



AUSTRALIAN
EARTH
SCIENCE
EDUCATION

Bushfires of 2019-2020

Causes and Effects



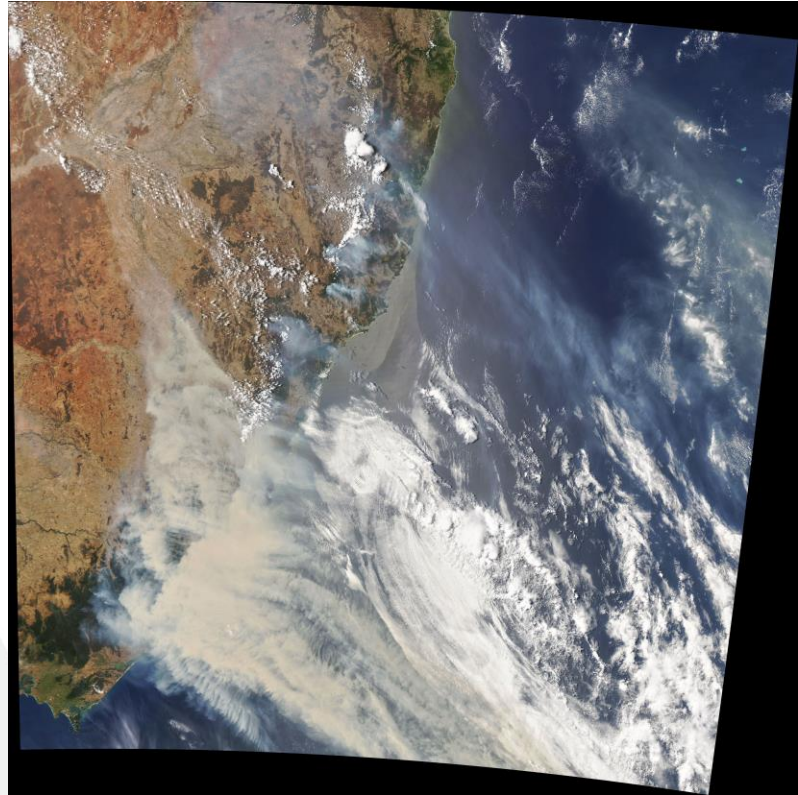
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Overview of fires

- 240 days
- 11 774 fires
- 5.5 million hectares
- 6% of NSW



Landsat 8 image of south-eastern
Australia 1 January 2020 (J Stevens, ausearthed.com.au
NASA Earth Observatory, public domain)



What lit the fires?

- **Lightning**
- Debris burning
- Powerlines
- Equipment
- Shredded tire



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(M Kozlenko 2007, Creative Commons)

Causes – Climate change

- Steady increase in temperature
- 2019 – hottest year on record (at that point)
- Overall decrease in rainfall



Causes – Drought and climate drivers

- 3rd year of drought
- Positive Indian Ocean Dipole
- Negative Southern Annular Mode
- Neutral ENSO



Causes – Dry landscape

- Little grass left west of dividing range
- Gullies and swamps dry up



Causes – Fuel load

- Fuel load was average for past 30 years
- More flammable due to extreme dryness
- Hazard reduction burning only effective in moderate weather



Causes – Fire Weather

- Hot nights and high westerly winds
 - Catastrophic – 6 days
 - Extreme – 22 days
 - Severe – 72 days
- Highest **MINIMUM** fire weather in December



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

The fire ground includes:

Impact



5.4 million
hectares of land
in NSW



37% of all
NSW national park estate



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

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

Damaged ecosystems

- 81% of Greater Blue Mountains Heritage Area
- 52% of heathland ecosystems
- 39% reduction in ecological carrying capacity



Vegetation recovery 6 months after fire in
the Blue Mountains World Heritage Area

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Effect on threatened species

- 60 plants live mainly in fire ground
- Threatened animal species include
 - long-nosed potoroo
 - frog *Philora pugh*
 - greater glider
 - Hastings River mouse



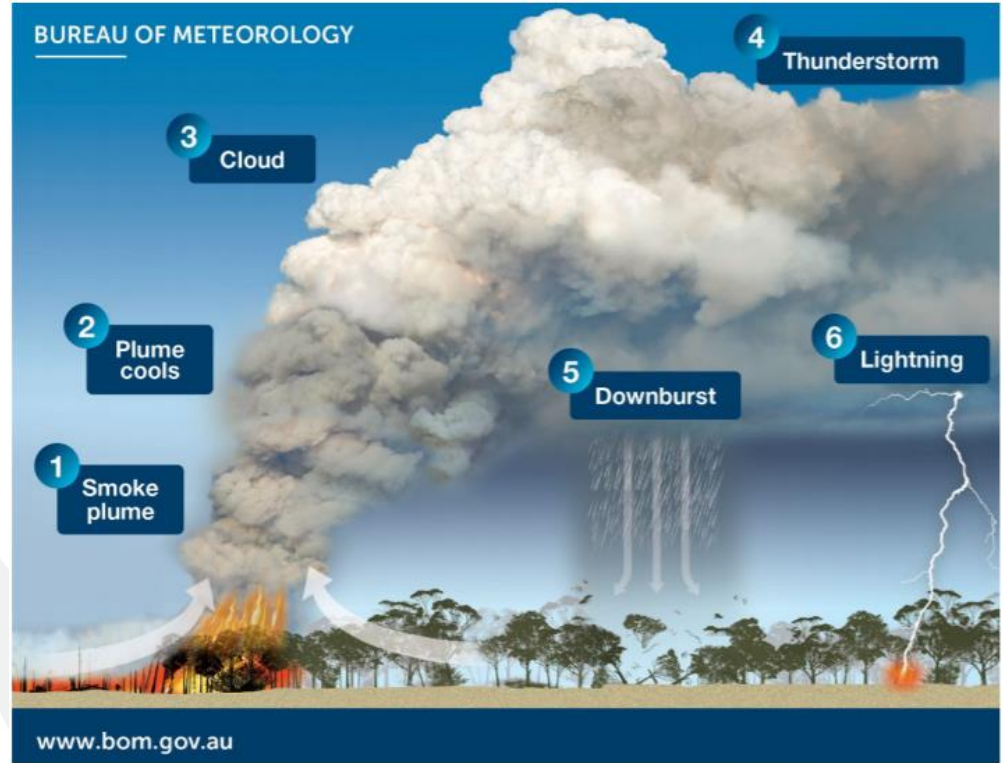
Long-nosed potoroo (G Pandey
2018, Creative Commons)

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Fire-generated thunderstorms

- 89 fire-generated thunderstorms
- Extreme wind
- Lightning
- Tornadoes
- Black hail
- Spread embers



From: Owens D, O’Kane M (2020). Final Report of the
NSW Bushfire Inquiry. P 68.

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Erosion

- 113% increase in national parks
- 143% increase in state forests
- 59% increase on other Crown land



Erosion after fires in Yellowstone National Park, USA
(J Peaco/National Park Service, public domain)

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Runoff affects water quality

- Heavy rains in February
- Soil, leaves, ash and debris in runoff
- Decomposing organic material uses up oxygen



Ash flowing into a river after a fire in New Mexico, USA
(US Dept of Agriculture 2013, Creative Commons)

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Human contribution: Climate change

- Greenhouse gas release leading to climate change
- Consistent warming
- Less rainfall
- Extreme weather



Human contribution: Hazard reduction burning

- Fuel load was not unusually high
- Reduction burning is helpful if in normal fire weather
- Reduction burning has no effect during severe fire weather



NSW RFS volunteer conducting a hazard reduction burn in 2019 (R Lagois 2020, Creative Commons) ausearthed.com.au



Human contribution: Traditional Aboriginal land management

- Not necessarily for fuel reduction
- Limited funding
- Difficult to get permission



Cultural burning in the Top End (CSIRO 2000, CSIRO Science Image)



Human contribution: Firefighting

- Hard to spot fires
- Fires in difficult areas
- Weather challenges
- High number of fires
- Late extra support

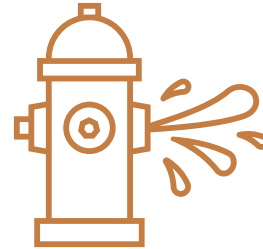


Water bombing helicopter in action (Aussie Oc 2015, Creative Commons)



Recommendations from Inquiry

- 76 recommendations
 - Improvements in fire fighting methods and equipment
 - Better telecommunication
 - Government response
 - Education





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