

- This happened before in 2010-2011
- Mapping impacts
- Conservation implications
- Fire management implications

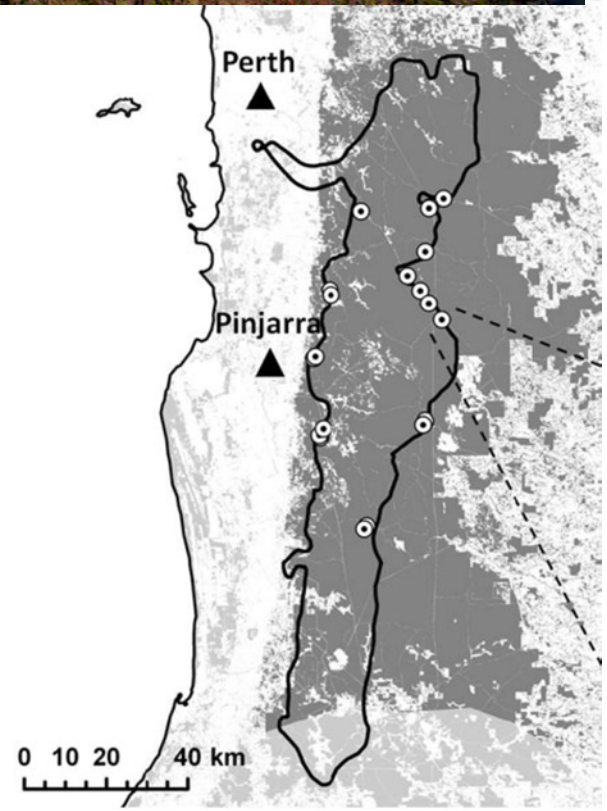
This happened before

Eur J Forest Res (2013) 132:497–510
DOI 10.1007/s10342-013-0690-5

ORIGINAL PAPER

Sudden forest canopy collapse corresponding with extreme drought and heat in a mediterranean-type eucalypt forest in southwestern Australia

George Matusick · Katinka X. Ruthrof · Niels C. Brouwers · Bernard Dell · Giles St. J. Hardy



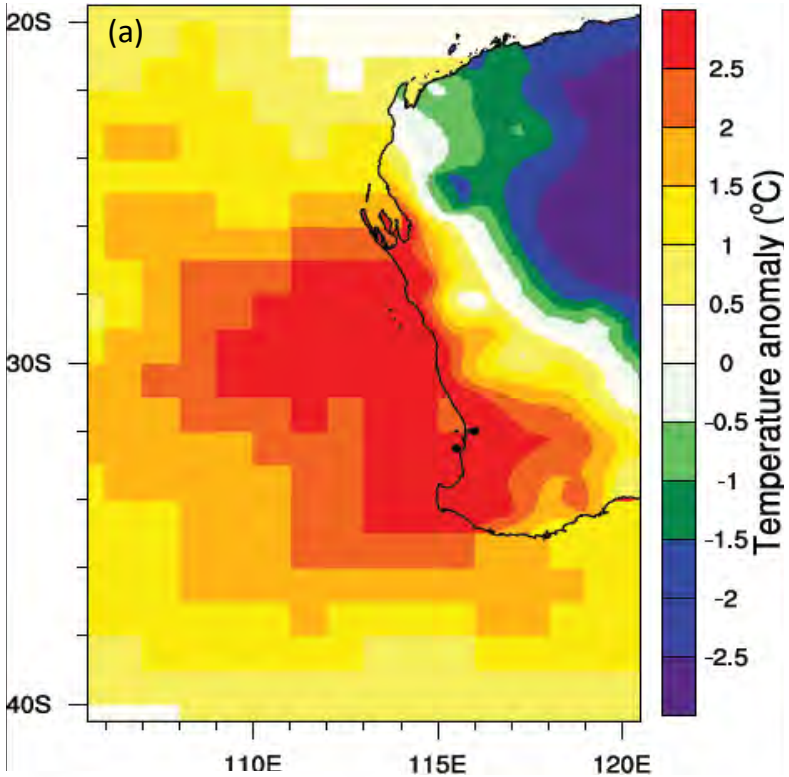
SCIENTIFIC REPORTS

Article OPEN | Published: 30 August 2018

Subcontinental heat wave triggers terrestrial and marine, multi-taxa responses

Katinka X. Ruthrof, David D. Breshears, Joseph B. Fontaine, Ray H. Froend, George Matusick, Jatin Kala, Ben P. Miller, Patrick J. Mitchell, Shaun K. Wilson, Mike van Keulen, Neal J. Enright, Darin J. Law, Thomas Wernberg & Giles E. St. J. Hardy

Scientific Reports **8**, Article number: 13094 (2018) Download Citation



Climate shift not just about the mean but about events

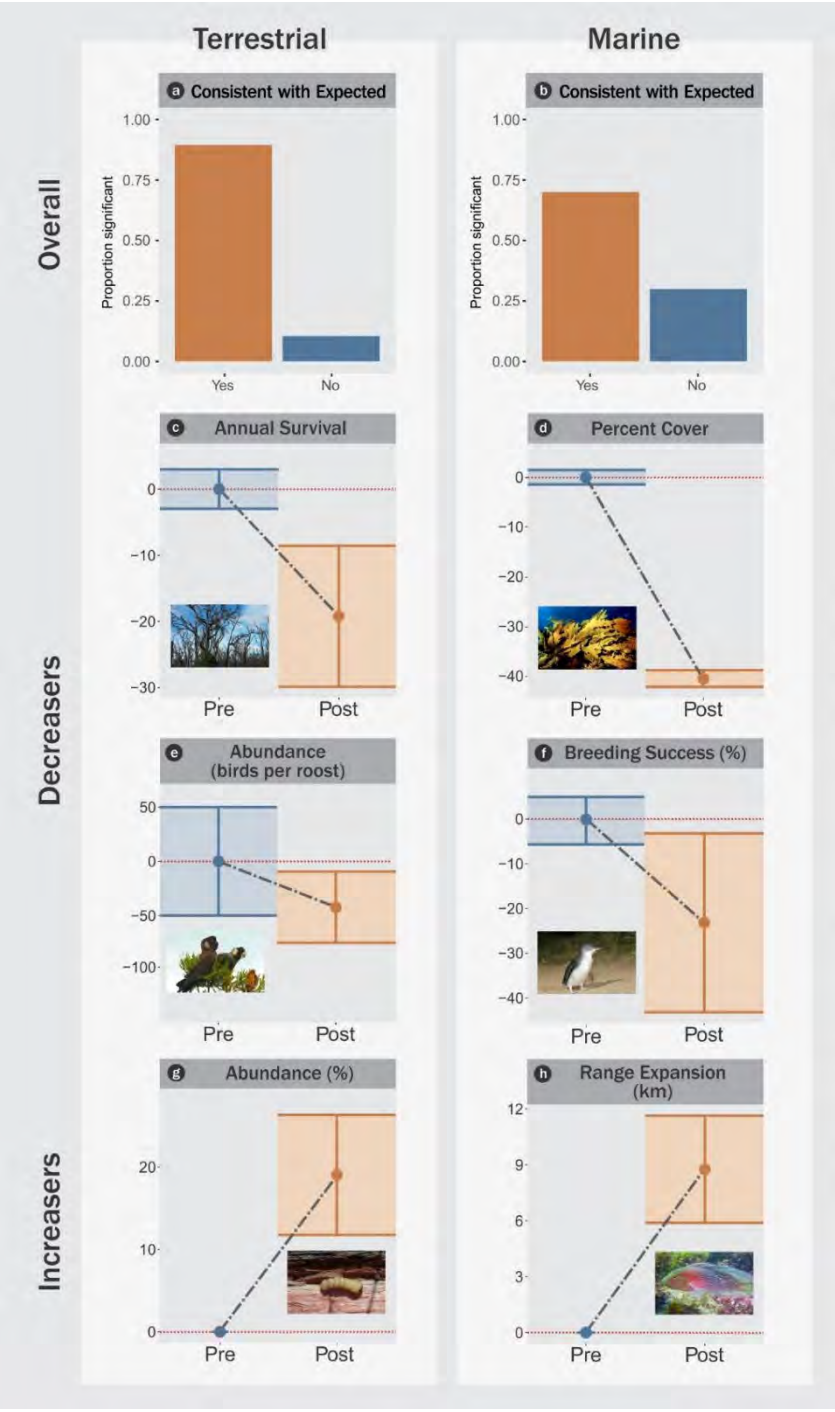
– extent, intensity, frequency

Global Change Biology

Primary Research Articles | Full Access

Carbon consequences of drought differ in forests that resprout

Lewis L. Walden, Joseph B. Fontaine, Katinka X. Ruthrof, George Matusick, Richard J. Harper, Giles E. St. J. Hardy



So what do we know?

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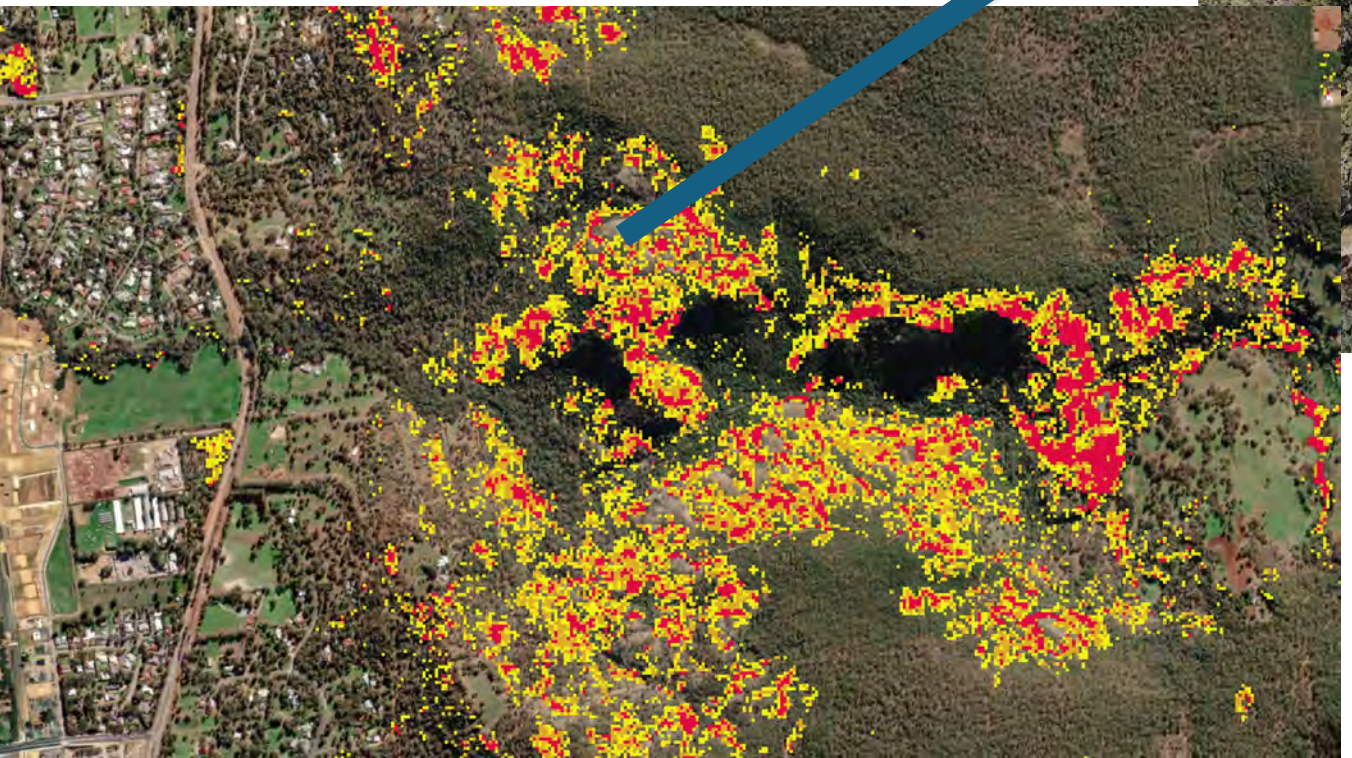
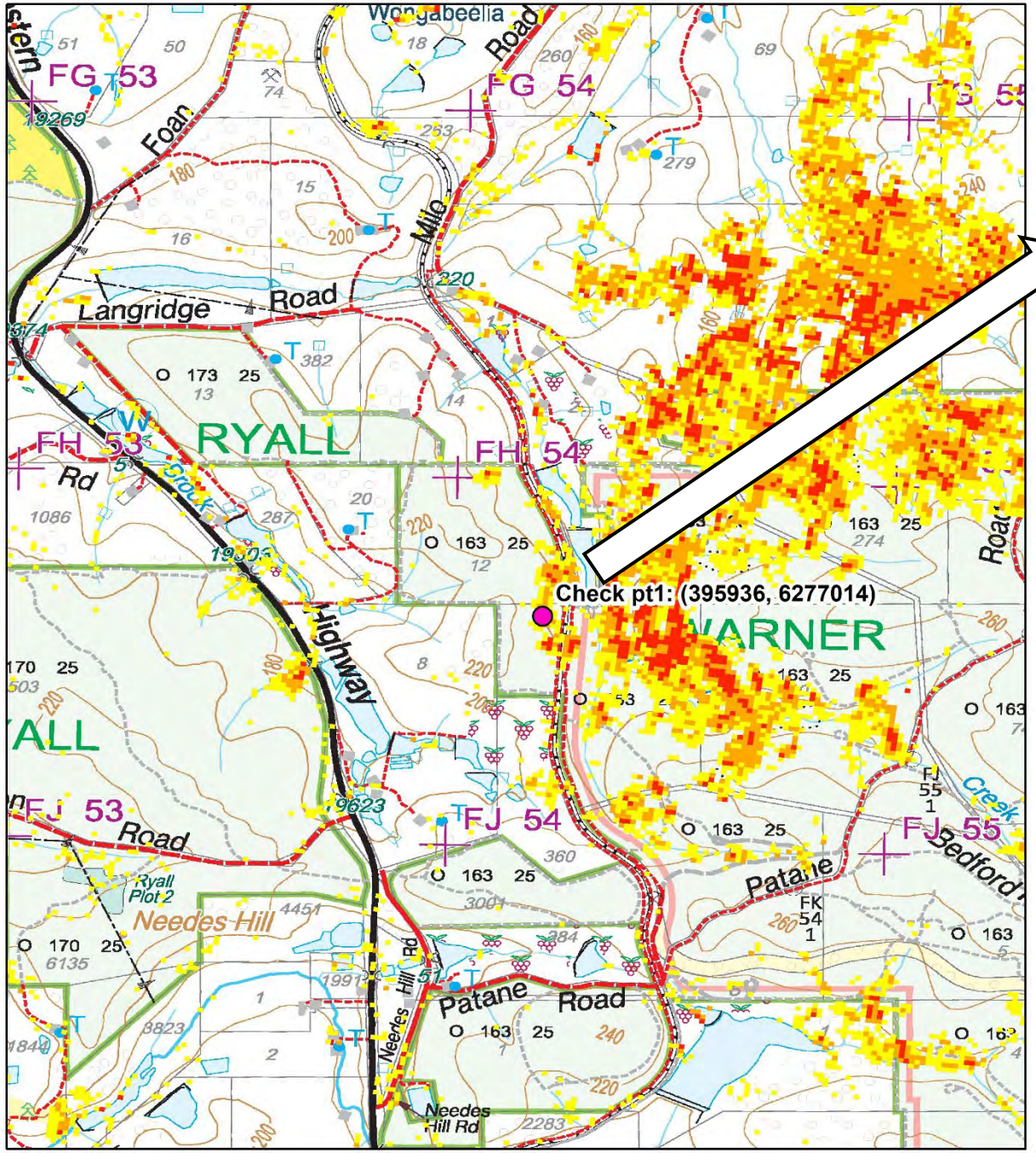
Mapping: Linking satellite and ground data

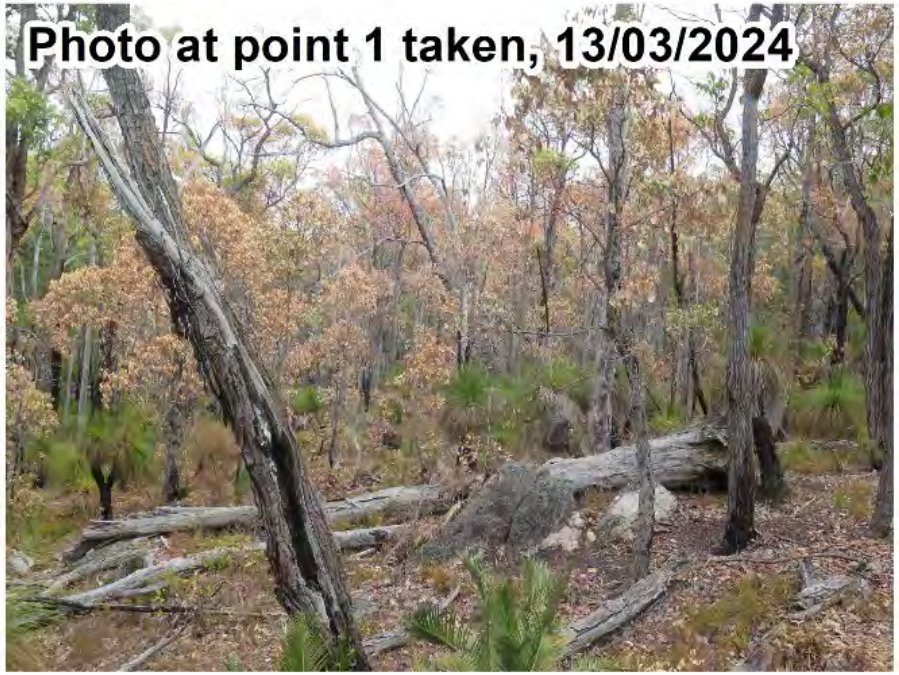


Wungong Gorge

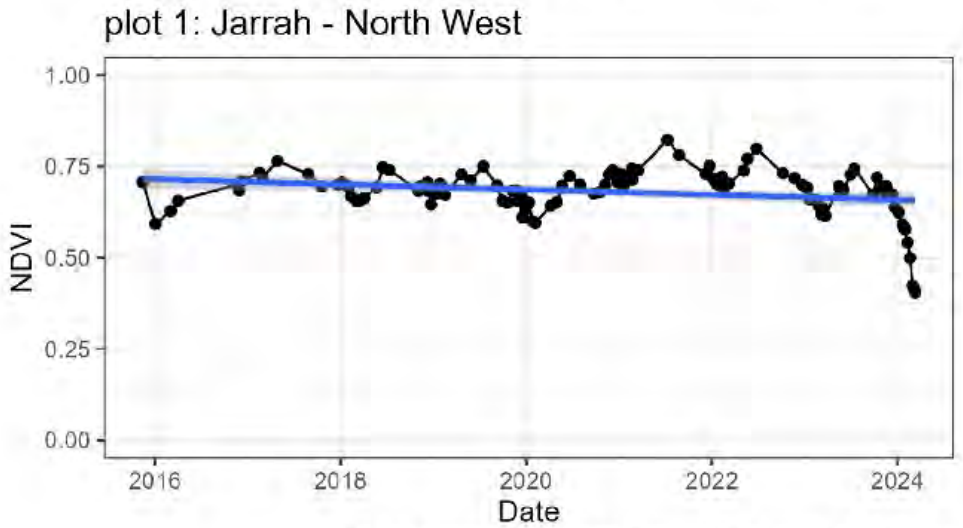
Remote sensing is a discipline unto itself
~Weekly images with 10 or 30 m resolution
Visible and IR parts of the spectrum
Indices based on ‘greenness’

2024 drought check point: Kirup

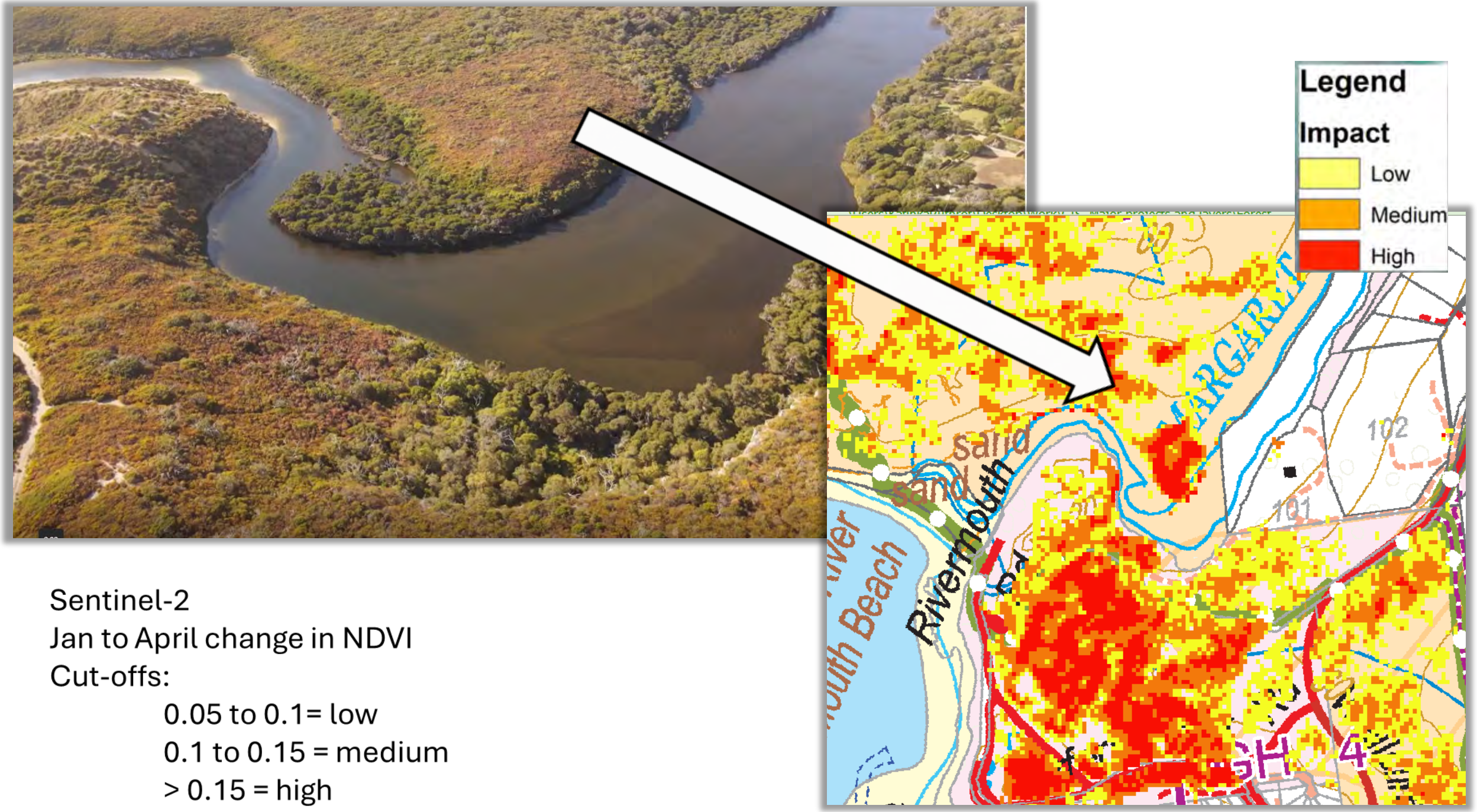




Sentinel Normalised Difference Vegetation Index

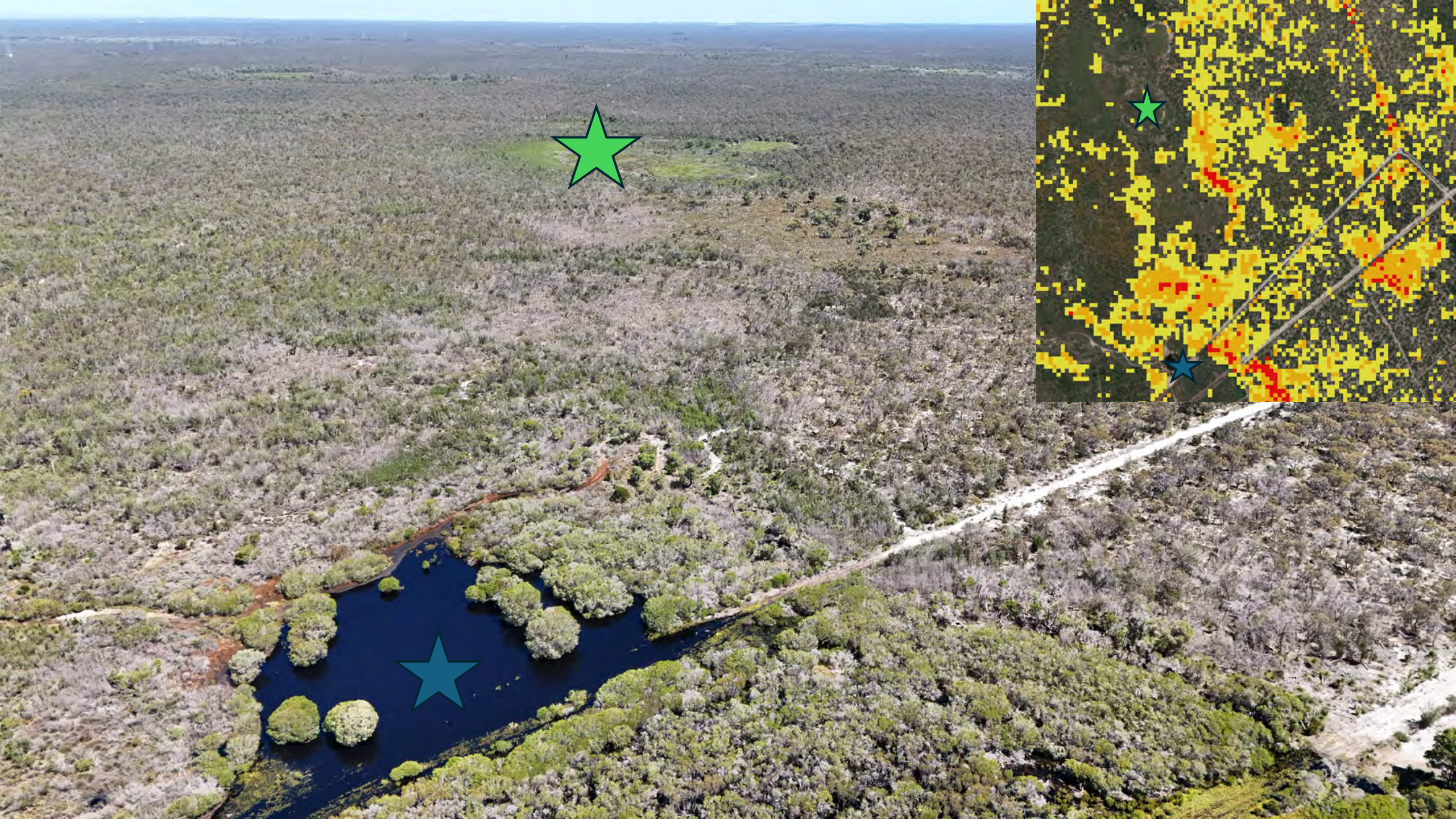


No silviculture at this point from 2015-10-22 to 2024-03-16



Sentinel-2
Jan to April change in NDVI
Cut-offs:

0.05 to 0.1= low
0.1 to 0.15 = medium
> 0.15 = high



Die-off Survey 2024	20m radius plots. As homogenous as possible						
Date						Plot photo time	
Observer name							
Location: GPS coordinates							
Understory: shrubs and herbs	**Unimpacted**						**Impacted**
% total cover: live and dead (circle one)				0-25%	26-50%	51-75%	76-100%
% die-off (circle one)	<5%	6-10%	11-25%	26-50%	51-75%	76-90%	>90%
Dominant species (3-5), if known (whole plot)							
Dominant species affected by die-off							
Average height (m) (live or dead)							
Midstory: small trees and young trees							
% total cover: live and dead (circle one)				0-25%	26-50%	51-75%	76-100%
% die-off (circle one)	<5%	6-10%	11-25%	26-50%	51-75%	76-90%	>90%
Dominant species, if known (whole plot)							
Dominant species affected by die-off							
Average height (m) (live or dead)							
Overstory: trees							
% total cover: live and dead (circle one)				0-25%	26-50%	51-75%	76-100%
% die-off (circle one)	<5%	6-10%	11-25%	26-50%	51-75%	76-90%	>90%
% bare branches (old dead)							
Dominant species, if known (whole plot)							
Average height (m) (live or dead)							
Site information							
Soil type (laterite, sand, loam, limestone)							
Any boulders or granite outcrops: If yes, distance (m)							
% of site that is composed of boulders or granite				0-25%	26-50%	51-75%	76-100%
No. of large (10cm round) branches on ground							
Notes (anything of interest): e.g., healthy species							

Field work: ground truthing

For understorey, mid and overstorey:

- Total cover
- % die-off
- Dominant species
- Site information

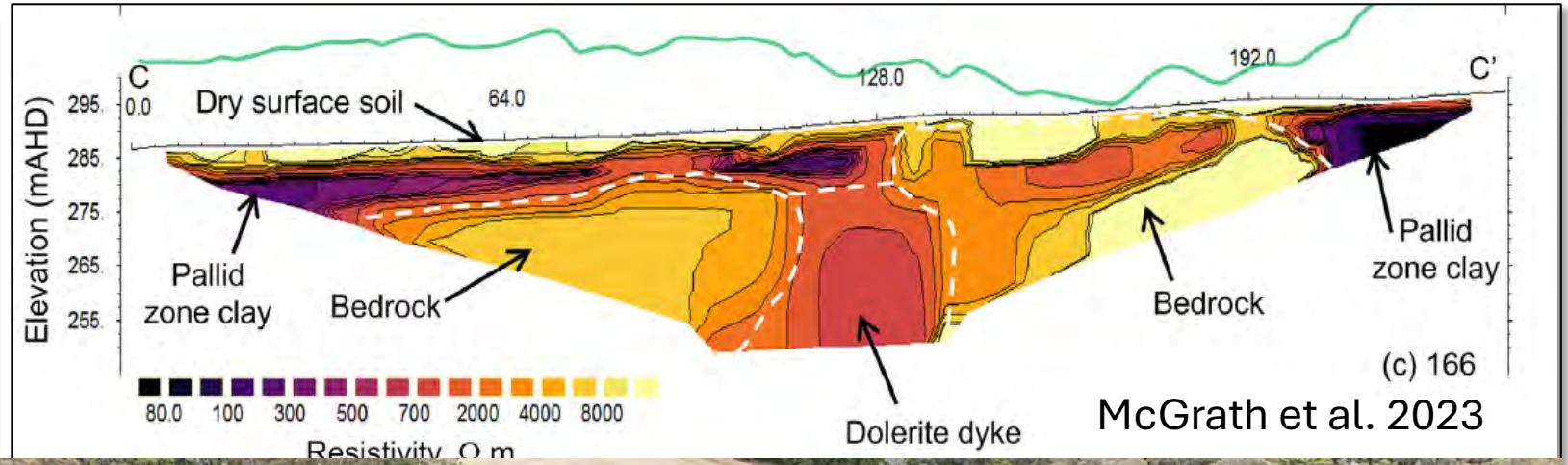
For each site:

- Characteristics: ecosystem type
- Above and below ground

Site history:

Interactions between die-off and fire (TSF, severity, etc.), harvesting, etc.

Site characteristics



McGrath et al. 2023

- What are the vulnerabilities and thresholds?
  - For sites
  - For species
  - For their history

Ecotonal groundwater decline

So what do we know?

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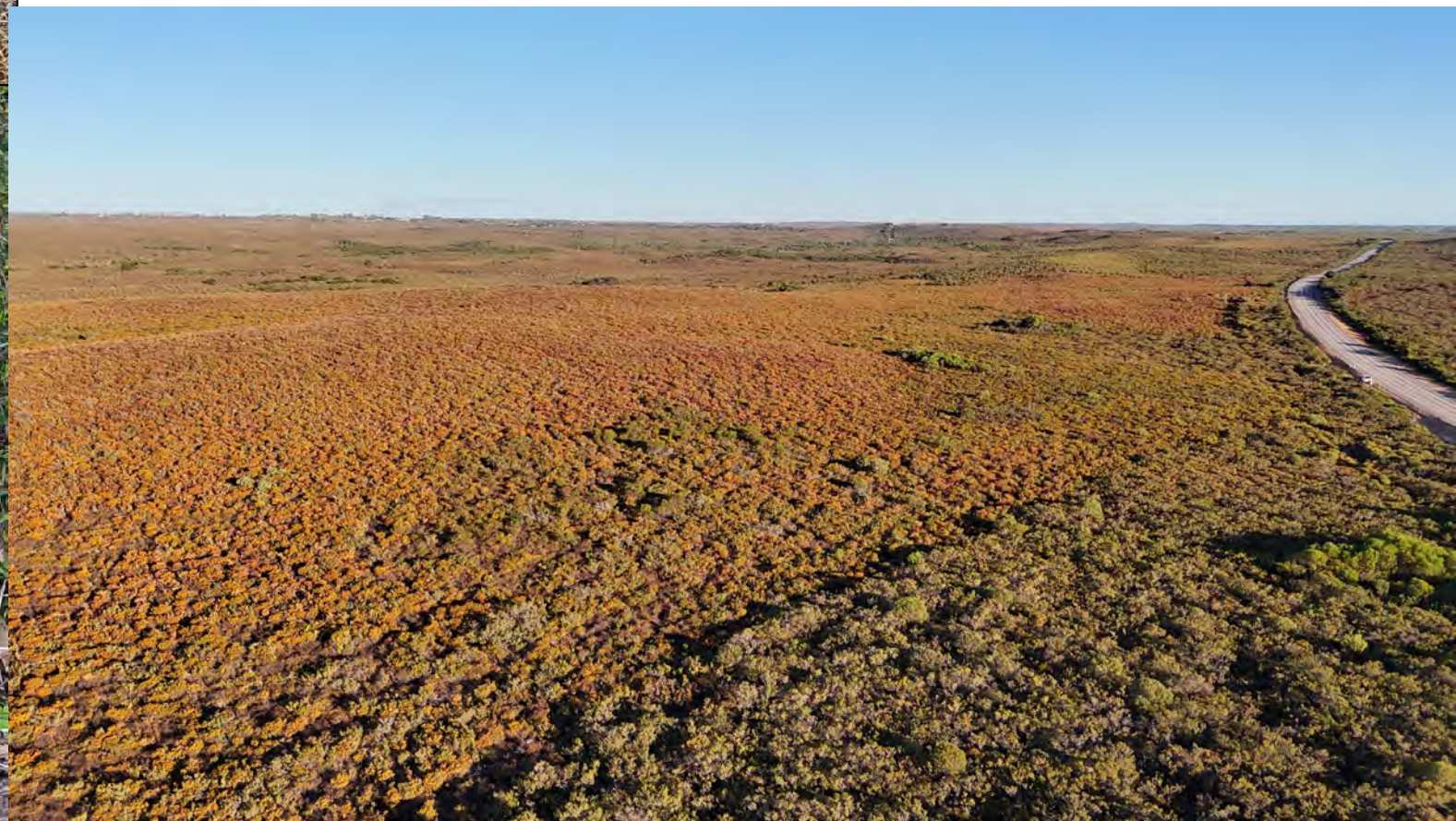
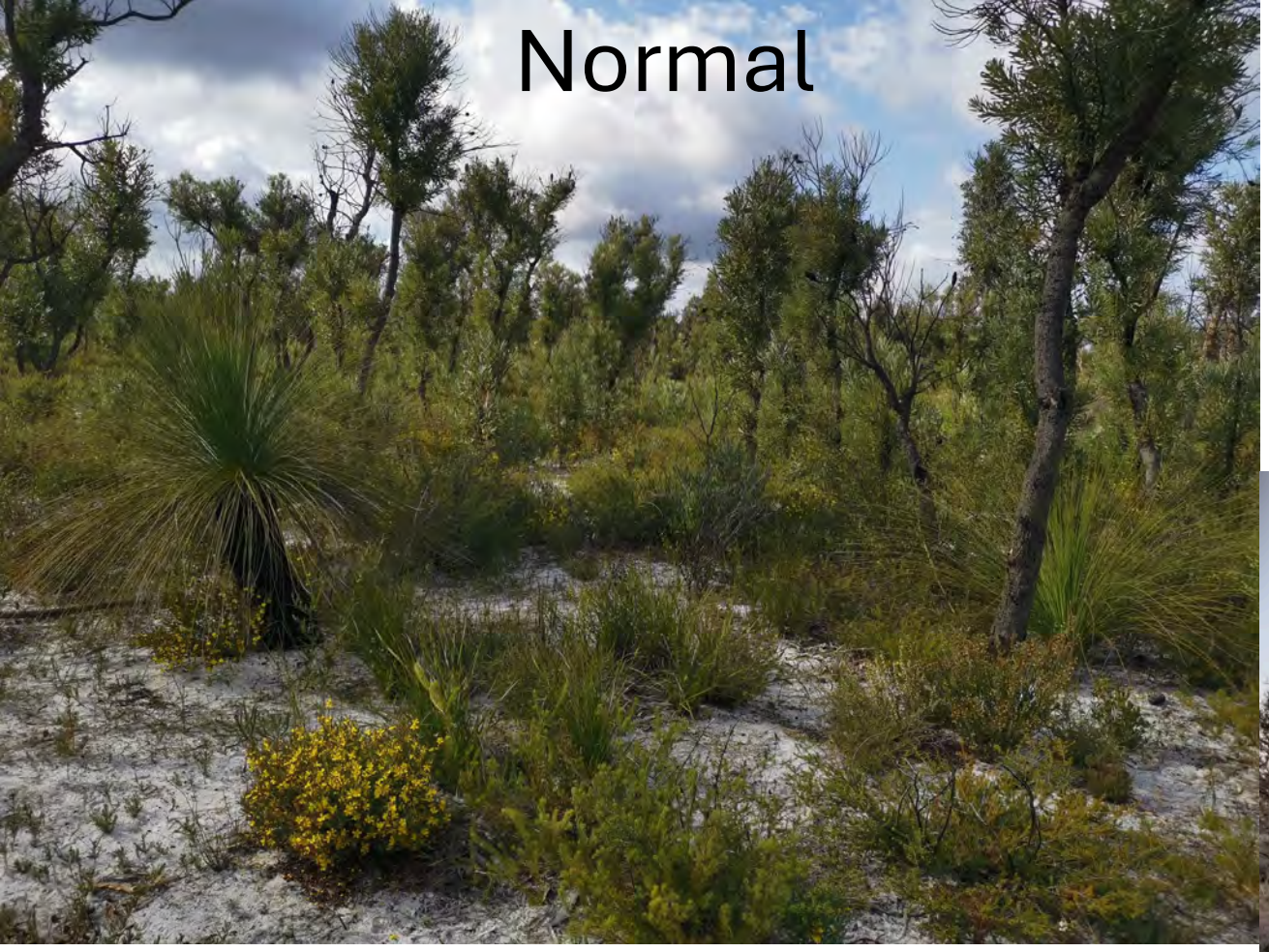
Risk factors – ongoing research

Species filtering
Weeds
Site history





How long to recover???
What is ‘recovery’?


04 May 2024


17 May 2025

Germinating seeds

Ecology matters: sensitive phases after the die-off event.

How long is the phase?

Resprouting


29 Apr 2024


16 May 2025

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Themes

FIRE: Loads, structure, behaviour
CONSERVATION: Recovery time? Sensitive species
DECISIONS: Duration of impact? Burning…

Considerations over time

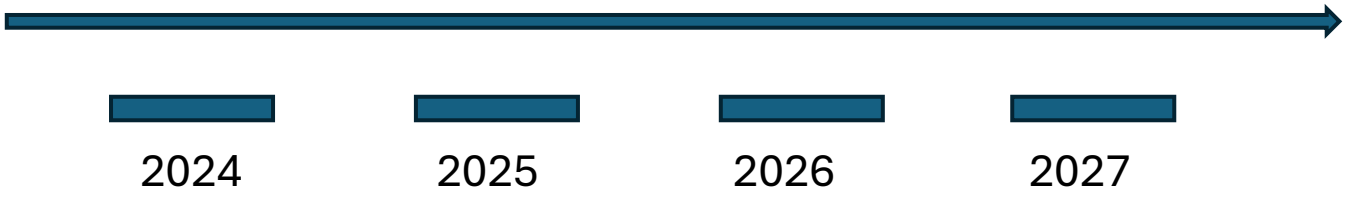
Altered fire

?

Baseline conditions

?

Altered ecological sensitivity to fire



Wrap-up

Key Points:

- Mapping close to complete
- Tracking recovery and fire effects
- Predisposing factors… groundwater, soil depth, fire,
- Conservation implications

Things we can talk about further:

- Interactions w past fire
- Interactions w weeds
- Future risk
- Forecasting --- how far ahead in the season?

Questions?