Testing tolerance: Forest health in the era of megafires

Presented by:

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Acknowledgement

- Wadawurrung
- Dja Dja Wurrung
- Gunaikurnai
- Taungurung
- Bunurong

Cultural fire on
Dja Dja Wurrung Country

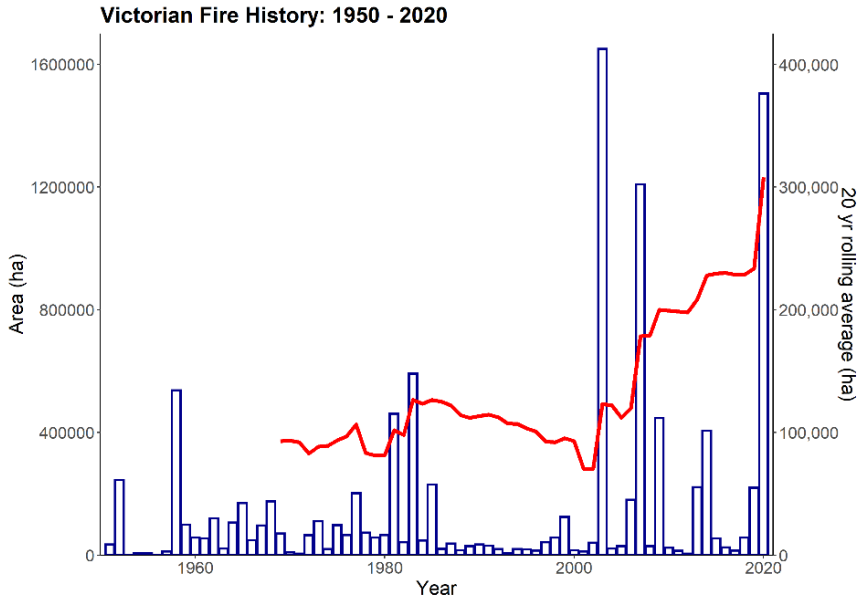
An opening caveat

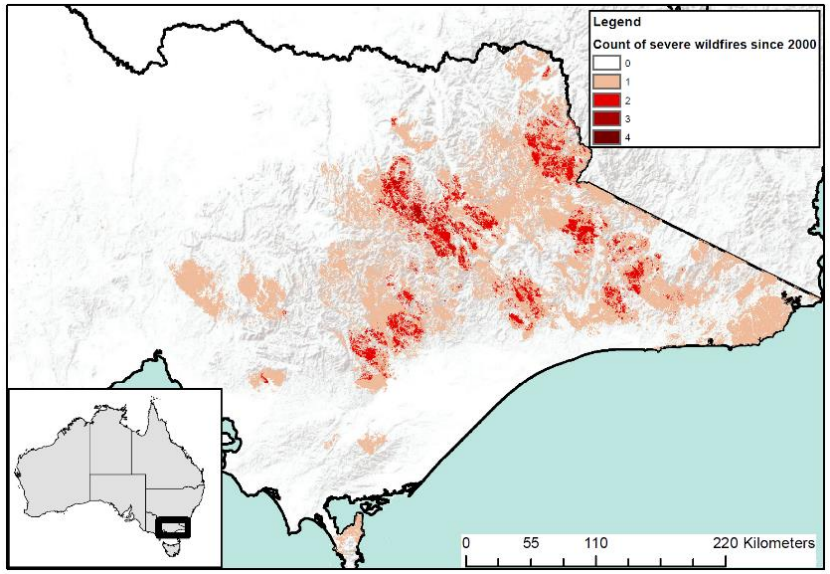
- Often our focus is on a single fire and its impacts
- Fire is not the threat; it's the regime.
- And how that fire regime is changing.

Cultural fire on
Dja Dja Wurrung Country

Setting the scene: wildfires in Victoria

- Eight large (>125,000 ha) wildfires since 2000
- 2000 – 2020: **6.2 million hectares**
- 1950 – 2000: **4.5 million hectares**
- Large severe fires have overlapped, creating 'reburns'
- As of the beginning of the 2020s:
  - one million hectares now burned twice since 2000;
  - 25% repeat high severity burns
- What happens to native forests if they burn a **few times in one decade** - rather than **one time every few decades**?





Fairman et al, 2016, International Journal of Wildland Fire
Geary et al, 2022, Diversity & Distributions

Alpine Ash forests (statewide)

Snow gum woodland

Low elevation mixed species forest

~~Wilson's Promontory forests~~

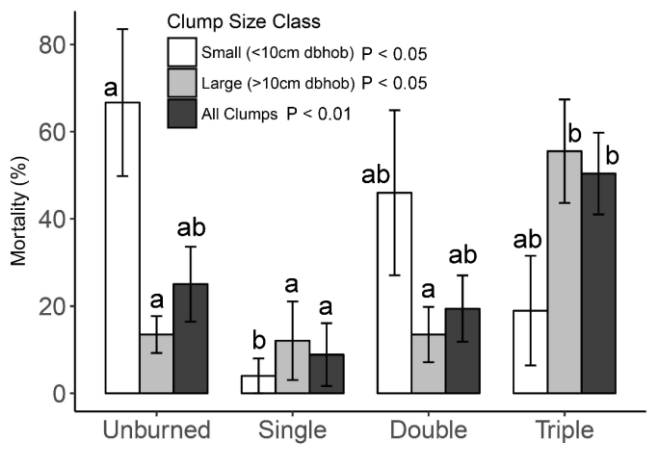
0 10 20 km

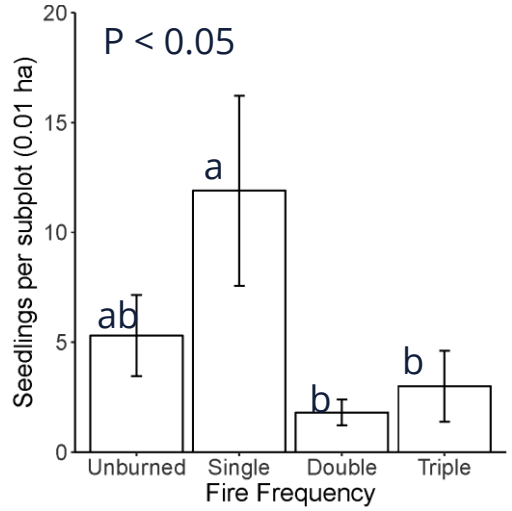

Snow gum
forests

The top of the hill: how does frequent fires effect snow gums?

Fairman et al, 2017, Journal of Vegetation Science

- Snow gums: basal resprouting the dominant response
- Assessed impact of **one** - **three high severity fires** over **10 years**
- **Increase** in **tree mortality** with more frequent fire
- Large trees particularly impacted by three fires - **50% of all individuals die;** 80% on some sites
- Regeneration: pulse after single fire, **significantly reduced after two and three fires.**
- We also detected a decline in the number of resprouts on trees that did survive





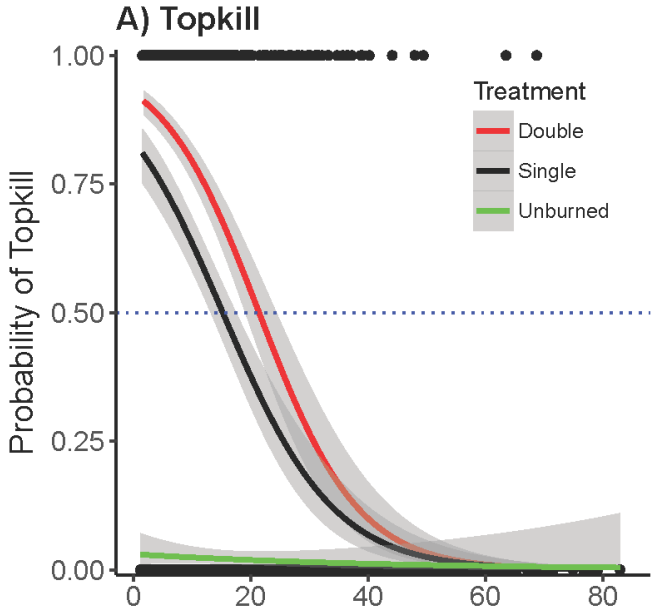
Fairman et al 2017 *Journal of Vegetation Science*
Kasel et al 2024 *Fire*

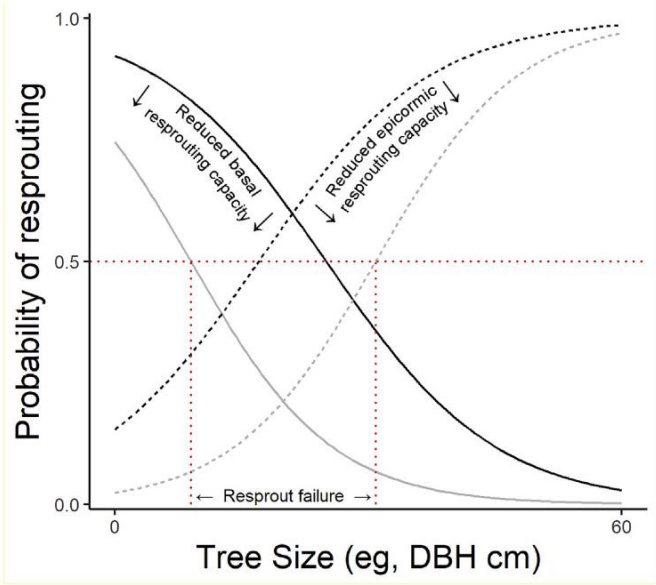
Frequent fire impacts more than just snow gums

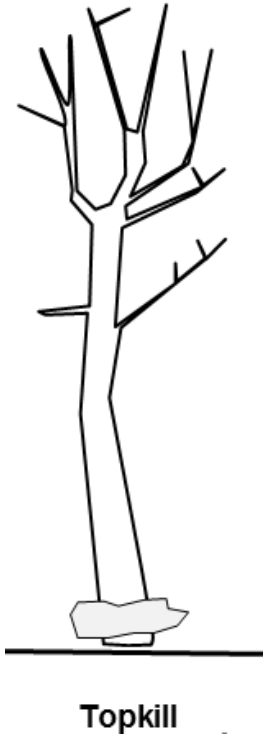
- Higher fire frequency = **decrease** in post-fire **shrub** cover, **increase** in post-fire **grass** frequency
- Shrub species composition **significantly changed** with increasing fire frequency
- Composition of **triple burn differed from single burn sites** = a shift in initial floristics post-fire.
- Very frequent severe fires decrease survival of established trees, reduced recruitment, and encourage a grass and herb dominated ecosystem
- But - the interval between fires is important in driving these impacts.

Topkill can be as consequential as tree mortality

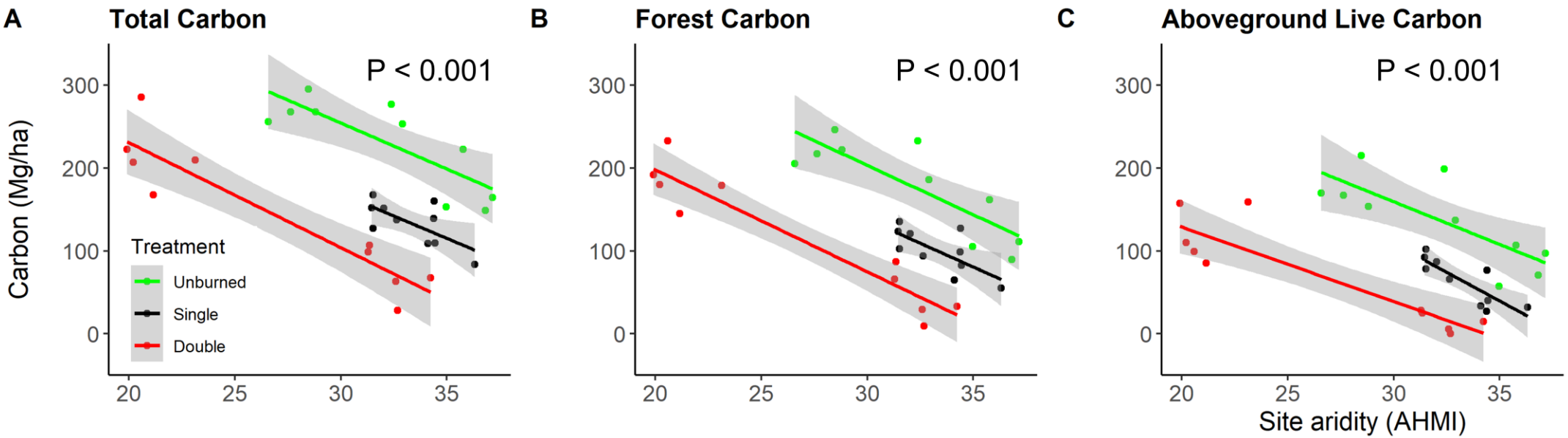
- Impacts of **one to two high severity fires over six years**
- Smaller stems more vulnerable to fire (under **15 cm diameter)**
- This appears to be an “escape size”, beyond which the stem is more likely to resist fire
- **Frequent fire complicates this**
- More frequent fire results in larger stems topkilled (**21 cm diameter)**
- **A stem that would survive one fire doesn’t survive the second**
- We also detected a lowering of resprout success and overall increase in mortality.







Fairman et al, 2019, Journal of Environmental Management



- Site aridity and fire frequency effects on carbon storage
- More frequent fire = lower carbon stocks at similar aridity
- Soil carbon significantly lower. Changes in soil structure?
- Broader impacts to forest structure

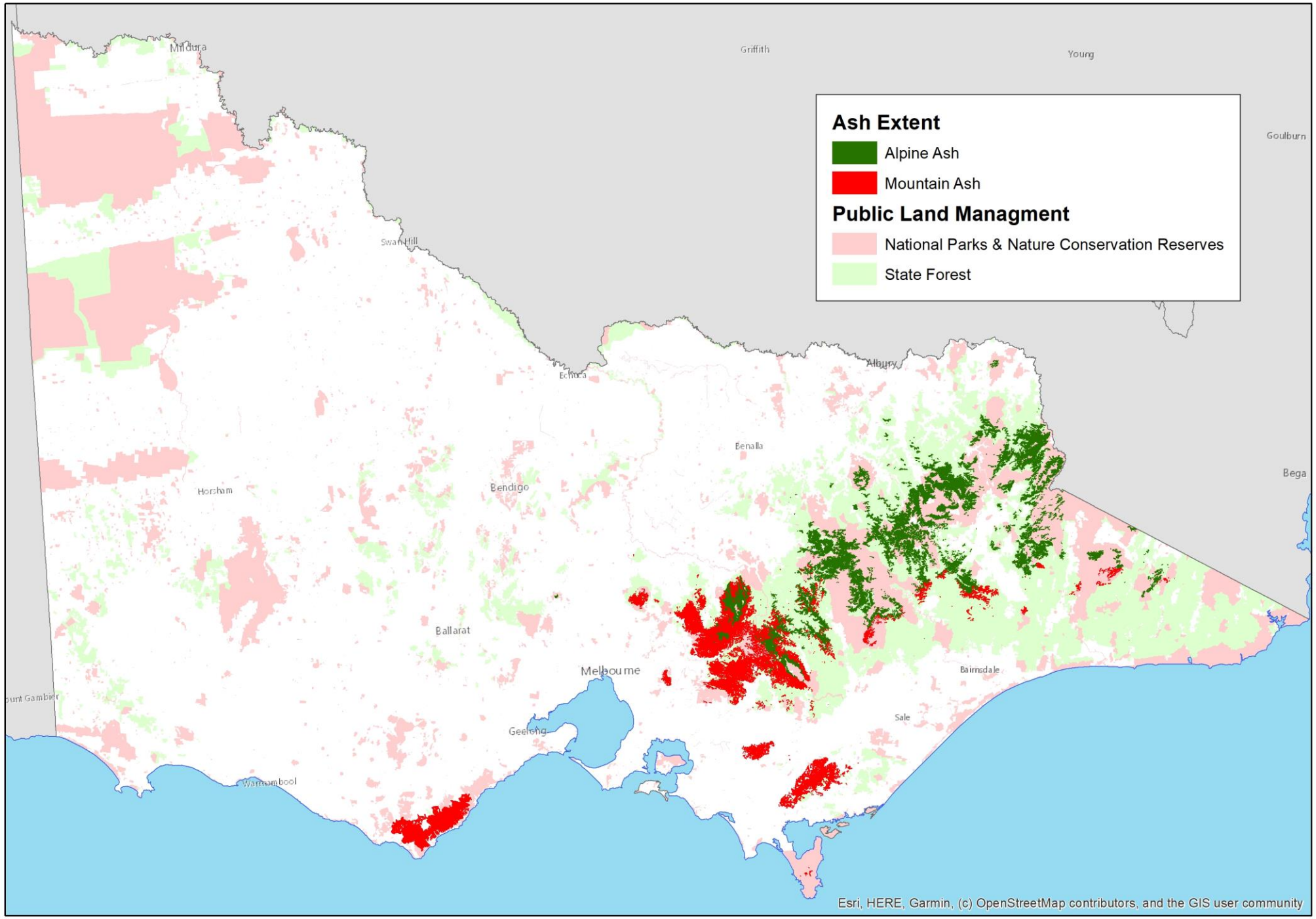
Fairman et al, 2022, Forest Ecology & Management


Unburned


One severe fire


Two severe fires


Alpine ash
forests


Ash Extent
Alpine Ash
Mountain Ash
Public Land Managment
National Parks & Nature Conservation Reserves
State Forest
Mildura
Griffith
Young
Goulburn
Swan Hill
Echuca
Albury
Benalla
Bega
Horsham
Bendigo
Ballarat
Melbourne
Bairnsdale
Sale
Geelong
Warrnambool
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

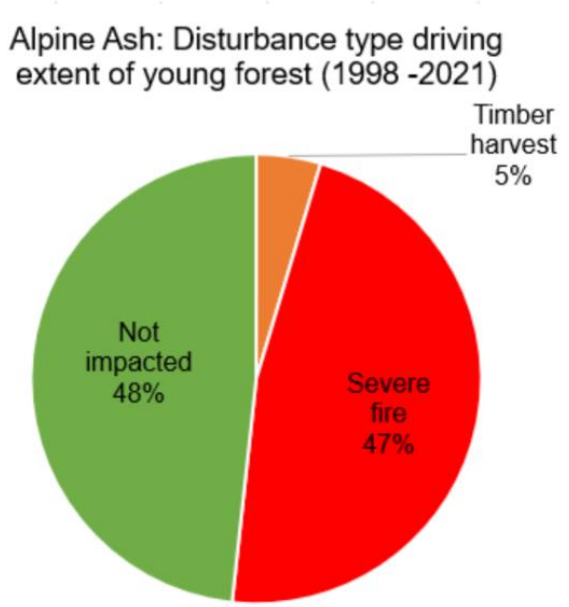
Threats to Alpine Ash forests

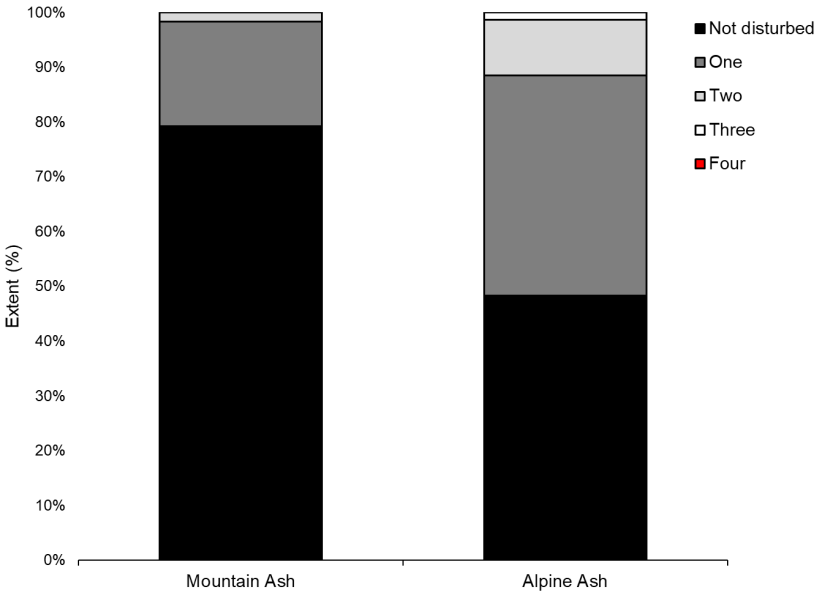
- Occur in high rainfall / productivity regions; fire generally infrequent
- Trees killed by high severity fire (thin bark; weak resprouting)
- Summer wildfires generally coincide with high canopy seed
- Post-fire seedfall generates mass regeneration
- **Regenerating trees have little reliable seed for 15 - 20 years**
- ‘immaturity risk’
- Fire return before maturity = forest cannot regenerate

Recurrently burned alpine ash on Lake Mountain circa 1975 (photo: Leon Costermans)

The reburn burden in alpine ash

- The intense fire activity of 1998 – 2020 resulted in substantial fire impact and reburn
- Cumulatively ~175,000 ha (47%) of Alpine Ash extent burned by severe fire.
- ~39,000 ha has been impacted by repeat severe fire
  - 10% of total extent of Alpine Ash.
  - 5,000 ha of *three* severe fires

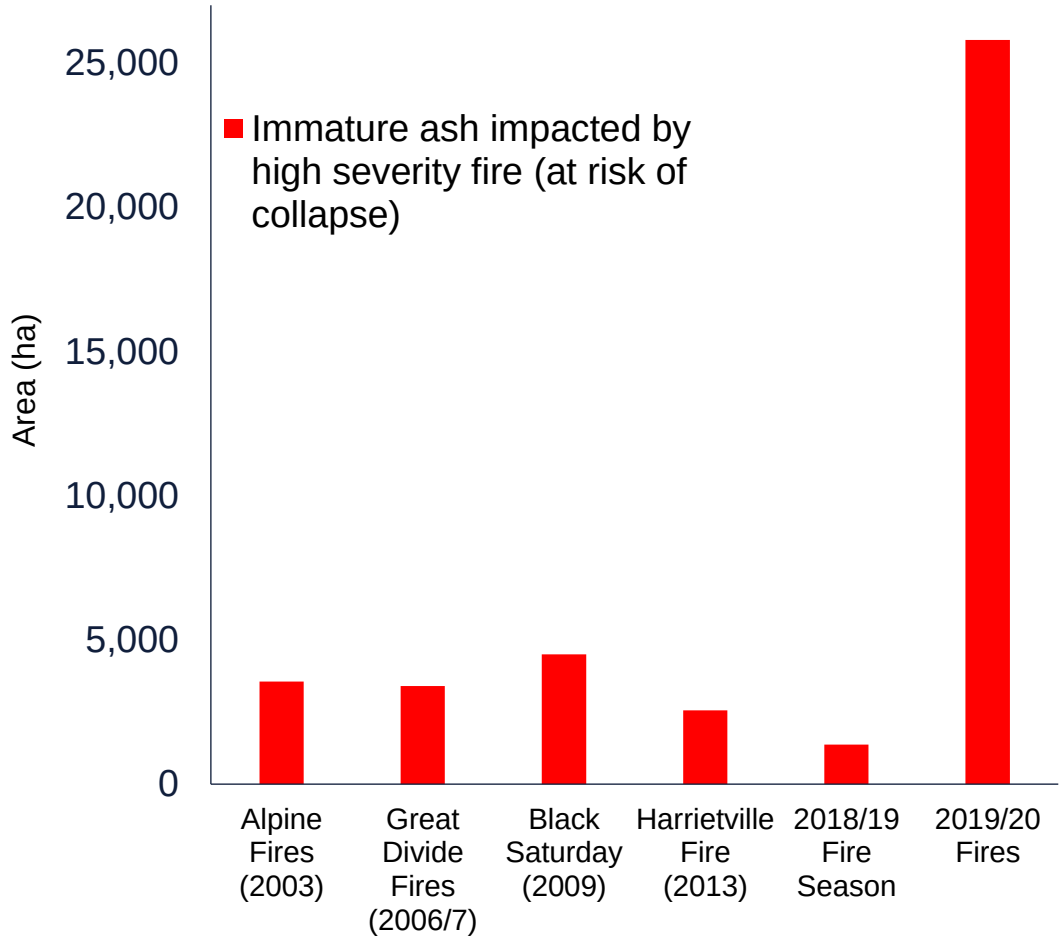




Fairman 2023, *Strategic Assessment of Ash Forest Immaturity Risk,* Report to DEECA

The reburn burden in alpine ash

- 2019/20 fire a major year for reburn.
  - 25,800 ha of young ash burned at high severity and at **high risk** of regeneration failure
  - Not the first time this has happened this century – but the scale is unprecedented.
- Major forest restoration program undertaken by Vic Govt
- Arrested the loss of ~11,500 ha

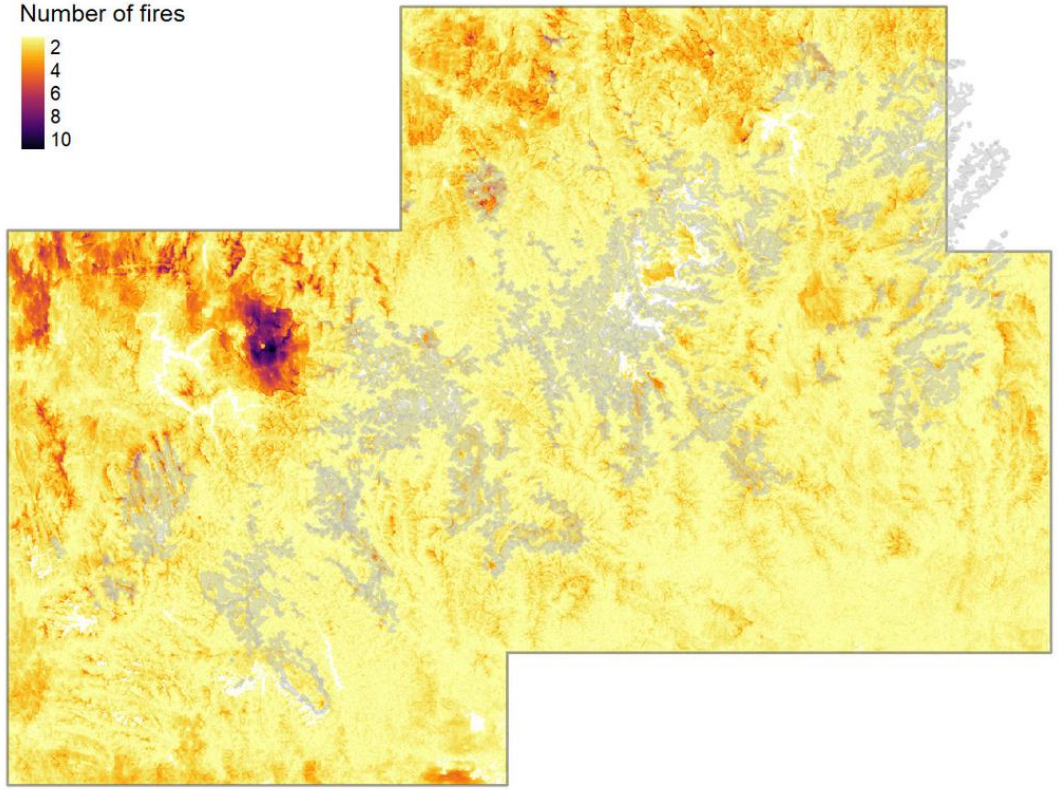


Owen Bassett – many reports!

Future risks to alpine ash

Long term (100 year) risks from fire / climate modelling

- Annual area burnt, high-intensity fire area and prevalence of short-interval fires will all increase for alpine ash
- 67% of range predicted to be at some level of immaturity risk
- Highest risk:
  - patches on the periphery of the distribution
  - closer to roads, or
  - near drier landscapes at lower elevations.

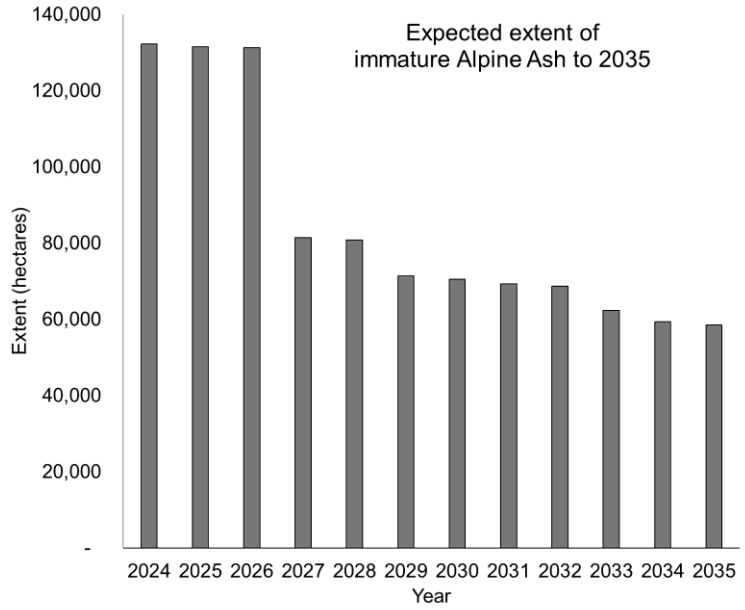


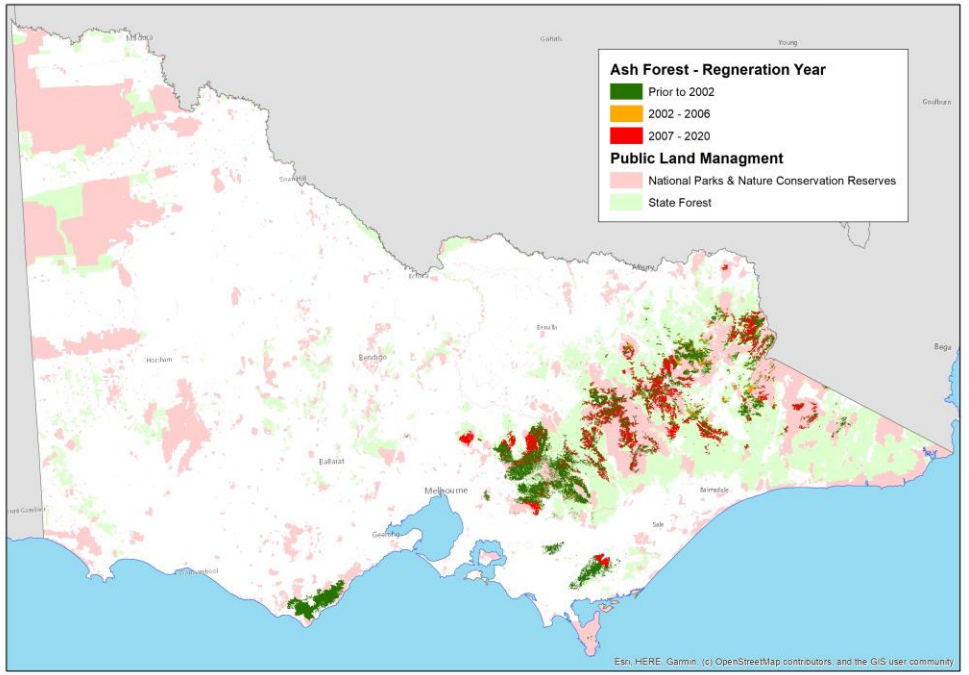
McColl-Gausden et al 2020 *Diversity and Distributions*

Future risks to alpine ash

Short-term (10 year) risks from current forest structure

- Assuming 20-year immaturity
  - 130,000 ha of immature alpine ash currently in the landscape;
  - In 2035: 54,000 ha immature alpine ash forest
- Precocious flowering may mitigate some of these risks
- Alpine ash immaturity is a **current** and **ongoing** risk for the next decade





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Take home messages

- Victoria is a experimental landscape in extensive, severe and frequent fires
- Scale and extent impacting a range of forest ecosystems
- There is still much to learn
- The big questions
  - How do we manage the landscape to reduce risks?
  - How do we manage landscapes of the future?
  - How do we expect our future landscapes to look?
  - When do we intervene, when do we walk away?
  - Should I have been a social scientist?

The Resist-Accept-Direct framework – USGS / USNPS

FLARE WILDFIRE RESEARCH

THE UNIVERSITY OF MELBOURNE

Thank you for listening

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Special thanks