# MANAGING BUSHFIRE IN THE NEW MILLENNIUM


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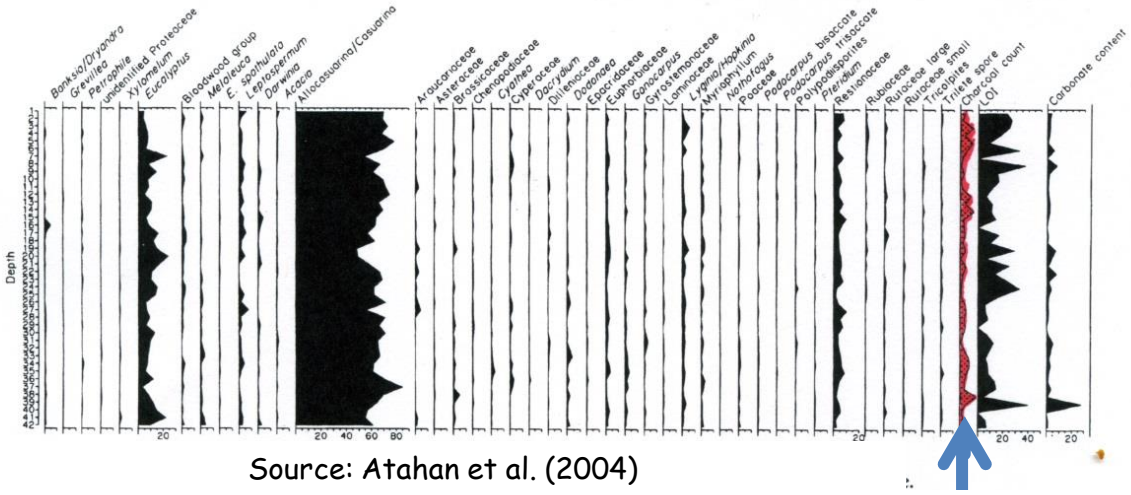
# Once upon a time in a land far away…

## before people;

- Australia was a wilderness
- Charcoal in the Pliocene sediment
- Vegetation, climate & lightning- fire regime drivers
- Fire – an evolution force

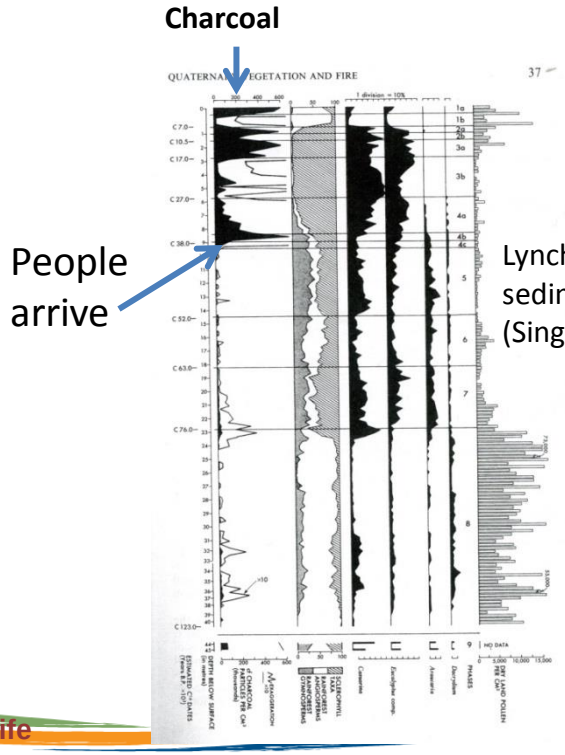



Source: Atahan et al. (2004)

Charcoal

# ~50k bp - people arrive

- Aboriginal people used fire skilfully and purposefully
- Fire frequency increased
- People were the predominant ignition source
- A new dynamic equilibrium established
- Likely a fine-scale mosaic of diverse seral stages (fuel ages)




Great Sandy Desert, WA 1953 (source: RAAF)
1 km

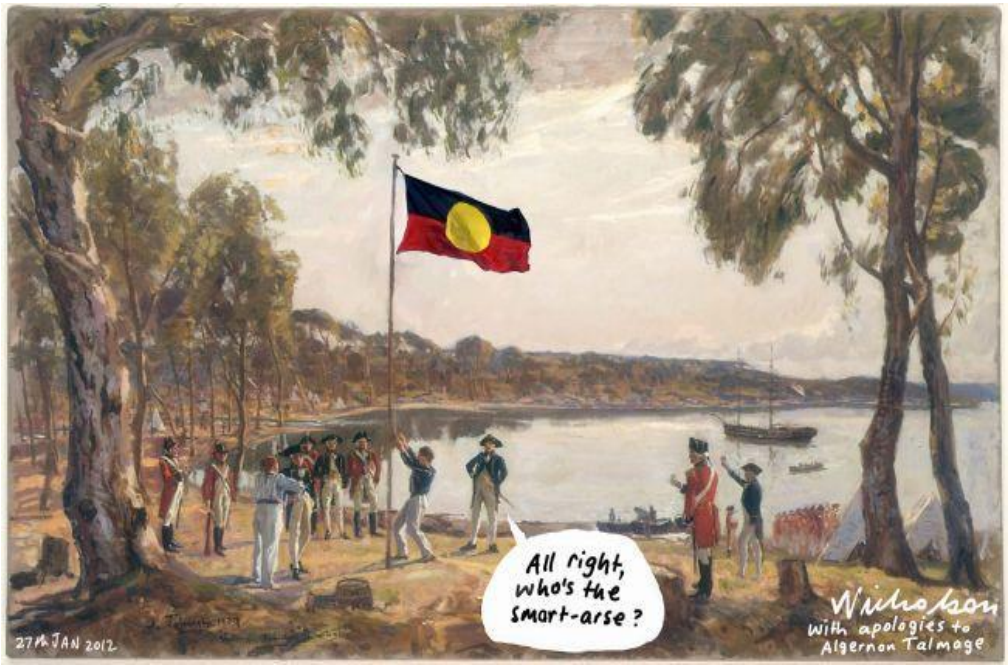
# Pintupi and fire

Fire important physically and spiritually

- Used fire for many reasons
- Most fires small but some large
- Burnt when spinifex was ‘dense’
- Early growth stages most valued

# European colonisation

- Aboriginal people displaced, population decimated, burning practices disrupted
- Europeans 'fire-phobic'
- First Bushfire Ordinance in Swan River Colony 1847:
  "*Minors and Aborigines to be flogged for lighting fires*"
- By 1860s, Aboriginal burning virtually extinguished in southern Australia
- By 1960s, Aboriginal burning in central and northern Australia extinguished or disrupted
- Fire regimes changed



# Depopulation of the Western Desert

virtually complete by 1960s - fire regime flipped within 15 years

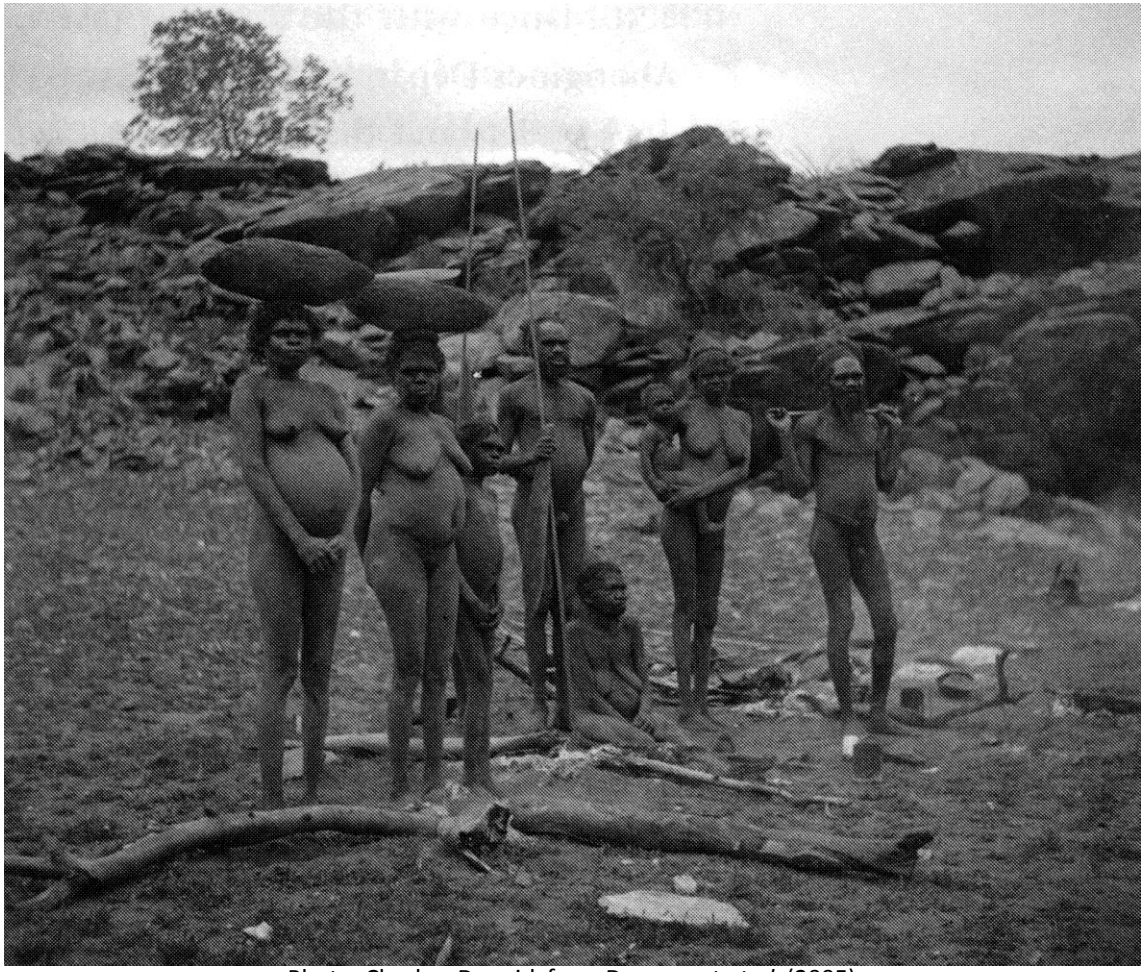


Photo: Charles Duguid, from Davenport *et al*. (2005)

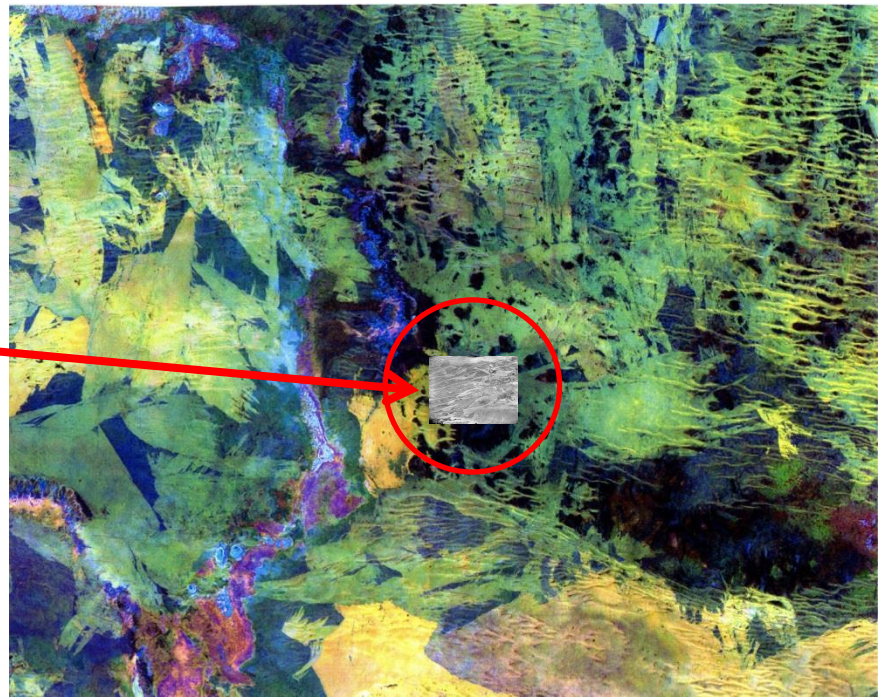
# Fire regime changed rapidly and dramatically following depopulation of the desert

8 km

People in the landscape (pre-1960s)

Mostly frequent, small, low intensity cool season Aboriginal fires

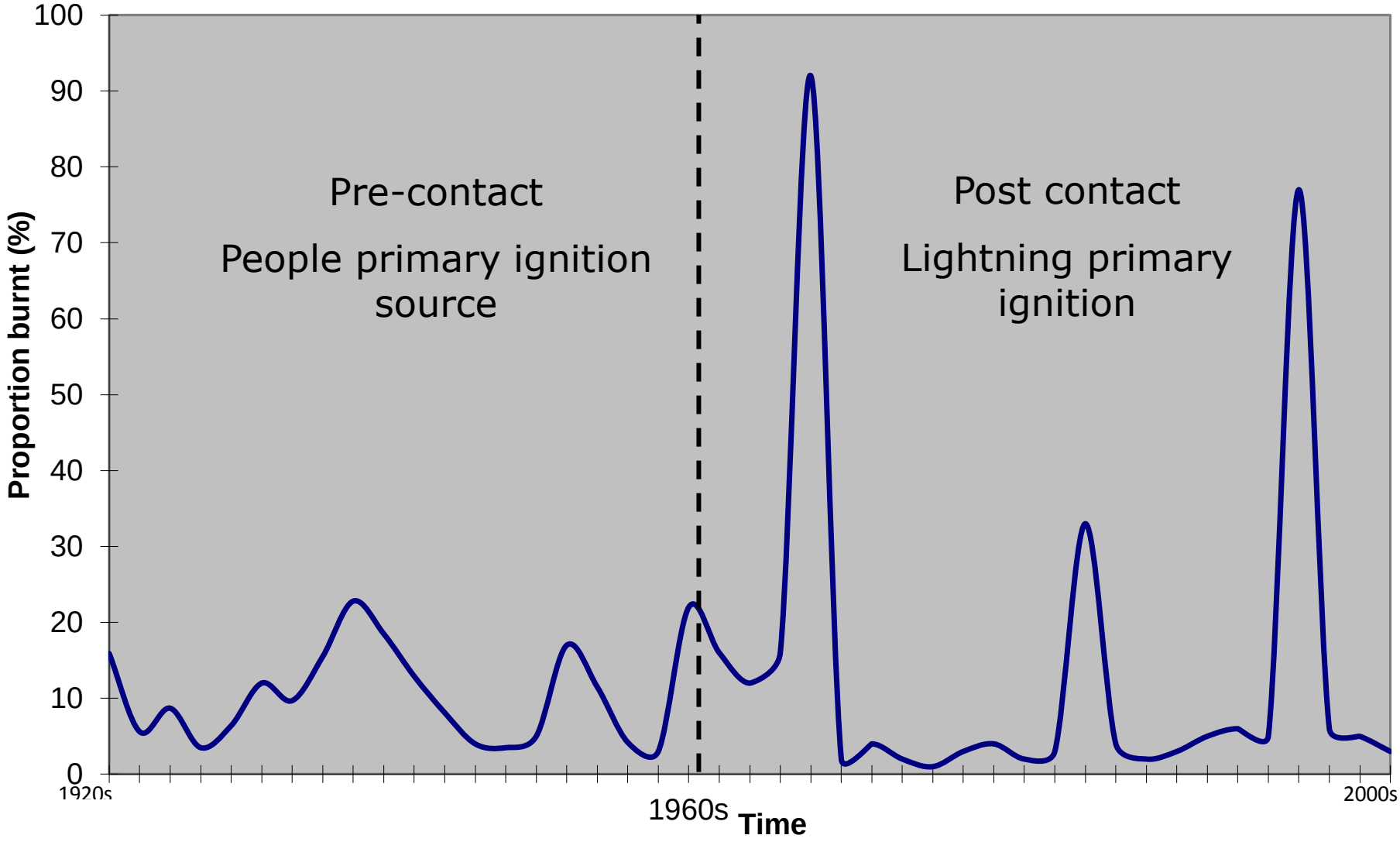
80 km



No people in the landscape (post 1960s)

Mostly infrequent, large, intense, hot season lightning fires

# Reconstruction of the trend in annual area burnt pre- and post contact in a Western Desert landscape



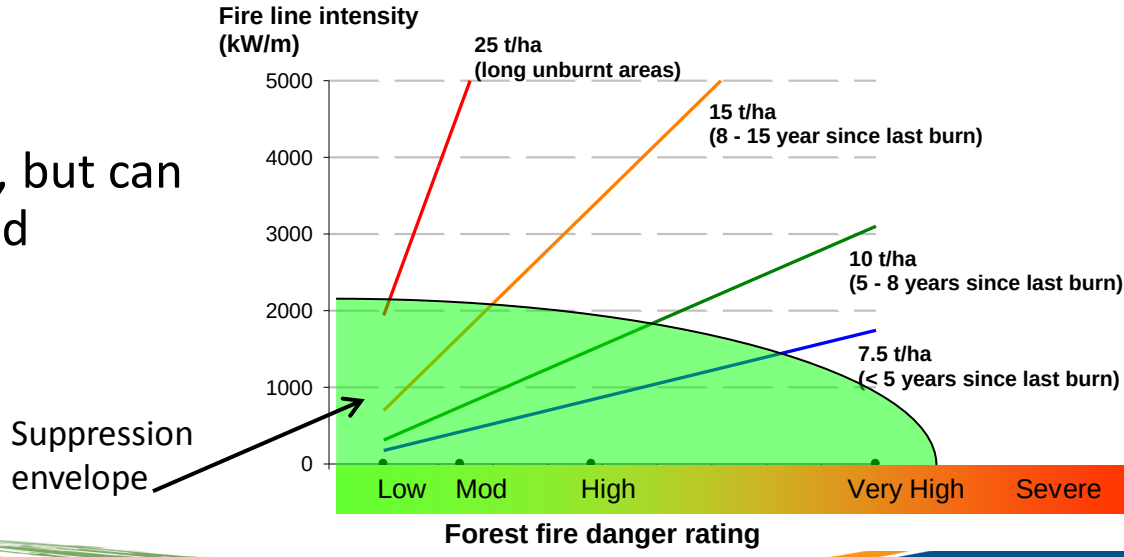
# The European solution – southern Australia

## fire exclusion and suppression early 1900s-1950s

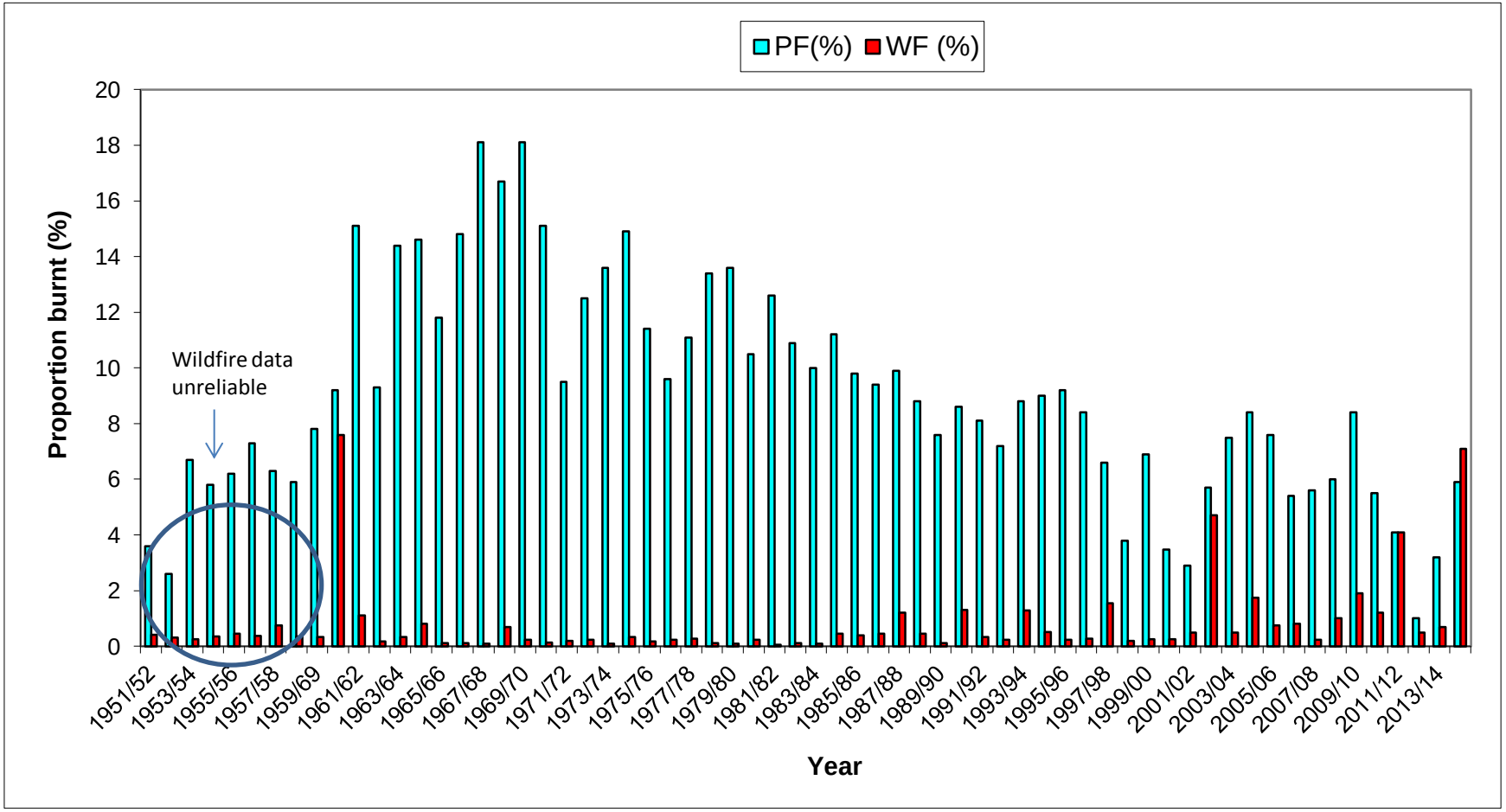

# Fire exclusion eventually fails

## Policy change to prescribed burning

- If fuels are allowed to build up over large areas, suppression will fail and large damaging bushfires will result
- Reducing fuel load and flammability reduces the speed and power of a bushfire
- Does not prevent bushfires, but can reduce their severity and aid suppression



# Proportion of the south west WA forest region (2.5M ha) burnt by wildfire and prescribed fire annually 1951/52 - 2014/15 (63 yrs)




Source: Departmental Annual Reports; Burrows and McCaw 2013

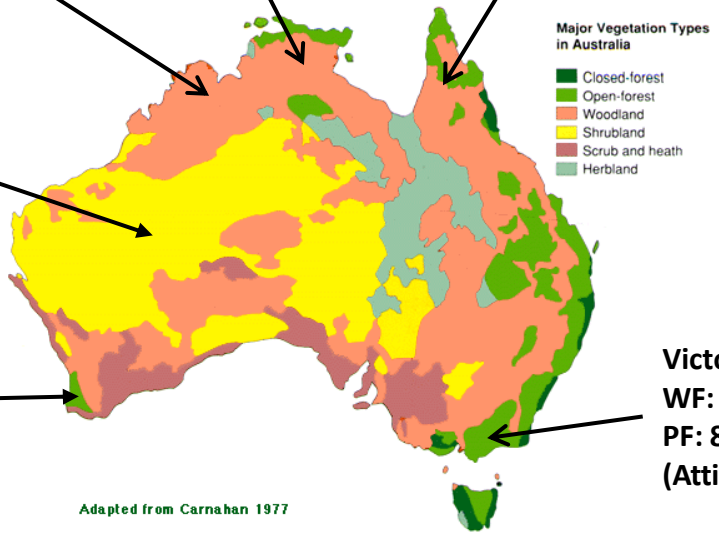
# Mean annual area burnt by wildfire (WF) and prescribed fire (PF) in the last decade (or so)

**Kimberley woodland savanna (2005-2015)**
**WF: 5.25 M ha/annum (25.6%)**
**PF: 2.25 M ha/annum (11.3%)**
**(NAFI; DPAW)**

**NT woodland savanna (2005-2015)**
**Area burnt: 16.8 M ha / annum (31.2%)**
**(NAFI)**

**Cape York woodland savanna (2005-2015)**
**Area burnt: 8.98 M ha/annum (22.9%)**
**(NAFI)**

**Western Desert spinifex (2000-2015)**
**WF: 5.5 M ha/annum (8.6%)**
**PF: 0.6 M ha/annum (1.0%)**
**(DPAW)**



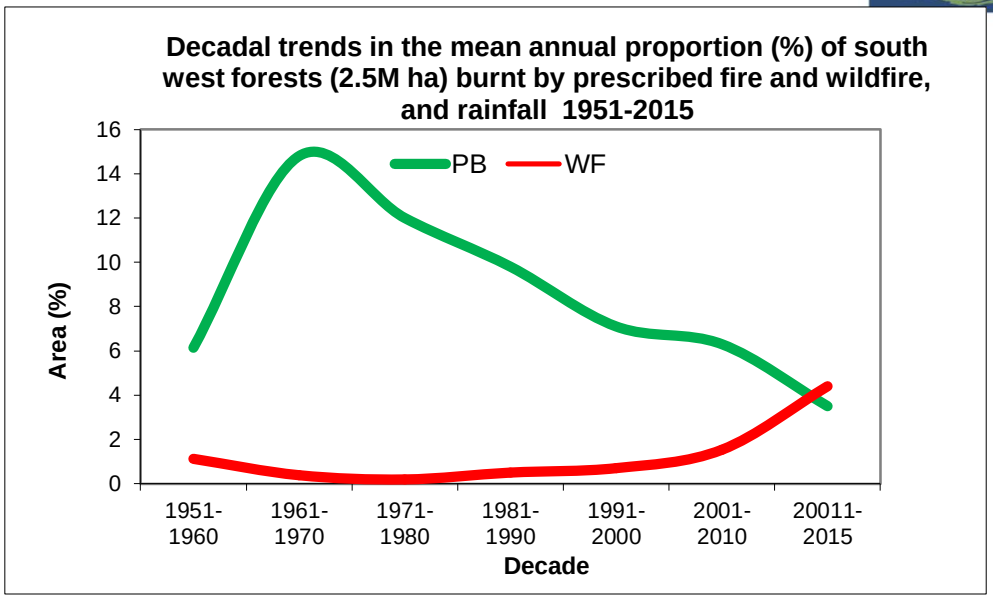

**South-west forests (2005-2015)**
**WF: 45,385 ha/annum (1.8%)**
**PF: 132,129 ha/annum (5.2%)**
**(DPAW)**

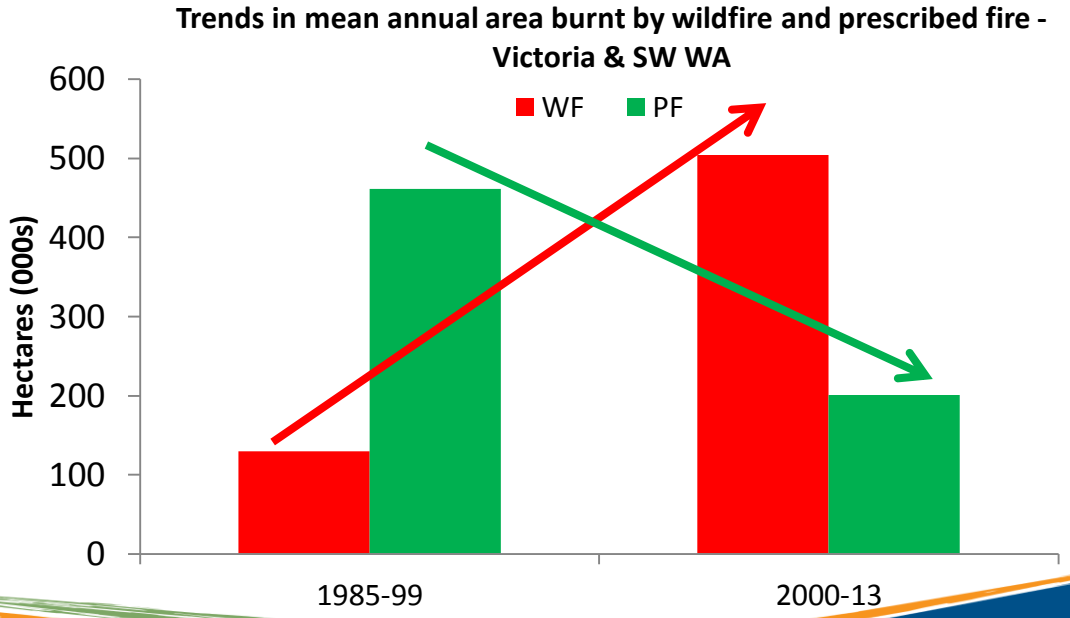
**Victoria (forests) (1997-2010)**
**WF: 428,000 ha/annum (5.4%)**
**PF: 89,000 ha/annum (1.2%)**
**(Attiwill and Adams 2013)**

# An alarming trend

## Coincidence or cause and effect?

- In SW WA, prescribed burning reduced the scale of bushfires 1960s-1990s.
- BUT big fires return in the new millennium
- Similar pattern across southern Australia
- Similar pattern in central and northern Australia following cessation of traditional Aboriginal burning



Waroona fire WA Jan. 2016
Lightning - 70,000 ha
2 lives, 150+ homes
Total Cost: $155 million

# Fire ain't fire

Prescribed fire
- ❑ Time, place and conditions known
- ❑ Spatially 'controlled' and usually small
- ❑ 'Cool' fire
- ❑ Frequent
- ❑ Low impact
- ❑ Patchy (area burnt)

Wildfire
- ❑ Time, place and conditions unknown
- ❑ Spatially 'uncontrolled' and can be very large
- ❑ 'Hot' fire
- ❑ Infrequent
- ❑ High impact
- ❑ Homogenous (area burnt)

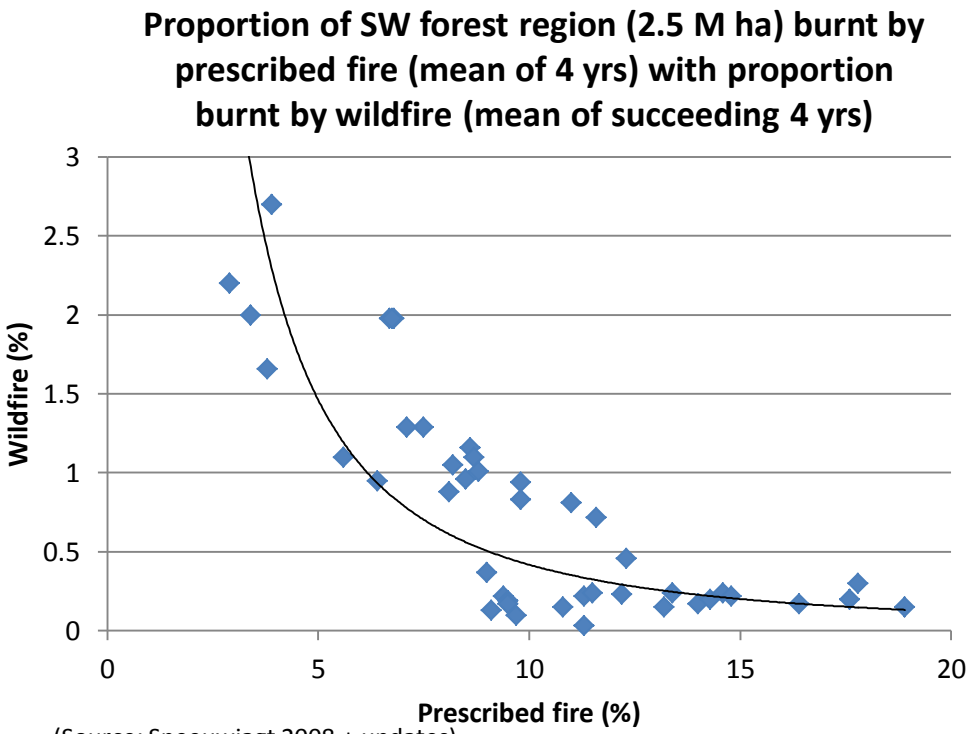
# And prescribed fire ain't prescribed fire

To be *effective, prescribed burning must be:

- ❑ Strategic
- ❑ Done at appropriate temporal and spatial scales
  - ❑ Large cells
  - ❑ At least 8-10% treated each year
  - ❑ At least 40% ≤ 4 years old
- ❑ Done to appropriate standards

Otherwise, it will be ineffective

(*effective: <1% per annum burnt by wildfire, acceptable residual risk, acceptable losses)



(Source: Sneeuwjagt 2008 + updates)

# The cost of bushfires

- Lives lost, people injured
- Homes destroyed
- Communities dislocated
- Infrastructure and industries damaged
- Harm to environmental and conservation values
- High monetary cost

# Estimate of total area burnt by bushfire and some losses in Australia 2005/06 - 2015/16

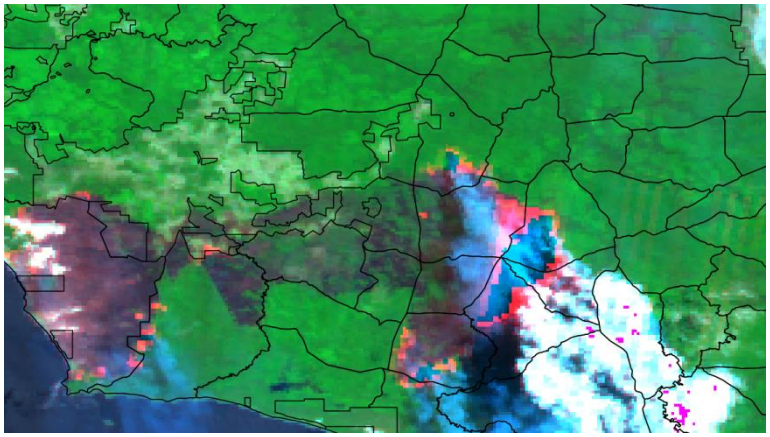
| Region | Wildfire (ha) | Prescribed fire (ha) | Lives (Wildfire) | Buildings (Wildfire) |
|---|---|---|---|---|
| Southern | 3.6 M | 2.4 M (56% in WA) | 202 | 5513 (~60% homes) |
| Central | 168 M | 13 M | - | ? |
| Northern | 233 M | 99 M | - | ? |
| TOTAL: | 404.6 M | 114.4 M | 202 | 5513 |

## Cost of wildfires 2005/06-2015/16:

- Monetary : ~$7 Billion?
- Social cost: ??
- Biodiversity cost:??
- Environmental services cost:??

(Sources: Aust. Inst. Criminology, National Insurance Council; Vic 2009 Bushfires Royal Comm.; Ferguson Inquiry, Govt Dept websites., Bushfire CRC, ABS, Wikipedia )

# Bushfires threaten endangered wildlife

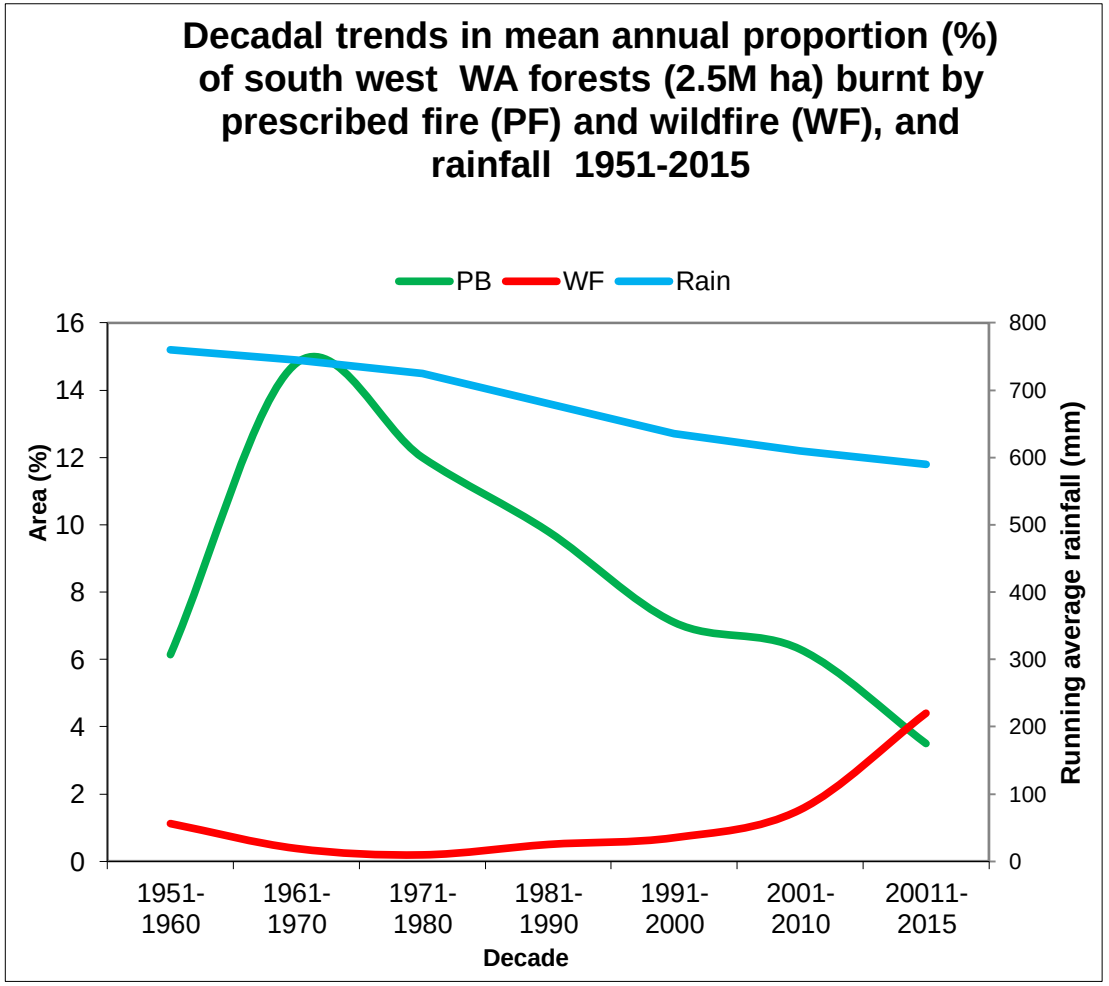



*"Recent bushfires near Albany have threatened the survival prospects of the critically endangered Gilbert's potoroo"*

*"About 500 quokkas died in the Northcliffe bushfire reducing the local population by more than 90%"*

# Why a sharp increase in bushfire in southern Australia this millennium?

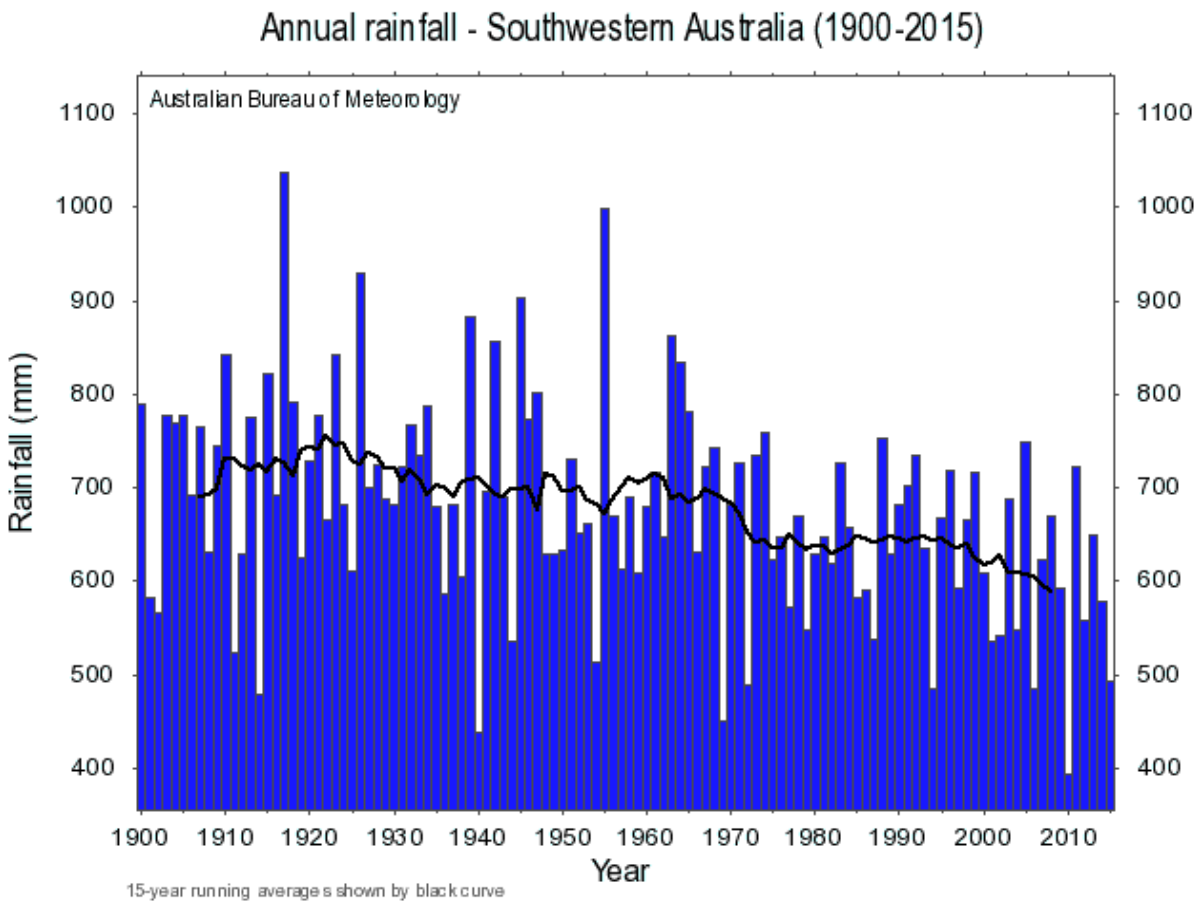
- Can we blame it all on climate change?
- Or is it multi-factorial?
- The reduction in anthropogenic burning is a key factor



# Reasons for the decline in prescribed burning

## Climate change

- Warmer, drier
- More days of HIGH+ FDR
- Reduced window for ‘safe’ prescribed burning




(Courtesy Brad Santos BoM)

# Reasons for the decline in prescribed burning

## Land use change

- Horticulture / viticulture
- Plantations
- Industrial legacies
  - mining
  - timber harvesting
- Declined native forest timber industry

# Reasons for the decline in prescribed burning

## Other factors

- Air quality concerns
- Population growth
- Change in land owner demographic
- Reduced capacity / resources
- Risk aversion
- Onerous risk management processes
- Local opposition to prescribed burning

# What can we do?

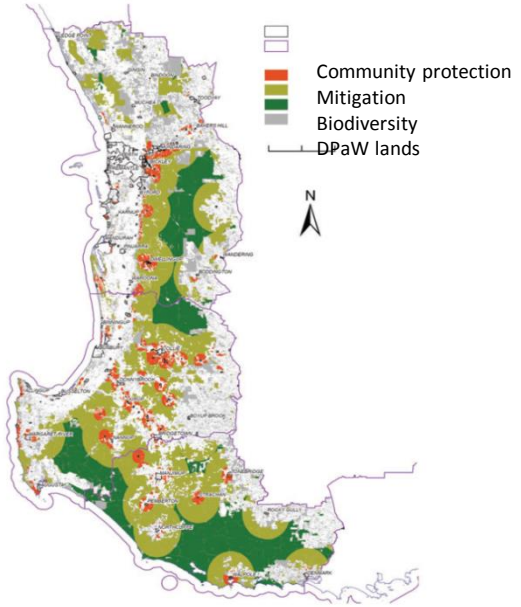
*"Insanity: doing the same thing over and over again and expecting different results"* (Albert Einstein)

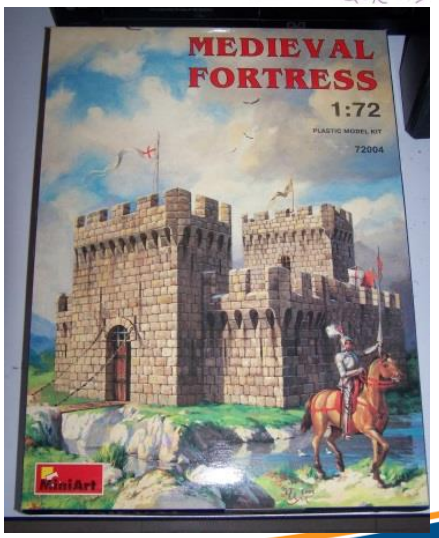
## Burn smarter:

- Targets such as 8% per annum :
  a) may be unachievable
  b) may not deliver good asset protection outcomes

- Risk-based approach to identify where and when to carry out burning for optimal protection
  - Zoning (e.g., DELWP Vic)
    - Community protection zone
    - Bushfire mitigation zone
    - Biodiversity management zone

- Zoning is not a 'medieval fortress' strategy – we need to manage fuel in <u>all</u> zones

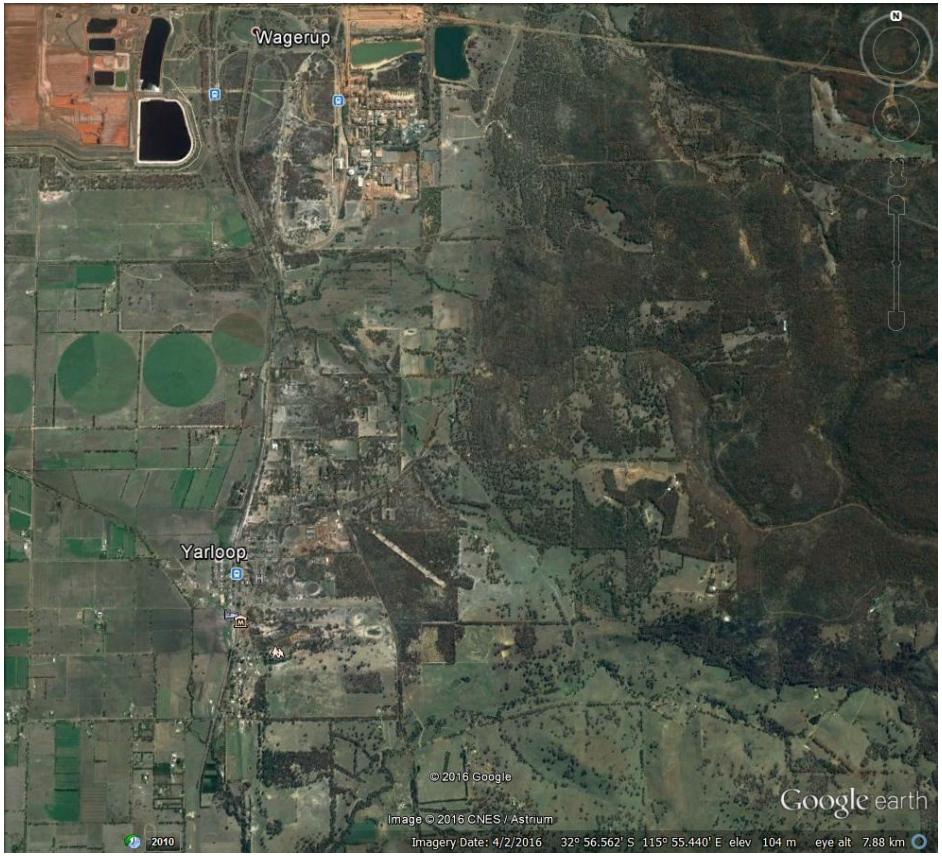


# What can we do?

Reverse the trend - Increase the area of prescribed burning

- ❑ Larger burns
- ❑ Widen the prescription window
- ❑ Winter burning
- ❑ Night burning
- ❑ Adoption of new technology – drones, remote sensing, etc.
- ❑ Better weather forecasting
- ❑ Better smoke plume modelling
- ❑ Improved collaboration with other land holders (shared responsibility)
- ❑ Better community engagement and support



# Desired fire management outcomes


- Mitigate harmful effects of bushfires

  (Treating vegetation as fuel )

- Healthy ecosystems, biodiversity and environmental services

  (Treating vegetation as biodiversity and habitat)

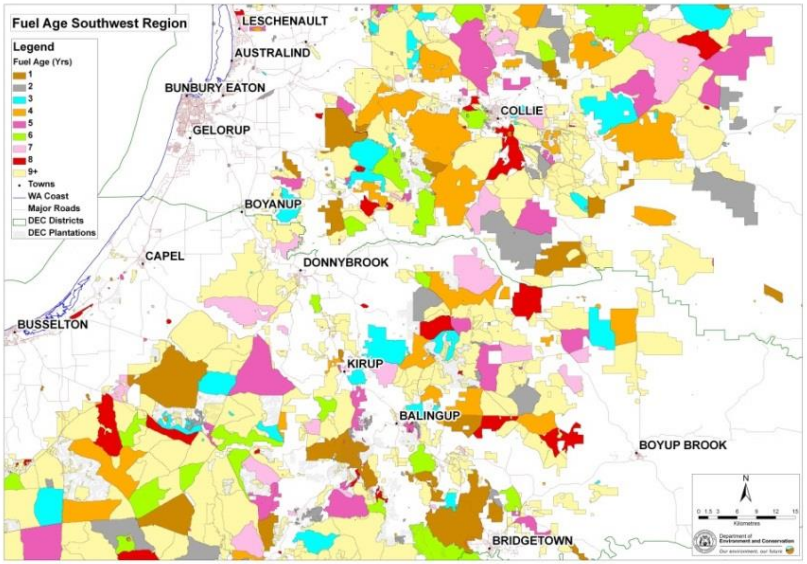
# Burning for biodiversity and the environment

Prescribed fire regimes based on current knowledge of:

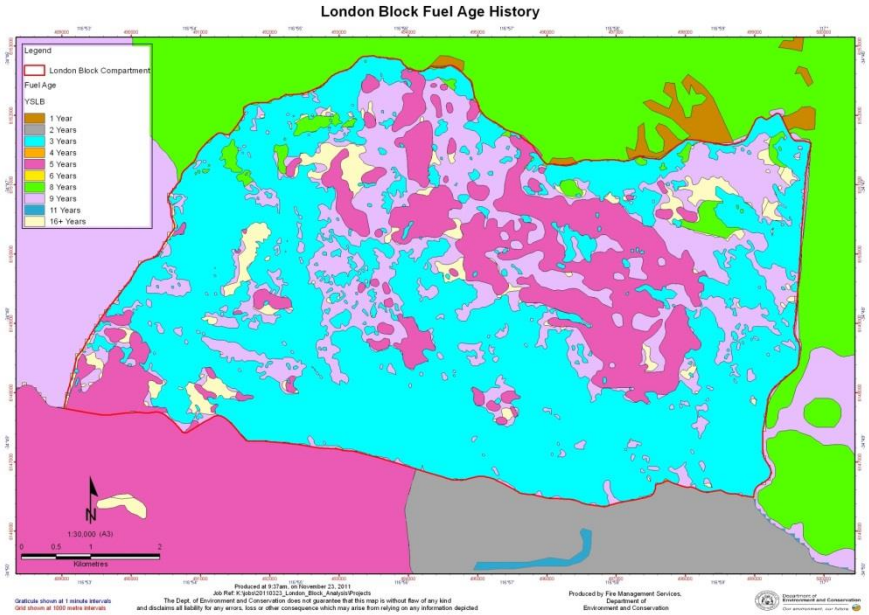
- Threatened species habitat requirements
- Life histories and vital attributes of keystone and umbrella plant species
- Indigenous/historical regimes
- Diverse seral stages at appropriate temporal and spatial scales
- Emissions abatement

# All fire-prone landscapes are a mosaic of different fuel ages / times since last fire But which is the best mosaic?

Current practice: patches mostly 2,000-7,000 ha




Walpole fire mosaic trial: patches mostly 5 - 2,500 ha



# Apparent conundrum – 'fire sensitive' species and communities in flammable landscapes?

- 'Flammability differentials' enable quasi fire refugia to function
- Vulnerable to large, intense hot season fires
- Protected by frequent, low intensity patchy fires

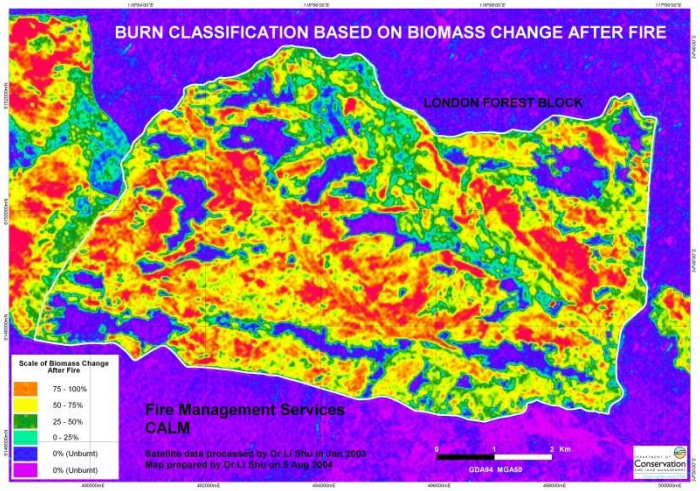
Mulga groves in spinifex meadows

Rainforest in tropical savannas

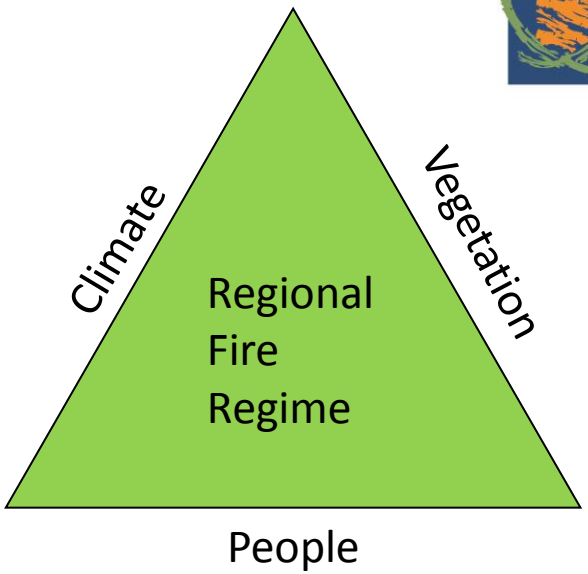
Rock outcrop communities in in jarrah forest

# Important knowledge gaps

- Long term effects of fire regimes, including fire exclusion and large, wildfires
- Fire response models for vulnerable biota in a changed climate
- Interactions with other threatening processes
- Fire regimes for emissions abatement
- Landscape fire ecology:
  - Understanding spatial pattern of fire
  - Creating optimal fire mosaics



# To finish




In Australia's fire-prone landscapes:

- People have been burning for thousands of years and must continue to do so
- When people burn less, there is more wildfire
- Large wildfires are unacceptable today because they are harmful and costly
- Relying on a strategy of fire exclusion and suppression will continue to fail to protect the things that are important to us
- Burn smart:
  - risk-based
  - work with nature
- Fire scientists work with managers to meet challenges of the new millennium

# THANK YOU

(Prescribed aerial burn, Pilbara, WA)