

Chapter 2

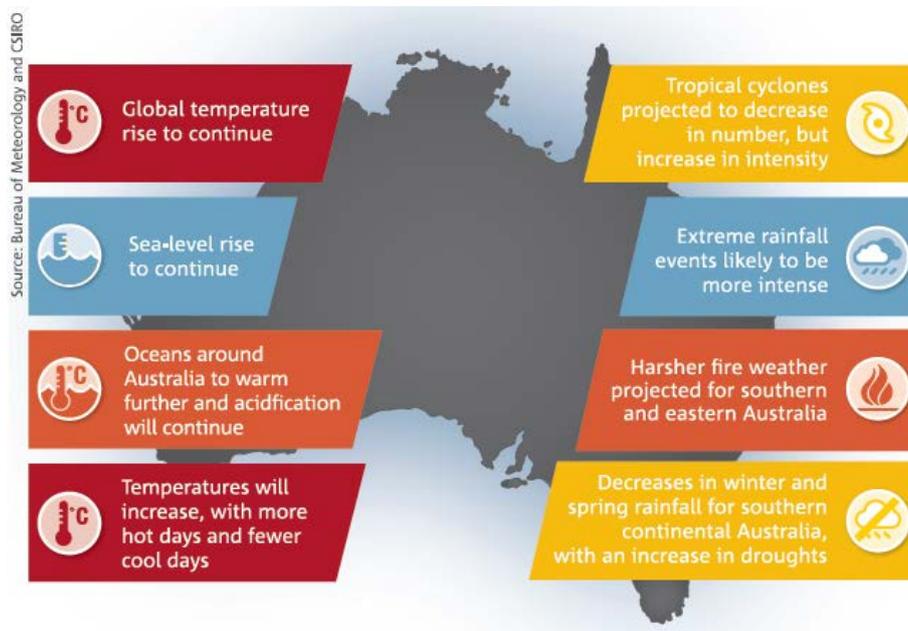
Impact of climate change

2.1 This chapter examines the impact of climate change on fire frequency and magnitude in Tasmania and in particular, the Tasmanian Wilderness World Heritage Area (TWWHA). The committee heard that fire conditions and dry lightning strike are increasing in the TWWHA. Recent research into climate change and its impact on Tasmania has increased understanding of these threats to the World Heritage Area. However, stakeholders indicated that there is a continuing need for further recognition of, and preparation for, climate change in the TWWHA.

Fire conditions and dry lightning strike

2.2 *State of the Climate* is a biennial review of variability and changes in Australia's climate, and how Australia's climate is likely to change in the future.¹ In October, the Bureau of Meteorology and the Commonwealth Scientific and Industrial Research Organisation (CSIRO) released *State of the Climate 2016*. Its findings are shown below.

Figure 2.1: Predicted changes to Australia's climate, next 100 years



Source: Bureau of Meteorology and Commonwealth Scientific and Industrial Research Organisation, *State of the Climate 2016*, 2016, p. 22, accessed 14 November 2016.

1 Bureau of Meteorology and Commonwealth Scientific and Industrial Research Organisation (CSIRO), *State of the Climate 2016*, 2016, <http://www.bom.gov.au/state-of-the-climate/State-of-the-Climite-2016.pdf> (accessed 14 November 2016).

2.3 Several submissions reflected these climate predictions. CSIRO, for example, reiterated that Australia is expected to experience a warming climate, with increases in extremely high temperatures, decreases in annual mean rainfall and relative humidity, and small changes in annual mean wind-speed. In particular:

Increases in the extent and frequency of droughts are likely in south-eastern Australia, and annual total forest fire danger index has increased 10–40 per cent in many locations in the last 35 years.²

2.4 The Department of the Environment and Energy (DEE) said that 'there has been an observed increase in extreme fire weather, and a longer fire season, in parts of Australia since the 1970s'. Further, 'future projections of these conditions show an increase in the frequency and severity of extreme fire danger'.³

2.5 Submitters agreed that fire conditions were elevated during the 2015–2016 fire season but the Bushfire and Natural Hazards Co-operative Research Centre (BNH CRC) commented that it was difficult to link the precedent conditions or bushfires to climate change although 'many researchers have pointed to this as a possibility'.⁴

2.6 Similarly, CSIRO cautioned that it is not clear how climate change will affect future fire risk, the behaviour and spread of bushfires, and the difficulty of suppressing bushfires, all of which depend on a number of factors.

The relationship between climate change, the occurrence of synoptic patterns conducive to elevated fire danger and the occurrence of bushfires in south-eastern Australia is complex, multi-faceted and only beginning to be understood.⁵

Reduced rainfall

2.7 Several submissions noted weather elements—such as unseasonal warm temperatures, below average rainfall, low humidity and unprecedented soil dryness—that preceded and/or were present at the start of the 2016 bushfires.⁶

2.8 A particular focus was the amount of rainfall in south-eastern Australia leading up to the 2015–2016 fire season. The Wilderness Society (Tasmania) and Greenpeace Australia Pacific (Wilderness Society (Tasmania) and Greenpeace)

2 CSIRO, *Submission 1*, p. 6. The Forest Fire Danger Index measures the degree of fire danger in Australian forests.

3 Department of the Environment and Energy (DEE), *Submission 23*, p. 3. Also see: United Firefighters Union of Australia–Tasmania Branch (United Firefighters Union (Tasmania)), *Submission 34*, p. 6.

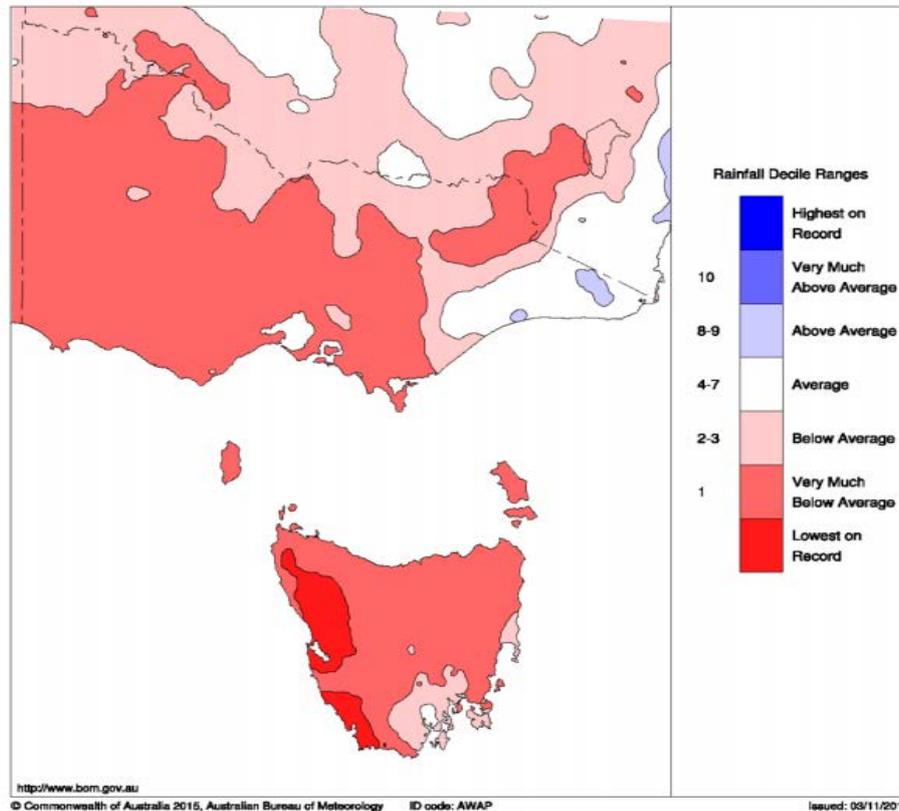
4 Bushfire and Natural Hazards Co-operative Research Centre (BNH CRC), *Submission 4*, p. 1. Also see: Friends of the Earth Australia, *Submission 19*, p. 2.

5 CSIRO, *Submission 1*, p. 6.

6 See for example: Tasmanian Government, *Submission 24*, p. 4; The Wilderness Society (Tasmania) and Greenpeace Australia Pacific (Wilderness Society (Tasmania) and Greenpeace), *Submission 27*, p. 7.

submitted that large parts of western Tasmania experienced the lowest spring rainfall on record, with the trend continuing into summer.⁷

Figure 2.2: Rainfall in south-eastern Australia, 1 August to 31 October 2015



Source: Wilderness Society (Tasmania) and Greenpeace, *Submission 27*, p. 8.

2.9 The BNH CRC reissued its seasonal bushfire outlook as a result of this exceptionally dry October.⁸ The revised outlook assessed a significantly larger part of Tasmania as being at 'above normal' risk (not including the TWWHA which remained at 'normal') and observed:

The first half of spring has seen very low rainfall for almost all of Tasmania, especially in the west. Above-average daytime temperatures have increased evaporation rates, which further increases fuel dryness. The fire season has commenced in the eastern half of the state, with many fires proving difficult to control because of the dryness of fuels.⁹

2.10 The Australian Conservation Foundation similarly explained that the lack of rain had rendered wilderness areas—such as the TWWHA—unusually dry and susceptible to fire:

7 Wilderness Society (Tasmania) and Greenpeace, *Submission 27*, p. 7.

8 BNH CRC, *Submission 4*, p. 1.

9 BNH CRC, [Hazard Note](http://bnhcrc.com.au/hazardnotes/12), November 2015, Issue 12, <http://bnhcrc.com.au/hazardnotes/12> (accessed 14 November 2016).

Normally wet rainforests have a natural protection against fire, as they are cooler and wetter ecosystems than surrounding environments. The preceding dry spring and summer meant that this natural protection was compromised, and once the lightning sparked a flame, the amount of dry fuel above ground and dry peat below meant that the fires spread incredibly rapidly and were difficult to control.¹⁰

Dry lightning strike

2.11 In 2013, the Parks and Wildlife Service, Tasmania (PWS) reported that fires started by dry lightning strike now appear to be the main threat to the TWWHA. However, the PWS stated 'it is too early to know whether a shift in climate may be contributing to a long-term increasing trend in dry lightning activity in summers'.¹¹

2.12 Some submitters and witnesses did not agree with this assessment, contending that climate change is creating, or likely creating, dry lightning storms. In particular, David Bowman, a Professor of Environmental Change Biology at the University of Tasmania, has argued that climate change is not only increasing fire frequency and magnitude, it is also causing the dry lightning storms that ignite bushfires.¹²

2.13 At the height of the 2016 bushfires, Professor Bowman wrote:

Since the declaration of the World Heritage Area, fire has been carefully regulated with a prohibition of campfires, which has sharply reduced the number of bushfires. Unfortunately, over the last decade there have been an increasing number of lightning storms that have ignited fires.

...

The current fire season is shaping up to be truly extraordinary because of the sheer number of fires set by lightning, their duration, and erratic and destructive behaviour that has surprised many seasoned fire fighters. The root cause of [this] has been the record-breaking dry spring and the largely rain-free and consistently warm summer, which has left fuels and peat soils bone dry.

There are two ways to think about the recent fire situation in Tasmania. We can focus on the extreme climate conditions and unusual fire behaviour, or we can see what is happening as entirely predictable and consistent with climate change.

I have formed the latter view because the current fires are part of a global pattern of increasing destructive fires driven by extreme fire weather.

10 Australian Conservation Foundation, *Submission 20*, p. 4.

11 Parks and Wildlife Service, Tasmania (PWS), '[Case study—Fire Management in the Tasmanian Wilderness World Heritage Area](http://parks.tas.gov.au/file.aspx?id=35224)', 26 September 2013, p. 10, <http://parks.tas.gov.au/file.aspx?id=35224> (accessed 14 November 2016).

12 Professor David Bowman, *Submission 13*, p. 1.

A critical feature of the current Tasmanian fires is the role of lightning storms—climate is not only creating the precursor weather conditions for the fires, it is also providing the storms that ignite them.¹³

2.14 Professor Bowman described this as a 'philosophical rupture with the very notion of wilderness'. He commented:

If you think about it, a wilderness is a free standing, self-sustaining system, independent of humans...what is occurring here is the challenge of managing systems where we have had certain expectations or certain understandings and those expectations are changing.¹⁴

2.15 Environmentalists and conservationists agreed with Professor Bowman's views on climate-induced fire conditions and dry lightning strike in the TWWHA. For example, the Australian Conservation Foundation submitted:

...climate change is increasing the regularity and intensity of the lightning that ignited the fires, drying out environments and fuel loads, and lengthening and intensifying the fire season.¹⁵

2.16 BirdLife Australia submitted that there is 'no empirical scientific evidence yet available to link the increased frequency of dry lightning strikes and concomitant fires in the TW WHA with contemporary changes in our climate'. However, 'the relationship is consistent with our current understanding and earlier predictions of increased frequency and intensity of extreme events associated with climate change'.¹⁶

2.17 The committee notes that CSIRO is currently researching the cause of bushfires in south-eastern Australia. Dr Andrew Sullivan from the CSIRO advised that the study does not include Tasmania but could do so if there were a reprioritisation of resources and access to historical fire occurrence data.¹⁷

Climate research

2.18 The Australian and Tasmanian Governments acknowledge the need for further research on climate change in Tasmania. Both governments have funded a number of recent initiatives that have contributed to understanding of climate change. These studies are in addition to independent research projects.

13 D. Bowman, 'Fires in Tasmania's ancient forests are a warning for all of us', *The Conversation*, 29 January 2016, <https://theconversation.com/fires-in-tasmanias-ancient-forests-are-a-warning-for-all-of-us-53806> (accessed 14 November 2016).

14 Professor David Bowman, *Committee Hansard*, Launceston, 2 November 2016, p. 11.

15 Australian Conservation Foundation, *Submission 20*, p. 3.

16 BirdLife Australia, *Submission 3*, p. 8. Also see: Rob Blakers, *Submission 21*, p. 2.

17 Dr Andrew Sullivan, Principal Research Scientist and Team Leader, Bushfire Behaviour and Risks, CSIRO, *Committee Hansard*, Canberra, 1 November 2016, p. 3. The project is in its early stages, with data analysis yet to commence.

Australian Government

2.19 The Australian Government has a major role in the provision of authoritative climate information. The DEE identified a number of organisations that have recently received funding from the Australian Government and the purpose for that funding:

- CSIRO—to develop a set of national climate change projections (presented in regional clusters), to help plan for increased future fire weather and longer fire seasons;
- \$9 million over three years (2014–2017) to the National Climate Change Adaptation Research Facility, based at Griffith University—to develop practical information and tools to help manage climate risks; and
- a maximum of \$47 million over eight years (2013–2021) to the BNH CRC—to continue and expand research efforts into natural hazards.¹⁸

Tasmanian Government

2.20 The Tasmanian Government also identified some of its initiatives to increase understanding of global warming risks to Tasmania, such as the *Climate Futures for Tasmania* project and, in particular, the Tasmanian Wilderness World Heritage Bushfire and Climate Change Research Project (Bushfire and Climate Change Research Project).¹⁹

2.21 In March 2016, the Tasmanian Premier, the Hon Will Hodgman, announced that the government would be investing \$250 000 in a 'forward looking research project that examines the impact of climate change and strengthens our fire-fighting techniques specific to our wilderness areas'.²⁰

2.22 Dr Tony Press, Adjunct Professor of the Antarctic Climate and Ecosystems Cooperative Research Centre, was appointed to lead the Bushfire and Climate Change Research Project, which is expected to be completed by the end of 2016.²¹

2.23 At the Launceston public hearing, Dr Press presented the committee with some preliminary findings, including:

...the projections are that the [areal] extent of the TWWHA subject to dry lightning will actually decrease...but, on the other hand, the most extreme dry-lightning potential environmental events do not decrease in extent. You might get an overall decrease in dry-lightning events, but you will still get the same numbers of intense dry-lightning events. You will still get the

18 DEE, *Submission 23*, p. 2.

19 Tasmanian Government, *Submission 24*, pp. 16–17.

20 The Hon Will Hodgman, Premier, '[Research project to protect wilderness areas](http://premier-dev.dpac.tas.gov.au/releases/research_project_to_protect_wilderness_areas)', *Media Release*, 9 March 2016, http://premier-dev.dpac.tas.gov.au/releases/research_project_to_protect_wilderness_areas (accessed 14 November 2016).

21 Dr Tony Press, Chair, Tasmanian Wilderness World Heritage Bushfire and Climate Change Research Project (Bushfire and Climate Change Research Project), *Committee Hansard*, Launceston, 2 November 2016, p. 17.

types of extreme events that have emerged over the last couple of decades with this picture of increased lightning in the Tasmanian Wilderness World Heritage Area. If you combine that with [the] general tendency for increased dryness and extended fire seasons, you can see that a pattern is emerging of fire risk, as a whole, increasing in the world heritage area over the century. Also, the vegetation communities into which to fire can spread will start to change, and you will start to get some of those vegetation communities that have historically been barriers to fire now becoming endangered themselves.²²

2.24 Dr Press concluded that the risk of fire directly impacting natural (and to a lesser extent, cultural) values in the TWWHA will increase. He added 'the challenge is: how do you manage that landscape in order to protect those natural and cultural World Heritage values'?'²³

2.25 The committee notes that the final report will examine 'the kinds of research that is required to underpin the management of the World Heritage Area'.²⁴

Independent research projects

2.26 Submitters and witnesses commented on various types of research that they considered will, or would, help to protect and conserve the TWWHA. This research focuses on dry lightning strike and ecological impacts where it was argued there is a lack of knowledge and understanding.

2.27 Dr Jonathan Marsden-Smedley, a fire researcher and operational fire management specialist based at the University of Tasmania, described his current project titled *Changes in the climate patterns of western and southwestern Tasmania: bushfires, snowpack and the implications of climate change*.

2.28 Dr Marsden-Smedley hypothesises that changes in Antarctic zone and other greenhouse gasses have increased the number of high pressure cells, and decreased the number of low pressure cells, crossing Tasmania, with consequent marked changes to Tasmania's weather (especially, to rainfall patterns in south-western and western Tasmania). In summer, these changes:

...increase the potential for lightning fires, and if fires start, the predominantly dry conditions result in a significant increase in the potential for large fires (eg greater than 10 000 ha) in all vegetation and soil types (eg fires in rainforests, alpine areas and peat).²⁵

2.29 Dr Marsden-Smedley noted that, in the TWWHA, there has been 'about a 20 times increase in lightning fire number, about a 70 times increase in average

22 Dr Tony Press, Chair, Bushfire and Climate Change Research Project, *Committee Hansard*, Launceston, 2 November 2016, p. 17. Also see p. 18.

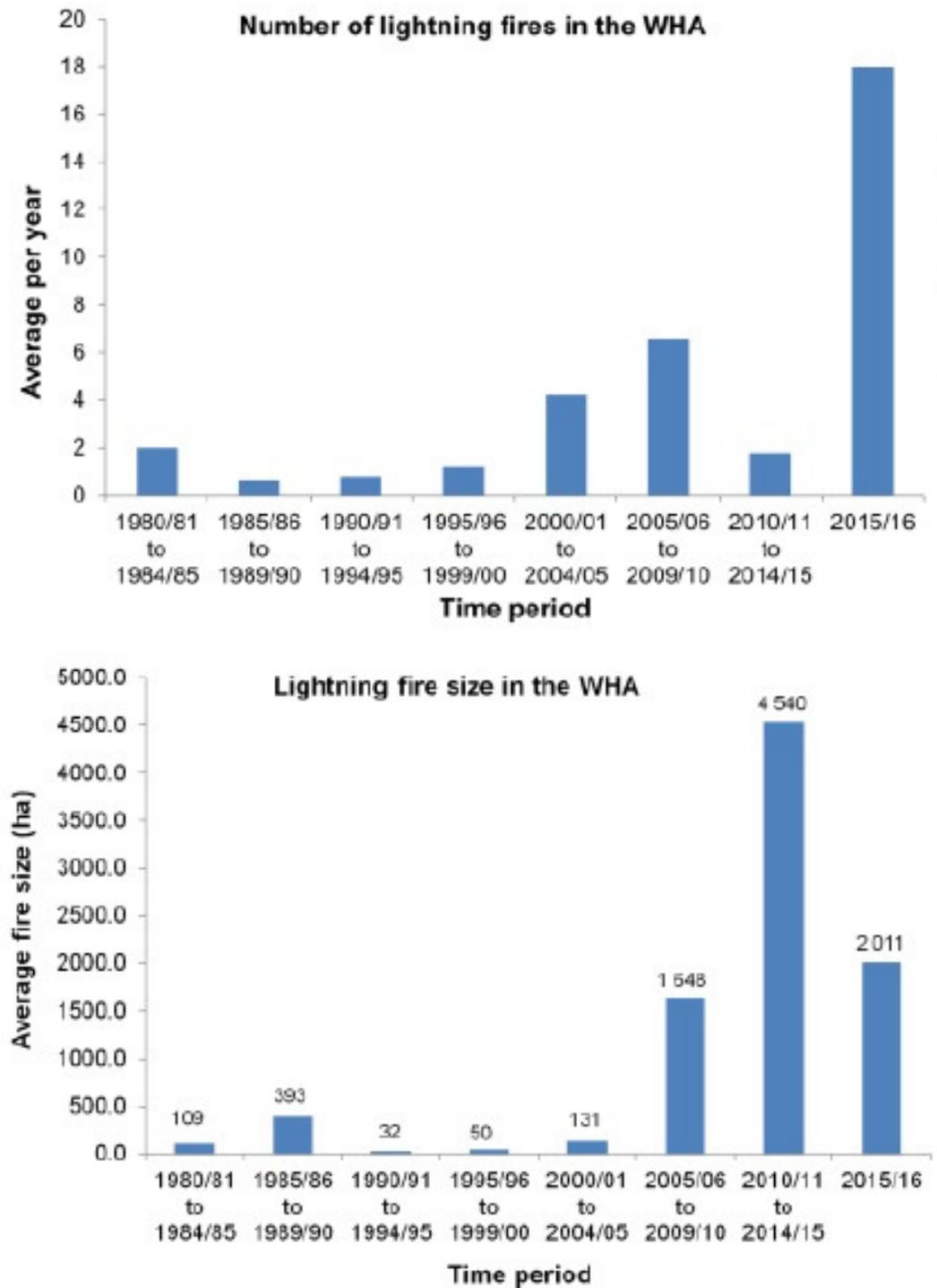
23 Dr Tony Press, Chair, Bushfire and Climate Change Research Project, *Committee Hansard*, Launceston, 2 November 2016, p. 18.

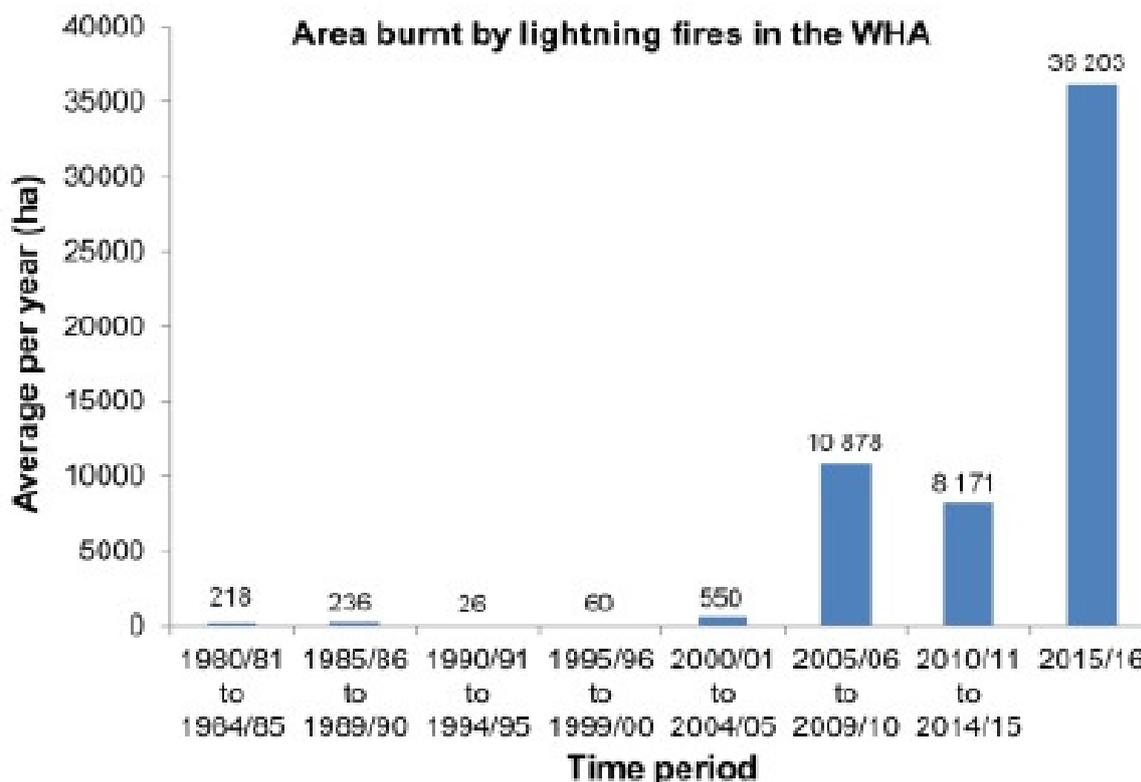
24 Dr Tony Press, Chair, Bushfire and Climate Change Research Project, *Committee Hansard*, Launceston, 2 November 2016, p. 17.

25 Dr Jonathan Marsden-Smedley, *Submission 17*, p. 2.

lightning fire size and about a 570 times increase in the area burnt by lightning fires', comparing the periods 1980–2000 and 2000–2016.²⁶

Figure 2.3: Lightning fires in the TWWHA, by number, size and burnt area, 1980–2016





Source: Dr Jonathan Marsden-Smedley, *Submission 17*, p. 3.

2.30 The Australian Conservation Foundation submitted that it could not find any direct and publicly available research on climate impacts on lightning in Australia.²⁷ Its submission identified research from the United States of America, including a 2014 study that showed a 12 per cent increase in lightning for each degree of global warming.²⁸

2.31 Professor Bowman highlighted other potential research areas: ecology research (see chapter three) and the threat to organic soils in the TWWHA caused by increased landscape fire in a warmer and drier climate:

Research is required to (a) evaluate the relationship between organic soil moisture and likelihood of combustion, (b) determine how this is affected by antecedent meteorological conditions and (c) quantify how fire intensity influences the vulnerability of organic soil loss due to combustion during fire and erosion afterwards.²⁹

2.32 Professor Bowman told the committee that research should be peer reviewed and accessible in order to contribute to the body of knowledge. He considered that this has been 'a little bit underdone' in Tasmania, despite the TWWHA having 'extraordinarily interesting systems':

²⁷ Australian Conservation Foundation, *Submission 20*, p. 3.

²⁸ D.M. Romps et al (2014), 'Projected increase in lightning strikes in the United States due to global warming', *Science*, 14 November 2014: Vol. 346, Issue 62111, pp. 851–854, <http://science.sciencemag.org/content/346/6211/851.full> (accessed 14 November 2016).

²⁹ Professor David Bowman, *Submission 13*, p. 4.

It is a World Heritage area with many unique properties, and one of them is that it has got all this strange Gondwanic vegetation yet a lot of it is highly flammable. So getting that information out is extremely important...there is some really excellent science and excellent land management being done in the Tasmanian government. But it would probably be great if it could be seen.

...

That is how we are going to all inform ourselves, because the other thing with a rapidly developing situation like climate change is that we are all going to have to bend...Having these evidence based conversations is critical, and the evidence ideally is peer reviewed so people can understand it, it can be refined, it is available and it is credible.³⁰

2.33 Dr Press acknowledged Professor Bowman's comments and advised that the Bushfire and Climate Change Research Project will 'pull a lot of that grey literature together and put in in one place so that [it can be incorporated] into the report'.³¹

Planning for climate change

2.34 Some submitters and witnesses argued that increased fire conditions, changing ignition patterns and climate change increasingly threaten the Tasmanian wilderness.³² Accordingly, policy makers should plan for a greater incidence and severity of bushfires in the TWWHA.

2.35 For example, the Tasmanian Greens argued:

Tasmanian and Australian governments have a legal and moral responsibility to ensure management of the TWWHA is appropriately resourced—and this will require increased resourcing—in the decades ahead as the threat to the Outstanding Universal Values of the TWWHA intensifies.³³

2.36 Friends of the Earth Australia submitted:

The presence of climate change enhanced fire regimes needs to be considered the new reality of managing the WHA, with obvious implications for resourcing of firefighting agencies and approaches to managing fires when they do occur. Part of the response needs to involve a stronger focus on protecting those ecological assets which are most

30 Professor David Bowman, *Committee Hansard*, Launceston, 2 November 2016, pp. 10–11.

On the subject of managing expectations, see: Professor David Bowman, *Committee Hansard*, Launceston, 2 November 2016, pp. 12–13; Dr Richard Thornton, Chief Executive Officer, BNH CRC, *Committee Hansard*, Launceston, 2 November 2016, p. 21.

31 Dr Tony Press, Chair, Bushfire and Climate Change Research Project, *Committee Hansard*, Launceston, 2 November 2016, p. 16.

32 See for example: BirdLife Australia, *Submission 3*, p. 2; Professor David Bowman, *Submission 13*, pp. 1–2; Mr Greg Cooper, Branch Secretary, United Firefighters Union (Tasmania), *Committee Hansard*, Launceston, 2 November 2016, p. 28.

33 Tasmanian Greens, *Submission 22*, p. 6.

vulnerable to the effects of fire. Fire sensitive vegetation in Tasmania is mapped, and information about priority ecosystems must form a core part of decision making when fire responders are allocating resources, both at the state wide and local levels.³⁴

2.37 The Wilderness Society (Tasmania) and Greenpeace warned that 'widespread, simultaneous outbreaks of uncontrolled fires in remote, difficult country are...likely to become a frequent feature of Tasmanian summers'. The submission called on governments to respond to the 'permanent threat' by providing:

...increased financial resources for research, policy-making and coordination capacity pertaining to bushfires; for more permanent staff in key fire-fighting agencies and management authorities; and for increased capacity for remote-area and rapid response fire-fighting. However, on many of these long-term issues, governments are going backwards.³⁵

2.38 A few submitters focused specifically on human resource requirements, arguing that this resource will affect Tasmania's capacity to respond to future bushfires. Mr Greg Cooper representing the United Firefighters Union of Australia–Tasmania Branch stated:

Climate change is real. I don't care what anyone says. It is real. It is getting warmer...It will impact. And in order to be able to manage it, you need to have more resources.³⁶

2.39 The committee notes comments from the Landscapes and Policy Hub, a research body funded by the National Environmental Research Program. In a 2015 study for the Tasmanian State Emergency Service, the Landscapes and Policy Hub considered that increased fire danger will have social and political implications—such as influencing the pace and direction of fire policy, logistics and funding.³⁷

2.40 Following the 2016 bushfires, the Tasmanian fire agencies commissioned an independent review into the management of the fires (2016 Independent Operational

34 Friends of the Earth Australia, *Submission 19*, p. 3.

35 Wilderness Society (Tasmania) and Greenpeace, *Submission 27*, p. 23. The submission referred to the 2014–2015 Federal Budget, wherein CSIRO's research funding was reduced by \$111.4 million over five years: Commonwealth of Australia, *Budget Measures: Budget Paper No. 2 2014–15*, p. 170, http://www.budget.gov.au/2014-15/content/bp2/download/BP2_consolidated.pdf (accessed 14 November 2016). Also see: Australian Conservation Foundation, *Submission 20*, p. 5.

36 Mr Greg Cooper, Branch Secretary, United Firefighters Union (Tasmania), *Committee Hansard*, Launceston, 2 November 2016, p. 31. In 2013, the National Institute of Economic and Industry Research estimated that Tasmania will need to employ an additional 72 career firefighters by 2030: National Institute of Economic and Industry Research, *Firefighters and Climate Change*, February 2013, p. 26 (accessed 14 November 2016). Also see: Friends of the Earth Australia, *Submission 1*, p. 3.

37 Landscapes and Policy Hub, *Fire danger in Tasmania: the next 100 years*, March 2015, p. 3, <http://www.nerlandscapes.edu.au/system/files/LaP3%20Future%20fire%20danger%20summary%20-%20singles.pdf> (accessed 14 November 2016).

Review).³⁸ The review was conducted by the Australasian Fire and Emergency Service Authorities Council (AFAC) and was released in April 2016.³⁹

2.41 The Review Team commented briefly on climate change and its predicted impact on future fire conditions:

...there is considerable scientific advice and evidence to the effect that climate change may bring about longer and more severe fire seasons, reducing opportunities for controlled burning and increasing pressure on firefighting resources. While many people we spoke to considered fire conditions in Tasmania in early 2016 to be unprecedented in terms of drought conditions and availability of fuels to burn, we consider that it would be prudent for the Tasmanian fire agencies to plan on the basis that these conditions may recur in the future.⁴⁰

2.42 Various other aspects of the 2016 Independent Operational Review are considered later in chapters three and four of this report.

Committee view

2.43 Reputable organisations have accurately predicted global warming that has resulted in Australian climate change. Submitters agreed that this has manifested in increased fire conditions in the TWWHA, although the precise link between climate change and bushfires has not yet been determined. The committee notes that over time the threat will also increase due to the erosion of natural protections that are currently available to certain vegetation types.

2.44 In order to mitigate and prepare for risks posed by global warming, the committee considers that the Australian Government should recognise that climate change has increased fire conditions in south-eastern Australia and the risk to natural and cultural values in the Tasmanian Wilderness World Heritage Area.

Recommendation 1

2.45 The committee recommends that the Australian Government:

- **recognise that climate change has increased fire conditions in south-eastern Australia and the risk to natural and cultural values in the Tasmanian Wilderness World Heritage Area; and**

38 The Tasmanian fire agencies are: PWS, Tasmania Fire Service, and Forestry Tasmania.

39 Australasian Fire and Emergency Service Authorities Council (AFAC), *AFAC Independent Operational Review, A review of the management of the Tasmanian fires of January 2016* (2016 Independent Operational Review), Prepared for Tasmania Fire Service, Forestry Tasmania and Parks and Wildlife Service Tasmania, April 2016, <http://www.nerplandscapes.edu.au/system/files/LaP3%20Future%20fire%20danger%20summary%20-%20singles.pdf> (accessed 14 November 2016).

40 AFAC, 2016 Independent Operational Review, Prepared for Tasmania Fire Service, Forestry Tasmania and Parks and Wildlife Service Tasmania, April 2016, p. 8 (accessed 14 November 2016).

-
- **report annually to the World Heritage Committee on the state of conservation in the Tasmanian Wilderness World Heritage Area.**

2.46 There is some disagreement on whether climate change will cause a long-term increase in the number of dry lightning strikes in the TWWHA. However, on the evidence available, it is clear that these strikes pose a significant and increasing threat to the World Heritage Area.

2.47 Governments and stakeholders recognise that there is a paucity of research specific to climate change in Tasmania. The committee is pleased to see recent efforts being made to bridge this knowledge gap, including independent research in relation to dry lightning strike in the TWWHA. The committee notes however that there does not appear to be a research focus on climate-related ecological and biodiversity impacts, which are integral facets of the World Heritage listing.

2.48 The committee is concerned that increasing climate change will continue to threaten the TWWHA and its OUV. To plan for and manage these impacts, authoritative and publicly available information is essential.

