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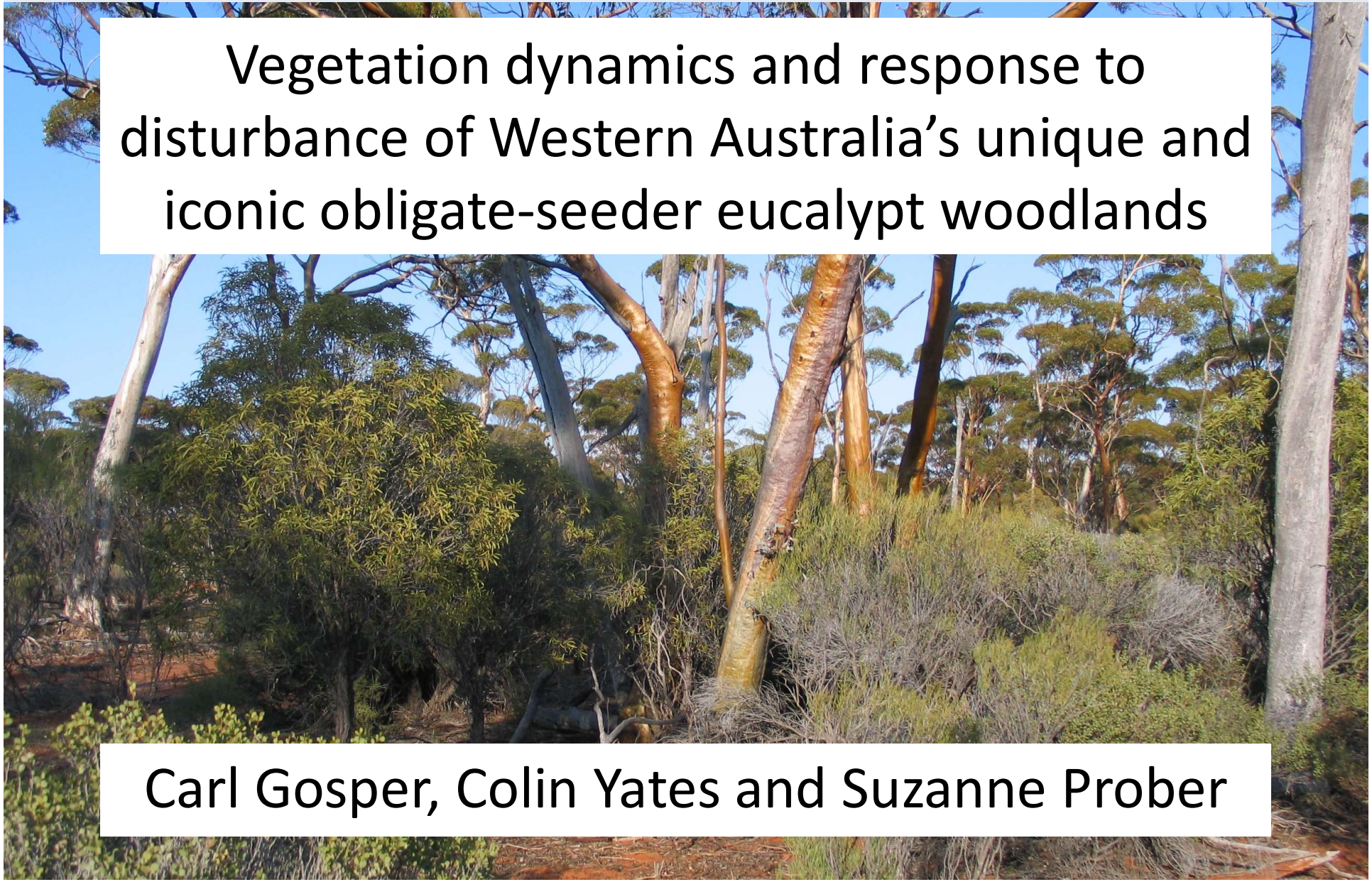
Vegetation dynamics and response to disturbance of Western Australia's unique and iconic obligate-seeder eucalypt woodlands



Carl Gosper, Colin Yates and Suzanne Prober

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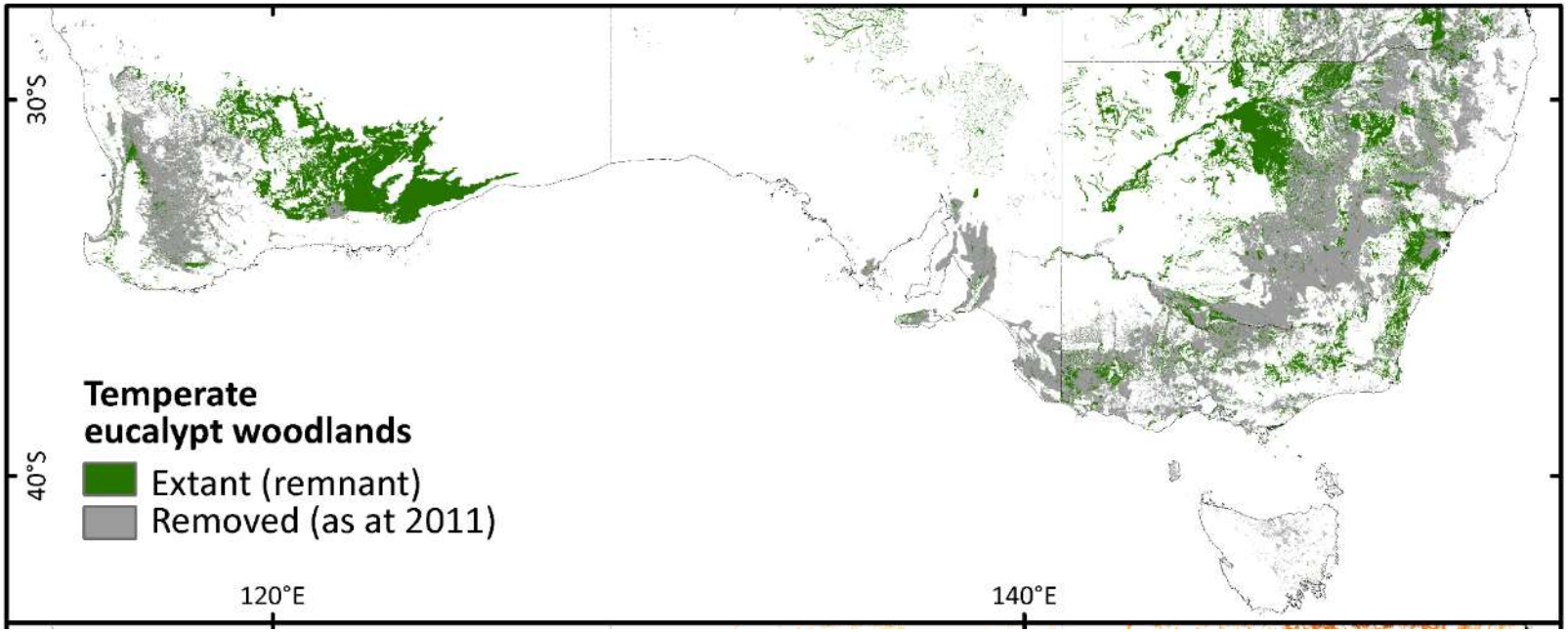
Temperate eucalypt woodlands

- Well-spaced eucalypts over low understories of grasses, herbs and/or shrubs
- Intermediate rainfall zone
- Productive soils
- Favoured environment for Aboriginal people



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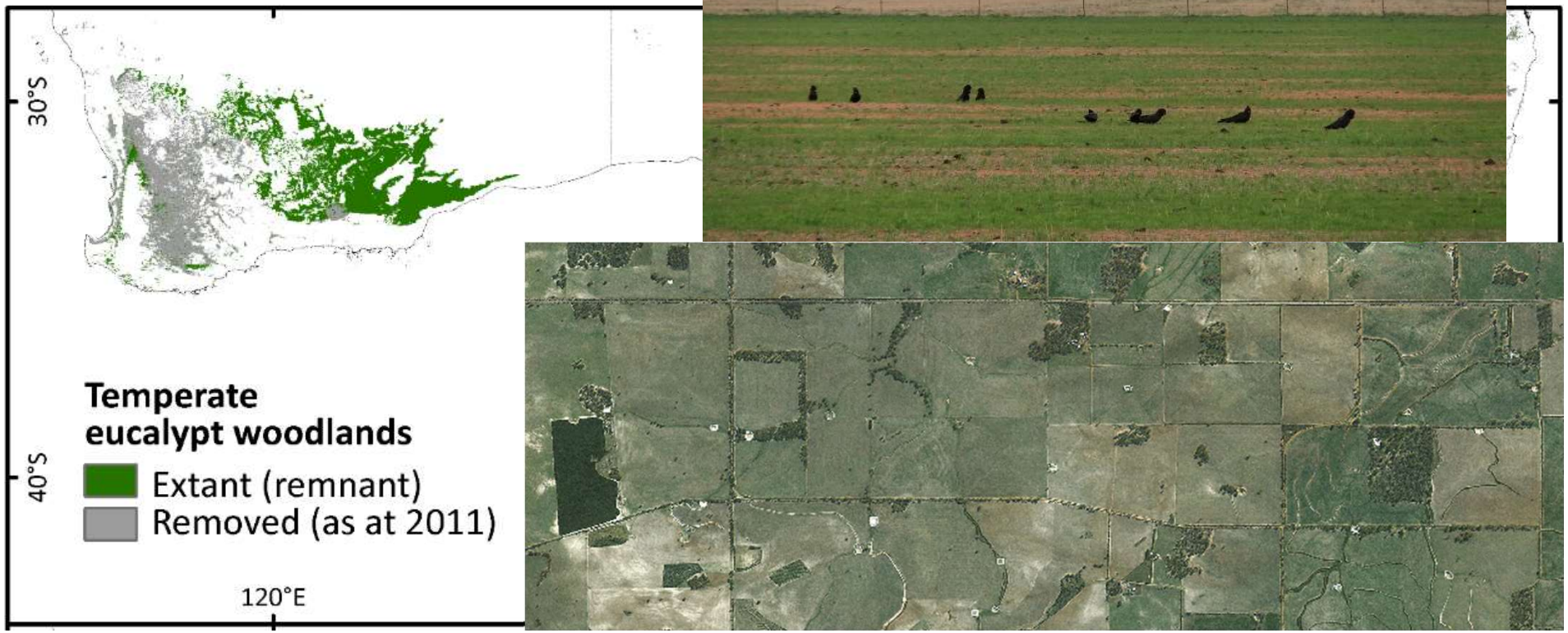
Temperate eucalypt woodlands

- Largely cleared from agricultural regions
- Small native vegetation remnants
- Linear corridors



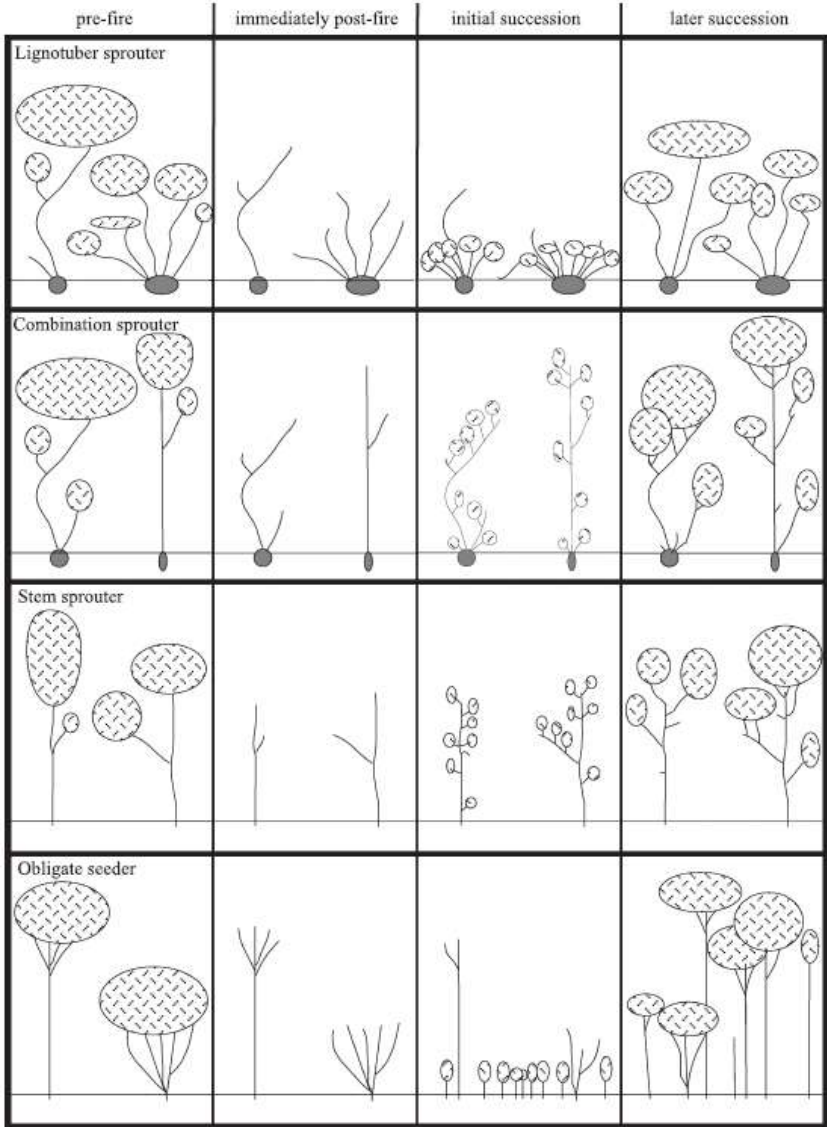
Temperate eucalypt woodlands

- Eucalypt Woodlands of the WA Wheatbelt TEC (EPBC Act)
- Several Priority Ecological Communities (WA)
- Threats:

- Vegetation clearance, fragmentation
- Weed invasion, pest animals
- Pesticide, herbicide pollution
- Grazing by stock, macropods
- Salinity, waterlogging
- Altered fire regimes e.g. frequency and intensity
- Climate change

Eucalypt response to disturbance

- Eucalypts vary in how they respond to crown-destroying disturbances – fire, windthrow
- Resprouters – from stem and/or lignotuber
- Obligate-seeders



Nicolle (2006) *Aust. J. Bot.* **54**, 391–407

Temperate eucalypt woodlands of SWWA

	Disturbance response Resprouter	Obligate-seeder
Number of taxa	40	55
Eucalypt sections	7	3
Prominent examples	*E. loxophleba* (York gum)	*E. salubris* (gimlet)
	E. wandoo (wandoo)	*E. astringens* (brown mallet)
	E. capillosa (wheatbelt wandoo)	*E. gardneri* (blue mallet)
	E. longicornis (red morrel)	*E. salmonophloia* (salmon gum)
	E. rudis (flooded gum)	*E. transcontinentalis* (redwood)

Gosper et al. (2018) *Austral Ecology*

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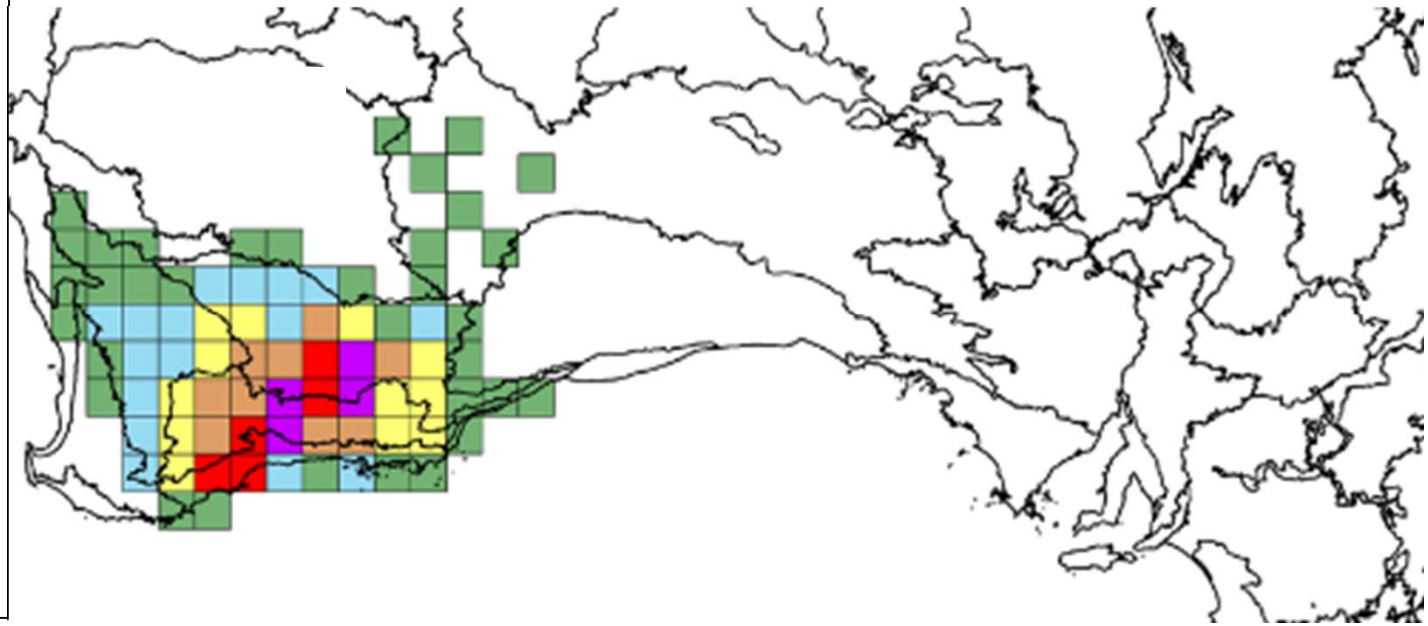
Obligate-seeder eucalypt woodlands

- Only occur in SWWA
- Richness greatest on south coast and GWW

Richness of obligate-seeder eucalypts

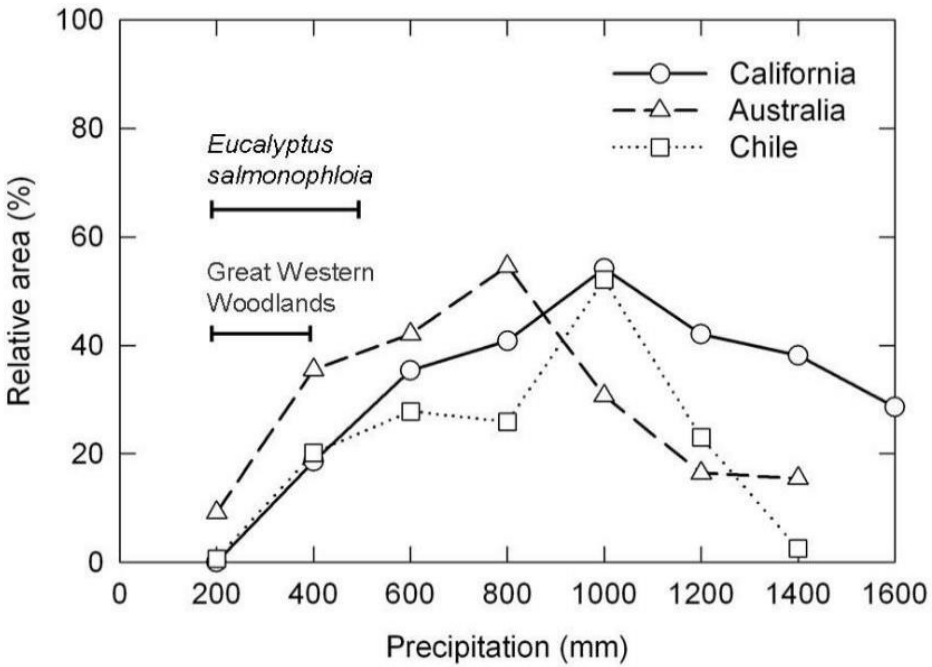
Taxa richness:
- <5
- 6-10
- 11-15
- 16-20
- 21-25
- >26

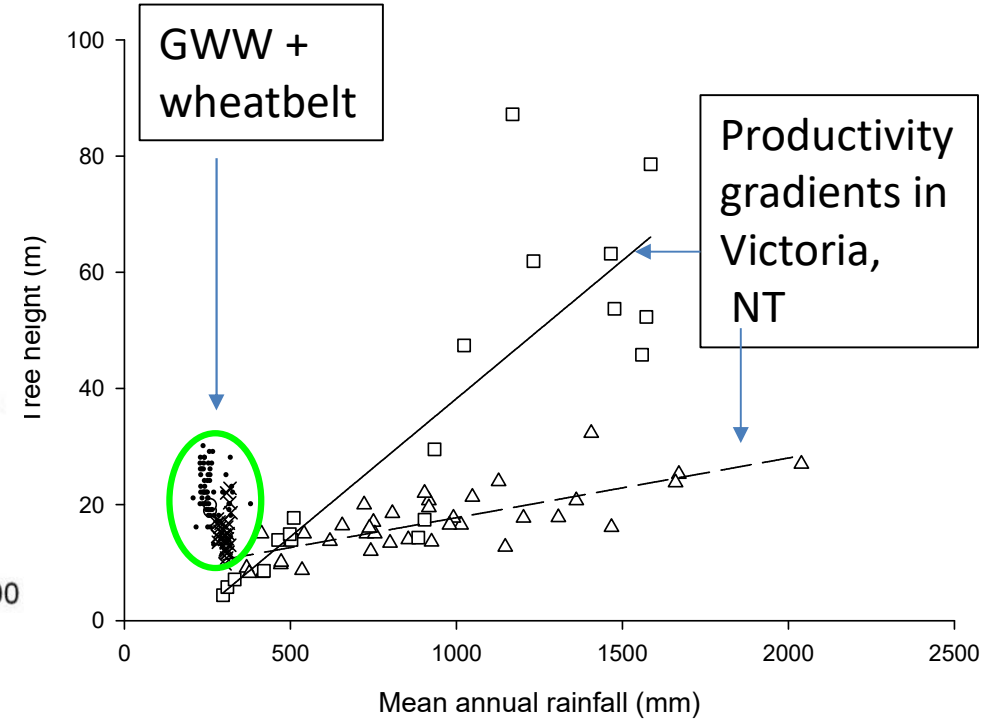
Yates et al. (2017) Ch. 23 in *Australian Vegetation*



Obligate-seeder eucalypt woodlands

- Exceptional tree stature relative to MAR





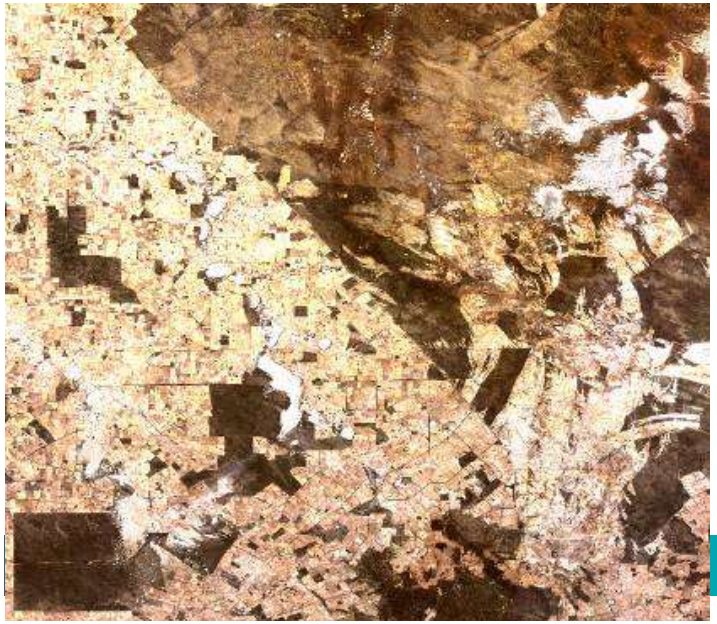
- Vegetation dynamics largely overlooked

Prober et al. (2012) *Climatic Change*
Gosper et al. (2018) *Austral Ecology*

Gimlet chronosequence

- *Eucalyptus salubris*
- Challenge of ageing long-unburnt woodlands
- TSF determined through:

- Landsat imagery; growth ring counts; allometric relationships between size and growth ring counts



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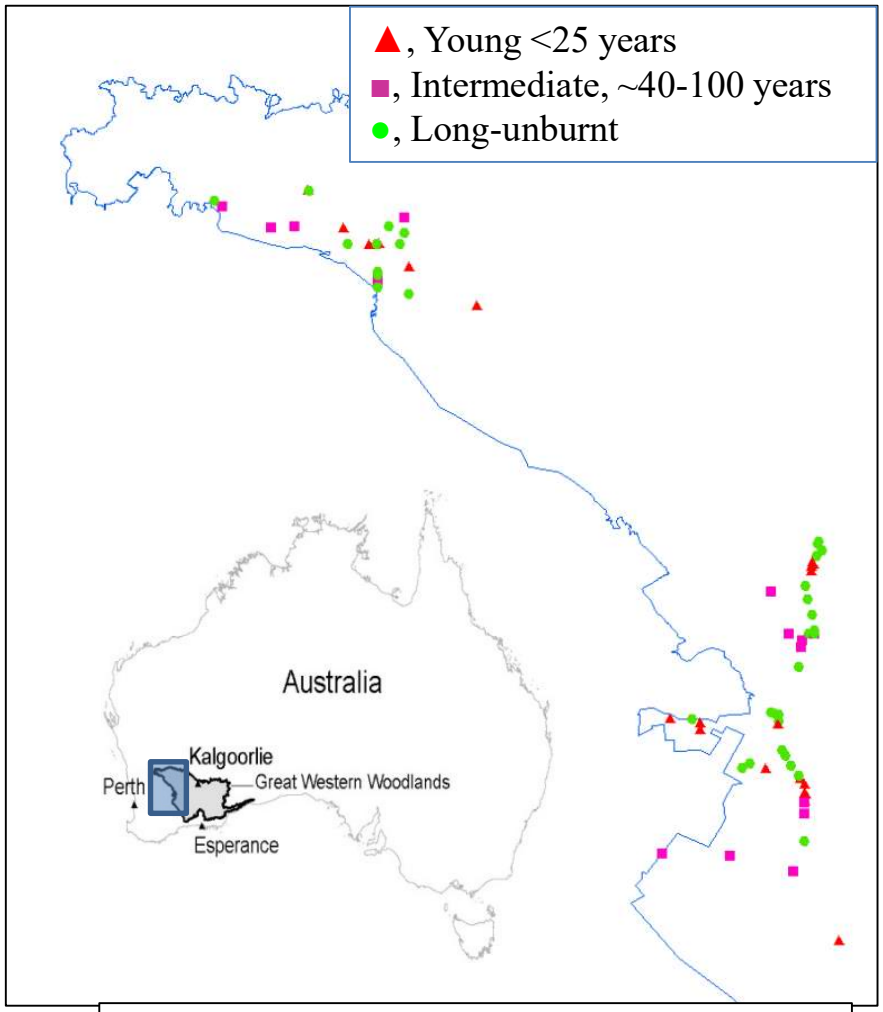
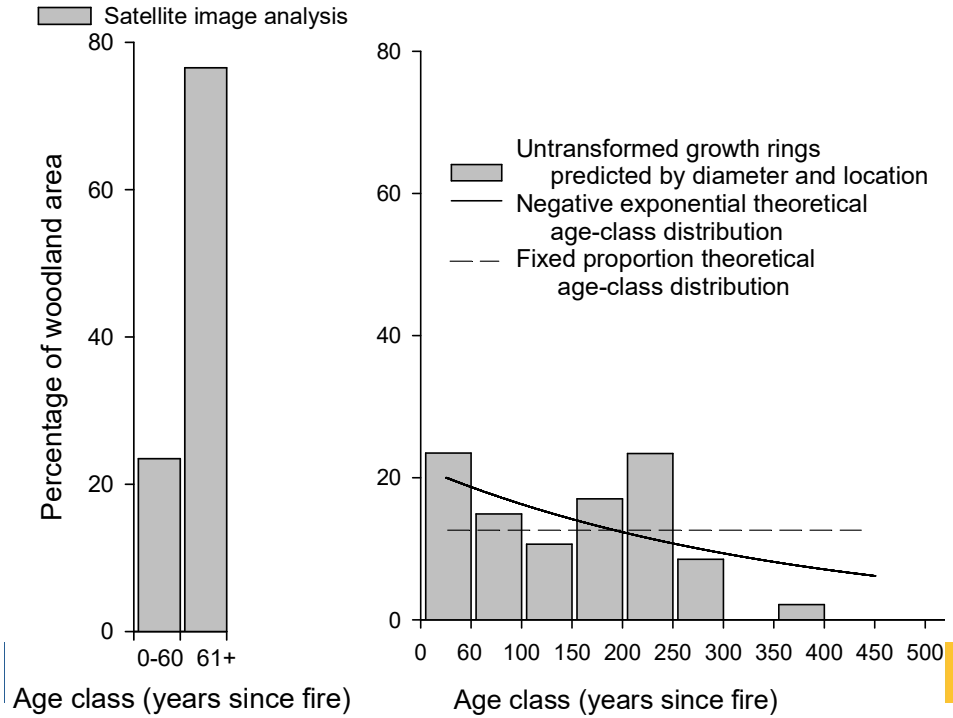
Gimlet chronosequence

- 76 sites
- 3 to ~400 years since fire



Estimated age-class structure



Gosper et al. (2013) *Aust. J. Botany*

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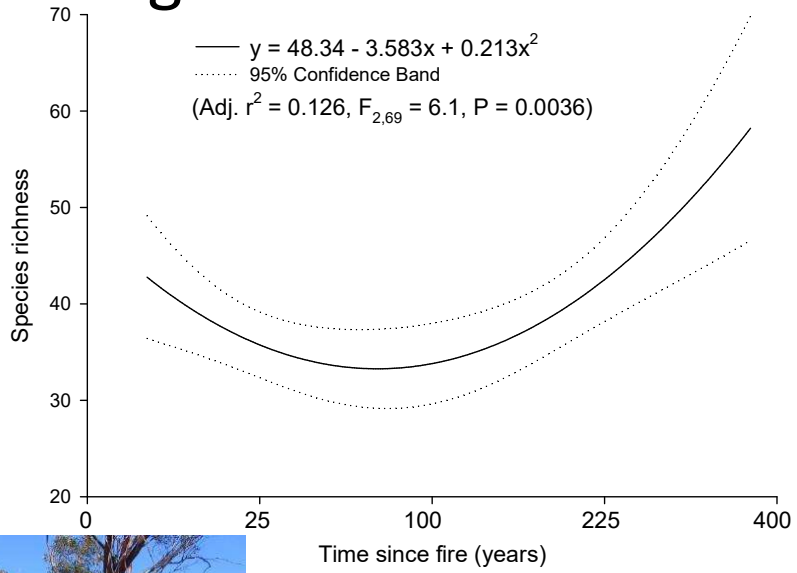
Plant communities

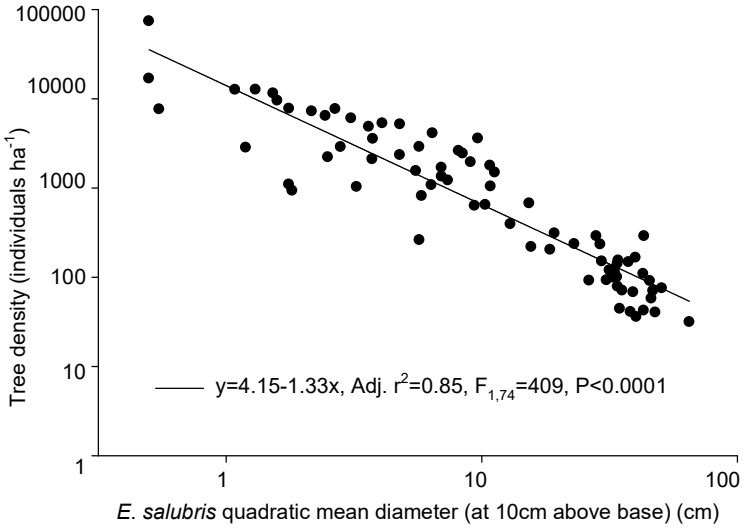
- 'U'-shaped relationship between richness and TSF
- Higher diversity post-fire and in long-unburnt woodland

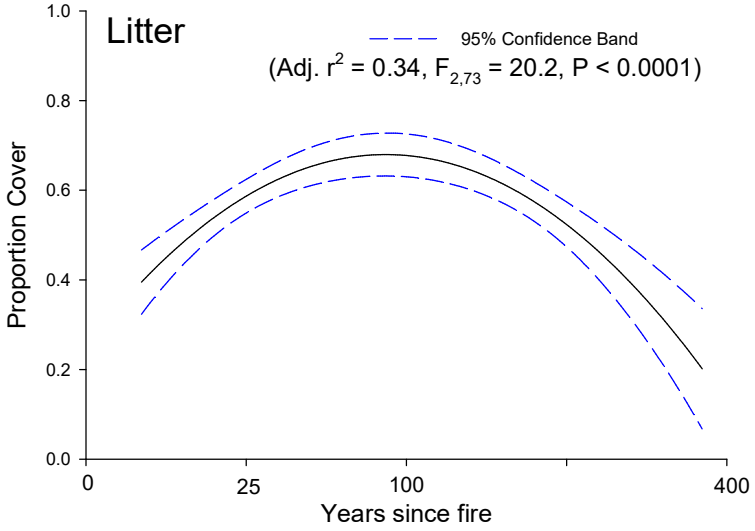


Gosper et al. (2013) *Journal of Applied Ecology*

Vegetation structure/fuel

- Density-dependent thinning
- Fuel cover peaks at intermediate TSF (~35-150 years)
- Discontinuous litter cover in young and mature woodlands reduces flammability
- Paucity of grass





Gosper et al. (2013) *Forest Ecology and Management*
(2014) *International Journal of Wildland Fire*

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Ants

- 37273 ants, 232 taxa
- Abundance of functional groups matched successional changes in vegetation structure
- Targeted searches for the CR arid bronze azure butterfly

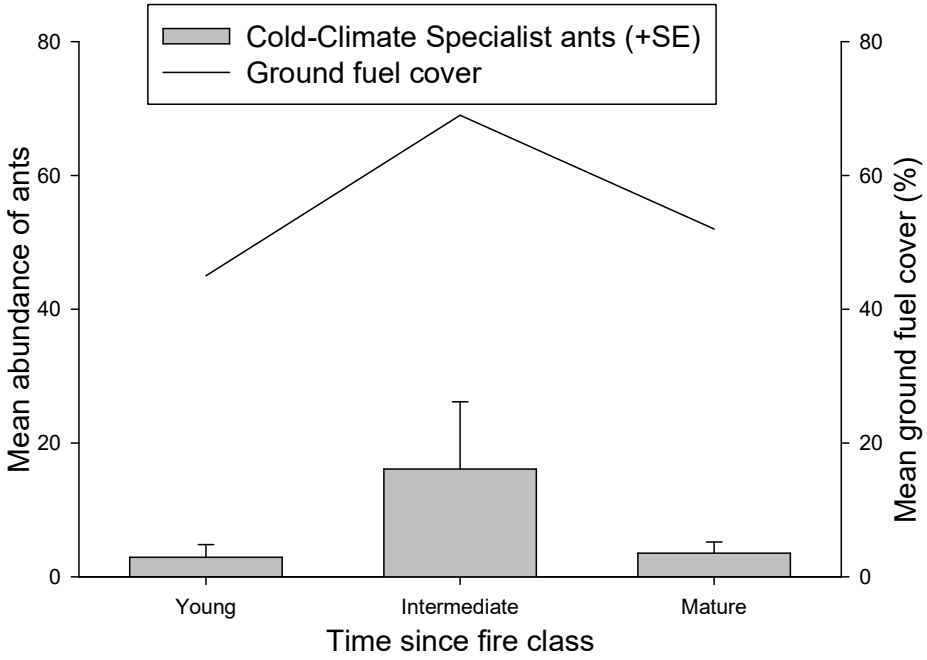


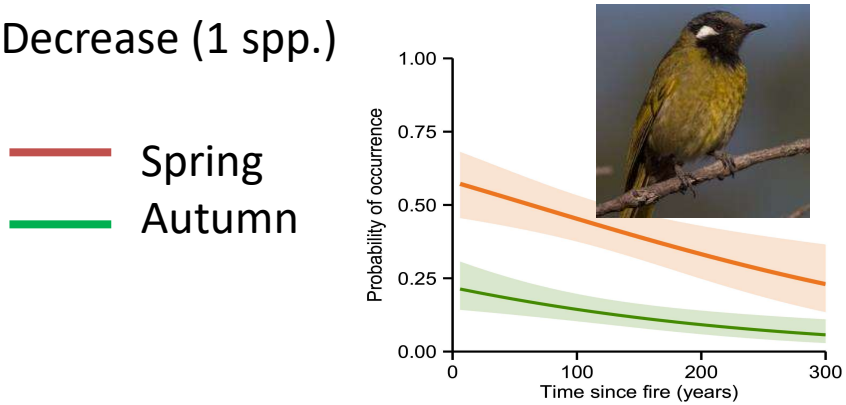
Photo: Andy Williams, DBCA

Gosper et al. (2015) *Forest Ecology and Management*
Gosper and Williams (2018) *Landscope*

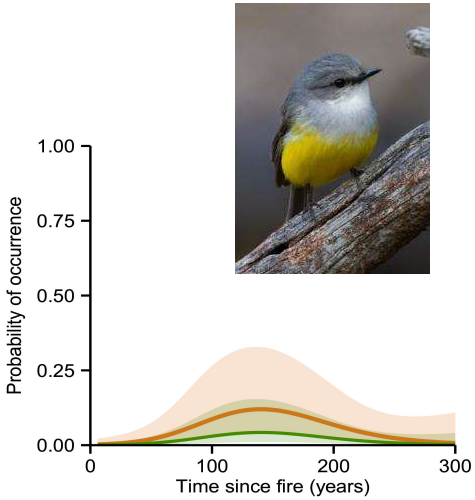
Birds

- Strong effects of TSF at the species and community level
- 4 distinct response types

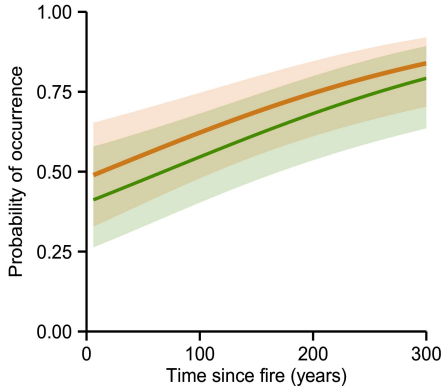
(i) Decrease (1 spp.)



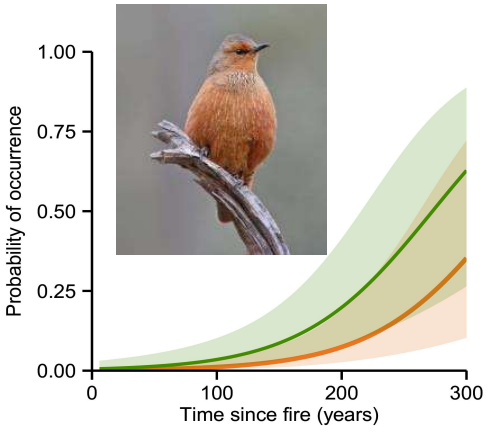
(ii) Bell (2 spp.)



(iii) Increase (5 spp.)



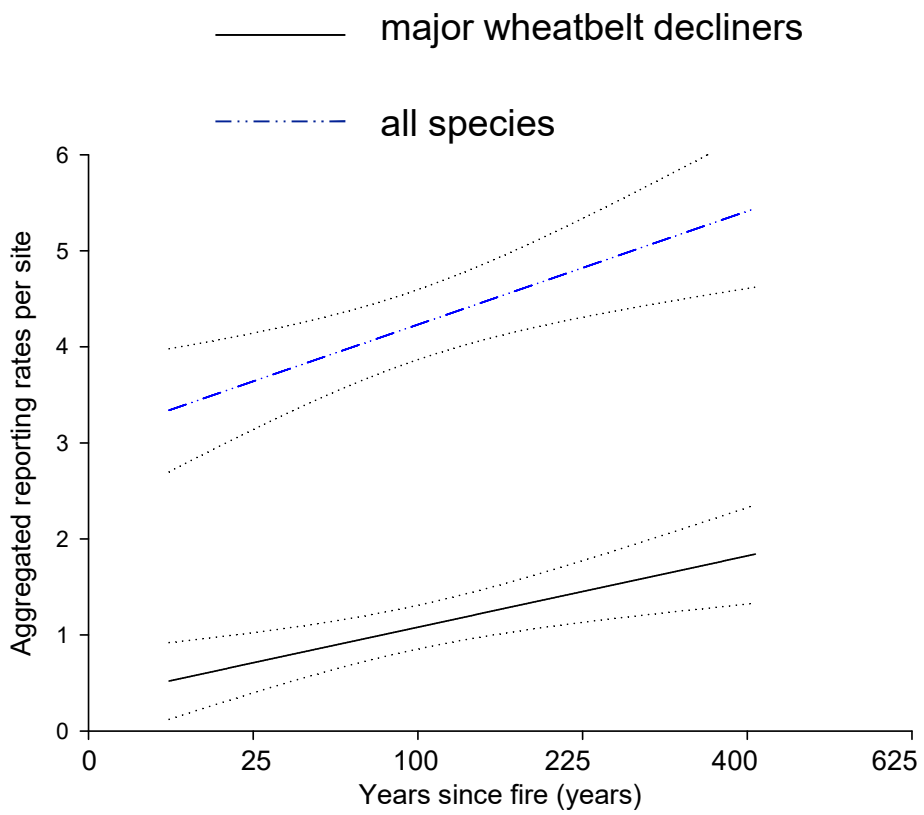
(iv) Delayed (2 spp.)



Gosper et al. (in press) *Ecological Applications*

Birds

- Richness and abundance increased with greater TSF
- Woodland birds that are major wheatbelt decliners favour long-unburnt woodlands



Gosper et al. (2019) *Biological Conservation*

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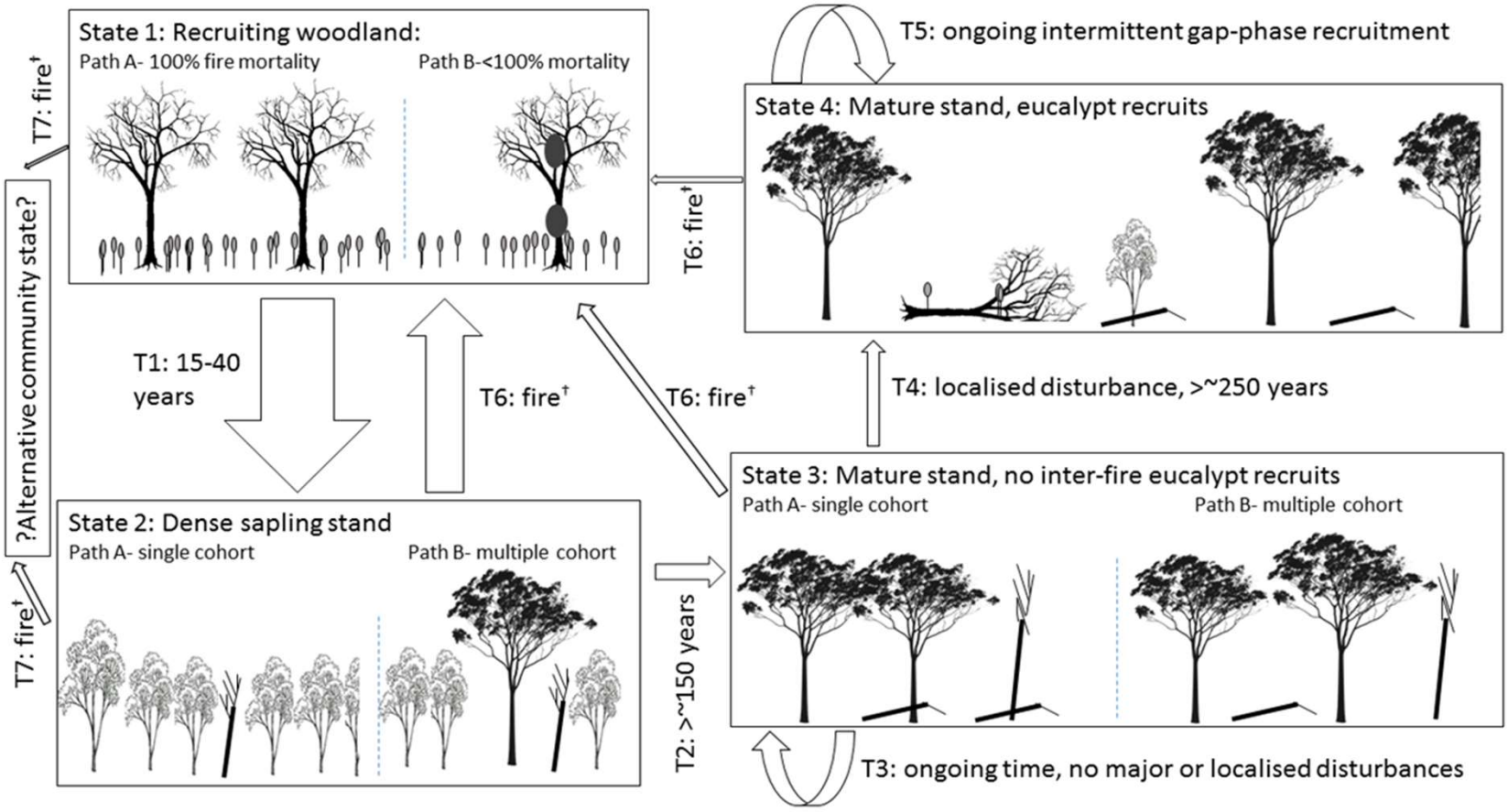
Obligate-seeder woodland vegetation dynamics model



Gosper et al. (2018) *Austral Ecology*

Obligate-seeder woodlands – major conclusions

- Multi-century perspective is needed to gauge woodland responses to disturbance
- Disturbance is not necessary to maintain woodland vigour and richness
- Mature woodland is important for some fauna of conservation concern
- Flammability peaking at intermediate TSF (positive flammability-TSF feedback)
- Vegetation dynamics have more in common with ash wet eucalypt forests than resprouter temperate eucalypt woodlands

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Obligate-seeder c.f. resprouter woodlands

- Rates of vegetation recovery after disturbance
- Carbon and woody debris dynamics
- Expected stand structures and groundcover type when considering vegetation condition