Major Bushfires in Australian History. The 1974 and 1975 Australian Bushfires.

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Summary.
In contrast to the temperate southern regions of Australia, fire events in Central Australia are driven by above average rainfall in the preceding years, rather than below average rainfall or drought in the current year. Widespread fire events in central Australia were found to be associated with two or more consecutive years of above-average rainfall. Fuel loads in long-unburnt grassland can get to high levels.

In 1974–75 Australian a series of bushfires (wildfires) burned across Australia over many months. They burned an estimated 117 million hectares, approximately 15% of Australia's land mass suffered fire damage, and included areas of New South Wales, the Northern Territory, Queensland, South Australia and Western Australia. The fires killed six people, approximately 57,000 farm animals, farmers' crops, and destroyed nearly 10,200 kilometres of fencing.

As noted by Cheney (1976) in relation to the 1974-75 Fire Season: *The first large fires burnt in June on the Barkly Tablelands and in the Victoria River District of the Northern Territory. Further huge outbreaks occurred during the following months through to February, with the occurrence moving south through the centre of Australia and towards the eastern coast of New South Wales as grasslands progressively cured with the onset of summer.*

The review includes two case studies in relation to the extent and impact of the bushfires. The first case study used for the 1974/ 5 bushfires is from west of Lake Mackay in the Gibson Desert, Western Australia. The second case study used for the 1974/ 5 bushfires is from the southern Tanami Desert in southern Northern Territory.

The review looks at bushfire suppression in an area of central Australia and also an area in Western NSW. The Moolah-Corinya fire in western NSW was "the largest fire ever contained by man in New South Wales without the help of the weather." It burned 1.166 million hectares and its perimeter was over 1,000 kilometres.

Aboriginal cultural burning/ prescribed burning/ ecological maintenance burning are important programs for reducing fuel loads, providing bushfire buffers, in setting up safe and healthy landscapes and reducing fauna kills in large bushfires.

Australian Wildlife Conservancy (AWC) undertakes large scale annual prescribed burning across their large estate and is Australia's largest non-government fire management program. In 2020, AWC worked with their Wilinggin and Dambimangari Aboriginal Corporation Partners to carry out prescribed aerial burning over an area equivalent to the size of Tasmania – about 6.5 million hectares in planned strip burning using aircraft and ground burning. The 2020 burning program total distance flown across the Kimberley amounted to an estimated 40,000 kilometres, with an estimated total of 220,000 incendiaries dropped. The AWC approach provides a good platform for undertaking prescribed burning, reducing fuel loads, looking after wildlife, reducing greenhouse gas emissions and working closely with Aboriginal groups.

As outlined in Section 10, the review has identified a number of learnings and adaptive management strategies in relation to the 1974/ 5 bushfires and also considered for the future. This section has been broken down in a number of areas, looking at the 1974/ 5 bushfires as well as combined with the learnings and opportunities of today. Opportunities include considering fire management strategies on individual farms and regional areas; using thunderstorm and lightning monitoring service; using satellite technology and greater focus on alliancing and establishing relationships and partnerships in regards to assets. Opportunities in relation to prescribed burning strategies include undertaking prescribed burning in the early dry season is implemented in part to limit the spread of the more destructive wildfires that occur in the later part of the year; refining prescribed burning strategies; adopt prescribed burning programs that use either helicopters, fixed-wing aircraft or drones to drop aerial incendiaries or ground based programs and considering the AWC aerial prescribed burning approach provides a good platform for undertaking prescribed burning, reducing fuel loads, looking after wildlife and reducing greenhouse gas emissions.

1 Introduction.
Reasons for looking more closely into the 1974 and 1975 bushfires in Australia was to understand the scale and severity of the bushfires; consider Aboriginal and pastoral burning practices; to understand fuel loads and dynamics and to try and tease out any potential learnings/ adaptive management strategies for future bushfire management. Available time to research this paper was limited and to a degree, restricted by Covid 19 restrictions on movement and library access.

2 The 1974/ 75 bushfire season and locations.
The 1974/ 75 bushfire season and locations are addressed in the sections below.

2.1 Details and areas of the 1974/ 75 bushfire season.
Information extracted from Wikipedia on 15 September 2021, "1974–75 Australian bushfire season":

1974–75 Australian bushfire season

Location	• *New South Wales* • *Northern Territory* • *Queensland* • *South Australia* • *Western Australia*
Statistics	
Total area	*117 million hectares (290 million acres)*
Date(s)	*October 1974 – February 1975*
Buildings destroyed	*10,200 kilometres (6,300 mi) of fencing*
Deaths	*6*
Livestock losses	*57,000*

The 1974–75 Australian bushfire season is a series of bushfires, also known around the world as wildfires, that burned across Australia. Fires that summer burned up an estimated 117 million hectares…….[1][2] Approximately 15% of Australia's land mass suffered "extensive fire damage"[1][3] including parts of New South Wales, the Northern Territory, Queensland, South Australia and Western Australia.

Statistics

The fires killed six people, approximately 57,000 farm animals, farmers' crops, and destroyed nearly 10,200 kilometres (6,300 mi) of fencing.[4]:339–345

The Australian Bureau of Statistics attributed the extent of the fires to "exceptionally heavy rainfall in the previous two years".[3]

Stephen J. Pyne qualified the fire season as the most destructive event in terms of hectares burned among historical fires in Australia, but added that "the 1974/75 fires had almost no impact and much of the damage was found by satellite after the fact."[5] In 2011, retired Australian government scientist David Packham warned that "we are in for one big season" that could repeat the 1974 summer fires.[6]

Areas impacted.

Australia, being a federation of States and territories, breaks up the 1974-1975 fires by state or region.

References and Wikipedia state-based information is included in Annexure 1, and details are summarised in Table 1 below.

Table 1. Summary of Wikipedia state-based information.

State	Wikipedia Bushfire area hectares (ha)	Areas affected	Losses
WA	29.0 M	Damaging east and north-east of Kalgoorlie.[4]:344	
SA	15.0 M	The areas affected were the north-west of the state (arid and semi-arid zones), and the Adelaide Hills.[4]:344	
Qld	7.3 M	Areas damaged: Thargomindah, Bulloo Shire, Boulia Urandangie, McKinlay Shire.[4]:340	95 cattle, 6,850 sheep lost.
NT	45.0 M	The fire reached Barkly Tableland, Victoria River district, near Newcastle Waters.[4]:339	
NSW	3.5 M	Bourke to Balranald, Cobar Shire, Moolah–Corinya—most of the Western Division.[4]:341 The Moolah-Corinya fire was "the largest fire ever contained by man in New South Wales without the help of the weather." It burned 1.166 million hectares (2.88 million acres) and its perimeter was over 1,000 kilometres (620 mi).[8]	Six people killed. 50,000 livestock lost, 10,170 kilometres (6,320 mi) of fencing destroyed. Lost crops, and widespread damage to infrastructure, including communications, roads and railways.[7]
Total	99.8 M		

The author has tabulated three sources of bushfire information in regards to the 1974/ 75 bushfire areas in each state in Table 2:

- the Wikipedia area information above;
- The area details provided in Ellis et al. 2004; and
- The area details provided in Cheney (1976).

Table 2. Assessing three sources of bushfire information in regards to bushfire areas in each state

State	Wikipedia areas (ha).	Ellis et al (2004) Appendix D areas (ha)	Cheney (1976) areas (ha).	Assessment of areas data.
WA 1974–1975	29.0 M	29 M	29 M ha	Consistent all 3 sources of area information.
SA 1974–1975	15.0 M	16 M	16 M ha	Close in all 3 sources of area information.
Qld 1974 October to 1975 February	7.3 M	7.3 M	22 M ha	Wide divergence in areas. It is possible that the differences in estimates relate to protective burning by graziers.
NT 1974–1975	45.0 M	45 M	45 M ha	Consistent all 3 sources of area information.
NSW 1974–1975	3.5 M	4.5 M	5 M ha	Some relatively minor divergence in all three sources.
Total	99.8 M	101.8 M	117 M	Some divergence in all three sources.

Further state based detail from Luke and McArthur (1978) is included as Annexure 2. Key points from this:

- This is very good data.
- A small additional area of 1974/ 75 bushfires is included in Victoria, of 0.12 million hectares.
- As outlined in Table 26.1 of Annexure 2, of the total area of 117.1 million hectares burnt in the 1974/ 75 fire season, 60.02 million hectares was pastoral land and 57.1 million hectares was on unoccupied land.
- As outlined in Table 26.2, 93.6 million hectares was burnt by bushfires and 23.5 million hectares was burnt by graziers burning off.
- Reviewing the state based area figures in Table 26.2 in regards to graziers burning off explains much of the difference in area estimates outlined in Table 2 above.

This review has used the 117 M hectares as used by Luke and McArthur (1978), Cheney (1976) and Wikipedia in its summary statistics, but has noted the varying area estimates in this review.

McFadden (2020) noted the loss of 40 homes, a considerable number, the author has not seen this information anywhere else. McFadden also notes that "*The 1974-1975 Australian bushfires were almost apocalyptic".*

Noting the considerable time since the 1974/ 75 bushfires, the author disagrees with the Wikipedia information above that the 1974/ 75 bushfires no impact in relation to *"the 1974/75 fires had almost no impact and …."* and also "The 1974-1975 Australian bushfires were almost apocalyptic" statement.

The following facts in relation to impacts of these bushfires are important:

- Six people were killed.
- The scale of the bushfires and the considerable areas burnt at the later stages of the dry season, there were times when the fires were higher intensity and noting there is new research in regards to the impacts of these fires in biodiversity and other values.
- In NSW alone, 50,000 livestock were lost and 10,170 kilometres of fencing destroyed. In addition, there were lost crops, and widespread damage to infrastructure, including communications, roads and railways.
- If McFadden is correct, 40 houses were lost.
- It is likely that there were unreported losses in the other states, especially the NT, SA and WA.
- Many landholders were impacted by the bushfires.
- The large scale of the bushfire efforts to contain the Moolah-Corinya fire in Western NSW, more information is detailed further below in relation to this bushfire.

The author agrees that much of the extent/ scale of the damage was identified after the bushfires and the scale of impacts was considerably smaller than southern Australia major bushfires, but there were considerable impacts.

2.2 Locations of the 1974 and 1975 bushfires.

A map of the extensive areas burnt in the 1974/ 1975 bushfires is shown in Figure 1 and was prepared by Alan McArthur (Luke and McArthur 1978) and also reproduced in Cheney (2007) and other documents.

Figure 1 emphasises the extent of the 1974/ 75 bushfires across Australia, aapproximately 15% of Australia's land mass suffered fire damage.

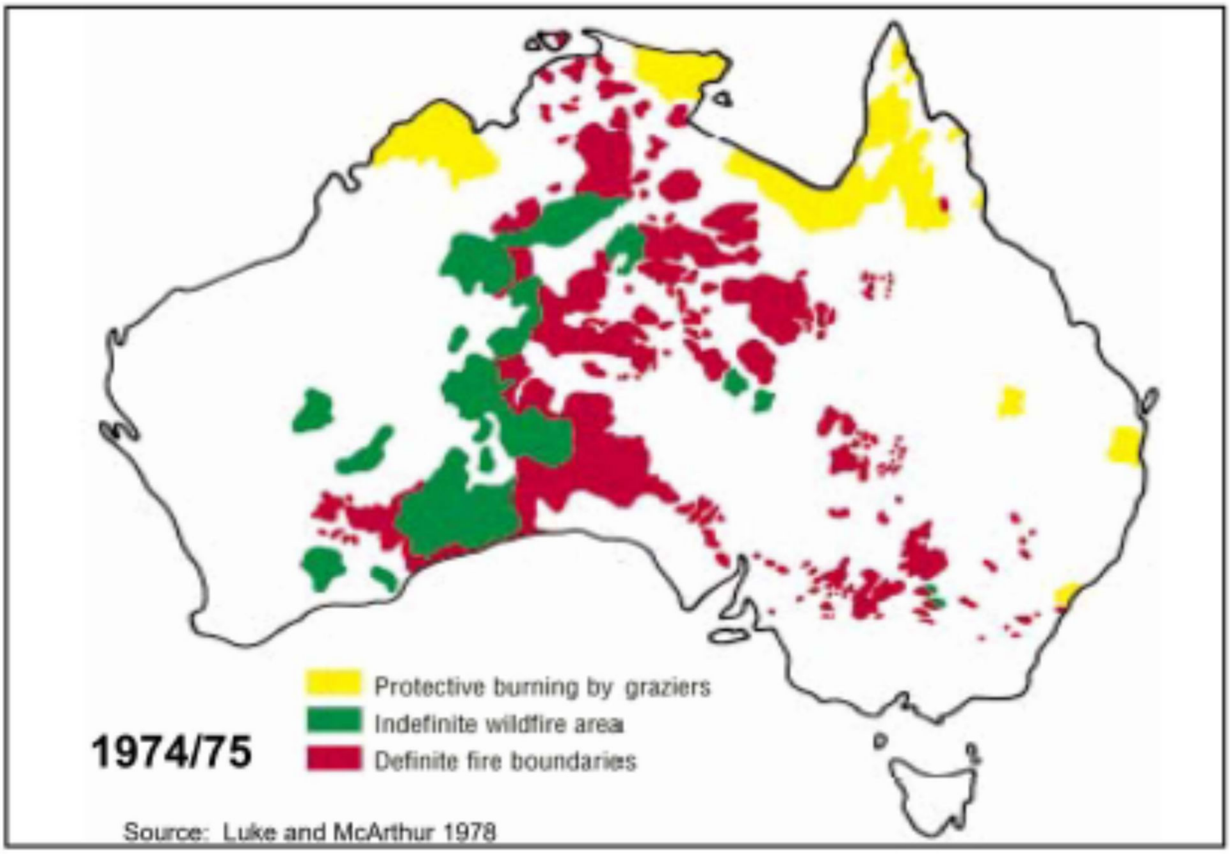


Figure 1. Area burnt by bushfires across Australia, compiled by Alan McArthur.

In the light of current knowledge, difficulty in identifying all the fires at the time, indefinite areas and improved satellite imagery compared to 1978, it is possible that McArthur underestimated the areas burnt in Northern areas both on the indefinite wildfire area and the area designated as protective burning by graziers.

2.3 Other important details in relation to the 1974 and 1975 bushfires.

As detailed in Cheney (1976):

During the 1974-75 fire season a large number of lightning fires occurred in heavy grass fuels in central Australia and were responsible for the major proportion of the total area of 117 million ha burnt throughout Australia during that season (Luke and McArthur 1978).

and:

The 1974-75 Fire Season.

Unprecedented rainfall during 1974 resulted in lush, continuous grass and herb growth throughout the arid zone of Australia where the vegetation is normally sparse and, in most seasons, fires are not able to cover large areas. The first large fires burnt in June on the Barkly Tablelands and in the Victoria River District of the Northern Territory. Further huge outbreaks occurred during the following months through to February, with the occurrence moving south through the centre of Australia and towards the eastern coast of New South Wales as grasslands progressively cured with the onset of summer. By the end of the season it was estimated that the total area burnt in Australia during the season was over 117 million ha. Extensive areas were burnt in all States except Victoria and Tasmania and the breakdown by States in millions of hectares is W.A. - 29, S.A. - 16, N.T. - 45, Qld. - 22 and N.S.W. - 5 (Luke and McArthur 1978).

The areas burnt were approximately half pastoral land of various degrees of improvement and half unoccupied land. It was not feasible to estimate the total damage resulting from these fires; it would be high on improved holdings and negligible (or even considered beneficial by some graziers) on some unimproved areas. However, the losses of fencing and loss of potential earnings were enormous. In the Western Division of New South Wales alone where fires *burnt 3.84 million ha the losses were assessed at $5.09 million. These losses were made up mainly of fencing, $2.39 million, loss of pasture, $0.86 million, and fire fighting costs, $1.42 million.*

Generally there was an absence of strong winds during the season and it seems that no State had a day which could be truly described as a 'blow-up' day, although there were several brief periods of relatively strong winds. Had days of very strong winds and extreme fire danger occurred the area burnt and damage caused would have been considerably greater.

and:

At the other end of the scale the extensive pastoral fires in the 1974- 75 fire season caused little public concern although the losses ran into millions of dollars; the few people involved experienced fire behaviour well exceeding their normal expectations and undoubtedly suffered considerable hardship. Certainly the hazard to life was not high due to relatively low rates of spread, but other factors such as suppression and stock protection were more difficult than associated with high intensity grassfires in more developed pastoral areas because of the sparse population and lack of access. These fires should be considered as disaster fires for relief purposes and are important when further investment in the areas is considered.

The 1974/5 bushfires were correctly assessed as disaster fires, mainly in terms for relief purposes and also when considering further investment in the areas.

Two individual bushfires disasters in the 1974/ 75 bushfires were reviewed by Cheney (1976), but not in detail:

- One was the Barkly Tablelands bushfire in June 1974, these fires covered 2.5 M hectares.
- The other was the December 1974 Cobar and Balralnald bushfires in NSW, these fires covered 1.2 M hectares, further detail is provided: *Another low-occurrence zone exists in western New South Wales in the area between Hay and Balranald where salt bush (A triplex sp.) vegetation is predominant and there is rarely sufficient fuel to carry a fire except in years of exceptionally heavy rainfall.*

As included in Cheney (1995):

Even the normally arid interior of the country is capable of carrying extensive fires. In 1974-75, lush growth of grasses and forbs following exceptionally heavy rainfall in the previous two years provided continuous fuels through much of central Australia and in this season fires burnt over 117 million hectares or 15 per cent of the total land area of this continent.

and:

The fire season in different regions of Australia depends primarily on latitude. In northern Australia the main fire season is winter and spring (the dry season of wet-dry tropics) and when the prevailing wind direction is from the south-east. The fire season in southern Australia is predominantly summer and autumn…. The most severe fire weather occurs in the south-eastern corner of Australia south of a line between Adelaide and Sydney. This is where high pressure systems located in the Tasman Sea can force hot, dry air from the centre of the continent and where low pressure troughs travelling across the southern ocean can form very strong pressure gradients and produce very strong, dry winds. In other parts of the country strong winds during the dry season are rare; they are generally associated with the tropical cyclones and are mostly heavily moisture laden, though, on occasions, cyclonic winds have caused havoc during the fire season in Western Australia.

Cheney (1976) provides further detail in relation to the Northern Territory:

In northern Australia it is expected that the frequency of large fires causing economic losses will increase. Until recently much of the Top-End of the Northern Territory, had been subjected to annual burning, particularly in the open tropical woodlands, during the dry season. In 1965, Stocker (1966) observed that the area north of Katherine was burnt out within the first 2 or 3 months of each dry season. Although these fires may have covered large areas and were occasionally of high-intensity, they were accepted as a routine feature of the environment and not incompatible with management for extensive grazing.

In August 1976 an aerial survey of the same area examined by Stocker estimated that less than 30 per cent of area had been burnt by wildfires and much of this was in the immediate vicinity of Darwin and the Stuart Highway (Hooper pers. comm.). As more areas are brought under more intensive forms of management, there will be capital improvements in the form of improved pastures, fencing and perhaps stock which will require protection from an annual burning regime. The result of fire control becoming more effective will be large areas of continuous grass fuel persisting during the dry season. Unless countered by extensive and strategic burning of firebreaks early in the dry season this will provide the situation where large areas can be burnt by relatively high-intensity fires under the influence of strong, dry, south-easterly winds.

The frequency of large fires in the Northern Territory ……...is largely restricted to those areas where some form of fire protection has been established and is not at all indicative of the frequency of burning per se in Northern Australia.

3 Australian land use, arid zones and bushfire risks.

These issues are addressed in the sections below.

3.1 Australian land use and arid zones.

Land use across Australia is highlighted in Metcalfe DJ & Bui EN (2017), Figure 2. The main areas of the bushfires were on areas currently assessed as grazing native vegetation, minimal use and other protected areas.

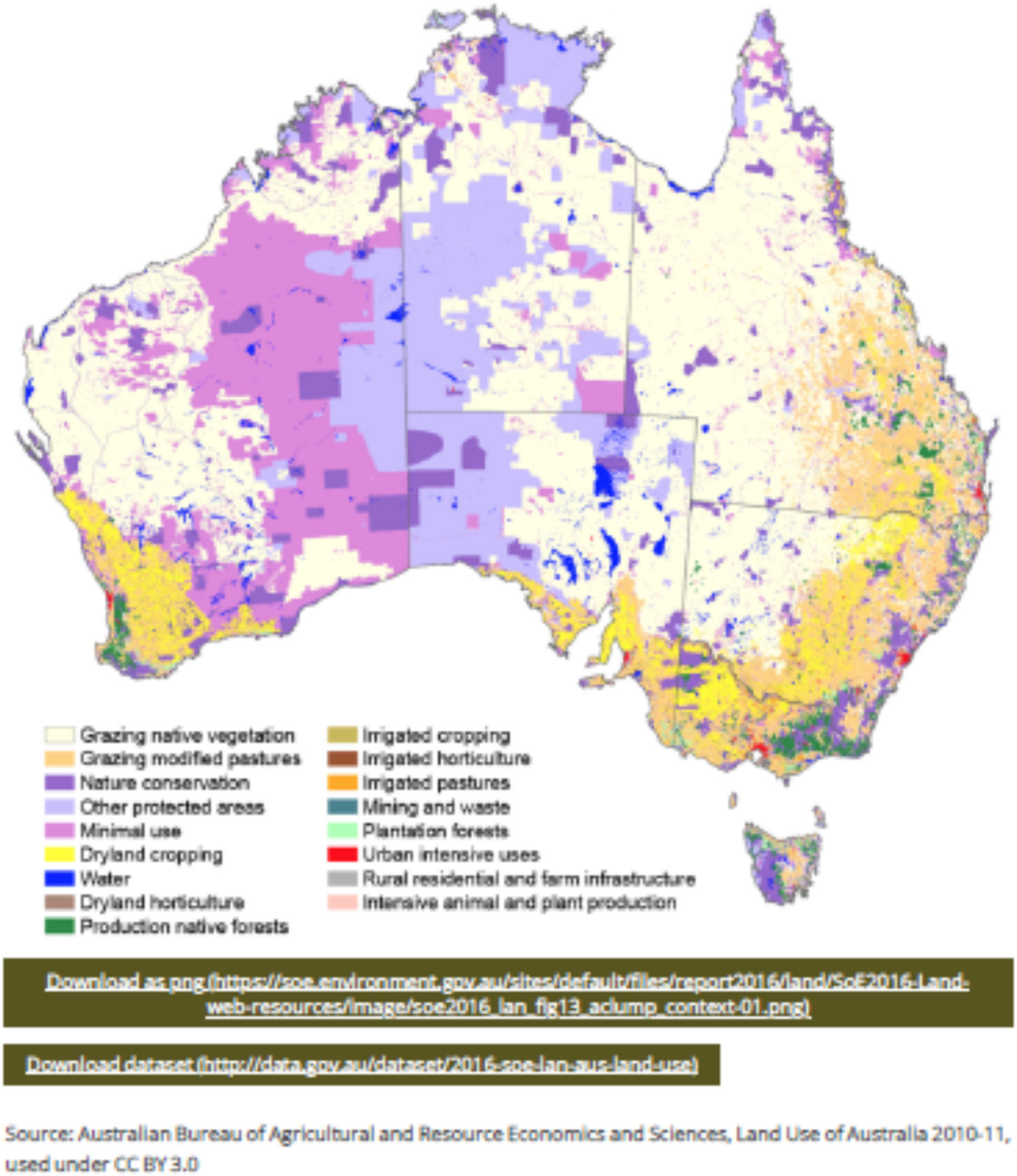


Figure 2. Land use across Australia is highlighted in Metcalfe DJ & Bui EN (2017).

The major climatic zones across Australia is outlined in Morgan et al (2020) and included as Figure 3.
The 1974/ 75 bushfires were mainly with areas marked as desert and grassland.

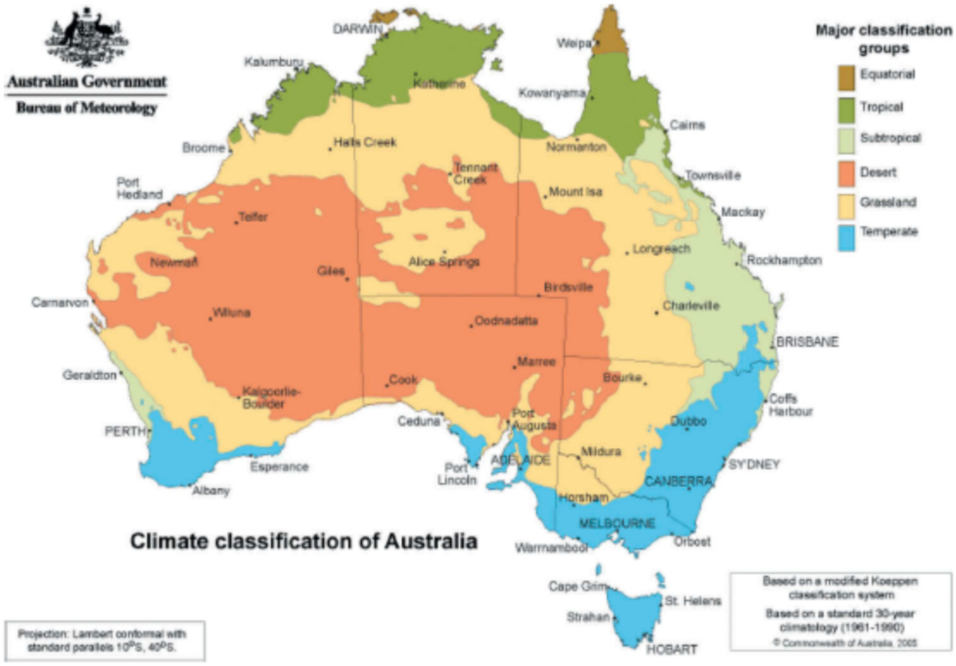
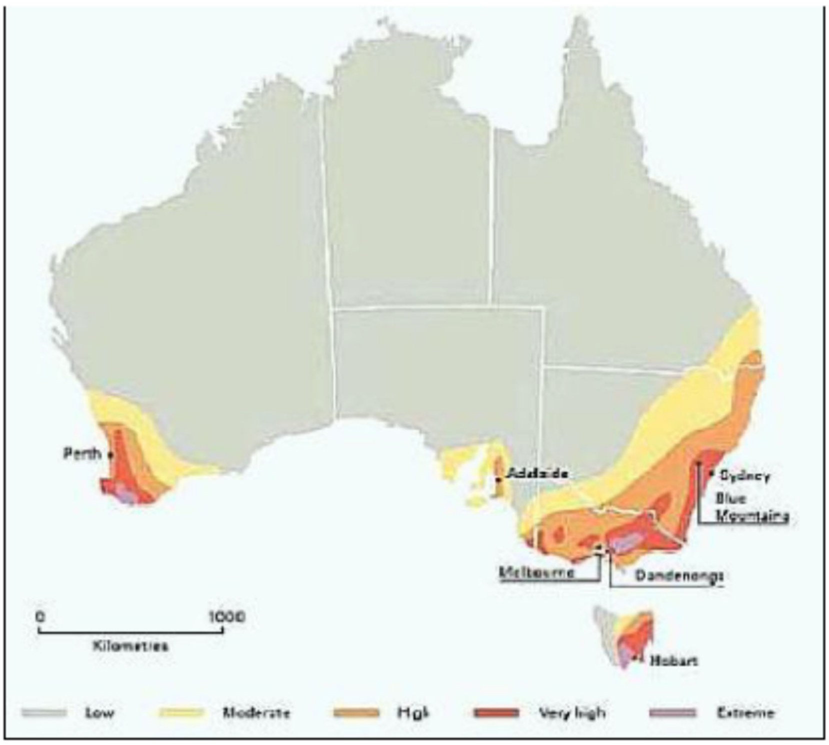


Figure 1. Major climatic zones in Australia based on a modified Koeppen classification system (source: http://www.bom.gov.au/jsp/ncc/climate_averages/climate-classifications)

Figure 3. The major climatic zones across Australia.

3.2 Bushfire risks.

Mapping extracted from Romsey Australia (2021) in Figure 4 highlights the relative lower risk of bushfires in the drier areas of Australia. Noting this, intense/ large bushfires do occur in these areas, especially after higher rainfall levels over consecutive years and consequent rapid fuel build up.



Bushfire Risk Map

Image courtesy: Blong.R.J, Sinai.D and Packham c2000, (16)

Figure 4. Australian Bushfire risk map.

4 Rainfall and weather in relation to bushfires, including the 1974/ 1975 bushfires.

These issues are addressed in the sections below.

4.1 Heavy rainfall in consecutive years and often resulting bushfires.

As detailed in Allan (2009): *In contrast to the temperate southern regions of Australia, fire events in central Australia are driven by above average rainfall, rather than below average rainfall or drought. McArthur (1972) stated that several consecutive years of exceptional rains are required to produce enough fuel for wildfires in a semi-arid area – an insightful observation prior to the wet years throughout inland Australia during the mid-1970s.*

Widespread fire events in central Australia were found to be associated with two or more consecutive years of above-average rainfall as noted in Edwards (2008).

4.2 Heavy rainfall and bushfires during the 1974/ 5 season.

The 1974-75 Fire Season.

Unprecedented rainfall during 1974 resulted in lush, continuous grass and herb growth throughout the arid zone of Australia where the vegetation is normally sparse and, in most seasons, fires are not able to cover large areas. The first large fires burnt in June on the Barkly Tablelands and in the Victoria River District of the Northern Territory. Further huge outbreaks occurred during the following months through to February, with the occurrence moving south through the centre of Australia and towards the eastern coast of New South Wales as grasslands progressively cured with the onset of summer. (Cheney 1976).

Other information adds to this outlined in Allan (2009):

… Following exceptional rains from 1973 to 1978, fuel loads increased greatly. In that period, over 33 percent (240,000 km²) of the Alice Springs Pastoral District burnt in almost 600 separate fires.

Several periods of extensive fires in the pastoral region have been reported, both by early explorers and settlers, and coincide with the two wettest periods in the Alice Springs rainfall records (Figure 2.2, Figure 5 of this review):

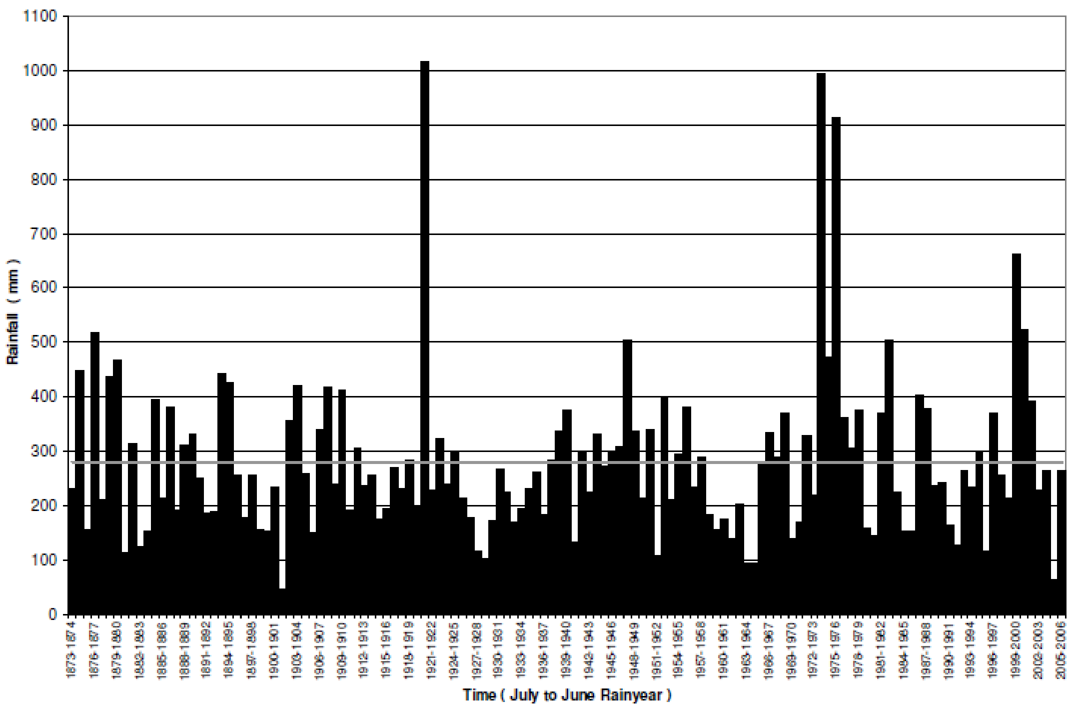


Figure 2.2: Alice Springs rainfall: 1873–2006, calculated for the July to June rainyear

Note: The rainyear average was 280 mm.

Figure 5. Alice Springs rainfall 1873 to 2006.

Figure 5 highlights the very high rainfall levels that occurred at Alice Springs in the mid-1970s towards the right hand side of the figure (twin peaks).

Allan (2009) continues: *Summary. This report provides an overview of fire in central Australia as a context for a regional focus on the southern Tanami Desert. A comparison of two periods of widespread fires, 1974–1977 and 2000–2002, shows a change in the patterns of fire, which have an association with changes in land use, population* *mobility and distribution. A re-evaluation of the link between fire occurrence and antecedent rainfall confirmed the correlation between area burnt and two-year cumulative rainfall in sub-regional areas in central Australia. The opportunity to burn and the potential for large wildfires increased when the 24- month cumulative rainfall exceeded 120% of the average two-year rainfall for July to June rain years.*

Figure 6 of this report highlights twenty-four-month cumulative rainfall and rainfall anomaly data from Wentworth weather station in southwest NSW (Wright et al. 2021).

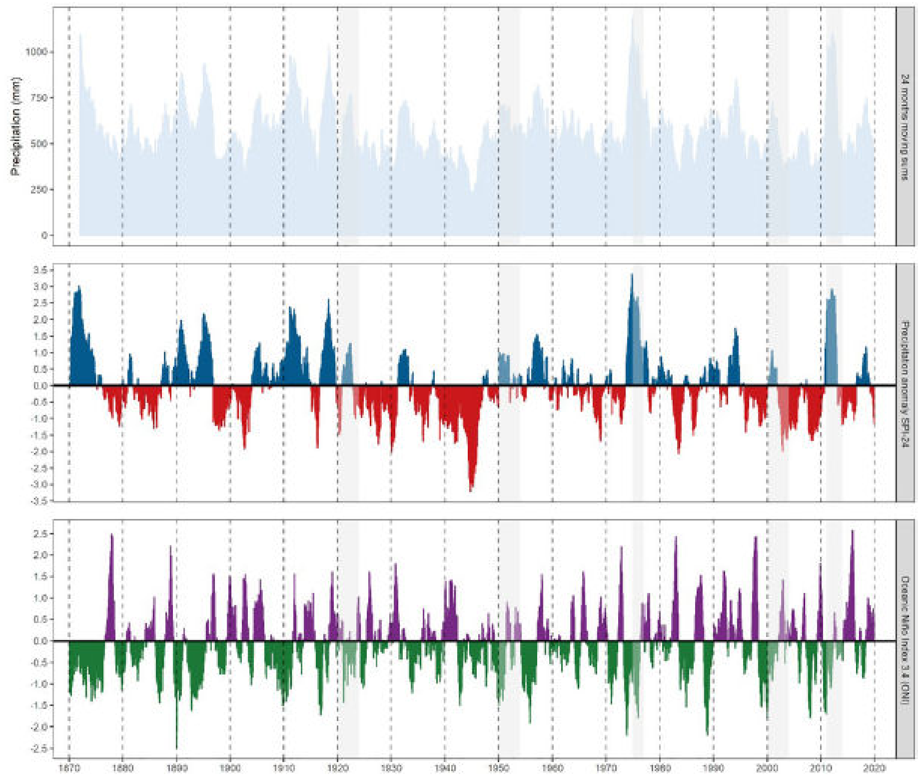


FIGURE 3 | Twenty-four-month cumulative rainfall and rainfall anomaly data from Wentworth weather station in southwest NSW. Bottom panel shows Oceanic Niño Index (ONI) 3.4 from 1870 to present. Major rainfall events/periods associated with big arid zone wildfires are shown in gray bands.

Figure 6. Twenty-four-month cumulative rainfall and rainfall anomaly data from Wentworth weather station in southwest NSW. Bottom panel shows Oceanic Niño Index (ONI) 3.4 from 1870 to present. Major rainfall events/periods associated with big arid zone wildfires are shown in gray bands.

Interpreting this data in Figure 6 above, the reviewer has noted:

- Wentworth is 160 km west of Balranald (as shown on the bushfire location map) and close to the areas of the bushfires.
- In relation to the mid 70's (1974/ 5 bushfires), the grey bands highlight big arid zone bushfires and this includes a band in the mid 70's, noting the data is broad and difficult to determine precisely.
- The top chart highlights the 24 months cumulative rainfall, the mid 70s have the highest rainfall since the 1870s and as expected cumulative rainfall commences well before the fire band.
- The middle chart is rainfall anomaly and is both high and wide, the widest since 1920.
- The lower chart is Oceanic Nino Index 3.4 and gets down to below -2.0 before the grey fire band. As extracted from the web, the ONI tracks the running 3-month average sea surface temperatures in the east-central tropical Pacific between 120°-170°W. Scientists call the area the Niño 3.4 region. The Niño 3.4 index typically uses a 5-month running mean, and El Niño or La Niña events are defined when the Niño 3.4 SSTs exceed +/- 0.4C for a period of six months or more.

4.3 Rainfall records for the 1974 and 1975 bushfire locations.

The author has extracted BOM rainfall data for four representative locations across Australia close to or within bushfire affected areas. This data is included in Annexure 3.

The author has interpreted the data in Annexure 3 and this is outlined in Table 3 below.

Table 3. Interpretation of extracted BOM rainfall data for four representative locations across Australia close to or within bushfire affected areas.

Location	Number of wet years in 1973 to 1975 period compared to mean	Number of wet years in 1973 to 1975 period compared to 90 th percentile	Lower rainfall months from July 1974 to June 75, compared to mean (12 months)	Lower rainfall months from October 1974 to February 75, compared to mean
Kalgoorlie-Boulder Airport WA	3	2 (and close to 3, just short in 1973)	5	October 1974, Dec 1974, Jan 1975 (3 of 5 months)
Alice Springs Airport NT	3	2 (and close to 3, just short in 1973)	6	Nov 1974, Jan 1975 (2 of 5 months)
Norley Station Qld (24.6 km from Thargomindah)	3	2 (and close to 3, just short in 1973)	5	Nov 1974, Dec 1974 (2 of 5 months)
Cobar MO NSW	2 (and close to 3, just short in 1975)	2 (not 1975)	9	Nov 1974, Dec 1974, Jan 1975, Feb 1975 (4 of 5 months)

Table 3 data highlights that:

- The period before the 1974/5 bushfires was very wet compared to mean rainfall data and indeed exceeded 90 th percentile rainfall levels at the four assessed locations over a two year period. At three of the locations rainfall was very high over three years, the first three locations listed in the above table. This fits with the findings of Edwards et al. (2008), McArthur (1972) and others in regards with widespread fire events are found to be associated with two or more consecutive years of above-average rainfall.
- In the 1974/ 5 fire season, there were lower individual rainfall months from July 1974 to June 75, compared to mean (12 months) at all locations, ranging from 5 months to 9 months of that 12 month period. This is likely to have assisted in drying out heavy fuels at a faster pace.
- During the period October 1974 to February 1975, there were lower individual rainfall months than normal mean rainfalls at all the four locations, ranging from 2 to 4 months out of the 5 month period. This likely highlights the conditions at the locations were suited to spread of bushfires in 1974/75, noting the high fuel loads present.

5 Bushfires, seasons, storms, impacts and management in central Australia.

Interesting information in regards to bushfires, seasons, storms, impacts and management in central Australia is included in Griffin et al. (1983):

In the pastorally occupied region of central Australia, annual wildfire occurrences are related to antecedent rainfall, and the seasonal distribution of fires is correlated with the incidence of thunder storms. Lightning is the main cause of wildfires, and the geographical distribution of thunderstorms is strongly influenced by topography.

Wildfires are largest and most frequent in the spinifex fuel habitat in normal or average years, but the plains country fuel habitat carries most wildfires following periods of rainfall substantially above the long-term average. Acacia shrublands had the lowest numbers of fires and show poor adaptation to frequent burning.

and:

Implications for management

Luke and McArthur (1978) described the wildfire seasons for Australia as having a latitudinal distribution, such that central Australia has its peak fire season from October to January. During the period studied, most area was burnt between September and January…. Central Australia includes the boundary between Luke and McArthur's " spring fire season" (September to December) and "spring and summer fire season" (October to January). As fire season is best defined as the time during which serious (large) fires occur, the period September to January is an accurate definition of the central Australian fire season. The fire season is closely correlated with months of increased thunderstorm activity, high temperatures and low relative humidity.

and:

During the decade 1970 to 1980, vast areas of inland Australia were consumed by wildfires (Luke and McArthur, 1978) . Fire is a common feature of Australian land scapes, including arid areas, and it has been postulated that inland fires only become widespread following periods of above average rainfall, when an abundance of fuel is produced **(***McArthur, 1972). The pattern of build-up to such high-risk wildfire seasons strongly contrasts with that of higher rainfall sclerophyll forest areas , where high fire danger follows drought periods which dry out accumulated forest litter …... However, one of the major central Australian fuel habitats (spinifex plains) is a perennial fire hazard, and wildfires have been reported there even during drought periods…..*

and:

Loss of topfeed trees and shrubs, particularly mulga (Acacia aneura), was evident over wide areas following wildfires. In most affected Acacia shrubland areas, extensive germination of mulga occurred subsequently, although several areas were affected by repeat burns which removed regeneration.

Loss of pasture to grazing animals was not measured during the period, although some properties were almost completely burnt out by single or multiple fires over a short period. Loss of fencing was a serious problem ……Between 1974 and 1979, an estimated I0 000 km of fencing was damaged , with a replacement cost of Au. $4 million.

No estimate of stock losses due directly to wildfires was made over the period, but they were probably small…..

The current wildfire regime in central Australia is one of periodic widespread fires, usually of high intensity and occurring over the summer period. The management of landscapes for pastoralism, conservation or other purposes is made more difficult, if managers do not have some control over such a fundamental ecological factor as fire. Sustained above-average rainfall increases the likelihood of high, continuous fuel levels. While the perennial spinifex fuel habitat carried increasing numbers of fires after wet periods, the plains country carried proportionately more. The rapid response to rainfall of the shortlived plains grasses may account for the increase in fire numbers. Intensifying fire management on the plains country during pluvial phases, either through prescribed fuel reduction burning or by protection with fire breaks, would reduce the pressure on fire suppression resources during critical periods.

In relation to wind, *"Wind influenced the spread of fire in many instances, but very strong winds were fortunately not a prominent feature of the season"* (Luke and McArthur 1978).

6 Fuel and fire intensity in relation to the 1974/ 1975 fire season.

These issues are addressed in the sections below.

6.1 Fuels and fuel loads in relation to the 1974/ 75 bushfires.

There is valuable information in regards to rainfall and fuel growth in Section 4. Further discussion on fuel loads is outlined below.

Allan (2009) observed: *Following exceptional rains from 1973 to 1978, fuel loads increased greatly. In that period, over 33 percent (240,000 km²) of the Alice Springs Pastoral District burnt in almost 600 separate fires (Griffin & Friedel 1985).*

and:

In general, fuel loads in spinifex country are slow to recover from fire and the interval between fires usually ranges from 7 to 20 years, depending on rainfall and location. Fire intervals are shortest in the north-west of the Alice Springs pastoral district and increase along the decreasing rainfall gradient to the south-east.

and:

Also, the proportion of the fires caused by lightning increased from 58% over the 10-year period to 71% for the three-year period of higher rainfall and fuel loads.

Griffin et al. (1983) added to this: *The fact that the number of years of antecedent rainfall is different for the best relationship with number of fires or the area burnt can be explained by differences in the productivity and continuity of fuels. The plains fuel habitat……, for example, was able to produce sufficient and more continuous fuel for fire spread in a shorter period than the spinifex fuel habitat, under the same rainfall conditions. Fire sizes were also frequently influenced by roads, areas of low fuel because of grazing, firebreaks and fire suppression.*

Wright et al. (2021) further notes: *….. post-fire seral state spinifex, which is usually dominated by highly flammable non-spinifex tussock grasses such as Aristida holathera Domin….., can accumulate fuels quickly under high rain conditions and burn as readily, albeit at lower intensity, as old growth spinifex…*

and:

Fuel loads in long-unburnt grassland range from 1.6 to >12 tons ha–1, depending on fuel age and whether the fuel array consists purely of Triodia spp. or includes woody species.

The Royal Commission into National Natural Disaster Arrangements (2020) notes:

Although reducing bushfire risk is not necessarily the primary purpose of Indigenous land management, reduced fuel loads and improved ecosystem resilience can be important benefits of its application.

6.2 Pictorial record of the fuels before the 1974/ 75 bushfires.

Images highlighted in Luke and McArthur (1978) highlight the increases in fuels in 1974/ 75 in central Australia:

Abnormally heavy grass in the Cobar district of New South Wales in September 1974 close to country severely burnt in December 1974.

Heavy continuous stands of Mitchell and Flinders grasslands on the Barkly Tableland, N.T., one fire in this type of country travelled for 280 km and burnt 2 400 000 ha in June–July 1974.

Condition of very sparse vegetation in a drought year at Kunoth Experimental Station on Hamilton Downs, 40 km north-west of Alice Springs, N.T.
Photo: R. Winkworth, CSIRO, 1972

The same area as below after exceptionally heavy rainfall in 1973–74 (*c.* 1000 mm): the mulga intergrove area now carries a dense stand of annual and short life perennial plants.
Photo: R. Winkworth, CSIRO, November 1974

6.3 Intensity of bushfires.

The potential fire intensity of bushfires across Australia is outlined in Figure 7 outlined in Morgan et al. (2020). The 1974/ 75 bushfires were mainly with areas marked as low and moderate intensity.

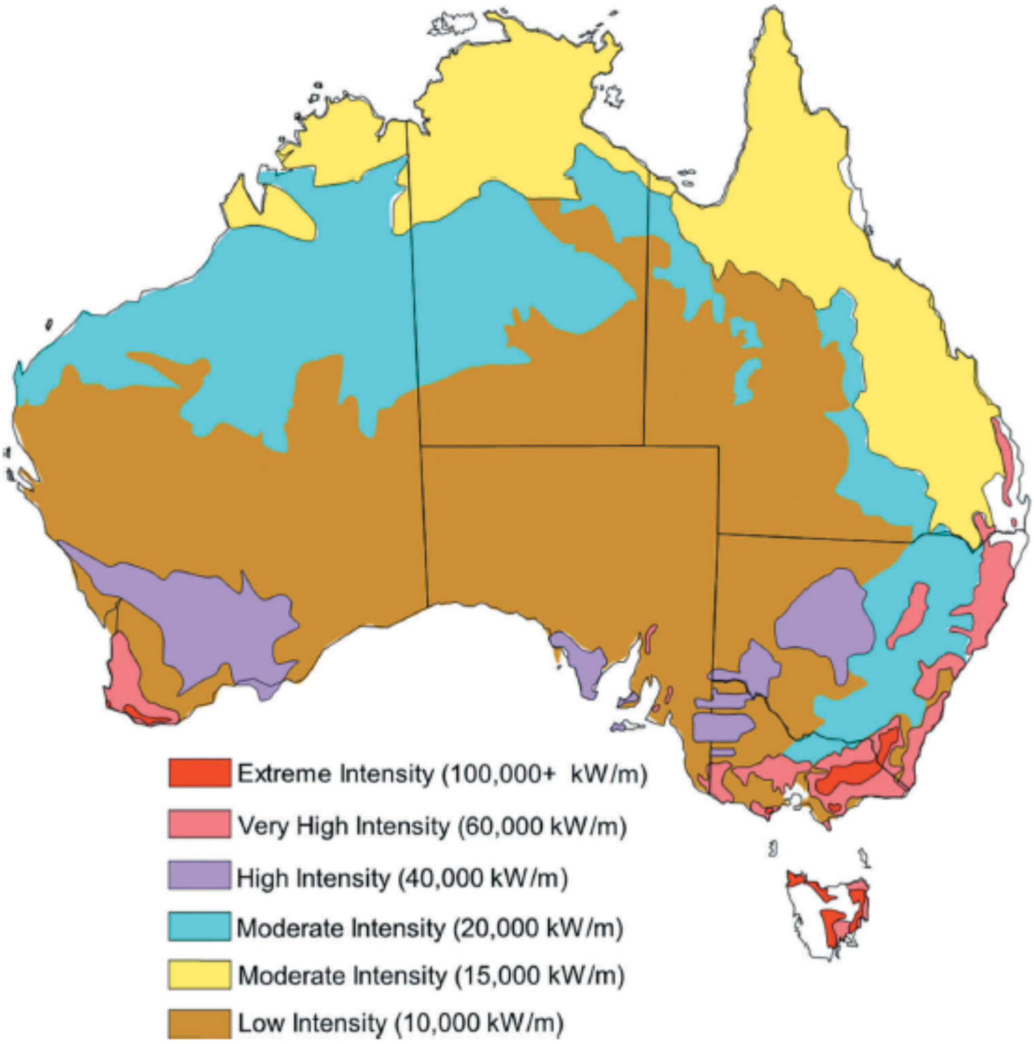


Figure 2. Potential fire intensity across Australia based on a combination of vegetation types, terrain and weather patterns (source: Tolhurst 2003)

Figure 7. Potential fire intensity of bushfires across Australia.

Cheney (1976) indicated that:

The fire control authorities recognise that no fire suppression system has been developed in the world which can halt the forward spread of a high-intensity fire burning in continuous heavy fuels under the influence of extreme fire weather. However, being public bodies, their activities to avert a fire disaster and to a lesser degree their general attitudes are limited by the attitudes of the public at large. Here the indications are that the majority of people are not properly aware of the hazards that high-intensity fires present in their areas.

Wright et al (2021) reported:

- *Large-scale high-intensity conflagrations occur during periods of meteorological extreme in many fire-prone ecosystems.*
- *Contemporary fire cycles in these grasslands* (spinifex) *are characterized by periodic wildfires that are large in scale (e.g., occasionally exceeding 10,000 km2) (Allan and Southgate, 2002), high in intensity (e.g., up to c. 14,000 kW; Burrows et al., 1991), and driven by fuel accumulations that occur following exceptionally high rainfall years.*

The Royal Commission into National Natural Disaster Arrangements (2020) wrote:

Research in northern Australia demonstrates that savanna burns conducted early in the dry season can reduce the incidence of more destructive and higher intensity fires.

And further:

Using both aerial and ground burning techniques allows for more effective fire projects, mitigating the intensity and extent of late-season bushfires, while the fire breaks create barriers around sensitive vegetation and cultural sites.

7 1974/ 5 bushfire case studies.

Two cases studies are outlined below.

7.1 A West Australian 1974/ 75 bushfire case study.

The first case study used for the 1974/ 5 bushfires is from west of Lake Mackay in the Gibson Desert, Western Australia.

Figure 4 has been extracted from the paper by Wright et al. (2021) and is included as Figure 8 of this review. The extent of fire in the landscape as highlighted by fires in light grey evident on 1979 satellite imagery (presumed to have occurred in response to fuel accumulations after high rainfall years of 1974/1975) is very large, assessed over an area of nearly 11 M hectares.

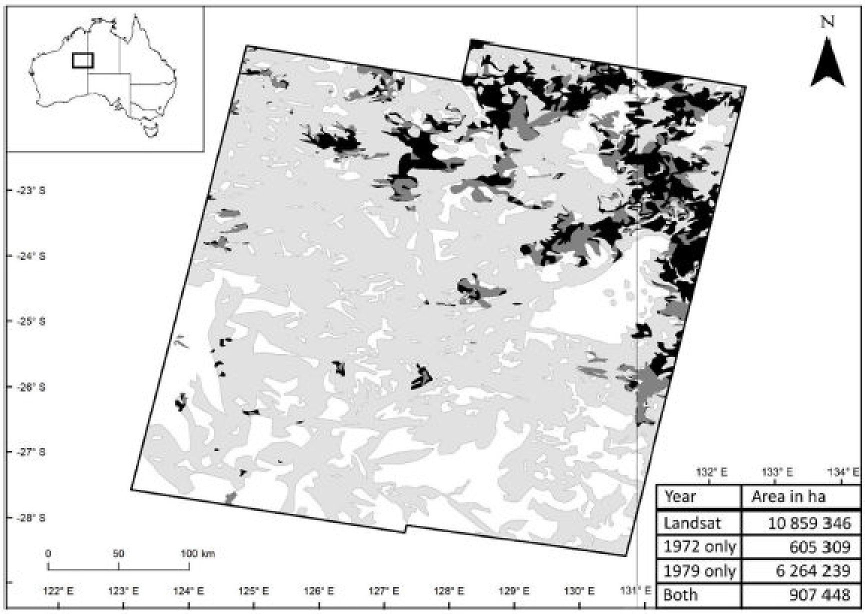


FIGURE 4 | 1970s fire scars from homelands of the Pintupi Nine, west of Lake Mackay in the Gibson Desert, Western Australia. Fires in light gray were evident on 1979 satellite imagery and are presumed to have occurred in response to fuel accumulations after high rainfall years of 1974/1975. Fires in black were burnt twice (1972 and 1979), and areas in dark gray were burnt in 1972 only. White areas were unburnt throughout study period.

Figure 8 of this review. 1970s fire scars from homelands of the Pintupi Nine, west of Lake Mackay in the Gibson Desert, Western Australia. Fires in light gray were evident on 1979 satellite imagery and are presumed to have occurred in response to fuel accumulations after high rainfall years of 1974/1975. Fires in black were burnt twice (1972 and 1979), and areas in dark gray were burnt in 1972 only. White areas were unburnt throughout study period.

Burrows and Christensen (1991) produced evidence that the size of burnt patches in the West Australia Western desert (west of Lake Mackay) 53,484 hectare study area dramatically increased coinciding with the departure of the Pintubi Aboriginals. The average size of a burnt patch increased from 34 ha in 1953 to 32,184 ha in 1988. The data from this study (Table 1) is included in Annexure 4 of this review.

The 1977 fire data would most probably relate to the 1975 bushfires in WA, and could also relate to bushfires in 1974 and 1976. The 1977 fire data indicates a mean area of 10,584 ha, total burnt area of 31,752 ha, both much larger areas than 1953 and 1973.

7.2 A Northern Territory bushfire case study from the southern Tanami Desert.

The second case study used for the 1974/ 5 bushfires is from the southern Tanami Desert in southern Northern Territory as outlined in Allan (2009). A summary of the fires illustrating area burnt by major vegetation community and ignition source is listed below in Table 4 of this paper (adapted from Griffin et al. 1983). The second half of the table provides a summary of the three-year period July 1974–June 1977. The total fire area burnt in 1974-1977 was 24,604,400 ha and 67 % of all fires in the period were caused by lightning, 28 % by people and 5 % unknown causes. The mean fire size was largest for spinifex (89,000 ha), then Acacia shrubland (74,100 ha), then plains (45,200 ha) and finally Hills (23,300 ha). The mean fire sizes in 1974-1977 were larger than those in the period 1970 to 1980, likely mainly due to the high fuel loads at the time.

Table 4 of this review. Comparison of fire numbers, area and causes in central Australia, July 1970 to June 1980.

Table 2.1: Comparison of fire numbers, area and causes in central Australia, July 1970 – June 1980

	Spinifex	Hills	Acacia shrubland	Plains	TOTAL
All fires 1970–1980					
Total number of fires	301	162	35	287	785
Total area burnt (km²)	177 908	34 068	13 357	78 939	304 272
Mean fire size (km²)	591	210	381	274	
Caused by lightning (%)	66	57	48	53	58
Caused by people (%)	23	36	43	42	34
Unknown (%)	11	7	9	5	8
All fires 1974–1977					
Total number of fires	158	87	17	160	422
Total area burnt (km²)	140 769	20 289	12 611	72 375	246 044
Mean fire size (km²)	890	233	741	452	
Caused by lightning (%)	68	64	59	69	67
Caused by people (%)	24	32	24	29	28
Unknown (%)	8	3	18	3	5

Source: Griffin et al. 1983

Figure 9 of this review uses extracted Figure 2.19 from Allan (2009) and this Figure indicates that:

- There were bushfires/ fires in every month during July 1974 to June 1977.
- Months with bushfires/ fires at or over 3 M hectares/ month during July 1974 to June 1977 were September, October, November, December and January.
- There is greater early dry season burning (March to June) in these pastoral areas in 2000 to 2003 than in 1974/ 5, less areas of burning in November to February in 2000-2003 than in 1974/ 5 and greater areas of burning overall 2000-2003 than in 1974/ 5. This pattern could be influenced by factors such as previous rainfall, seasonal weather, fuel loads and lightning strikes.

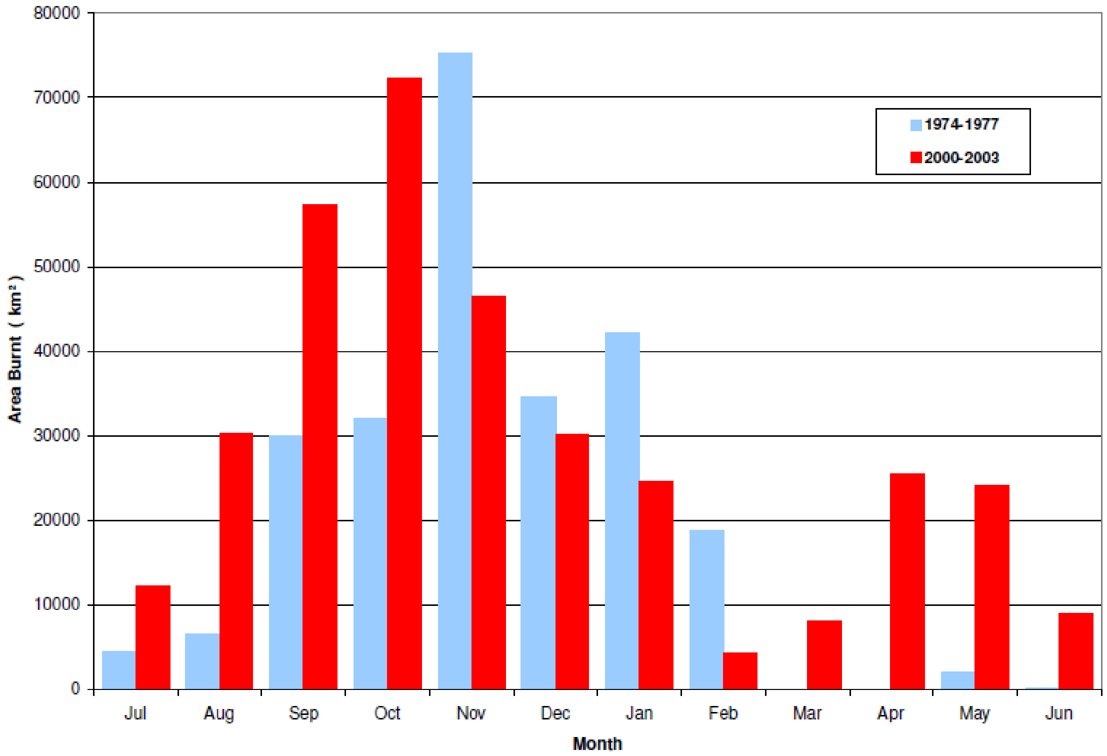


Figure 2.19: Frequency distribution of monthly area burnt in pastoral central Australia for two 3-year periods

Note: Periods are July 1974 – June 1977, derived from Bushfires Council fire reports (Griffin et al. 1983), and July 2000 – June 2002 based on NOAA AVHRR satellite-derived fire history maps.

Figure 9. Frequency distribution of monthly area burnt in pastoral central Australia for two 3-year periods.

8 Suppression of the 1974/ 75 bushfires.

Two cases are outlined below, noting there is little information publicly available in regards to bushfire suppression of these bushfires.

8.1 Bushfire suppression in Central Australia.

As outlined in Griffin et al. (1983):

Most current fire management practice in central Australia is aimed primarily at wildfire suppression. Factors hindering wildfire management are a lack of ability to predict fire occurrences, delay time between ignition and reporting of fires in remote areas, and long distances between fires and sparse suppression resources.

and:

Considerable effort is channelled into fire suppression action, mostly concentrated over a few months of the year. Little effort has yet been directed at mastering the use of prescription burning in central Australia, both for hazard reduction or landscape management purposes. In average or dry periods, management could concentrate more on the perennial spinifex fuels where fires will still carry. A program of prescribed hazard reduction burning during winter months, when the demand on wildfire control resources is lo west, could help to reduce the summer fire hazard.

Neither the ecological nor economical effects of wildfires were effectively assessed over the period reported here. Some observations on wildfire effects on vegetation in arid Australia have been made (e.g. Lay, I976; Wilson and Mulham, 1979; Noble et al., 1980; Leigh and Noble, 1980; Hodgkinson and Griffin, 1982), but these mainly relate to the impact on pastoral lands. Fire in the wider context of conservation and management of overall arid landscapes is beginning to receive attention (e.g. Gill, 1977; Latz and Griffin, 1978; Good, 1981). Control of wildfire may be important for the maintenance of some wildlife populations (e.g. Bolton and Latz, 1978).

Thunderstorms most frequently develop in the late afternoon (Brunt and Mackerras, 1961; Magono, 1980), but fires initiated by associated lightning are seldom observed or reported until the next day. An improved thunderstorm monitoring service using available weather radar scans would substantially increase the ability to predict the likely occurrence of lightning-initiated fires.

Improved wildfire management will come with an increased ability to predict the likely occurrence of fires. The simple models presented here improve the ability to predict number of fires, area likely to burn, and the seasonal distribution of fires.

Luke and McArthur (1978) *"In the thinly populated inland, limited manpower and equipment were the main problems for firefighters and local authorities".*

8.2 Bushfire suppression on the Moolah-Corinya bushfire in western NSW.

Information extracted from the Anon (1975):

One of the fires, the Moolah-Corinya fire, south western Cobar just before Christmas was the largest fire ever contained by man in New South Wales without the help of the weather.

When finally put out after 11 days, it I had burnt out 1,166,000 hectares and had a perimeter of more than 1000 kilometres. The fire was composed of two outbreaks which eventually linked up. The Corinya fire started about 64 km north of Ivanhoe, and then burnt north to the Barrier highway, and north east to within 50 kms of Cobar. It linked up with the Moolah fire which burnt the south east corner of this area to the Roto-Cobar Road.

At the Barrier highway, the Corinya linked up with the point where the Musheroo fire had started earlier, and which had burnt north east towards Tilpa, where it had in turn linked up with the Tundulya fire near its point of origin.

The latter fire also travel Northeast to be halted near the Cobar Louth Road adjacent to the Darling River near Louth.

The linking of these fires, and the earlier Wing Ding fire has given an unbroken line of burnt country extending for 215 km north North East from near Ivanhoe to Louth.

Huge firebreak.

Mr Kearney was planning a bulldoze firebreak, in his own words about 25 miles long and about 25 feet wide in a bid to start a backburn to stop the spread of the fire.

After much deliberation it was decided the burn would go ahead and that the width of the break be widened to 12 metres.

At 9 on Saturday night 21st of December the back fire started with some 120 civilians and army personnel along the fire line.

The burn was a success and relieved the situation in the area, allowing the deployment of men and equipment to other locations.

The battle continued throughout Sunday and Monday, with increasing reports coming in that defies weren't contained.

Early on Tuesday, 24th December, an aerial survey showed that the fire still burning had nowhere to go and that unless fresh fires occurred south of the fire breaks, only mopping up was to be maintaining some sections.

The Ivanhoe control was close to 1630 hours on Christmas Eve.

Figure10 sketch of the Moolah-Corinya fire is provided below:

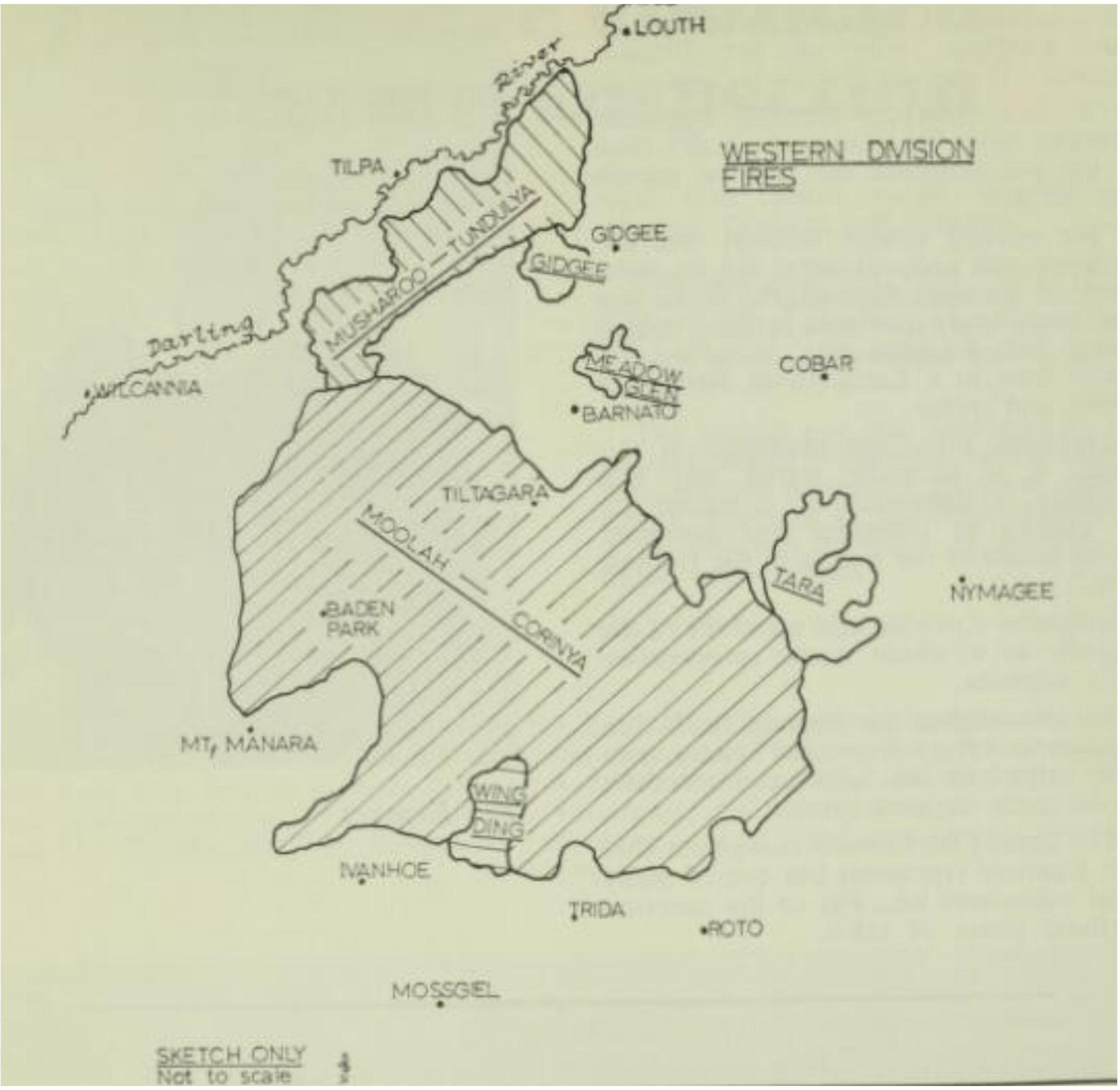


Figure 10. Sketch of the Moolah-Corinya fire.

9 Cultural/ prescribed burning to reduce bushfire risks and impacts.

These issues are addressed in the sections below.

9.1 Importance of cultural and prescribed burning.

Many authors have reported on the importance of cultural and prescribed burning as outlined below.

McKemey et al. (2020) noted:

Cultural burning can have different aims for optimising food resources, finding food, keeping the forests clean and optimising biodiversity. The Firesticks Alliance Indigenous Corporation, which brings together many Aboriginal communities engaged in cultural burning in southeast Australia, used the term cultural burning to describe 'burning practices developed by Aboriginal people to enhance the health of the land and its people. Cultural burning can include burning or prevention of burning for the health of particular plants and animals … or biodiversity in general. It may involve patch burning to create different fire intervals across the landscape or it could be used for fuel and hazard reduction. Fire may be used to gain better access to Country, to clean up important pathways, maintain cultural responsibilities and as part of culture heritage management' (Firesticks Alliance Indigenous Corporation 2019).

The Royal Commission into National Natural Disaster Arrangements (2020) reported:

In the West Arnhem Land Fire Abatement program in the NT, Indigenous rangers worked with government agencies and scientists to introduce cultural burning to a large part of Arnhem Land, resulting in a reduction in the frequency *and magnitude of large bushfires. [1965] (/publications/html-report/endnotes#edn1965) In return, they now receive carbon credits, which can be sold to the Australian Government and other buyers. Back to top ↑ 9/14/21, 11:15 AM*

Cheney (1976) observed:

Despite improvements in fire control, provided there are heavy fuel loads and possible ignition sources, large fires will break out under conditions of extreme fire danger and will burn out of control for many hours. Under these circumstances any suppression technique is largely ineffective and the magnitude of the disaster can only be reduced by hazard reduction and fire protection measures undertaken at an individual level.

Duguid et al. (2009) reported:

When exceptional rainfall occurs, the amount of non-spinifex fuels can increase rapidly. Both burnt breaks and patches can grow over quickly with a flush of non-spinifex fuels. With enough rain, a burnt area could carry a summer wildfire as soon as one year after a prescribed burn. In these circumstances, prescribed burn areas may reduce the intensity of a fire and slow down the rate of spread, but may not contain a fire. After extreme rain events, increased burning of patches and breaks is required to reduce the extent and incidence of wildfires. Some managers and fire-scientists have recommended that prescribed burning effort should be focused on spinifex vegetation in years of average rainfall. But during and immediately following high-rainfall years the emphasis should shift to include burning more non-spinifex grassland. This may include burning in areas that normally do not carry wildfires and where prescribed burning is minimal and ineffective in average conditions. Long-term strategies should emphasise the need to adjust fire management plans in response to flushes of annual fuels.

9.2 AWC prescribed burning and 2020 case studies and achievements.

Australian Wildlife Conservancy (2021) reported:

Fire has played an important role in the evolution and function of Australian landscapes for tens of thousands of years.

In recent decades, a growing appreciation of the ecological importance of fire has led to a reappraisal of fire management with regards to conservation. AWC's approach varies between regions and ecosystems: different strategies are required to manage fire in the Central Australian deserts to in the tall, wet eucalypt forests of Mt Zero-Taravale, or in the tropical savannah woodlands of Cape York and the Kimberley.

In northern Australia fire patterns are strongly influenced by the prevailing monsoonal climate – characterised by a dramatic high rainfall 'wet season' (November–February) followed by a low-rainfall 'dry season' over the winter months. The wet season drives rapid growth in the grassy understorey, which subsequently cures, leading to high fuel loads heading into in the dry season. The early dry season is therefore a critical time for managing fire in northern Australian savannah ecosystems.

AWC land managers start implementing prescribed burns when conditions allow at the end of the wet season (typically March-May). Prescribed burning involves a range of techniques: matches, drip torches, and aerial incendiaries are used to ignite fires according to a strategic annual burn plan. Prescribed burning in the early dry season is implemented in part to limit the spread of the more destructive wildfires that occur in the later part of the year.

At Newhaven in Central Australia, a vastly different climate prevails, one which is characterised by multiple years of low rainfall, and occasional years of much higher rainfall (known as a 'boom-bust' climate system). Large areas in Central Australia are dominated by highly flammable spinifex grasses (Triodia spp.), which are both tolerant to fire, and promote its spread.

High rainfall 'boom' years are followed by extensive fires across Central Australia in the subsequent 12-24 months. In this context, prescribed burning is used to introduce fire at times when the country would not otherwise burn. A series of permanent fire breaks are maintained, and fuel loads are managed across the property to maintain a mix of vegetation age classes with clearly defined targets.

The result is a landscape that includes patches of mature vegetation that haven't burned for several years, and other patches that have carried fire more recently. Other important objectives of fire management include the protection of life and property, and the control of invasive weeds. In total, prescribed burns across AWC sanctuaries cover more than one million hectares each year.

Australian Wildlife Conservancy (2020) stated:

AWC's team of fire practitioners and our Dambimangari and Wilinggin Partners in the Kimberley have gone to extreme lengths to ensure that this year's prescribed burning program is able to proceed, despite the restrictions imposed by the current COVID-19 lockdown in Western Australia.

This is Australia's largest non-government fire management program. This year, AWC is working with our Wilinggin and Dambimangari Aboriginal Corporation Partners to carry out prescribed aerial burning over an area equivalent to the size of Tasmania – about 6.5 million hectares.

At the time of writing, fourteen staff and Rangers are working on-site as part of this intensive two-month effort.

Strategically, burning the country at this time of year is central to AWC's conservation land management across northern Australia's tropical savannas and continues our Partners' tradition of right-way fire. By reducing fuel loads and breaking up homogeneous patches of older vegetation, prescribed burns in the early dry season substantially reduce the threat of high intensity, large-scale wildfires igniting later in the year.

Historically, large uncontrolled wildfires have been a leading cause for wildlife declines and AWC research has shown that wildfires compound the impacts of feral cats and feral herbivores on native animals.

AWC's fire management program has halved the extent of wildfire in properties we manage across northern Australia.

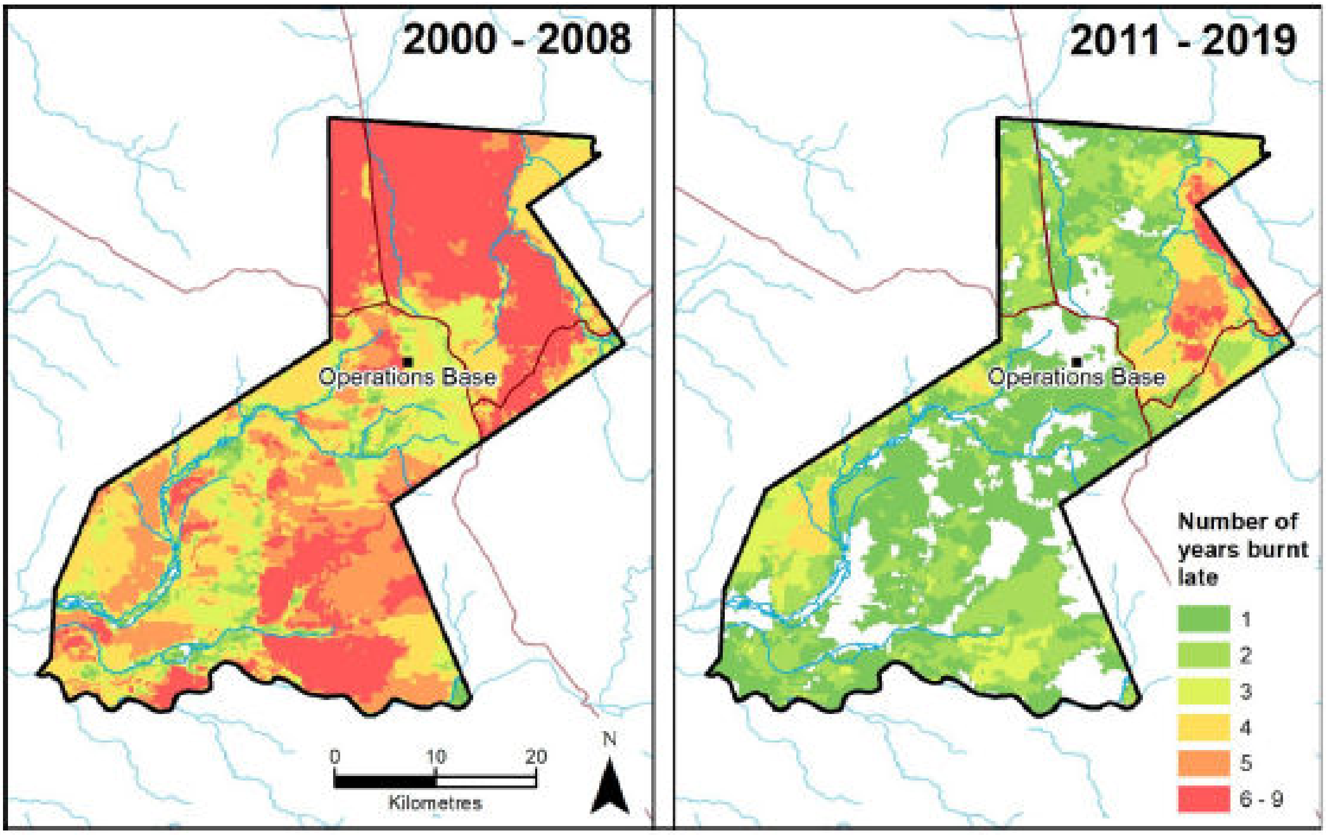
Early dry season burns tend to be cooler and burn more patchily than late dry season wildfires. Over 15 years at Mornington Wildlife Sanctuary, AWC's ecological survey program has demonstrated that small mammals, seed-eating birds and birds that rely on creek-side vegetation have responded positively to the reduction in wildfires.

By reducing large-scale wildfires, early dry season burning in this way also leads to a reduction in greenhouse gas emissions. In the central Kimberley alone, AWC's EcoFire project (comprising prescribed burning on AWC sanctuaries and commercial grazing land), is estimated to avert the emission of up to 75,000 tonnes of CO2e into the atmosphere annually – the equivalent of taking 18,750 cars off the road for a year.

On Charnley River-Artesian Range Wildlife Sanctuary, the team has already dropped more than 20,000 incendiaries to complete the planned burns.

When the 2020 burning program wraps up later this month, the total distance flown across the Kimberley will amount to around 40,000 kilometres, with a total of 220,000 incendiaries dropped.

Kanowski (2020) compares the effective ness of prescribed burning in reducing the extent of late season fires at Piccaninni Plains in the NT over 9 year periods using improved AWC management approaches. The comparison area figures extracted from this document outline the effectiveness of prescribed burning in reducing the extent of late season fires and associated impacts are included below in Figure 11 of this review.



Piccaninny Plains late fire frequency. Late fire frequency is the number of years each area has been burnt in a late fire in the nine years for each time period.

Figure 11. Piccaninny Plains late fire history.

Implementation of AWC's fire management program has halved the extent of wildfire in properties we manage across northern Australia (Kanowski *2020) and is highlighted in Figure 12. This holds true for Western Australia, Northern Territory and Queensland and indicates that our general approach to fire management in northern Australia is effective, despite differences between sites and details of the approaches adopted by each manager.*

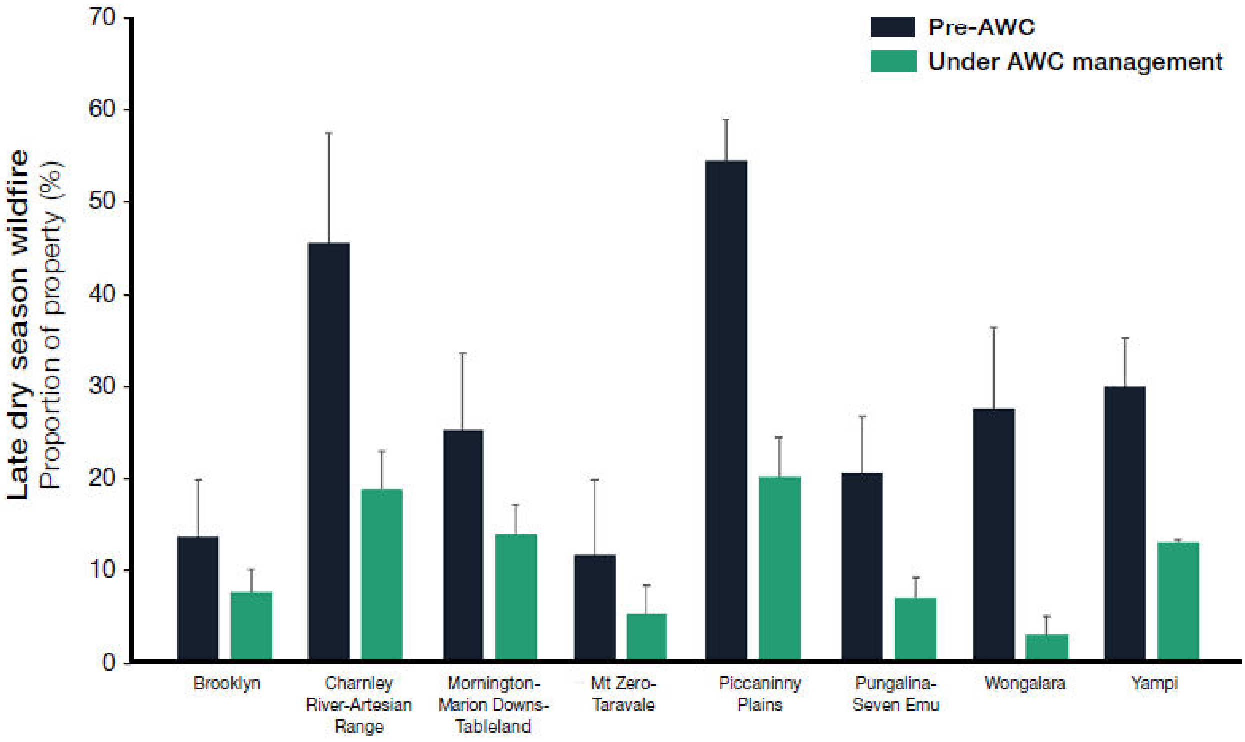


Table showing reduction in late dry season wildfire before and after AWC management across our north Australian sanctuaries.

Figure 12. Figure showing reduction in late dry season wildfire before and after AWC management across our north Australian sanctuaries.

10 Learnings and adaptive management strategies considered in regards to the 1974/75 Australian bushfires and also considered from today's perspective.

This section has been broken down in a number of areas, looking at the 1974/ 5 bushfires combined with the learnings and adaptive management opportunities of today.

The 1974/ 75 bushfires.

1. In 1976, it is understood that Cheney, McArthur, Luke and others were pretty much unaware of the amount of burning that took part in the tropics over the 6 month duration of the monsoonal fire season and fires could occur over the entire 12 period in the arid Zone. Early season fires passed mostly unnoticed.
2. Satellite scanning of the world has greatly changed our appreciation of how much of the world burns in any one year. The only ones that draw public attention are those that burn in heavy fuels and impact on built assets.
3. The 1974/ 5 bushfires were nearly 46 years ago, and after 2-3 years of high rainfall levels over consecutive years, fuel loads were high at the time of these bushfires. Large areas in Central Australia are dominated by highly flammable spinifex grasses, which are both tolerant to fire, and promote its spread.
4. The 1974/5 bushfires were very large fires, as noted in this review, these fires burnt an estimated 117 M hectares across NSW, SA, WA, NT and Queensland.
5. Noting the considerable time since the 1974/ 75 bushfires, the author considers the 1974/ 75 bushfires weren't apocalyptic, but did have impacts as outlined in this document.
6. The Moolah-Corinya fire in Western NSW was "the largest fire ever contained by man in New South Wales without the help of the weather." It burnt 1.166 million hectares and its perimeter was over 1,000 kilometres.
7. There is little detail in relation to refining management strategies, but these were likely captured in many cases by local landholders and groups. It is believed that there would have been valuable lessons in regards to backburning.

Adaptive fire management strategies, alliancing and infrastructure and conservation.

1. Adopt fire management strategies on individual farms and regional areas reducing late season hot bushfires, optimising biodiversity and grass feed opportunities.
2. Adopt thunderstorm and lightning monitoring service using available weather radar scans to maximise the ability to attack lightning-initiated fires where required.

3. Consider the use of satellite technology by farmers, groups and land managers in the bushfire seasons.
4. Optimise the focus on alliancing and establishing relationships and partnerships in regards to assets, where possible involving all assets, businesses and infrastructure in regards to this.
5. Consideration of strategic fire breaks.
6. Looking at this laterally, there are potential opportunities to review farm and local practices to further reduce bushfire risks for stock, houses, structures at the paddock, farm and local government level, identifying strategic areas for stock safety areas on each landholding, this could vary each year. The same applies for identifying refuge areas, establishing effective firebreaks and managing fuel loads on roads which are escape paths.
7. Forward Information updates to regions/ landholders in regards to fuel loads, mitigation, bushfires, suppression, ideas etc, maybe through regular bushfire bulletins.
8. Organise fire training and PPE for key personnel who will be involved in bushfires protecting houses, structures and infrastructure and assets and will defend infrastructure and people. There will always be a lot of people assisting in bushfire control and mop up, and it is better that these personnel be trained and have sound bushfire PPE when megafires arrive.

Cultural and prescribed burning strategies.

Although the areas control burnt may not always be fully effective in stopping fires, it is generally agreed that they often provide valuable assistance in suppression activities. As noted by Cheney (1976), despite improvements in fire control, provided there are heavy fuel loads and possible ignition sources, large fires will break out under conditions of extreme fire danger and will burn out of control for many hours. Under these circumstances any suppression technique is largely ineffective and the magnitude of the disaster can only be reduced by hazard reduction and fire protection measures undertaken at an individual level.

1. Undertake cultural and prescribed burning in the early dry season in part to limit the spread of the more destructive wildfires that occur in the later part of the year.
2. Refine cultural and prescribed burning strategies to manage fire from deserts to in the tall, wet eucalypt forests and tropical savannah woodlands. Consider more active and timely prescribed burning of spinifex in the areas surrounding mulga communities to reduce the impact of widespread fires on isolated mulga communities.
3. Consider the AWC approach for fire management which provides a good platform for undertaking mild burning, reducing fuel loads, looking after wildlife and reducing greenhouse gas emissions.
4. Fire management using aerial ignition of prescribed fire has significantly changed the periodicity of fire and seems to benefit biodiversity where applied.
5. Consider adoption of cultural/ prescribed burning programs that use either helicopters, fixed-wing aircraft or drones to drop aerial incendiaries or ground based programs.
6. Consider other important objectives of prescribed fire management include the protection of life and property, and the control of invasive weeds.
7. Maximise greenhouse gas advantages with cultural and prescribed by reducing large-scale wildfires, early dry season burning in this way also leads to a reduction in greenhouse gas emissions. Use of drone incendiary technology can increase the savings further.

Fauna.

1. As outlined in this review, control of wildfire is important for the maintenance of wildlife populations.

11 Conclusions.

In contrast to the temperate southern regions of Australia, fire events in central Australia are driven by above average rainfall, rather than below average rainfall or drought. Widespread fire events in central Australia were found to be associated with two or more consecutive years of above-average rainfall. Fuel loads in long-unburnt grassland can get to high levels.

The 1974–75 bushfires burned over an estimated 117 million hectares which is approximately 15% of Australia's land mass. Of the total area of 117.1 million hectares burnt in the 1974/ 75 fire season, 60.02 million hectares was pastoral land and 57.1 million hectares was on unoccupied land. Of the total area of 117.1 million hectares burnt in the 1974/ 75 fire season, 93.6 million hectares was burnt by bushfires and 23.5 million hectares was burnt by graziers burning off.

The majority of the economic damage occurred in New South Wales, South Australia and Southern Western Australia. The fires killed six people, approximately 57,000 farm animals, and caused unspecified crop damage, and destroyed nearly 10,200 kilometers of fencing.

Noting the considerable time since the 1974/ 75 bushfires, the author considers the 1974/ 75 bushfires weren't apocalyptic as suggested by one author, but did have impacts, including the fact that six people were killed; in NSW alone, 50,000 livestock were lost and 10,170 kilometres of fencing destroyed. In addition, there were lost crops, and widespread damage to infrastructure, including communications, roads and railways; if correct, 40 houses were lost; it is likely there are unreported losses in the other states, especially the NT, SA and WA; many landholders were impacted by the bushfires; the scale of the bushfires and the considerable areas burnt at the later stages of the dry season, there were times when the fires were higher intensity and noting there is new research in regards to the impacts of these fires in biodiversity and other values and finally the scale of the efforts to contain the Moolah-Corinya fire in W NSW, more information is detailed further below in relation to this fire.

The Moolah-Corinya fire in western NSW was "the largest fire ever contained by man in New South Wales without the help of the weather." It burned 1.166 million hectares and its perimeter was over 1,000 kilometres.

Aboriginal cultural burning/ prescribed burning/ ecological maintenance burning are important programs for reducing fuel loads, providing bushfire buffers, in setting up safe and healthy landscapes and reducing fauna kills in large bushfires.

Australian Wildlife Conservancy (AWC) undertakes large scale annual prescribed burning across their large estate and is Australia's largest non-government fire management program. The 2020 burning program total distance flown across the Kimberley was estimated at around 40,000 kilometres, with an estimated total of 220,000 incendiaries dropped over 6.5 million hectares of strip burning using aircraft and ground burning. The AWC approach provides a good platform for undertaking prescribed burning, reducing fuel loads, looking after wildlife and reducing greenhouse gas emissions and working closely with Aboriginal groups.

As outlined in Section 10, the review has identified a number of learnings and adaptive management strategies in relation to the 1974/ 75 bushfires and also for the future. This section has been broken down in a number of areas, looking at the 1974/ 75 bushfires as well combined with the learnings and opportunities of today. Opportunities include considering fire management strategies on individual farms and regional areas; using thunderstorm and lightning monitoring service; using satellite technology and greater focus on alliancing and establishing relationships and partnerships in regards to assets. Opportunities in relation to prescribed burning strategies include undertaking prescribed burning in the early dry season is implemented in part to limit the spread of the more destructive wildfires that occur in the later part of the year; refining prescribed burning strategies; adopt prescribed burning programs that use either helicopters, fixed-wing aircraft or drones to drop aerial incendiaries or ground based programs and considering the AWC aerial prescribed burning approach provides a good platform for undertaking prescribed burning, reducing fuel loads, looking after wildlife and reducing greenhouse gas emissions.

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Annexure 1. Wikipedia state-based information on the 1974/ 5 bushfires.

Information extracted from Wikipedia on 15 September 2021, "1974–75 Australian bushfire season".

Australia, being a federation of States and territories, breaks up the 1974-1975 fires by state or region.

New South Wales

Six people killed. Area burned: 3.5 million hectares (8.6 million acres). 50,000 livestock lost, 10,170 kilometers (6,320 mi) of fencing destroyed. Bourke to Balranald, Cobar Shire, Moolah–Corinya—most of the Western Division.[4]:341 Lost crops, and widespread damage to infrastructure, including communications, roads and railways.[7]

The Moolah-Corinya fire was "the largest fire ever contained by man in New South Wales without the help of the weather." It burned 1.166 million hectares (2.88 million acres) and its perimeter was over 1,000 kilometres (620 mi).[8]

Northern Territory

Area burned: 45 million hectares (110 million acres). The fire reached Barkly Tableland, Victoria River district, near Newcastle Waters.[4]:339

Queensland

The bushfire season was defined as October 1974 to February 1975. Area burned: 7.3 million hectares (18 million acres). 95 cattle, 6,850 sheep lost. Areas damaged: Thargomindah, Bulloo Shire, Boulia Urandangie, McKinlay Shire.[4]:340

South Australia

Area burned: 15 million hectares (37 million acres). The areas affected were the north-west of the state (arid and semi-arid zones), and the Adelaide Hills.[4]:344

Western Australia

Area burned: 29 million hectares (72 million acres) of fires, damaging east and north-east of Kalgoorlie.[4]:344

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1	^ Jump up to:a b *"New South Wales, December 1974 Bushfire - New South Wales". Australian Institute for Disaster Resilience. Government of Australia. Archived from the original on 13 January 2020. Retrieved 13 January2020. Approximately 15 per cent of Australia's physical land mass sustained extensive fire damage. This equates to roughly around 117 million ha.*
2	*^ Cole, Brendan (7 January 2020). "WHAT CAUSED THE WILDFIRES IN AUSTRALIA? AMID WORST BLAZES FOR A DECADE, 24 PEOPLE ARE CHARGED WITH ARSON". Newsweek. Archived from the original on 14 February 2020. Retrieved 14 February2020. In 1974, 117 million hectares of land was burnt in wildfires in central Australia.*
3	^ Jump up to:a b *Cheney, N. P. (1 January 1995). "BUSHFIRES – AN INTEGRAL PART OF AUSTRALIA'S ENVIRONMENT". 1301.0 – Year Book Australia, 1995. Australian Bureau of Statistics. Retrieved 14 January 2020. In 1974-75, lush growth of grasses and forbs following exceptionally heavy rainfall in the previous two years provided continuous fuels through much of central Australia and in this season fires burnt over 117 million hectares or 15 per cent of the total land area of this continent.*
4	^ Jump up to:a b c d e f *Ellis, Stuart; Kanowski, Peter (2004). "National Inquiry on Bushfire Mitigation and Management - 2004". Canberra, Commonwealth of Australia: Council of Australian Governments. pp. 339–345. ISBN 0-646-43442-X. Archived from the original on 13 January 2020. Retrieved 14 February2020 – via University of Wollongong.*
5	*^ "How this year's fires compare to others". NewsComAu. 6 January 2020. Archived from the original on 4 February 2020. Retrieved 19 February2020.*
6	*^ "Summer bushfires risk rivals the 1970s". Australian Broadcasting Corporation. 6 October 2011. Archived from the original on 30 October 2016. Retrieved 14 February 2020. Retired CSIRO scientist David Packham says a repeat of the summer of 1974-75 is a strong possibility. "We are in for one big season in these more dry and arid regions, going from sort of the Mallee-type areas of Victoria-South Australia and New South Wales*
7	*^ Chang, Charis (7 January 2020). "'Forever fires': How the Australia bush fires compare to other disasters". The New Zealand Herald. Retrieved 14 February 2020. widespread damage to infrastructure, including communications, roads, railways and property fencing. Farmers lost crops and livestock.*
8	*^ Bush Fire Bulletin, Winter/Spring 1975, Official Journal of the Bush Fire Council of New South Wales, Sydney: Bush Fire Council of N.S.W., 1975, p. 4, retrieved 14 February 2020 – via Trove*

Annexure 2. Stated based bushfire detail provided in Luke and McArthur (1978).

Luke and McArthur (1978) outline a number of important points in relation to the bushfires in each state:

In most parts of the inland, vegetation was generally denser than normal in the spring of 1973. In the summer of 1973/ 74 phenomenal rains fell over most of the inland and were followed during succeeding months by sufficient rain to maintain the resulting increase growth.

With some exceptions and local variations, the spring of 1974 was dry and in consequence the surface vegetation passed from a green to a cured conditions within a space of several weeks. Curing had taken place earlier on the Barkly Tableland of the Northern Territory. It was there in late June and early July 1974 that the first large fire occurred and eventually covered 2.4 million hectares.

Several other large fires developed in the Barkly Tableland at about the same time but the fire situation eased in August and September. In October there were there were further large fires in the Victoria River district and near Newcastle Waters. By November fires had moved south to about the latitude of Alice Springs, and it was in this region that the Northern Territory fire season reached it's peak in December and extended into January and February 1975.

In Western Australia about 12 million hectares of pastoral country were burnt, mainly by series of fires to the east and north east of Kalgoorlie during a peak period which lasted from October to December. Fires in remote areas are more difficult to assess, but these would probably have brought the total area of land burnt in the bush fires to 29 million hectares.

The area burnt in in inland regions of South Australia is estimated at 16 million hectares, comprising 3 million hectares of pastoral country and 13 million hectares of unoccupied land. A large proportion of the North-West of the state was burnt during this period from early November until early in February.

In Queensland most fires occurred in semi-arid country in the far west where the main fire season began in September 1974 and persisted until the end of January 1975. The total area burnt by bushfires has been estimated at 22 million hectares including 15 million hectares of country burnt for grazing purposes.

In New South Wales most large fires occurred in or near western division from mid December to February where they covered about 4 million hectares.

In Victoria where the area of semi-arid country is much less than any other mainland States, fires were confined to a little over 100000 hectares is of Mallee near Mildura.

Other data is included in the tables below.

Table 26.1
Summary of area burnt in each State during the 1974–75 fire season and the proportion burnt on pastoral holdings and unoccupied crown land

State	*Area burnt* *Pastoral (million ha)*	*Unoccupied (million ha)*	*Total area burnt (million ha)*	*Total area of State or Territory (million ha)*	*Percentage burnt*
W.A.	12	17	29	252.8	11.5
S.A.	3	13	16	98.4	16.2
N.T.	20.4	24.8	45.2	134.8	33.5
Qld	20	2	22	172.8	12.7
N.S.W.	4.5	0.3	4.8	80.1	6.0
Vic.	0.12	—	0.12	22.8	0.5
Tas.	—	—	—	—	—
Australia	**60.02**	**57.1**	**117.1**	**768.7**	**15.2**

Table 26.2
Summary of area burnt in each State during the 1974–75 fire season according to whether the fire was a bushfire or one deliberately set for management purpose

State	*Total area of State or Terriotry (million ha)*	*Area burnt (million ha)*	*Area burnt by* *Bushfires (million ha)*	*Graziers burning off (million ha)*
W.A.	252.8	29	25	4
S.A.	98.4	16	16	—
N.T.	134.8	45.2	41	4.2
Qld	172.8	22	7	15
N.S.W.	80.1	4.8	4.5	0.3
Vic.	22.8	0.1	0.1	—
Total	**768.7**	**117.1**	**93.6**	**23.5**

Annexure 3. Rainfall table for four key locations in the 1973 to 1975 period close to or within bushfire affected areas.

Source. BOM website data. The Monthly rainfall is the total of all available daily rainfall for the month.

Note mean and 90 th rainfall data are calculated over the life of the collection of each dataset and this period varies from site to site.

Location	Year	J	F	M	A	M	J	J	A	S	O	N	D	Total
Kalgoorlie -Boulder Airport m	1973	24.6	6.1	8.7	65.7	26.7	65.2	50.6	61.2	17.5	17.0	32.3	11.2	386.8
Kalgoorlie -Boulder Airport	1974	19.7	11.8	142.8	54.8	29.2	20.4	26.8	13.2	59.0	5.6	29.4	5.0	417.7
Kalgoorlie -Boulder Airport	1975	0.2	132.4	28.0	58.2	45.0	12.3	38.0	13.4	7.0	70.0	7.8	8.6	420.9
Kalgoorlie-Boulder Airport	**Mean**	**27.2**	**32.4**	**25.0**	**20.0**	**24.8**	**27.1**	**24.2**	**21.0**	**13.5**	**15.7**	**18.8**	**16.3**	**264.9**
Kalgoorlie-Boulder Airport	**90th %ile**	**81.4**	**80.5**	**67.8**	**54.5**	**47.1**	**54.4**	**48.9**	**43.3**	**29.4**	**33.8**	**40.3**	**39.8**	**392.2**
Alice Springs Airport	1973	53.5	9.2	0.8	13.4	10.4	101.2	22.5	59.0	13.7	19.6	91.9	54.2	449.4
Alice Springs Airport	1974	241.2	146.0	62.6	91.6	24.0	0.0	0.0	30.6	54.4	73.1	10.8	48.2	782.5
Alice Springs Airport	1975	17.0	84.2	60.2	0.2	0.0	3.5	28.4	33.0	57.4	31.5	56.9	228.9	601.2
Alice Springs Airport	**Mean**	**40.1**	**40.9**	**31.8**	**16.2**	**18.0**	**12.8**	**14.5**	**8.4**	**8.6**	**20.1**	**28.3**	**38.7**	**282.2**
Alice Springs Airport	**90th %ile**	**105.1**	**146.6**	**76.5**	**42.1**	**60.9**	**36.6**	**42.2**	**20.8**	**28.3**	**53.9**	**64.6**	**86.4**	**457.9**
Norley Station Qld	1973	20.8	65.3	25.7	58.4	8.9	5.1	29.9	34.5	12.7	39.4	60.4	71.6	432.7
Norley Station Qld	1974	374.8	37.9	24.1	47.7	35.0	0.0	0.0	18.0	9.1	27.0	20.0	0.0	593.6
Norley Station Qld	1975	81.0	89.0	44.0	0.0	0.0	33.0	0.0	15.0	39.0	36.0	0.0	113.0	450.0
Norley Station Qld	**Mean**	**37.7**	**39.5**	**33.0**	**19.7**	**21.3**	**19.1**	**14.4**	**12.6**	**12.7**	**18.5**	**25.4**	**25.9**	**281.6**
Norley Station Qld	**90th %ile**	**103.3**	**110.7**	**92.7**	**54.9**	**59.6**	**48.2**	**44.0**	**36.7**	**37.7**	**41.4**	**61.0**	**60.9**	**443.5**
Cobar MO	1973	63.4	114.9	28.7	13.9	23.0	64.5	26.4	50.9	11.1	104.6	100.9	82.5	684.8
Cobar MO	1974	151.8	126.4	36.2	122.2	10.6	10.3	18.9	28.4	17.5	77.9	24.7	3.9	628.8
Cobar MO	1975	6.4	27.3	19.6	0.1	0.0	45.5	1.4	35.0	102.0	61.7	4.6	67.0	370.6
Cobar MO	**Mean**	**44.0**	**42.3**	**35.7**	**27.0**	**32.1**	**29.1**	**27.7**	**25.8**	**24.6**	**33.3**	**35.1**	**34.8**	**389.5**

Location	Year	J	F	M	A	M	J	J	A	S	O	N	D	Total
Cobar MO	**90th %ile**	**116.9**	**121.0**	**68.8**	**75.9**	**75.7**	**64.7**	**62.0**	**61.5**	**63.9**	**68.4**	**80.5**	**94.6**	**625.9**

Annexure 4. Number, area and perimeter statistics for burnt patches at Lake Mackay.

Table 1. Number, area, and perimeter statistics for burnt patches clearly visible on black-and-white aerial photography and on Landsat satellite imagery of a 53,483 ha study in the Western Desert, Western Australia.

Year	Number of burnt patches	Burnt patch size (ha)				Total burnt (ha)	Total perimeter (km)
		Maximum	Mean	Mode	Median		
1953	372	1,744	34	2	6	12,643	1,198
1973	27	13,534	845	5	197	22,800	412
1977	3	30,618	10,584	-	-	31,752	293
1988	1	32,184	-	-	-	32,184	272