

The  
Climate  
Institute

Sport & Climate Impacts:  
How much heat can sport handle?

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# SPORT & CLIMATE IMPACTS:

HOW MUCH HEAT CAN SPORT HANDLE?

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## WHY + HOW

Sport is embedded in Australians' lives, community and economy. And, like many other areas of Australian life, sport is starting to feel the impacts of climate change, leading to some adaptations and posing questions as to whether others are possible.

This report synthesises recent research on the physical impacts of extreme weather caused by climate change, and analyses vulnerability and resilience to climate change among sporting codes, clubs and grounds across the country.

The goal is to stimulate a broader discussion about climate change amongst sports professionals and administrators, and the millions of fans.

## WHO

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Thanks to Helen Ester, Dr Liz Hanna and Alvin Stone for their assistance with this report.

## WHERE

*Sport & Climate Impacts* and associated interactive content can be accessed at:  
[www.climateinstitute.org.au](http://www.climateinstitute.org.au)

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# FOREWORD

In my role with the AFL in the last few years, I talked to many people about a range of issues — and naturally some of them were closer to my heart than others. The issues I encountered in the AFL are vast; they touch people from every conceivable walk of life. Some resonate on a personal basis more than others.

As a board member of The Climate Institute, I'm engaged on an issue that is important in so many ways. When thinking about how best I could provide a clear understanding of why I'm involved with the Institute, first on my mind is how climate change is impacting us locally and globally. I think about the fact that climate change is gravely affecting the way we live and the way our children will live in decades to come. I think about the effect it's having on infrastructure and the future of our economy, and about the dangerously high global levels of CO<sub>2</sub> we're currently faced with.

The science is loud and clear. Our world is warming, and places like Australia are experiencing ever wilder weather: more drought, bushfires, and other extreme weather events.



The Climate Institute has documented in previous work the impacts of climate on infrastructure and large sectors like finance and transport.

For this summer — and to mark a year since Melbourne experienced a severe heatwave while athletes played multiple-hour tennis matches at the Australian Open — the Institute is documenting the impacts of climate change on sport. Summer and winter sports alike are impacted. Some are showing resilience, changing their practices and amending playing grounds. Others will find adaptation much harder.

Sport, of course, is near and dear to me. So I'm very pleased to provide the opening words to this report.

I hope that you will find it compelling and consider the many aspects of our lives that climate change is altering, in some instances forever. Like in other areas of our society and economy, we need to act now for greater resilience in managing unavoidable climate impacts, but to also call for urgent decarbonisation of the Australian and global economies to avoid unmanageable climate impacts. We can't afford to stay on the sidelines on this issue.

**Andrew Demetriou,**  
former CEO of the Australian  
Football League and Board  
Member of The Climate Institute.

# EXECUTIVE SUMMARY

HEATWAVES, CHANGED RAIN PATTERNS, FLOODS, AND DROUGHT ARE CHALLENGING PLAYING GROUNDS AND FACILITIES AROUND THE COUNTRY. FROM LOCAL TO PROFESSIONAL SPORT, ATHLETES, SPECTATORS, OFFICIALS AND VOLUNTEERS ARE FEELING THE HEAT.

Climate change and extreme weather events threaten the viability of Australian sport as it's currently played, either in the back yard, at local grounds, or in professional tournaments.

Heatwaves, changed rain patterns, floods, and drought are challenging playing grounds and facilities around the country. Continued global warming is and will have direct impacts on all sports. From local to professional sport, athletes, spectators, officials and volunteers are feeling the heat and the very real impacts of climate change.

Sport is embedded in Australian society, and central to our culture and economy. Participation in sport improves mental and physical health, enhances community cohesion, and contributes significantly to employment.

The majority of Australians engage in sporting activities ranging from bush walking to team competition. Almost two-thirds of Australian children participate in organised sport outside school. More than 7.5 million Australians attend a sporting event each year. The sports industry contributes \$12.5 billion to the economy.

But sport can't go on as it has.

Global warming is likened to extreme weather on steroids. For Australia, already a country of extremes, that is bad news. Climate change is making heatwaves more frequent and intense, increasing high and low rainfall extremes and worsening droughts, floods, and bushfires. Average temperatures in Australia have warmed by about 0.9°C since 1910. Seven of the years since 2002 have been the hottest on record.

This report finds that most sports are struggling to cope, especially at the local level. Heat policies are often ambiguous and vary at state, national and international level, with ambiguity about application. Duty of care thresholds vary within and across sports from 32°C to 41°C. By comparison, one of Australia's largest unions, the Construction, Forestry, Mining and Energy Union (CMFEU), is explicit in its heat policy slogan: "35°C, That's Enough".

CSIRO and the Bureau of Meteorology predict the number of days over 35°C across the nation will increase significantly by the end of the century. Hot days will increase 2.5 times in Adelaide, treble in Melbourne and Hobart, quadruple in Sydney, be six times higher in Canberra and 20 times higher in Brisbane. In Perth, for more than two months out of a given year, the mercury will soar over 35°C, as it will for 10 months in Darwin.

The health dangers of extreme heat are well understood. Most of us maintain a core temperature around 37°C. Above 38°C becomes uncomfortable, and with each additional degree health problems progressively kick in. From 40°C onwards death becomes more likely. Athletes are at particular risk, as are vulnerable spectators, especially children and the elderly.

Recently, athletes, spectators and experts have begun speaking up about safety and viability of summer events. During heatwaves, fans at both elite and community level sport have stayed away.

Rumblings are coming from AFL, rugby, cricket, and others. In 2014, major tournaments like the tennis Australian Open and cycling's Tour Down Under in South Australia last year illustrated the challenges.

There have been some changes in sports facilities. The Melbourne Park precinct, where the Australian Open is held, will soon have three arenas with retractable roofs to shade courts and seating areas.

In Queensland adaptations also tackle flooding. Brisbane experienced two major floods in 2011, affecting most of the city, including sporting grounds. Suncorp Stadium, for instance, was covered by 1.5 metres of water. In rebuilding, management took into account changing weather conditions and included many flood resistant adaptations.

Like all major developments and infrastructure, stadiums and other large sporting grounds should not be constructed or enhanced without clear consideration of climate risks. Scenarios of short and long-term climate projections should be taken into account.

Elite sport may be able to afford some adaptations. But the ability to respond at local sporting grounds is more questionable.

Snow sports are also hard hit and their viability in Australia is significantly threatened. Rising temperatures have led to a loss of as much as 40 per cent of snow cover since the 1980s. This has hurt winter tourism in the Australian alps, while many winter athletes like skiers and snowboarders have gone overseas to train.

If we continue to fail to tackle the challenge of climate change, sports and much more will suffer. We have to act to reduce heat trapping pollution but also be much more aware of the growing dangers of unchecked climate change.

# ECONOMICS OF SPORT



Sport is fundamental to Australia's society, culture and economy. Participation in sport improves mental and physical health,<sup>1</sup> enhances community cohesion and well-being,<sup>2</sup> and contributes significantly to employment.<sup>3</sup>

Some 80 per cent of Australians aged 15 and over engage in sporting activities ranging from bushwalking to team competition at least once a year. Almost two-thirds of Australian children participate in organised sport outside school.<sup>4</sup>

Watching sport is also very popular: more than 7.5 million Australians attend at least one sporting event a year.<sup>5</sup>

Among the major codes in 2013, NRL saw 3.1 million people through the gates, soccer's A-League attracted 1.8 million spectators, and cricket attracted 1.7 million fans over the summer.<sup>6,7</sup> However, the biggest crowds by far are for AFL, which drew almost 7 million in 2014.<sup>8</sup>

Sport's popularity has direct economic benefits. In 2012, the AFL earned \$425 million, the Australia Open about \$240 million, Cricket Australia \$206 million (\$296 million in 2013/14), NRL \$136 million and FFA \$95 million.<sup>9</sup> The 2014 Tour Down Under is estimated to have generated about \$46 million for the South Australian economy.<sup>10</sup>

The forthcoming ICC Cricket World Cup and AFC Asian Cup, both in 2015, as well as the 2018 Commonwealth Games are expected to boost the local economies of host cities, as athletes and spectators visit from across the globe. Cricket Australia CEO James Sutherland said he expects the World Cup will bring in at least of \$350 million.<sup>11</sup>

Sport contributes over \$12.5 billion to the economy.<sup>12</sup> It employs 75,000 people.<sup>13</sup> Sport also contributes to the economy by making Australians healthier.<sup>14</sup> Being active makes for more productive workers, according to Frontier Economics, who found that sport in people's lives helps boost the GDP by as much as 1 per cent of GDP (\$12 billion) per year.<sup>15</sup>

The visibility and market power of major sporting tournaments, codes and clubs, and professional sportspeople, earns millions of dollars. Media rights, sponsorships and partnerships form a significant portion of the revenue stream for professional, as well as local, sporting events, leagues, clubs and individual athletes.

But as sporting events look ahead to more sales and profits, they also face significant challenges posed by extreme weather events, like drought, heatwaves, floods and severe storms.



**MORE THAN 7.5 MILLION  
AUSTRALIANS ATTEND  
AT LEAST ONE SPORTING  
EVENT A YEAR.**

AUSTRALIAN BUREAU OF STATISTICS



# CHALLENGING CLIMATE

The impacts of climate change on sport are far-reaching.

Heat directly affects athletic performance and welfare. Drought and changed rainfall patterns affect ground surfaces and increase costs. These range from increased water and energy use to insurance premiums to cover the increased injury risks of harder grounds. Extreme rainfall threatens short-term ground washouts, and more extensive damage to grounds surfaces, which also impact maintenance and insurance costs.

Although Australia's climate is characterised by great variability, the "land of droughts and flooding rains" is experiencing greater climate extremes.<sup>16</sup> Climate change is making heatwaves more frequent and intense, high and low rainfall extremes more frequent and bushfires worse.<sup>17</sup> The last few years have been dominated by these extremes, and include a series of droughts and flooding rains.<sup>18</sup>

Average temperatures in Australia have warmed by about 0.9°C since 1910.<sup>19</sup> Seven of the 10 warmest years on record have occurred since 2002.<sup>20</sup>

2013 was Australia's hottest year on record, also marking the hottest month (January) and hottest day (January 7).<sup>21</sup> 2014 was also boiling — the third hottest on record,<sup>22</sup> and it had the hottest spring.<sup>23</sup>

The frequency of extremely hot days in Australia has already doubled since 1960.<sup>24</sup> By the end of the century, the number of days in a year over 35°C will rise significantly across Australia's major cities, the Bureau of Meteorology and CSIRO have warned.<sup>25</sup>

Five separate studies in 2014 concluded that Australia's climate has shifted and extreme heat waves are more likely to occur.<sup>26-30</sup> Bureau of

Meteorology scientists reported that the frequency of days above 40°C is rising and record hot days now outnumber extremely cold days by more than two to one.<sup>31</sup>

Heatwaves rank as Australia's deadliest natural threat to human life – causing more deaths since 1890 than bushfires, cyclones, earthquakes, floods and storms combined.<sup>32</sup> Looking out to 2050, heat-related deaths across Australia's capital cities are predicted to quadruple.<sup>33</sup>

And it's not just heat. Rain patterns, snowfall and ocean swells are also changing.

Southern Australia – where most of us live and play sport – has seen a significant decline in average annual rainfall. The projections are for significantly reduced rainfall in winter and spring.<sup>34</sup>

At the same time, in the north, the risk of torrential downpours and flooding rises with every degree.<sup>35</sup>

Snowfall has been steadily declining in the alpine regions of south-east Australia since the 1980s, with as much as 39 per cent of snow cover lost in the last decade alone.<sup>36</sup>

And in unwelcome news for surfers, fewer days with large waves are expected to occur in eastern Australia.<sup>37</sup>

If 0.9°C of warming in Australia has led to this, the severity of temperature rises beyond this are hard to grasp.

If the world continues on its current path, global average temperature will rise by at least 4°C. The international community is working towards keeping the rise to below 2°C but it has much to do.

BY THE END OF THE CENTURY, THE NUMBER OF DAYS IN A YEAR OVER 35°C WILL RISE SIGNIFICANTLY ACROSS AUSTRALIA'S MAJOR CITIES. HOT DAYS WILL INCREASE 2.5 TIMES IN ADELAIDE, TREBLE IN MELBOURNE AND HOBART, QUADRUPLE IN SYDNEY, BE SIX TIMES HIGHER IN CANBERRA, AND 20 TIMES IN BRISBANE. IN PERTH, FOR MORE THAN TWO MONTHS OUT OF A GIVEN YEAR, THE MERCURY WILL SOAR OVER 35°C, AS IT WILL FOR 10 MONTHS IN DARWIN. CSIRO & BUREAU OF METEOROLOGY



# MANAGING HEAT & HEALTH

## ONE OF AUSTRALIA'S LARGEST UNIONS HAS A HEAT POLICY EXPLICIT IN THE SLOGAN "35°C, THAT'S ENOUGH".

As heat records were broken throughout Australia in 2014, so too were unprecedented moments marked in the sports arena. Almost every summer sport was affected by extreme heat. Athletes, spectators and experts questioned the logic, safety and long-term viability of scheduling events in the height of summer.<sup>39</sup>

The dangers of extreme heat to the human body are well understood. Humans maintain a core temperature around 37°C. Above 38°C becomes uncomfortable, and with each additional degree health problems progressively kick in. Organ damage occurs. From 40°C onwards death is more likely.<sup>40</sup>

The risk of athletes' body temperature rising towards the 40°C limit in extreme heat, even with moderate humidity is very real. In conditions of over 40°C, like those experienced during the 2014 Australian Open, it can become an "uncompensable environment" where it is impossible to lose heat, in essence overheating the body.<sup>41</sup> Irrespective of the method of measure – whether ambient temperature, or the established wet bulb globe temperature (WBGT) which takes into account temperature, humidity, wind speed and exposure to sunlight – if body temperatures rise too high the risk of heat stress, heat stroke and death become a reality.<sup>42</sup>

It is an employer's responsibility – whether in the sports field or any other – to ensure safe working conditions. See Figure 1.

Governments across the country have guidelines for health in hot weather,<sup>43-44</sup> and unions such as The Construction, Forestry, Mining and Energy Union (CMFEU) make it clear that this is a matter of workplace safety. This union's heat policy is explicit in the slogan "35°C, That's Enough".<sup>45</sup>

With heatwaves intensifying and becoming more frequent into the future,<sup>46</sup> there is a duty of care for sports organisations to adapt their heat policies for future conditions. These should include allowing for longer breaks, scheduling matches to avoid heat, and postponing and cancelling events when key duty of care thresholds are breached.

Heat policies vary significantly among sports and across different levels of the same sport. Some have no heat policy at all. But even where heat policies exist, a consensus is emerging that they are not sufficient and are not being applied appropriately or consistently.<sup>47</sup> Figure 2 shows differing heat policies across sporting codes with threshold temperatures ranging from 32°C to 41°C.

The 2014 Australian Open was an example of a confused approach to heat policies. Tennis matches as long as six hours were played despite temperatures of 41°C for four consecutive days. Officials deliberated enforcing the WBGT thermal stress measure, which is the most commonly used in Australia and the US. They only invoked the policy mid-afternoon on day three of the heatwave as the mercury hit 43.3°C.

FIGURE 1  
WBGT HEAT STRESS MEASURE EXPLAINED



The wet bulb globe temperature (WBGT) can be measured by covering a standard thermometer with a moist cloth and shading it from sunlight. It is always below the dry bulb (standard) temperature – and significantly below if the air is dry. If the WBGT exceeds the skin temperature, it means that heat removal becomes impossible.<sup>48</sup> When playing sport in extreme heat, the body undergoes significant stress and at a certain point cannot recuperate quickly enough to function properly.

Following criticism that players suffered "inhumane" conditions and that the heat policy lacked clearly defined and understood temperature triggers, the Australian Open released an updated extreme heat policy in December 2014.

The new policy provides a framework for the implementation of the policy – announcing that the referee's call to postpone a match will take into account when the ambient temperature exceeds 40°C and WBGT reading exceeds 32.5, whilst considering the forecast and state of play.<sup>49</sup>

AFL, NRL and A-League coaches and player associations have also called for improvements in their respective leagues' heat policies after extreme heat impacted games during 2013, 2014 and 2015 seasons.<sup>50-52</sup>

In February 2013, medical staff were on "high alert" when Port Adelaide and St Kilda locked horns in 38°C in Adelaide.<sup>53</sup> The match went on without triggering the AFL's heat policy, prompting a call for action from coaches. Collingwood coach Nathan Buckley told the press that "there's a duty of care to the playing group to make sure that we shuffle things a little bit to make sure players aren't under undue duress."<sup>54</sup>

The AFL's heat policy relies heavily on the discretion of officials. Quarters may be shortened, more trainers may deliver water and more player rotations may be permitted. However the policy does not outline

the objective measurements used to assess heat stress.<sup>55</sup> At the state level there is slightly more clarity, with explicit recommendations when temperature exceeds predefined thresholds, especially if children are involved.<sup>56</sup>

Elite cycling also suffers from an inconsistent approach to managing heat risks. As the South Australian State Emergency Service declared an "extreme heat warning" in the lead up to the 2014 Tour Down Under, and bushfires threatened the first stage of the race, race director Mike Turtur told media: "We are governed by [Union Cycliste International] rules. There is no heat policy at the UCI."<sup>57</sup>

The absence of a heat policy under UCI jurisdiction also contradicts Cycling South Australia's hot weather policy – which has clear recommendations for cancelling and postponing races above 37°C.<sup>58</sup>

Elite sports must protect the health of their players, spectators and staff and support teams. They must also be moral leaders: highlight the increasing health risks and give the imprimatur to local clubs to install and follow realistic health policies.

Parents will increasingly demand more objective tests rather than rely on subjective tests by local officials. Many of these officials are voluntary and many not be trained in interpreting heat policies.



### AFL National Policy

The AFL's National Extreme Weather Policy<sup>69</sup> and Guidelines for Prevention of Heat Injury<sup>69</sup> say to:

+ Avoid scheduling matches in extreme conditions.

+ In matches already underway, implement more breaks, shorten games, postponement/delay, and/or more water delivery to the field.

The measure and fixed triggers of the policy is not set; it's left to league officials. The policy gives responsibilities to players, clubs and medical officers:

+ Players must monitor hydration, notify medical staff of stress, avoid playing if ill, and apply sunscreen.

+ Clubs must provide cooling aids such as ice vests, report heat stress, and assign an official to monitor heat stress during and after matches or training.

+ Medical officers must identify and monitor vulnerable players' hydration and performance, weigh players to manage fluid requirements, manage symptoms of heat stress and report incidents of heat stress, and ensure proper medical equipment is on hand.

### South Australian National Football League

Policy kicks in if the weather forecast exceeds 32°C, or conditions reach that temperature.<sup>61</sup> The policy prescribes extra breaks at the 15-minute mark of each quarter for two minutes following a next break in play.

At 26-32°C, training hours are cut back and extra breaks are implemented. At 31-35°C, matches can be shortened, postponed, or cancelled. Above 36°C, training and matches are not to be held between 10am-4pm without consultation with the league.

### AFL Victoria Country

Regional leagues in Victoria have different heat policy triggers for children, adolescents and adults.<sup>62</sup>

For forecasts of 34°C+, matches or training involving kids and adolescents should be postponed or cancelled. For adults, training or matches can be rescheduled. But if they continue, additional shading areas and water is to be provided, sessions shortened, and more interchange made between players.



### International Cricket

Rules are dictated by the International Cricket Council (ICC).<sup>63</sup> Umpires can allow for extra drinks intervals in hot conditions. However the ICC is not explicit on heat.

The ICC says that play can be suspended "If at any time the umpires together agree that the conditions of ground, weather or light are so bad that there is obvious and foreseeable risk to the safety of any player or umpire, so that it would be unreasonable or dangerous for play to take place, then they shall immediately suspend play, or not allow play to commence or to restart. The decision as to whether conditions are so bad as to warrant such action is one for the umpires alone to make following consultation with the ICC Match Referee."<sup>64</sup>

### Cricket Australia

Cricket Australia's rules are also not explicit on heat, listing only rain in the dangerous or unreasonable conditions clause. Under extreme heat, umpires can permit extra water breaks.<sup>65</sup>

### The South Australia Cricket Association

Clearly defines extreme heat at temperatures of 37°C+, or 34°C+ for kids in their policy. It provides for umpires to cancel play, vary the starting time and length of a match, and increase hydration and rest breaks under extreme heat.<sup>66</sup>

### Cricket Victoria

Recommends cancelling play or if continued, for matches to include hydration breaks every 30-60 minutes. However extreme heat is not specifically defined.<sup>67</sup>



### Tour Down Under

In 2014, race director Mike Turtur told media: "We are governed by [Union Cycliste International] rules. There is no heat policy at the UCI."

### Cycling South Australia

Racing will be cancelled or postponed on any race day if the Bureau of Meteorology forecasts the Adelaide temperature to be 37°C or higher in the 4:00pm forecast issued the day before, unless it is clearly stated otherwise on the event information. Racing may be modified on any race day by the Chief Commissaire when temperatures are forecast between 32-37°C, and racing will continue as normal below 32°C.<sup>68</sup>

### Cycling Victoria

Under the Victorian policy races are halted at 41°C and above, races are modified, postponed and endurance events can be cancelled at 38-40°C.<sup>69</sup>



### Australian Open

The Grand Slam Committee governs the four major tournaments, the Australian Open, French Open, Wimbledon and US Open. Significantly, the Australian Open updated its own heat policy in December 2014.<sup>71</sup>

Implementation of the policy is at the discretion of the referee, advised by when ambient temperature exceeds 40°C and the WBGT reading exceeds 32.5°C, whilst considering the forecast and state of play.

Matches can be suspended at the end of an even number of games or completion of a tiebreak.

### Tennis Australia

Tennis Australia, the national governing body, updated its Extreme Weather Policy in September 2014.<sup>71</sup> More stringent rules are in place for matches involving people under 16, or seniors. For professional adults, the policy activates at the WBGT:

+ At WBGT of 30°C+, extended breaks are given, and the number of sets in a game is reduced.

+ At WBGT of 34°C+, matches can be suspended or delayed.

FIGURE 2

THE CLIMATE INSTITUTE REVIEWED HEAT POLICIES ACROSS SPORTS, AND FOUND A VAST DIFFERENCE AMONG THEM. EVEN WITHIN A PARTICULAR SPORT, REGIONAL AND INTERNATIONAL POLICIES VARY.

# ATHLETES & COACHES SPEAK UP

In Australia and around the world, extreme weather has led to deteriorating conditions at sporting events in recent years. Athletes, coaches, sports administrators and commentators have spoken up.

Among the most vocal were Winter Olympians during the 2014 games in Sochi, Russia, where unusually warm temperatures led to less snow and hampered many events. Athletes questioned their safety having to compete in such conditions.<sup>72</sup>

US cross country skier Andy Newell led the writing of a letter, signed by 105 Winter Olympians including three Australians, which called on world leaders to take action on climate change and to commit to a global agreement at the Paris climate talks in 2015.<sup>73</sup>

The letter called for leaders to “recognize climate change by reducing emissions, embracing clean energy and preparing a commitment to a global agreement at the UN Framework Convention on Climate Change in Paris 2015 ... The urgency ... is not to be taken lightly since time is definitely something we do not have on our side.” See Case Study: Defrosting Snow Sports, page 25.

In Australia, one of the primary concerns has been the impact of extreme heat.

Last year, in particular, saw a growing chorus of concern for the players and spectators alike. There have been changes to practices, and questions about whether matches should be held at different times of the year, or day.

Melbourne Storm coach Crag Bellamy called for NRL bosses to adjust scheduling to “do the right thing by the players’ welfare” after the Storm’s season opener in 2013 in 34°C Melbourne sun.

Bellamy said: “It just seems to be the heat is coming later in the year than it used to. It used to come in January and February and it’s now coming in March

... It might be something the NRL can have a look at for the first month of the competition, just playing night games.”<sup>74</sup>

Perth Glory coach Alistair Edwards voiced concerns following Glory’s match with Adelaide United. “Being asked to play in those conditions is unacceptable; it ruins the spectacle ... We tried to get the game changed all week, for player welfare issues ... The concern for us is literally the players’ welfare because basically to play in 35 degree heat is dangerous.”<sup>75</sup>

The club’s bottom line also suffered, with only 8,574 fans passing through the gates, 2,000 less than any home crowd to that point of the season.<sup>76</sup>

During the sweltering 2014 Australian Open, Kazakhstani tennis player Galina Voskoboeva said: “We were pushing ourselves so hard. It’s not healthy. Are we going to wait until someone dies on court?”<sup>77</sup>

Cricket Australia is among the sporting bodies that have taken steps to address that worry. Lead Sports dietician Michelle Cort told media last year that when matches are held under extreme heat, the players have “to swallow a thermometer pill inside which monitors core body temperature” as a way of keeping track how much heat they can handle.<sup>78</sup>

Alex Rance, Richmond footballer and 2014 All-Australian centre half-back, talked to The Climate Institute about playing during the 2014 heatwave. He said it affected training, recovery time, and game performance. Rance said he worries about the sustainability of playing in extreme heat in the long-run, for both players and spectators.

“Especially for finals, that’s when you want to see the most elite teams play and if it’s going to be affected by an extreme heat wave ... it’s a real balancing act that the AFL has to play between burning us out and making the game still good to watch, which obviously the environment comes into consideration.”

A ball-girl is assisted from the court after collapsing during the first round match between Milos Raonic of Canada and Daniel Gimeno-Traver of Spain during their first round match at the 2014 Australian Open on Jan. 14, 2014. (AP via AAP/Aijaz Rahi)



**IT LOOKS TERRIBLE FOR THE WHOLE SPORT WHEN PEOPLE ARE COLLAPSING, BALL KIDS ARE COLLAPSING, PEOPLE IN THE STANDS ARE COLLAPSING. IN THIS HEAT, THAT’S WHEN YOU’RE REALLY PUSHING YOUR LIMITS AND YOU DON’T WANT TO SEE ANYTHING BAD HAPPEN TO ANYONE.**

**ANDY MURRAY**

# CASE STUDY: THE AUSTRALIAN OPEN



Russia's Maria Sharapova cools off by pouring water over her head during her women's singles match against Italy's Karin Knapp on day four of the Australian Open tennis tournament in Melbourne on January 16, 2014. (AFP/AAP/Mal Fairclough)

Four consecutive days of temperatures above 41°C during an already hot summer saw part of the 2014 Australian Open dubbed “hot as hell” by media.<sup>79</sup> One of the world's biggest tennis tournaments, heavily attended and watched on TV by millions across the world, became notorious for the unbearable conditions in which athletes and spectators found themselves.

Players hallucinated, collapsed, vomited and labelled the conditions “inhumane”, as matches as long as six hours were played in sizzling heat. Croatian Ivan Dodig questioned if he would die on court.<sup>80</sup> Jamie Murray of the UK experienced painful cramps for several hours after playing.<sup>81</sup> A record nine players retired in the first round.

Players' sneakers and water bottles melted. Ball kids and spectators collapsed, and fans left in droves to avoid the heat. More than 1,000 fans were treated for heat exhaustion, mostly on one particularly hot day.<sup>82</sup>

The heat policy was not implemented until the third day when heat rose above 41°C, despite players, officials and commentators expressing concern about the risk of extreme heat posed to players, spectators and officials. Once activated, the policy still required the roofs on both major arenas to remain open until the completion of a set underway. This meant that, for instance, Italian Karin Knapp and Russian superstar Maria Sharapova played for nearly an hour in unshaded 44°C conditions.

THE RECORD HOT WEATHER EXPERIENCED DURING THE 2014 AUSTRALIAN OPEN HAS HUMAN FINGERPRINTS ALL OVER IT, SCIENTISTS AT THE UNIVERSITY OF MELBOURNE CONCLUDED, WITH ODDS OF 100 TO ONE AGAINST.



Frank Dancevic of Canada lies on the court after collapsing during his first round match against Benoit Paire of France as temperatures topped at 43°C at the Australian Open on January 14, 2014. (AP via AAP/Aijaz Rahi)

Some 643,280 people attended the 2014 Australian Open,<sup>83</sup> down on the 2013 attendance of 684,457.<sup>84</sup> During the worst of the heat, daily attendances fell by 12,000 on Tuesday and 15,000 on Friday. *The Australian Financial Review* reported that the tournament was “set for a large financial loss from the hot Melbourne weather” as ticket sales plunged by 10 per cent, even though pre-sales had been up 8.5 per cent on the previous year.<sup>85</sup>

Meanwhile, major infrastructure systems in Melbourne buckled, resulting in power losses and train and tram service cancellations.<sup>86</sup>

Over 200 people died, more than double the average for that time of year. There was a 20-fold increase in calls to ambulances and most Melbourne hospitals were at capacity.<sup>87</sup>

Melbourne is set to host the Australian Open every January through to the 2030s. Significant improvements in heat management are urgently required to keep players and spectators safe, and the city functioning.

# BUILDING GREATER RESILIENCE

If sport is to keep its fan base and continue earning big profits, arenas and sports grounds across the nation will have to make adaptations to keep players and fans safe.

Various upgrades, from retractable roofs to flood proofing operating systems, are underway. These often come with additional programs on energy efficiency, renewable energy, water conservation, recycling and waste management. This has undoubtedly been motivated by cuts to operating costs as much as by generating environmental benefits. They are all part of attempts to increase resilience to extreme weather events and changed rainfall patterns.

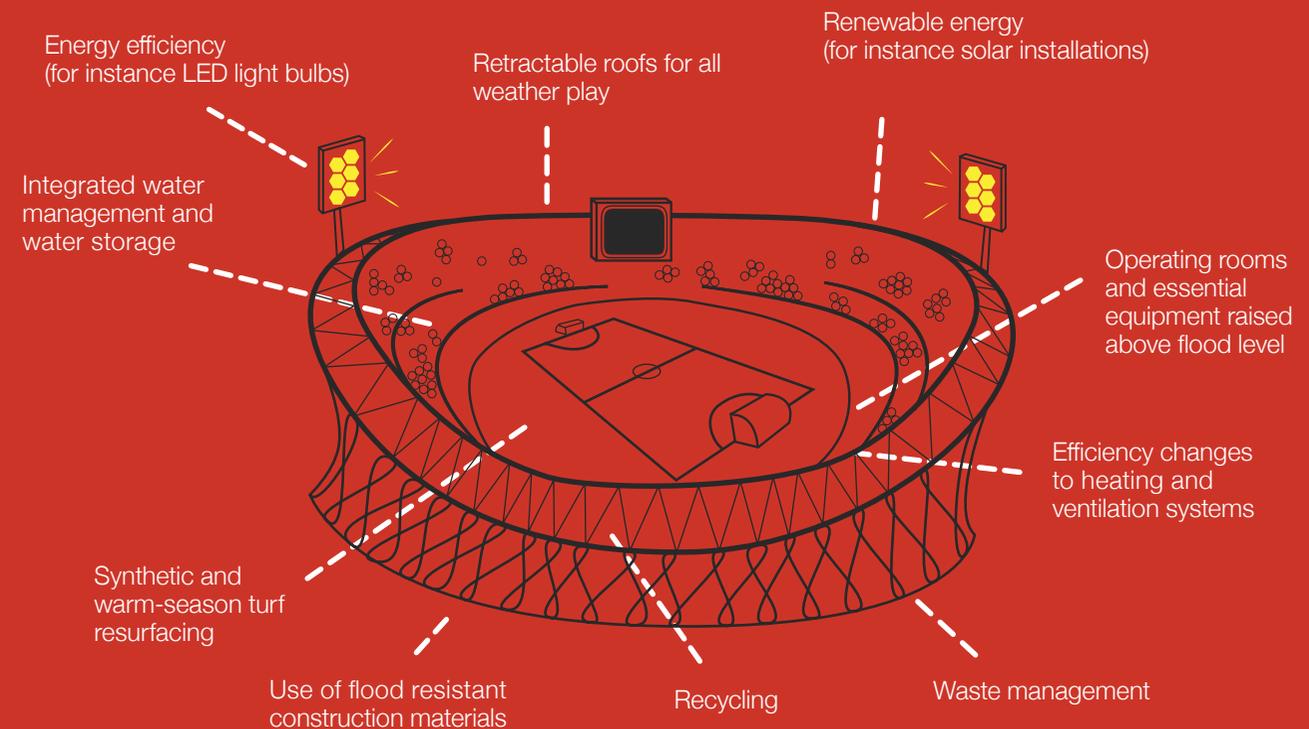
An enduring image from the 2011 floods in Queensland was the Suncorp Stadium field covered by 1.5 metres of the muddy water that engulfed the city. While the stadium was back up and running within four weeks, the damage that was done to the operating systems and equipment meant the Maroons (rugby league), the Reds (rugby union) and the Roar (soccer) all won national titles out

of temporary dressing rooms.<sup>88</sup> For four months the stadium didn't run at full scale, suffering loss of income and the looming possibility of larger insurance premiums.

The total repair bill mounted to \$16 million.<sup>89</sup> Flood resistant construction materials were used wherever practical including block walls and elevated and relocatable fixtures and fittings.<sup>90</sup> The main switchboard was raised above the flood level. Energy and water efficiency measures were put in place, and the stadium now cuts carbon emissions by offering free public transport with ticket sales.<sup>91</sup>

Metricon Stadium on the Gold Coast has also made operational adaptations. The glass edge of the stadium's roof is made from high-efficiency solar panels. In an Australian first, up to 20 per cent of the stadium's total electricity needs will be generated by this solar halo. Metricon also has water tanks with significant capacity and recycles as much as 75 per cent of its waste.<sup>92</sup>

FIGURE 3  
STADIUMS AND OTHER SPORTING GROUNDS AROUND AUSTRALIA ARE MAKING VARIOUS ADAPTATIONS TO COPE WITH EXTREME WEATHER. THIS GRAPHIC ILLUSTRATES SOME OF THE MOST COMMON ONES.



But Melbourne has seen by far the most progressive changes to its arenas.

The Victorian government is revamping the Melbourne Park precinct at a tune of \$338 million. One of the first improvements is a new roof to offer more than 3,200 square metres of shade over and around three of the courts. The roof was fixed in an open position in 2014 and will be fully retractable for the 2015 Australian Open.<sup>93</sup>

Melbourne Park already has energy efficiency measures in place. Integrated water harvesting across the precinct can store 4.5 mega-litres of water for toilet flushing and irrigation, reducing the precinct's water use by 72 per cent.<sup>94</sup>

Nearby Etihad Stadium has a retractable roof, ensuring that events can go on regardless of weather conditions. The roof, the only one of its kind in the Southern hemisphere, can open or close in eight minutes. The stadium has also reduced its water usage by a quarter, by installing 17 rainwater tanks on its roof.<sup>95</sup>

Most recently, the iconic Melbourne Cricket Ground (MCG) partnered with technology giant Siemens AG to minimise its energy consumption. Set to launch in May 2015, the project will result in the MCG generating enough energy savings annually to power 835 houses. The upgrades include energy efficient lights, a new building management system; changes to the heating and ventilation systems; and a new chilled water system and modernised room control.<sup>96</sup>

Like all major developments and infrastructure, stadiums and other large sporting grounds should not be constructed or enhanced without clear consideration of climate risks. This should go beyond assessment of current climate exposure to incorporate future climate change. Appropriate future climate scenarios to consider include the internationally agreed goal of 2°C rise but also, where possible, the 4°C towards which we are heading.

Management strategies for community grounds and sport fields should also consider these climate risks, and also incorporate consideration of the climate scenarios.

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# HURTING LOCALLY



**IN 2007, MORE THAN HALF OF COMMUNITY SPORTING LEAGUES IN RURAL VICTORIA DELAYED OR CUT SHORT THEIR SEASON DUE TO DROUGHT.**

During the Millennium Drought of 2006-2009, ovals and playing grounds across the country dried up and cracked. Impact injuries increased significantly. While elite professional venues may be able to afford expensive upgrades, local grounds will struggle. There's evidence already of this struggle.

Victoria was particularly hard hit.

In 2007, three quarters of metro and rural AFL leagues delayed or cut short their season due to temporary and permanent ground closures. Over 100 community cricket clubs in Geelong were forced to end their season three months early, and football pre-seasons were affected by the lack of available training ovals.<sup>97</sup>

In nearby Dandenong, 74 sports grounds were damaged, costing \$1.3 million to rehabilitate. Insurance premiums rose, and some grounds lost insurability altogether, as was the case for nine cricket grounds in the City of Moonee Valley.<sup>98</sup>

Water restrictions and rising water costs exposed 1,700 water-intensive clay tennis courts throughout the state. Local governments trucked in water for community grounds at significant cost: the city of Boroondara, for example, spent \$550,000 to keep the grounds watered.<sup>99</sup>

In response to the sustained hard, dry playing conditions, the governing bodies of all major Australian football codes and Cricket Australia collaborated with a sports insurance company to develop a new synthetic turf for community fields. This turf replicates the playing characteristics of natural grass, and is arguably one of the first examples of climate change adaptation in Australian sport.<sup>100</sup>

Other responses to warmer, drying conditions include the resurfacing of natural turf grounds with warmer season grasses, and investments in water efficiency and water-harvesting infrastructure. Some of these moves have been supported by government and council grants.<sup>101</sup>

Although innovative, some of these adaptations present new problems. Synthetic grounds, for instance, are highly reflective of heat, raising the ambient air temperature. They also require more upfront capital as they are more expensive to install, which may be an obstacle if clubs are already struggling financially.<sup>102</sup>

THE ARTIFICIAL TURF PROJECT IS ONE  
STEP IN THE BATTLE WITH CLIMATE ISSUES  
WHICH IMPACT ON GREEN OPEN SPACE,  
WHICH IS ESSENTIAL FOR THE SURVIVAL  
OF THE GAME.

AFL, 2008



# CASE STUDY: DEFROSTING SNOW SPORTS

Snow sports are particularly vulnerable in a warming world. Warmer temperatures lead to less snowfall, with consequences for ski seasons, alpine tourism, and athletic training.

In Australia, snow conditions have been declining since the 1980s, with as much as 39 per cent of snow cover lost in the last decade alone. By 2020 that could rise to 60 per cent, according to a Griffith University study.<sup>104</sup> Other studies predict that ski slopes could be mostly bare of snow by 2050.<sup>105</sup>

Alpine resorts make up 2 per cent of Australia's tourism industry.<sup>106</sup> Most of the industry consists of small businesses, operating in winter. Australia is set to lose winter tourism worth around \$1.8 billion, employing some 18,000 people.<sup>107</sup> The decrease in snow cover also has a profound impact on spring and summer water supplies and critical agriculture areas like the Murray-Darling Basin that depend on water from the Australian alps catchments for around 30 per cent of its inflow.<sup>108</sup>

Overseas, the 2014 Winter Olympics in Sochi, Russia, marked a new low in snow conditions during a major sports event. Organisers had stockpiled three years' worth of snow, but temperatures above zero caused constant melting across the courses and venues, endangering the competitors.

In Sochi, over 100 Olympians – including three Australians – signed on to a letter penned by

US skier Andy Newell calling on world leaders to address climate change, which they say is threatening winter sport.<sup>109</sup>

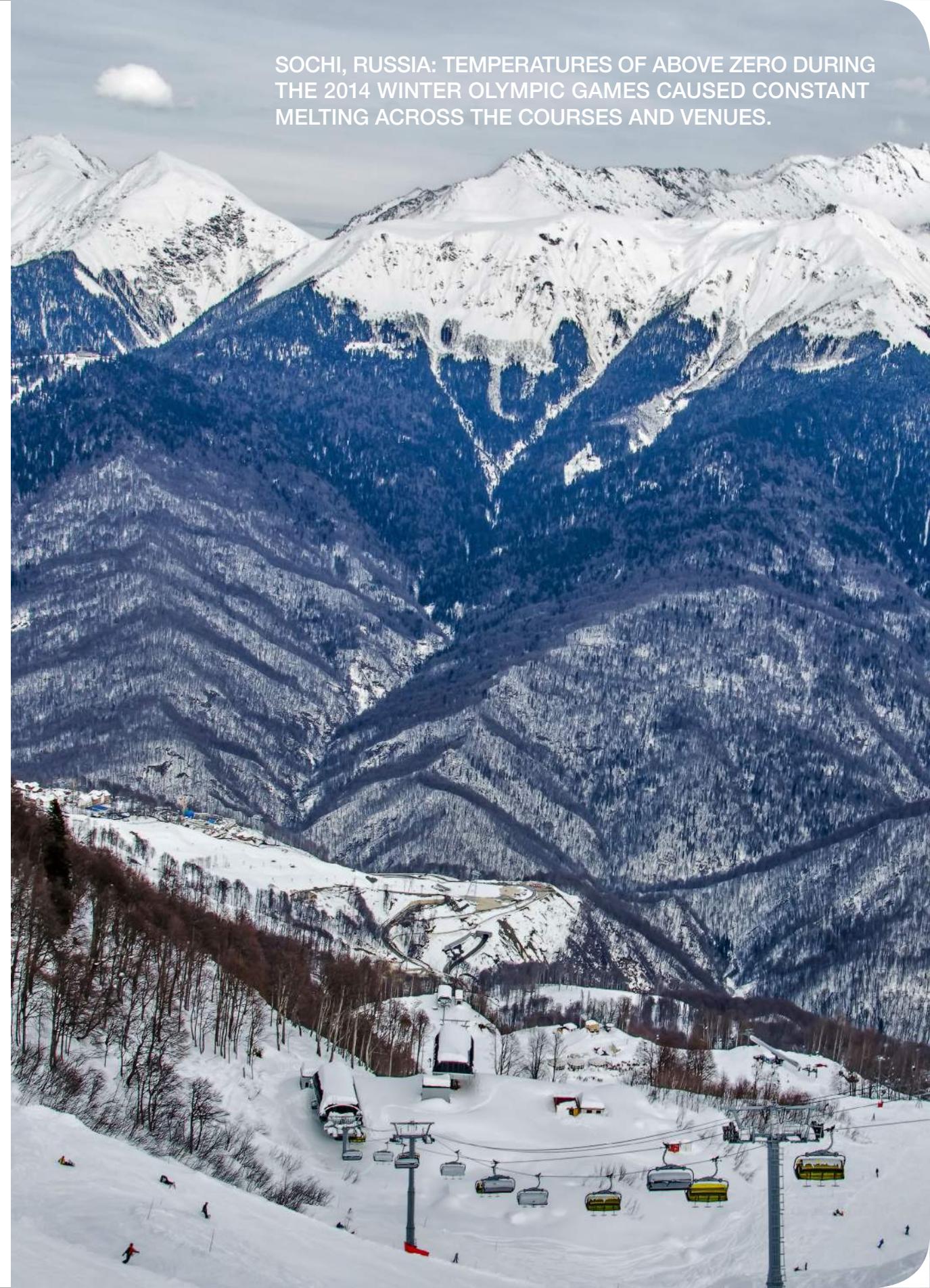
In an interview with The Climate Institute,<sup>110</sup> Newell said: "Snow conditions are becoming much more inconsistent, weather patterns more erratic, and what was once a topic for discussion is now reality and fact. Our climate is changing and we are losing our winters."

The conditions in Sochi were not an anomaly. A University of Waterloo study found that only six out of the 19 locations that have hosted the Winter Olympics since 1924 would have a climate suitable for hosting them again in the late 21st century. Among those that would not be suitable were Sochi and winter favourites like Whistler, Canada.

Snow sport industries have adapted by increasingly heavy reliance on artificial snowmaking, which requires significant water and electricity consumption. As temperatures rise further, snowmaking will become not only more necessary but also more expensive, inefficient and ineffective.

Technological and economic thresholds of snowmaking were reported to be the dominant limit to adaptation in the Australian winter tourism industry.<sup>111</sup>

SOCHI, RUSSIA: TEMPERATURES OF ABOVE ZERO DURING THE 2014 WINTER OLYMPIC GAMES CAUSED CONSTANT MELTING ACROSS THE COURSES AND VENUES.



# Q + A: LYDIA LASSILA

MT BULLER, VIC, 2010: LYDIA LASSILA ENJOYING RARE PROPER SNOW CONDITIONS. LIKE MOST AUSTRALIAN WINTER SPORTS ATHLETES, SHE HAS TRAINED OVERSEAS SINCE 2009 DUE TO THE UNRELIABLE SNOW CONDITIONS IN AUSTRALIA.

Australian freestyle skier Lydia Lassila, who has won gold and bronze at the Winter Olympics, was among the 105 Olympians who petitioned world leaders to address climate change.

**Q: In Sochi, over 100 Olympians signed on to the letter written by US skier Andy Newell warning that climate change threatens winter sport and calling for action from world leaders. Why did you sign?**

Andy's letter really resonated with me prior to Sochi. As an athlete, it's easy to get lost in the preparation and focus of an approaching Olympic Games but no one can deny the grim statistics and impacts of climate change. To think the Winter Olympics may not exist in years to come is a sad thought. But only a small piece in the big picture and there is a lot more at stake, which is why I signed the letter.

**Q: In the letter Andy said that "once-consistent winters" no longer exist in Vermont where he grew up. Can you comment on your own experiences?**

I didn't grow up skiing in Australia and found winter sport when I was 17 years old. But since then my family have enjoyed the benefits of being able to ski on Australian soil. Australian ski seasons are getting shorter and more unpredictable and if it continues down this way, my children, my grandchildren and their children won't get to experience snow in the Aussie alpine regions.

**Q: What do you think are the major impacts of climate change, as you've experienced them?**

Even over the last 14 years of my career, I have seen a shift in pre-season training. It has become more unpredictable and it keeps getting pushed back later into the season not leaving much time to prepare for the World Cup circuit.

We have had to find 'early snow' on glaciers over 3,000 metres (which is not an ideal training altitude for our sport) or in the far north of Finland in order to guarantee we get the pre-season training in. Less and less resorts will be able to host an Olympic Games and it threatens winter sport in general which affects sporting cultures particularly in the northern hemisphere.

**Q: What do shorter seasons and less predictable conditions mean for you and other skiers and snowboarders in Australia?**

Our seasons are too short to get adequate amount of on-snow training. Given the unpredictable nature of our Aussie winter, many Australian athletes already train predominately at overseas facilities or resorts. Although I would like to train on home soil, I haven't been able to since 2009 due to inconsistency of the conditions.



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# CONCLUSION

Among developed countries, Australia is the most vulnerable to the impacts of climate change. These are already felt across many aspects of Australian society, and their severity will increase. Sport, as a key part of Australian life, and a major contributor to economic activity, will need to adapt to this reality. Without urgent climate action there will be limits to the adaptation.

As this report documents, many sporting bodies are beginning to change in a wide variety of ways and with varying effectiveness. Many sports bodies have responded to past experiences of extreme heat, drought and flooding by reducing their exposure to these risks. However, it is less clear that these responses are being done with a clear understanding of future climate change.

To ensure that investments in dealing with extreme weather are sufficient to cope with climate change, the management of sports infrastructure and operations should incorporate climate change projections. Tools are being created to facilitate prediction of climate conditions in specific areas, such as the NSW Department of Environment's recently launched Adapt NSW tool, which gives local projections through 2070.<sup>112</sup>

However, even in the short term there are clearly shortcomings in the ways that some sports manage climate risks. Policies for dealing with extreme heat are variable and often inadequate. These need to be

reviewed to meet a higher duty of care, especially for more vulnerable groups like children and seniors.

Some adaptations, although expensive, are possible for elite sporting leagues that have deep pockets and community reach. But community programs – some of which are already struggling – will only become harder to sustain.

The future holds questions around the viability of outdoor summer sport as we know it, and whether major international tournaments should be moved to different seasons of the year, at great disruption for host cities and organisers. Winter sports are perhaps the most vulnerable, as fewer parts of the world will sustain conditions allowing for sports like skiing, snowboarding and others in a world that is getting hotter.

Sport is an important enabler of our wellbeing and a key entertainment or pastime for our nation. If more than 80 per cent of the nation is involved in sport at least recreationally, then it is an element of life to be preserved for future generations.

All – from professional players and their management, to spectators and commentators – need to be aware of the risks posed by climate change to sport. To manage the risks, we all, including political and business leaders, need to be off the bench and on the field with our best efforts.



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