

Caught behind

Climate change,
extreme heat and
the Boxing Day Test



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Front cover. Bushfire smoke blankets SCG as Stephen O'Keefe plays in Sheffield Shield, December 2019.

Photo. Phil Hillyard / Newspix.

Below. Orange Cricket Ground. *Photo.* Claudia Hiscox.

Key findings

- **Australian cricket is already experiencing the impact of climate change and extreme heat—increasing the risk of heat stress on players and the likelihood of match disruptions.**
- **Under current emissions scenarios, the number of extreme heat days in Melbourne during December is expected to increase significantly over the next 40–60 years.**
- **If no effective climate mitigation action is taken, consideration should be given to moving the Boxing Day Test to the shoulder months of November or March.**
- **Cricket Australia is presented with a unique opportunity to take effective climate action to safeguard the future of one of our most cherished national sporting events.**



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Australian cricket and the boxing day test

Sport holds an almost unmatched position in Australian culture. It shapes the identity of a large majority of Australians and provides a vast range of physical and psychological benefits to the four out of five adults who play at least once a week.¹⁻³ It helps drive our economy too, contributing an estimated 2-3% of the nation's GDP.⁴

Of the many sports played across the country, cricket is one of the most loved and iconic, and its many forms take pride of place in the Australian sporting schedule.

During the 2018/19 season alone:

- Over 2.1 million Australians attended professional matches⁵
- Cricket Australia was the most popular Australian sports website, achieving 1.4 billion video views across its platforms and attracting a record January audience of 2.87 million people⁵
- Cricket Australia's Australian Cricket Census claimed that 1.65 million Australians played the sport in some form during the season⁶ (note: these figures have been contested)⁷

Played in the peak of Melbourne's summer, the Boxing Day Test is arguably the jewel in Australian cricket's crown. For many, the opening ball marks the end of Christmas, as working calendars give way to five days of serial drama, and checking in on the score becomes a national pastime.

Despite its renown, the Test has a surprisingly short history in its current form. While there are instances of Boxing Day cricket being played as far back as 1892, the regular clash we have come to know and love only became a staple of the cricketing fixture in 1980.

Over the last 40 years, the Boxing Day Test has grown into a major tourism drawcard for Victoria, and it is promoted heavily by the Victorian Government as a reason to visit Melbourne over the summer.⁸ Recent years' events have also included multi-day festivals co-sponsored by Cricket Australia that have sat alongside the Test itself.

This economic and cultural value has not gone unnoticed by other states, with the chief of Perth's new \$1.6 billion stadium recently stating it was ready to host the Test should the MCG be deemed unsuitable due to recent poor pitch conditions.⁹ While the quality of the pitch is key to ensuring player safety, so too is protecting players and spectators from the impacts of extreme weather conditions.

Higher concentrations of greenhouse gases in our atmosphere are fueling changes in extreme summer heat¹⁰ and pose enormous risks to the longevity of the game as we know it. While Boxing Day cricket has had to endure hot spells in the past, these events are becoming much more frequent as a result of unprecedented changes to Australia's climate.

Consequently, the conversation on extreme heat and sport is changing. During the Sydney Ashes Test in January 2018, England's captain, Joe Root, was hospitalised as air temperatures hit 42°C, suffering from dehydration and viral gastroenteritis. A heat tracker in the middle of the ground showed a reading of 57.6°C.¹¹

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Cases like Root's appear to divide players, officials and commentators: although some lionise the effort to play on in extreme conditions,¹² others have criticised the International Cricket Council (ICC) and Cricket Australia, which had no explicit heat policy at the time. Former Australian cricketer Dean Jones, who famously made 210 against India in extreme conditions in Chennai in 1986,¹² tweeted that "cricket should be called off after 41°C"¹³. Similarly, as the 2019/20 summer begins, cricketers playing in Sydney have spoken out on the health risks of playing in bushfire smoke.¹⁴

But the conversation must be about more than monitoring players and calling off games. Produced by the British Association for Sustainable Sport, the recent Hit For Six report called on cricketing bodies worldwide to take strong and effective climate action. Its messages are especially pertinent in Australia: as hot spells continue to intensify, Australian cricket will become more dangerous in December.

Caught behind brings together climate, media and sports research to:

- Review the current management of extreme heat in Australian cricket,
- Investigate cricket's contributions to the risks posed by climate change, and
- Question the viability of continuing to host the Boxing Day Test in December under a "business as usual" greenhouse gas scenario.

This report presents an opportunity for the governing bodies of Australian cricket to display leadership on climate change: not only to adapt to the changing impacts of extreme heat, but to play their part in avoiding the worst impacts in the future.



"...Because of the **burning of fossil fuels** and changes in land use, the concentrations of greenhouse gases in the atmosphere are rising and causing surface temperatures to increase, leading to an '**enhanced**' **greenhouse effect**."

State of the Climate report,
CSIRO and Bureau of Meteorology (2018)

Climate change and Australia's role

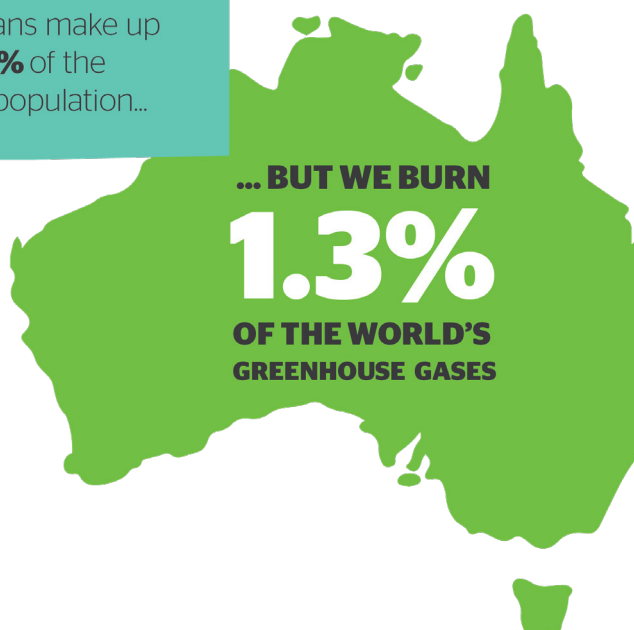
2018's State of the Climate report, published by the CSIRO and the Bureau of Meteorology, explains that recent global climate change trends are overwhelmingly human caused.¹⁵

Humans have emitted more carbon dioxide since 1970 than we did in the 200 years before that.¹⁶ This unprecedented acceleration is presently warming the globe by 1.7°C, changing the climate system 170 faster than the last 7,000 years of human history.¹⁷ Recent figures from the United Nations Environment Programme show that this acceleration continues today, as greenhouse gas emissions have risen at a rate of 1.5% per year in the last decade.¹⁸

Although Australia has a small population, its impact on global emissions is much larger, and it's one of the largest per capita emitters in the world. In the 2020 Climate Change Performance Index, Australia was ranked worst on climate policy among all 57 countries assessed.¹⁹

Batting above our average

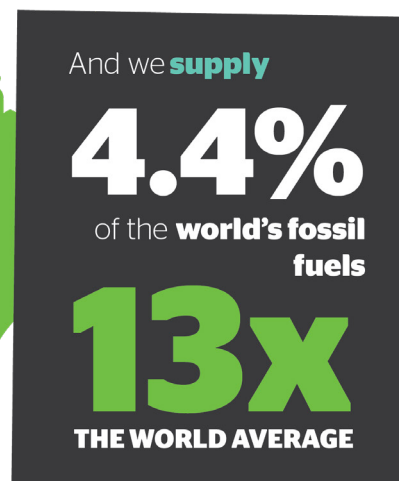
Australians make up just **0.3%** of the world's population...



These emissions have had consequences for Australia and the rest of the world. Australia's climate has warmed by just over 1°C since 1910, warming particularly quickly since 1950.¹⁵ All but one of Australia's ten warmest years on record have occurred since 2005, with nine of the last ten years charting warmer than average temperatures.²¹

This single degree of warming has led to drastic changes at a local level, increasing the frequency of extreme weather—particularly extreme heat.¹⁵ This has had a particular impact on Australia's hottest days and nights, which have warmed in the last century.²² Very high monthly daytime and night time temperatures now occur six times more frequently than they did 30–60 years ago.¹⁵ In some cases, changes in variability may mitigate heat extremes—or intensify them.

Figure: Australia's domestic emissions (excluding land use and agriculture) compared to its scope 3 emissions (domestic emissions and exports, less agriculture, land use and imports).²⁰ Multiple of the world average is calculated by taking Australia's scope 3 emissions per-capita and dividing by global per-capita emissions less land use and agriculture.



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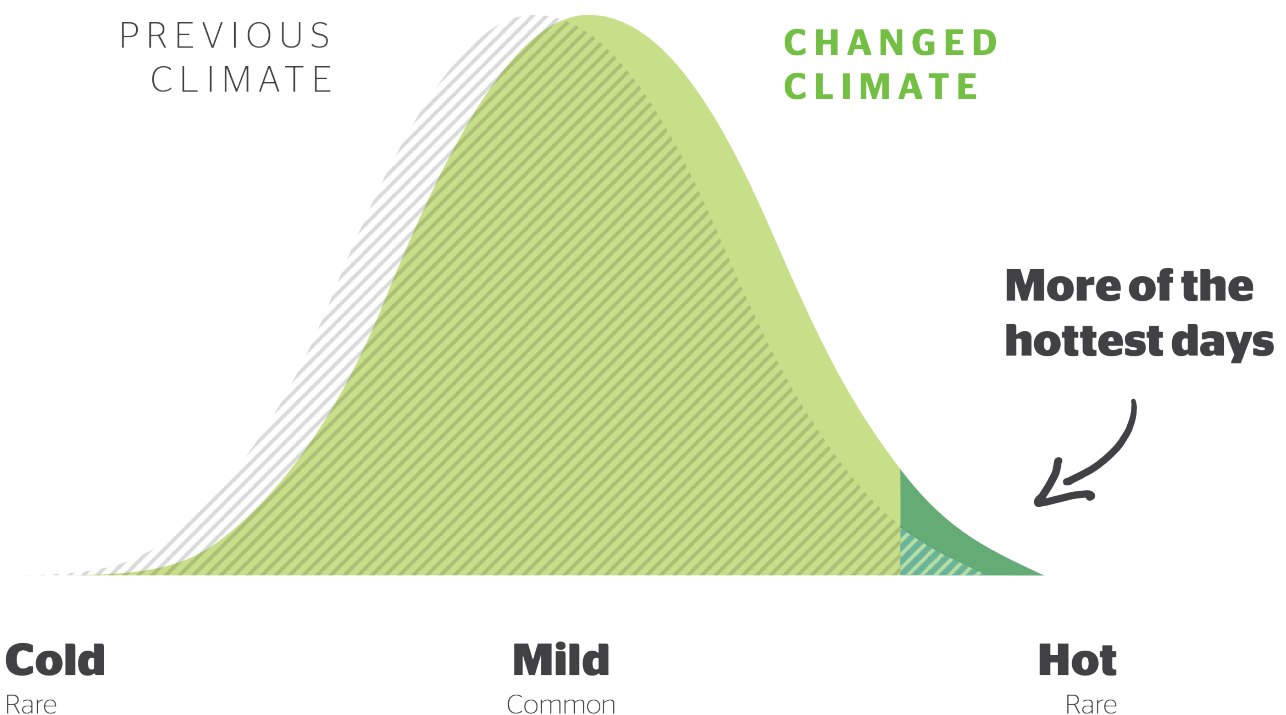
Climate change, extreme heat and the Boxing Day Test

Large parts of Australia also face increases in other extreme weather events, including storms, fire weather and flooding¹⁵ with serious consequences for every region of Australia.

With current global levels of greenhouse gas emissions, Australia can expect to see further increases in temperatures, resulting in more extremely hot days and fewer extremely cool days.¹⁵

Figure: The combination of warmer average temperatures and increased variability can have a large impact on the heat extremes we experience. Other combinations of warming and changed variability can impact hot and cold extremes in other ways.

Mean extremes



The impact of extreme heat on players

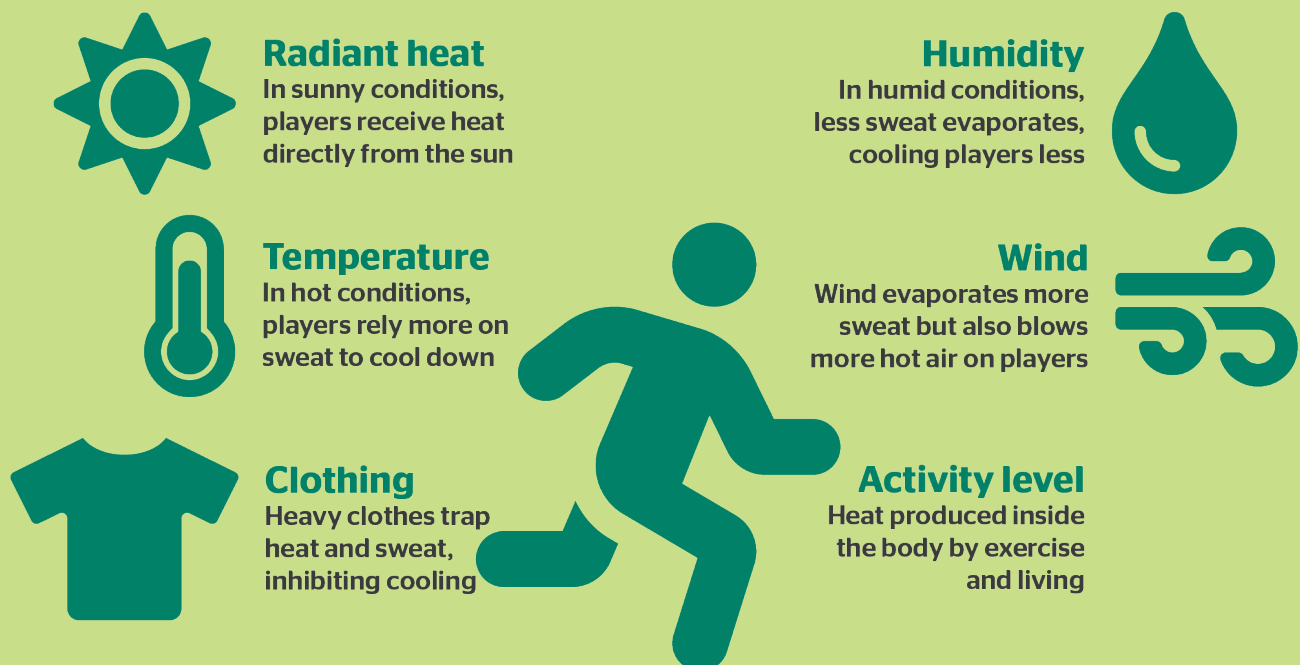
Extreme heat is a major health hazard for cricketers, disrupting the thermoregulation that maintains our core body temperature at around 37°C.²³

The Hit for Six report describes the escalating symptoms of heat stress, beginning with muscle cramps, profuse sweat, thirst and fatigue. But things change with more severe forms of heat stress. Players often present surprising symptoms as they progress toward heat stroke: sweating often stops as players run low on body fluids, they may feel chills, and problems with the nervous system may impair coordination and thinking.²⁴

These symptoms, among others, are life-threatening signs.²⁴ Even mild hyperthermia can pose a threat if it continues for hours as cricket Tests do,²³ so players need to be managed carefully during play and adequately rested during breaks.

In cricket, the environmental factors present on the ground, as well as a player's activity levels and clothing, influence individual heat stress risks. Batters, who run in helmets, pads, thigh pads, arm and chest protectors, are at particular risk due to their protective clothing²⁵ and their activity level, or metabolism.²⁶

A recipe for heat stress



Cricket Australia's heat policy

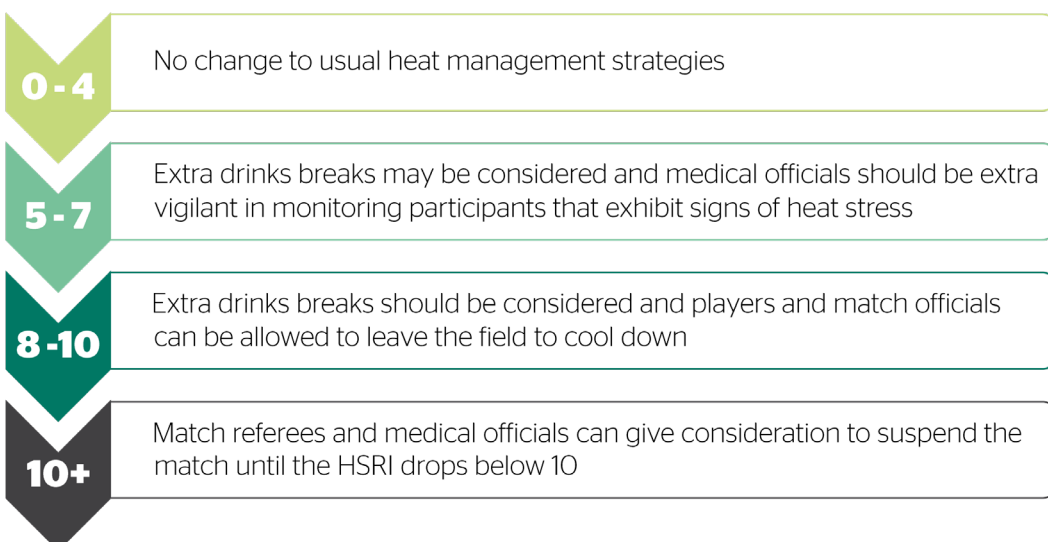
In 2018, Cricket Australia published a Heat Stress Management Policy – the first of its kind in world cricket. The Hit for Six report celebrates this policy for being best practice and world leading in its scope to protect players from the impacts of extreme heat.²⁴

But this policy only applies to Cricket Australia-sanctioned competitions; international level matches, like the Boxing Day Test, are governed by the ICC. The ICC's policy is brief: "it is solely for the umpires together to decide whether conditions... mean that it would be dangerous or unreasonable for play to take place."²⁷ Although this gives umpires discretion to call off play, it also gives them no tools with which to evaluate risk. Cricket Australia states that although it will enact its heat policy in relation to players representing Australia in international cricket, the ICC ultimately has the final say.

Cricket Australia's policy uses a bespoke Heat Stress Risk Index (HSRI), developed in collaboration with the Thermal Ergonomics Lab at Sydney University.²⁸ This index calculates the combined heat stress risk on players using the factors discussed previously: **temperature, radiant heat, humidity and wind**, combined with **clothing** and **activity level**. The policy outlines interventions to be implemented as the HSRI rises.

The policy also provides strategies for heat stress management in order to alleviate the impacts of playing cricket on days of extreme heat. Players' hydration is monitored before, during and after matches and training sessions. A combination of external and internal cooling methods is recommended, including cold water immersion, ice ingestion (slushies and icy poles) and cold wet towels placed on the neck and face.²⁸ In addition, players are advised on specialised clothing to ensure they do not overheat. Stadiums like the SCG, the MCG and the Gabba are also required to provide facilities to support players, such as ice baths, air-conditioned changing rooms and/or industrial fans.²⁹

Cricket Australia's heat stress risk index rating



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Cricket Australia declined to answer whether it tracks the number of times its heat policy has been enacted. Its HSRI index is proprietary.

Nevertheless, indices similar to the HSRI, incorporating humidity and other factors, are frequently used by sporting bodies and other organisations in their heat stress policies. For example, Tennis Australia stops play when one of these indices, the Wet Bulb Globe Temperature (WBGT), reaches 32.5.³¹ Even milder conditions can pose a threat to people with heavy clothing or high activity levels: one study of Australian soldiers on a 10 kilometre march with heavy equipment at WBGT 22–25 found that over a third developed symptoms of heat exhaustion or hyperthermia.³²

Observations at Melbourne weather stations show that heat stress, as measured by the WBGT, is rising.

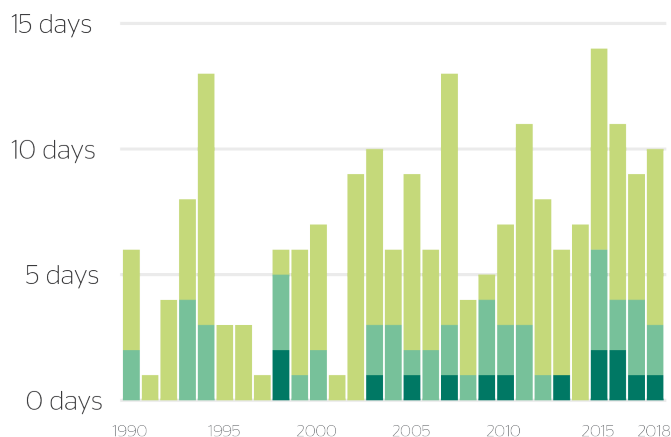
Figure: number of days with observed peak daily Wet Bulb Globe Temperature (WBGT) at two Melbourne weather stations, Moorabbin (948700-99999, from 1990) and Essendon (948640-99999, from 1995). WBGT records, sourced from the global HadISD dataset, employ a simplification that includes temperature and humidity but not wind or radiant heat. To avoid overestimating WBGT, only observations between 10 AM and 6 PM are considered; however, on hot, sunny days, WBGT may be underestimated.

What about the spectators?

Cricket Australia's heat policy is focussed on protecting players, player support personnel and match officials, but spectators also need to be considered.

Although they may only be sitting or standing during the game, spectators face heat balance risks for other reasons. People in the stands comprise not only young adults but also the elderly and children, groups that face particular challenges managing heat.³⁰ Spectators are not monitored for changes as players are, and younger spectators may not be able to communicate the symptoms of heat stress well.

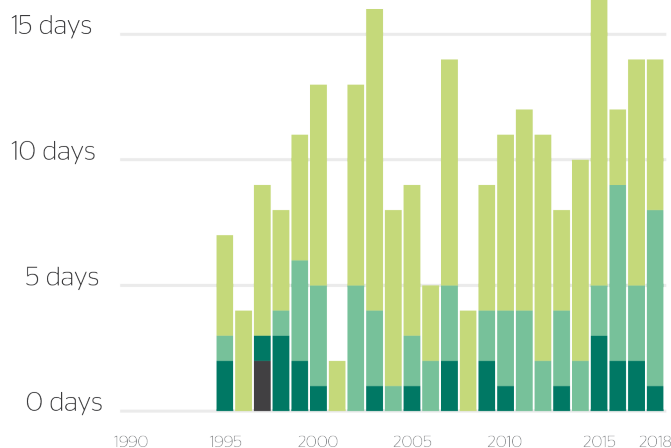
Moorabbin



WBGT

25-28 28-30 30-34 Over 34

Essendon



Local snapshot

Red Cliffs Cricket Association

Disruptions due to climate change are being felt all the way down to grassroots cricket.

Red Cliffs Cricket Association, located in the Mildura region, is just one example of local cricket feeling the heat. In the last 40 years, Mildura's average daytime January temperatures have increased by 2.7°C. On average, the regional centre now sees 5.5 more January days over 38°C than in 1980. It's no wonder Peter Kelly, the Association's Secretary from 2015 to 2019, is concerned.

Mildura's January days of 38°C or above

+5.5 more days since 1980

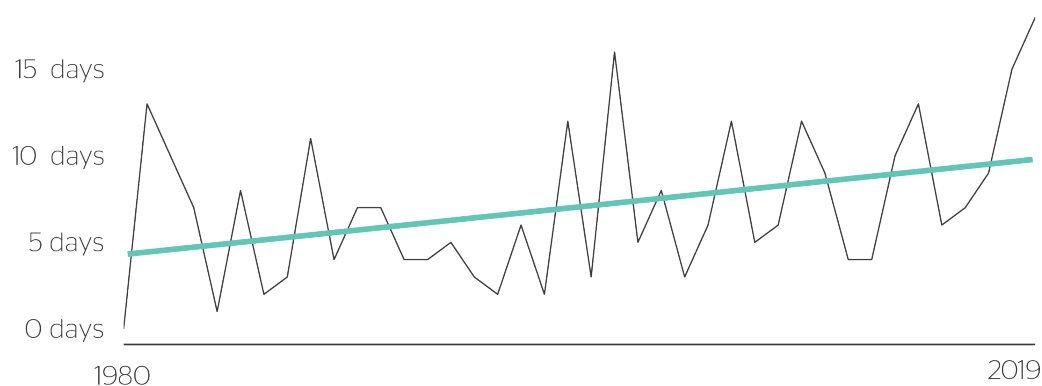


Figure: the number of January days of at least 38°C each year at the Mildura weather station (076031). Data from the Bureau of Meteorology's ACORN-SAT dataset.

The Association has had to make several changes to cope with the increase in heat:

"We cracked the record last January [2018], when we were looking for a cool change to be under 40°C and we went for three consecutive days over 46°C."²⁴

Kelly recalled that in the past, games had been suspended due to heat "about once every summer." In contrast, "over the last four years, we've had about four days that we've had to call it each season... the whole of January was pretty well 43°C last year and the year before."

"We now play shorter games in January and have taken one of the Saturdays out **because of the hot temperatures** we've had for the past few years. **It's getting that consistent.**"

- Peter Kelly, Red Cliffs Cricket Association Secretary (2015-2019)

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Red Cliffs is particularly concerned about its junior teams. Given that young people are more susceptible to sports-related heat stress,³³ extra care must be given to their participation, especially when training after a full day at school.

Though they've had basic guidance from the state level on how to deal with the heat, it's the clubs that are taking the initiative. Unlike Cricket Australia, which is well funded, local associations have been getting creative with the facilities on hand. According to Kelly, they've had six nights in the last few years where the sessions have moved to the pool because it was above 43°C. "Cricket training in the swimming pool has become a new normal," he says.

Initiatives that clubs in the **Red Cliffs Cricket Association** are taking to adapt to extreme heat:

- **Mist sprays** set up at some grounds to cool players and spectators
- Training moved to the **local swimming pool** on extreme heat days
- **Cold showers** available to players at only certain grounds
- **Water bottles in eskies** available to encourage hydration

Resources available to **Cricket Australia** to protect players from extreme heat:

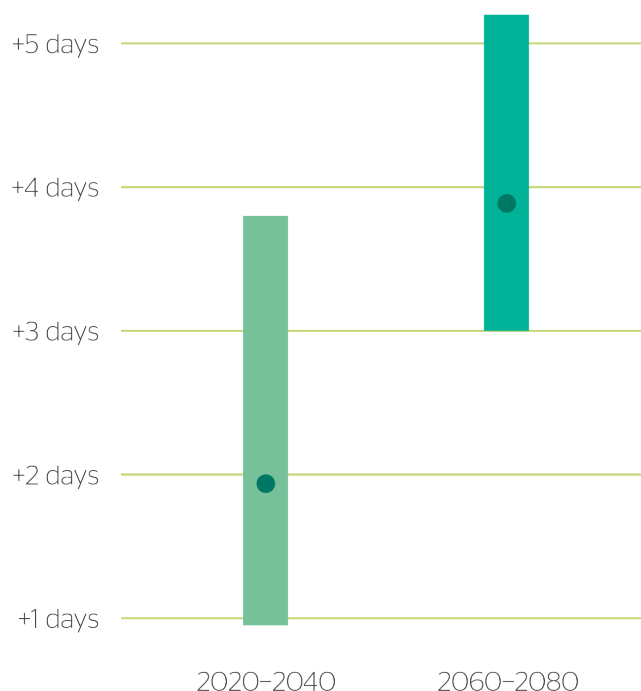
- **Air conditioned changing rooms** available at all grounds
- **Industrial fans** available at all grounds
- **Ice baths** available at all grounds
- A team of **sports doctors** available to monitor players' hydration

This begs the question of how local clubs are going to be supported in future extreme heat events. The Red Cliffs Cricket Association wants to upgrade its grounds for the juniors so they have quality shading and a good water supply. This is going to be vital, with climate models projecting that within the next 40–60 years, there will be an additional four January days of 38°C beyond the trends of recent decades. Given that in 2019, Mildura experienced 18 days of 38°C or above, this does not bode well for the future.

Kelly also noted that if water restrictions continue as projected, clubs could be faced with the burden of having to source water for themselves, which could further weigh on their resources. "We need to make sure there are good facilities that encourage people to stay playing cricket—we can't stay in the swimming pool."

More January heat projected for Mildura

Under business as usual, Mildura is projected to see more 38°C+ days over the next 60 years than in 1990–2010.



The future of the **Boxing Day Test**

Cricket Australia and local clubs alike are already taking steps to manage the increasing impacts of extreme heat on cricketers. In December, when the Boxing Day Test is played, we've already seen a rise in observed heat stress, suggesting that even current playing conditions pose risks to players' health.

Looking forward, high-resolution climate models³⁴ show that under current emissions scenarios, the number of days at 35°C or above will increase. This means the extreme heat affecting the MCG in summer is set to spill out into spring and autumn. In other words, the shoulder months of November and March will look and feel more like the Decembers of recent memory.

These projections also raise red flags for grassroots competitions, many of which lack access to effective or scalable heat management resources.

Despite the extensive heat management resources available to professional teams, continuing to play the Boxing Day Test in its current format at the end of December will expose players and fans to unprecedented levels of extreme heat. If no effective climate mitigation action is taken, consideration should be given to moving the Melbourne Test to the shoulder season.

Such a change would inevitably present significant economic, logistical and cultural challenges to Australia, affecting cricket administrators, players and spectators. But it isn't without precedent: after Qatar won the rights to the 2022 FIFA World Cup,³⁵ FIFA, recognising the country's blistering summer heat, announced that the event would be shifted from its traditional time in the Northern Hemisphere summer to the winter.^{36,37}

Moving the event isn't the only option, but alternatives come with their own risks. Because radiant heat is a significant factor in heat stress, night Tests could lower the heat stress risk to players and others, but there may be logistical, cultural or safety challenges involved in this. Similarly, splitting Test days into mornings and evenings may avoid the most intense sun, but it would challenge the established—and, arguably, rigid—structures of Test cricket, presenting new issues in scheduling and crowd control.

Figure: The projected change in the average annual number of hot days (35°C or hotter) each month of the summer and shoulder seasons in 2060–2080, relative to December in 1990–2010. Projections are for the SRES A2 scenario—often referred to as a high-end business as usual scenario—projecting a temperature rise of 3.5–5.5°C by 2100.¹⁶ Bars represent the range of estimates for each month across an ensemble of climate models; points represent the average estimate for the ensemble. Results are similar at all temperature thresholds from 30°C to 43°C, although at more extreme thresholds November and March have a lower number of days.

When should the Boxing Day Test be played?

By 2060–2080 under business as usual, the heat of recent Decembers is projected to expand to the shoulder season, while the summer months get hotter still.



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Climate action scorecard for Cricket Australia

Supports Australia becoming a net zero greenhouse gas polluter by 2050?

Declined to answer

Supports the transition of Australia's electricity sector to 100% renewable energy?

Declined to answer

Plans to transition electricity use to 100% renewable energy?

Declined to answer

Assessed what impact predicted increases in extreme heat will have on elite and community participants?

Yes

Tracks the number of event days that are delayed or abandoned as a result of extreme heat?

Declined to answer

Receives sponsorship from fossil fuel companies?

Yes

Signed up to the UN Sports for Climate Action Initiative and incorporated its five principles into strategies, policies and procedures?

No

Alinta Energy is a commercial partner of Cricket Australia.

Alinta Energy is a subsidiary of Pioneer Sail Holdings, which is owned by Chow Tai Fook Enterprises. Pioneer is Australia's seventh largest greenhouse gas polluter, **producing 11.3 million tonnes in FY 2017/18.***

Marsh & Lloyds is a commercial partner of Cricket Australia and **insures Adani's proposed mega coal mine in QLD.**

* Power companies top list of nation's biggest emitters [Internet]. Sydney Morning Herald. 2019. Available from: <https://www.smh.com.au/business/the-economy/the-dirty-top-ten-these-are-australia-s-biggest-polluters-20190228-p510u5.html>

Opportunities for **Australian cricket**

Cricket Australia has taken steps to ensure players are protected from the impacts of extreme heat. However, it is at risk of being caught behind if instances of extreme heat keep intensifying. The International Olympic Committee and United Nations argue that “sport is not just a victim of climate change; it is also a contributor, through greenhouse gas emissions.”³⁸

In its 2017-2022 Strategy Report, Cricket Australia declares it wants “to meet the demands of the future”. Specifically, it states, “We want to be visionary, flexible and creative while continuing to respect the tradition of cricket.”³⁹

However, bar a single sentence stating its operations aren’t subject to any environmental regulations, neither the strategy report, nor its 2018/19 Annual Report⁵ provide any comments on sustainability, environmental responsibility or climate change. There is no mention of offsets to the considerable air travel taken by players nor improving energy efficiencies of their physical premises. Not only that, but Cricket Australia’s major sponsor, Alinta Energy, is an electricity and gas company that in FY 18/19 were responsible for 9.27 million tonnes of scope 1 emissions.⁴⁰

The United Nations Sports for Climate Action Framework calls on sporting organisations to acknowledge the contribution of the sports sector to climate change and their responsibility to strive towards climate neutrality.⁴¹

Using the guiding principles of this framework, Cricket Australia is presented with an opportunity to take the lead on climate action, capitalising on its position as one of the nation’s largest sporting organisations. This would also bring its operations into alignment with the celebrated sustainability work of its close working partner and host of the Boxing Day Test, the Melbourne Cricket Club. In addition to the framework, Cricket Australia could explore options to support community clubs in generating clean energy.

"While the sport sector alone cannot turn back the tide of climate change, it is a **hugely important player** in this issue."

- International Olympics Committee

UN Sports for Climate Action Framework

| SYSTEMATIC CHANGE | TAKE ACTION | | EDUCATE & INSPIRE OTHERS | | |
|--|---|---|---|--|--|
| <p>Undertake systematic efforts</p> <p>Comprehensively incorporate climate change and its impacts into business strategy.</p> <p>Establish responsibility for sustainability at the board level.</p> <p>Implement robust approaches to reduce climate impact.</p> | <p>Measure overall climate impact</p> <p>Gather information on current activities to establish a baseline carbon footprint.</p> <p>Evaluate overall climate impacts of the organisation's GHG emissions.</p> <p>Understand how the organisation can take effective action.</p> <p>Top priority should be on activities with the highest climate footprint.</p> | <p>Reduce overall climate impact</p> <p>Prioritise activities & opportunities that avoid carbon emissions.</p> <p>Choose to optimise resource efficiency.</p> <p>Switch to more efficient renewable energy and low-carbon technologies.</p> <p>Implement measures to deal with unavoidable emissions, e.g. carbon offsetting.</p> | <p>Educate others on climate action</p> <p>Communicate your efforts both internally & externally to raise awareness about sustainability.</p> <p>Optimise the impact of collective effort on climate action.</p> <p>Inform stakeholders about climate action initiatives.</p> <p>Encourage stakeholders to take action themselves.</p> | <p>Promote sustainable consumption</p> <p>Adopt sustainable procurement policies to motivate providers to develop cleaner options.</p> <p>Communicate with fans & other stakeholders to promote the use of greener sustainable options.</p> <p>(E.g. give preference to sustainable means of transport.)</p> | <p>Advocate for climate action</p> <p>Consistently support climate action by mobilising resources.</p> <p>Showcase sustainable action via broadcasting channels, social media, athletes as role models & ambassadors, events & association & club networks.</p> |

Given cricket's vulnerability to increases in extreme weather, decisions to not directly address future sustainability challenges also place Cricket Australia and its directors in a precarious position. There is growing discussion that, under the Australian Corporations Act, company directors could potentially be held legally responsible if they continue to let climate risk go through to the keeper. (Cricket Australia is a company limited by guarantee and is therefore must comply with the Corporations Law.)⁴²

Climate change risks may soon represent "material financial issues" for Cricket Australia, not just ethical environmental concerns that might previously have been considered secondary to directors' duties. In such a scenario, directors of Cricket Australia could face liability under the Corporations Act for failing to adequately address⁴³ and report⁴⁴ these risks. In addition, Cricket Australia and its directors could be liable for breaches of State and Territory health and safety laws for failing to adequately address the health risks posed to both players and the public.⁴⁵

By addressing these risks, Cricket Australia has the opportunity to not only reduce its overall climate impact and mitigate the impacts of extreme heat on its players, but to mobilise its huge national audience on the importance of collective climate action from every sector of the community.

“

It is conceivable that **directors who fail to consider the impacts of climate change** risk for their business, now, **could be found liable** for breaching their statutory duty of due care and diligence going forwards.

”

- The centre for policy development

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”

Dr Russell Seymour, Sustainability Manager
at Lord's Cricket Ground, London.

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