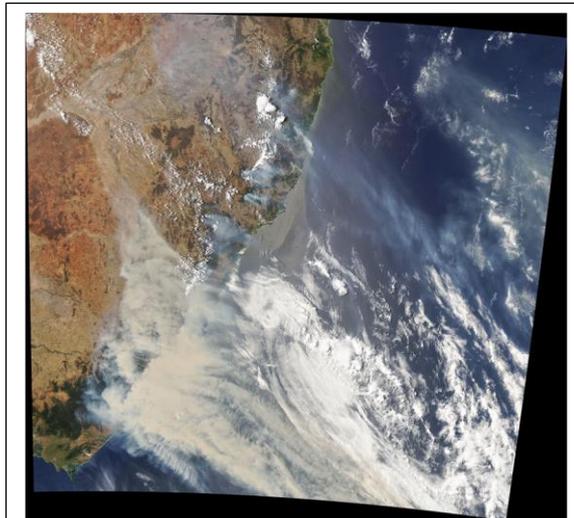




During the summer of 2019-2020, eastern Australia experienced the largest recorded fire season. New South Wales was the most affected state. For 240 days between July 2019 and March 2020, 11 774 fires burned across NSW.

The consequences of the summer fires were devastating. Twenty-six people died, more than a billion animals died, thousands of homes were destroyed and more than 6% of the state burned. Estimates of the total area burnt range from 5.5 – 12.8 million hectares (Owens & O’Kane 2020; Granwal 2020). Burned areas included 81% of the World Heritage listed Greater Blue Mountains Area and 54% of the Gondwana Rainforest of Australia World Heritage property in New South Wales. Fifty-seven parks or reserves were completely fire affected and 73 had 75-99% of their area affected by fire.



January 1, 2020 image from Landsat 8 of fires in southeastern Australia (J Stevens, NASA Earth Observatory, public domain).

### Causes of the fires

#### Ignition

Lightning was the main cause of ignition for the fires, including the Gospers Mountain fire that burned more than 500 000 hectares. Of 32 major fires, 26 were caused by lightning. Other causes were debris burning (3), powerlines (2), equipment (1), shredded tire (1) and undetermined (1).

#### Climate change

Climate change due to increased greenhouse gas emissions contributed to the disastrous conditions experienced in the summer. Rainfall is decreasing in the winter and spring over south-east Australia. 2019 was the hottest year on record at that point. More frequent and intense extreme weather played a major role in the catastrophic fire conditions.

#### Drought and climate drivers

Most of NSW was in its third year of severe drought in 2019. A strong and long-lived positive Indian Ocean Dipole and negative Southern Annular Mode are large-scale climate drivers that led to drought in Eastern Australia. The El Niño Southern Oscillation (ENSO) was close to the El Niño threshold, but had returned to a neutral condition by September 2019.

#### Dry landscape

The combination of extreme heat and extreme drought left the landscape drier than ever before. The moist gullies and swamps that often break up forest landscapes were dry, increasing the potential for megafires. The prolonged drought led to little grass cover west of the dividing range. This limited the high-risk areas to the forest regions on and east of the range.



### Fuel load

The fuel load (leaves and twigs on the ground) was generally high, but no higher on average than for the last 30 years. However, the fuel was much more flammable due to extreme dryness of the landscape. In areas that had been subject to hazard reduction burning, the fires slowed during moderate weather conditions. However, hazard reduction burning had little effect on fire spread and severity during times of extreme weather, which were common during the summer.



Fire danger during the bushfire season was Catastrophic on 6 days and extreme on 22 days (Mattinbgn 2014, Creative Commons)

### Fire weather

The negative Southern Annular Mode and a sudden stratospheric warming event led to strong westerly winds in combination with extreme heat and drought. The combination of weather and climate effects is brought together in the forest fire Danger Index that is posted on signs. This deadly combination led to six days of Catastrophic, 22 days of Extreme and 72 days of Severe fire danger from October to December 2019. In many areas, records were set for the number of high-risk days, but also for the highest monthly **minimum** fire weather conditions, particularly in December. The lack of reprieve from dangerous conditions certainly played a role in the severity and spread of the fires.

Nights generally bring higher humidity and lower temperatures, calming fires. This was not the case during the peak fire times in 2019-2020. In fact, the fires created an unprecedented number of fire-generated thunderstorms. These storms drove the spread of fire further and faster than the strong natural winds, transporting embers tens of kilometres.

fires created an unprecedented number of fire-generated thunderstorms. These storms drove the spread of fire further and faster than the strong natural winds, transporting embers tens of kilometres.

### **Impact on local ecosystems**

The extensive fires had a devastating effect on ecosystems across New South Wales. Whilst the total land burned was in excess of 6% of the state, this represented 37% of national parks, 42% of state forests and huge areas of World Heritage status. These areas provide key habitats for native flora and fauna. Almost a thousand threatened animal and plant species live in areas affected by fire.

The ecological carrying capacity of the fire ground was reduced by 39% compared to 2013 assessments. Heathland ecosystems were most heavily damaged (52%), followed by wet sclerophyll forests (50%) and rainforests (37%). More than 60 threatened plant species live predominantly in the fire ground. Threatened animal species reported mainly (>80% of reports) in the fire ground include the critically endangered long-nosed potoroo, the endangered frog *Philora pughi*, the greater glider endangered population in Eurobodalla and the endangered Hastings River mouse.



The massive fires generated 89 thunderstorms with extreme winds, lightning, tornadoes and black hail. These storms knocked down trees, destroyed vegetation and further spread the fires.

The reduction in vegetation increased erosion across the fire ground, more than doubling erosion rates in national parks and state forests. Topsoil loss is particularly devastating because of the slow rate of soil formation in Australia and the loss of vital trace elements contained in topsoil.

Heavy rains in February 2020 led to increased water runoff and erosion. The runoff contained soil, leaves, ash and burn debris, affecting water quality. As the organic material decomposes, it uses up oxygen that would otherwise be used for respiration by fish, oysters and other aquatic species. The NSW government is monitoring water quality in at risk areas to document the impact over time.

### Key facts about the 2019-20 fires in New South Wales

The fire ground includes:



**5.4 million**  
hectares of land  
in NSW



**37%** of all  
NSW national park esta



**42%** of all  
NSW state forest



**4%** of all  
NSW freehold land



**81%** of the  
Greater Blue Mountains  
World Heritage Area



**54%** of Gondwana  
Rainforests of  
Australia World  
Heritage Area in NSW



**25%** of  
suitable koala habitat  
in eastern NSW



**52%** of  
heathlands in NSW



**293** threatened  
animal species have  
sightings recorded  
in the fire ground



**680** threatened  
plant species have  
sightings recorded in  
the fire ground

From Department of Planning, Industry and Environment (2020).  
NSW Fire and the Environment 2019-20 Summary, p 5.

### Contribution of human activity

#### Climate change

The enhanced greenhouse effect results from increased release of greenhouse gases as a result of human activities. Whilst not directly responsible for any single weather event, higher temperatures and more extreme weather associated with the enhanced greenhouse effect contributed to the devastating fire conditions.

#### Hazard reduction burning

In the wake of the fires, many individuals identified a lack of hazard reduction burning as a possible factor in the bushfires. As noted above, the amount of fuel was similar to 30-year averages. In some areas where hazard reduction burning had taken place, this slowed the fire and allowed backburning or construction of mechanical firebreaks. However, when fire weather was severe, hazard reduction and recent natural fires had no effect on the severity and spread of the fires.

#### Traditional Aboriginal land management

Cultural burning does not necessarily aim to reduce fuel for bushfires. It is about caring for Country,

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maintaining healthy, diverse landscapes and practicing cultural traditions. Legislative and funding limitations make it difficult for Aboriginal groups to carry out cultural burning over the longer timeframes necessary to achieve vegetation change. The bushfire inquiry recommended that the NSW Government commit to greater application of cultural burning and evaluation of these techniques, which are credited with saving property in several areas during the 2019-20 season.



Water bombing helicopter in action  
(Aussie Oc 2015, Creative Commons)

### Firefighting

Many of the most devastating fires started in regions that were difficult to access and difficult to spot with current technology. For example, the Gospers Mountain fire was detected when 4 hectares were burning at 1pm on 26 October, but it was too windy and rugged to insert a firefighting team or water bucket with helicopters. Four hours later (5 pm) the fire had grown to about 25 hectares and was too large for a single firefighting crew. The next day firefighters were brought in, helicopters deployed and fixed-wing water bombers on the scene. However, crews had to be withdrawn by mid afternoon due unpredictable fire conditions caused by extreme fire weather.

The high number of fire incidents stretched resources past breaking point. At times, the NSW Rural Fire Service (RFS) was managing more than 150 fires. Extra air support from overseas was brought in relatively late when large fires

were well established. Firefighters from the RFS were supported by Fire and Rescue NSW, National Parks and Wildlife Service, the Forestry Corporation of NSW, the State Emergency Service, the NSW Police Force and thousands of interstate and overseas personnel.

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