HAZARD NOTE

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**TOPICS IN THIS EDITION** | FIRE IMPACTS | FIRE SEVERITY | FIRE WEATHER

# NORTHERN AUSTRALIA SEASONAL BUSHFIRE OUTLOOK 2019

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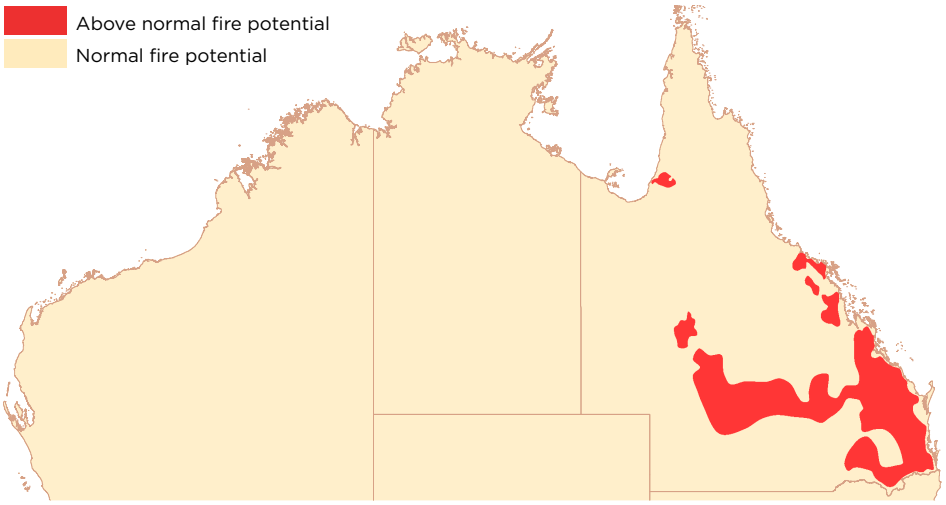
## BUSHFIRE POTENTIAL

Covering Queensland, the Northern Territory, northern Western Australia and northern South Australia, the *Northern Australia Seasonal Bushfire Outlook 2019* provides information to assist fire authorities in making strategic decisions such as resource planning and prescribed fire management to reduce the negative impacts of bushfire. A *Seasonal Bushfire Outlook* incorporating southern Australia will be published in late August, and will include an update on the northern fire season if required.

Bushfire potential depends on many factors. In northern Australia, conditions are determined by the nature of the previous wet season. The volume, location and timing of rainfall are critically important when estimating vegetation (fuel) volumes and growth. They also affect the timing of the drying of the vegetation. The climate outlook for the next few months is also a crucial factor. Of particular interest are the future tendencies of Pacific sea surface temperature associated with El Nino-Southern Oscillation, a major climate driver over Australia. Other less quantifiable factors, such as the distribution and readiness of firefighting resources, are also considered.




▲ Areas are based on the Interim Biogeographic Regionalisation for Australia and other geographical features.

## ANTECEDENT CONDITIONS

Seasonal fire conditions are a function of fuel amount and state, and seasonal weather conditions. In northern Australia recent weather and climate is particularly important, as it determines the condition and amount of available grass and woody fuels. Years with abundant summer rainfall due to an active monsoon and tropical cyclones tend to see more fuel growth and present increased fire risk when the fuels dry out. Years with reduced rainfall, which may be hotter and give more bad fire weather days, are often associated with reduced fuel growth, which may reduce fire activity.

The past two years have seen unusual climatic conditions affect most of Australia. Perhaps most notably, record warmth has been experienced across many regions nationally, particularly so for maximum temperatures. The two-year period ending June 2019 has seen the hottest national mean temperature on record at +1.65˚C above the 1961-1990 average (previous record +1.38˚C in 2014-2016). During these two years, many notable temperature records have been experienced including Australia's hottest summer on record (2018/19), along with many individual and multi-day high temperature extremes (Figure 1, page two). Accompanying the warm conditions has been widespread and significant rainfall deficiencies and drought, which has locally persisted for more than two years. The below average rainfalls have reflected both poor monsoonal rainfall and reduced winter rainfall in more southern areas.

The northern wet season (October 2018 to April 2019) was notably dry for much of northern Australia. In contrast, inland Queensland near Mount Isa, and the tropical Queensland coast from near Townsville to Cape York, experienced unusually wet conditions, with flooding evident in December, January and February (Figure 2, page two). Vegetation growth, which provides the fuel for bushfires, matches the overall pattern of rainfall and temperature, with poor growth affecting most of Australia including the tropics. A notable exception is north east Queensland, where greenness and recent fuel growth has been high due to the heavy summer rains.

The second half of 2018 saw the development of a positive Indian Ocean Dipole (IOD), a feature which tends to suppress rainfall across Australia. In the Pacific, sea surface temperatures have been persistently warmer than average, at times reaching the threshold typically used to declare an El Niño event. However, the atmosphere has not always been consistent with the presence of an El Niño. These extended near-El Niño conditions in the Pacific likely contributed to suppressing rainfall over Australia. Unusually, the pattern of ocean cooling which often occurs during late summer and autumn with past El Niño events did not occur in early 2019, meaning that the drying influence on rainfall persisted throughout the northern wet season.

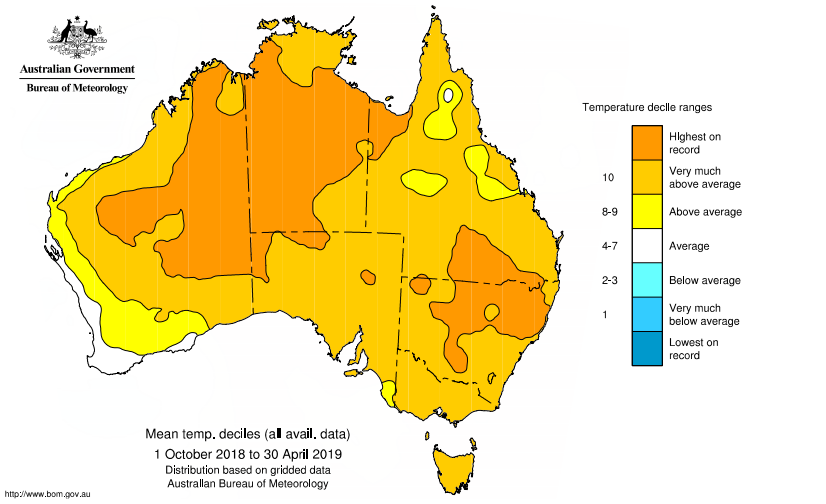
Recent high temperatures reflect the background global warming trend, in combination with natural variations. Australia's mean temperature has now

## DEFINITIONS

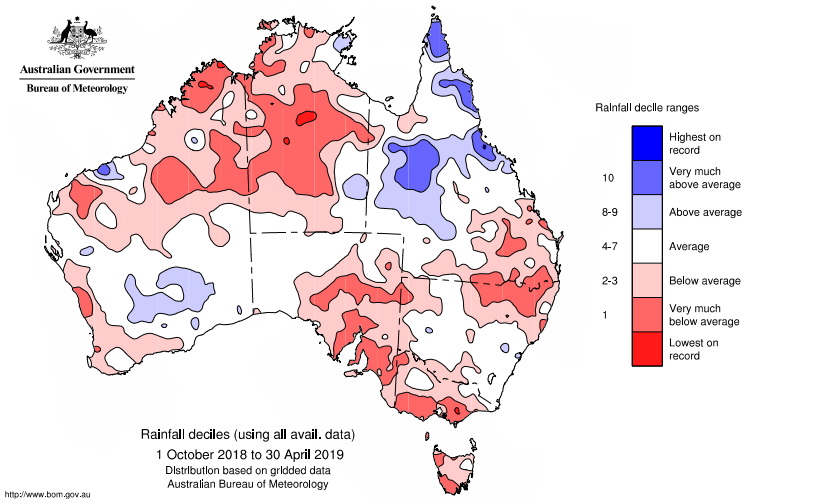
Bushfire potential: The chance of a fire or number of fires occurring of such size, complexity or other impact (such as biodiversity or global emissions) that requires resources (from both a pre-emptive management and suppression capability) beyond the area in which it or they originate. Fire potential depends on many factors including weather and climate, fuel abundance and availability, recent fire history and firefighting resources available in an area.

Rainfall decile: A decile is a statistical technique that ranks sorted observations into 10 equal groups. A decile rainfall map will show whether the rainfall is above average, average or below average for the chosen time period and area.

IBRA: Interim Biogeographic Regionalisation for Australia. Australia's landscapes are divided into 89 large geographically distinct bioregions based on common climate, geology, landform, native vegetation and species information.




▲ Figure 1: MEAN TEMPERATURE DECILES FOR OCTOBER 2018 TO APRIL 2019 SHOWING UNUSUALLY WARM CONDITIONS ACROSS AUSTRALIA.




▲ Figure 2: RAINFALL DECILES FOR OCTOBER 2018 TO APRIL 2019 SHOWING DRY CONDITIONS OVERS MUCH OF AUSTRALIA.

warmed by 1.4°C since 1910, which is significant compared to interannual variability, which is typically near 1°C. One consequence of the rising temperatures is an increase in fire weather severity, during the dry season in northern Australia and the warm season in southern Australia. As measured by fire weather indices, northern Australia experienced record high fire weather in 2017 and this record was broken again in 2018. The increase in the south also means that the northern and southern fire seasons are increasingly overlapping, particularly during the spring period.

The dry season in tropical Australia officially commences in May and ends in September. Large rainfall totals are rare, with the climate dominated by warm to hot temperatures, lower humidity and east to south east winds which may become gusty and elevate fire risk. Low rainfall and warm to hot temperatures mean that fuels are already dry. The combination of weather and climate factors means the 2019 fire season is now well underway, with dryness running a few weeks ahead of seasonal norms.

Winter into spring is historically a period of lower fire risk in more southern areas of Australia. However, notably dry conditions and severe drought in combination with a trend to earlier and more severe fire seasons means that there is again an increased risk of early fire activity affecting areas such as south east Queensland and eastern New South Wales. These areas will be covered in more detail in the *Southern Australia Seasonal Bushfire Outlook 2019* in late August.

## CLIMATE OUTLOOK

The Pacific Ocean has experienced warmer than average conditions for more than twelve months and approached the threshold for an El Niño on a number of occasions. However, climate model guidance suggests that the Pacific is now likely to continue near or below the threshold for an El Niño, meaning an event is not likely. The ENSO Outlook status is now inactive.

The Indian Ocean continues to experience average or cooler than average waters to Australia's north west, and warmer waters further west. This pattern is typical of a positive Indian Ocean Dipole (IOD) event, with the IOD index sitting above the positive threshold in recent weeks. Most climate models surveyed by the Bureau suggest a positive IOD will persist through winter. A positive IOD often results in below average winter and spring rainfall over southern and central Australia, extending into northern Australia during spring.

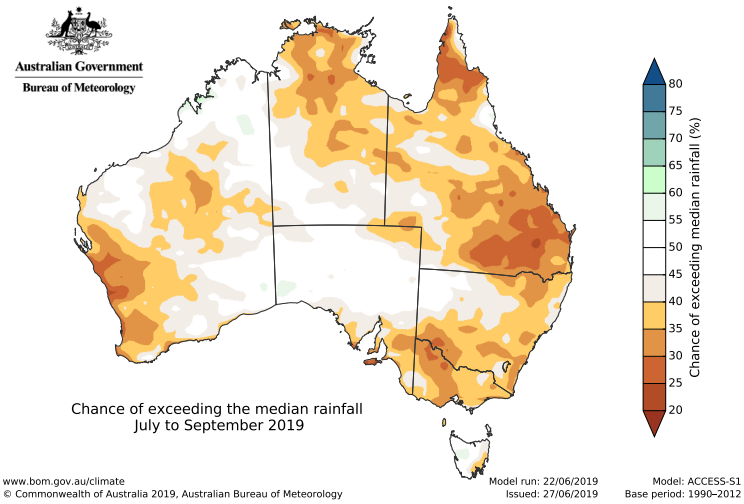
Overall, the Bureau's forecast suggests that the start to the 2018/19 wet season is likely to be delayed. The outlook for the coming wet season will be updated monthly as new data and model forecasts become available.

The outlook for July to September rainfall suggests that below average rainfall is likely across much of Australia, though probability shifts are not strong (Figure 3, page 3). The tendency for below average rainfall is consistent with a positive IOD, and the continued warmth in the tropical Pacific Ocean.

Historical outlook accuracy for July to September is moderate to high for most of the country, but low in parts of south east Australia and far northern Queensland. The July to September period is normally dry for northern Australia, with typically low

rainfall except near the Queensland coast. This means that the impact of rainfall in the coming months is likely to be modest.

July to September is likely to bring average to above average maximum temperatures to tropical parts, with probabilities favouring warmer days in the range of 60 to 80% (Figure 4, page 4). The one exception is far north Queensland, where probabilities are near 50:50. Overall the forecast suggests that recent warmer than average conditions are likely to continue through the remainder of the dry season. The outlook for minimum temperatures also favours warmer than average conditions (not shown) with probabilities broadly above 60%. Historical accuracy for July to September maximum temperatures is moderate to high for most of Australia, except parts of the inland north, and south east and south west Australia. Minimum temperature accuracy is moderate to high for the northern half of the country and Tasmania, but generally low elsewhere.




▲ Figure 3: CHANCE OF EXCEEDING THE MEDIAN RAINFALL FOR JULY TO SEPTEMBER 2019.

## REGIONAL SUMMARIES

### QUEENSLAND

Looking back at the previous fire season, both the *Northern Australia Seasonal Bushfire Outlook 2018* and the *Southern Australia Seasonal Bushfire Outlook 2018* (*Hazard Note 49*, July 2018 and *Hazard Note 51*, September 2018) identified above normal fire potential for forested areas along Queensland's Central Coast, Whitsundays and the Capricornia – areas that experienced unprecedented bushfires in November/ December 2018. These bushfires were the result of long term climate drivers - a lack of rainfall along the coast had led to drier soils and hotter daytime temperatures. During the bushfires there were a series of low pressure systems over south eastern Australia that drove a strong westerly air flow. These systems brought hot dry winds from central Australia right to the Queensland coast and resulted in record temperatures and forest fire danger indices. The fire danger rating reached Catastrophic on the afternoon of 28 November in parts of Queensland, the first time the Catastrophic rating had been recorded in the state.

December 2018 saw record rainfall on the North Tropical Coast, as well as the Herbert and Lower Burdekin forecast districts. February and March 2019 also saw record and very much above average rainfall over northern parts of the state. Conversely for the six month period December 2018 to May 2019, rainfall has been below, and very much below average in south eastern parts of Queensland.

This rain has resulted in the root zone soil moisture being average or above average for most of the state, except for areas around Rockhampton and south to the New South Wales border, where the soil moisture is below average. In this area, the rainfall and temperature outlooks make it very likely that this current soil moisture deficit will persist into the fire season, increasing the available fuel in forested areas in south eastern parts of the state.

In grass and woodland areas, the rainfall has resulted in above average fuel in the far south west, and a high chance of above average growth for the south east and inland parts through until August, likely increasing the grass fuel load in these areas.

Inland Queensland has been drought affected since 2013, and as a result there has been very little grass fuel available. The rainfall received over the last six months will very likely see a return to average fuel loads in inland parts.

Since 1990, there has been a trend for Queensland fire seasons to start earlier and persist longer. This was the case in 2018/19, which saw record forest fire danger indices in August, February and March, in line with this trend. This trend is likely to continue in 2019 given the current conditions, climate outlook, and with a delayed start to the wet season likely.

Taking the antecedent conditions and climate outlook into account, above normal fire potential is expected in forested areas along the coast south of Rockhampton down to the NSW border for woodland and grass fuels, inland areas in the south, a small area west of Mackay and in the south west of Cape York. Normal fire potential is expected for all other parts of Queensland.

### NORTHERN TERRITORY

Late and weak monsoon activity led to dry conditions for the 2018/19 wet season, with the Top End experiencing the driest wet season since 1992. Combined with the hottest wet season on record, this resulted in Top End rainfall being 34% below the long-term rainfall average. As an example, the total rainfall for Darwin Airport was 1,174 mm, with the long-term average being 1,677 mm. Areas of the north eastern Top End were affected by Severe Tropical Cyclone *Owen*, which saw rainfall totals and vegetation growth reach average conditions for this area. The effectiveness of planned mitigation activities across the Northern Territory have varied due to the differing conditions experienced during the wet season. Where planned burns have been undertaken by land managers, including carbon farming projects, good results have been achieved to minimise the risk of bushfires occurring later in the year.

#### Central regions

Large areas of central Australia have received very much below average rainfall in the previous 12 months. In some areas, rainfall totals have been the lowest on record. This in turn has led to below average, to well below average, grass growth across both the Alice Springs and Barkly regions.

Severe Tropical Cyclone *Trevor* in mid-March resulted in good rainfall totals in areas of the Mitchell Grass Downs and Simpson Strzelecki Dunefields regions. This has resulted in patchy grass growth across the area of rainfall and flooding, but not enough to suggest any more than normal bushfire potential. With lower than average fuel loads across most of central Australia, particularly in the Tanami, pastoralists in this region are de-stocking, and on a smaller scale some planned burning will continue to address

any patchy high fuel loads across Aboriginal lands and some Parks and Wildlife Reserves.

**Top End region**

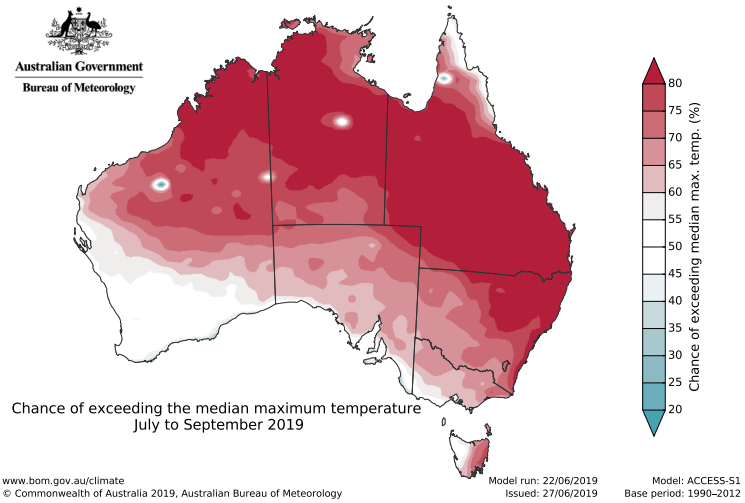
Below average rainfall across the majority of the Top End has resulted in mainly average and below average fuel loads. An exception to this is the Gulf Coastal region, with higher than normal fuel loads after rainfall from both *Owen* and *Trevor*. Grassland curing has been earlier than normal in the western regions, with the Gulf and Arnhem Coastal regions continuing to cure, as well as areas that received rain during May.

The relatively poor wet season allowed for earlier access to country for mitigation activities. Aerial mitigation works in the Daly Basin and Pine Creek regions commenced two weeks earlier than usual with good results. Finer scale burning close to populated areas has been undertaken, although with the late season rain in May, mitigation activity in the Darwin Coastal and Daly Basin regions will continue as weather permits. Mitigation has been reduced in most other Top End regions due to the dry conditions and the retention of grass fuels for primary production by landowners. Mitigation activities on carbon farming projects are continuing, especially across Arnhem Land.

Due to the dry conditions, flood plain areas will dry out early and become susceptible to fires.

**Gamba grass prevalent area**

Gamba grass continues to spread to new locations across the north west Top End, increasing fuel loads and changing fire and land management practices on properties. Targeted mitigation efforts have varied depending on tenure and the management objectives of landholders. Rainfall in May has seen rapid growth of Gamba grass in some locations closer to the Darwin Coastal region, with a lower curing rate than surrounding vegetation. Where burning has taken place, the residual Gamba matter may carry another fire later in the season.




▲ Figure 4: CHANCE OF EXCEEDING THE MEDIAN MAXIMUM TEMPERATURE FOR JULY TO SEPTEMBER 2019.

## NORTHERN WESTERN AUSTRALIA

The late onset of the monsoon season and reduced thunderstorm activity over northern parts of Western Australia have contributed to the region's driest summer since 2004/05. Below average rainfall, low root zone soil moisture profiles and above average temperatures have resulted in an earlier start to grassland curing in the East Kimberley.

A combination of the 2018 dry season fire activity, the poor wet season, and prescribed burning and grazing in early 2019 have contributed to reduced grass fuel loads across the landscape. However, bushfire potential is still expected to be normal this year, due to remaining fuels from the previous year and the probability of the trend for elevated dry season fire weather conditions, as has been experienced over the past last two years.

With similar conditions in the Pilbara, grass curing rates have remained close to 100% for a substantially longer period than usual, other than for the Pilbara Coast which received rain during Severe Tropical Cyclone *Veronica* and is the only area to have experienced close to normal wet season grass regrowth. The remainder of the Pilbara has had very little grass regrowth and the vegetation remains very dry – this is expected to result in an earlier onset of the fire season.

## NORTHERN SOUTH AUSTRALIA

Northern parts of South Australia have recorded average to below average rainfall over the past 12 months, leading to average vegetation growth in large parts of the North West and North East Pastoral areas.

Due to the drier conditions in parts of the Aṉangu Pitjantjatjara Yankunytjatjara (APY) Lands over the past 12 months, animals such as camels, donkeys and horses have been migrating from the west into the APY Lands in the search of water. The impact of this migration, combined with lower rainfall, has lowered available fuel in some parts of the APY Lands. As a result, a normal fire season is likely across the North West Pastoral, including the APY Lands.

An influx of floodwaters from Queensland has resulted in some areas of above average grass growth along the waterways and tributaries that flow into Kati Thanda–Lake Eyre. This growth is limited to the vicinity of the Kati Thanda-Lake Eyre basin, and is not anticipated to cause increased fire risk across the broader region beyond what would occur in a normal year.

The Bushfire and Natural Hazards CRC is a national research centre funded by the Australian Government Cooperative Research Centre Program. It was formed in 2013 for an eight-year program to undertake end-user focused research for Australia and New Zealand.