

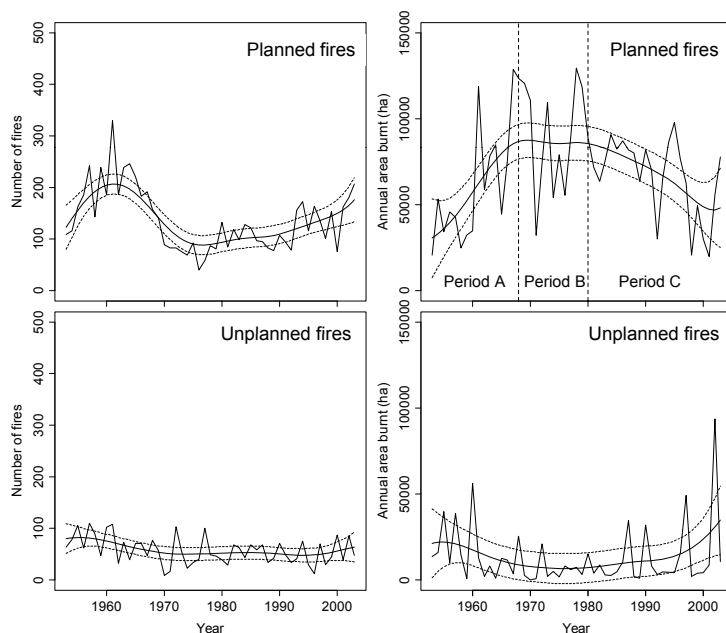
# Long-term impacts of prescribed burning on regional extent and incidence of wildfires – evidence from fifty years of active fire management in SW-WA

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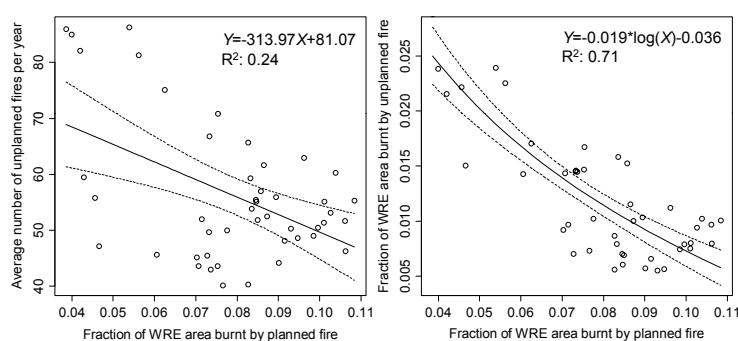
## Key research questions

1. To what extent has the annual area burnt by prescribed fire reduced the annual incidence and extent of unplanned fires?
2. What is the longevity of fuel reduction burns in terms of significantly affecting the annual incidence or extent of unplanned fire?
3. Has widespread use of prescribed burning led to changes in the length of fire intervals or the size distributions of unplanned fires?
4. Has the composition and spatial distribution of fuel age classes changed over time, and...
5. how much have these changes contributed to the reduction of the incidence and annual extent of unplanned fire?



Above: Annual number and extent of planned and unplanned fires.

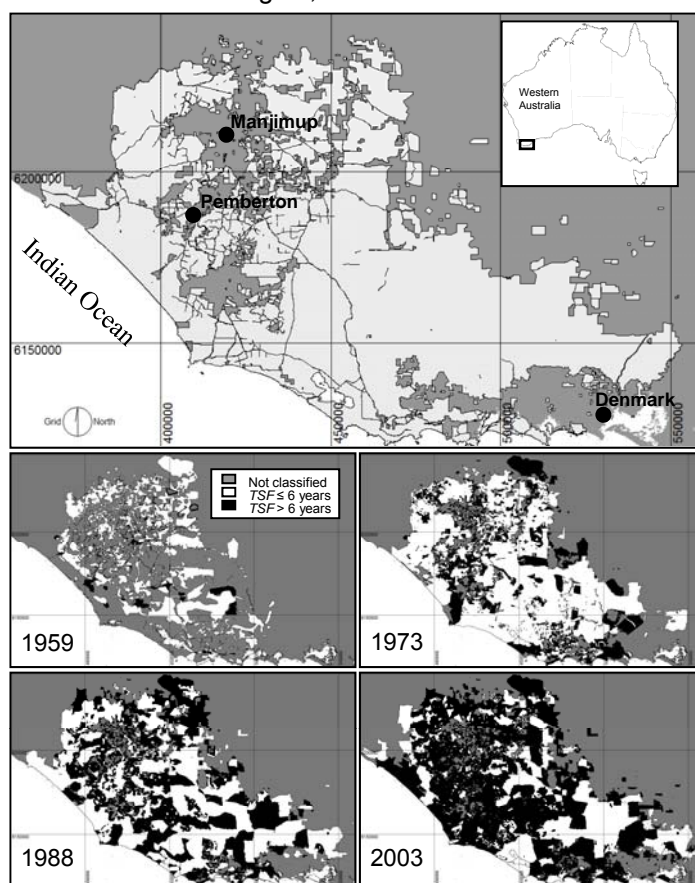
Below: Six-year running means of the annual number (left) and extent (right) of unplanned fires against six-year running means of the annual extent of planned fire (1958-2003).



## Material & methods

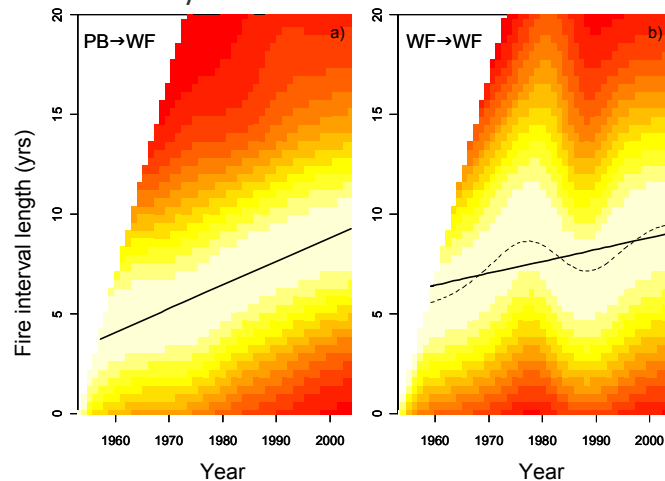
1. Fire history data base containing over 10,000 digitised fire scars for the period 1953-2003 (source: WA-DEC).
2. Quantile regression to quantify the effect of prescribed burning on incidence/extent of unplanned fire at the regional scale, as well as the longevity of that effect.
3. Relative risk mapping to identify significant deviations in the incidence of unplanned fires of a given size range.
4. Patch metrics to quantify temporal changes in the spatial patterning of fuel age classes.
5. Generalised Additive Models (GAMs) to quantify the effect of spatiotemporal changes in fuel age patterning on the incidence and extent of unplanned fire.

## Warren Region, SW Western Australia

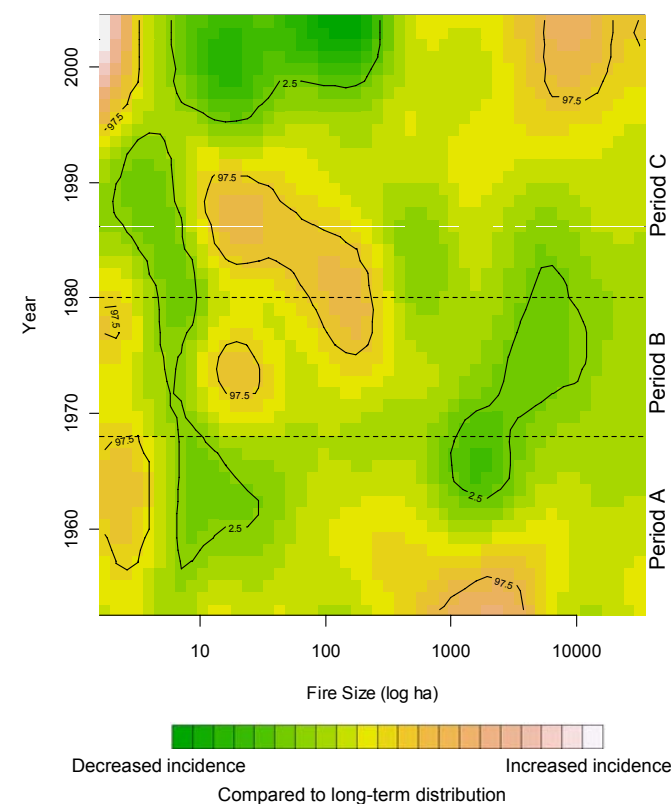


## Study area

- The Warren Region (above) is characterised by open forest dominated by jarrah (*Eucalyptus marginata*) and marri (*Corymbia calophylla*), with tall open forest of karri (*Eucalyptus diversicolor*) on more fertile soils.
- The WA Department of Environment and Conservation (DEC) manages a total of 0.93 Mha.
- Systematic prescribed burning was introduced in the 1950s and strongly expanded in the 1960s when aerial ignition became common, allowing 5-10% of the area to be targeted annually.



Above: Probability density functions of uncensored fire intervals over time (1953-2003). Left) intervals bounded by two unplanned fires; Right) intervals started by a prescribed fire and ending by an unplanned fire. The density increases from low (red) to high (white) brightness values. The black curves are linear and smooth models fitted to the ridge formed by the mode for each year.



Above: Probability density surface for the frequency-size distribution of unplanned fires over time. Contours indicate times and/or fire sizes for which the incidence is significantly lower or higher than the long-term average for the region. Horizontal dashed lines separate management periods A-C.

## Key findings

1. Prescribed burning ceased to have significant effects on annual wildfire numbers or extent for time lags (i.e.  $year_{treatment} - year_{response}$ ) larger than ~6 years.
2. 6-year running averages of mean annual extent of prescribed fire explained:
  - 24% of mean annual number of unplanned fires
  - 71% of mean annual area burnt by unplanned fires.
3. The most probable length of time a site remained unburnt by wildfire has doubled since the early 1960s to about 8-9 years by the early 2000s.
4. The incidence of large wildfires was significantly lower than the long-term average when the annual extent of prescribed fire was near maximum and significantly higher when the annual extent of prescribed fire was small.
5. Prescribed burning has pronouncedly changed the spatial patterning of fuel age:
  - Patches of older fuels (TSF>6 years) have increased in area, perimeter-area ratio, and connectivity.
  - Patches of younger fuels (TSF≤6 years) have first increased, and later decreased, in area and connectivity.
6. The spatial patterning of young and old fuels alone explained:
  - 21% variation in annual number of wildfires
  - 64% variation in annual extent of wildfires

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- Western Australian Department of Environment and Conservation for providing fire data