# PRESCRIBED BURNING FACT SHEETS

South-West Forests Defence Foundation Inc

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## PREFACE

The Western Australian Department of Biodiversity, Conservation and Attractions (DBCA) carries out an industrial-scale prescribed burning program that targets an area of 200 000 hectares annually across the State's south-west forests. Elsewhere, vast natural areas of the entire State are also targeted for annual prescribed burning.

While the burns are underway, it is only because of the smoke drifting across where most of us live that people are aware that the bush is being burnt. The severe health impacts of this pollution, and the real risk of the loss of property from escapes, are tolerated by the public because of a general belief in the State Government's stated primary reason for the burning: that it is effective in greatly reducing the risk of loss of life and property from out-of-control summer wildfires. We are also told that fire is a natural part of our environment and the flora and fauna are adapted to it, with the inference that this repetitive burning causes no long-term harm. With bi-partisan political support, the Government and its agencies refuse to accept any reasonable concerns with, or objections to this entrenched practice. While the public at large has almost no first-hand experience or understanding of the true scale and impacts of this burning, little will change.

All is far from well. An accumulating body of scientific research shows that prescribed burning, as currently practised, does not effectively protect us or our forests from summer wildfire and is causing irreversible loss of biodiversity. The single-minded justifications we are given for what is occurring in our forests must be challenged.

The South-West Forests Defence Foundation Inc. presents you this comprehensive publication with the facts about prescribed burning and with the information, images and references that will help you understand the issues and decide for yourself.

## FACT SHEETS



The South-West Forests Defence Foundation Inc. respectfully acknowledges the Noongar peoples, their Elders past and present, who have lived amongst and cared for the forests and woodlands of south-western Australia for tens of thousands of years.

We understand that their long and deep relationship with their country has given them the knowledge, skills and wisdom to manage these lands and the exceptional and unique biodiversity they contain. We further understand that this knowledge exists nowhere else.

We applaud the Noongar peoples for actively preserving their knowledge and passing it down to emerging Elders, and for their generosity in sharing their knowlege and wisdom with the wider community.

It is therefore our sincere hope that Noongar peoples now be ernestly listened to and urgently given better opportunities to share their knowledge and once again be a key part of forest management.

# 1 FACT VS FICTION

## EXPOSING MYTHS ABOUT PRESCRIBED BURNING IN SOUTH-WEST FORESTS

MYTH: “Prescribed burning is the best way to protect life, property and biodiversity from wildfires.”

**FACT: Smoke from prescibed burns kills people.**

Between 2002 and 2017 smoke from prescribed burns was estimated to have caused the death of 21 people in south-west W.A. In this period four people died directly from wildfire. Estimated health-related costs in 2017 alone were $24.1 million (Fact Sheet 4).

**FACT: Prescribed burns have escaped and destroyed houses.** (Fact Sheet 8).

Dwelling destroyed by out-of-control prescribed burn in Margaret River.

Source: Report on “Investigation of the house losses in the Margaret River Bushfire 23 November 2011”, Department of Fire & Emergency Services, October 2012.

**FACT: Prescribed burns kill animals and plants.**

Prescribed burns kill mammals, birds, reptiles, frogs, insects and plants. They cause old, valuable habitat trees to collapse pushing already threatened species closer to extinction. Many plant species and communities are not adapted to frequent, hot fire. (Fact Sheet 3).

A critically-endangered ringtail possum after Warrungup Spring prescribed burn in 2018.

Source: Allison Dixon.

**FACT: Frequent prescribed burning is causing biodiversity loss.**

In most of its prescribed burns DBCA is allowed to injure or kill any number of threatened plants and animals. (Fact Sheet 3).

“Where prescribed burning impacts restricted, discontinuous or rare habitats, there is a high probability of species loss and irreversible changes to biodiversity.”

Humane Society International, 2022.

Critically endangered *Banksia verticillata* killed in prescribed burn at Poison Hill, Nuyts block, April 2018.

MYTH: “Aboriginal people burnt the forests extensively and the Department of Biodiversity, Conservation and Attractions (DBCA) is simply continuing Noongar land management practices.”

**FACT: DBCA’s prescribed burning differs from Noongar use of fire in scale, intensity and frequency.**

Noongar people did not burn the karri or tingle forests or other sensitive environments. Deliberately or accidentally, DBCA burns every ecosystem type in the south-west forest region. (Fact Sheet 6).

**FACT: Prescribed burns produce greenhouse gases and contribute to climate change.**

Annual prescribed burns totalling approximately 200 000 ha have GHG emissions equivalent to about 10% of Western Australia’s reported annual emissions. (Fact Sheet 7).

**FACT: State and federal legislation is not being applied to DBCA's prescribed burning program.**

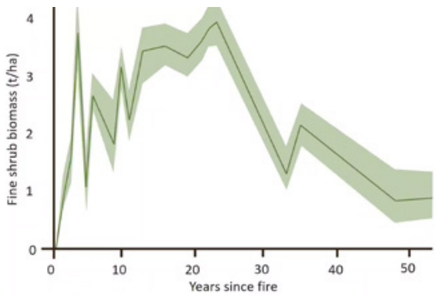
- The federal *Environment Protection and Biodiversity Conservation Act 1999* is not being applied to protect the south-west's precious biodiversity from prescribed burning.
- Under the state *Biodiversity Conservation Act 2016*, DBCA's minister authorises DBCA to take (kill) or disturb any number of threatened fauna and flora during prescribed burns.
- Prescribed burning is exempt from the *National Environment Protection (Ambient Air Quality) Measure*.
- Prescribed-burn greenhouse gas (GHG) emissions are accounted for as 'natural variations' and not included in Australia's reported totals. (Fact Sheets 3 and 4).

MYTH: "Prescribed burning reduces the fuel load."

**FACT: Burning stimulates growth, increasing fuel load.**

Dense understorey in jarrah forest after burning.

Source: Philip Zylstra, https://theconversation.com/coming-of-age-research-shows-old-forests-are-3-times-less-flammable-than-those-just-burned-179571




Graph showing that the fine shrub biomass peaks 25 years post fire then declines.

Source: figure 5-7 https://openresearch-repository.anu.edu.au/handle/1885/10037 Philip Zylstra.

(Fact Sheet 5).

**FACT: Prescribed burning stops natural reduction of forest floor fuel load.**

Prescribed burns kill microbes, invertebrates and fungi that decompose and reduce flammable litter naturally, and animals that turn it over.

A single Woylie (weighing around 1.2 kg) turns over approximately 5 tonnes of soil per year.

Source: Humane Society International Australia.

(Fact Sheet 5).

MYTH: "Keeping 45% of the south-west forests with a time-since-burn of less than 6 years allows fire suppression when a wildfire reaches an area with low fuel load."

**FACT: In extreme fire weather ground-level fuel loads play no part in fire propagation.**

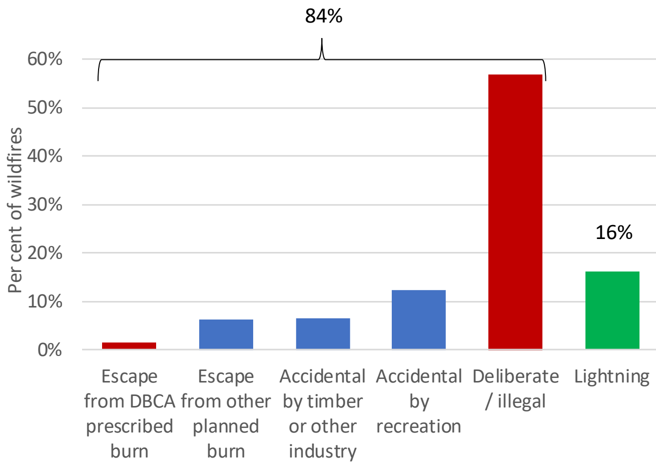
Almost all damaging wildfires occur in extreme fire weather. Fire quickly climbs to the tree crowns and then travels at that level. Only a wind or weather change will stop it. (Fact Sheets 2 and 5).

Source: DFES website: https://www.dfes.wa.gov.au/hazard-information/bushfire/during

MYTH: "Reducing the fuel load is the only way to protect people and property from wildfires."

**FACT: Most wildfires are started by people.**

From July 1991 to December 2023, around 8400 south-west wildfires were recorded in the DBCA_060 database. The main cause was arson (59%). More can and should be done to stop arson. (Fact Sheet 8).




**FACT: Immediate detection and rapid suppression of ignitions is the safest and most effective way to protect life, property and biodiversity from wildfires.** (Fact Sheet 8).

# 2 PRESCRIBED BURNING DOES NOT REDUCE THE AREA OF WILDFIRE

## FACTS ABOUT PRESCRIBED BURNING AND WILDFIRE IN SOUTH-WEST FORESTS

The Western Australian Forests Department began prescribed burning in the south-west forests in the 1950s. It aimed to protect the timber resource from wildfires by burning the flammable vegetation (the 'fuel load') on the forest floor. The relatively long history of prescribed burn and wildfire areas (Table 1) can be used to examine the effect that the prescribed burning regime has had on reducing wildfire area using statistical modelling.

A 2009 study[1] estimated a **leverage** of 0.25 for the south-west forests, that is, on average, 4 ha of prescribed burning has reduced wildfire extent by 1 ha. Campbell et al. (2022)[2] re-visited this work using data from 1953 to 2020 from the Perth, Northern Jarrah, Southern Jarrah and Warren bioregions. Their results detected relationships between antecedent fire area and wildfire area in the Warren and Southern Jarrah bioregions. In forest in the Warren bioregion, it was estimated that, on average, 17 ha of prescribed burning had reduced wildfire extent by 1 ha. In the Southern Jarrah forests, a valid relationship existed but with the finding that no amount of prescribed burning reduced the extent of wildfire. When data for all four bioregions were combined, the finding was that, on average, 50 ha of prescribed burning had reduced subsequent wildfire extent by just 1 ha.

**These values highlight the ineffectiveness of prescribed burning in reducing the extent of wildfire.** Fire literature[3,4] discusses 'fuel-driven fires' versus 'weather-driven' fires. The uncontrollable wildfires in the south-west forests occur during hot, dry, windy conditions. Other authors[5] also discuss forest structure. A few years after a prescribed burn, understorey vegetation such as karri wattle and netic has sufficient height and flammability to function as fire 'ladders' that carry ground level fire to the tree tops where the wind is strongest, temperatures are highest and fire is uncontrollable.

Experimental bushland burning
Source: CSIRO.

These statistical analyses use historic data. In a hotter and drier future, weather-driven fires will be more frequent and ground level fuel loads even less important.

**Statistical modelling** seeks to reveal valid relationships between causes or 'drivers' and a particular effect or 'outcome', in this case the area of wildfire subsequently occurring. Drivers might be:

- Antecedent burn area over the past, e.g. 1, 2, 5 or 8 years
- Weather drivers, such as temperature, relative humidity and rainfall
- Landscape attributes.

Statistical techniques are used to determine the relative importance of the drivers in influencing the extent of subsequent wildfires.

The term **leverage** is used to report the effect of antecedent burn area on subsequent wildfire area. For example, a leverage of 0.25 means that, on average, an antecedent burn area of 1 ha would reduce subsequent wildfire area by 0.25 ha.

Table 1

| Year | Prescribed Burn Area (ha) | Wildfire Area (ha) | Year | Prescribed Burn Area (ha) | Wildfire Area (ha) |
|---|---|---|---|---|---|
| 1981 | 264 550 | 7 407 | 2002–2003 | 144 835 | 139 744 |
| 1982 | 316 507 | 2 380 | 2003–2004 | 192 119 | 22 226 |
| 1983 | 272 986 | 4 225 | 2004–2005 | 213 102 | 50 569 |
| 1984 | 252 851 | 9 164 | 2005–2006 | 194 105 | 21 905 |
| 1985–1986 | 268 951 | 16 951 | 2006–2007 | 138 602 | 31 774 |
| 1986–1987 | 250 360 | 8 079 | 2007–2008 | 143 681 | 9 862 |
| 1987–1988 | 277 283 | 9 433 | 2008–2009 | 151 818 | 23 910 |
| 1988–1989 | 242 379 | 11 364 | 2009–2010 | 212 017 | 47 380 |
| 1989–1990 | 278 364 | 1 766 | 2010–2011 | 136 746 | 28 189 |
| 1990–1991 | 365 164 | 1 656 | 2011–2012 | 103 165 | 103 837 |
| 1991–1992 | 309 350 | 14 452 | 2012–2013 | 23 468 | 2 216 |
| 1992–1993 | 159 749 | 12 726 | 2013–2014 | 78 234 | 17 118 |
| 1993–1994 | 250 830 | 6 150 | 2014–2015 | 147 082 | 178 240 |
| 1994–1995 | 260 846 | 29 051 | 2015–2016 | 154 149 | 96 223 |
| 1995–1996 | 233 758 | 10 101 | 2016–2017 | 247 360 | 9 171 |
| 1996–1997 | 157 721 | 18 443 | 2017–2018 | 218 965 | 7 066 |
| 1997–1998 | 126 085 | 76 798 | 2018–2019 | 168 043 | 7 551 |
| 1998–1999 | 98 117 | 9 148 | 2019–2020 | 132 940 | 26 692 |
| 1999–2000 | 174 455 | 10 866 | 2020–2021 | 171 236 | 31 731 |
| 2000–2001 | 87 866 | 14 647 | 2021–2022 | 146 154 | 34 856 |
| 2001–2002 | 74 739 | 18 989 | 2022–2023 | 175 414 | 21 343 |

For more information **southwestforestsdefence.org**

## Other studies

Price et al.[4] analysed fire data from 30 eastern states bioregions. Here the drivers were: antecedent fire in the preceding 1, 2 and 5 years; maximum annual temperature; number of days above 35°C; number of days with relative humidity below 15%; and July–Dec and Jan–May rainfall anomalies. Of the 20 bioregions with enough data, only four exhibited any leverage – all in mountainous eucalypt forests on the Great Dividing Range. However, two of the bioregions with no leverage (South East corner and South Eastern Queensland) had very similar driver characteristics (e.g. rainfall, percent forest and fuel load) to the four with leverage.

Price et al. concluded:

- *Our results suggest that the contention of Burrows and McCaw (2013)[6] and Sneeuwjagt et al. (2013)[7] that prescribed fire is universally effective is not supported by historical fire records in southeast Australia, even when restricted to forests.* ***In all Bioregions, measures of weather variation had a stronger influence on area burnt than did past fire area.*** *It seems that strong effects of past fire on area burnt are the exception rather than the rule.*
- *Our results imply that in most Bioregions in southeast Australia, the potential for prescribed burning to significantly reduce the area of unplanned fire is limited.*
- *The most efficient use of prescribed fire is applying it in the immediate proximity of assets, where a resultant reduction of fire intensity can be of immediate benefit in terms of impacts on structures and ease of suppression (Price & Bradstock, 2010, 2012)[8,9].*

Brown et al. (1991)[10] concluded that although the number of unplanned fires decreased following the introduction of prescribed burning, the annual area burnt by unplanned fire decreased only slightly (average size of unplanned fires had doubled).

Another South African study analysed a 72-year fire history of the Swartberg Mountain Range and revealed a greater number of large (>3000 ha) unplanned fires, but no change in total annual extent of unplanned fires when prescription burning was replaced with a minimal intervention policy (Seydack et al., 2007)[11].

### Conclusions

Analysis of historic prescribed burn and wildfire data from south-west forests showed that prescribed burning had negligible or no effect in reducing subsequent wildfire area.

The only bioregion where prescribed burning was seen to have contributed to reduced wildfire area was the Warren, where it was estimated that, on average, every 17 ha of prescribed burning had reduced wildfire extent by 1 ha.

Another Australian study also deduced little benefit from prescribed burning, and challenged the long-held belief that prescribed fire is universally effective in reducing wildfire extent. Measures of weather variation were seen to have had a stronger influence on area burnt than past burn area.

The most efficient use of prescribed burning is to apply it in the immediate proximity of assets, in locations where the ground-level fuel load can be monitored frequently and addressed through burning or clearing. Broad-scale use in remote areas has been shown to be ineffective and therefore a waste of public money and resources. It is also harmful to biodiversity.

## Redirect resources from broad-scale, ineffective prescribed burning to

- **targeted, localised burning or clearing**
- **rapid detection and response.**

**References**

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# 3 PRESCRIBED BURNING REDUCES BIODIVERSITY

SOUTHWEST FORESTS DEFENCE FOUNDATION INC

**FACTS ABOUT PRESCRIBED BURNING AND WILDFIRE IN SOUTH-WEST FORESTS**

## Inappropriate fire regimes pose a high risk to Australian mammal species.

Endemic Australian land mammal fauna has suffered an extraordinary rate of extinction (>10% of the 273 species) since European settlement, compared with only one extinction in continental North America since European settlement[1]. A further 21% of Australian endemic land mammal species are now assessed to be threatened, indicating that the rate of loss of 1–2 extinctions per decade is likely to continue. The 29 Australian endemic mammal extinctions comprise 35% of the world's modern mammal extinctions. Some 1.5% of the world's 5500 mammal species are extinct, a proportion substantially less than Australia's 10%. Woinarski et al.[1] quantified threat factors to mammal species. After feral cats, **inappropriate fire regimes are the second greatest threat factor**, followed by foxes.

## Inappropriate fire regimes are threatening animal and plant species.

In Western Australia's Forest Management Area, where prescribed burning by the Department of Biodiversity, Conservation and Attractions (DBCA) and its predecessors has been extensive since 1952, there are now 42 threatened animal species and 129 threatened plant species. Threatened animal and plant species have increased by 24 and 51 respectively, since the end of last century[2,3]. That is, on average, one additional animal species and two additional plant species have been added to the threatened species lists each year.

| | Status 1999 | | | | | Status 2019 | | | | | Status 2024 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | V | E | CE | EX | Total* | V | E | CE | EX | Total* | V | E | CD | CE | EX | Total* |
| **Flora** | **25** | **28** | **25** | **(1)** | **78** | **31** | **41** | **41** | **(1)** | **113** | **34** | **50** | | **45** | **(6)** | **129** |
| Frogs | 2 | 1 | | | 3 | 2 | | 1 | | 3 | 2 | | | 1 | | 3 |
| Birds** | 4 | 1 | | | 5 | 2 | 5 | | | 7 | 2 | 5 | 1 | 1 | | 9 |
| Fish | | | | | 0 | 2 | 4 | | | 6 | 2 | 4 | | | | 6 |
| Invertebrates | 1 | 2 | 1 | | 4 | 2 | 5 | 4 | | 11 | 3 | 7 | | 4 | | 14 |
| Mammals | 5 | | | (3) | 5 | 2 | 2 | 2 | (3) | 6 | 2 | 2 | 2 | 2 | (3) | 8 |
| Reptiles | | | 1 | | 1 | | | 1 | | 1 | 1 | | | 1 | | 2 |
| **Total fauna** | **12** | **4** | **2** | **(3)** | **18** | **10** | **16** | **8** | **(3)** | **34** | **12** | **18** | **3** | **9** | **(3)** | **42** |

V = vulnerable; E = endangered; CD = conservation (habitat) dependent; CE = critically endangered; EX = extinct.
* Total threatened species doesn't include extinct species . ** Nonmigratory birds

## Why is biodiversity important?

Biodiversity provides many basic human needs: food, shelter and medicine, and crucial services: pollination, seed dispersal, climate regulation, water purification, nutrient cycling and control of agricultural pests [1].

Biodiversity losses increase the likelihood of disease spread from animals to humans (zoonotic diseases), and therefore could worsen epidemics that harm humans and wildlife[4]. Zoonotic diseases include: COVID-19, Lyme disease, Ebola virus, influenza, HIV, the plague, Salmonella and rabies[5].

South-western Australia is a biodiversity hotspot. This means that it has a high level of biodiversity **that is highly threatened**.

Prescribed burning kills all components of biodiversity: mammals, birds, reptiles, frogs, insects, fungi and plants, including critical habitat trees. DBCA does not admit to this death toll, yet species are being added to, not removed from the lists of vulnerable, endangered and critically endangered plants and animals. The pretence that everything is all right is a clear indication that DBCA has lost its way.

## The current prescribed burning regime is not protecting biodiversity.

The primary objectives of fire management for conserving biodiversity are[9]:

"Protection of fire-sensitive and fire-dependent ecosystems and niches, including riparian zones, aquatic ecosystems, and peat wetlands." Yet

- rivers are often used to control prescribed burn extent;
- many peat wetlands have been burnt;
- granite outcrops are burnt;
- DBCA burns tingle and karri forests, areas that were not burnt by Indigenous peoples.


Prescribed burning in peat swamps results in the loss of peat beds accumulated over a period of around 5000 years.

Source: Bradshaw et al. (2018)[6] Figure 3.

## Changed burning regimes in south-west forests are pushing species and ecosystems to extinction.

Prescribed burning is carried out in either spring or autumn with a return interval of around 5–7 years in jarrah forest and 8–11 years in karri forest, compared with a pre-European, wildfire burn frequency of 81 years in jarrah and much longer in karri forest (Bradshaw et al.[6]), with wildfires generally occurring in summer. This frequent burning with a different seasonal pattern from naturally-occurring fire is affecting plant and animal species and ecological communities, as many species need many years to re-colonise burnt areas or to mature to an age at which they can reproduce. Two-thirds of south-west prescribed burns are carried out in spring. Spring burning destroys many flowering plants before they produce seed, kills nesting birds and can leave smouldering logs that may re-ignite and start wildfires throughout the summer. The table below lists recovery times for some fauna species after burning (Bradshaw[7]).

There are now 8 threatened mammals in south-west forests, including the Woylie and the Western Ringtail Possum, which are critically endangered, and the Red-Tailed and South-Western Brush-Tailed phascogales, which are conservation-dependent.

**Minimum time for recovery after fire for some fauna species:**

| Species | Recovery time (years) | Status |
|---|---|---|
| Western Ringtail Possum | > 11 | CE |
| Tammar Wallaby | 25–30 | |
| Woylie | 25–30 | CE |
| Honey Possum[8] | 26 | |
| Quokka | 30–40 | V |
| Numbat | 25–30 | E |
| Splendid Fairy-Wren | > 12 | |
| Red-winged Fairy-Wren | > 12 | |
| Mallee Fowl | 20– >55 | V |

V = vulnerable; E = endangered; CE = critically endangered

Western Australia's faunal emblem, the Numbat, is endangered and needs habitat that is fire-free for more than 25–30 years to thrive.
Source: Humane Society International Australia.

## Changed burning regimes in south-west forests are pushing species and ecosystems to extinction.

South-west forest flora and fungi have survived and evolved for millions of years with wildfires started only by lightning. Although it was previously thought that fire was required for many south-west native plants to propagate, whether there are any plant species that fail to reproduce in the absence of fire is not known with any certainty[6]. There is no scientific evidence that plants are genetically adapted to fire.

Prescribed burns at the frequency with which they are carried out in south-west forests are pushing plant species to extinction. Unnatural fire regimes threaten ecological communities such as:

- *Banksia* woodlands[12]
- *Empodisma* peat swamp[13]
- red, yellow and Rate's tingle forest[13]
- jarrah (*Eucalyptus marginata*) and other forests, in which prescribed burning on a 5–7 year rotation is likely to permanently simplify the litter flora and invertebrate fauna, with far-reaching effects on forest health and hygiene[6]

and individual plant species, for example:

- young karri trees (*Eucalyptus diversicolor*), which are fire-sensitive for up to 25 years[6]
- *Corymbia ficifolia* (red flowering gum), which needs 25 years without fire to survive. Current frequency and intensity of fire are preventing the successful recruitment of new juvenile trees to replace those killed[13].

'Fire regimes that cause declines in biodiversity' have been identified as a key threatening process[12] under the *Environment Protection and Biodiversity Conservation Act 1999*. Prescribed burning, through changes to fire spatial pattern, increased plant disease spread and changed ecosystem characteristics (e.g. habitat and predator interactions), has been identified as affecting *Banksia* woodlands (E), the Western Ground Parrot (CE), White-Cheeked Honey Eater (not listed) and the Woylie (CE)[12].


Prescribed burning of banksia woodland in southwestern

Western Australia. Source: Bradshaw et al. (2018)[6] Figure 3.

Tingle tree destroyed by frequent burning

Source: South-West Forests Defence Foundation Inc.

## The current prescribed burning regime in south-west forests leaves few areas unburnt for more than 15 years.

DBCA claims it includes fire regimes that provide habitat diversity[9]. This is clearly not true as its aim is to have very little area with time-since-burn of more than 15 years (mustard colour in graph below). In 2004 and 2013 there was very little in the Central Jarrah Landscape Conservation Unit (LCU) with time-since-fire of more than 18 years. The lack of long unburnt forest impacts animals that have long recovery times after fire, including the threatened Western Ringtail Possum, Woylie, Quokka, Numbat and Mallee Fowl. **Negligible long unburnt forest habitat (>30 years since burn) is maintained.**

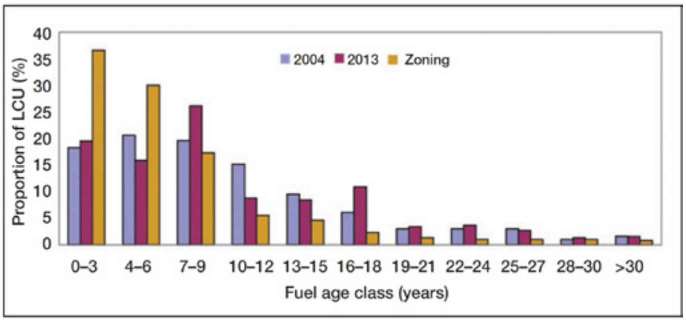



Figure 6 from Burrows & McCaw[10]. Fuel age class distribution in 2004 and 2013 and the theoretical distribution under a zoning fire-management strategy for the Central Jarrah Landscape Conservation Unit. See next page for zoning.

Burnt Empodisma peat swamp
Source: South-West Forests Defence Foundation Inc.

## The current prescribed burning regime is not protecting built infrastructure and people.

The *Position Statement: Prescribed burning on vested lands*[9] states:

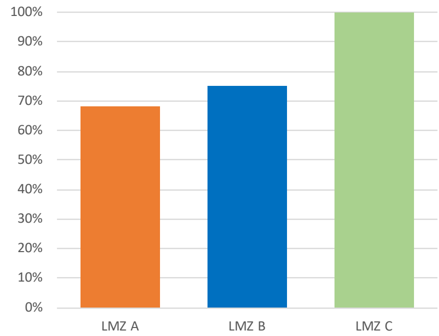
Effective and sustainable fire management practices should consist of:

• protection of life, property and community assets.

DBCA has annual prescribed burn targets for three land management zones (LMZ A–C) defined by distance from infrastructure, and an overall target of 200 000 ha:

| | Distance | Target area (ha) |
|---|---|---|
| LMZ A | Within 3.5 km | 20 000 |
| LMZ B | 3.5 to 11 km | 70 000 |
| LMZ C | Greater than 11 km | 110 000 |

Over the past 8 years the areas burnt in LMZ A and LMZ B, close to infrastructure, have been under target, while in LMZ C, remote from infrastructure, the target was achieved or exceeded.




Area burnt as a percentage of the target area in the different zones for the 8 years 2015/16 to 2022/23 inclusive from DBCA annual reports.

**DBCA's prescribed burns do not achieve the targets close to infrastructure, where they would be most likely to protect people's lives and community assets, but do so remote from settlements, where large areas can be burnt with less effort, cost and risk.**

**The biodiversity of south-west forests is being severely impacted by this approach.**

## In prescribed burns DBCA is allowed to harm or kill any number of threatened plants and animals.

Under Section 40 of the state's *Biodiversity Conservation Act 2016*, the Environment Minister may authorise taking (killing) or disturbance of threatened species. For example, authorisation number TFA 2324-0111 authorises DBCA to take or disturb any number of individual animals of 21 threatened species, including the critically-endangered Woylie and Western Ringtail Possum, during prescribed burning in the Frankland District in 2023–24. DBCA obtains similar authorisation for other prescribed burns.

A burnt critically-endangered Western Ringtail Possum photographed by Allison Dixon after a prescribed burn at Warrungup Spring in 2018. **The prescribed burn killed 17 of the 22 individuals being monitored**[11]. Source: Allison Dixon.

The federal *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*) provides environmental protection Australia-wide. Exempt activities include continued lawful land uses that were occurring before July 2000 that have continued in the same location without enlargement, expansion or intensification. DBCA's prescribed burning program is more intensive that previously, with aerial ignition being the norm and fires left to burn at an intensity dictated by the weather conditions, not by control at ground level. The *EPBC Act* is not being applied to protect the south-west's precious biodiversity. This coupled with the state situation under which DBCA's Minister endorses DBCA to undertake prescribed burns (effectively DBCA endorsing itself) means that there is a lack of scrutiny at both levels of government of this harmful practice. This is despite:

- the drier and warmer climate, which is changing fire regimes and forest ecology;
- the increasing number of flora and fauna species being added to the threatened species lists. In the Forest Management Area, 24 fauna species and 51 flora species have been added since the end of last century.

There is no formal consultation process in either the design of the burn program, or the planning of individual burns. There is no independent assessment of burns. The Conservation and Parks Commission has a legal duty to assess DBCA's implementation of management plans.  It has not assessed a DBCA prescribed burn since 2006. With a single agency responsible for planning the burns, doing the burns and subsequently judging their success, there is a serious failure of oversight.

**Threatened mammals in south-west forests:**

| | | |
|---|---|---|
| *Bettongia penicillata ogilbyi* | Woylie, Brush-Tailed Bettong | CE |
| *Dasyurus geoffroii* | Chuditch | V |
| *Myrmecobius fasciatus* | Numbat | E |
| *Petrogale lateralis lateralis* | Black-Flanked/-Footed Rock-Wallaby | E |
| *Phascogale calura* | Red-Tailed Phascogale | CD |
| *Phascogale tapoatafa* | South-Western Brush-Tailed Phascogale | CD |
| *Pseudocheirus occidentalis* | Western Ringtail Possum | CE |
| *Setonix brachyurus* | Quokka | V |

In addition to the mammals listed, there have been 3 extinctions: *Bettongia lesueur graii* (Burrowing Bettong; in 1940s), *Perameles myosuros* (Marl; in 1910s) and *Potorous platyops* (Broad-Faced Potoroo; in 1870s).

V = vulnerable; E = endangered; CD = conservation (habitat) dependent; CE = critically endangered; EX = extinct.

Live Quokka on Rottnest Island.
Source: South-West Forests Defence Foundation Inc.

Dead Quokka found after the 2018 DBCA escaped prescribed burn at Poison Hill in Nuyts block, D'Entrecasteaux National Park[13].

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13 Fire and Biodiversity Western Australia (FaBWA) & the Denmark Environment Centre Inc. (2023) *Icon to Ashes.*

# Typical prescribed burn impacts

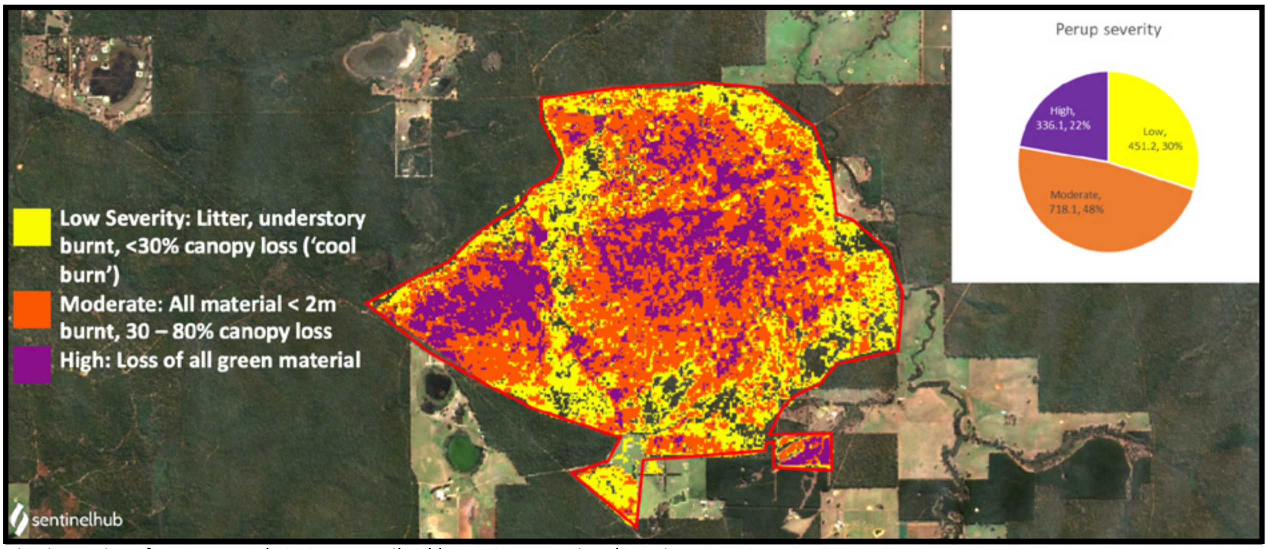
A typical flight path for a prescribed burn ignition is shown below.

Source: Flight Radar 24.


Ignition of Clear Hills, Walpole Wilderness Area (FRK_086) 9344 ha prescribed burn on 14 October 2023. Incendiaries were dropped 100 m apart on gridlines with 200 m separation.

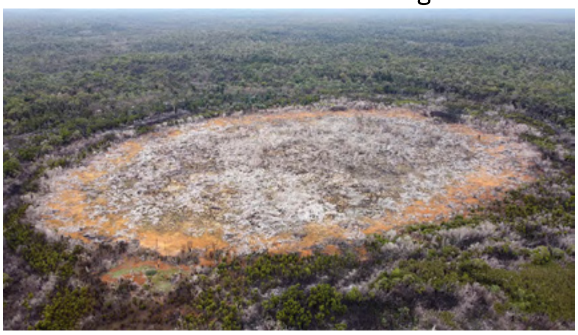
Once ignited prescribed burns are not controlled. The photo below shows forest after the Perup March 2021 prescribed burn, and the next figure the burn's intensity.

Photograph of forest following Perup prescribed burn. Source: Kingsley Dixon.

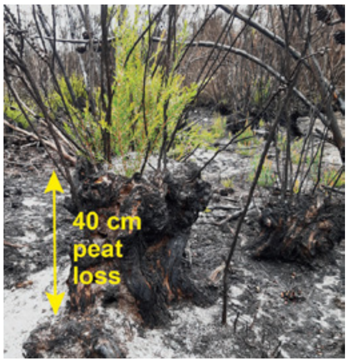



Fire intensity of Perup March 2021 prescribed burn. Source: Kingsley Dixon.

The *Empodisma* peatlands ecological community was listed in the **endangered** category of the threatened ecological communities list under the *Environment Protection and Biodiversity Conservation Act 1999* in September 2023. A recovery plan was not recommended. The listing stated that the *Conservation Advice* is effective in implementing priority management actions, mitigation against key threats and support for recovery. Yet DBCA continues to burn sensitive ecological communities and threatened species, such as peatlands.



Karara block, Frankland District November 2020 prescribed burn burned a large peat swamp for approximately 5 – 6 months including through summer. Source: Fire & Biodiversity WA (FaBWA) *Icon to Ashes.*




Sharpe block, Frankland District November 2021 prescribed burn. 40 cm peat loss represents a loss of at least 5000 years of peat accumulation. Source: FaBWA *Icon to Ashes.*

# 4 PRESCRIBED BURNING IS BAD FOR HUMAN HEALTH

## FACTS ABOUT PRESCRIBED BURNING AND WILDFIRE IN SOUTH-WEST FORESTS

The impact of poor air quality on the health of the general population is well described, and pollution from prescribed burning carries the same risks. The more serious health impacts on fire-fighters and first responders are not considered in this fact sheet.

As described in Box 1, particulate matter resulting from bushfires, causes **health problems,** with larger particles ($PM_{10}$) contributing directly to airway inflammation and exacerbation of throat and lung disease, and smaller particles ($PM_{2.5}$), which enter the bloodstream, causing vessel inflammation with narrowing causing heart attacks, strokes or worsening of metablic problems. $PM_{2.5}$ is critical for two reasons: first, it cannot be seen and second, people may not know they are at risk because often they have no symptoms from their blood vessel disease. Evidence shows there is no safe threshold of exposure to either $PM_{10}$ or $PM_{2.5}$ (Borchers et al.[1]; Zosky et al. 2021[2]).

Using *National Environment Protection Measure for Ambient Air Quality (Air NEPM)* reports for Western Australia from 2002–2017, Borchers estimated deaths, hospital admissions and emergency department attendance due to elevated $PM_{2.5}$ concentrations from prescribed burning. The estimated increases were:

- 21 premature deaths from prescribed burning (95% confidence interval 8–35)
- ~140 hospitalisations for cardiovascular and respiratory problems
- ~63 emergency department visits with asthma.

The total estimated health costs attributable to prescribed burning were $97.1 million, with 2017 having the greatest annual health cost estimated at $24.1 million.

Knowing a prescribed burn is about to happen does not help prevent health problems. Warnings to stay indoors, aimed at individuals with, for example, lung disease, are uncertain in impact. Recommendations to get additional treatment carries its own risks. Importantly, many people with heart or vascular disease are asymptomatic. Therefore, the only way to reduce the health impacts of poor air quality is to reduce the pollution release at the source.

As well as the federal *Environment Protection and Biodiversity Conservation Act 1999* not being applied to Department of Biodiversity, Conservation and Attractions' (DBCA) prescribed burning program, alarmingly, neither is the *Air NEPM*[3]. The *Air NEPM* classifies bushfires and prescribed burns as exceptional events that are not assessed. In the period 2018–2021, there were more exceedances of the daily $PM_{10}$ and $PM_{2.5}$ standards (Box 2) by prescribed burns (135), than by bushfires (31) and all other causes (109), making it clear that prescribed burns greatly affect south-western Australia's air quality.

The exemption from the *Air NEPM* is presumably because it is wrongly perceived that the prescribed burning program saves human lives and property. However, the health impact suggests exactly the opposite.

**Box 1. Air pollution standards for bushfire smoke**

Bushfire smoke, like other forms of air pollution, includes gases and particulate matter. Particulate matter is a complex mixture of solid and liquid particles and is classified according to size:

$PM_{10}$ – particles smaller than 10 microns in diameter. These contribute to visible smoke haze, can irritate the eyes, throat and lungs but are too large to enter the bloodstream.

$PM_{2.5}$ – particles smaller than 2.5 microns in diameter. These are too small to see and when breathed in, will penetrate deep into a person's lungs and enter the bloodstream.

Standards laid out in the *Air NEPM* are legally binding on each level of Australian government.

The standards are:

| | Maximum concentration | |
|---|---|---|
| Pollutant | Daily average | Yearly average |
| $PM_{10}$ | 50 µg/m³ | 25 µg/m³ |
| $PM_{2.5}$ | 25 µg/m³ | 8 µg/m³ |

Each state and territory is required by the *Air NEPM* to annually report all breaches of this standard, including the sources of pollution.

**Box 2. $PM_{10}$ and $PM_{2.5}$ data**

Western Australia has 12 sites for monitoring $PM_{10}$ and/or $PM_{2.5}$. Five are in the Perth metropolitan area (Armadale, Caversham, Duncraig, Quins Rocks, South Lake); the remainder are in Albany, Bunbury, Busselton, Collie, Geraldton, Kalgoorlie and Mandurah. The number of exceedances observed in daily $PM_{10}$ and $PM_{2.5}$ observations for the years 2018–2021[4,5,6,7] attributed to wildfires and prescribed burns (PB) are:

| Year | $PM_{10}$ | | $PM_{2.5}$ | |
|---|---|---|---|---|
| | Wildfire | PB | Wildfire | PB |
| 2018 | 5 | 15 | 3 | 17 |
| 2019 | 5 | 5 | 7 | 11 |
| 2020 | 1 | 11 | 4 | 25 |
| 2021 | 2 | 17 | 4 | 34 |

All prescribed burn exceedances were recorded at Perth metropolitan sites or Albany, Bunbury, Busselton, Collie and Mandurah, except on one day in April 2021, when a $PM_{2.5}$ exceedance was attributed to prescribed burning at Geraldton.

The table above shows that there is an order of magnitude more days when bad air quality is attributed to prescribed burning than to wildfires.

Smoke haze over Perth.
Source: Environmental Protection Authority https://www.epa.wa.gov.au/policies-guidance/air

People with the following conditions are most at risk from bushfire smoke:

- Asthma, chronic obstructive pulmonary disease and other lung conditions
- Heart and cardiovascular disease: contributing to heart attacks and heart failure
- Metabolic disease: with worsening diabetes and high blood pressure
- Pregnancy: with increased risk of premature birth, lower birth weight, pre-eclampsia and gestational diabetes
- Older people who have many co-morbidities
- Children: more affected, because of developing airways and breathing more air per kilogram body weight than adults.

Young boy having asthma attack
Source: Designed by Freepik www.freepik.com

**Conclusions**

Currently, the health impacts from prescribed burning are an order of magnitude worse than those from wildfire. This alone should guide a review of the current prescribed burning regime, and a re-think of how better to protect people, property and biodiversity.

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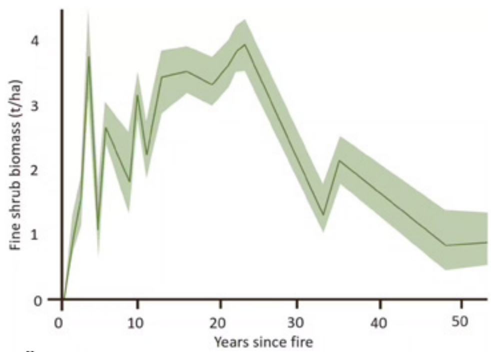
# 5 BURNING STIMULATES GROWTH AND INCREASES FLAMMABILITY

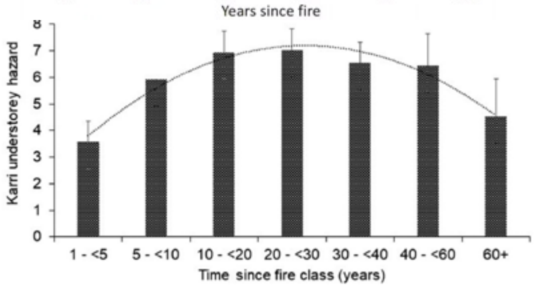
## FACTS ABOUT PRESCRIBED BURNING AND WILDFIRE IN SOUTH-WEST FORESTS

The three requirements for plant growth are sunlight, water and nutrients. Burning vegetation breaks down organic matter and releases nutrients into the soil; fire removes dead or overgrown vegetation allowing more sunlight and water to reach the soil surface. Fire also plays a role in seed germination for some species. Fire often promotes fast-growing, 'greedy' weed species instead of slower-growing native species, so frequent fire will change an ecosystem's species composition.

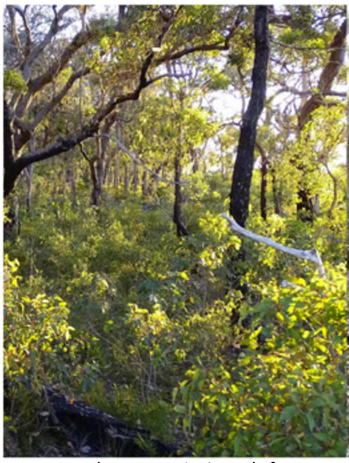
The recovery of jarrah and karri forests after burning was studied by Burrows (1994)[1] and Burrows et al. (2023)[2]. The fine shrub biomass (tonnes/ha) for jarrah forests and the karri understorey fire hazard in the graphs opposite show that understorey (regrowth) biomass is lowest, immediately after fire, then steadily increases to a peak at around 25 years for jarrah forest and between 10 to 30 years for karri forest. Jarrah forest understorey biomass drops rapidly from its peak to an amount, at about 50 years, similar to that at 2 years after fire. The decrease in understorey biomass in karri forest is less abrupt. The understorey fire hazard of long unburnt karri forest (60+ years since fire) is only slightly greater than recently-burnt forest.




Graph showing the fine shrub biomass taken from figure 5-7 in Burrows[1]. Source: Philip Zylstra[3].




Karri forest understorey fire hazard. Source: Burrows et al. 2023[4].

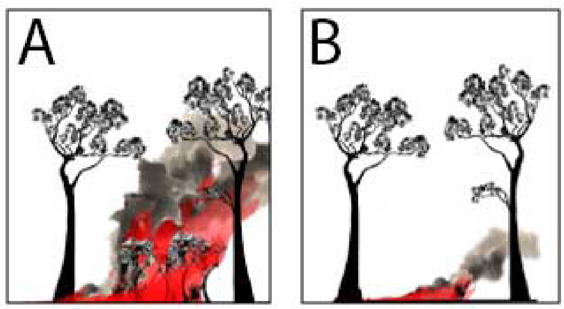


Dense understorey in jarrah forest after burning.
Source: Phil Zylstra[3]

Long unburnt jarrah forest

The left photo shows a jarrah forest several years after burning while the right one shows a jarrah forest that has not been burnt for a long time. The long unburnt forest has less flammable undergrowth, and thus is less fire prone.

Forest flammability is affected far more by structure than by fuel load[4,5,6,7]. The mechanism for increased flammability of disturbed forests is the dense understorey growth, which causes greater flame height and acts as a pathway to ignite the tree crowns (A, in figure below). Plant communities, through the processes of growth and succession over time, transfer biomass from acting as fuel to acting as overstorey shelter (B, in figure below). In a mature forest where heavy biomass held in taller growth has excluded shorter plants, the only fuel available to a fire may be the layer of leaf litter on the forest floor[6]. The mature canopy acts as overstorey shelter keeping the forest damper and greatly reducing wind speeds at ground level, thus reducing rate of fire spread[5,6,7]. Long unburnt forests in south-western Australia were shown to be 7 times less likely to burn than forests recovering from fire[5].




Source: Phil Zylstra[5].

# Burning stimulates growth and makes forests more flammable.

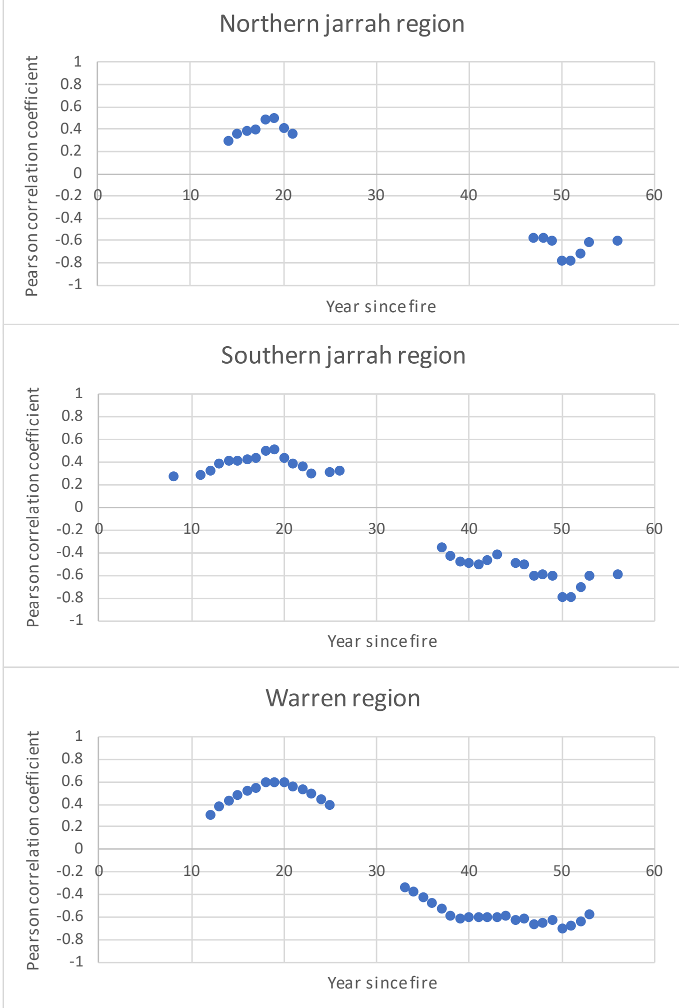
Campbell et al.[8] showed that burning makes forests more flammable by correlating the probability of large wildfires (>1000 ha) against previous prescribed burn data.

All regions show a significant positive correlation between large wildfires 10–25 years after prescribed burning and a significant negative correlation at 30 or more years after prescribed burning. In the southern forests, the strongest positive correlation occurs at around 18 to 19 years after prescribed burning, which roughly corresponds to the peak of fine scrub biomass in jarrah and understorey hazard in karri forests (see graphs on previous page). From 20 years onwards the southern forests become increasingly less prone to large wildfires. The negative correlation at 50 years post-fire shows that large fires are infrequent in rarely-burnt forests. This relationship was more apparent in the Warren region, which is predominantly karri-marri forest, than in the jarrah forests further north, but it is clear in both.

Recent research has shown the lower flammability of mature forests, even when the expected future climate is accounted for[5]. Prescribed burning should be minimal in forests distant from human settlements so that the forest can mature to a less flammable state, which would also benefit fire-sensitive plant and animal species (Fact Sheet 3).

The forest on alternate sides of the road have different periods since last burnt; karri forest near Walpole. Source: South-West Forests Defence Foundation Inc.

The Pearson correlation coefficient quantifies the strength of the relationship between two variables. Its values range from -1 to 1. A value of 1 indicates a perfect linear relationship, that is, as one variable increases the other increases proportionally. A value of -1 indicates a perfect inverse relationship.




Graphs from Campbell et al.[8] Figure 9: Statistically significant ($p<0.05$) Pearson Correlation between median probability of large wildfires per year versus annual prescribed burn extent for time lags 0–60 years.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# 6 DBCA PRESCRIBED BURNING HAS NO SIMILARITY TO INDIGENOUS BURNING

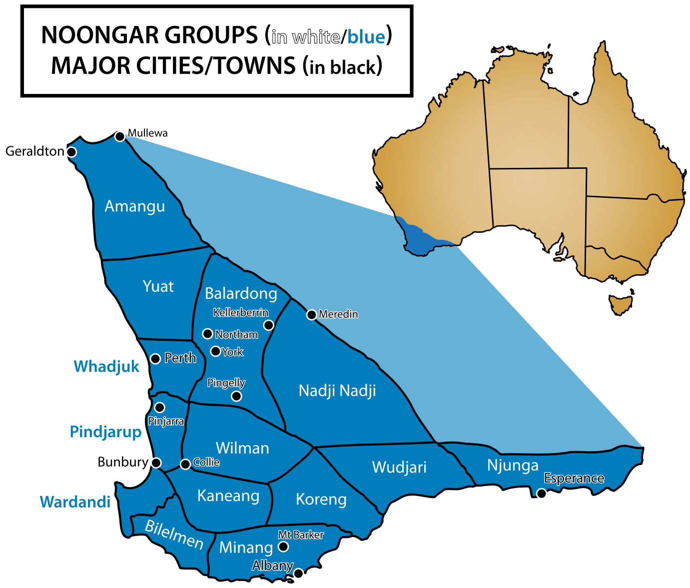
## FACTS ABOUT PRESCRIBED BURNING AND WILDFIRE IN SOUTH-WEST FORESTS

Contemporary fire management in the south-west forests, with its dependence upon broad-scale prescribed burns, contrasts starkly with the approach of the Noongar people, south-western Australia's First Nations peoples.

The Noongar people have lived in the south-west corner of Western Australia for at least 45 000 years. That their burning regimes were strictly controlled is demonstrated in the early colonial literature of Barker (1830) and Nind (1831). Firing regimes were ecosystem- and ownership-specific, with most burning related to procurement of animal resources (hunting). Burning activities were rare in old climatically-buffered infertile landscapes, such as the south-west eucalypt forests[1]. The Noongar people did not burn:

- Red tingle forest[2]
- Karri forest[3]
- Granite outcrops
- Peat wetlands
- Other sensitive environments.

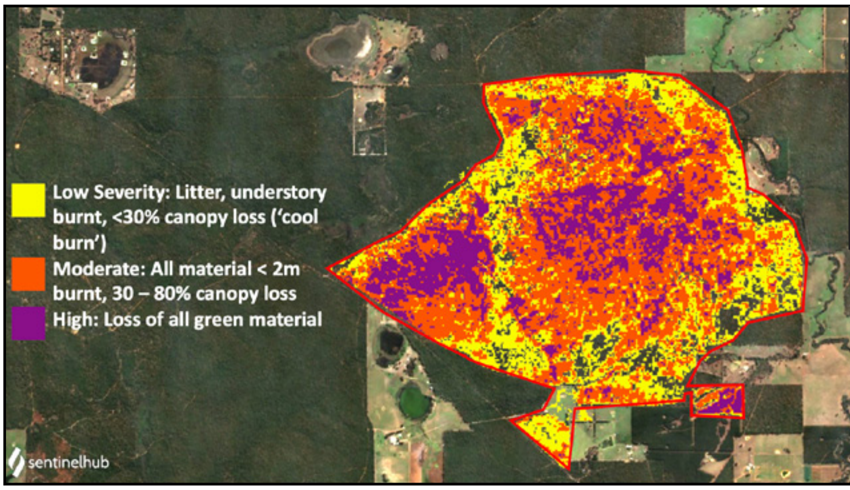
The Department of Biodiversity, Conservation and Attraction's (DBCA's) prescribed burns are indiscriminate. They are mostly ignited by dropping incendiaries from aircraft and not controlled at ground level, so once lit, they burn any ecosystem in their path, including peat wetlands, riparian zones and sensitive granite outcrops. For a comparison between Noongar and DBCA burning see the next page.

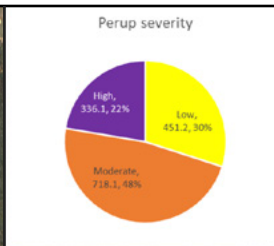



By Brooke Ottley - Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=17662112

Red-tailed black cockatoo. Source: John Carnemolla.

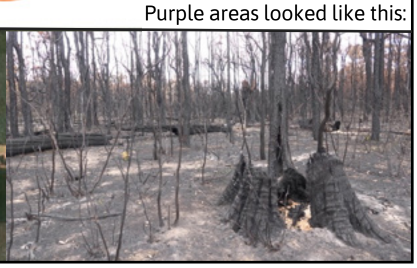
Prescribed burns cause old trees with nesting hollows used by threatened red-tailed, Baudin's and Carnaby's black cockatoos to burn out at the base and collapse.




Intensity of the Perup prescribed burn. Source: Kingsley Dixon.

Purple areas looked like this:



| **Noongar burning** | **DBCA prescribed burning** |
|---|---|
| Burning was highly localised and for very specific reasons, e.g., to improve hunting or foraging[1]. | DBCA has a blanket target of burning 200 000 ha per year over the forest management area. |
| Noongar burning regimes were strictly controlled: Nind (1831)[1] commented: "all of them (the Noongar people) have a right to break down grass trees, kill bandicoots, lizards, and other animals, and dig up roots; but presence of the owner of the ground is considered necessary when they fire the country for game." | DBCA does not consult in good faith or address serious public concerns. Most of the areas burnt each year are not targeted to protect human infrastructure and assets as they are tens of kilometres away from infrastructure. |
| The Noongar people lived on Country of which they had intimate knowledge and they could burn when the weather conditions were exactly what they needed to produce the desired results. With their ongoing connection to country Noongar people should be involved in fire management decisions. | DBCA staff do not have Noongar awareness of country or weather. With the detailed preparation of people and gear needed immediately before a burn and the urge to meet its annual target, DBCA is under pressure to go ahead with burns at unsuitable times and in unsuitable conditions. |
| Ignition was at a limited number of locations on the ground - 'firestick burning'. The Noongar people did their burns bare-footed.  Indigenous burning in the Great Western Woodlands. Source[7]: https://doi.org/10.1111/aec.12377 | Incendiaries are dropped from aircraft, so that the burn area is quickly ignited in a blanket grid of ignition points. Animals are unable to escape such an unnatural pattern of fire.   Flight path for a 2022 prescribed burn in the Walpole Wilderness area. Source: Flight Radar 24. |
| The Noongar people never burnt in spring. Most burns were done in autumn. | DBCA burns in any season when conditions are suitable. Most prescribed burning has been conducted in spring, the worst possible time for nesting birds[4] and flowering plants. |
| Noongar burns are controlled at ground-level to achieve a desired outcome, so are generally 'cool' burns. | The (road) perimeter of a prescribed burn area is first ignited by hand, to form a fire-break to contain the main aerial burn. After the incendiaries are dropped, the conditions and weather changes during the day dictate the resulting fire intensity. |
| The Noongar people did not burn sensitive old ecosystems[1]. They did not burn red tingle forest (Wadandi Pibulmun Yunungjarlu Elder Wayne Webb)[2] or karri forest[3]. | Deliberately or accidentally, DBCA routinely burns sensitive ecosystems including riparian zones, peat wetlands and granite outcrops. |
| The Noongar people did not burn at a frequency that would endanger ecosystems. | DBCA's frequent prescribed burns have a disastrous effect on many species of flora and fauna and their habitat structure[6]. |

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# 7 PRESCRIBED BURNING INCREASES GREENHOUSE GAS EMISSIONS

## FACTS ABOUT PRESCRIBED BURNING AND WILDFIRE IN SOUTH-WEST FORESTS

The Department of Biodiversity, Conservation and Attractions (DBCA) manages 2.5 million hectares of forest in the south-west of Western Australia. Its prescribed burning program targets 200 000 ha of this Forest Management Area (FMA) annually. At this rate, 45% of the FMA will be maintained at a 'fuel age' of less than six years. Analysis of wildfire and prescribed burn extents in the FMA (Campbell et al, 2022)[1] has shown that on average 50 ha of prescribed burn has reduced wildfire extent by 1 ha (leverage of 50:1; Fact Sheet 2).

Since the effects of climate change have increased the severity and frequency of devastating wildfires, it makes sense to analyse the greenhouse gas (GHG) contribution of both prescribed burning and wildfire.

Using methodologies from the IPCC (2006)[2], and Volkava et al. (2019)[3], the estimated GHG emissions for prescribed burning and wildfire in south-western Australian forests have been calculated in the box on the next page. The results are approximately 40 tonnes per ha and 80 tonnes per ha respectively ($CO_2$-equivalent). The higher value for wildfire is due to the increased patch area and the increased fraction of biomass combusted.

This means that 200 000 ha of prescribed burning would emit approximately 8 million tonnes of GHG per year, 25 times as much as the 0.32 million tonnes that would be emitted from the 4000 ha of wildfire it is supposedly preventing.

DBCA burned 175 414 ha of the FMA in the 2022–23 prescribed burning program (DBCA annual report)[4]. This burning would have emitted approximately 7 million tonnes of GHGs or **8% of Western Australia's reported total emissions of 83 million tonnes for the period[5].**

This photo shows a prescribed burn in Mt Lindesay National Park, in November 2019 that was as hot as a wildfire, so would have had similar emissions. Source: Roger D'Souza.

Styx block prescribed burn, November 2023. Source: Bart Lebbing.

The IPCC has estimated the maximum atmospheric GHG concentration required to limit global warming to 1.5 deg C. At the world's current emission rate, just 9–11 years remain to reach net zero emissions to limit global warming to 1.5 deg C. Australia has less time (7 years; Pugh 2022[6]). Clearly, GHG emissions need to be radically reduced. Prescribed burning south-west forests makes a significant, completely avoidable contribution and, on this basis alone, it should be discontinued in its current form. This is recognised in Europe where prescribed burning is prohibited in many European countries (Narayan, 2007[7]).

**Conclusions:**

- Stopping the annual broad-scale 200 000 ha prescribed burning program would eliminate approximately 8 million tonnes per year of GHG emissions.
- The expected increase in wildfires is estimated to be 4000 ha, which would have GHG emissions of approximately 0.32 million tonnes.
- The net saving in GHG emissions would represent approximately 1.5–1.7% of Australia's current emissions and 8–10% of W.A.'s emissions.
- Resources from DBCA's current broad-scale prescribed burning program could be redirected to more targeted strategies to protect human life and infrastructure.

## GHG emission calculations for 1 ha of prescribed burn and 1 ha of wildfire

The principal greenhouse gases of concern are carbon dioxide, methane and nitrous oxide.

Emission equation[2]: $E_i = A * P * M * CF * EF_i$

where
- $E_i$ GHG emission (g) due to gas i
- $A$ Fire area (ha)
- $P$ Patchiness
- $M$ Biomass available for burning (t/ha)
- $CF$ Combustion factor = fraction of biomass burnt
- $EF_i$ Emission factor = g of gas i emitted per kg of matter burnt

and $i$ is
- $CO_2$ for carbon dioxide
- $CH_4$ for methane
- $N_2O$ for nitrous oxide

Parameter values:

$A$ = 1 ha

$P$ = 0.65 for prescribed burn (PB), 0.8 for wildfire (WF)[8]

$M$ = 20.2 t/ha for litter < 6mm, 72.7 t/ha for coarse wood debris (CWD)[3]

$CF$ = 0.6 for litter in PB, 0.9 for litter in WF, 0.3 for CWD in PB, 0.5 for CWD in WF[3]

$EF_{CO2}$ = 1640 g/kg for litter, 1479 g/kg for CWD[9]

$EF_{CH4}$ = 0.9 g/kg for litter, 10.9 g/kg for CWD[3]

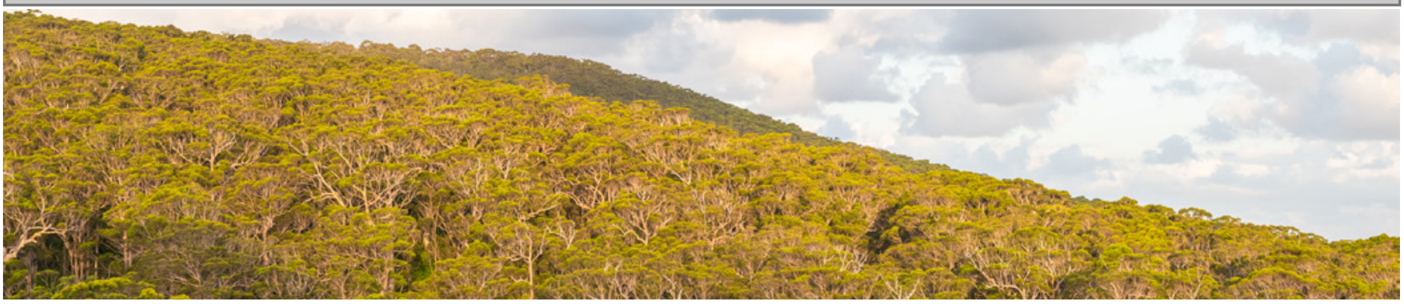
$EF_{N2O}$ = 0.072 g/kg for litter, 0.038 g/kg for CWD[3]

The different GHGs have different potentials for contributing to global warming. This is expressed as global warming potential (GWP). To calculate the $CO_2$-equivalent emissions for a GHG, the mass of gas emitted is multiplied by the GWP.

GWP = 1 for $CO_2$, 34 for $CH_4$, 298 for $N_2O$[9]

Using the emission equation, the parameter values and the GWP, the $CO_2$-equivalent GHG emissions are:

**40 t/ha for prescribed burning and 79 t/ha for wildfire.**



Walpole National Park January 2020. Source: South-West Forests Defence Foundation Inc.

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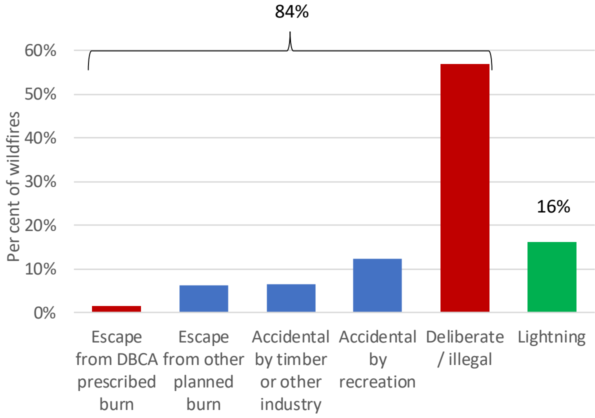
# 8 WILDFIRE CAUSES AND BEHAVIOUR

## FACTS ABOUT PRESCRIBED BURNING AND WILDFIRE IN SOUTH-WEST FORESTS

## Ignition

The main cause of wildfire is deliberate, illegal ignition. Using the fire history data, it is estimated that 57% of wildfires were started by arson. Lightning accounted for 16% of wildfires; the remaining 27% were escapes from industry, planned burns or recreation (campfires).




Causes of south-west wildfires from the DBCA_060 database[1] for January 1992 to December 2023. The 30% of wildfires with unknown cause were assigned a cause in the same ratio as wildfires with known cause.

Wildfires burn houses down, disrupt power supplies and kill people. Our drying climate in south-western Australia makes wildfires more likely to occur. The community should be educated about arson, which should be heavily penalised and not tolerated. Fire-fighters need to be adequately resourced to respond quickly, efficiently and effectively to wildfires.

85 firefighters and multiple fixed-winged water bombers fought an out-of-control wildfire started by arsonist(s) in the Walpole Wilderness area in April 2024.
Source: Department of Biodiversity, Conservation and Attractions.

Dwelling destroyed by out-of-control prescribed burn in Margaret River.

Source: Report on "Investigation of the house losses in the Margaret River Bushfire 23 November 2011", Department of Fire & Emergency Services, October 2012.

## Fuel

Dense understorey regrowth in tingle forest of karri wattle and karri hazel following mass germination triggered by prescribed burning. Giants block, Tingledale, Frankland District. Source: Icons to Ashes[2].

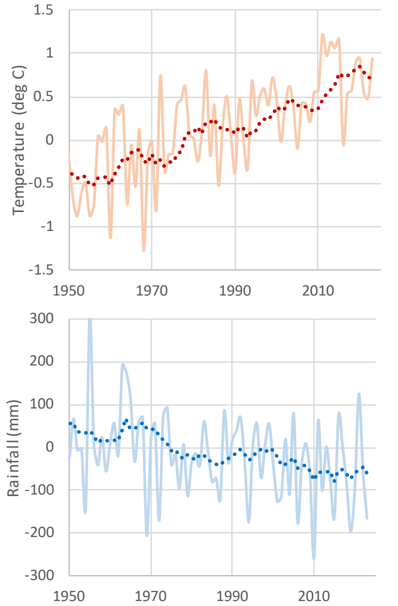
**Forest left unburnt and allowed to mature is less flammable than frequently burnt forest.** In the adjacent photo dense understorey is apparent[3]: As time-since-burn increases, understorey in red tingle and other forest self-thins and self-prunes. The litter on the ground decays and poses a lower fire risk than when still suspended. The canopy shelters the forest floor, greatly reducing wind and fire severity. In this way, long unburnt forest controls fire rather than fuelling it.

In contrast, prescribed burning creates dense regrowth, which burns severely during high-intensity fires. A study by Zylstra et al.[3] showed that in dense regrowth, firefighters are often unable to extinguish the flames and need to resort to backburning - a risky fire suppression technique that can greatly increase the area burnt.

## Climate and weather

The climate in south-west forests is hotter and drier than last century and this trend is predicted to continue. This is stressing forest ecosystems and threatening their biodiversity. Prescribed burning adds to these stresses.

- Forests are becoming drier.
- Fire seasons are becoming longer.
- Weather-driven fires will become more prevalent and fuel load on the forest floor less important.
- It is becoming more dangerous to undertake prescribed burning and there is a greater likelihood of escape.
- Periods of extreme weather conditions are increasing.



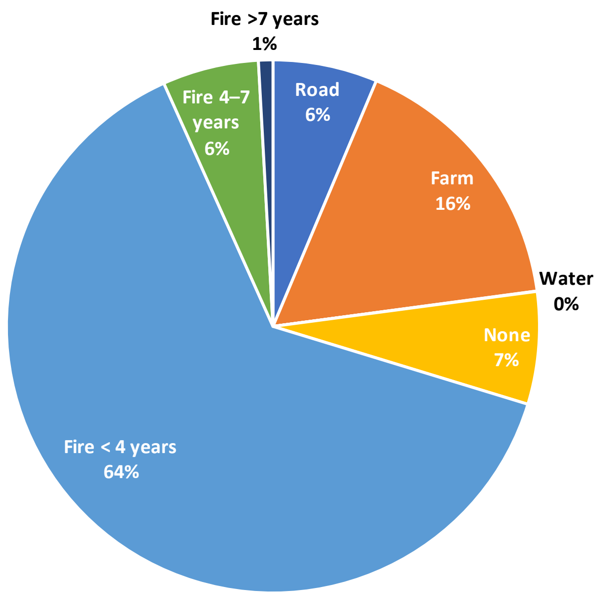

Bureau of Meteorology annual temperature and rainfall anomalies for south-western Australia relative to the 1961–1990 baseline with 10-year moving average. Source: [http://www.bom.gov.au/cgi-bin/climate/change/timeseries.cgi](http://www.bom.gov.au/cgi-bin/climate/change/timeseries.cgi)

## What stops wildfires?

Small wildfires may be stopped by weather changes, firefighting or reaching a low flammability barrier such as a river, road or fire-break. Very intense, large wildfires are generally only stopped by wind or weather changes, even if low flammability barriers may aid firefighting at the margins.

An analysis[4] of 312 south-west wildfires that occurred in the dry periods of 2010/11 to 2021/22 considered the characteristics of the area in which the fire died out or was extinguished. By number, most wildfires were extinguished when they reached a road. These were most likely smaller fires, easily controlled. By area, most fires (64%) were extinguished in an area which had been burnt within the previous 3 years; only a small portion of wildfires stopped at a road (6%). Large intense fires readily jump roads and rivers.

This analysis[4] shows that forest burnt within the last 3 years poses a low fire risk. Frequent burning may be an appropriate strategy close to critical infrastructure, but would lead to major changes to the forest ecosystem. The environmental, human health and economic costs of burning at that frequency could not be tolerated. **This analysis does not highlight the low flammability of long unburnt forest since it was not represented sufficiently in the data.**




Percentage of total area of bushfires studied that stopped (were extinguished) at roads, farms, areas burnt in preceding 3 years, areas burnt 4–7 years previously and areas not burnt for more than 7 years. 'None' indicates a border type was not identified.
Source: Tristan Campbell *personal communication*[4].

## Fire-fighting resources and effort

Immediate detection and rapid suppression of ignitions is the safest and most effective way to protect life, property and biodiversity from wildfires.

**References:**

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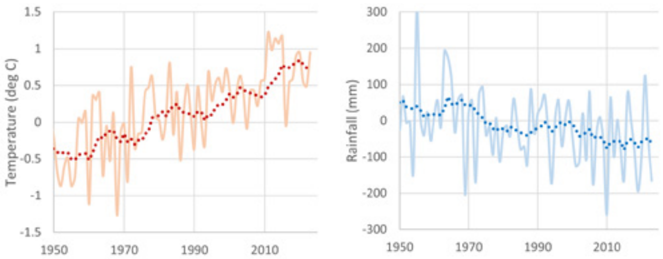
# 9 CLIMATE AND FORESTS

## FACTS ABOUT PRESCRIBED BURNING AND WILDFIRE IN SOUTH-WEST FORESTS

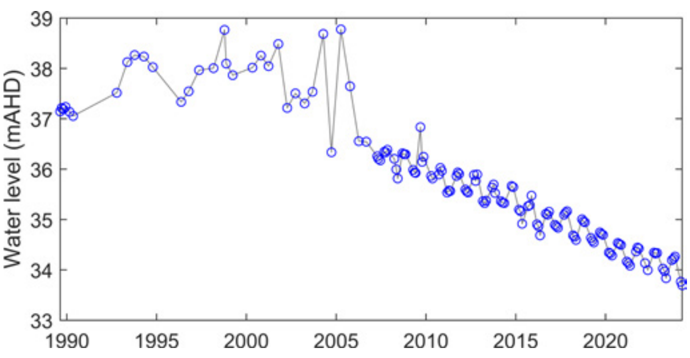
## Past climate

South-western Australia's climate has changed. There was a major step down in Perth rainfall in 1974, and another in 2000. Further south the rainfall step downs occur later[1]. Bureau of Meteorology (BOM) mean temperature and rainfall anomalies for south-western Australia relative to the 1961–1990 baseline show these changes[2].




BOM temperature and rainfall anomalies for south-western Australia relative to the 1961–1990 baseline with 10-year moving average.
Source: http://www.bom.gov.au/cgi-bin/climate/change/timeseries.cgi

The decreased rainfall and higher temperatures, which have caused the groundwater that the trees rely on to decline, have already taken a toll on south-west forests. The graph below shows a superficial bore located in forest on the Blackwood Plateau with a groundwater decline of 4 m since 2000.




Source: Department of Water and Environmental Regulation (DWER) bore 60918175[3]. Note: pre-2000 quality control was not rigorous.

Other forest regions with local groundwater systems, although not monitored, are also suffering.

## Future climate

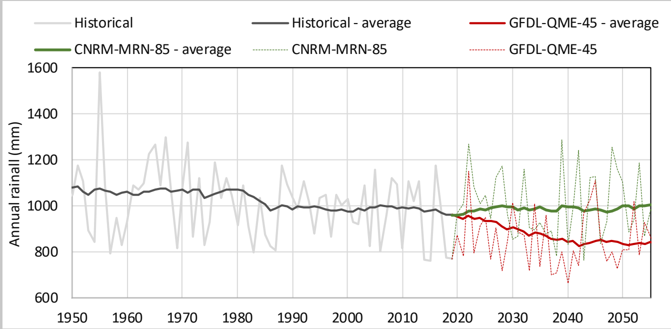
South-western Australia is one of the locations where global climate models have successfully predicted changing rainfall and temperature due to human-induced global warming. Climate models predict further warming and drying in south-western Australia:

- temperature increases
- rainfall decreases
- changed rainfall seasonality with more summer rainfall (relatively).

Rainfall will be less effective in generating stream flow and groundwater recharge due to

- increased evaporation
- greater interception losses.

For example, the Department of Water and Environmental Regulation (DWER)[4] estimated inflows to Nullaki (Wilson Inlet) using two global climate models that had increased temperatures and evapotranspiration (+ 5%); and 1) similar rainfall to (CRNM-MRNBC-85[5]) or 2) less rainfall (GFDL-QME-45[6];-14%) than the last 30 years. The predicted inflows for the next 30 years to Nullaki were 1) 10% less for the wet scenario and 2) 64% less for the dry scenario, compared with the flows for 1994–2023.




Historical and future potential wet (CRNM-MRNBC-85[5]) and dry (GFDL-QME-45[6]) annual rainfall for estimating Nullaki future inflows. Source: Hennig et al.[4].

Future evapotranspiration increases and decreased rainfall will cause the groundwater decline in forests to continue, causing tree deaths until a new equilibrium is reached.

**The forests are stressed, prescribed burning adds to these stresses.**

## In our forests the higher temperatures and reduced rainfall will:

- cause lower groundwater tables which will lead to more vegetation deaths
- cause streams to have less flow and a shorter flow duration
- reduce the number of days with weather conditions allowing prescribed burning
- make prescribed burning more dangerous and escapes more likely
- make arson very dangerous with greater probability of causing harm.

## Deforestation also causes decreased rainfall.

Andrich et Imberger[1] claim that 55% of the decrease in winter rainfall on the Darling Scarp, and 62% of the decrease in winter rainfall in the wheat belt, from 1960 onwards, can be attributed to land clearing. The remaining 45% and 38% of the rainfall decline is therefore attributed to some combination of long-term natural variation and human-caused climate changes.

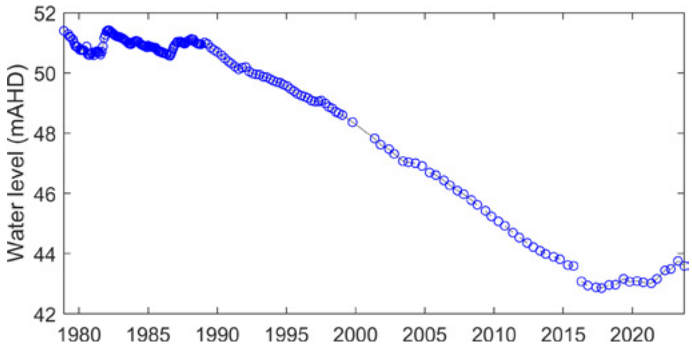
It was estimated that by 1970, 30% of the coastal strip had been cleared, and during 1970–1980 a further 50% was cleared (12 500 km$^2$). Similarly, during the 1950–1970 period, 48 000 km$^2$ or 28% of the wheatbelt area was cleared reducing native vegetation from around 60% to 30%. By 1980 only 20% of native vegetation remained. The periods of rapid vegetation clearing align with the inland rainfall declines relative to those observed at coastal stations.

## Loss of canopy from prescribed burning reduces soil moisture.

Burning forests eliminates foliage, dead woody material and other litter on the ground. These changes result in more solar radiation reaching the forest floor causing it to dry out. This not only makes the remaining litter more flammable, but also kills the fungi and animals that decompose it naturally.

## Abstraction for water supply can also causes groundwater decline.

Abstraction, decreased rainfall and increased temperatures work together to decrease groundwater levels. There was a steady decline in Gnangara mound groundwater levels following increased abstraction for Perth's water supply in the 1990s. This led to the drying of some local wetlands. Below shows the water level decline in a bore on the mound and photos of Loch McNess in 2007 and 2015[7].




Source: DWER bore 61610676[3].

Loch McNess in August 2007 (top) and in September 2015 (bottom)[7].

**References**

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# WHAT SHOULD BE DONE?

**Radically revise DBCA's current, target-driven, industrial-scale prescribed burning program so that it reliably maintains a low fire hazard in Land Management Zone (LMZ) A, the forested areas immediately surrounding communities (i.e. within 3.5 km).**

Recent events prove that prescribed burning is failing in its aim of protecting communities. Hazard reduction work should be concentrated in the LMZ A, where the program currently fails to meet its target and where escapes have had catastrophic consequences. Mechanical removal and mulching of fire escalating vegetation should be added to prescribed burning as a fire hazard reduction tool in these areas, one that does not contribute to smoke-induced health hazards.

**A drying and heating climate will inevitably result in increased wildfire. Rapid detection and suppression is likely to become the only possible way to prevent destructive, catastrophic wildfire, whatever the ignition source.**

Prescribed burning is already largely ineffective in reducing the area burnt by wildfire and as conditions become drier and extreme weather events increase in frequency, it will soon be obsolete. Suppressing fires at points of ignition will then be the only way to prevent landscape-scale fire.

**In LMZ B and LMZ C (between 3.5 and 11 km and more than 11 km from communities, respectively), make the effective protection and enhancement of biodiversity the sole objectives of land management.**

Broad-area aerial ignition must be discontinued. It is consistently demonstrated to be indiscriminate and destructive.

**Management burning in LMZ B and LMZ C should apply the techniques practised by the traditional custodians of the forests and involve them in these operations.**

Noongar peoples possess a unique knowledge and understanding of the bush and how to apply fire so that biodiversity is preserved and promoted. It has worked for thousands of years. They did not burn the karri and tingle forests, granite outcrops or peatlands, and the frequency of fire applied elsewhere was mostly narrowly targeted or low. If communities are proximally well protected, remote forest areas can be steadily and deliberately managed back to pre-European settlement condition with many long-unburnt patches.

**Strict building codes and other protection measures in fire-prone areas should be urgently transitioned into effect and enforced.**

Most of the destruction of property and infrastructure is due to failure of owners to construct or retro-fit buildings so they resist attack by embers and high intensity but short-lived radiant heat. No amount of wildfire hazard reduction in surrounding forest or bushland will remove the need for these essential protection measures.

**Education programs are urgently required to improve community understanding of the importance of biodiversity and the destructive impacts of arson and planned, frequent, extensive burning.**

Incredibly, arson is the source of most wildfires and while DBCA continues to set the example that it does, this too is unlikely to change.


A C-130H water bomber as used in W.A.
Source: https://www.emergency-live.com/marketplace/coulson-aviation-secures-c-130h-hercules-airtanker-four-year-firefighting-contract-in-western-australia/

Web version QR code link: