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PROGRAM B

Reconstructing the fire history of an unmanaged semi-arid landscape: Lake Johnston Region, WA

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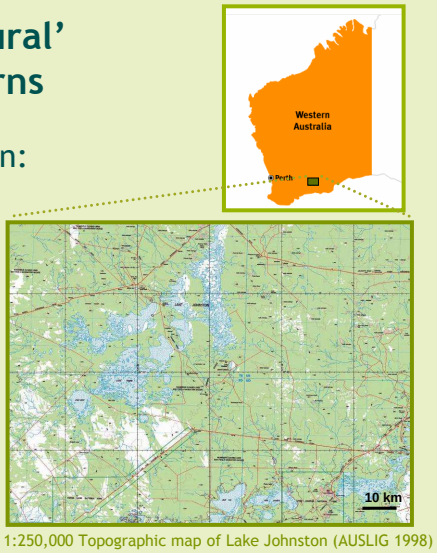
Government of Western Australia — Department of Conservation and Land Management — Conserving the nature of WA

The University of Western Australia

Understanding 'natural' historical fire patterns

The Lake Johnston region:

- Extensive area (~15,500 km^2)
- Minimal fire intervention
- Relatively unaltered fire history



1:250,000 Topographic map of Lake Johnston (AUSLIG 1998)

Approach

1. Map fire history:
   Digitally map fire scars from aerial and satellite imagery
2. Validate mapped fire history:
   Dendrochronological analysis of *Callitris* populations
3. Stratify Landscape:
   According to: time since last fire, number of repeated fires
4. Characterise fire history:
   Determine fire attribute distributions
5. Utilise fire history database:
   Investigate drivers and constraints of fire patterns and interactions with vegetation distribution

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Step 1: Map fire history

- Available data: Aerial photo-mosaic (1958) and satellite imagery (1972-2005)
- Visible fire scars persistent for up to 20 years
- Fire history information >60 years

1958 Aerial photo-mosaic

2004 Satellite image

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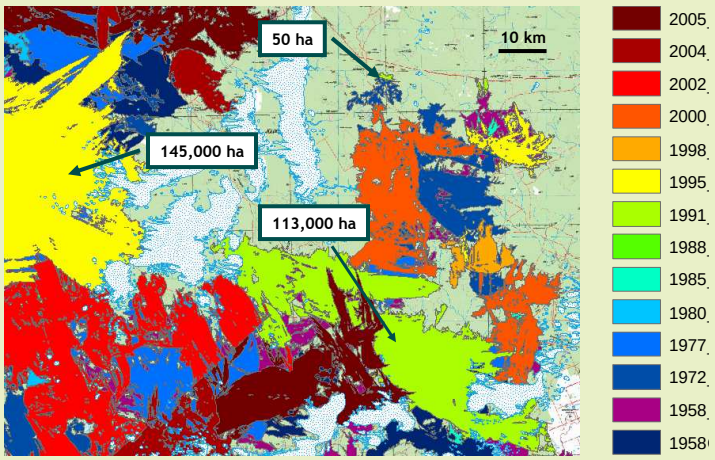
Step 1: Map fire history



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Step 1: Map fire history

- High frequency of satellite images since 1980s
- Post-1985 fire dates known
- Pre-1985 fire dates uncertain

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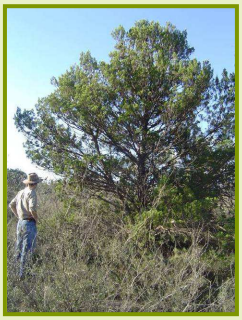
Step 2: Validate fire history database

Two native conifers widespread in the Lake Johnston region: *Callitris preissii* & *Callitris canescens*

- Distinct growth rings
- Thin bark – 'fire sensitive'
- Obligate seeders – poor capacity to resprout



Callitris preissii

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Step 2: Validate fire history database

Dendro*pyro*ecology usually examines 'fire scars'

Fire-killed 100+ yo *Callitris preissii*

Seedlings 4 years after fire

Fire-scarred *Pinus edulis*

Callitris killed outright & are serotinous seeders

- Establishment dates

Step 2: Validate fire history database

Stand age structure indicative of fire history:

- Even aged stands = *time since last fire*
- Fire-killed stands = *interval* between successive fires

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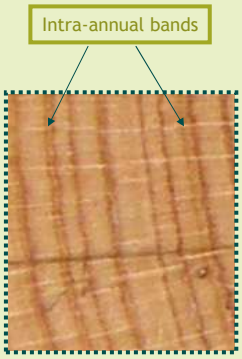
Step 2: Validate fire history database

Dendrochronological potential of *Callitris*

- Narrow rings (0.1-0.5mm)
- Intra-annual ("false") rings

Douglas Fir, *Pseudotsuga menziesii*

Callitris preissii



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Step 2: Validate fire history database

L. Cullen & P. F. Grierson (In prep.)

- *Callitris columellaris*
- Lake Tay, WA ← Within the Lake Johnston Region
- ~350 year chronology
- Series inter-correlation (R = 0.67)

C. Sgherza (Hons., UWA, 2006)

- *C. canescens* & *C. preissii*
- Lake King, WA ← ~100 km west of the Lake Johnston region
- 200 year chronology
- Series inter-correlation (R = 0.8)

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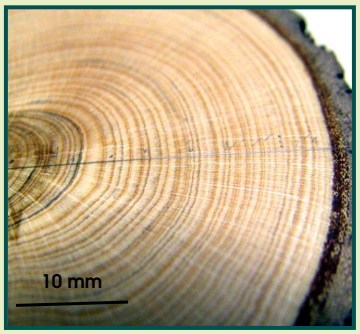
Step 2: Validate fire history database

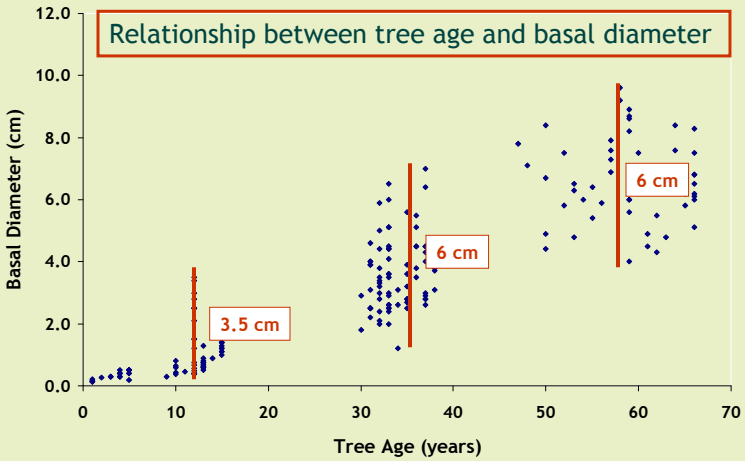
Calibration:

- Recent (post-1985) fire scars of known dates
- Post-fire lag in germination ~1-2 yrs
- Calendar dates assigned to pre-1985 fires



Growth rings of *Callitris preissii* established in 1957

Step 2: Validate fire history database



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Step 2: Validate fire history database

Potential of *Callitris* as a bio-indicator of fire (and in dendrochronology)

- Even aged stands (range = 2-5 years)
- High correlation among ring width chronologies (R = 0.6-0.8)
- High mean sensitivity (~0.4)

Callitris has significant potential in dendroecology

Fire-killed *Callitris preissii* (2004)

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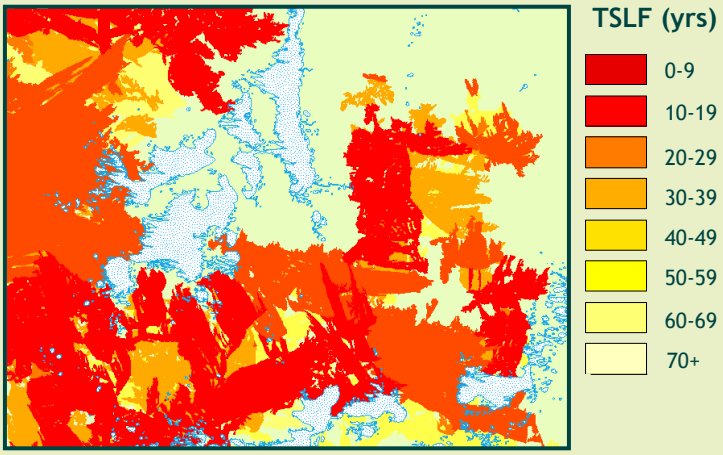
Time since last fire:



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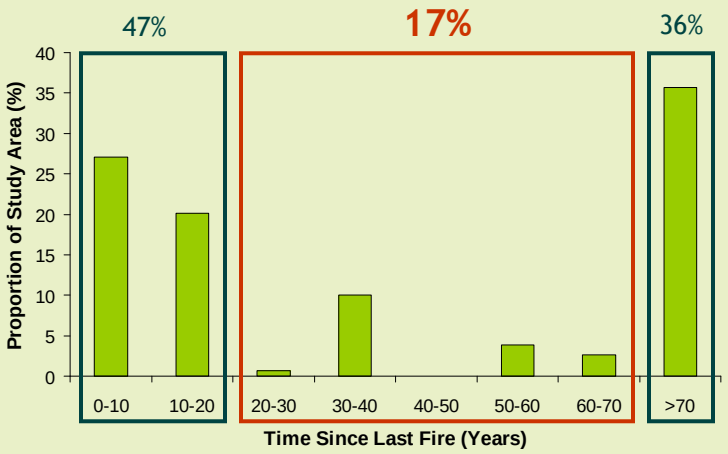
Time since last fire:



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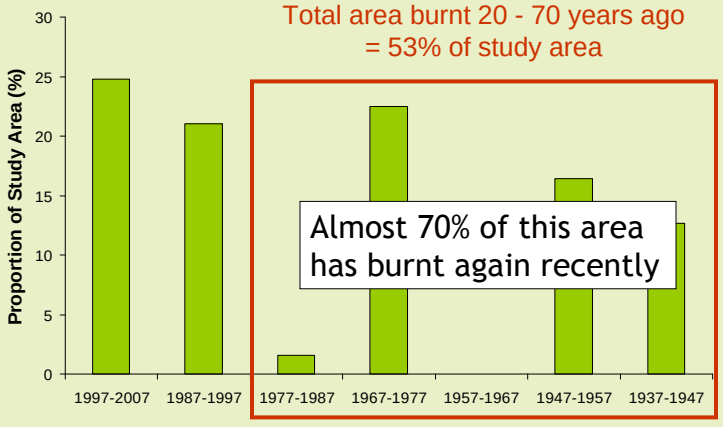
Area burnt by decade



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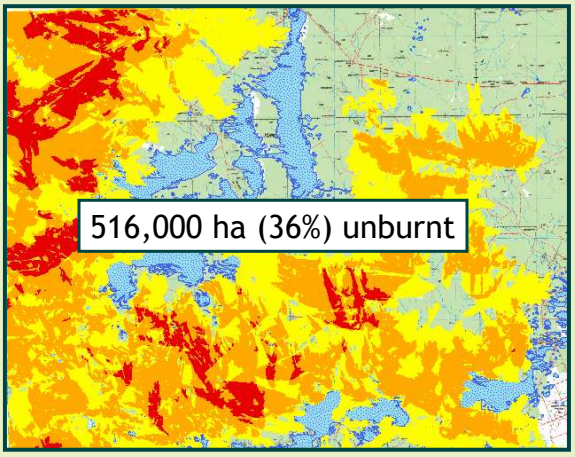
Number of repeated fires:



Number of fires

- 1
- 2
- 3

449,500 ha (32%) burnt once

372,250 ha (27%) burnt twice

75,000 ha (5%) burnt three times

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Expected outcomes

1. Comprehensive fire history database
2. Knowledge of landscape-scale fire patterns
3. Contribute scientific expertise relevant to fire management in semi-arid landscapes

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