Indicators of Ecologically Sustainable Forest Fire Management

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Sustainable Forest Management

Key Criteria

- Biodiversity conservation
- Productive capacity
- Ecosystem health and vitality
- Soil and water
- Global carbon cycles
- Natural and cultural heritage
- Socio-economic benefits

Constraints to measuring “ecologically sustainable management”

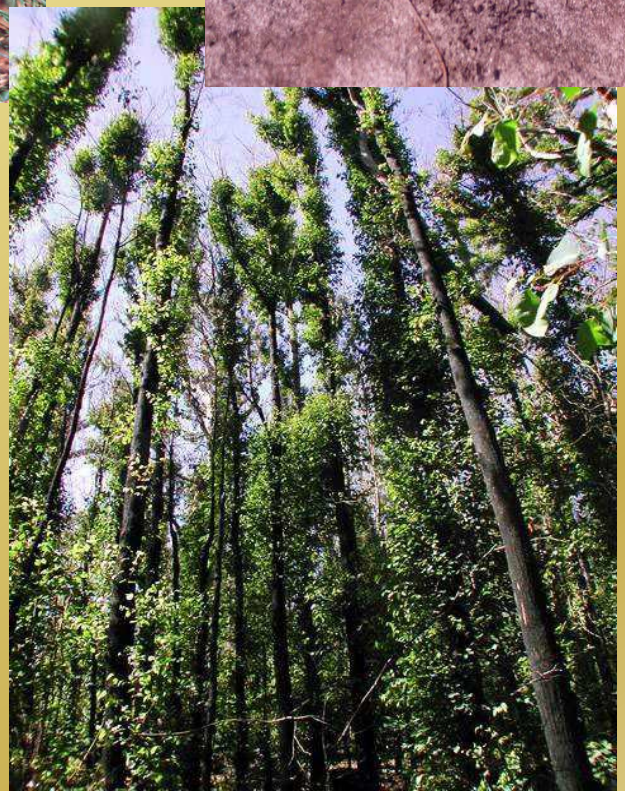
- Imperfect knowledge
- Impossible or impractical to measure the entire biota
- Spatial and temporal scales

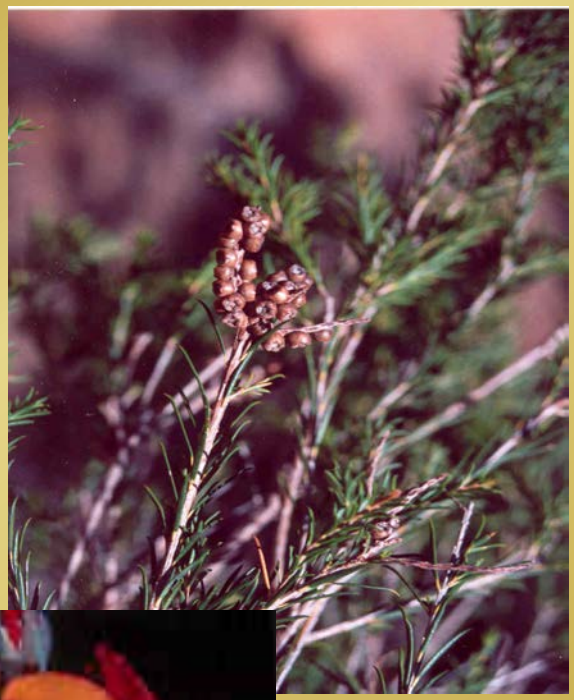
Biodiversity Conservation

- CAR reserve system
- Informal reserves
- Environmental safeguards
- Research and monitoring

“The planet Earth has burned for more than 350 million years. For all this time, fire has continued as an environmental presence, an ecological process, and an evolutionary force.”

- FIRE: THE GOOD, THE BAD, THE UGLY



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Forest fire management aims

- To conserve biodiversity
- To minimise the adverse impacts of fire on human life, property and industry

Are current forest fire regimes consistent with ecologically sustainable forest management?

Prescribed fire in forests

- Ecological objectives
  - processes
  - biodiversity
- Protection objectives
  - human life and property
  - forest products values
  - forest conservation values
- Silvicultural objectives
  - regeneration
  - stand management

Fire Management Strategies

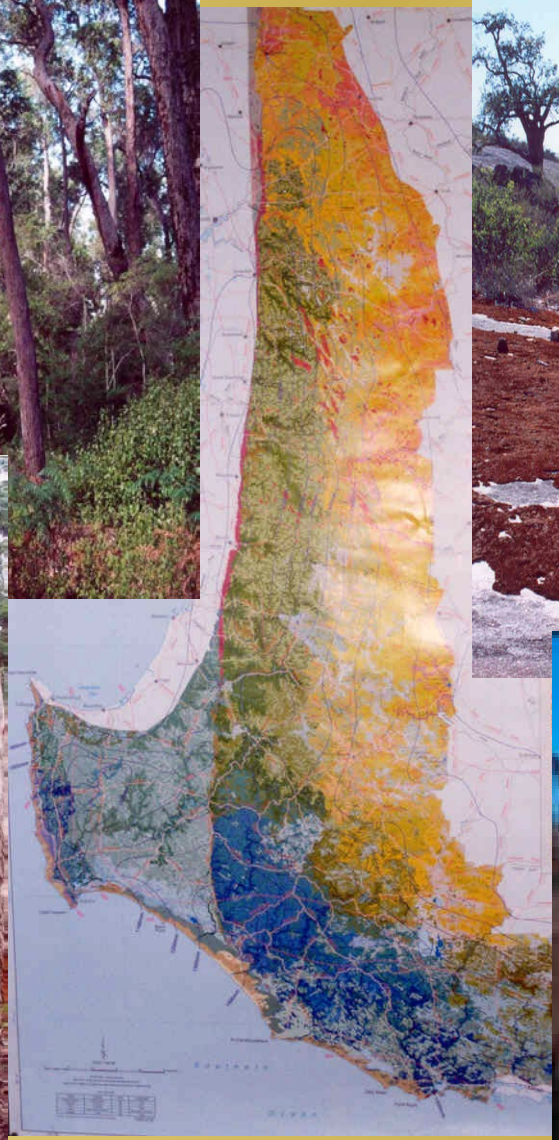
- Detection
- Suppression
- Prescribed fire
  - Appropriate fire regimes

Definition

Fire regime:

- fire intervals (frequency)
- fire season
- fire intensity
- fire patchiness and scale

Forests - a complex mosaic



Indicators of ecologically sustainable fire regimes

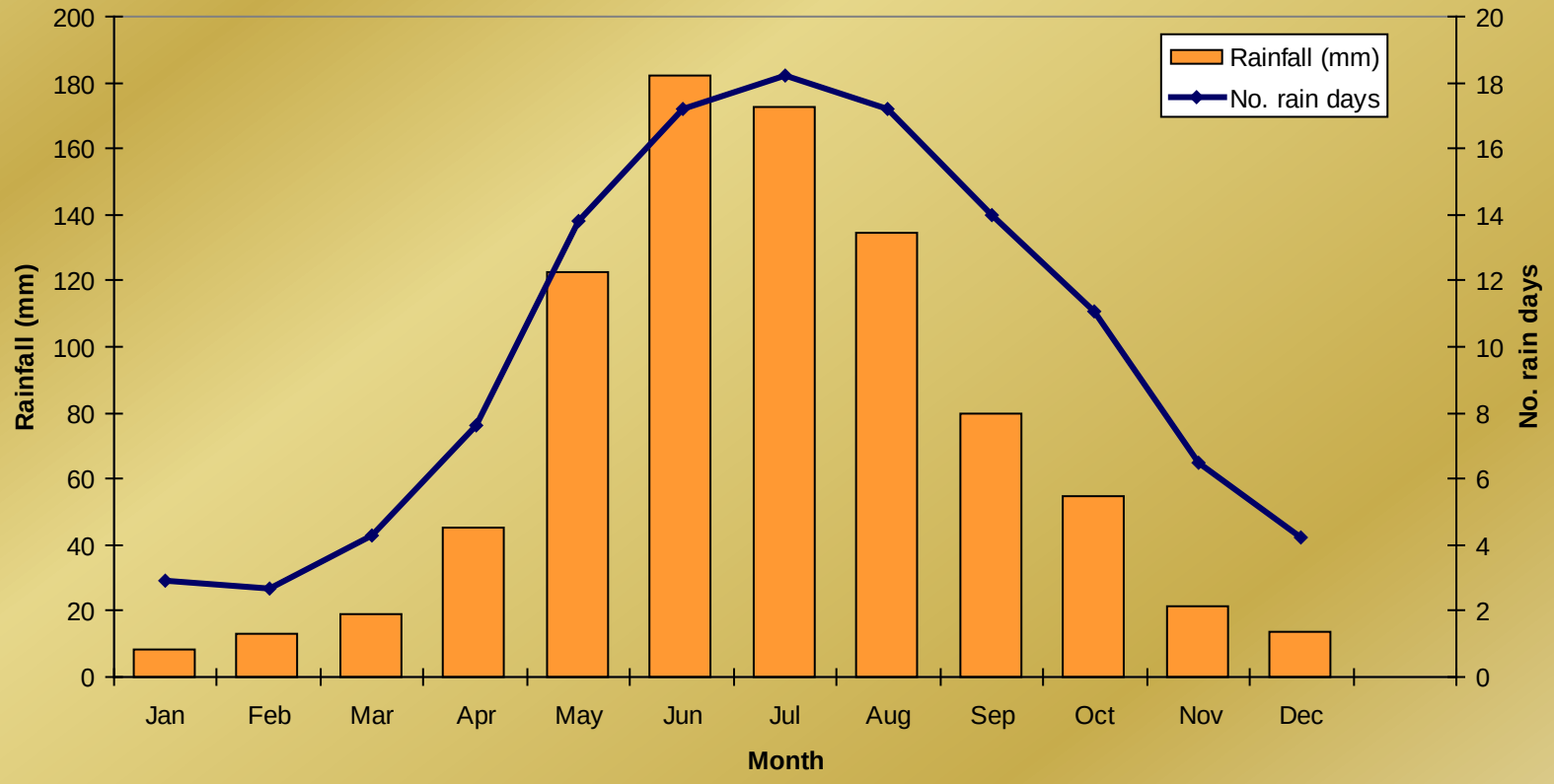
- Using indicators to define fire regime tolerances.
- If current forest fire regimes are within these limits, then we can be confident that they are ecologically sustainable.

Some indicators of ecologically sustainable fire regimes

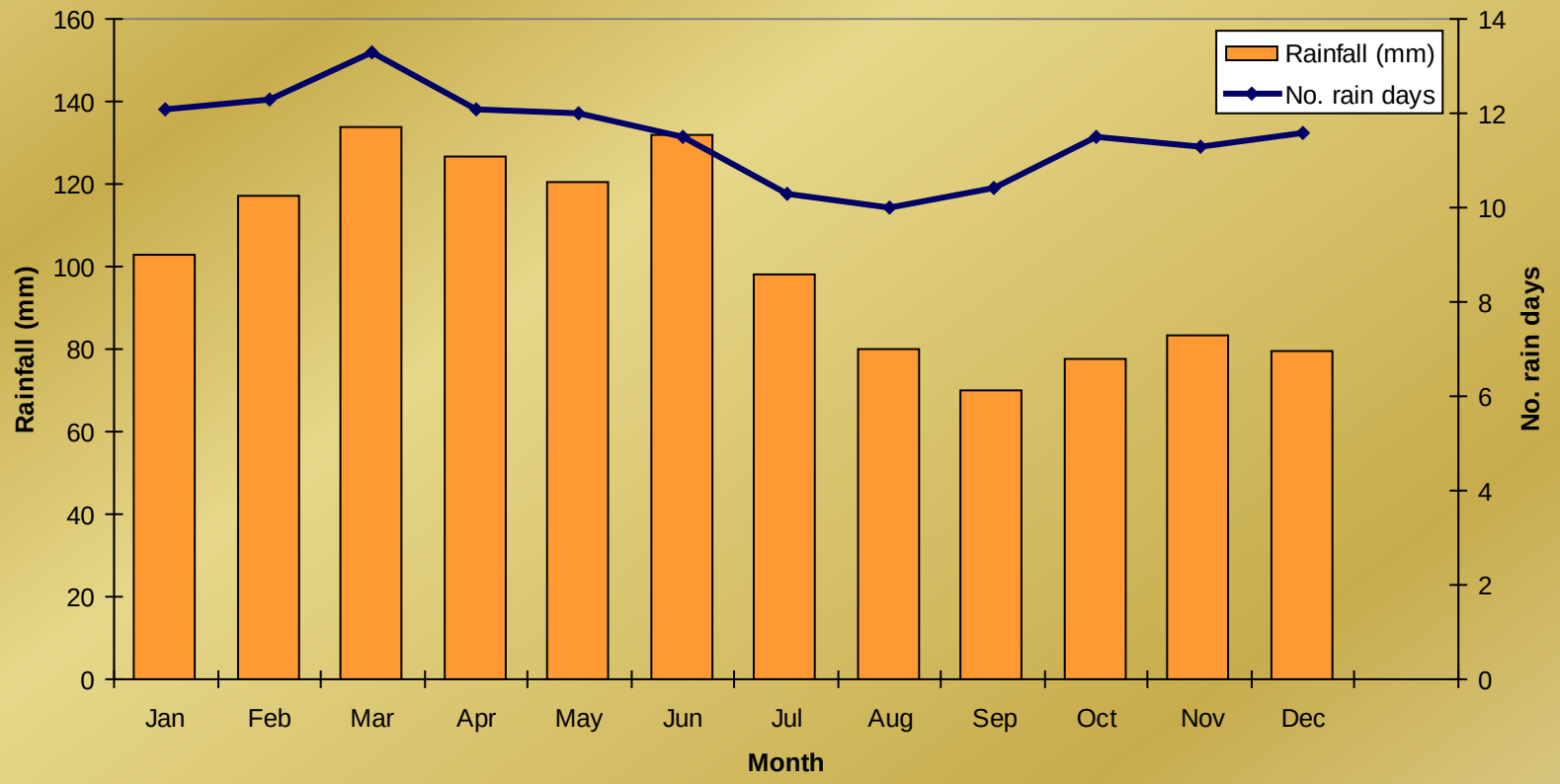
- **Climatic:** Characterise regional fire proneness
- **Historic:** Provide fire regime bounds
- **Biological:** Define fire intervals, season, intensity, scale & patchiness

Climatic indicators - jarrah forests

- Mediterranean type



Mean Monthly Rainfall and No. of Rain Days for Sydney, NSW

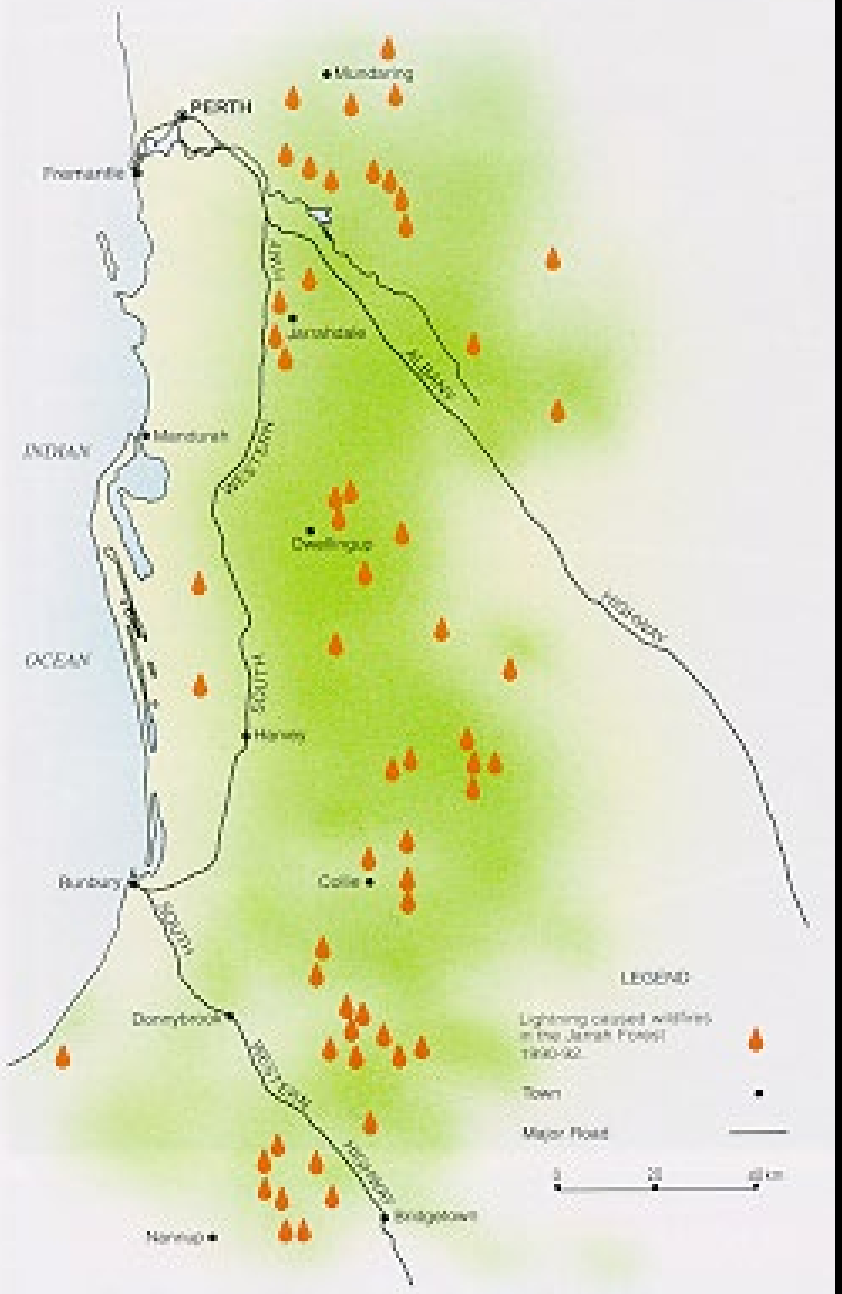


Climatic indicators - jarrah forests

- Mediterranean type
- Annual summer drought
- 140-160 dry fuel days annually
- Up to 30 lightning-caused wildfires annually

Climatic indicators - jarrah forests

- Mediterranean type
- 140-160 dry fuel days annually
- Annual summer drought
- Up to 30 lightning-caused wildfires annually
- Region characterised as “fire prone”


Mundaring
PERTH
Fremantle
Jarrahdale
Armadale
Mandurah
INDIAN
OCEAN
Dwellingup
Harvey
Bunbury
Collie
Donnybrook
Bridgetown
Nannup
LEGEND
Lightning caused wildfires in the Jarrah Forest 1960-62
Town
Major Road

Historic indicators jarrah forests

- Extensive, frequent use of fire by Nyungars
- Fires in spring/summer/autumn
- Mostly low intensity, occasionally high intensity
- Balga trees show 3-4 year fire intervals in drier parts of the forest
- Riparian areas and low fuel habitats burnt less frequently

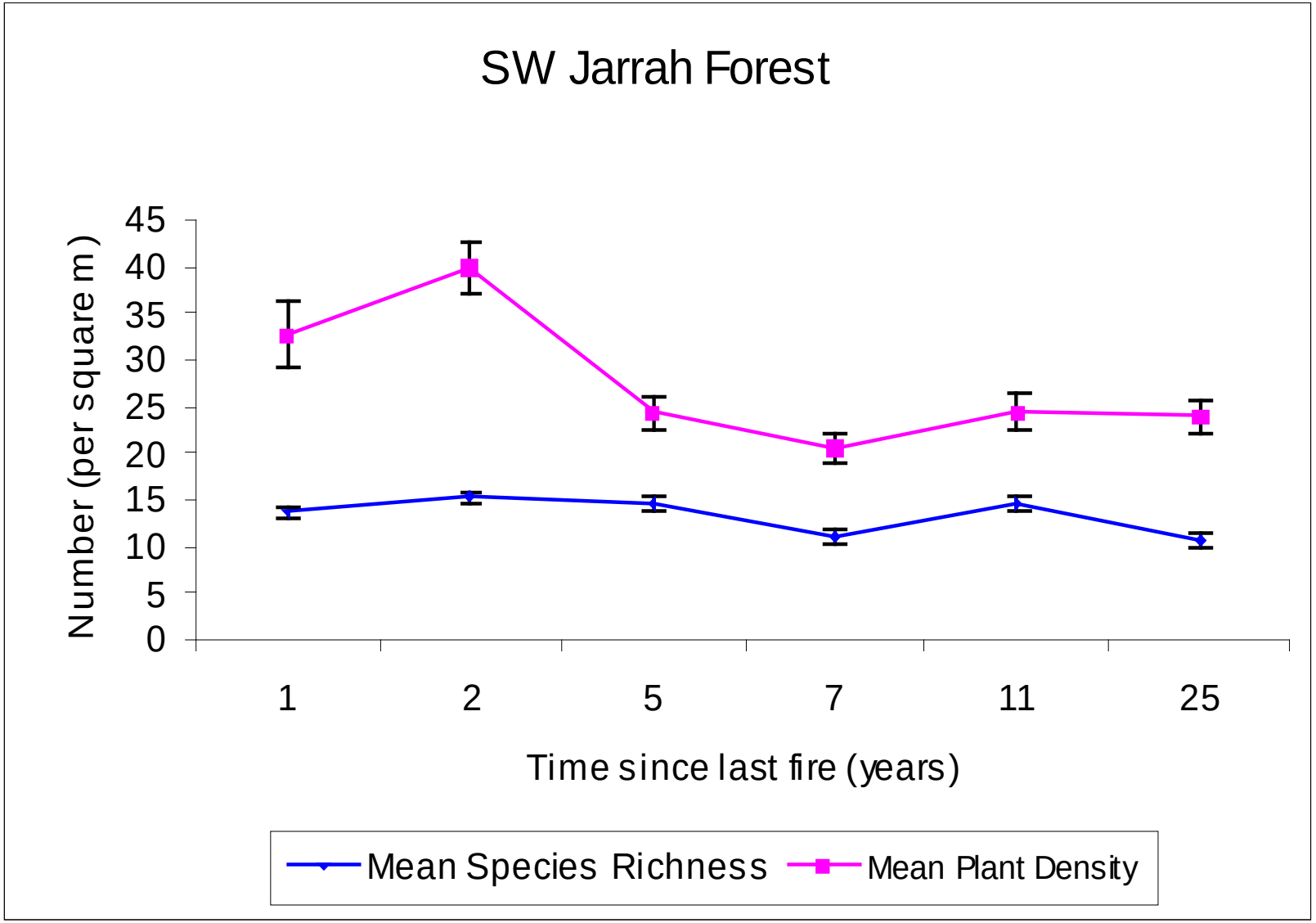
Biological indicators flora


T1-4M
P6-101


T1 - 1
P6 -101

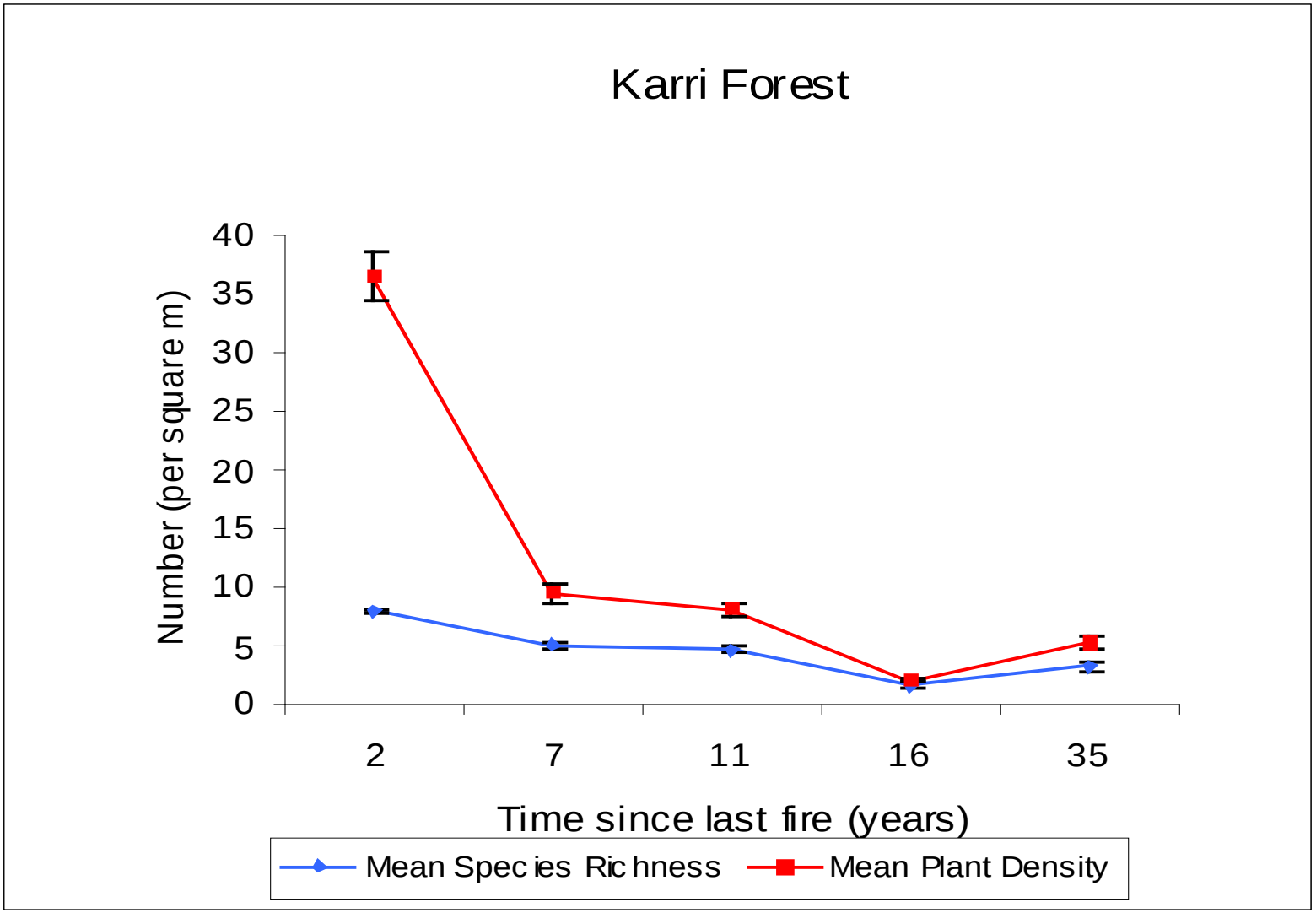
Plant community responses to a fire

Species richness & abundance with time since fire

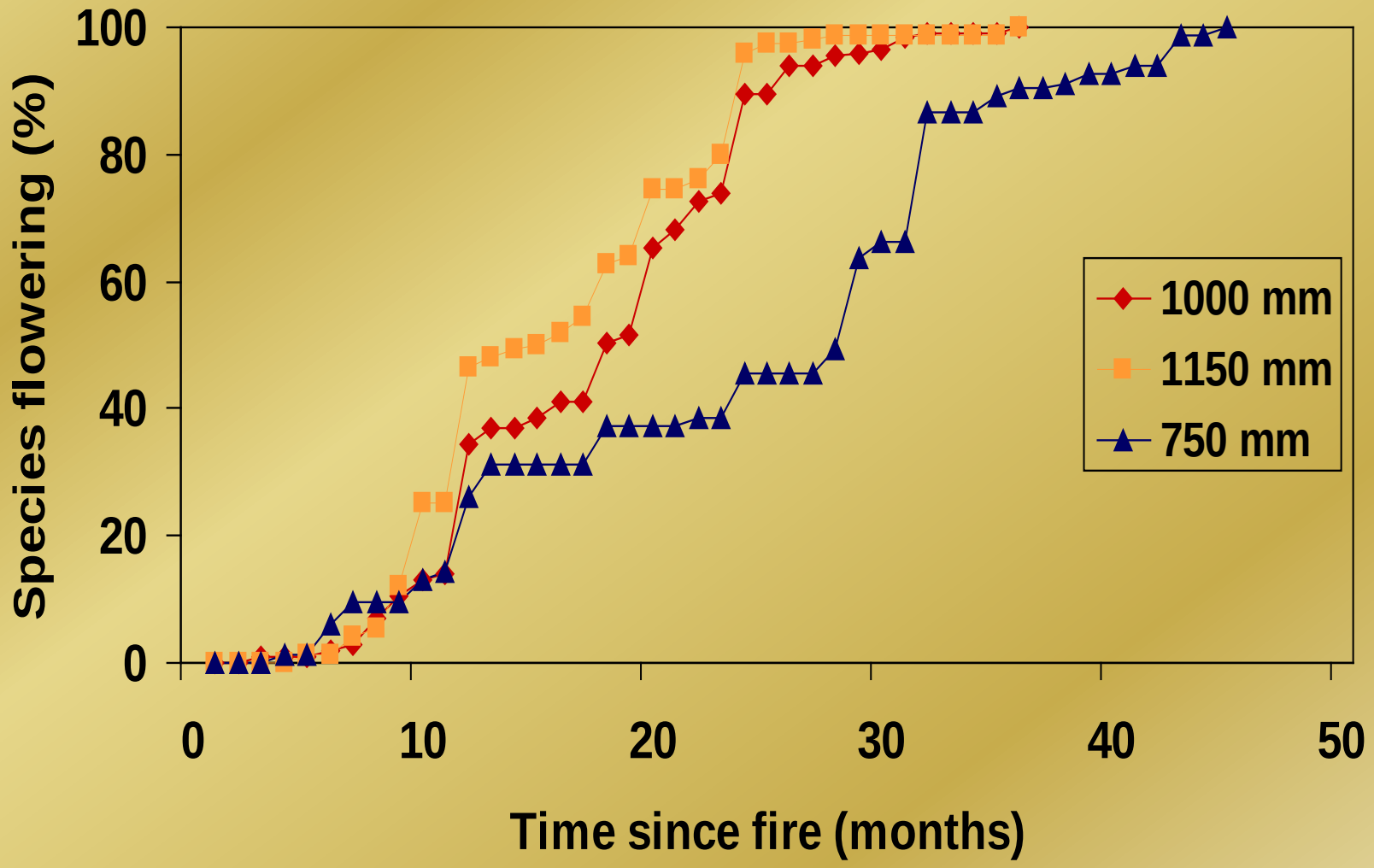


Plant community responses to a fire

Species richness & abundance with time since fire



Time to first flowering after fire for some 400 upland forest understorey species

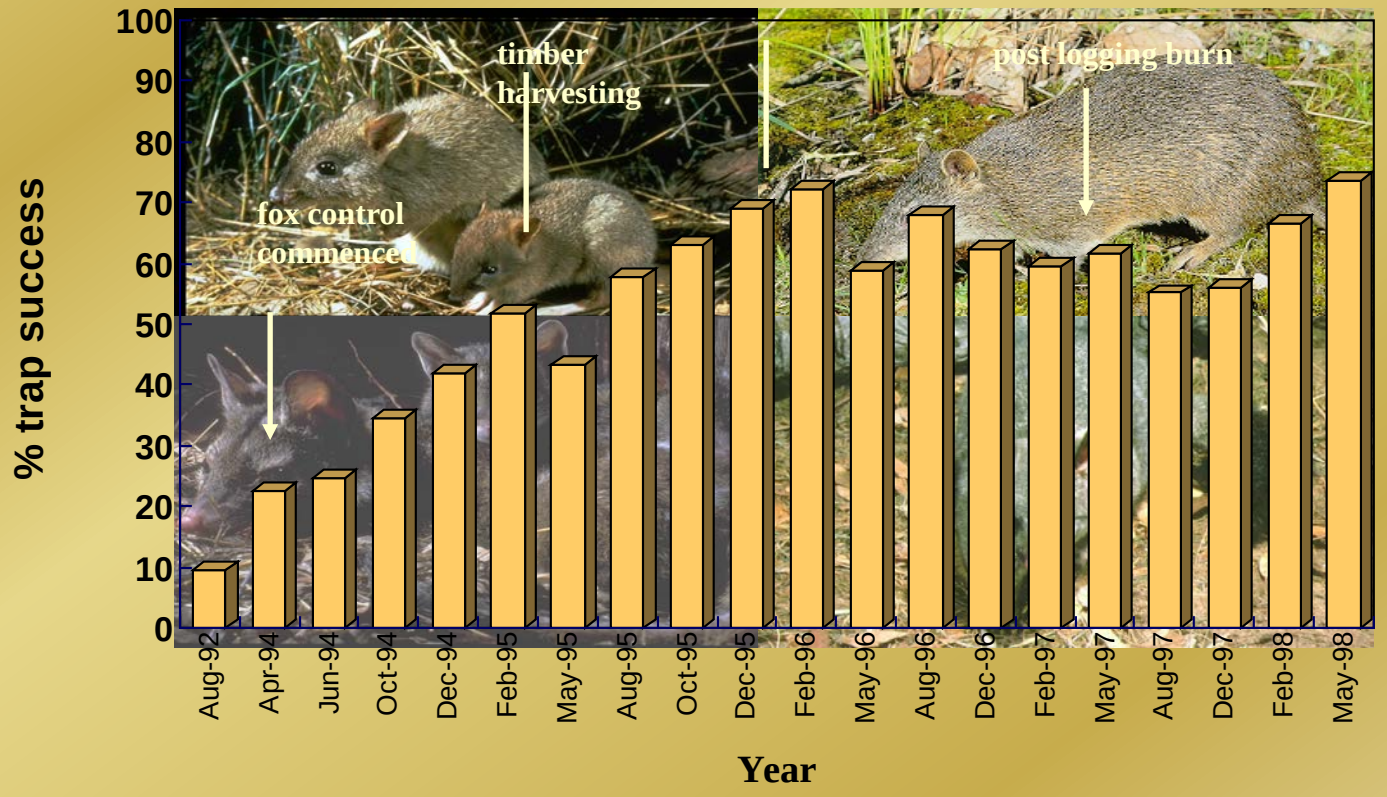


Biological indicators (*flora*) - jarrah forests

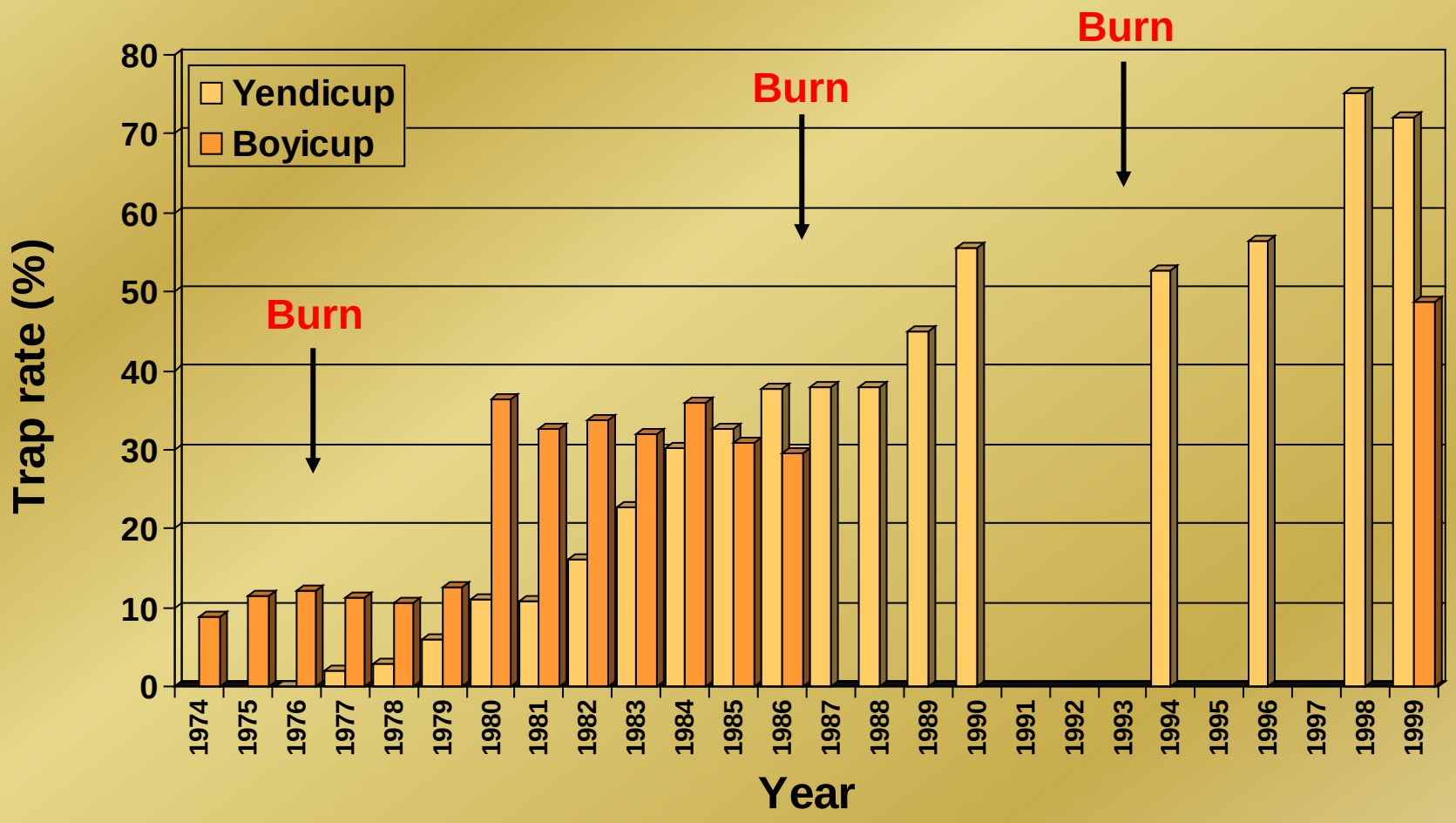
- Some obligate seeders on moist sites flower 6-8 years after fire.
- Thicket-forming species in broad valley floors are obligate seeders and depend on dry fires for regeneration.
- Seedling regeneration and survival is most prolific after summer/autumn fire.

Biological indicators (*fauna*) - Jarrah Forests

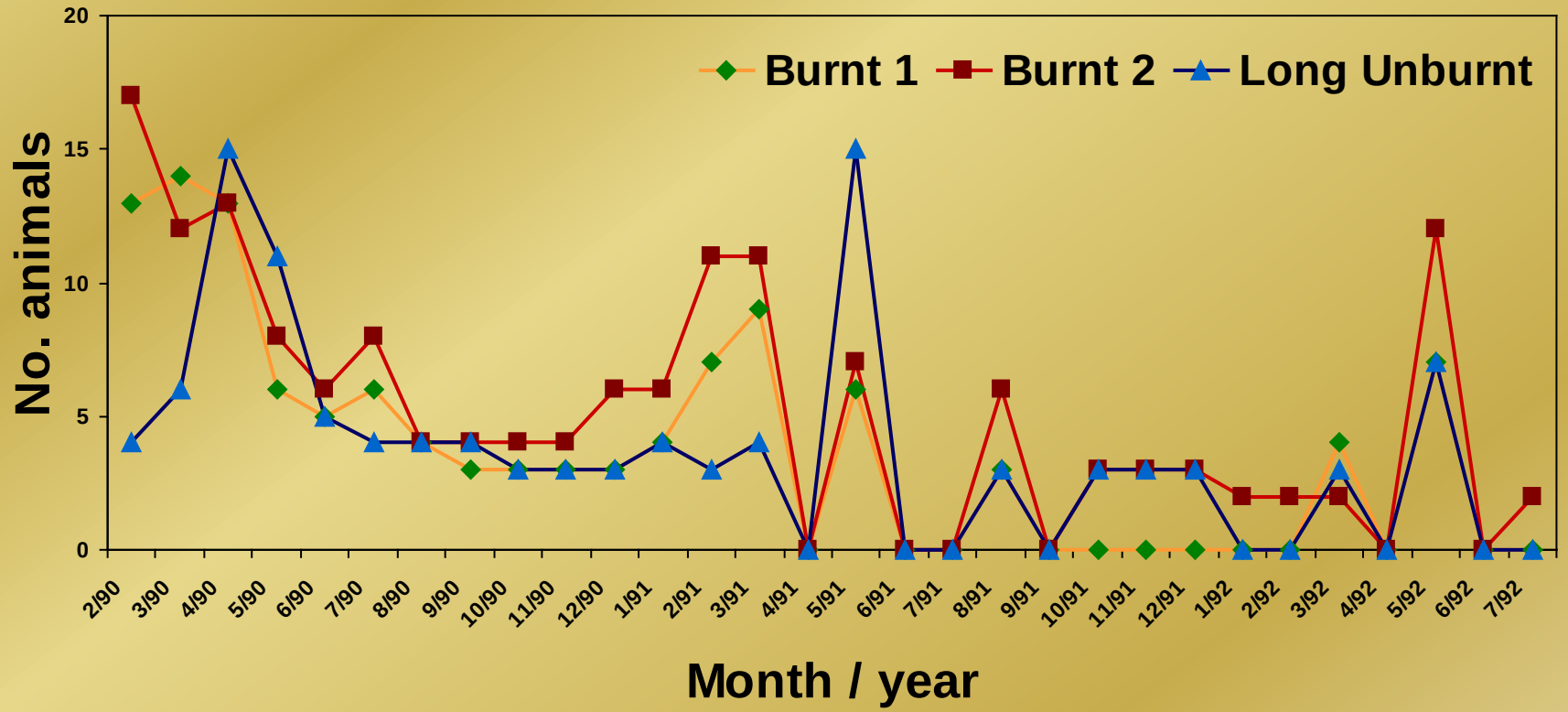
Trap success rates for medium sized mammals in logged and burnt forest



Mammal trap rates in Perup forest

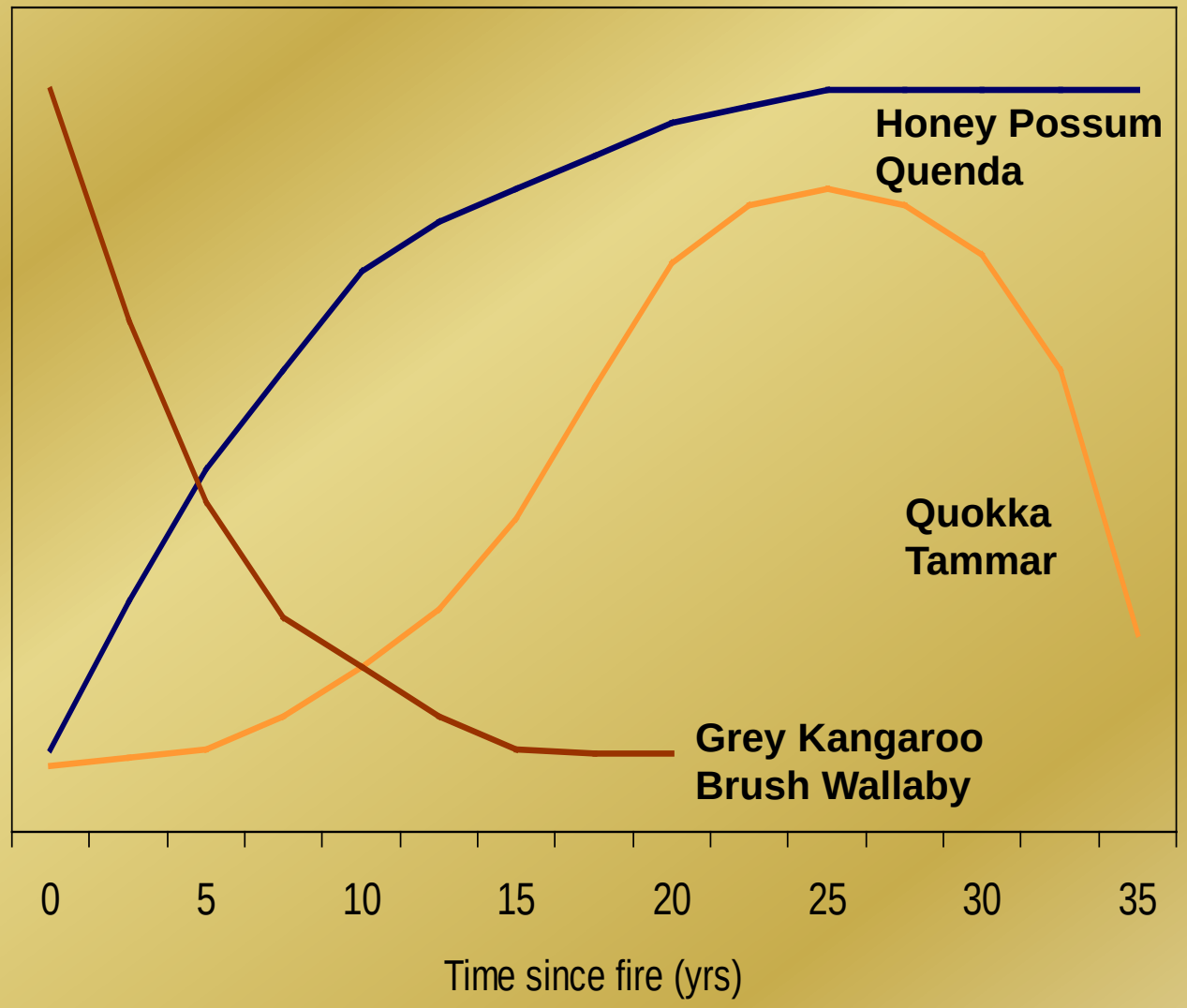


Response of Red-tailed Phascogale to a 100 ha fire



•(Burrows &Friend 1998)

Generalised post-fire population trends for some jarrah forest mammals



Biological indicators (*mammals*) - Jarrah Forests

- Behavioural and biological adaptations to fire
- No single fire interval is optimal for all species
- Severity of fire impact proportional to fire size and intensity

Birds

- Some species are disadvantaged by recent fires and others are advantaged
- Large intense wildfires reduce bird abundance by up to 60% but it recovers in 3-5 years
- Low intensity patchy fires have little long-term effect on bird populations in jarrah forest

Fire & Invertebrates

- Resilience and stability maybe adversely affected by frequent and large scale fires under dry conditions.
- Invertebrates vary in their response to fire. Some prefer frequent fire, others infrequent fire. Some prefer spring fire, others prefer autumn fire.
- At the landscape scale, species richness is optimised by diverse fire regimes.

To Summarise

- Forests are a complex mosaic of plant communities that vary in their response to fire.
- Forest plants display a variety of fire adaptive traits.
- Many (but not all) plants & communities benefit from fire at some stage in their life cycle to stimulate regeneration and reproduction.
- No single fire regime benefits all species.
- Diverse fire regimes at appropriate temporal & spatial scales promotes floristic and structural diversity.
- Fire is integral to forest management

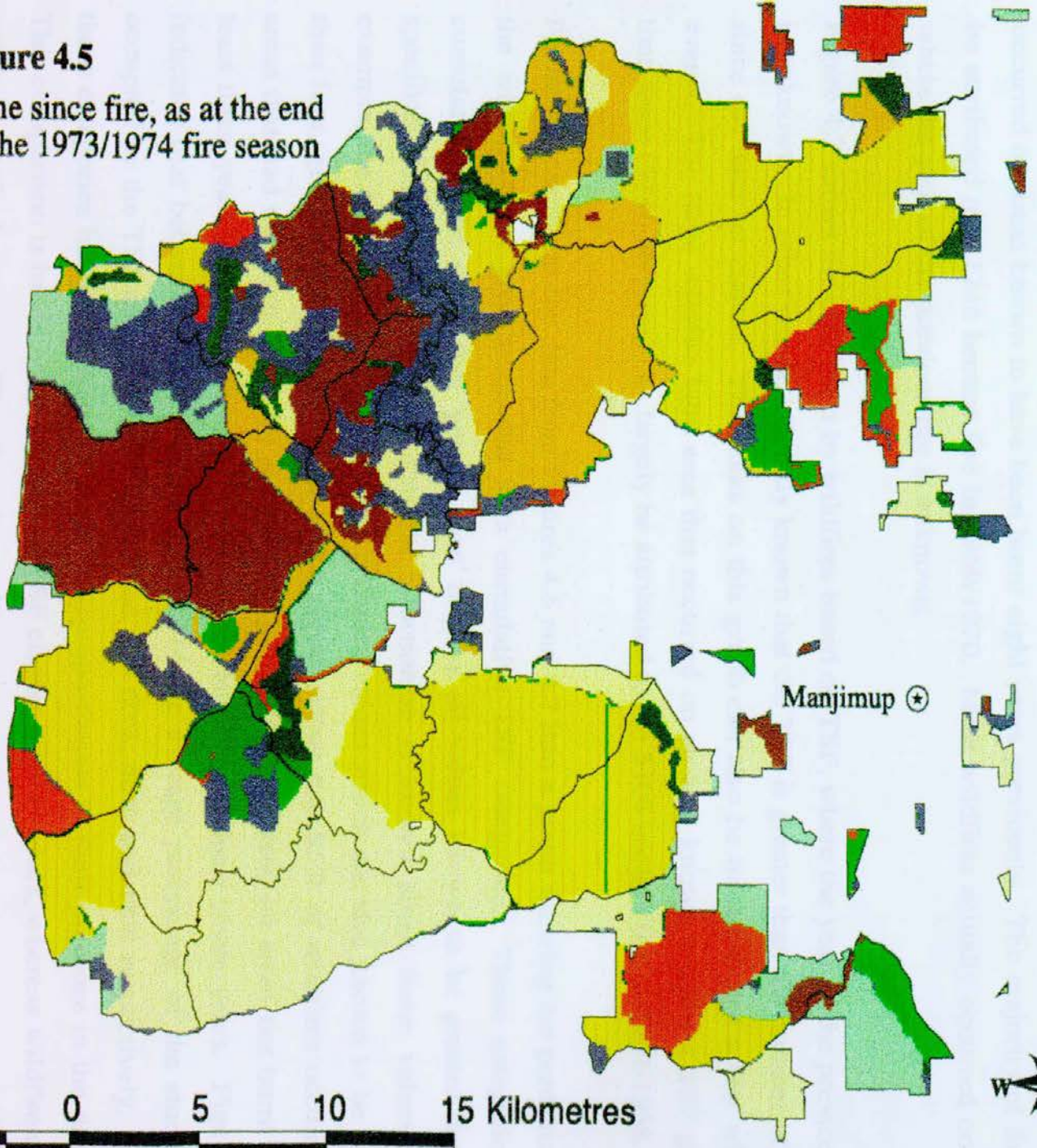

“Is the use of fire in forestry operations ecologically sustainable?”

Five-way test for ecologically sustainable forest fire management

1. Does fire management restrict frequency of large wildfires?
2. Does fire interval allow for replenishment of seed banks?
3. Does the fire regime include a fire-free period to allow for maturation of special habitats?
4. Does the fire regime include seasonal diversity?
5. Does the fire regime maintain a fire-induced mosaic at the appropriate scale?

Figure 4.5

Time since fire, as at the end of the 1973/1974 fire season



Prepared by: David Robertson
University of Western Australia
5 October 1998

Further reading

- Abbott and Burrows (Eds.) 2003: Fire in ecosystems of south-west Western Australia: impacts and management. Backhuys publishers, The Netherlands

- Draft Forest Management Plan (2002). Conservation Commission of Western Australia