



Love 40 degrees?

Climate change,
extreme heat and
the Australian Open



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Front cover. Julien Benneteau , Sydney International Tennis tournament. Photo. AAP. Below. Dalila Jakupovic suffers coughing fit due to bushfire smoke haze at 2020 Australian Open. Photo supplied by. AAP.

Key findings

- Australian tennis is already experiencing the impact of climate change, with smoke from bushfires and extreme heat driven by climate change increasing health risks for players and the likelihood of match disruptions.
- Under current greenhouse gas emissions scenarios, the number of extreme heat days in Melbourne during January is expected to increase significantly over the next 40-60 years, while November and March will be comparable to recent Januarys.
- A series of adaptation actions should be considered to protect participants from the worsening impacts of extreme heat, including extending the length of the Australian Open or moving the event to November or March.
- By implementing the principles of the United Nations Sports for Climate Action Framework, Tennis Australia is presented with an opportunity to address the root causes of climate change and, in doing so, contribute to safeguarding the longevity of tennis in Australia.



Contents

Key findings.....	2
Australian tennis and the Australian Open.....	4
Climate change and Australia's role	6
How heat impacts tennis players	8
The Australian Open Heat Policy	9
Local case study: Spring Gully Tennis Club	12
The future of the Australian Open	14
Opportunities for Tennis Australia	17
References	19

Tennis in Australia

and the Australian Open

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

Tennis is one of the nation's most popular sports, with more than 1.2 million Australians playing the game in 2019.⁵ As the nation's premiere tennis event, the Australian Open is an icon of the Australian summer. First held in 1905, the tournament is now one of the largest annual sporting events in the Southern Hemisphere. For the second half of January, the eyes of the world are locked on Melbourne, with television coverage beaming into some 900 million homes globally.⁶

It is also the best attended tennis tournament in the world, attracting a record-breaking 780,000 fans in 2019, up 7% from the previous year.⁶ The influx of spectators makes the Australian Open a significant summer tourism attraction for Melbourne, providing an opportunity to see the world's best players in one spot, alongside a multitude of concerts, entertainment and gourmet food.

This coverage and attendance generates considerable economic benefits. Each year, the event injects more than \$290 million into the Victorian economy and creates over 1,000 jobs.⁶

The Australian Open has become known for its high temperatures, having been described by former world No. 1 Andre Agassi as akin to "playing in a giant kiln".⁷ This is projected to intensify with higher concentrations of greenhouse gases in our atmosphere fuelling further increases in extreme January heat.⁸

Recent high-profile impacts of extreme heat have caused experts to cast doubt on the appropriateness of playing the renowned event at this time of year due to the health risks.⁹ Criticism and concern has also come from players. Novak Djokovic described his 2018 match against Gael Monfils as "brutal" while Monfils reported to court doctors with fears of fainting due to dizziness

and shortness of breath.¹⁰ On the day of their clash, air temperatures peaked at 40°C and court temperatures reached 69°C.¹⁰

Canadian player Frank Dancevic deemed the 2014 tournament "inhumane" as players competed in temperatures that surpassed 40°C for several days in a row.¹¹ Water bottles melted on court, players and ballkids collapsed and vomited due to heat stress, and more than 1,000 spectators were treated for heat exhaustion.¹²

Ahead of this year's tournament, hazardous air pollution from the catastrophic 2019–20 bushfire season has emerged as an additional health hazard. In early January, Novak Djokovic voiced concerns around air quality, suggesting organisers consider delaying the tournament if Melbourne's air quality didn't improve.¹³ Despite this, the Kooyong Classic and Australian Open qualifiers commenced on a day when Melbourne's air quality was rated as the worst in the world.¹⁴ This saw several players seek medical attention for breathing issues, with Dalila Jakupovic collapsing in a coughing fit and forfeiting her game.¹⁵

In light of these worsening conditions, the effects of climate change on Australian tennis remain a concern. **Love 40 Degrees?** brings together health, sports and climate research to:

- Highlight the impact of extreme heat on tennis players
- Assess the management of extreme heat in Australian tennis events
- Investigate the viability of continuing to host the Australian Open in its current format under a "business as usual" greenhouse gas emissions scenario

With the eyes of the world on the Australian Open, Tennis Australia is presented with an opportunity to not only adapt to the changing impacts of extreme heat, but to lead by example to reduce future impacts.



"...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 Bureau of Meteorology, explains that recent global climate change trends are overwhelmingly human-caused.¹⁶

Humans have emitted more carbon dioxide since 1970 than we did in the two hundred years before that.¹⁷ This unprecedented acceleration has changed the climate system 170 faster than the last 7,000 years of human history.¹⁸ Recent figures from the United Nations Environment Programme show that this acceleration is ongoing, as GHG emissions have risen at a rate of 1.5% per year in the last decade.¹⁹

Although Australia has a relatively small population, its impact on global emissions is disproportionately large. In the 2020 Climate Change Performance Index, Australia was ranked worst on climate policy among all 57 countries assessed.²⁰

Climate change is being felt heavily in Australia. All but one of the nation's ten warmest years on record have occurred since 2005.²² Our hottest and driest year was recorded in 2019.²³ Nationally, Australia's climate has warmed by just over 1°C since 1910, with temperature increases accelerating in the last 70 years.¹⁶

This single degree of warming has led to drastic changes at a local level, increasing the frequency of extreme weather—particularly extreme heat.¹⁶ Australia's hottest days and nights have warmed in the last century.²⁴ Monthly averages of daytime and nighttime temperatures are now “very high” six times more often than they were 30–60 years ago.¹⁶

Figure: Australia's domestic emissions (excluding land use and agriculture).²¹ Multiple of the world average is calculated by dividing this figure by global per-capita emissions less land use and agriculture.

Heavy hitters

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



We are also the world's largest supplier of

coal

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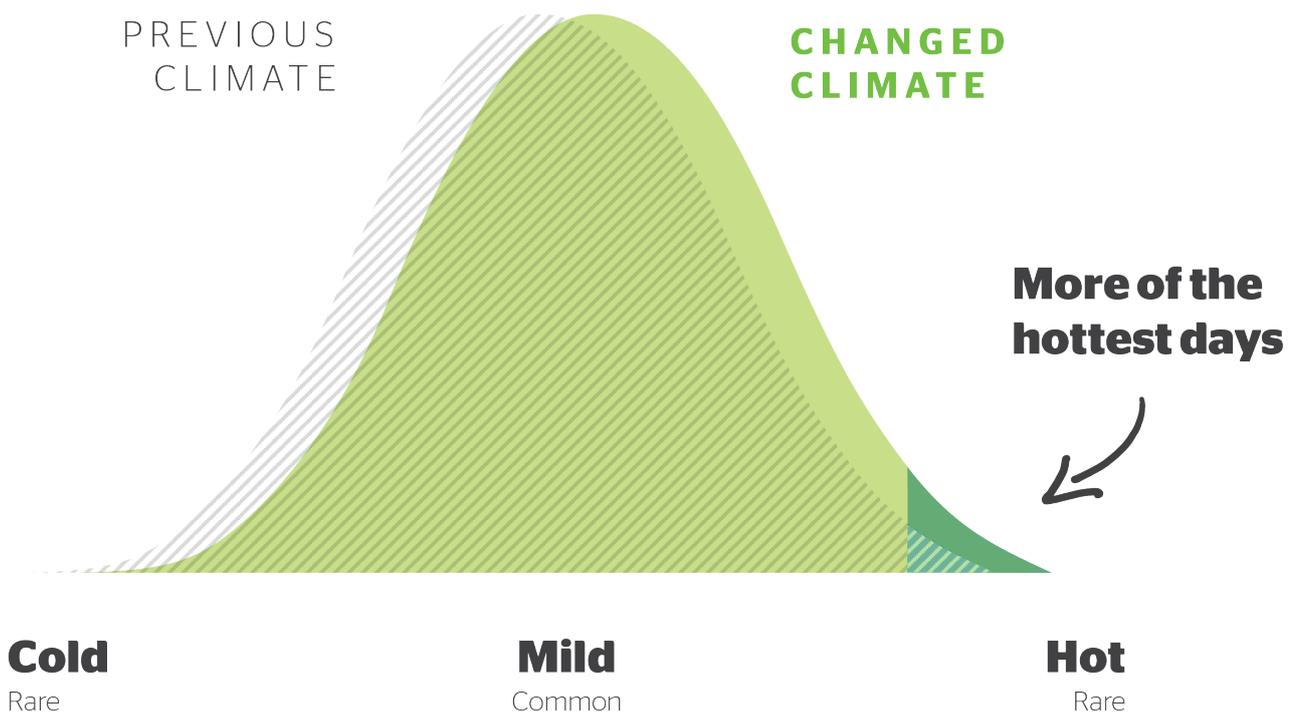
Climate change, extreme heat and the Australian Open.

Australia also faces an increase in other extreme weather events, including storms, fire weather and flooding¹⁶ with serious consequences for every region of Australia. The current bushfire crisis devastating large parts of Australia underscores the risks extreme weather poses for the country.

If global levels of greenhouse gas emissions continue to increase on current trajectories, Australia can expect to see further increases in temperatures, resulting in more extremely hot days and fewer extremely cold days.¹⁶

Figure: Warmer average temperatures can increase the heat extremes we experience. Changes in variability can further affect hot and cold extremes.

Mean extremes



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How heat impacts tennis players

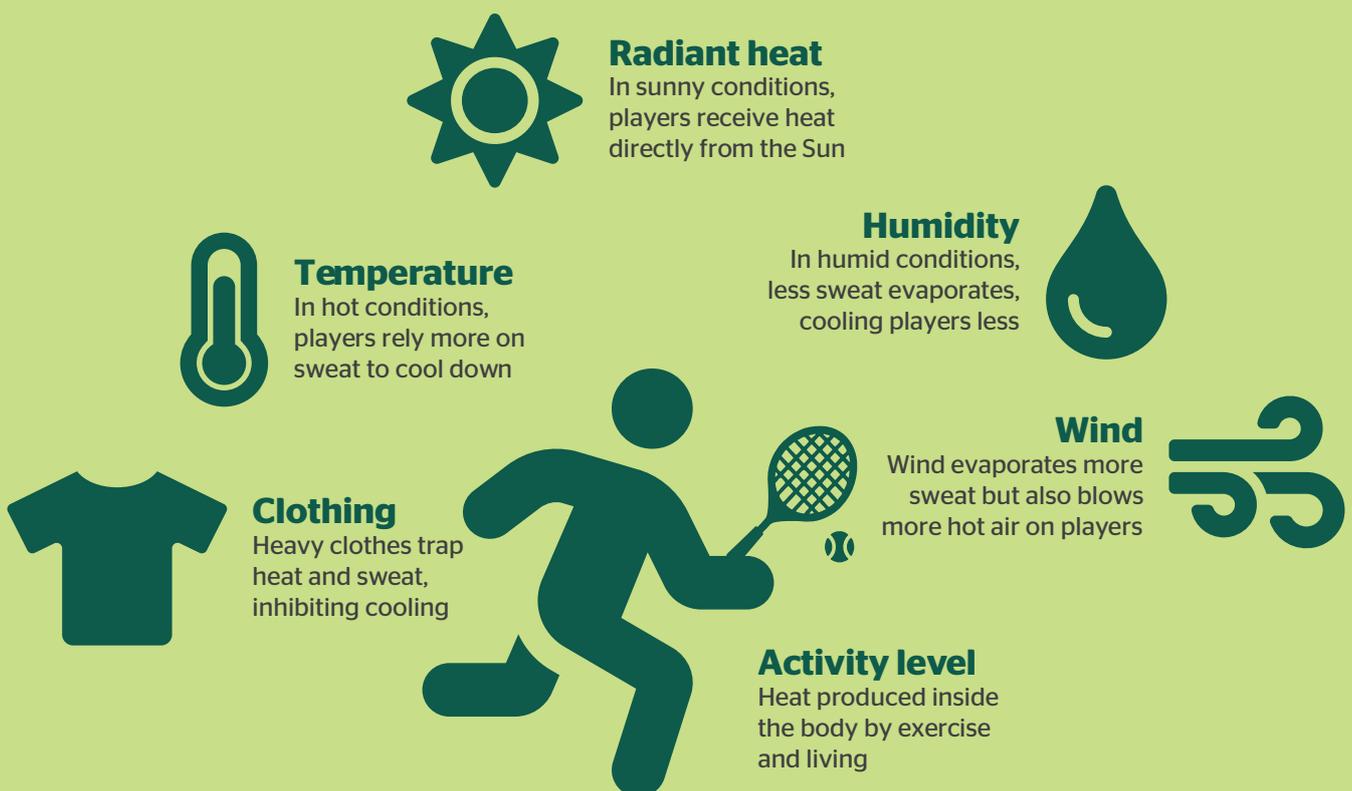
Extreme heat is a major health hazard for tennis players, disrupting the thermoregulation that maintains our core body temperature at around 37°C.²⁵ The illnesses that develop when the body's temperature rises to dangerously high levels (over 39.5°C) are collectively referred to as heat stress.²⁶

The British Association for Sustainable Sport describes the escalating symptoms of heat stress in sport, beginning with muscle cramps, profuse sweat, thirst and fatigue.²⁷ But things change as the condition becomes more severe. Tennis players often present surprising symptoms as they progress toward heat stroke: sweating can stop as the body runs low on fluids, players may feel chills, and problems with the nervous system may impair coordination and thinking.²⁷ These symptoms, among others, are life-threatening.

To prevent this, tennis players should be managed carefully during matches. Unlike continuous endurance events, like marathon running, tennis players frequently start and stop high-intensity exercise.²⁸ In normal conditions, the breaks in play allow players to shed built-up heat from their bodies and recover adequately.²⁶

But extreme heat complicates this recovery process, even among elite players.²⁹ High temperatures, humidity and radiant heat—from the sun and the court surface—all increase the heat stress risk by compounding the heat during play and making recovery more difficult.

A recipe for heat stress



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The Australian Open Heat policy

In 1998, the Australian Open became the first Grand Slam tournament to introduce an extreme heat policy.³² Amid concerns from players about dangerous levels of extreme heat, tournament organisers developed and introduced the Australian Open Heat Stress Scale in 2019, abandoning its Wet Bulb Globe Temperature (WBGT)-based policy.³³

It is important to note that this policy is specific to the Australian Open. For most of its other competitions, Tennis Australia still uses a WBGT-based policy; the body refined it in November 2019 to reduce exposure to dangerous heat.³⁴

Both policies measure risk using a combination of environmental factors, including radiant heat, humidity, air temperature and wind speed.^{34,35}

But where the Tennis Australia policy estimates these factors from nearby weather stations, the Australian Open Extreme Heat Policy directly measures heat stress at five positions around the precinct, including on the main courts of Rod Laver Arena, Margaret Court Arena and Melbourne Arena. A score, called the Australian Open Heat Stress Scale, is then calculated from these readings.³⁵

The health risks of bushfire smoke.

The disastrous 2019-20 bushfire season has brought into sharp focus the impacts of smoke on human health—impacts that only intensify when playing sport.³⁰ An athlete's respiratory rate and volume increases when engaging in high intensity sports, which increases the amount of airway exposure to pollutants. This can negatively impact performance and lead to long term health effects including decreased lung function.³¹

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Australian Open heat stress scale

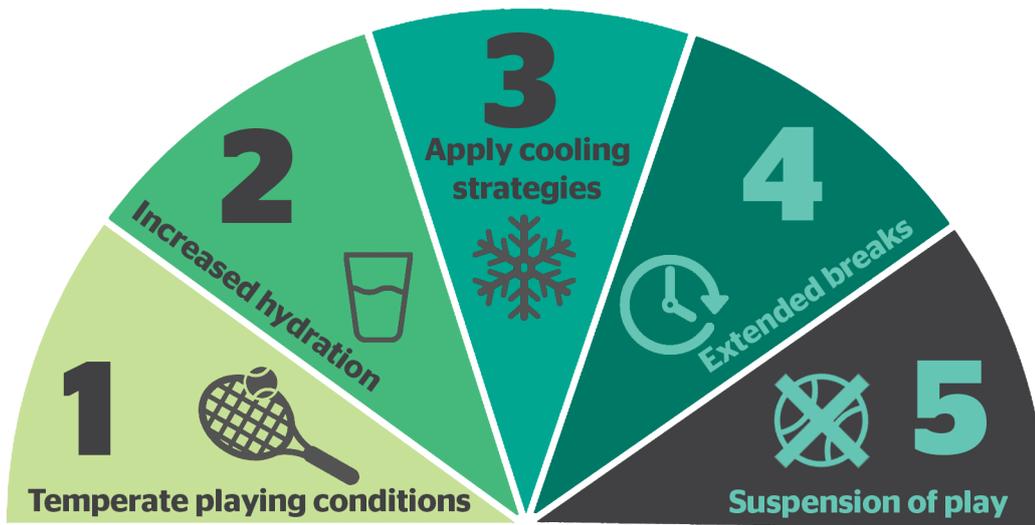


Figure: Australian Open Heat Stress Scale. Adapted from the Australian Open Heat Policy.³⁴

As this Heat Stress Scale increases from 1 to 5, the policy introduces progressive steps to control heat stress. At 3.0, players are actively cooled using ice vests and ice baths. At 4.0, players are allowed longer breaks between sets. When the Heat Stress Scale hits 5.0, play can be suspended. The three main courts are equipped with retractable roofs that can optionally be closed when the Extreme Heat Policy is enforced.³⁵

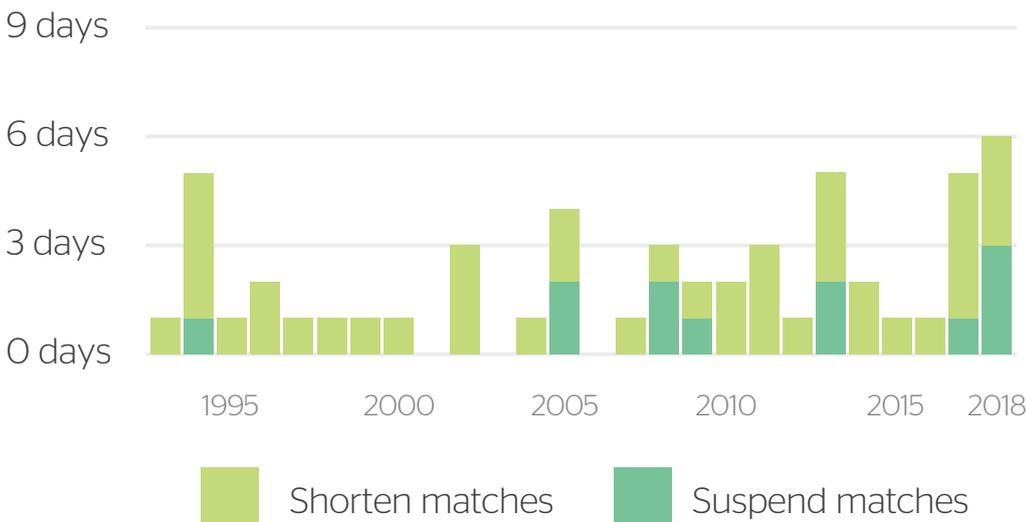
Tennis Australia and Australian Open organisers declined to answer whether they track the number of days on which play has been delayed or abandoned as the result of extreme heat. Because the Australian Open Heat Stress Scale is proprietary, this report has instead investigated these impacts using the current WBGT-based Tennis Australia policy. The analysis shows that heat stress in recent years has been particularly severe, leading to greater impacts on play. This corresponds with a 2018 study which found that Australian Open matches saw more match doctor consultations and cooling device callouts as the WBGT soared.³⁶

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Figure: Number of January days where Tennis Australia’s current heat policies, to reduce and suspend matches respectively, would be invoked based on observed peak daily Wet Bulb Globe Temperature (WBGT) and temperature at two Melbourne weather stations – Moorabbin (from 1993) and Essendon (from 1997). 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 temperature and WBGT observations between 10 AM and 6 PM are considered; however, on hot, sunny days, WBGT may be underestimated.

Moorabbin



Essendon



Local snapshot

Spring Gully Tennis Club

Extreme heat isn't only disrupting the professional circuit in Australian tennis: grassroots competitions are affected too—and without the same access to extensive heat management strategies.

Located on the outskirts of Bendigo, and with more than 300 members, Spring Gully Tennis Club (SGTC) is well and truly feeling the heat. Club Secretary, Ardel Shamsullah, reflects on how changes in the region's climate is affecting the club's night competitions, previously considered immune to extreme heat.

"We've cancelled night competitions because forecasts had the shade temperatures still above 37°C ... with the sun shining on the court, it can be 45°C or more."

The Bendigo temperature record confirms Mr Shamsullah's experience that nights are getting hotter in the region. Bendigo's warmest January nights have increased by 3.4°C since 1992, and the average nighttime temperature has risen by 2.2°C in the same period.

While cancellations are steadily becoming more frequent at SGTC, the club is adapting so players can endure the heat during matches and training. The club is installing water fountains and umbrellas next to the courts, and keeps the club house open longer to allow players to retreat from the heat.

SGTC doesn't host daytime competitions itself, but many of the club's members play in external competitions held by the Bendigo Tennis Association, where Mr Shamsullah notes heat policies are being invoked more often.

"While there are a lot of reasons (for the decline in Saturday afternoon competitions) I think one of them is the discomfort of playing in the heat," Mr Shamsullah suggests, describing daytime summer temperatures in the region as "dangerously hot."

For the local tennis community in Bendigo, it is unlikely there will be any reprieve on the horizon. Climate modelling suggests extreme heat days in the region will increase under current emissions scenarios.

Beyond the direct impacts of increased extreme heat on play are additional risks of bushfires. Given the recent unprecedented fires in Victoria, this does not bode well for SGTC, which is located in a wooded reserve. On a recent catastrophic fire danger day Mr Shamsullah explains that the club was forced to cancel the evening competition "after the power was cut off with no certainty of it being restored before the event."

Mr Shamsullah expresses the need for the club to formalise an extreme heat policy which includes an adequate bushfire response strategy.

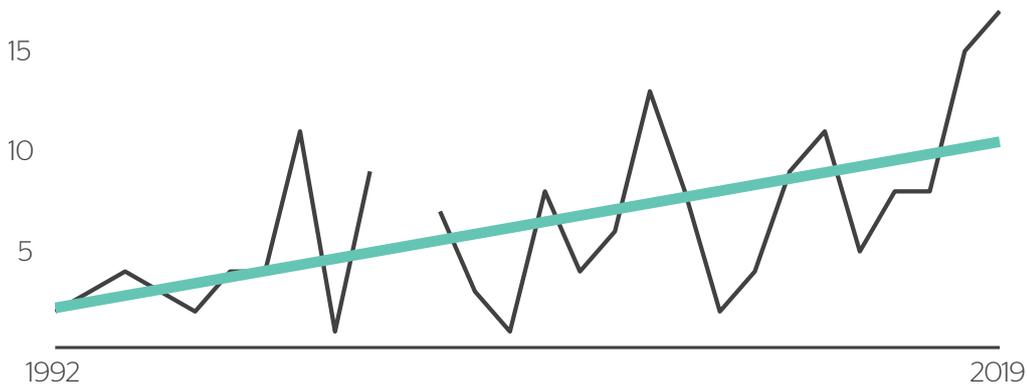
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Figure: The number of January days of at least 35°C each year at the Bendigo Airport weather station (081123). Data from the Bureau of Meteorology.

Bendigo Airport's January days 35°C or above

+8.3 more days since 1992



More January heat projected for Bendigo

Under business as usual, Bendigo is projected to see more days of 35°C+ over the next 60 years compared to 1990-2010.

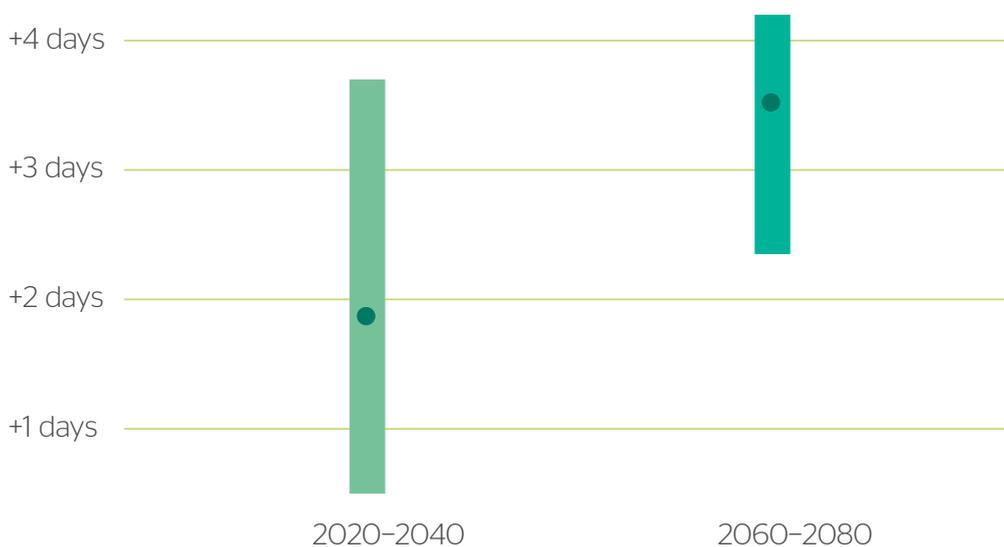


Figure: The projected change in the average number of January days of at least 35°C each year near the Bendigo Airport weather station each month of the summer and shoulder seasons relative to January in 1990–2010. Projections are for the SRES A2 scenario—often referred to as a business as usual scenario—projecting a global temperature rise of 2.0–5.4°C by 2100.³⁷ Bars represent the range of estimates for each month across an ensemble of climate models; points represent the average estimate for the ensemble.

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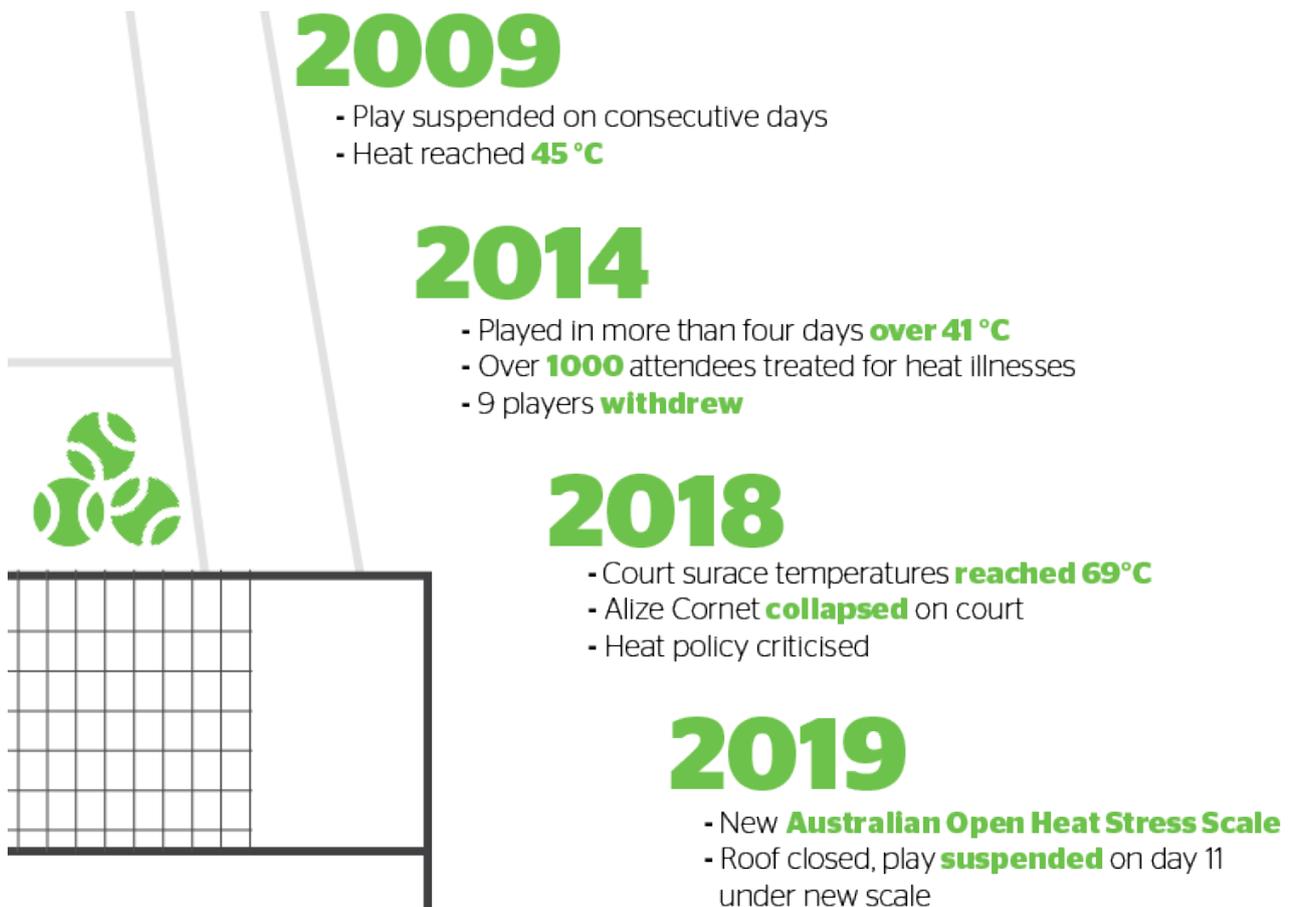
The future of the Australian Open

Reports of Australian Open participants suffering from heat stress in recent years show that even current levels of extreme heat pose significant risks to participants' health.

In the 115 years the event has been running, there has been a significant increase in average daytime temperatures and the number of extreme heat days during Melbourne's summer months.

Looking ahead, high resolution climate models show that under 'business as usual' emissions scenarios, Januarys in Melbourne will heat up, increasing the likelihood of match disruptions. Over the next 40–60 years, average maximum temperatures are projected to increase significantly, as are the number of days at 35°C or above.

Unforced error Climate and heat disruptions to the Australian Open



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These projections suggest that continuing to play the Australian Open in its current format will expose competitors and fans to unprecedented levels of extreme heat. As such, under a business as usual scenario, consideration should be given to a selection of adaptations to reduce the risk of heat stress.

One option would be to move the event to the shoulder months of November or March. Modelling suggests that in the future, these months may soon look similar to Melbourne's Januarys of recent memory. However, such a change would inevitably present significant economic, logistical and cultural challenges. In particular, this report recognises that this could have major implications for the Association of Tennis Professionals (ATP) Schedule.

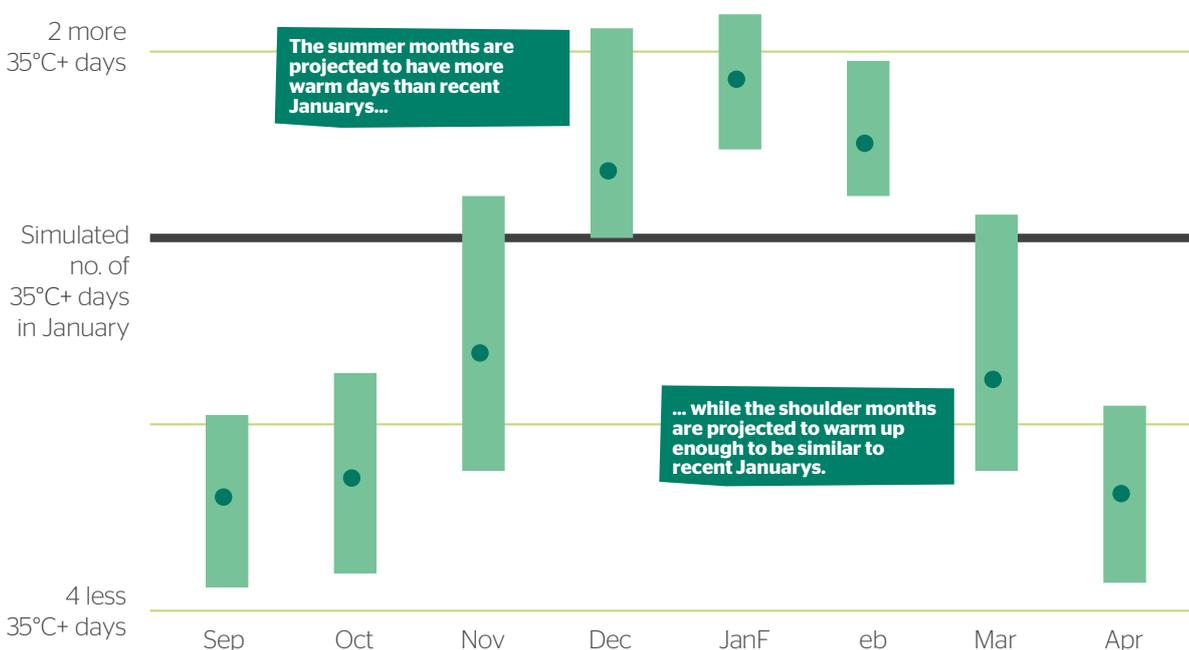
If this disruption was considered too great, another possibility would be to extend the overall length of the event by perhaps a week. At present, games are played right throughout the day, meaning players are still on the court when radiant heat is at its strongest. Extra days of play would provide room to avoid scheduling matches at the hottest time of each day. But this has its own challenges: ticketing would likely change if there were fewer events each day, and the Victorian school holidays currently end immediately after the event.

While neither option—playing the event at a different time of year or extending the tournament—is without risk, this is the unfortunate reality of outdoor sports in a changing climate.

Figure: The projected change in the average number of hot days each year (35°C or hotter) near the Rod Laver Arena each month of the summer and shoulder seasons in 2060–2080, relative to January in 1990–2010. Projections are for the SRES A2 scenario—often referred to as a business as usual scenario—projecting a global temperature rise of 2.0–5.4°C by 2100.³⁷ 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 November and March have a lower number of days at more extreme thresholds.

Turning up the heat on the Australian Open

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



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Climate action scorecard for Tennis 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?

Declined to answer

Assessed what impact heat stress will have on community participation in a changing climate?

Declined to answer

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?

Yes

ANZ is a major event partner of the Australian Open. Between 2015 & the end of 2017 ANZ funded fossil fuel projects that will create 2838 million tonnes of pollution over their lifetimes. **ANZ loan \$7.70 to fossil fuel projects for every \$1 they invest in renewable energy.**

Opportunities for Tennis Australia

Love 40 Degrees? explicitly recognises that for an event the size and significance of the Australian Open, neither adaptation option presented is economically or logistically ideal.

But incorporating extreme heat adaptations to protect participants is only one part of tackling this issue: as the projections in this report show, the impacts of extreme heat will continue to grow in the absence of effective climate change mitigation. As argued by the International Olympic Committee and the United Nations, “while the sport sector alone cannot turn back the tide of climate change, it is a hugely important player in this issue.”³⁸

In 2019, recognising its role in leading climate action, Tennis Australia became one of the largest Australian sporting organisations to sign the United Nations Sports for Climate Action Framework. This framework calls on sporting bodies to acknowledge the contribution of the sports sector to climate change and their responsibility to strive towards climate neutrality.³⁹

Australian Open tournament director, Craig Tiley, declared that “as the biggest sporting event in the world each January, the Australian Open is in a unique position to help drive awareness of the need for increased sustainability”.⁴⁰

“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

In an official correspondence, Tennis Australia confirmed it has “established a sustainability business unit to identify, support and encourage a culture of sustainability throughout both the organisation and the wider sport of tennis.” The organisation also claimed it would conduct other new sustainability initiatives during the 2020 tournament, including assessing its carbon impact. As of 14 January 2020, these initiatives have not yet been published.

These actions demonstrate early progress under the guidelines of the framework. Only time will tell if these early initiatives will fulfill Tennis Australia’s obligations under the UN Sports for Climate Action Framework.

Implementing the framework in full could also reduce the potential legal risk for Tennis Australia. There is growing discussion that, under Australian law, governing bodies that continue to double fault on climate change could potentially soon be held legally responsible for their inaction.⁴¹

Climate change risks may soon represent “material financial issues” for Tennis Australia, making it a primary duty for a director. In such a scenario, directors could face liability under the Corporations Act for failing to adequately address⁴² and report⁴³ these risks; implementing the framework may allow Tennis Australia to manage them.

This January, millions of eyes will be on the Australian Open, as the world’s best tennis players showcase their skills. Tennis Australia has a major opportunity to make a statement to the world by demonstrating its publicised commitment to climate action and in doing so safeguarding one of tennis’ most renowned events.

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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 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>

“

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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