

Can earlier commercial and research thinning trials guide ecological thinning?

Michael Ryan

Senior Forest Ecologist

Department of Energy, Environment and Climate Action

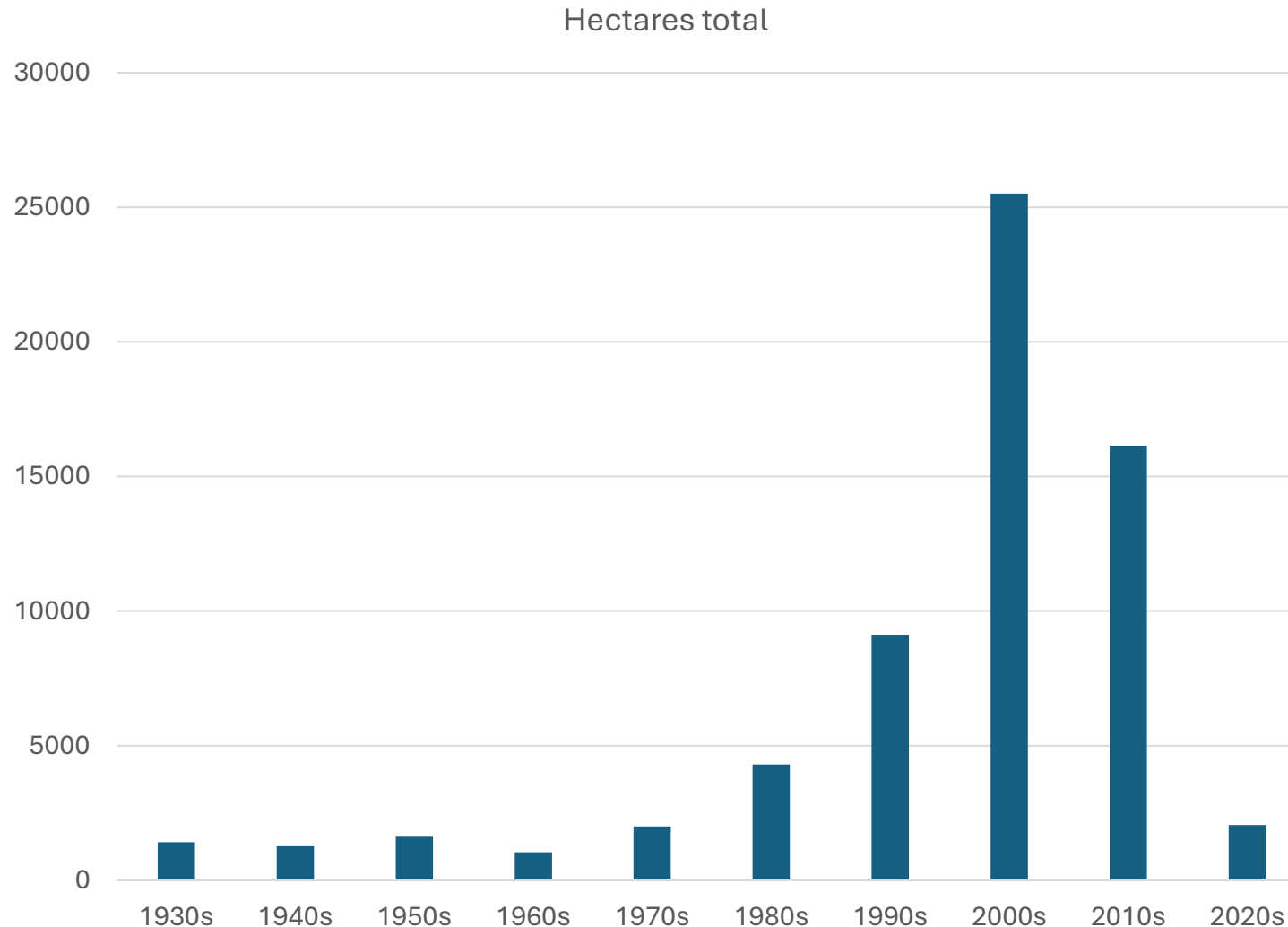
Presentation Outline

- A (short) history of thinning
 - Why – to concentrate growth on desired stems
 - Where
 - When
 - What Forest Types
- Ecological
 - Carbon
 - Water
 - Fire
 - Fauna
- Research trials and Growth plots
- Can earlier thinning work guide Ecological Thinning
 - Forest structures where we could first look
 - Desirable forest structures/attributes



A history of thinning – Which decade?

However Perrin Supervised thinning of regrowth stands in 1891, using labourers and licensees to produce mine props and firewood.⁷ By 1917, upwards of 8000 ha of Box-Ironbark and River Red Gum regrowth forests had been treated by thinning.



Area of forest thinning by decade (source: LASTLOG/SILVSYS)
– pre-1930s there are sketchy records

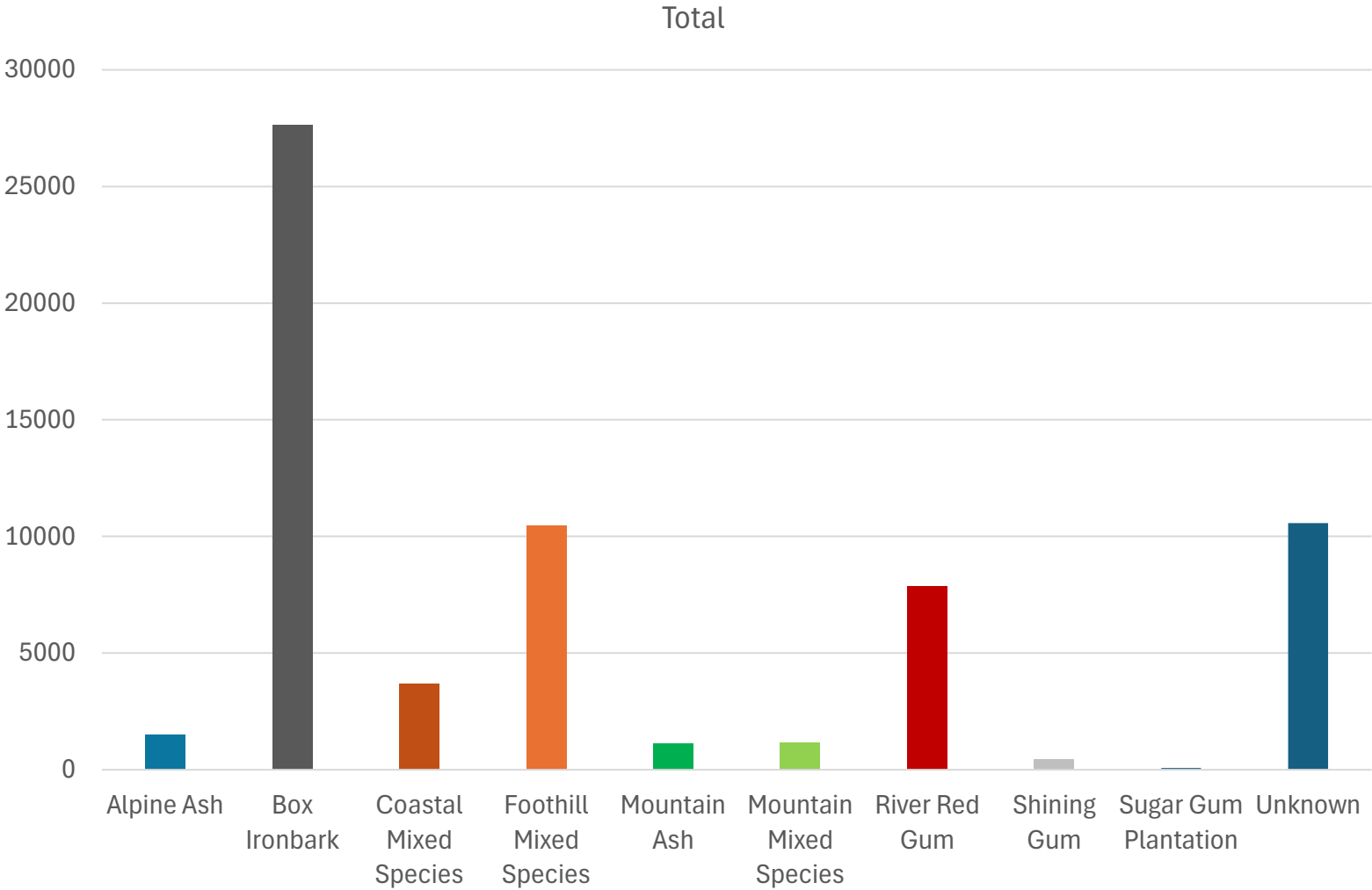
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Photo from the Box Ironbark
Silviculture Reference
Manual by Peter Fagg and
Owen Bassett 2014



Figure 6. Thinning of Box-Ironbark in Wellsford State Forest during 1914, showing the results 10 years later in 1924.

A history of thinning – Which Forest types?

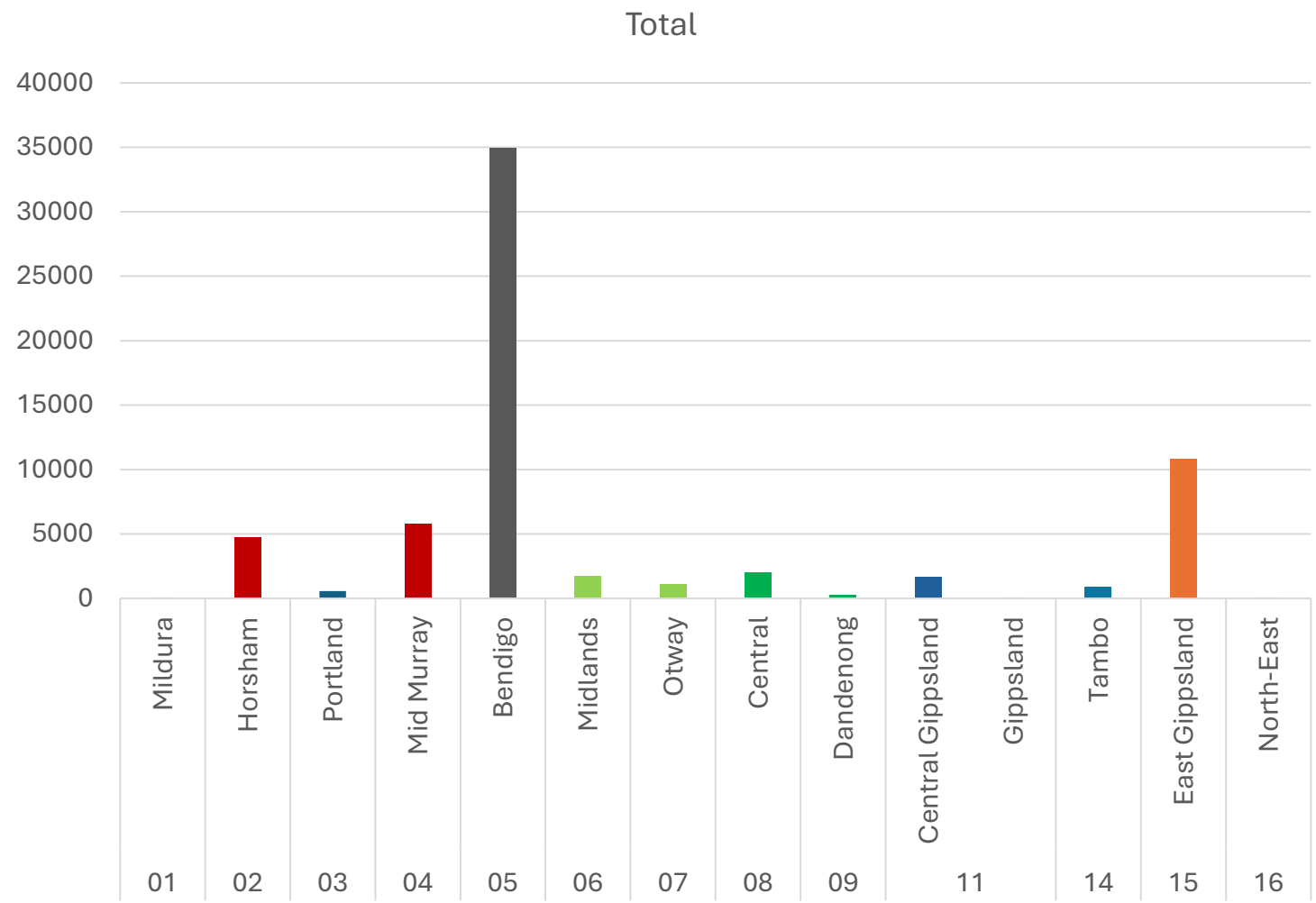


Forest type (grouped) by area: LASTLOG/SILVSYS/EucGroup)



Thinned Box Ironbark forests Bendigo FMA
(photo M. Ryan)

A history of thinning – Where?

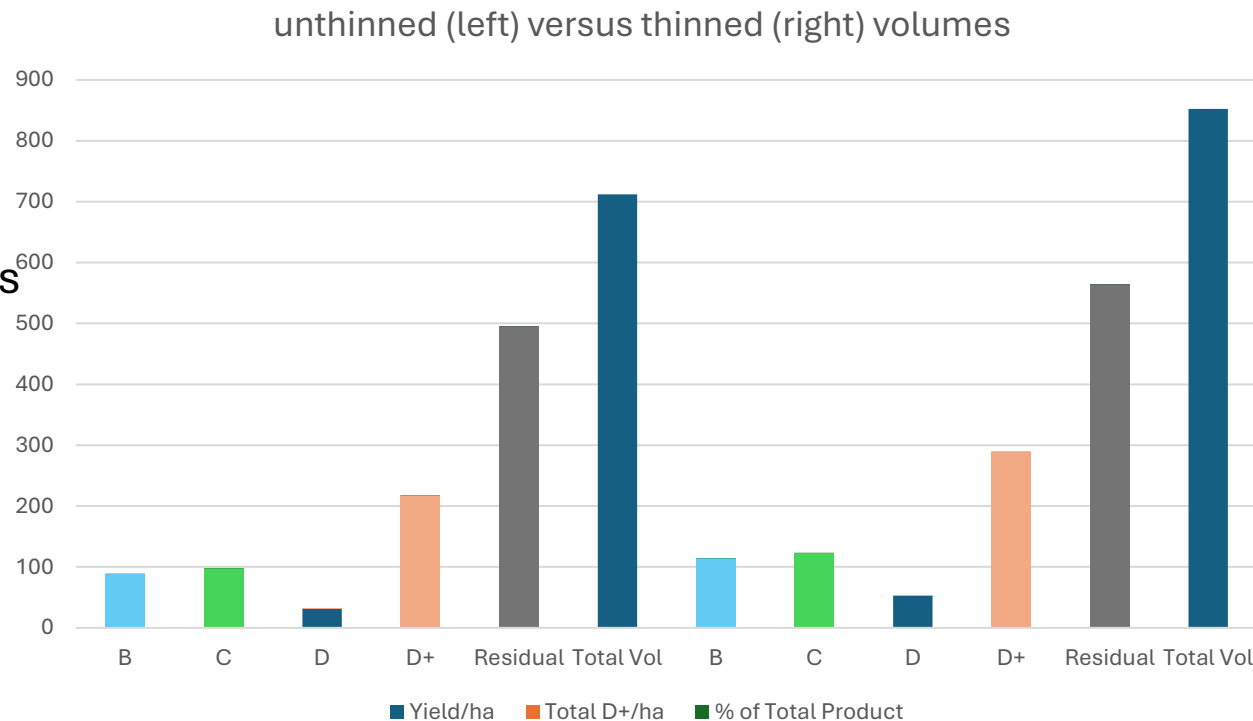


Forest type (grouped) by area: LASTLOG/SILVSYS/District)

Thinning implications for Timber/Carbon?

Why consider Timber and Carbon together?

- Standing carbon remains the same until there is a harvesting event.
- Once there is a harvesting event standing carbon reduces so where the products go is crucial for carbon balances.
- How quickly does carbon re-accumulate.
- What are the products used for ?
- Why were so many previously uniform thinned sites carrying more above ground carbon?



Comparison relates to completed coupes in Toolangi Forest District 1999/2000 - 2003/04

Area of unthinned coupes = 240 ha

Area of thinned coupes = 158 ha

Forest type (grouped) by area: LASTLOG/SILVSYS/District)

Standing timber / stored carbon?



Left: Uniform 1939 regrowth Mountain Ash which if thinned would initially lower the above ground carbon.

Right: Murtoa Stick Shed built in 1942 for grain storage using ash poles (photo M. Ryan)

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Longevity of harvested products?



Power poles are a long lasting store of carbon.



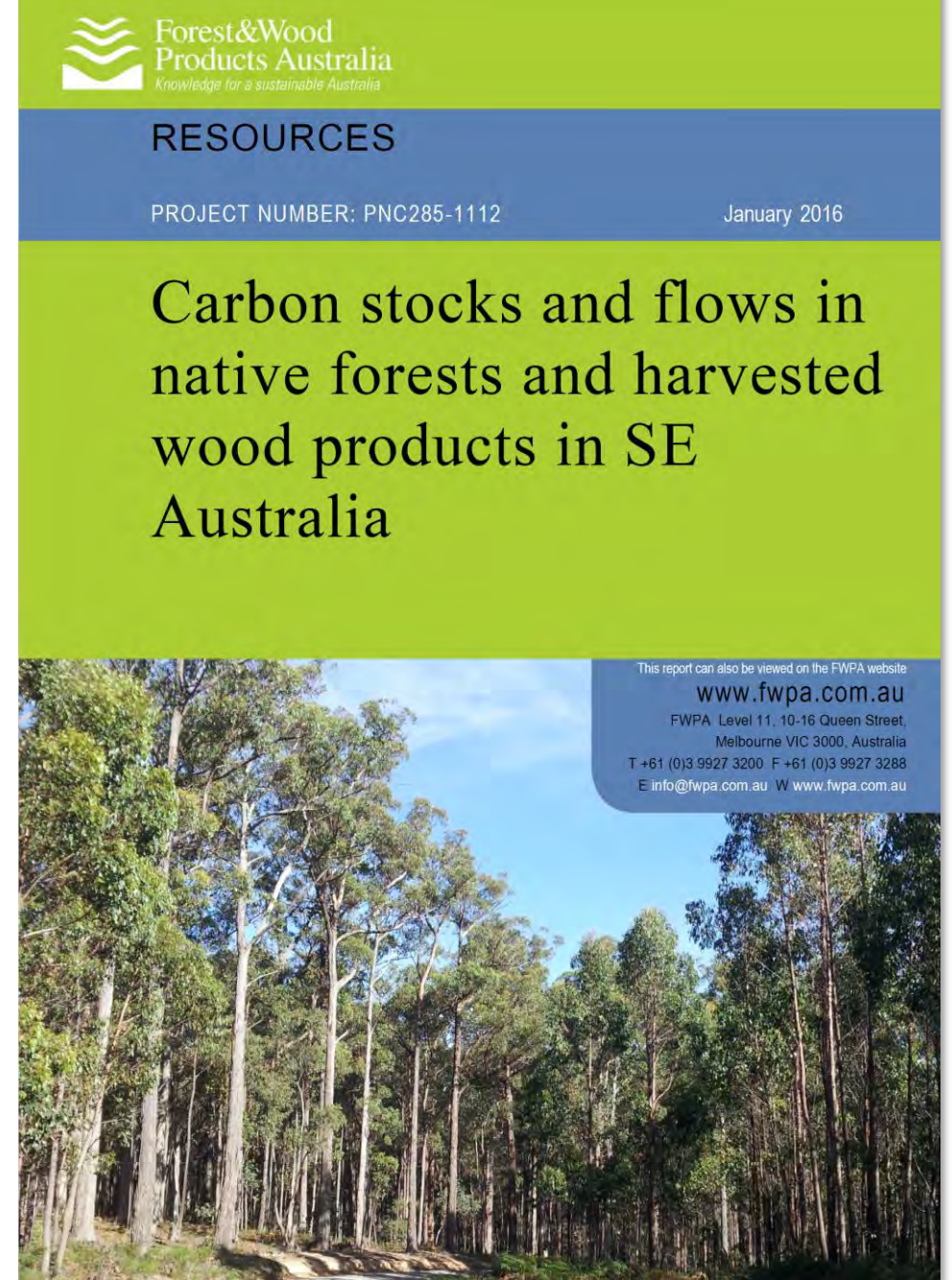
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Identification TAG on power pole (Messmate from 1964 batch 78)

Relevant research



Melbourne Uni Simon Murphy and NSW DPI Fabiano Ximenes (photo: M F. Ryan)



Relevant research – direct weighing of above ground carbon



Mountain Ash commercial log = 1107m³/ha
Mountain Ash Toolangi Average = 814m³/ha

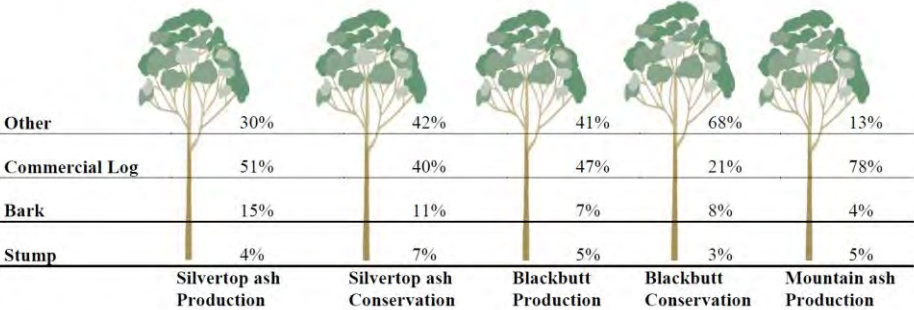
Why the difference?
How do we improve the Carbon outcomes?

Leaf and branch biomass weighing – Toolangi photo: M F. Ryan



Weighing sawlog components – Toolangi photo: M F. Ryan

Figure 1. Proportion of the biomass allocated to harvest components for the key species from the different case study sites



Thinning to increase water runoff

 DEECA Gippsland · Follow
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As Victoria's population grows, so does our demand for water 📈💧

Within the next decade, Melbourne, Geelong and parts of Gippsland are set to collectively need an extra 95 billion litres of water each year.

At the same time, our climate is becoming hotter and drier – with less rain falling into our water storages.

That's why we're exploring future options to meet water demand, that don't rely on rainfall 📌

A range of potential solutions are being investigated. No decisions having been made at this stage.

Read more here: <https://bit.ly/4gNc5EA>



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Large areas of post fire regrowth reduces runoff

Wallaby Creek
former old-growth
Mountain Ash
April 2009

Photo: M. F. Ryan



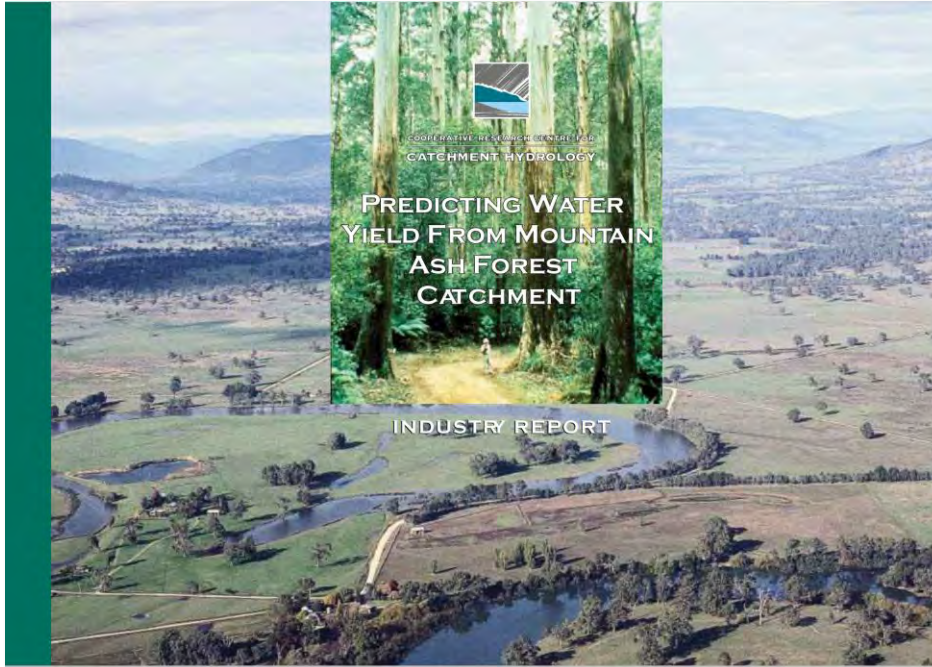
Sunday Creek Reservoir photo 2009: M. F. Ryan

Wallaby Creek
11 year old
regrowth and
dead stags
2021

Photo: M. F. Ryan
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The relevant research



PREDICTING WATER YIELD FROM MOUNTAIN ASH FOREST CATCHMENTS

by

Robert Vertessy, Fred Watson, Sharon O'Sullivan,
Sharon Davis, Richard Campbell,
Richard Benyon and Shane Haydon



COOPERATIVE RESEARCH CENTRE FOR
CATCHMENT HYDROLOGY

Industry Report
Report 98/4
April 1998

Typical flow gauging structure used in catchment treatment experiments.

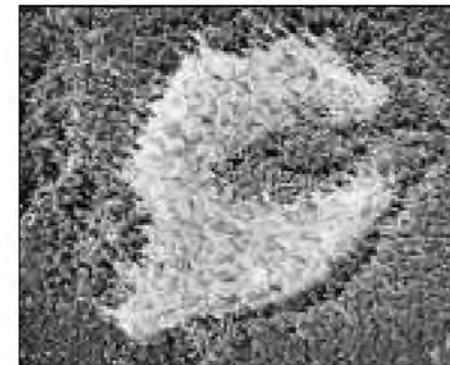


Above: Removal of a mature mountain ash tree from a logging coupe.



Right: Strip thinning experiment conducted by Melbourne Water and DNRE at the Crotty Creek catchment.

Below: Old growth clearfelling experiment, Myrtle-2 catchment, Yarra Ranges National Park.



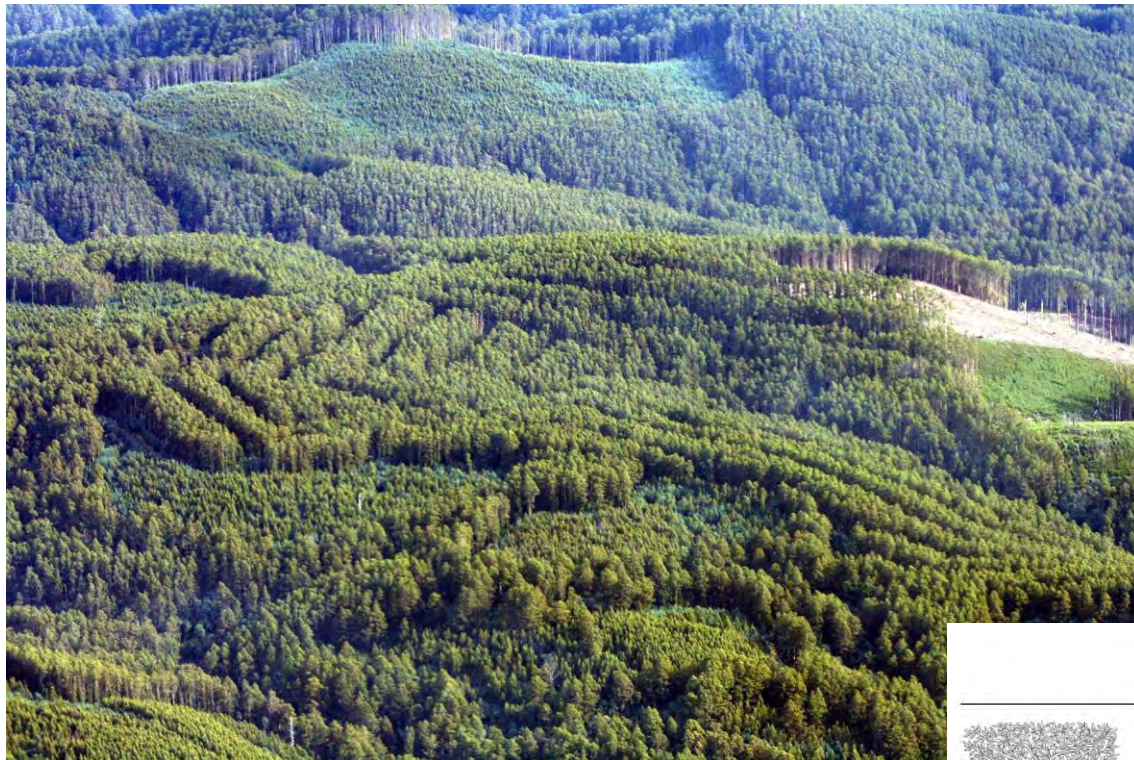
Different thinning experiments performed by Melbourne Water in the Black Spur group of catchments, Yarra Ranges National Park.

The research sites – Crotty Creek



Stereo pairs Aerial photos
1989 – Toolangi DEECA
office photo: M. F. Ryan

The research sites – Crotty Creek



Crotty Creek thinning trial photo 2008: M. F. Ryan



The long term effects of thinning treatments on vegetation structure and water yield

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^bCSIRO Land and Water, Clayton, VIC 3168, Australia

Thinning to increase water runoff

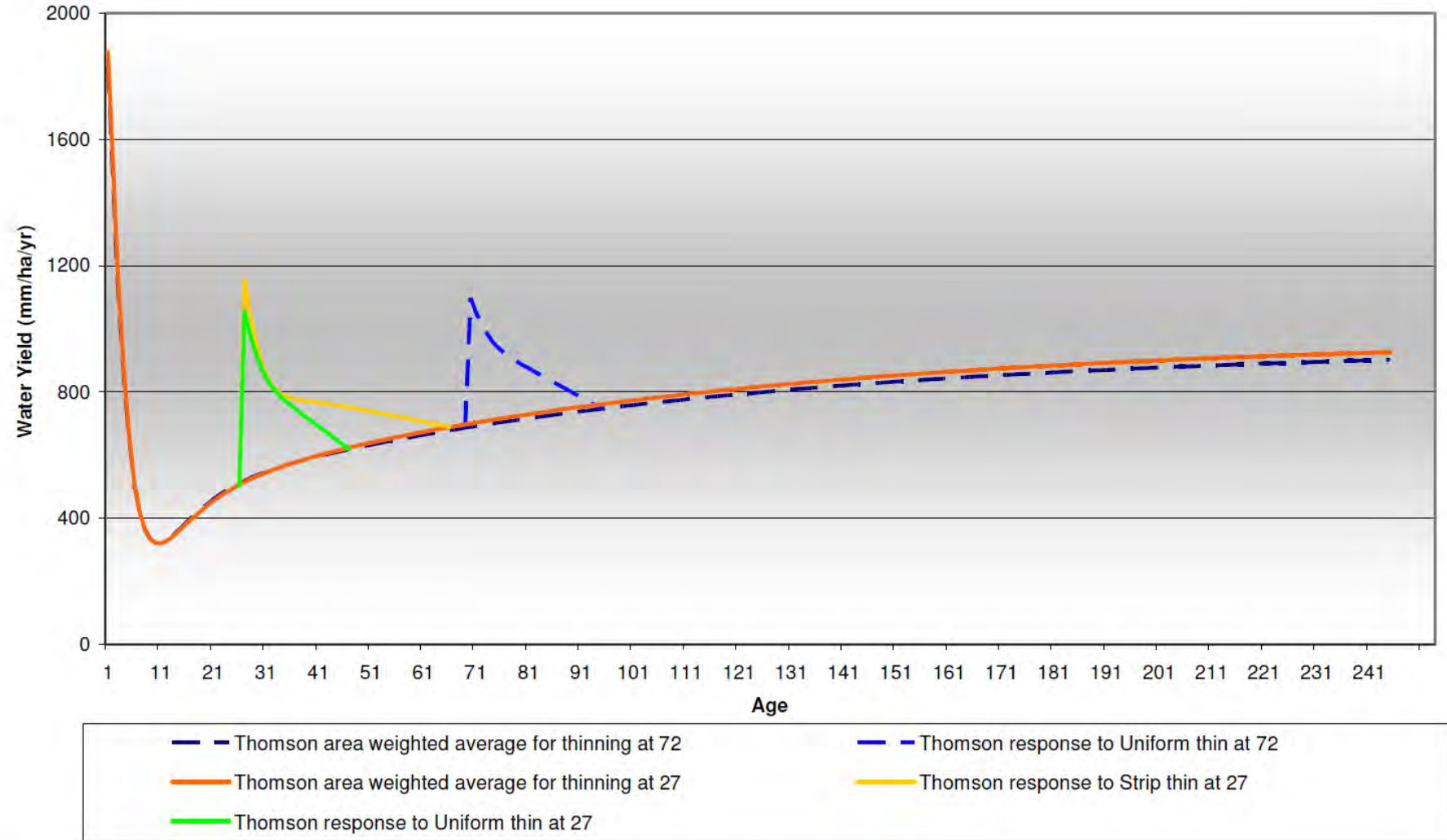


Figure 46: Thomson catchment area weighted averages for water yield on thinning sites and modelled responses for strip and uniform thinning at age 27 and uniform thinning at age 72.

Thinning for wildfire mitigation

Forest Ecology and Management 405 (2017) 92–100



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journal homepage: www.elsevier.com/locate/foreco



Impact of mechanical thinning on forest carbon, fuel hazard and simulated fire behaviour in *Eucalyptus delegatensis* forest of south-eastern Australia



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Australian Forestry



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Changes in fuel hazard following thinning operations in mixed-species forests in East Gippsland, Victoria

Emma Proctor & Greg McCarthy

To cite this article: Emma Proctor & Greg McCarthy (2015) Changes in fuel hazard following thinning operations in mixed-species forests in East Gippsland, Victoria, Australian Forestry, 78:4, 195–206, DOI: [10.1080/00049158.2015.1079289](https://doi.org/10.1080/00049158.2015.1079289)

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LETTER

Conservation Letters
A Journal of the Society for Conservation Biology

WILEY

Does forest thinning reduce fire severity in Australian eucalypt forests?

Chris Taylor | Wade Blanchard | David B. Lindenmayer

Current Opinion in Environmental Science & Health

Volume 23, October 2021, 100280

Potential for forest thinning to reduce risk and increase resilience to wildfire in Australian temperate *Eucalyptus* forests

Rodney J. Keenan¹, Christopher J. Weston², Liubov Volkova² ✉

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<https://doi.org/10.1016/j.coesh.2021.100280>

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Highlights

- Thinning can be beneficial for forest resilience.
- Thinning and burning are effective in reducing fuel loads and fire hazard.
- There is limited evidence about effectiveness of thinning for southern Australia.

Volkova et al 2017

- reduction in fuel hazard in thinned alpine ash forests
- modelled lower rates of fire spread
- reduced bark fuels
- slash fuels compressed in harvest
- Sites being re-assessed by UoM PhD student



Matlock 1939 Alpine Ash unthinned 2006 photo 2006: M. F. Ryan



Matlock 1939 Alpine Ash thinned 2006 photo 2006: M. F. Ryan

Proctor and McCarthy 2015

- East Gippsland lower overall hazard in thinned forests
- However an increased residence time
- And more difficulty in blacking out
- 1-2 severity classes lower in thinned forests
- effect up to 15 years



Figure 19. Fire control crew doing complete extinguishment of CWD (blacking out—increased amounts of CWD in thinned areas would contribute substantially to the difficulty of complete extinguishment)

Key figures in Proctor and McCarthy 2015



Figure 21. Unthinned area adjacent to thinned area in Figure 18 at Myrgatroyd Track Fire 16 December 2009: fire severity is full crown burn. There had been a substantial increase in fire severity compared to that in the thinned area. Photo taken 29 December 2009



Figure 22. Thinned area burnt in Myrgatroyd Track Fire 16 December 2009: fire severity in thinned stand above the road is reduced to partial crown scorch (some green crowns amongst the scorched ones). Photo taken 29 December 2009. Severity has been further decreased by the discontinuity in surface fuels caused by the road

Taylor et al 2020

- Used select areas burnt in 2009 fires under extreme drought
- Showed higher severity in thinned regrowth alpine ash
- Reduced severity in thinned mixed species regrowth but increased in 1939 regrowth
- However the text legend is the other way around to the figure legend



FIGURE 4 Ash forest unthinned, thinned, and thinned followed by wildfire. Photograph (a) is of unthinned Alpine Ash Forest near our study area around Mount Baw Baw; Photograph (b) is of Alpine Ash forest on the Blue Range in our study area that was subject to thinning prior to the February 2009 wildfires; Photograph (c) is of the same Alpine Ash forest in Photograph B following the February 2009 wildfires

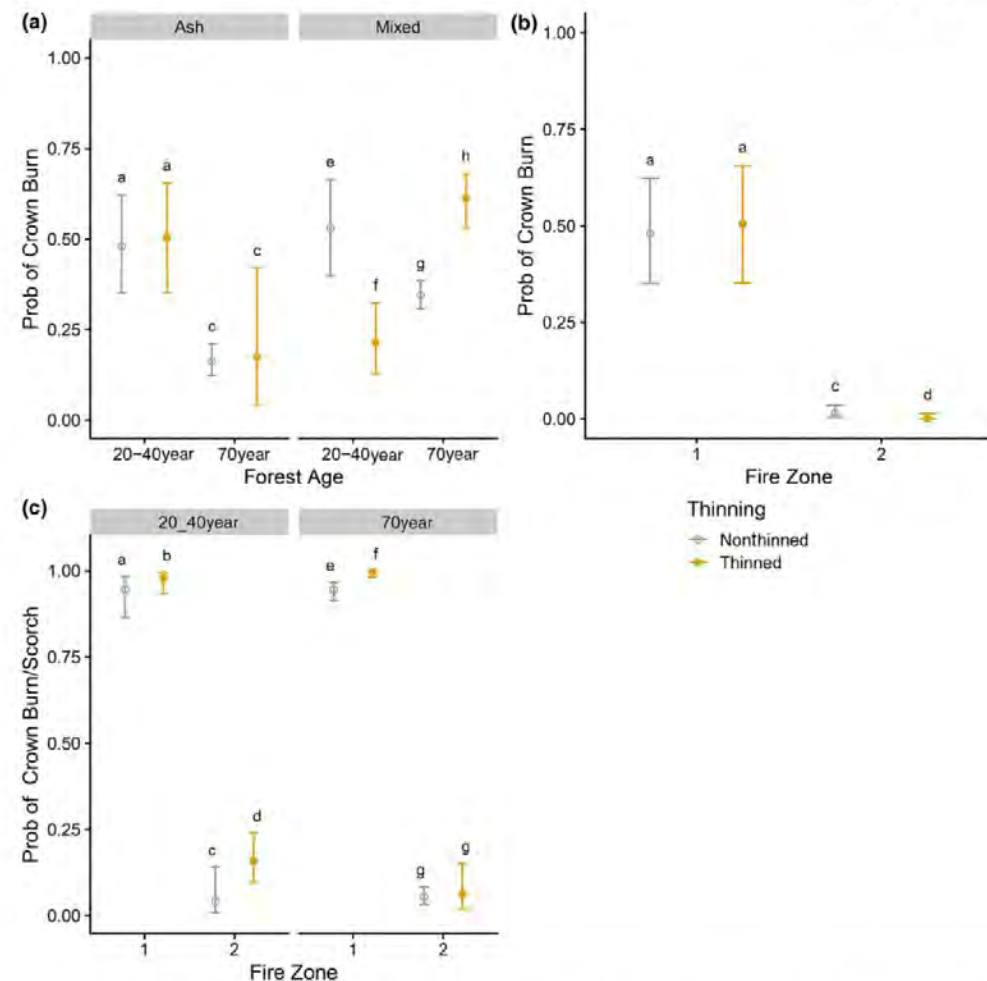


FIGURE 5 Factors that interact with thinning to influence the probability of either a Crown Burn or a Crown Burn/Crown Scorch. Thinned is shown in grey and unthinned is shown in brown. Panel a: Estimated probability of a Crown Burn showing the three-way interaction of forest type, forest age, and thinning for a zone 1 fire not facing the approaching fire. Panel b: Estimated probability of a Crown Burn showing the interaction between fire zone and thinning for 20- to 40-year-old ash forest not facing the approaching fire. Panel c: Estimated probability of Crown Burn/Crown Scorch showing the three-way interaction between forest age, fire zone, and thinning for an ash forest not facing the approaching fire. The error bars denote 95% credible intervals. Significant and marginally significant comparisons between thinned and non-thinned stands are indicated by different letters for the appropriate comparison. Where the letters for a given comparison are the same, there is no evidence of a difference. See Figures S2 and S3 for selected pairwise comparisons of the factor levels and their interactions on log odds ratio scale

Key figures in Taylor et al 2020

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Keenan et al 2023

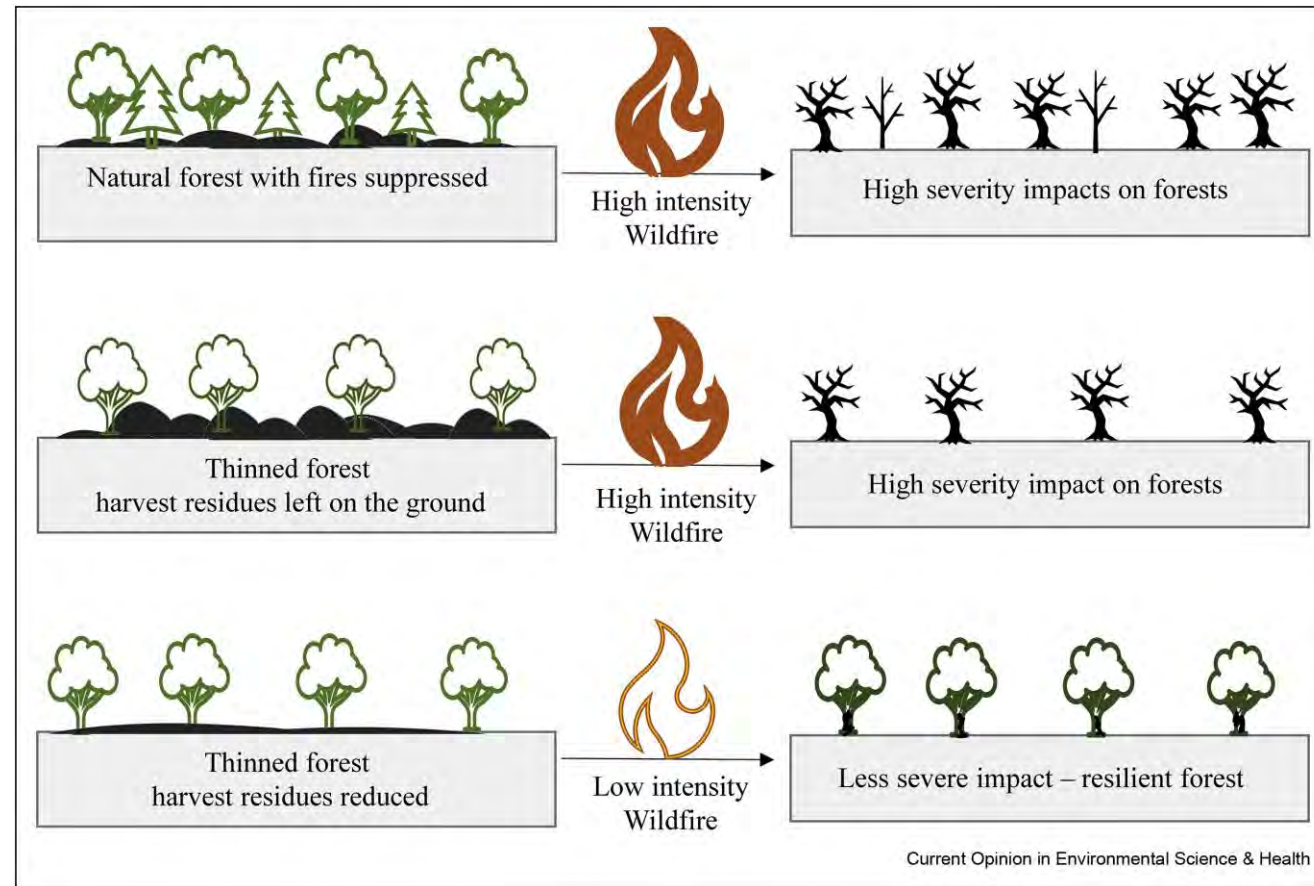
- Mechanical Fuel Load Reduction Trial
- Mixed species forest East of Cann River and in NSW
- Treatments 10 ha each of
 - Thinned
 - Thinned and burn
 - Burn only
 - Control
- Cann River Burnt in 2019/2020 fires

Limitations:

- Too little attention paid to fine fuel management

Overall Conclusions

- Manage fine fuels through removal or extraction row compaction
- Remove most of the woody fuels through high utilisation
- The benefit may be larger more resistant trees more quickly



Key figure from Keenan et al 2021

Can thinning be done for biodiversity?

- Limited information on fauna impacts
- Potential to assess former sites for impacts.

However

Thinning promotes larger trees

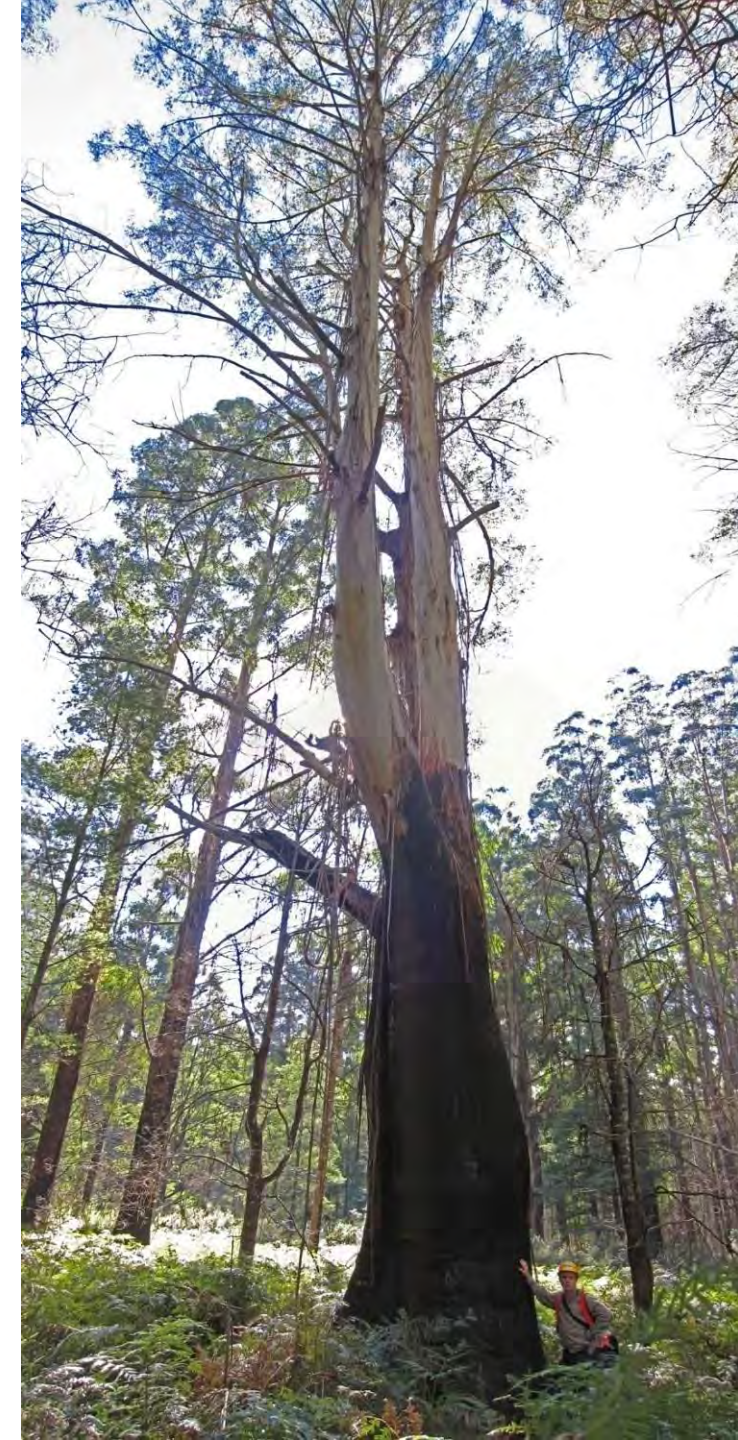
1. Thinning promotes larger trees
2. Larger trees are more resilient to fire
3. Normally takes ~120-150 years to naturally produce hollows in *E. regnans*
4. Thinning is normally done for commercial reasons and minimise damage

So can we thin for environmental reasons and encourage some damage for hollow development?

E. regnans 85m tall
1.8m dbhob from
1926 or 1905/06
origin.



E. regnans with
large branch
hollows
~2.2 m dbhob
from 1926 origin
or 1905/06



Early damage promotes hollow development



Damaged 1939 regrowth and early hollow development (Photos M. Ryan)

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Growing larger trees more quickly for habitat



Hollow bearing trees ~2m dbhob from 1851



Large regrowth ~2m dbhob from 1926

Tree ring analysis is useful for verifying ages



Large regrowth tree 240cm dbhob from fires in 1905/06 (105yrs), survived 1926 fire, 1939 fire and then site thinned in the 1950s



Large regrowth mountain ash tree stump 120cm dbhob from 1939 (71yrs)

Windblown mountain ash tree ~140cm dbhob from 1851 (159yrs)



Thinning from below, Special Management zone Research plots, Permanent Growth Plots

Toolangi and State forest

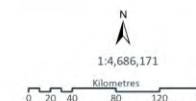


SILVSYS

- THA
- THB

Legend

- <all other values>
- PGP_VF
- RESEARCH_POLY
- <all other values>

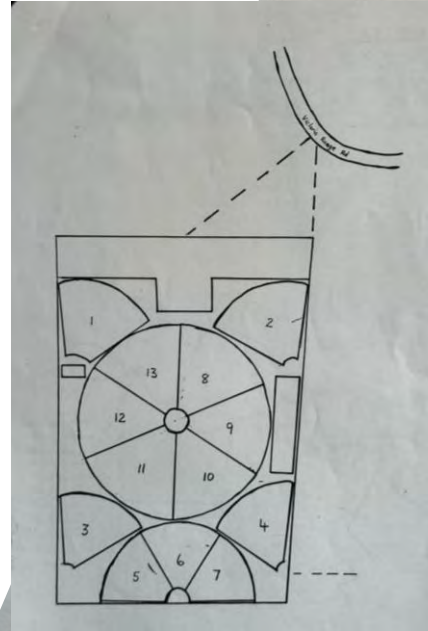
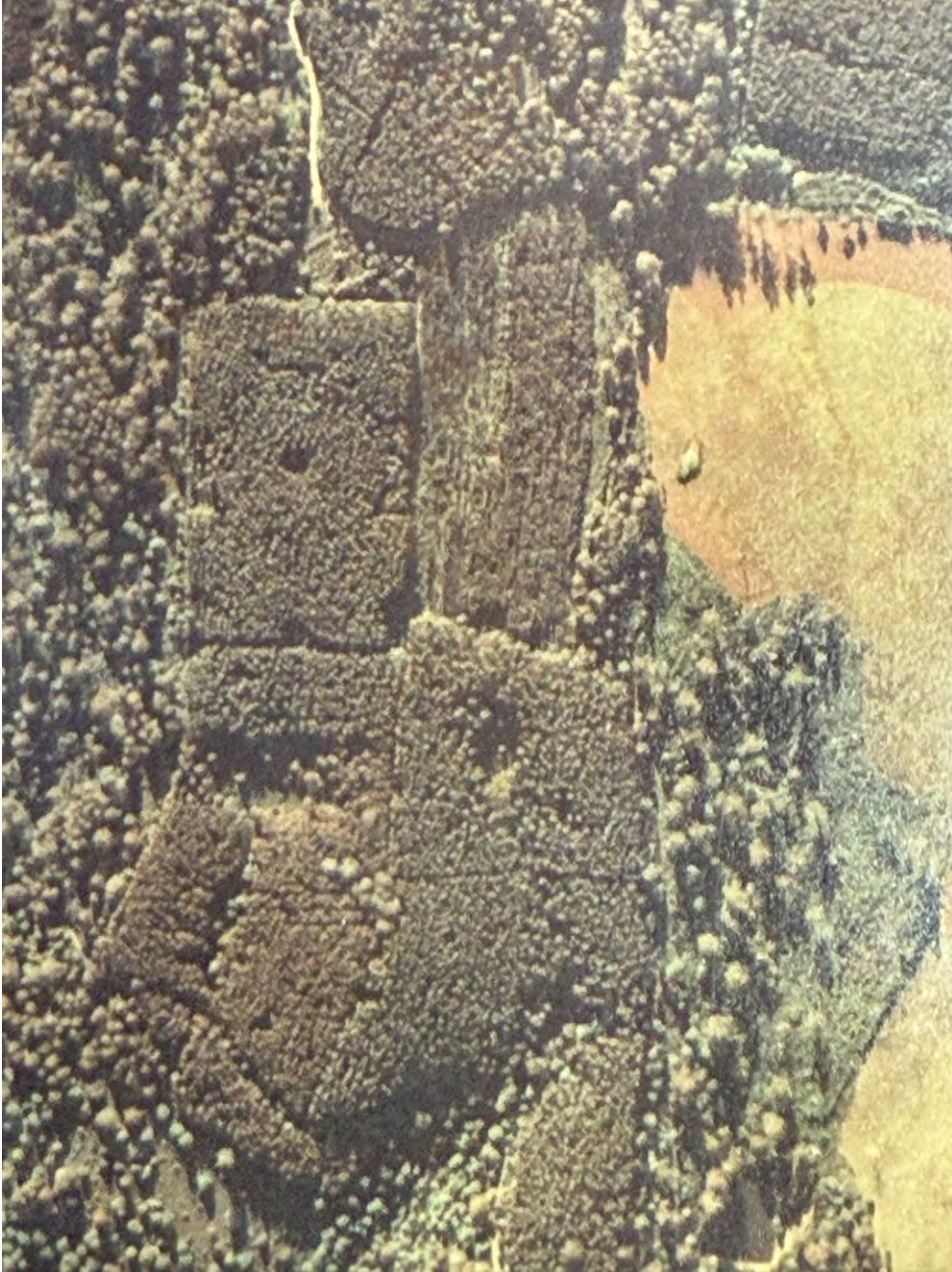


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Spatial Reference
Project Coordinate System: GDA 1994 VICGRID94
Geographic Coordinate System: GCS GDA 1994
Datum: GDA 1994
Projection: Lambert Conformal Conic

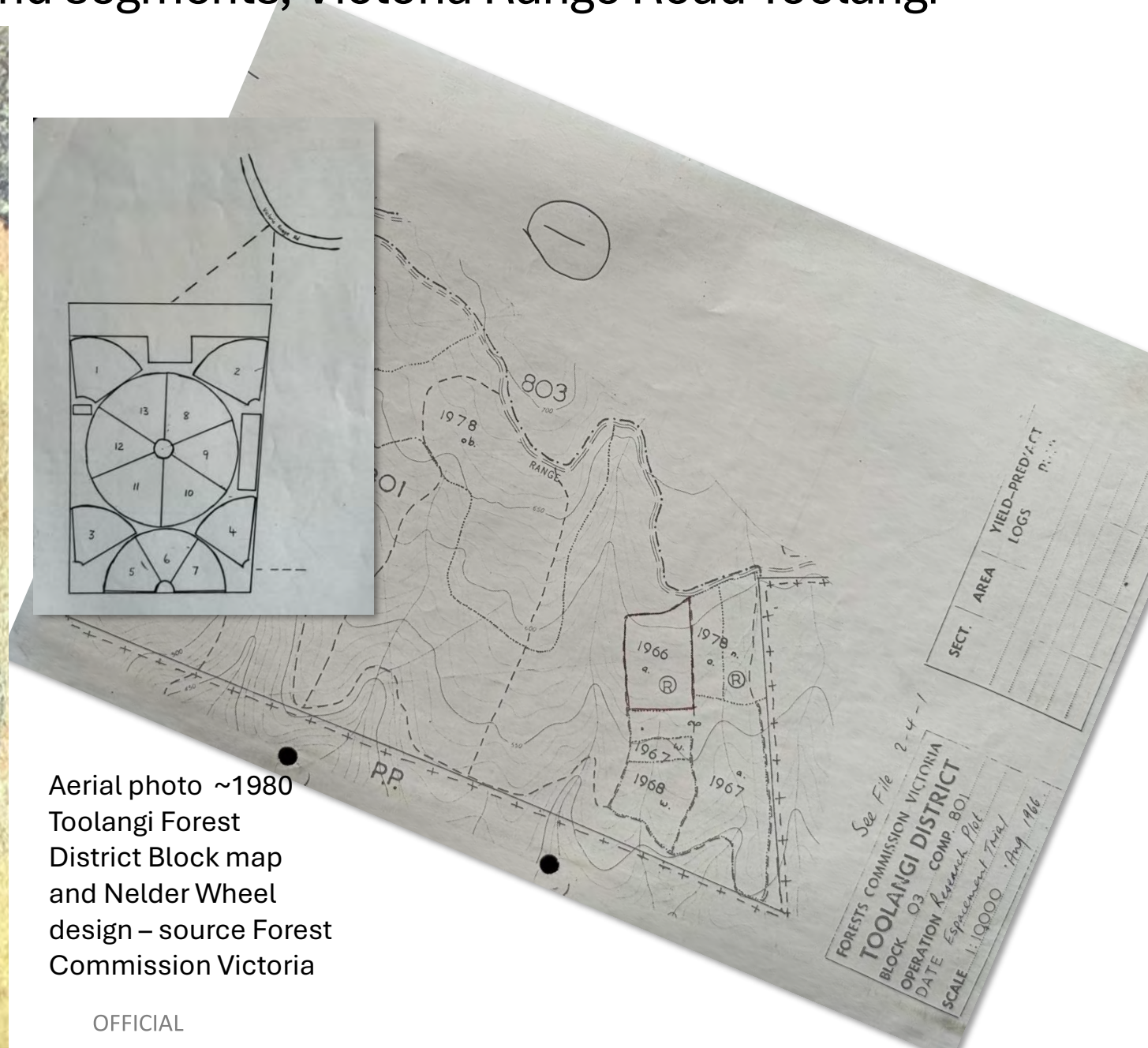
Spatial data is sourced from the Victorian Spatial Data Library (VSDL).
Map produced by Forest Fire Operations Division - Region - October 2025
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Espacement trial, Nelder Wheel and segments, Victoria Range Road Toolangi



Aerial photo ~1980
Toolangi Forest
District Block map
and Nelder Wheel
design – source Forest
Commission Victoria

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How to assess these sites for their biodiversity value?



Daylight surveys for habitat features



Leadbeater's Possum keyhole entry 2006 Alpine Ash regrowth Connors Plain winter 2017 — photo M.F. Ryan



Leadbeater's Possum: Connors Plain — photo Ben Drouyn

Night-time surveys for species detections

- Most done as a two person team one on the thermal who directs the second person where to photograph.
- Still restrictive in how much can be covered off track and in dense understory
- Some solo surveys are acceptable (especially during COVID) when on tracks and not in remote locations



Thermal Gear – FLIR T540 (geotag),
E86 (geotag) or FLIR T420 (no
geotag)



Survey gear – Canon 7DMark 2,
Tamron 18-400mm lens, Olight
Javalot 1300Lm torch

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Solo surveys are only OK on
tracks and in non-remote
locations.

Night-time surveys for species detections

- Court actions forced VicForests to detect every Southern Greater Glider
- The plaintiff wanted ground surveys every 50m across the gross planned area repeated three times
- So had to come up with a viable and safe alternative – hence use of thermal drones
- Started surveys in 40-50 year old thinned sites, pre-storm recovery sites and Western Vic sites
- Very successful at species detections – UoM engaged with DEECA/ARI to compare with ground surveys

THE CONVERSATION

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Drones with thermal cameras are revealing the secrets of elusive Australian forest wildlife

Published: September 15, 2025 10:02am AEST

Yellow-bellied glider. Benjamin Wagner, Author provided (no reuse)



The sound of a large drone humming over a forest at night, combined with a bright floodlight, is an eerie sight. It might evoke ominous thoughts of a search-and-rescue operation.

Author



Benjamin Wagner
Research Fellow - Forest Re
The University of Melbourne

[Drones with thermal cameras are revealing the secrets of elusive Australian forest wildlife](#) Dr Ben Wagner UoM

ECOLOGICAL APPLICATIONS

ECOLOGICAL SOCIETY OF AMERICA

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Thermal drone surveys to detect arboreal fauna: Improving population estimates and threatened species monitoring

Benjamin Wagner  Sarah W. Garnick, Michael F. Ryan, Joanne L. Isaac, Alana Begg, Craig R. Nitschke

First published: 12 September 2025 | <https://doi.org/10.1002/eap.70091>

Handling Editor: Karen E. Hodges

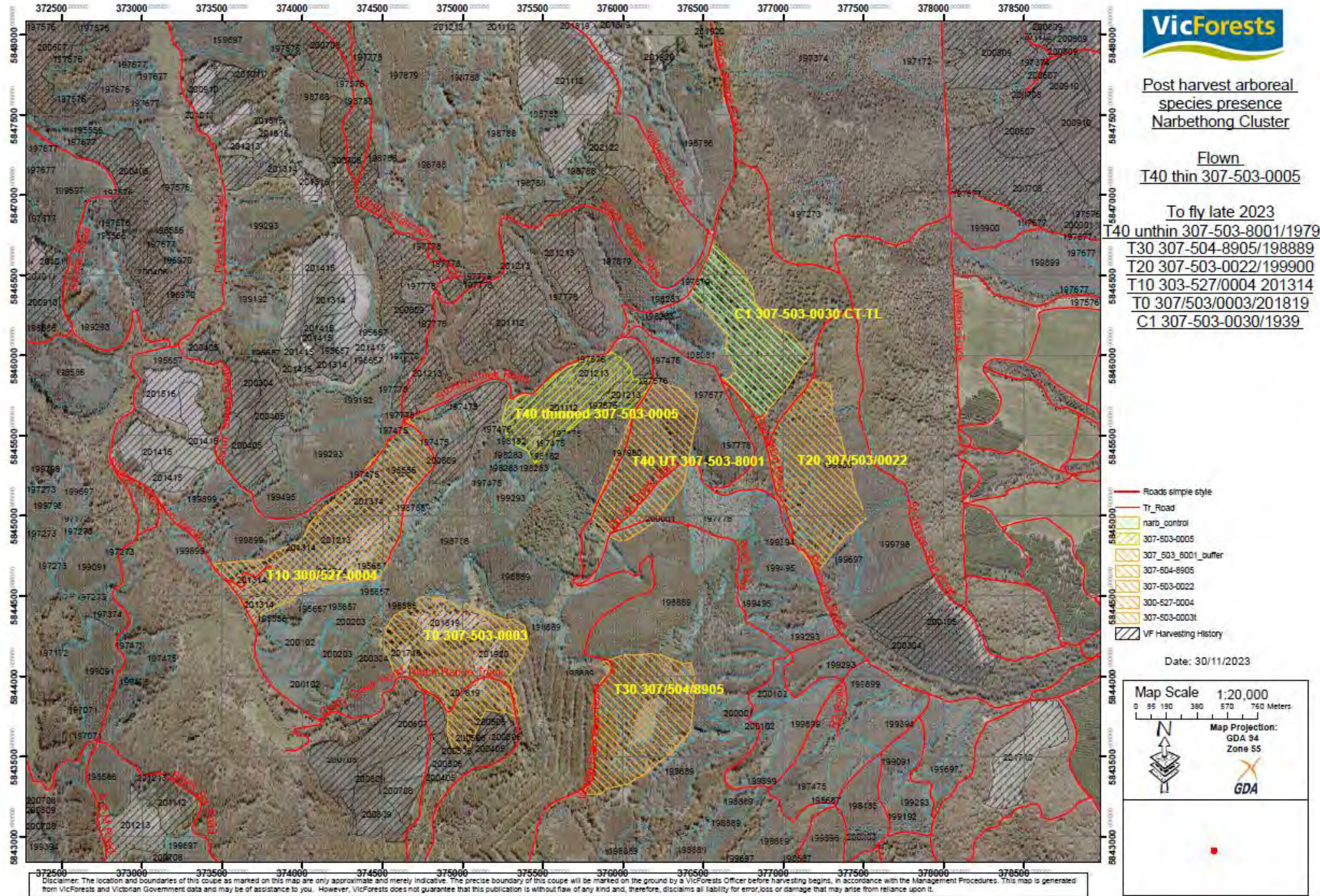


Thermal drone setup - Toolangi

Post harvest
fauna
monitoring
using thermal
drones

Once harvesting
ceased remaining
contract work
directed to post
harvest detections

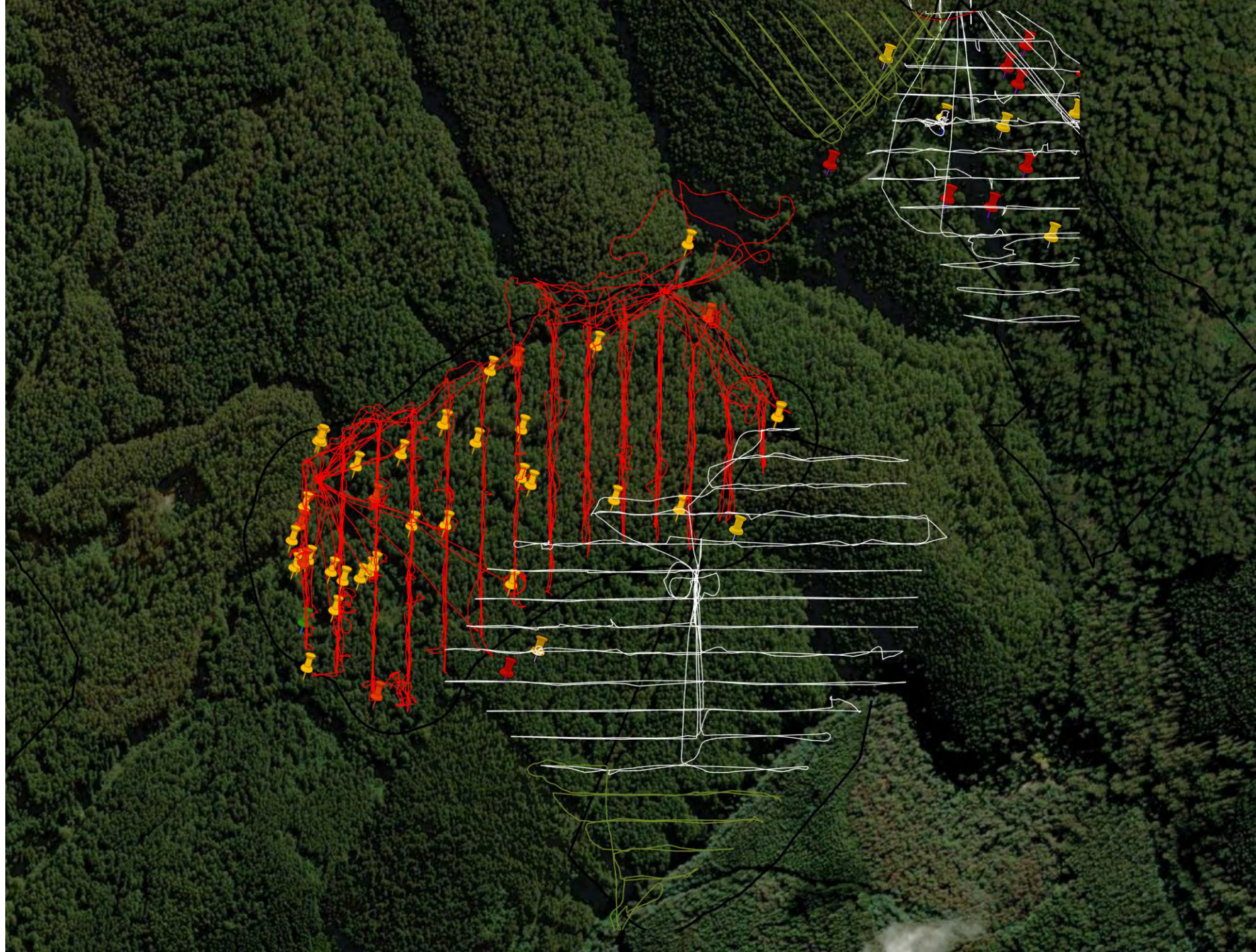
Five Ash and five
Mixed Species
clusters of 0-4
decades post
harvest plus thin
and control



Post harvest fauna monitoring using thermal drones

- As expected large areas of young post harvest regrowth with limited retention is poor for large gliders, but still have Leadbeater detections
- However Variable Retention Harvesting (post 2019) showed high species persistence.
- New silviculture and survey techniques may assist in guiding ecological thinning

Thermal drone transects and species detections – chrono sequence of time since harvest
T40 - thin- Red
T40 – unthin White lower
C1 – control White upper

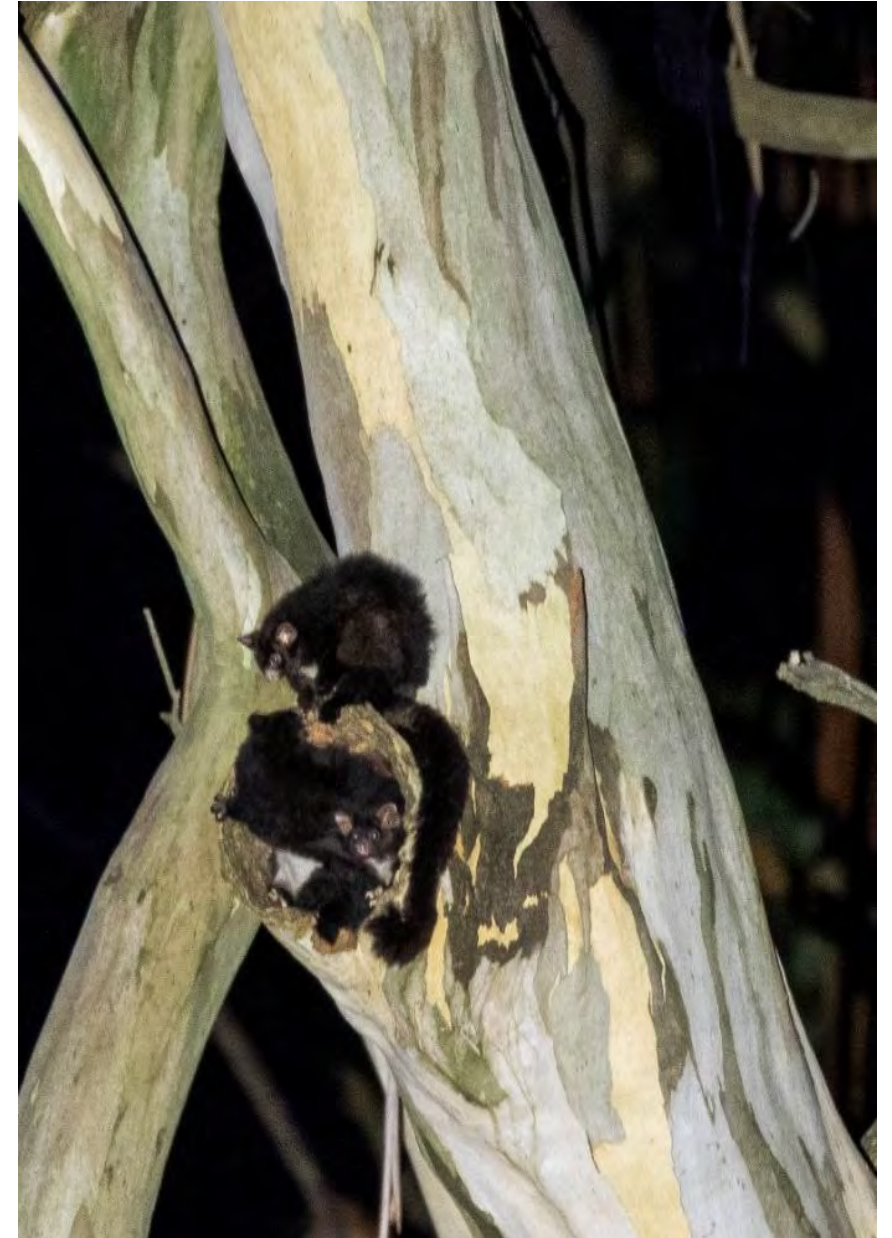


Conclusions

- There is long history of thinning
 - Most was for commercial reasons
 - Some for ecological purposes
- Good research available for implications on water runoff
- Good research for growth rates but many trial sites are discontinued
- Fuel hazard can be reduced with careful thinning addressing fine and coarse fuels
- Fauna surveys can now be done more efficiently and safely with drones
- Review lighter footprint silviculture for wildlife usage as a guide to future ecological thinning

Final message

- Be clear of the objectives and manage accordingly



Great Gliders emerging at dusk from Grey Gum trunk hollow. Toolangi Coles Creek track – photo M.F. Ryan