

Earth Observation

- To what extent has the impact of forest fires increased in New South Wales and Victoria, Australia?

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References: [2019–20 Australian bushfire season – Wikipedia](#) - [5] [Australia fires: A visual guide to the bushfire crisis - BBC News](#) - [4] [Fire 2021 | NSW State of the Environment](#) [3] [apo-nid307786.pdf](#) - [2] [2019–20 Australian bushfire season – Wikipedia](#) [Australia fires: Smoke turns New Zealand skies 'eerie' yellow](#) - [6]

Summary

Forest fires are a significant concern in Australia, and the country has experienced severe wildfires in recent years, including the Black Summer bushfires in 2019–2020, which devastated large areas of land and caused significant damage to wildlife and communities. According to data from the Australian Bureau of Meteorology, the country's fire season has become longer and more severe over the past few decades, and climate change is believed to be a significant factor in this trend.

New South Wales and Victoria are two states that have been particularly affected by wildfires in recent years. In 2019–2020, the Black Summer bushfires burned over 18 million hectares of land across the country, with significant damage occurring in New South Wales and Victoria. In these two states, the fires destroyed homes, businesses, and other structures, and caused the loss of numerous lives.

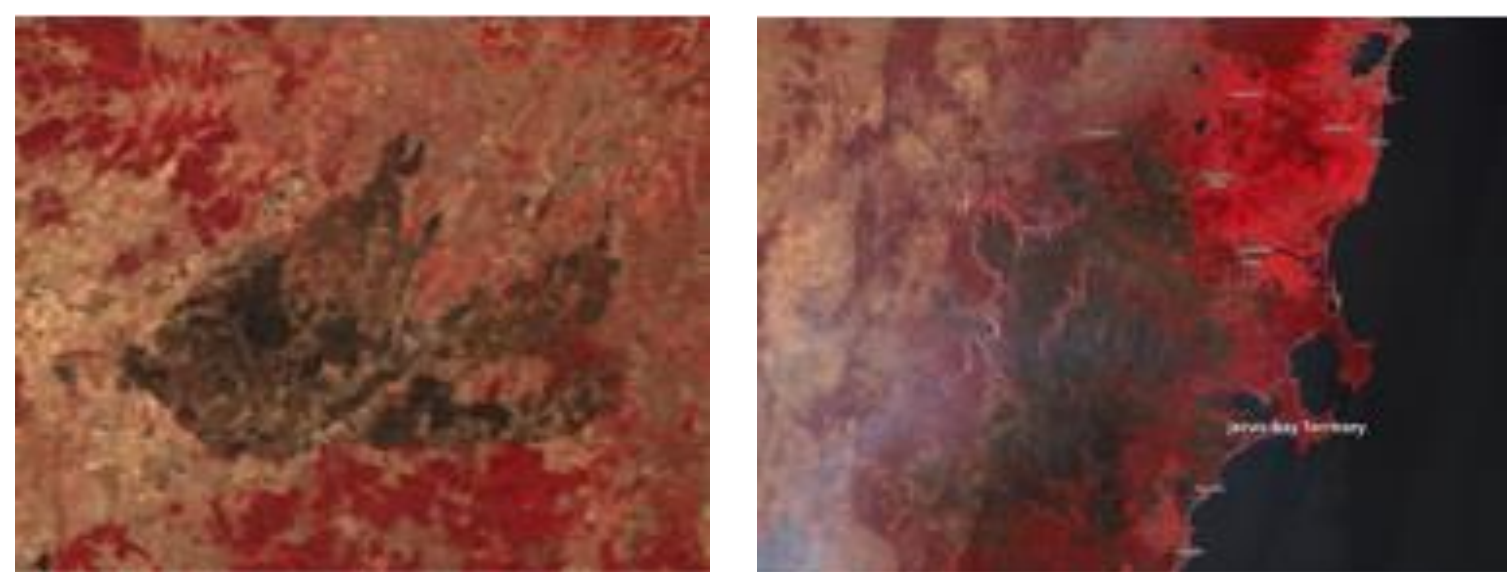


Figure 1
Area of Burn scar – 30/01/2020
One of the burn scars that was measured for the 2019-2020 forest fire season, located in New South Wales

Figure 2
Area of Burn scar – 24/02/2017
One of the burn scars that was measured for the 2016-2017 forest fire season, located in New South Wales.

In addition to the devastating impacts on wildlife and communities, the economic costs of wildfires in Australia are also significant. The fires can result in the loss of homes, businesses, and infrastructure, as well as disruption to agriculture and tourism industries. The Black Summer bushfires alone are estimated to have cost the Australian economy billions of dollars. The impacts of these fires can also be felt beyond Australia's borders, with smoke from the fires affecting air quality in neighbouring countries such as New Zealand [2]. Addressing the problem of wildfires in Australia will require a coordinated effort from all stakeholders, including government, industry, and communities, to mitigate the impacts and work towards a more sustainable future.



'Unpredicted' blazes in New South Wales [1]

A series of "unprecedented" bushfires are raging through Australia's south eastern state of New South Wales, with three people dead and more than 1,000 firefighters battling five emergency-level blazes and dangerous conditions.

[Australia fires: Smoke turns New Zealand skies 'eerie' yellow](#)

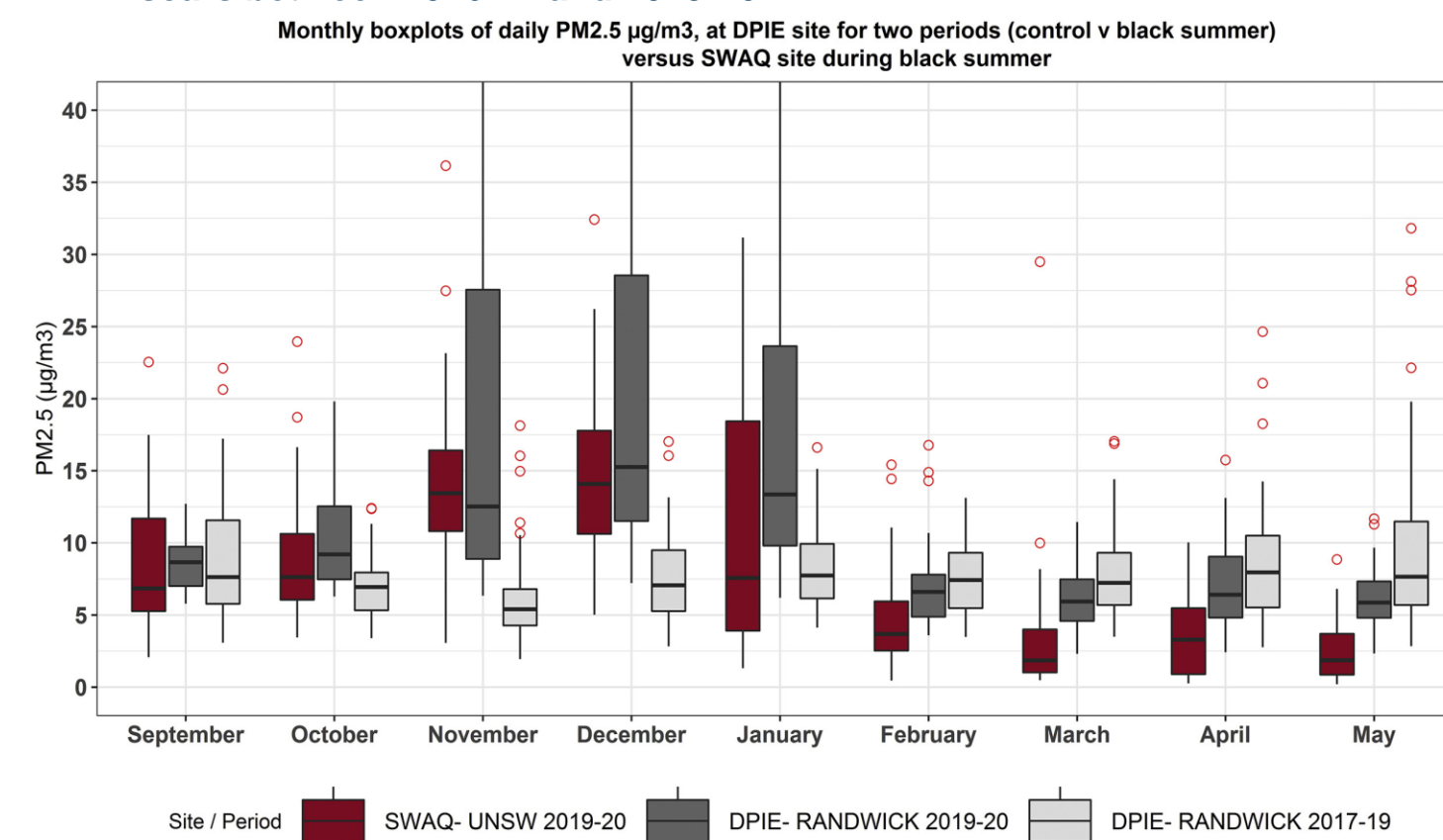
[6]



Mo06

Area of burn scar in 2016-17 (km ²)	Area of burn scar in 2019-20 (km ²)
155.69	2329.88
42.03	2500.44
89.57	1802.64
140.89	822.69
120.67	1791.22

Comparison table using data from EO browser to compare burn scars between 2016-17 and 2019-20



Monthly box plots of daily mean PM_{2.5} (µg m⁻³) at SWAQ-UNSW and the closest DPIE sensor (Randwick) during Sept–May 2019–2020, versus a historical baseline (Sept 2017–May 2019) at DPIE-Randwick.

This shows that during the peak fire season in the Black Summer (in January), the PM_{2.5} is averagely 6 µg/m³ higher than the usual PM_{2.5} in January. In addition, the whiskers on the box plot extends to over 40 µg/m³ which is more than 4/3 times the maximum Pm_{2.5} than the control variable. This demonstrates that during the later seasons, the air quality is significantly worse than it has been previously.

Research aims

The objective of this research is to comprehensively investigate and analyse the multifaceted impact of forest fires on various aspects, including air quality, wildlife populations, financial costs, and government responses. By delving into these dimensions, we aim to generate a comprehensive understanding of the far-reaching consequences of forest fires and contribute to informed decision-making for forest fire management and mitigation strategies.

One of the primary research aims is to investigate the effect of forest fires on air quality in a given area. Forest fires release a plethora of harmful pollutants and particulate matter into the atmosphere, including carbon monoxide, nitrogen oxides, volatile organic compounds, and fine particulate matter (PM_{2.5}), among others. These pollutants can have detrimental effects on human health, wildlife, and the overall ecosystem.

This research aims to provide a comprehensive understanding of the impacts of forest fires on air quality, wildlife populations, financial costs, and government responses. By analysing and synthesizing data from multiple dimensions, we aim to generate valuable insights for policymakers, stakeholders, and communities to develop effective strategies for forest fire management, risk reduction, and ecological resilience.

Background information

In the states of New South Wales and Victoria, it has been reported that the combined loss of mammals, birds, and reptiles due to the fires has exceeded 1 billion. Additionally, Professor Chris Dickman, an esteemed expert in the field of ecology, conservation, and management of Australian mammals from the University of Sydney's Faculty of Science, has estimated the loss of insects to be in the "hundreds of billions"

Background information (continued)

"These findings are consistent with other experts' assessments and have been intentionally and rigorously conservative in their estimations. The university's statement also acknowledges that the true extent of mortality is likely to be considerably higher than the estimates provided. [4]

An article from the Guardian from 4 January 2020:

Bushfires don't just burn animals to death but create starvation events. Birds lose their breeding trees and fruits and invertebrates they feed on. Ground-dwelling mammals that do survive emerge to find an open landscape with nowhere to hide, which one ecologist said became a "hunting arena" for feral cats and foxes. [5]

In the past few years there has been an increase in the damages caused in forest fires in NSW. For example, between the years 2018 to 2019, 288,000 hectares of land was burnt, compared to a drastic increase just one year later between 2019 and 2020 where 5,520,000 hectares of land were burnt.

Historically in NSW between 2 years, there isn't such an extreme difference between areas burnt within the 2-year period. This increase in damage is also shown where 2019-2020 saw 26 deaths in NSW, an increase of 22 from the previously highest count of 4 in 1993-1994.

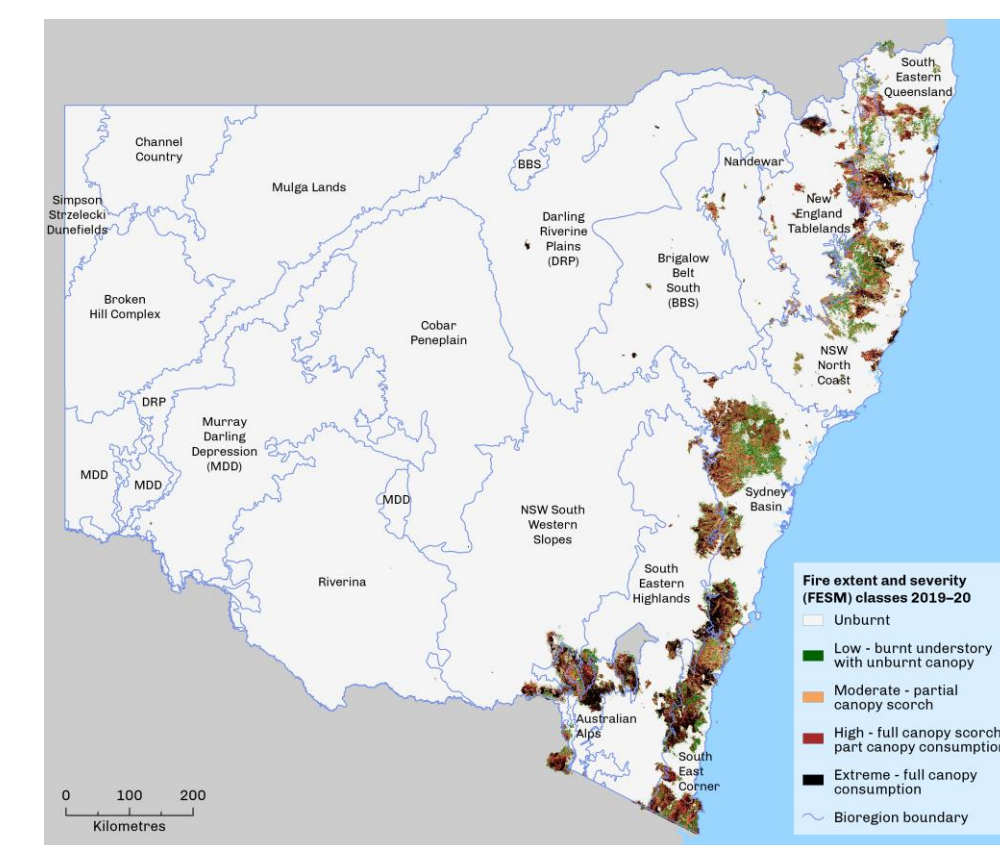
Year	Hectares burnt	Homes destroyed	Lives lost
1993-94	800,000	225	4
2001-02	744,000	135	0
2002-03	1,500,000	112	0
2012-13	1,400,000	62	0
2013-14	574,557	227	2
2017-18	260,000	74	0
2018-19	288,000	37	0
2019-20	5,520,000	2,476	26

Table 2-2: Area burnt, homes destroyed and lives lost during previous serious fire seasons in NSW. [5]

Final report of NSW bushfire enquiry as of 31 July 2020 using data obtained from the RFS 9NSW Rural Fire Service) 2020 [2]

Experimental Method

Our experimental methods aimed to cover the vast impact forest fires have on Australian land and wildlife, including, but not exclusively too, mammals and their inability to seek shelter after a fire has destroyed their habitat. We used Earth Observation browser to look at burn scars, using hectares to measure the areas affected before and after wildfires. Using both the 2016-2017 and the 2019-2020 seasons we found that burn scars had increased in area dramatically between the two. This would suggest that fires are more likely in these areas in the future due to the increasing temperatures.



NSW – EPO New South Wales Environment, Map 22.1: Fire extent and severity mapping 2019-2020 NSW Black Summer Bushfires. [3]

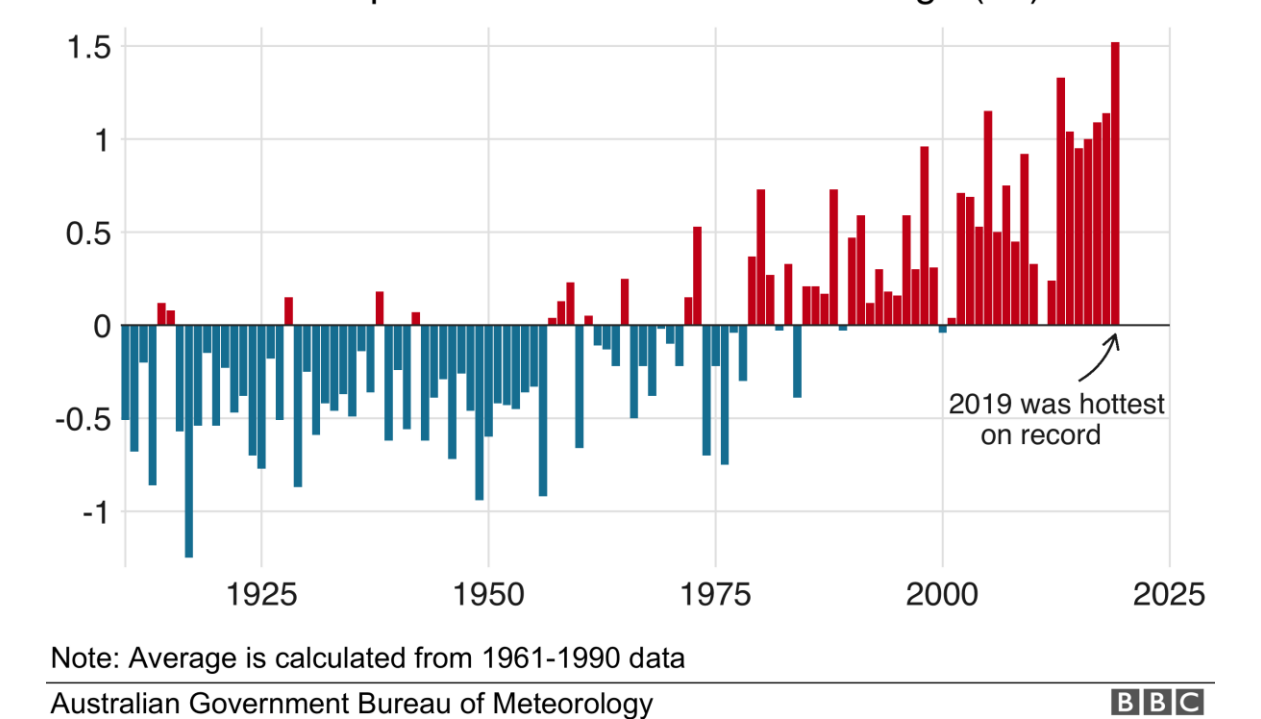


Results

The fires not only burned animals to death but also created starvation events and destroyed breeding trees and fruits, leaving ground-dwelling mammals with nowhere to hide, creating a "hunting arena" for feral cats and foxes. These impacts are believed to be caused by climate change, which has exacerbated the severity and length of the country's fire season. The burn scars seen are a clear representation of the damage wildfires cause and the increasing severity in which they are occurring.

Australia has been getting warmer

Annual mean temperature above or below average (°C)



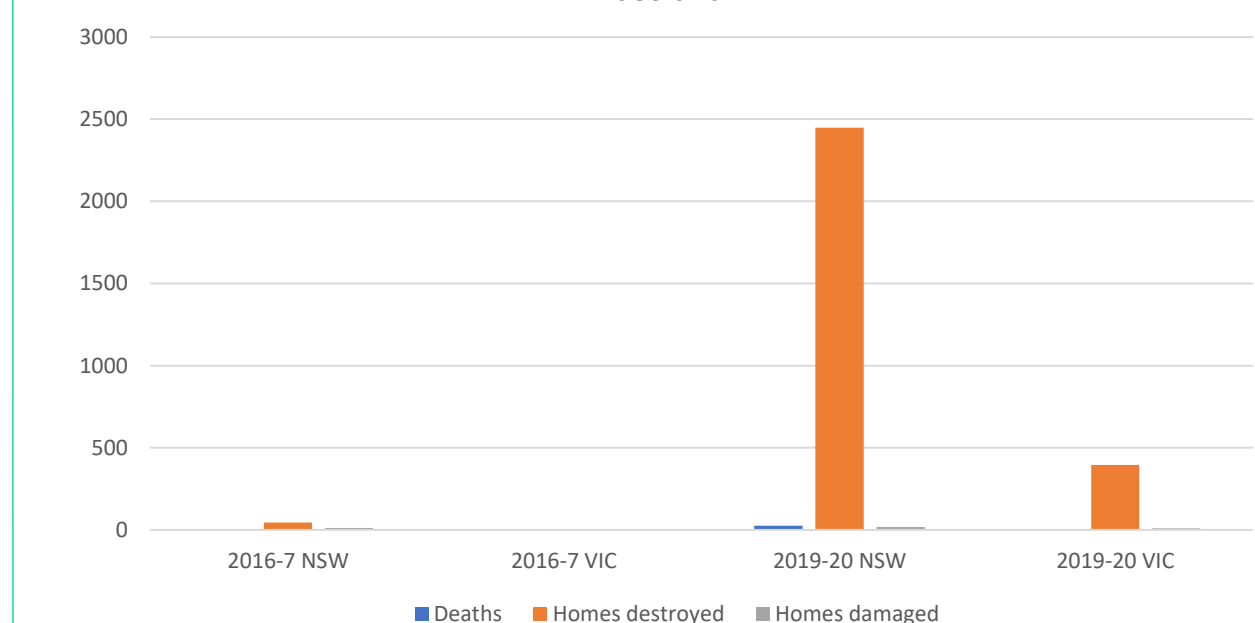
Note: Average is calculated from 1961-1990 data
Australian Government Bureau of Meteorology [3]

Source: [Australia fires: A visual guide to the bushfire crisis - BBC News](#) [4]

Analysis & conclusions

The impacts of wildfires in Australia are getting worse, with the country experiencing longer and more severe fire seasons over the past few decades. The Black Summer bushfires that occurred in 2019-2020 caused significant damage to wildlife and communities, with New South Wales and Victoria being particularly affected. The combined loss of mammals, birds, and reptiles due to the fires in these two states alone has exceeded 1 billion, with the loss of insects estimated to be in the "hundreds of billions." It is clear that urgent action is needed to address the impacts of wildfires and mitigate the effects of climate change on Australia's natural environment.

Impact of forest fires in New South Wales and Victoria, Australia



This graph shows impacts of forest fires in New South Wales (NSW) and Victoria (VIC), during two different periods: 2016-2017 and 2019-2020. In terms of human casualties, there were no reported deaths in either NSW or VIC during the 2016-2017 period. However, during the 2019-2020 period, NSW experienced 26 fatalities, while VIC reported 5 deaths. The destruction of homes during the 2016-2017 period was relatively limited, with 46 homes destroyed in NSW and only 2 in VIC. In contrast, the 2019-2020 period saw a significant increase in the number of homes destroyed, with NSW witnessing the destruction of 2,448 homes and VIC reporting 396 homes lost. Additionally, there were some homes damaged during both periods, but the numbers were comparatively lower. These statistics highlight the devastating impact of forest fires on both human lives and property, underscoring the importance of effective forest fire management and mitigation strategies in these regions.