



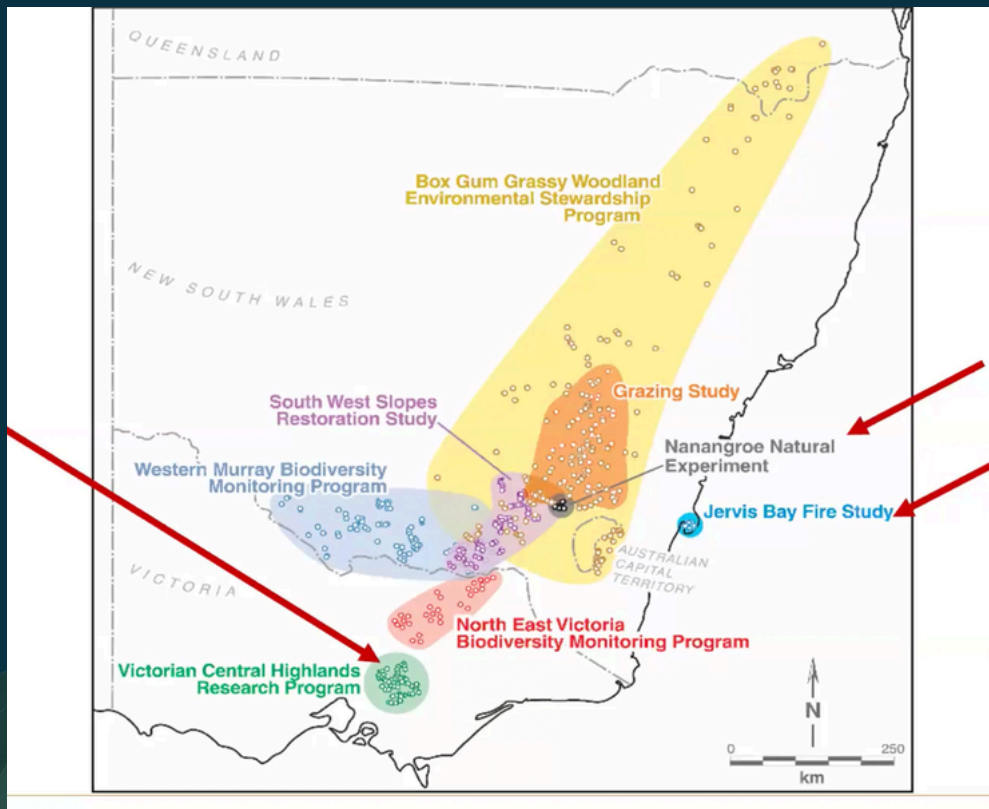
Disturbance & Flammability: How logging and burning can make forests more flammable

With Professor David Lindenmayer



Lindenmayer begins with the relationships between disturbance and flammability:

- 42 years of empirical measurements on forest & woodland structure & composition
- Post-fire environments (1983, 2003, 2009, 2019-20) in 4 large-scale, long-term studies
- Biodiversity responses to fire and other disturbances
- Interactions between disturbances



In this slide, the colours represent different long term studies – all are ongoing apart from one. The red arrows represent the intersection between landscape and its management and fire.



themes of the talk:

- Logging and fire effects
- Thinning and fire effects
- Prescribed burning
- What did it used to look like?
- Plantations and wood supply in a fire-prone future
- The future of nature forest management

Lindenmayer's background: Started working in tall wet forests in 1983. Had studied forestry and zoology. Notes that the legacy of landscape change remains with us 50 years later.

1983

- No discussion of climate change
- No discussion of ecosystem collapse
- Extent of biodiversity loss not recognized
- No notion of the value of ecosystem services
- No sense of First Nation's people work on Country
- Major wildfires were always a "surprise"

The Forest Wars

- Aim to expose key myths in forestry
- Use science & economics in myth busting – including fire
- Create a new vision for Australia's forests

THE SCIENCE

Relationships between logging and fire.

Climate is a key driver of fire. Fires becoming more flammable due to climate change, logging and in some cases, due to hazard reduction burning.

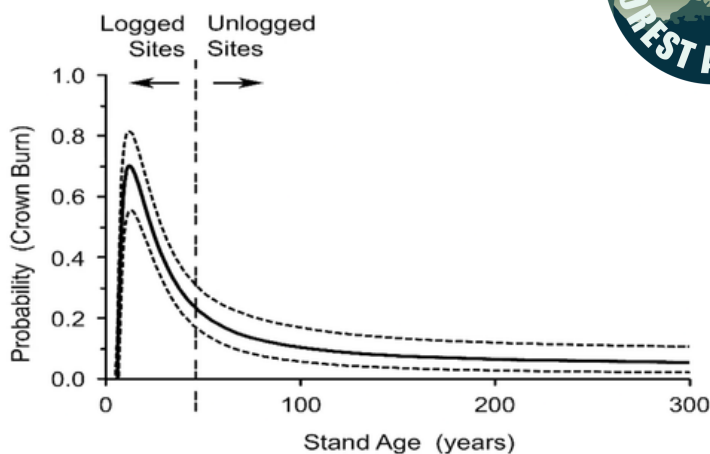
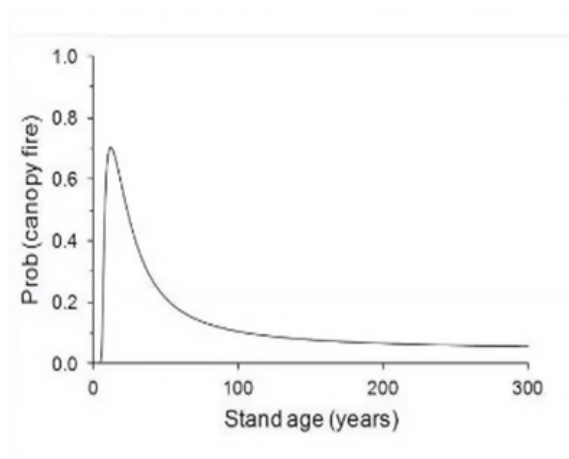
Increase in amount of fire in Australia, US & Alaska and other countries, and steep increase since 2015 of the amounts of area being burned.

In Australia:

In the past 20 years we've seen a big increase in megafires (more than a million hectares). Three in this century alone, there was just one (1939) in the previous century.

1995–2020 there are places that have burned up to four times. Statewide in Victoria, 30 percent of areas due to be logged were actually burned. Also a relationship between condition of forest and severity during fires.

The logging–fire interaction. Most severe fires occurring in the youngest forest.



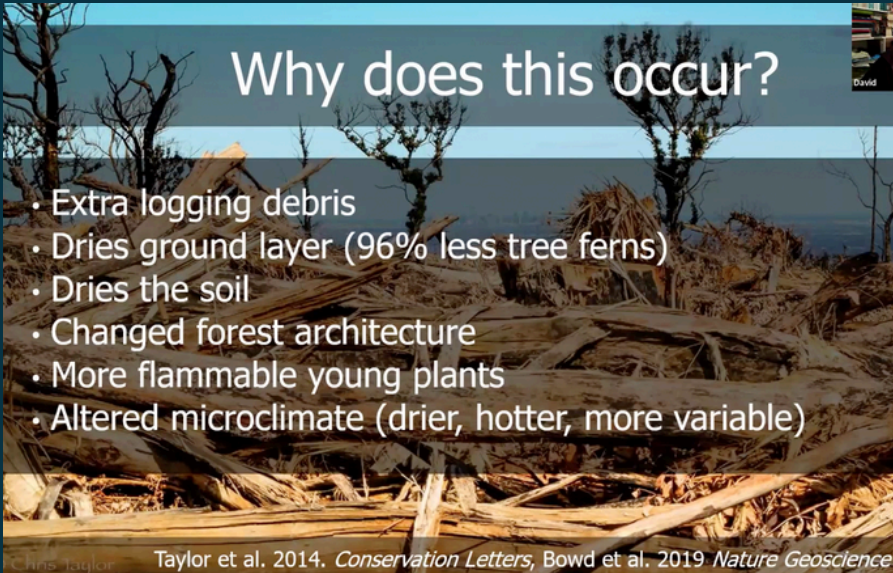
Lindenmayer et al. 2022 – in Runge et al. 2022 [CSIRO Publishing]

Very strong skew towards young, logged forests burning at higher flammability and reburning at high severity.

Ecosystem type	Location	Reference
Tall, wet forests	Victoria	Taylor et al. 2014; Lindenmayer et al. 2022a
Tall, wet forests	SW Western Australia	Zylstra et al 2022, 2023
Tall, wet forests	Tasmania	Furland et al. 2021
Wet+dry forests	NSW	Wilson et al. 2022
Various forest types Black Summer fire footprint	Victoria and NSW	Bowman et al. 2021 Lindenmayer et al. 2022b
Mixed vegetation types	Patagonia, South America	Tiribelli et al. 2018
Boreal and semi-boreal	Eastern Canada	Mackey et al. 2023, 2024
Wet forests	Western North America	Bradley et al. 2016; Zald and Dunn 2018, Levine et al. 2022
Western Woodlands	Inland Western Australia	Gosper et al. 2018
Tropical savannas	Northern Australia	Bowman et al. 2024
Exotic plantations	Chile	McWethy et al. 2018
Exotic plantations	Global	Bousfield et al. 2024

Lindenmayer and Zylstra 2024 *Biological Reviews*

Other kinds of forest also seeing these patterns (see above).
 Logged forests always burn at higher severity. Logged forests burn hotter under moderate fire weather than undisturbed forests burn at extreme fire weather.



Why does this occur?

- Extra logging debris
- Dries ground layer (96% less tree ferns)
- Dries the soil
- Changed forest architecture
- More flammable young plants
- Altered microclimate (drier, hotter, more variable)

Taylor et al. 2014. *Conservation Letters*, Bowd et al. 2019 *Nature Geoscience*

If you create areas of high fire risk, where its logged and regenerated, you have lots of hot spots where the forest is more flammable, and these spill over and burn the adjacent forest.

This is called a landscape trap.

Widespread logging = young forest = increased fire risk.

Repeated fire = fire burns young forest & keeps it young through re-burning.

This is what we're seeing in north-east Victoria.

Other researchers seeing similar things (eg: in Tasmania, and out of University of Wollongong).

Thinning is not the answer, however. Analysis after 2009 and 2019-20 fires showed that in some cases, thinning led to a higher severity fire. When the understory is removed, and some of the stand removed, this causes the forest floor to dry out and the forest becomes more flammable.

Some fire authorities are significantly aware that logging makes forests more flammable.

PLANTATIONS

90 percent of all sawn timber already comes from plantations.

Plantations are flammable, just like native forests, because they are young. In Australia, we buck the global trend, **plantations are four times LESS likely to burn compared to logged and regenerated forests.** This has enormous implications for our wood supplies.

If we're seeing this big change in the frequency of fires, and the intervals are reducing, the chance of being able to grow timber in logged and regenerated forests is getting less likely.

Almost no native forests are going to grow old enough to harvest a sawlog from them. Poor financial investment. Have to find another solution.

Every area of forest that's been logged in our lifetime is more flammable now that if it had never been logged.

PRESCRIBED BURNING

SOUTH WEST WA – PHIL ZYLSTRA'S WORK



- Prescribed burns are somewhat effective for 5-7 years, as previously thought
- Then *increased* fire risk for 4-5 decades
- Affected forests are 7 times more likely to burn than older forests
- In the worst climatic conditions, older forests were 3 times less likely to burn than *recent* prescribed burns



KEY FINDINGS

Quality would be better than quantity. Having a limited effect means doing it every few years, which is expensive and counter to scientific evidence.

Hazard reduction burning has very little risk reduction effect under extreme conditions. Eg: Marysville in Victoria. The tragedy that took place there, as well as Black Saturday fires.

[Later in the Q&A Lindenmayer adds to this. He recalls December 2008 there was a prescribed burn in Marysville, because Lindenmayer was there, and said there was incredible amounts of smoke. Barely two months later, Marysville was razed by the Black Saturday fires, including the areas that had been burned. In extreme conditions, no amount of prescribed burning is going to make a difference.]

Reality

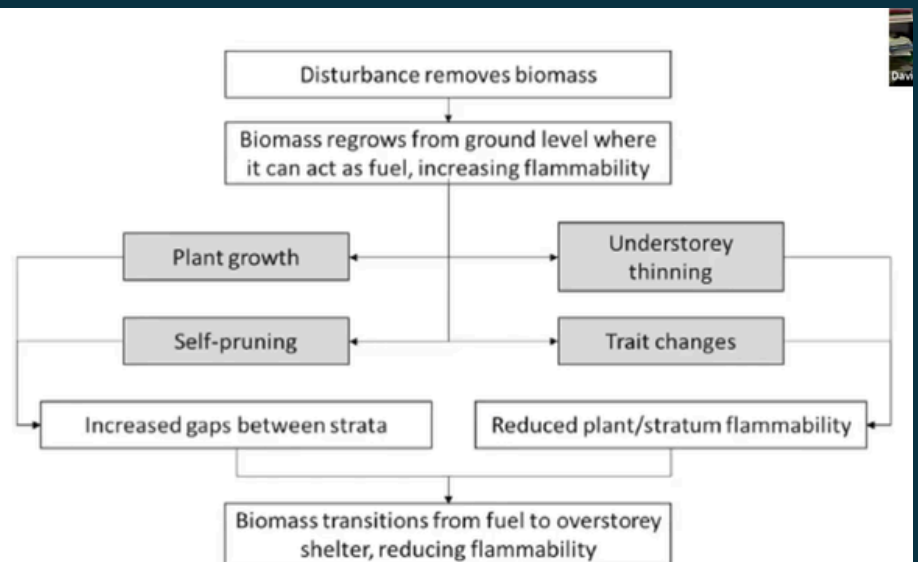
- Quality not quantity
- < 1 km from infrastructure
- Done every few years
- Distant burning to hit targets = limited effectiveness
- Does not always work – Marysville in Victoria
- Wrong to say "if only we had done more HRB" – wrt risk reduction (especially under extreme conditions)

(Gibbons et al. 2012 – PLOS One)

CONCLUSION: DISTURBANCE ADDS TO FLAMMABILITY.

Using the example of Alpine grazing making those areas more flammable by changing the ecosystem from alpine grasses to more flammable species that grew due to cattle grazing.

Lindenmayer also counters the argument that Indigenous First Nations people undertook extensive burning, but evidence does not support this (ecology, lidar analysis, carbon dating, testimonies etc)



Lindenmayer and Zylstra 2024 *Biological Reviews*

Conclusion

Tall, wet forests:.....

- Are naturally dense, wet environments
- Were NOT regularly burnt
- Were “no fire country”
- Were NOT farmed
- Were NOT open and park-like

Management implications

- Extensive thinning and widespread burning are not appropriate management actions for tall, wet forests
- Prescribed burning is not appropriate for tall, wet forests
- **Disturbance makes them MORE FLAMMABLE NOT less**
- Better to manage them by letting them grow to less flammable old growth stage
- Embrace new technologies for rapid detection & suppression

Lindenmayer et al. 2024 *Austral Ecology*

CONCLUSION

Fire needs to be fit for purpose, for ecosystems. Has to be the right fire for the right country, not massive industrial hazard reduction burns.

THE FUTURE OF FORESTRY

Have to exit native forest logging which will help manage for biodiversity, fire, carbon and water supply.

Use plantation based industry for wood products – reduces GHG emissions, best and highest return on natural asset, security of wood supply. Plantations are less flammable than native forests.

Increase focus on plantation design, urban forests and farm forestry.

Also new and emerging fibre industries, eg: Industrial hemp for pallets, paper

Formal protection as a fundamental strategy. Otherwise logging operations taking out 500 year old trees.

What are we going to do about our extremely flammable forests?

Some management issues

- Grow more old forest (where fire severity is lowest)
- Reduce factors that contribute to flammability (logging, long-interval HRB in some places)
- Don't do “salvage” logging – adds to flammability
- Beware of multiple (HS) fires in rapid succession

New tech in prevention, risk reduction, suppression, and use of high-payload drones is a reality.

This is \$42 million to do this for ACT, or Kosciusko National Park.



A better forest future



- Formal forest protection
- Build sensible and appropriate infrastructure
- Develop new technologies to tackle fires faster and more effectively
- Protect carbon stocks
- Invest more and smarter plantations – new kinds of feedstock like Hemp

In large national parks, there are areas for people to hunt deer, drive 4WDs and places where you don't do that. Walking, hunting, 4WD, opportunities for regional renewal.

Q&A

Q: How did mythology about forests and Indigenous use happen?

A: Looking at vested interests, myths have been promulgated. It no longer becomes a rational argument, because it doesn't make sense economically or any other way. It's around power and political bastardry. That's where it's got to. Victoria has spent \$1.5 billion on a loss-making forestry industry. Would be better ways to spend this money.

Prescribed burns are medieval fire management. More likely to die from respiratory complications of burns than in a wildfire.

In response to a question, Lindenmayer says he's seen no evidence that firebreaks or intense, high severity planned burns work. He's asked the Victorian government repeatedly and has seen no evidence.

Lindenmayer adds that the nuance in in prescribed burns is important – they can have some effect but need to be done very often and very close to people and property – and they last in effectiveness for only a few years – and they don't work under extreme fire weather.

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Also industrial prescribed burns are NOT the same as cultural burns nor ecological burns for habitat for particular species.