

## Angry Summer 2013/2014

Continuing hot on the heels of the 'Angry Summer' of 2012/2013, Australians again endured record-breaking extreme events this summer. Drought conditions affected inland eastern Australia, while parts of the north and west of the country experienced above average rainfall. There was an early start to the bushfire season in New South Wales, and parts of South Australia, Western Australia and

Victoria were ravaged by fires. Prolonged and intense heatwaves were experienced in major population centres, including Adelaide, Canberra and Melbourne.

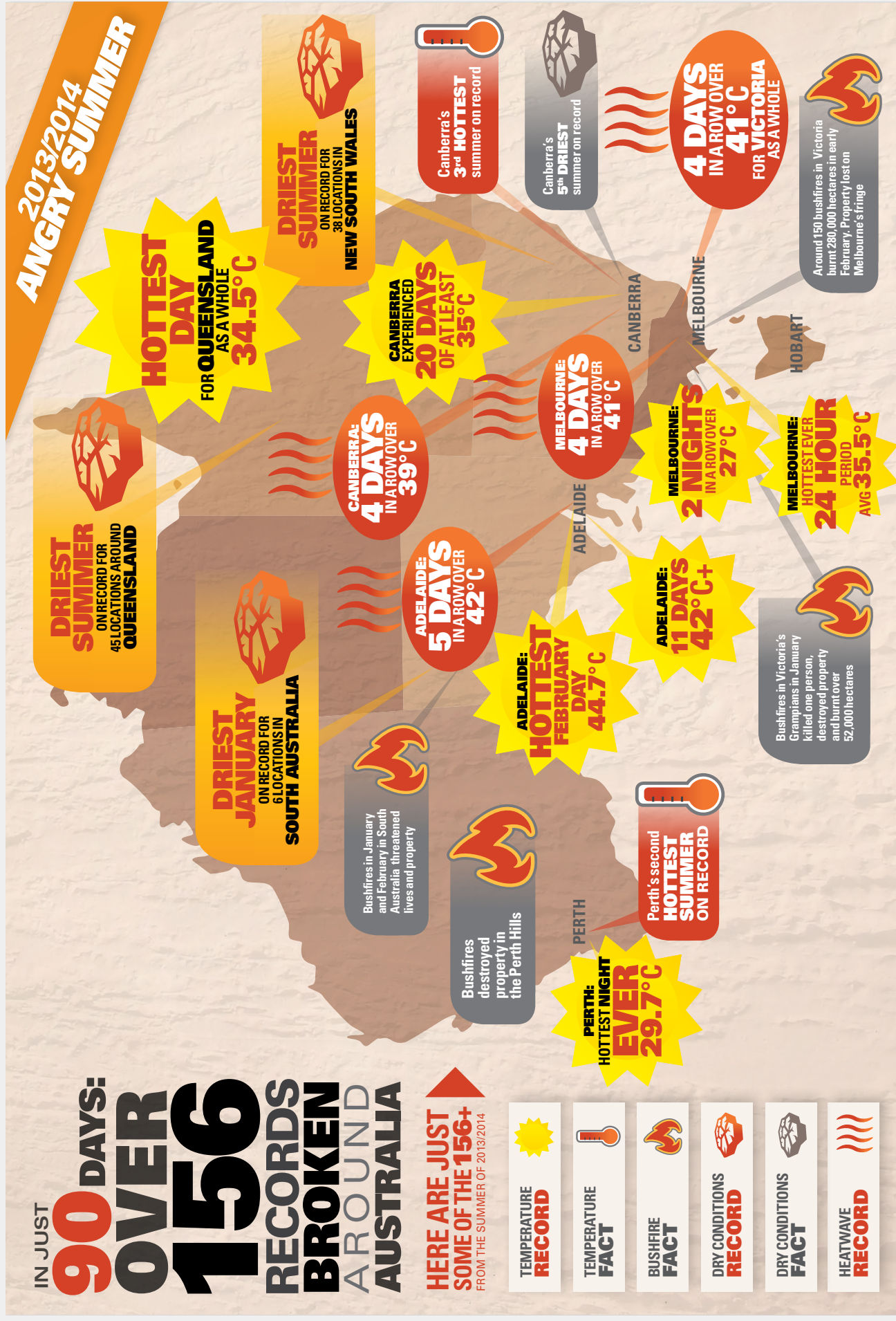
Over the 2013/2014 summer numerous extreme weather-related records were broken across Australia (Figure 1; Figure 2).

### Key findings

1. Heatwaves and hot days, drought and rainfall extremes (high and low), and bushfires dominated the 2013/2014 summer. For example:
  - Sydney had its driest summer in twenty-seven years
  - Canberra experienced 20 days of at least 35°C
  - Melbourne experienced its hottest ever 24 hour period (average 35.5°C)
  - Adelaide had a record of 11 days of 42°C or more during the summer
  - Perth had its second hottest summer on record
2. Climate change is already increasing the intensity and frequency of many extreme weather events in Australia.
3. Many of our largest population centres stand out as being at increased risk from extreme weather events, including heatwaves, drought and bushfires.
4. The impacts of extreme weather events on people, property, communities and the environment are serious and costly.
5. Limiting the increase in extreme weather activity requires urgent and deep reductions in the emissions of greenhouse gases. The decisions we make this decade will largely determine the severity of climate change and its influence on extreme events for our grandchildren. This is the critical decade for action on climate change.

This report provides a summary of extreme weather conditions in the 2013/2014 summer, continuing the trend of hotter summers and more weather extremes in Australia.

**Figure 1:** During the summer of 2013/2014 a series of extreme events hit the nation



**Source:** BoM 2014a-h; The Age 18 January 2014; The Age 11 February 2014

## Climate change and extreme weather

Australia has always been, and will continue to be, a land of extremes. However, climate change is now making many types of extreme weather worse, especially weather related to higher temperatures. For example, Adelaide experienced 13 days where the maximum temperature exceeded 40°C (the average is 2 days per summer). Recent record-breaking events show that climate change is already affecting Australians.

It is crucial that we are aware of the influence of climate change on extreme weather so that communities, emergency services, health services and other authorities are prepared for the likelihood of increasingly severe and frequent extreme weather.

## Summer 2013/2014 in detail

### Heatwaves

In Australia, a heatwave is defined operationally as a period of at least three days where the combined effect of high temperatures and excess heat is unusual within the local climate (BoM 2012; Nairn and Fawcett 2013). Heatwaves have widespread impacts, ranging from direct impacts on our health to damage to ecosystems, agriculture and infrastructure (Climate Council 2014).

### What happened?

During summer 2013/2014, intense and prolonged heatwaves scorched central and eastern Australia, with major population centres – Adelaide, Canberra and Melbourne – and their surrounding areas particularly affected.

Record high maximum temperatures occurred over 8.8 percent of Australia during the first four days of January, including 17 percent of New South Wales, 17 percent of the Northern Territory, 16 percent of Queensland and 8 percent of South Australia (BoM 2014a).

This summer's heatwaves were particularly significant because of their record-breaking duration in major population centres in southeast Australia.

Victoria experienced its hottest four days on record from 14–17 January, and Melbourne set

a record for four consecutive days at 41°C and above (14–17 January) and two nights in a row at 27°C or above (15–16 January) (BoM 2014b). Adelaide sweltered through a record-breaking five consecutive days of 42°C and above, and Canberra experienced a record run of four days of 39°C (BoM 2014b). During the summer of 2013/2014, Canberra recorded 20 days of at least 35°C (BoM 2014c).

Since 1950 the number of heatwave days each year has been increasing in Perth, Adelaide, Melbourne, Sydney, Canberra and Hobart, and across Australia as a whole (Perkins and Alexander 2013; Climate Council 2014).

### Climate change and heatwaves

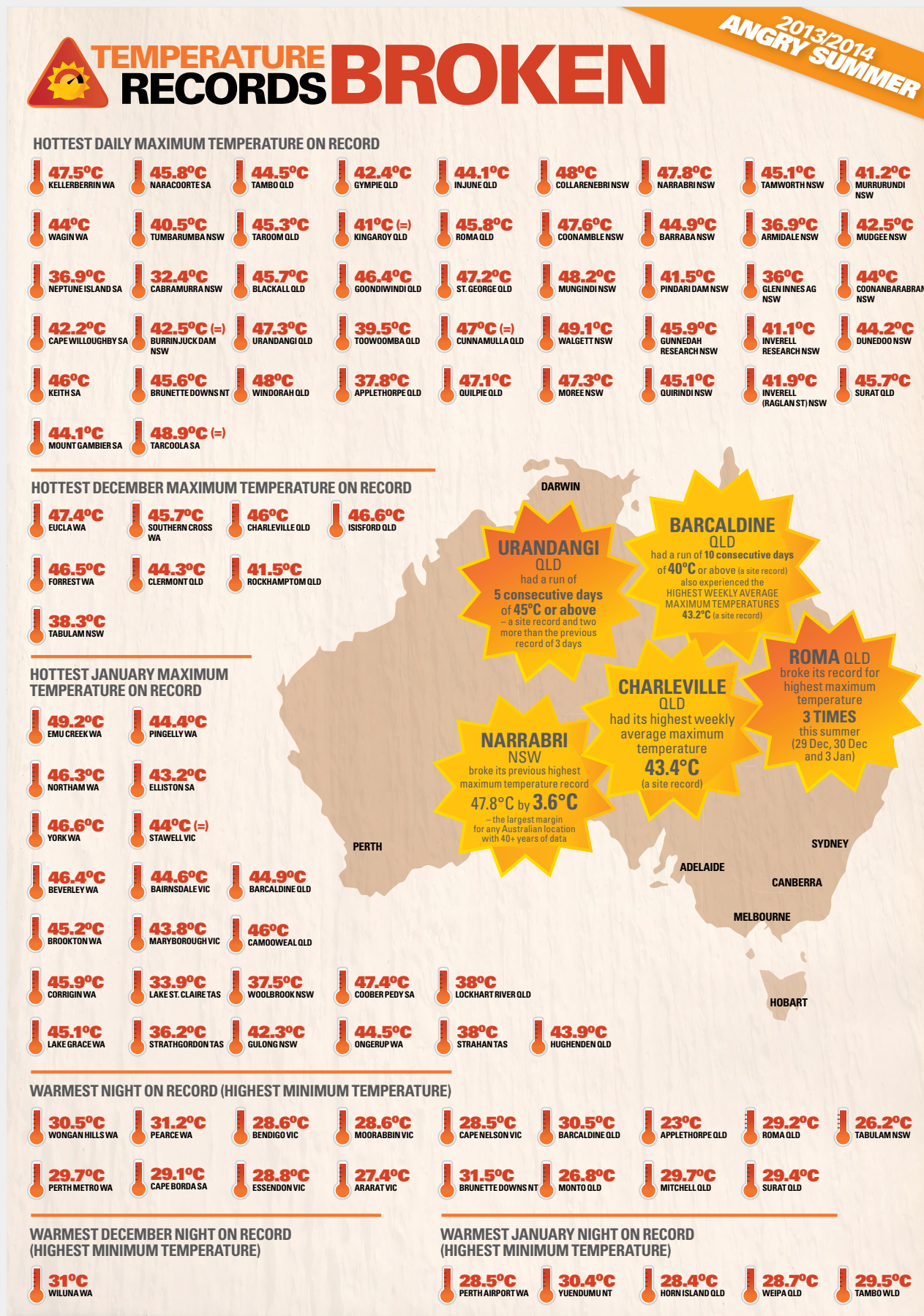
Hot days, hot nights and extended periods of hot weather – heatwaves – are one of the most direct consequences of climate change (Climate Council 2014). The increase in greenhouse gases in the atmosphere, primarily caused by the burning of fossil fuels, is trapping more heat in the atmosphere. This increases the likelihood of heatwaves and hot days and decreases the likelihood of cold weather (IPCC 2013).

Since 1960, the annual number of record hot days in Australia has doubled (CSIRO and BoM 2012) and over the past decade, record hot days have occurred three times more often than record cold days (Trewin and Smalley 2013; CSIRO and BoM 2014). Since 2001, the number of extreme heat records has been almost three times greater than the number of cold records for daytime temperatures, and almost five times greater for nighttime temperatures (CSIRO and BoM 2014). The nature of heatwaves in Australia is also changing: they are becoming hotter, lasting longer, starting earlier, and occurring more frequently (Perkins and Alexander 2013; Climate Council of Australia 2014).

Although Australia has always experienced hot weather, it now occurs more often, and is more intense because of climate change. Australia is not unique. Over the past decade, a remarkably large number of record-breaking and devastating heatwaves have occurred in many other parts of the world (Coumou and Rahmstorf 2012).



**Figure 2:** Individual site records broken during major heatwaves that scorched Australia during the summer of 2013/2014



Source: BoM 2014a; BoM 2014b

The IPCC Special Report on Extremes (2012) and the IPCC Fifth Assessment Report (2013) project that it is virtually certain (greater than 99 percent probability) that hot extremes will increase and cold extremes will decrease through the century compared to the current climate.

### Rainfall extremes (high and low)

Australia is a large country and rainfall varies across the continent.

#### What happened?

Dry conditions prevailed in many regions, particularly much of inland eastern Australia which was affected by drought conditions (BoM 2014i). Northeastern New South Wales and southeastern Queensland experienced serious rainfall deficits (lowest 10 percent of records), and Sydney had its driest summer in almost thirty years (BoM 2014i). Other smaller areas of Victoria, Tasmania and southwest Western Australia were also affected by serious rainfall deficits (BoM 2014i). On the other hand, rainfall was above average across the west of Queensland's Cape York Peninsula, through the north and west of the Northern Territory, through most of Western Australia and along the coast

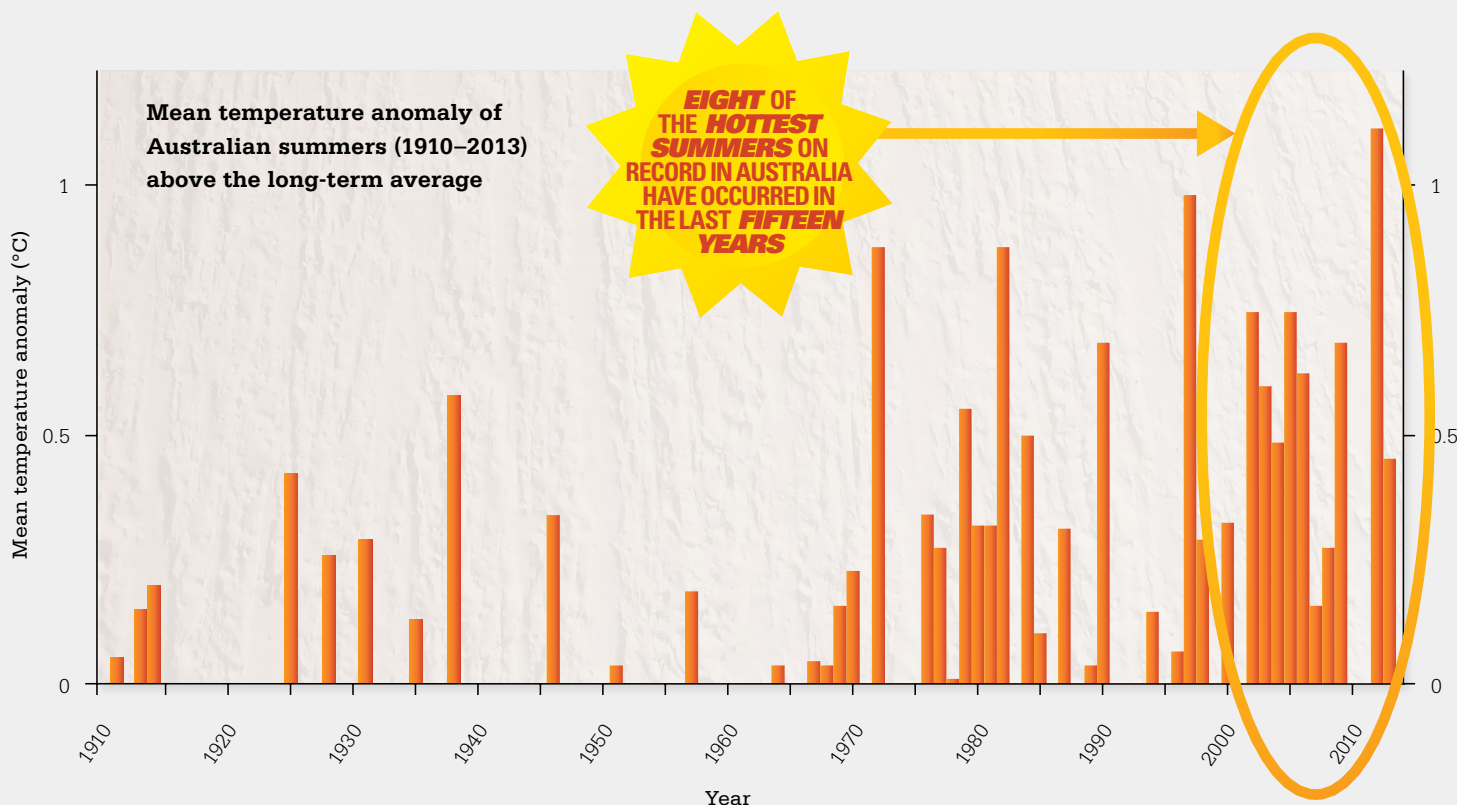
of South Australia. A large part of this area experienced the highest 10 percent of summer rainfall records. In the tropical north and eastern Western Australia, the majority of summer rainfall was the result of tropical cyclones or significant tropical lows (BoM 2014i).

### Climate change and rainfall extremes

The conditions that cause drought and rainfall are complex. While some parts of Australia have become wetter, much of the eastern part of Australia has become drier over the past four decades (Climate Commission 2013; BoM 2014i).

Since the 1960s, southeast Australia has experienced a number of major droughts. One of the most severe was the recent Millennium Drought (1997-2009), for which there is some evidence of a climate change influence (CSIRO 2012). The intensity of the subtropical ridge (STR), a high pressure system that often lies over southern Australia, has been implicated in the decreased rainfall in the southeast (CSIRO 2010). Rising global temperatures have been linked to an increase in the intensity of the STR (Timbal and Drosowsky 2013), with the result being a drier and more drought-prone southeast Australia.

**Figure 3:** The summer mean temperature anomaly for Australia (1910-2013) indicating a continuing trend of hotter summers, including eight of the hottest summers on record occurring in the past fifteen years. The summer anomaly is a deviation from the long-term average (1961 to 1990).



**Data source:** Modified from BoM 2014m

## **Bushfires**

Bushfires – a natural part of the Australian landscape – can severely affect biodiversity, human health, property, economic activity and infrastructure.

### **What happened?**

The intense and prolonged heatwaves that affected several capital cities and their surrounding regions this summer stacked the odds towards more severe bushfire weather. Fires burnt near Perth in mid-January 2014, destroying property and costing an early-figure estimate of \$15 million (ICA 2014). Fires also burnt large areas of Victoria's Grampians (The Age, 18 January 2014), and threatened communities on Melbourne's fringe (The Age, 11 February 2014) and in South Australia (The Guardian, 9 February 2014).

### **Climate change and bushfires**

Climate change is driving an increase in the risk of bushfires. More hot days and the increasing intensity, duration and frequency of heatwaves mean that the chance of very high fire danger weather – and in turn bushfires – is increasing (Climate Council 2013). Since the 1970s, significant increases in fire danger weather has been observed in the southeast of Australia (Clarke et al. 2013; CSIRO and BoM 2014).

## **The future for extreme weather in Australia**

Australia has experienced hotter summers since the middle of the 20th century (Figure 3), including eight of the hottest summers on record occurring in the last fifteen years. Over the coming decades, it is virtually certain that extreme hot weather will continue to become even more frequent and severe in Australia and other parts of the world.

To slow and eventually halt the increase in extreme heat and rising bushfire risk, the climate needs to be stabilized. This requires a rapid, deep and long-term reduction in greenhouse gas emissions. The current trend of rising global emissions needs to be turned around by 2020 and the right investment decisions need to be made over the next few years to deliver the longer term emission reductions that are required.

This is the critical decade for action. We are now in 2014 and approaching the halfway point in the decade. Despite the promising developments in low carbon technologies and energy efficiency measures, Australians have not yet reached a consensus on the need to decarbonize our economy and on the development of policies that will turn investments towards a decarbonized future. This challenge must be met if we are to minimize the risk of worsening extreme weather events for our children and grandchildren. It's time to get on with the job.



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