

# GAME CHANGER II

*The impact of climate change  
on sports in the UK*





This report was produced by:

**BASIS**

With contributions from:

National Centre for Atmospheric Science, University of Reading

Centre for Data Analytics, Bond University, Queensland

Supporting Partners:

Round Our Way, Sport Positive, Cool Down Sport for Climate Action Network

Acknowledgements:

Professor Ed Hawkins MBE

Roger Harding

Dom Giggins

Freddie Daley

Professor Steve Stern

Andrew Hignell

Claire Poole

Fran James

Jonathan Overend





<b>FOREWORDS</b>	<b>PAGE 4</b>
<b>EXECUTIVE SUMMARY</b>	<b>PAGE 6</b>
<b>YOUNG GOV POLLING: VIEWS FROM THE GROUND</b>	<b>PAGE 8</b>
<b>CLIMATE IMPACT ON SPORTS: THE SCIENCE</b>	<b>PAGE 9</b>
<b>FOOTBALL</b>	<b>PAGE 11</b>
<b>STORM BABEL: A GLIMPSE INTO THE FUTURE OF FOOTBALL?</b>	<b>PAGE 14</b>
<b>CASE STUDY: WHITBY TOWN FC</b>	<b>PAGE 16</b>
<b>GOLF</b>	<b>PAGE 18</b>
<b>CASE STUDY: MOND VALLEY GOLF CLUB</b>	<b>PAGE 20</b>
<b>CRICKET</b>	<b>PAGE 21</b>
<b>CASE STUDY: GLAMORGAN COUNTY CRICKET CLUB</b>	<b>PAGE 24</b>
<b>RECOMMENDATIONS</b>	<b>PAGE 25</b>
<b>REFERENCES</b>	<b>PAGE 26</b>

## FOREWORD



BY TAMMY BEAUMONT  
ENGLAND CRICKETER, WORLD CUP WINNER &  
2023 PCA PLAYER OF THE YEAR

For me, sport is unique in how it brings people together.

I have seen this most closely through my time in cricket. I grew up playing at a club which had players from aged five through to 72, and as a teenager I learnt so much from being around club members much my senior, as well as players of different religious beliefs, lifestyles and disabilities.

Communities end up growing around a club, connecting people around shared aims, shared values and shared experiences.

This unique value of sport and club environments is part of what makes the findings of this report so troubling.

From my own experience, I know that more and more severe weather events are taking place regularly and cricket is a game very much affected by these impacts. At my home ground Trent Bridge, the rainfall was so bad in March and April this year that the preparation of some of our practice surfaces was put back by over a month. For ours and many other clubs, most or all fixtures were cancelled or shortened for the first month of the season as a result of poor weather.

Beyond just the loss of missed games in the immediate term, we're risking longer-term impacts on sport too. The more games are called off, the more likely it is that players will lose interest in playing the sport.

While the women's game is still growing in the UK, men's cricket has had a decline in numbers playing recreationally. Were this trend to continue, we could also see it impacting the professional game in the future.

If the cricket season is spent mainly watching it rain or playing on dry, poor wickets, players may leave the sport for a game they get more opportunity in - or stop sport altogether.

We have an opportunity now to start turning this round. Let's draw on the strengths of sport, and its capacity to bring people together, to do just that.



## FOREWORD



BY RUSSELL SEYMOUR  
BOARD CHAIR, BASIS

Since the first Game Changer report was published nearly six years ago greenhouse gas emissions have continued to increase, habitats have been damaged and biodiversity reduced, waste has accumulated in the environment and the human population has increased. The climate, ecological and pollution emergency goes on, and in many areas we are no closer to slowing the trends, let alone reversing them. All of the issues highlighted in the first Game Changer report are still with us, and in most cases they are in a worse state now.

This doesn't mean we should throw our hands in the air in despair and give up - far from it. In fact, it has never been more important for governments, businesses and individuals to understand the issues and be moved to take further action. Sport has a significant, and unique, role to play.

Sport brings together multiple sectors to a focal point at our venues, events and competitions. We build and refurbish venues, we travel, we use energy, we eat and drink, we cook, we clean and we generate waste. At the same time there is no other human endeavor that generates so much interest and passion as sport, and that passion runs through generations – an eight year old and eighty-eight year old can share the excitement and thrill of a ball hit for six, the delight and surprise of a hole-in-one and the anxiety and relief on hearing the final whistle as your team hangs on for the win.

For these reasons, and more, sport has a remarkable reach with an engaged following. This brings an opportunity and a responsibility to help inform and influence fans and participants on sustainability issues, leading to action both at and away from events.

The first Game Changer report looked at how climate change was impacting sports in the UK. This follow up is a timely reminder that there is an existential threat to many sports. Game Changer II focuses on updating the situation for cricket, football and golf, providing evidence of the increasing impacts on these games from grassroots to elite levels and includes personal testimony from engaged athletes about how their playing experience has been affected in recent years.

Let's be clear: these impacts are not restricted to these three sports, nor to turf-based sports – they simply demonstrate the impacts being felt to a greater or lesser degree across all sports at all levels, as our growing network of BASIS members will confirm.

The examples in this report show the negative impacts, but also some of the positive responses. All of the signs are that grassroots participation sport in the UK is being increasingly hit by extreme weather and, until now, our sporting bodies have not moved fast enough to support clubs across the country. This is starting to change and the whole sector should be moved to take action: the future of clubs and all of the social and economic benefits they provide is on the line.

This is one fixture that cannot be postponed.



## EXECUTIVE SUMMARY

*The original Game Changer report, published in 2018, was the first of its kind to focus on the various impacts of climate change on different sports in the UK.*

*Its findings of the extensive risks facing sports were alarming, and sparked a host of additional studies and reports - such as *Hit For Six*, *Playing Against the Clock* and *Slippery Slopes* - that together build a compelling argument for the need to take climate change seriously if we wanted to protect the sports we love and the spectators and participants who harbour a passion for those sports.*

Five years on, as global concern grows and extreme weather events continue to cause chaos, the time feels right for an examination of where we are now at, which has led to this follow-up report, Game Changer II. This report synthesises data, surveys and first-hand experiences of the effects of extreme weather, particularly flooding, on golf, cricket and football. The results reveal a growing upheaval, especially at grassroots level, and reinforce that this issue has never been more vital to sport.

In cricket, across the County Championship we see a staggering 132,644 overs were lost to rain in the ten seasons played between 2013 and 2023.<sup>1</sup> Following in the wake of a men's Ashes series in which heavy rain played a headline role, the rate of abandonment of the England men's home One Day Internationals continues to climb, from 5% to 7% over the last five years. Similarly, the rate of England men's home T20 fixtures where the Duckworth-Lewis-Stern method (a mathematical formulation used to calculate the target score for a batting team when the game is interrupted by weather) has been required, or a match has been abandoned with no result, has increased from 8 to 10%.<sup>2</sup>

Former Glamorgan all-rounder Joe Cooke expresses his fears for how this increase in disruption will impact on the whole sport, from the grassroots to the elite level.

*“Wetter wickets and saturated grounds will affect the development of young players. For example, fast bowlers can't fully bowl at their potential on saturated wickets and can lose their ability to bowl fast [...] I think there is a worry for the future of cricket”.*

In the world of golf, a specially commissioned YouGov poll for this report reveals how 64% of spectators and players have experienced weather-induced disruption (such as rescheduling, reduction in duration or cancellation of matches) in the past year.

Meanwhile, an R&A survey of club professionals, golf course managers, green keepers, committee members and trustees sets out how 73% described flooding from significant rain events as a real threat to golf, with 90% expressing concern. Whilst 55% said it is already having an impact, almost a third (29%) said their club is not ready to deal with it.





Ladies European Tour Professional golfer Hannah Burke tells us about the growing concern amongst players.

*“We as a tour have certainly seen changes. We have had more weather delays, tournaments cut short and course conditions affected by flooding. The players are definitely noticing, as tournaments that have been played for years in the same area and at the same time are being affected”.*

That alarm is echoed in the realm of the country’s most popular sport, football, with Wycombe Wanderers midfielder David Wheeler telling us:

*“There are often comments from teammates about how crazy the weather has been lately. There is definitely a growing sense of concern and awareness [...] The grassroots and lower leagues filter upwards to the top level. If regular football isn’t accessible at this level then the development of the next generation of players will be disrupted”.*

Some organizations, such as Sport England with their plans to make funding dependent<sup>3</sup> on tackling the climate crisis and the aforementioned R&A, are undertaking positive steps. However, as we see in this report, there has never been a greater need for sporting governing bodies to prioritise the collection of data around extreme weather disruption to sporting calendars, from the grassroots level up.

Once sports are properly equipped with consistent and organized data, the increasing disruption and threat posed by climate change can be more efficiently monitored, evaluated and responded to. Without this, sports leave the back of the net unguarded against their greatest adversity: a rapidly altering climate.



*In a YouGov poll commissioned specially for this report, a pool of approximately 2,000 sports fans and participants from across the UK were asked a number of questions relating to their experiences of **climate change associated weather extremes**<sup>4</sup> (such as heavy rain, flooding and heatwaves) impacting sport.*

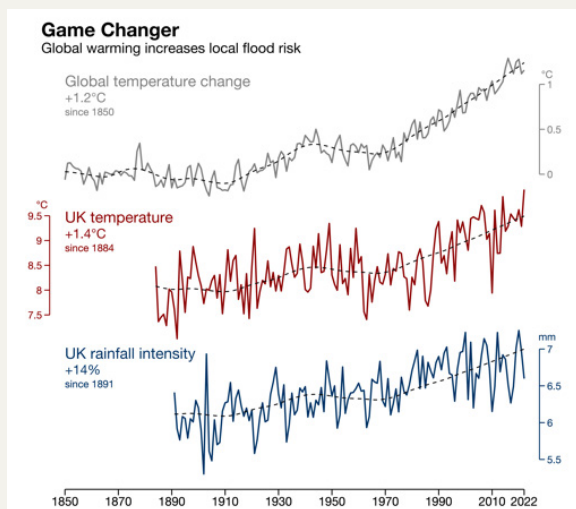
- 64% of golf spectators and players had experienced disruption (such as rescheduling, reduction in duration or cancellation of matches) in the past year since October 2022 while playing or watching due to weather extremes associated with climate change.
- For cricket, 60% of spectators and players had experienced climate-related disruption, whilst for football the figure was 40%.
- 44% of cricket spectators and players polled were worried about the impact on the sport due to the weather extremes associated with climate change.
- In golf, 35% of spectators and players polled were worried.
- 63% of all those polled agreed that the new independent football regulator being created by the government should have a duty to consider the impact of climate change on football and ensure clubs, the Football Association, Premier League and English Football League take appropriate steps to both protect the sport from climate impacts and, as much as reasonably possible, minimise its contribution to greenhouse emissions.



# CLIMATE IMPACT ON SPORTS: THE SCIENCE

BY PROFESSOR ED HAWKINS MBE  
NATIONAL CENTRE FOR ATMOSPHERIC SCIENCE,  
UNIVERSITY OF READING

*In 2021, the Intergovernmental Panel on Climate Change (IPCC) concluded that human activities (mainly burning fossil fuels) are unequivocally warming the planet. International negotiations are targeting rapid reductions in greenhouse gas emissions to reach global 'net-zero' to avoid breaching agreed limits for further temperature rises. However, we are already seeing the devastating impacts of global warming all over the world with hotter heatwaves, heavier rainfall, rising sea levels, increased risk of wildfires, and damaged ecosystems. These consequences will continue to get worse while global temperatures continue to rise.*



Our altered climate is already affecting sporting activities across the UK, whether as a participant or a spectator. As a direct consequence of global warming, the climate of the UK has changed: it is now warmer and wetter than a century ago (Figure 1). The UK has warmed by about 1.4C since 1884, and the UK experienced its warmest year on record in 2022, with a summer heatwave peaking above 40C for the first time. For sports played outside during the summer, heatwaves have already become more frequent and will continue to increase in severity.

Figure 1: Game Changer: global temperatures have increased by 1.2C since the pre-industrial era, leading to warmer UK temperatures and more intense rainfall.

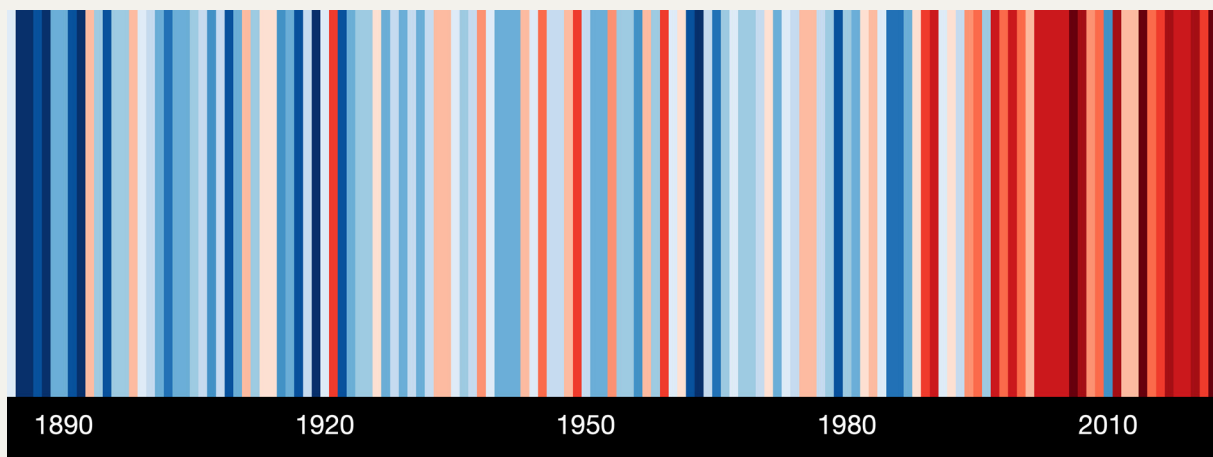


Figure 2: Climate Stripes showing the temperature change in the UK since 1884. <sup>5</sup>





Simple physics tells us that a warmer atmosphere can hold more moisture, meaning that when it rains, it rains more. Since 1891, the average intensity of UK rainfall has increased by 14% which, all else being equal, increases the risk of local flooding. The increases in rainfall are particularly striking in winter, meaning that different sports will be affected in different ways. The five wettest winters on record (since 1836) have all occurred in the last 35 years. Four of the six wettest months on record have happened in the last 25 years. For football and rugby union, the 25% overall increase in winter rainfall means experiencing wetter conditions more often. Drier years will still happen in future, but overall we expect to see further increases in rainfall in winter and autumn, with summer less affected.

The effects of climate change on the UK will involve more and hotter heatwaves and altered rainfall patterns. Our coastline is also at risk. Sea levels have risen by an average of around 20cm around the UK, driven by the melting of glaciers and ice sheets, and because the volume of the water in the oceans increases as it warms. This means that when a storm hits these islands, the

water levels will be higher than they would have been, increasing the risk of coastal flooding and erosion. The IPCC warns of 50-100cm of sea level rise globally by the end of the century, continuing into later centuries, but cannot rule out an even greater rise.

Sporting events are at risk, but they also cause emissions, often through travel of players and fans across the country and around the world. Stadiums and training facilities also consume huge amounts of energy and resources. Major clubs and organisations could set an example for the world by striving for their own net-zero goals, for example by making different choices on player travel, energy use and generation, and offering incentives to fans to travel differently. Starting conversations about climate change is also important and Reading FC adopted a climate change graphic as part of their kit during the 2022-23 season to share the importance of the issue and to recognise the start of their journey towards reducing emissions, while Real Madrid have donned an all-green kit to raise awareness.<sup>6</sup> It will require global efforts to halt global warming, but every action matters.





*The impacts of climate change on football in Britain have become impossible to ignore. Up and down the country, across the seasons, goalposts are literally being moved because of extreme weather. As a result, football's governing body, leagues, clubs, fans and individual players are beginning to recognise the risk posed to the Beautiful Game, and the need for greater ambition and action.*

*The recent sustainability strategy from England's Football Association, the oldest football governing body in the world, acknowledged that "we're already seeing matches affected due to extreme weather – particularly in our grassroots communities", adding that the "climate crisis is one of the most pressing issues of our time".<sup>7</sup>*

*By 2050, 39 of the 92 stadiums in the top four leagues of English football will face a high risk from more than three climate hazards, such as extreme rainfall, drought, flooding, and windstorms.<sup>8</sup>*





While it is true that climate change impacts football and fans as a whole, these impacts are not evenly felt. Some regions of the UK are more affected by specific climate impacts, such as extreme heat or flooding, than others.

The disparity within football across the UK, in terms of financial resources and facilities, also means that many wealthier clubs are better equipped to deal with climate impacts.

Research from the Climate Coalition [found that an estimated 62,500 amateur matches were cancelled](#)<sup>9</sup> or delayed by weather impacts each year, such as heavy rainfall or extreme heat. This is equivalent to every amateur football club in England facing five cancellations or postponements per year on average due to extreme weather.<sup>10</sup> In Wales, this figure rises to seven games a season.<sup>11</sup>

And the exact figures could be far greater than this. In evidence provided to a Select Committee in the UK Parliament, the Chair of the FA Debbie Hewitt revealed that “we have something like 120,000 games a season cancelled because the pitches are not playable”.<sup>12</sup>

While Premier League clubs are expected to face increasing climate hazards, it is the lower sections of the UK’s footballing pyramid that will be hit the hardest, whilst having the fewest resources to address these mounting impacts. Indeed, the financial implications for grassroots, amateur and semi-professional football clubs appear to be of increasing concern within that realm, with clubs across the country fearful for their futures.

Calls for greater climate action are growing louder across the world, from the pitch to the terraces. Over 40 international players heading off to the FIFA Women’s World Cup in Australia and New Zealand this year [joined forces as part of](#)

[one of the largest player-led climate campaigns in football](#),<sup>13</sup> aiming to “accelerate the climate conversation and set a precedent for what athletes can do to push for more environmental policies in football”.

Tessel Middag, the Rangers midfielder and Dutch international, has been one of the [players to speak out](#). She told this report of her concerns:

*“The impact of climate change on football is no longer a distant threat - it is here and now. These impacts will be felt the most in the women’s game and at the lower levels and grassroots due to less funding and lower quality pitches. Not only does this disrupt our ability to play right now, but it could stop new talent from entering the game and hampers fans’ ability to follow football.*

*“Football’s governing bodies need to recognise the threat climate change poses and act accordingly. There is so much more they could do to both reduce football’s impact on the environment and protect the future of football so it can continue to be played and enjoyed by so many.”*

Wycombe Wanderers midfielder and Professional Footballers’ Association sustainability spokesperson David Wheeler has stated that “climate change is the most significant threat to our way of life and the biggest issue of our time”, adding that “football can be a huge player in creating positive action around climate change”.<sup>14</sup>

Speaking to this report, Wheeler provided revealing insights into some of the challenges faced by the football family.

*“I think it was March this year (2023) and maybe one of the summer months where the rain seemed relentless. But for me, it’s more just that the weather doesn’t seem to match the traditional seasons like they used to. There are often comments from teammates*

*about how crazy the weather has been lately. There is definitely a growing sense of concern and awareness [...] but there are few that talk about it publicly. Very few clubs and organisations mention it. The solutions are often how to work around the weather as well, and not to try and tackle the root cause.”*

Although he plies his trade in the realm of professional football, Wheeler is conscious of the struggles engulfing clubs further down the pyramid and their far-reaching impact on the elite game.

“The pitches that are generally played on at this level don’t have the drainage to cope with excessive rainfall, and the surface is not at the quality or maintained to the extent that it could cope with extreme heat either. It will mean lost revenue to the clubs, regularly disappointed players and fans, and fixture congestion that risks the physical health of the players.

“The grassroots and lower leagues filter upwards to the top level. If regular football isn’t accessible at this level then the development of the next generation of players will be disrupted,” says Wheeler, illustrating the long-term implications of the 120,000 cancelled-games-per-season figure cited by FA Chair Debbie Hewitt.<sup>15</sup>

*“Access is everything. If you have regular reliable access to sport facilities, you are much more likely to persevere. It is also only through regular practice that you can produce elite talent at the pinnacle of the sport.”*

As well as affecting the development of players with the potential to emulate the likes of England international Jamie Vardy, who rose up the ranks from park pitches to the Premier League, Wheeler believes passionately in the positive physical and mental health benefits to wider society that would be put at risk.

*“I think football is the most popular sport largely because it is the most accessible and inclusive. The intensity of play can be adapted to fit the needs of the group from walking veterans football to professional and it provides all the physical and mental benefits you need.”*

And Wheeler foresees a scenario whereby if weather conditions continue along current trends and deteriorate further, with more and more events disrupted by rain and flooding, UK grassroots football is left to grapple with an existential crisis.

*“I think you’d be faced with a situation whereby the logical option for football development would be to invest heavily in artificial pitches across the country. However, that would have its own environmental issues!”*

Wheeler is not a lone voice. Fans want to see more from their football clubs too. According to Brand Finance, only 1 in 9 global football fans considers Europe’s biggest five leagues as a positive force for the environment.<sup>16</sup> A similar international trend was highlighted in a survey by the technology and consulting company Capgemini that found 67% of fans feel disappointed that the teams and players they follow are insufficiently prioritising environmental sustainability.<sup>17</sup> A UK-based survey of 1,400 football fans revealed over 90% agreeing on the importance of protecting the environment and fighting climate change.<sup>18</sup>

Comparable sentiments are reflected at club level: a survey of Wolverhampton Wanderers fans found that 85% said they care about environmental sustainability and climate change and a similar number said they had a good understanding of climate change, while 70% of them felt that their club has a responsibility to raise awareness of climate change.<sup>19</sup>

Furthermore, fans are prepared to take action themselves. A survey of football fans by Trainline found that 73% of those travelling to away fixtures wanted to reduce their carbon footprint, emphasising the importance of providing low-carbon travel options for fans.<sup>20</sup>

It is clear that for many within the football family, the effects of climate change and the desire to raise awareness around their impacts are becoming issues of paramount importance.





*Storm Babet, an intense extratropical cyclone that has impacted large swathes of England and Scotland in 2023, has caused widespread disruption, destruction and loss of life. Heavy rainfall has caused extensive flooding, with citizens told to evacuate and hundreds of homes damaged. Roads and railways were forced to close due to flooding and key transport hubs, such as London's King's Cross Railway Station, were ordered to close due to the overcrowding caused by the disruption to travel. In the words of Scottish Justice Secretary, Angela Constance, Storm Babet emphasises that climate change "is a crisis that is here now".*

British football was significantly impacted. Disruptions and postponements rippled through England's League Two and National League tables due to heavy rainfall, high winds and emergency services and transport systems facing extreme strain. Rotherham's game against Ipswich in the Championship was abandoned just three hours before kick-off due to safety concerns, much to the dismay of fans - especially the travelling Ipswich fans that had made the nearly 200 mile journey. If the game had gone ahead, and Ipswich had won, they would have leapfrogged league-leaders Leicester City.

Scottish fixtures were decimated by Storm Babet. On Saturday 21st October, 2023, just two fixtures in the top flight of Scottish football were able to go ahead. Further down the footballing pyramid, the disruptions were even greater. Commenting on the chaos caused by the storm, Chief Operating Officer of the Scottish Professional Football League, Calum Beattie, noted that the league

*"never postpone any matches lightly, but our discussions with the emergency services left us in no doubt that this was the correct decision."*

Stenhousemuir FC of Scottish League Two were one of the many clubs affected. Chairman Iain McMenemy told this report about the impact a postponement has at clubs where every cost counts: "There are always costs that cannot be

recouped as caterers have bought food etc and there will be hospitality bookings that won't come for a revised midweek evening fixture. Therefore a postponed home fixture can cost a club around £10k in actual spend, with around £5-10k in lost earnings at the revised fixture if it is midweek."

It was not the first time the club had a game postponed this season.

*"We had this scenario a couple of weeks prior where we knew the rain was forecast for during the night and all day Saturday, and we were meant to be travelling to Elgin," says McMenemy.*

*"We have had issues previously with their pitch becoming waterlogged and knew that the game would be off. However, the Scottish Professional Football League would not act in advance and would only offer an early morning pitch inspection. Due to travel times, we were forced to set off for the game knowing it was likely to be cancelled, which it was.*

*"At Stenhousemuir, we had our first flooding event in 2021 that impacted inside our stadium. The volumes of rainfall overwhelmed the drains in the roads outside and it caused significant damage inside the club. It happened a second time a few weeks later. Outside of first team issues, we do have to cancel community team training when conditions are particularly poor. This seems to be happening on a more regular basis. It certainly feels like there we*



*now have warmer spells, but much more rainfall. It also seems like we have more extreme events, such as named storms. In terms of football, it is the extreme events that would cause us issues. We may see less games off for snow, but more due to extreme rain and wind.*

*“If the trends continue, then even artificial surfaces will hit a point where they go out of use in extreme weather. For example, an artificial pitch doesn’t have an issue with surface conditions, such as mud. The rain drains through the surface into a good drainage system. However, with some of the more extreme events we are starting to see, as soon as the street drainage systems hit capacity, the drains cannot cope and the water has nowhere to go so pitches will flood. We are starting to see events where entire parts of a community’s drain or sewer system is overwhelmed.*

*“We have around 400 young people attend football programmes every week in our small club. We have over 100 adult participants including opportunities for men and women of all ages and ability. This includes walking football for over 50s, and specific programmes for those with weight concerns. We also have multiple mental health programmes. We are advocates of social prescribing, where people can be referred to our programmes by health professionals, rather than be put on some types of medication. All of this is at risk if facilities become unavailable through climate change.”*

While many matches in the English Premier League and Championship went ahead during Storm Babet, travelling fans faced insurmountable challenges in getting through the turnstiles before kick-off. Flooded roads and railway tracks caused spiralling cancellations across the UK’s transport network left fans stranded and football terraces nearly empty.

Many of the postponed matches are yet to be rescheduled but will inevitably pile on additional pressure for players, fans and clubs facing an already bloated fixture schedule. The destruction wrought by Storm Babet, and the disruption caused to the footballing calendar and fan experience, could provide insight into UK football’s future as extreme weather events become more frequent and severe. Furthermore, it highlights the interdependencies that a flourishing professional (and grassroots) game has, where transport infrastructure and the emergency services need to be made more resilient to increasing climate impacts.

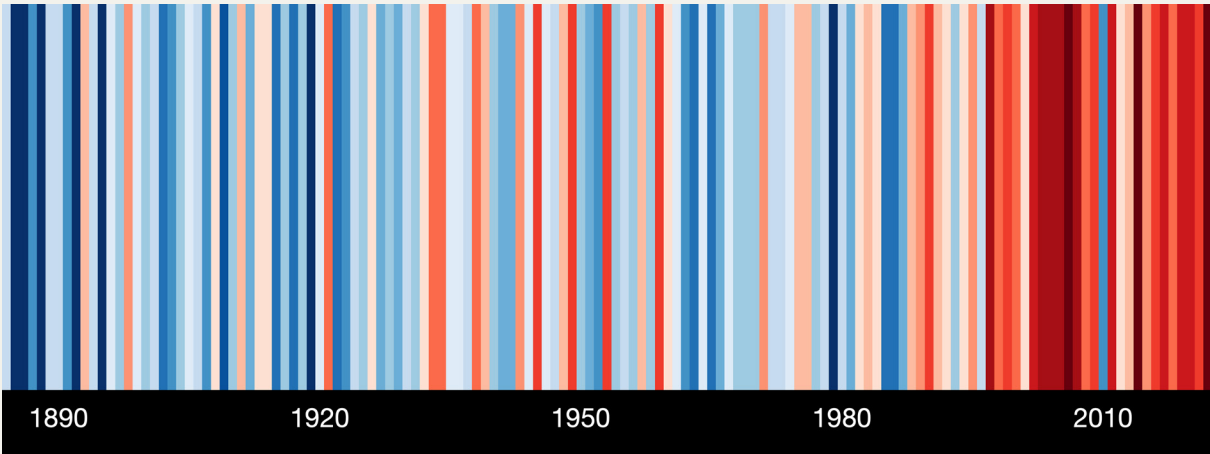


Figure 5: Climate Stripes showing the temperature change in Scotland since 1884. <sup>21</sup>



## CASE STUDY: WHITBY TOWN FC

*Whitby Town FC are a football club based in North Yorkshire, currently competing in the Northern Premier League in the seventh tier of English football. Founded in 1880, they play their home games at a 3,500 capacity ground in the north-west of Whitby.*

*Due to their location, Whitby Town are no stranger to bad weather. However, in recent years staff have noticed an uptick in the disruption caused by extreme weather events and the many challenges that arise. The 2022-2023 season saw extensive fixture disruption due to adverse weather conditions, in particular heavy rain and cold temperatures that caused pitches to freeze, with key fixtures having to be postponed. This year's New Year's Day bank holiday fixture, which was a local derby that usually attracts crowds of over 1,000 fans, had to be called off due to the pitch being unplayable as a result of heavy rain. This ultimately caused a large financial shortfall for the club.*



## CASE STUDY: WHITBY TOWN FC

Alongside rain, the 2022-2023 season saw widespread issues with frozen pitches preventing play. Many clubs in the Northern Premier League do not have the financial resources to invest in equipment to thaw pitches, which creates widespread disruption. Some clubs have invested in artificial pitches, but the disparity between those clubs that have such pitches and those that do not creates additional fixture scheduling challenges.



Whitby Town have also had to deal with the disruption and fall out caused by powerful storms. Storm Arwen, the cyclone that hit the UK in 2021, caused structural damage to the ground and destroyed a set of the floodlights, which fell onto the roof of a stand. In 2018, the 'Beast from the East', which brought strong winds and freezing temperatures to the UK, led to huge disruptions with multiple games called off due to unplayable pitches. As a result, all the fixtures were crammed into the tail-end of the season, which meant Whitby Town had to play on Tuesdays, Thursdays and Fridays. This obviously had a knock-on effect for player performance and fitness, as well as the fans' capacity to attend games.

Whitby Town's experience with increasingly severe and unpredictable weather events is one shared by many other clubs at the lower end of the UK's football pyramid. The disruption from postponed games and unplayable pitches can put considerable strain on clubs' already modest budgets,

which are yet to recover from the shock of the Covid pandemic. In addition, players and fans increasingly shoulder the frustrations and extra costs that arise from continued disruption and subsequent postponements. For instance, on away days, both players and fans can travel considerable distances, at substantial cost, only to find out that games have been called off. When this happens, it is the home club's responsibility to reimburse the travelling team, adding additional costs.

The mounting pressures - both financial and practical - that climate-induced weather events are causing grassroots clubs adds another layer of inequality to the UK's football pyramid. Differing levels of financial resources to address climate impacts and prevent disruptions within and between leagues, as well as the often rigid, one-size-fits-all approach towards pitch inspections and postponements, is stymying lower league clubs. As the impacts of climate change worsen, clubs like Whitby Town will face growing pressures and challenges that restrict their ability to deliver for the fans and communities they represent.





*The original Game Changer report<sup>22</sup> assessed the long-term threat to the UK's Open Championship venues and links courses (the oldest style of golf course, first developed in Scotland).*

*It tracked an upward surge in the levels of disruption caused by increased rainfall and more extreme weather, leading to the more frequent closure of more courses for longer periods. Over a ten year-period, for example, 2016/17 saw as much as 20% less playing time<sup>23</sup> at courses in the Greater Glasgow area than 2006/7.*

*Since the first Game Changer report was published in 2018, more work has been carried out to examine the impacts of climate change on golf<sup>24</sup> around the world. This has been conducted in the context of new extremes of weather affecting the world's leading tournaments - including in just the last year when spectators made a miraculous escape, unscathed<sup>25</sup> after trees crashed to the floor in fierce winds at the Masters (one of the wettest and coldest tournaments on record)<sup>26</sup> and 29mph gusts at the Senior Open Championship.<sup>27</sup>*



One of golf's highest-profile figures, Rory McIlroy, has joined the chorus of those to speak out on the subject, [telling the media at the DP World Tour<sup>28</sup>](#) Championship in 2021 that despite not professing to be an “eco-warrior” he is “someone who doesn't want to damage the environment”. McIlroy, who is based in Florida, went on to note the increased regularity with which he was witnessing extreme weather events.

*“I live in a part of the world where hurricanes are very prevalent and becoming more and more prevalent as the years go on. I think we can all play our part in some way or another.*

*“We play on big pieces of land that take up a lot of water and a lot of other things that could maybe be put to better use.”<sup>29</sup>*

These are challenges which the R&A, golf's governing body outside the USA and Mexico, has recognised and is helping clubs respond to, with dedicated resources to help [coastal clubs manage risks<sup>30</sup>](#) and help all clubs evaluate and [reduce their climate impacts<sup>31</sup>](#).

In the UK, the growing impacts of climate change on golf are increasingly concerning club professionals, golf course managers, green keepers, committee members and trustees.

In a [survey to inform the R&A's sustainability<sup>32</sup>](#) strategy:

- 73% described **flooding** from significant rain events as a real threat to golf, with 90% expressing concern. 55% said it is already having an impact, and almost a third (29%) said their club is not ready to deal with it.
- 70% described **soil saturation/standing water** as a real threat to golf, with 89% expressing concern. 65% said it is already having an impact, and almost a quarter (22%) said their club is not ready to deal with it.
- 37% described **extreme heat** as a real threat to golf, with 66% expressing concern. 30% said it is already having an impact, and more than a third (36%) said their club is not ready to deal with it.

- Almost half (48%) described **drought** as a real threat to golf, with 74% expressing concern. 52% said it is already having an impact, and more than a quarter (27%) said their club is not ready to deal with it.
- 39% described **storm damage** as a real threat to golf, with 67% expressing concern. 26% said it is already having an impact, and more than a third (36%) said their club is not ready to deal with it.
- Only 24% expressed concern about **coastal erosion**, but this rises to 69% when broken down to respondents from links courses, with 46% of links courses reporting that impacts have already been felt, and nearly a quarter (24%) saying their club is not ready to deal with it.

Ladies European Tour Professional golfer Hannah Burke shares many of those worries, relaying them to this report.

*“We as a tour have certainly seen changes. We have had more weather delays, tournaments cut short and course conditions affected by flooding. The players are definitely noticing, as tournaments that have been played for years in the same area and at the same time are being affected.*

*“[This] will affect grassroots golf. If golf courses are struggling to be maintained and to stay open during extreme weather conditions, then that gives less opportunities. It limits playing opportunities for juniors and players working through the ranks. It makes it harder on organisations to put events on and make sure they are funded going forwards. I feel like the strain would be felt on multiple levels and by multiple people.”*

## CASE STUDY: MOND VALLEY GOLF CLUB



*The carnage, chaos and cost experienced by Mond Valley Golf Club in Clydach, Swansea, further highlight those reasons for growing alarm amongst the golf community.*

In September, the club suffered “catastrophic” flooding<sup>33</sup> for the second time in three years.<sup>34</sup> after heavy rainfall, which is becoming more common in the UK because of climate change,<sup>35</sup> caused the River Tawe to burst its banks and flood the course and clubhouse. The water was up to nine feet deep in some parts and even submerged a van.

Club chairman Adrian Jones spoke in September of his despair<sup>36</sup> at the damage, as tables and bins were left floating on the surface.

“The whole of the club, the management board, the membership and everyone is devastated. It’s going to cost us a lot of money and it’s going to be frustrating for the members.

“We hire eight buggies off a firm and the buggies are parked in an elevated area where the water doesn’t normally get to, but the water got to them.”<sup>37</sup>

“It is total devastation here,” Jones added at the time. “We’ve worked so hard to rebuild the club after it was flooded in 2020.

“It’s a big loss of earnings for this time of year where we normally make a lot of money before the winter. We’re just devastated.”<sup>38</sup>

David Waghorn, the club’s president, also spoke of his distress at the flooding’s impact and its sudden onset.

*“It just came suddenly and out of nowhere. At around 10.30 in the morning [September 20th] everything was fine, but by lunch time the pitches, beer garden, the gym and changing rooms were all flooded. We had a steel storage container which was floating.*

*“I don’t remember anything like this. It was like a tsunami coming in. When you see the hard work that’s put into it, all done by volunteers, it’s heart-breaking.”<sup>39</sup>*

Meanwhile, club treasurer John Williams underlined the club’s importance in the local community.

*“It means a tremendous amount [to me]. I love the place. It’s a home [away] from home.*

*“We’ve got over 100 senior members and the club is a focal point. The course is flat and it’s a great meeting place for them.”<sup>40</sup>*





*The fourth Ashes Test at Old Trafford this year will go down in cricket folklore - for all the wrong reasons. The epic see-saw encounter promised to set up the most perfectly poised of climactic clashes in the fifth and final Test. England had Australia just where they wanted them. All they had to do was stay the course to level the series and go to the Oval for a searing winner-takes-all conclusion. Then rain stopped play and in doing so allowed Australia to retain the Ashes<sup>41</sup> in the most damp-squib fashion imaginable.*

*Rain in Manchester in the summer months is not unheard of. However, the nature of the rain (torrential and unceasing) and the unintended consequences of its untimely intervention brought the relationship between rain and results in cricket in this country into sharp focus,<sup>42</sup> and recalled the words of Australian captain Pat Cummins:*

*“Global warming is already wreaking havoc on our sport. And, while sport may not be the obvious or most important reason to tackle climate change, it gives us a window into the kind of future we could be facing.”<sup>43</sup>*



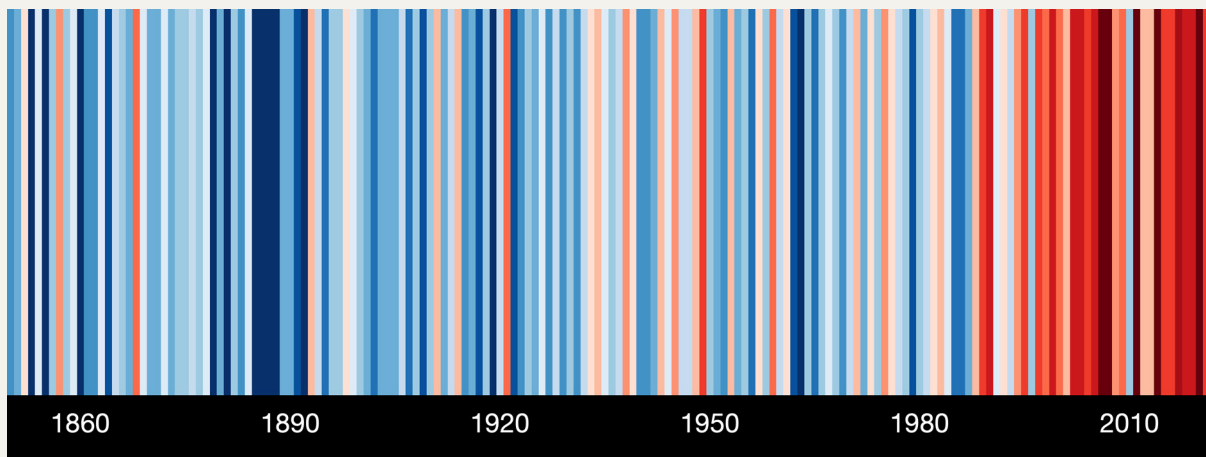


Figure 3: Climate Stripes showing the temperature change in Manchester since 1850 .<sup>44</sup>

Shortly after the Ashes, [rain scuppered key](#) England warm-up matches for the men’s World Cup,<sup>45</sup> [leaving them ‘undercooked’ for the defence](#)<sup>46</sup> of their title as they limped to [calamitous early defeats](#)<sup>47</sup> to New Zealand, Afghanistan and Sri Lanka at the tournament.

The Game Changer report of 2018 was the first time data about disruption to One Day International cricket had been analysed in the context of climate impacts, providing a benchmark for analysis. It was [followed in 2019 by the Hit For Six report](#)<sup>48</sup> which zoned in on the consequences of climate change on cricket around the world, leading the late, great [Shane Warne to call for the sport to be “proactive, not reactive”](#)<sup>49</sup> to the threats it faced.

“At times in the past, it has been hard to know who to believe, but I think we all have to admit now that climate change is a huge issue,” said Warne at the time of the report’s release.

*“Before I’d seen the report I hadn’t really thought about how it would impact the game of cricket. Some of the stuff that we were presented with: how hot it was for some of the players at certain times [...] how dangerous it was for them. How the risks affect local club cricket, how clubs have had their changing rooms destroyed by flooding in the UK, how the rising temperatures affect the way grass grows, was scary”*.<sup>50</sup>

Globally, the Game Changer and Hit For Six reports – and additional studies and articles building on them<sup>51</sup> – have outlined a sport which is amongst the worst-affected.<sup>52</sup> For the ECB (England and Wales Cricket Board) in particular the immediate impacts of periods of extreme rainfall [continue to be felt on a variety of levels](#)<sup>53</sup> - especially regarding pitch damage and match postponements

## FRESH DATA FACTBOX

Five years on from the first Game Changer report and utilising the same data sources and analytical methodology,<sup>54</sup> Game Changer II can reveal that:

- The rate of abandonment of the England men’s home One Day Internationals has increased from 5% to 7%.<sup>55</sup>
- The rate of England men’s home T20 fixtures where DLS has been required, or a match has been abandoned with no result, has increased from 8% to 10%.<sup>56</sup>
- In our first ever analysis of the England women’s home One Day Internationals, between 2018 and 2023 the disruption has increased to 12%, compared to 11% between 1999 and 2017.<sup>57</sup>
- Across the County Championship, 132,644 overs were lost to rain in the ten seasons played between 2013 and 2023.<sup>58</sup>



In the [original Game Changer report](#),<sup>59</sup> standout statistics included:

- 29 of 108 England men's team home One Day Internationals (50 overs) being rain-affected (27%). Of these, 18 used the Duckworth-Lewis-Stern method<sup>60</sup> (17% of total). Overall, 5% of matches during that time period were abandoned completely.
- Across the County Championship, at least 175 days - around 16,000 overs - were lost in five of the previous ten years.

Former Glamorgan all-rounder Joe Cooke is acutely aware of the challenges posed by the changing climate picture both at home and abroad.

*"In the 2021 County cricket season, there was a month of really wet weather in the UK where pitches were totally saturated and we didn't play more than three days out of four for about five games on the trot. This affected games and scores were really low during this time."*

*"This season at the grassroots level there has been an unusual level of postponements. In the North West where I played this year, and more generally, wicket conditions have been poor throughout the year which has negatively impacted the quality of cricket in my local league."*

Cooke believes that the consequences of such change could be far-reaching and drastic, ultimately impacting both ends of the cricketing spectrum in this country and potentially undermining the professional journey of the next Ben Stokes.

*"Wetter wickets and saturated grounds will affect the development of young players. For example, fast bowlers can't fully bowl at their potential on saturated wickets and can lose their ability to bowl fast."*

From his experiences in the dressing-room, Cooke is aware of a mounting sense of concern amongst players and cites some positive steps being undertaken.

"There is a lot starting to happen within cricket. Three or four counties have appointed heads of sustainability at their respective organisations and MCC (Marylebone Cricket Club) have recently launched a net zero strategy.

"I think athletes generally are starting to appear more educated and aware of the issues that the climate crisis will bring to cricket, especially since Pat Cummins's interest and voice on the topic.

*"Cricket is on the right path with the ECB acting on sustainability and helping counties to become more sustainable."*

However, Cooke's overriding feeling is one of deep alarm and frustration.

"There are still lots of organizations that have yet to take action or get involved and, even though there is a growing concern, it is still not the 'norm' to do so.

"I think there is a worry for the future of cricket. Innovation in terms of mitigating the impacts of the climate crisis, as well as action on sustainability and leading the conversation, is needed.

*"The Ashes this summer was a great opportunity for cricket in the UK as it created so much attention from people outside of the normal cricket sphere, reminiscent of the 2005 series which rejuvenated the sport. So for the Ashes series to be affected so directly by weather in the Old Trafford Test has a foreboding feel to it about future impacts on the sport."*

And Cooke is adamant that it is not something that wider society, let alone the sporting community, can afford to ignore or trivialise.

*"Cricket is a great sport for physical well-being as older ages can continue to play due to there being less impact on the body. The mental side of cricket is even more essential though, as there isn't a sport like it for social interactions. You get to know your teammates way more during a cricket match than in any other sport. And the connection to nature and being outside for a long time during the day is also so important to us."*

# CASE STUDY: GLAMORGAN COUNTY CRICKET CLUB

*Dan Cherry is head of operations at Glamorgan County Cricket Club, where the above County Championship data is collated, monitored and assessed. He has noted the changing nature of the disruption over the last few years, telling this report:*

“The main thing we have seen has been the changes in extremes of weather – we have experienced hotter, drier periods alongside more sustained bursts of wet weather. This has made it more challenging to deal with for grounds teams across the country.

“I think if you talk to all venues they would acknowledge that it is a changing picture and becoming more difficult to predict. We try hard to ensure that the customers are updated and that they have things at the venues to keep them busy but ultimately they have chosen to come and watch the cricket so if there is no live cricket to watch then I can understand how frustrating it must be.

*“People are now far more aware of the changes and the challenges that it presents. It is a real concern knowing that something that is effectively out of your control can play such a major part in your event. There have been a number of high-profile matches called off or disrupted in past seasons and this has a detrimental effect on future ticket sales, match experience for the customers and essentially has a very negative financial impact on the venue hosting the matches.”*

Cherry’s experiences and the latest data highlight how the issues raised by the Game Changer report in 2018 persist and continue to cast an ominous cloud across the sport.

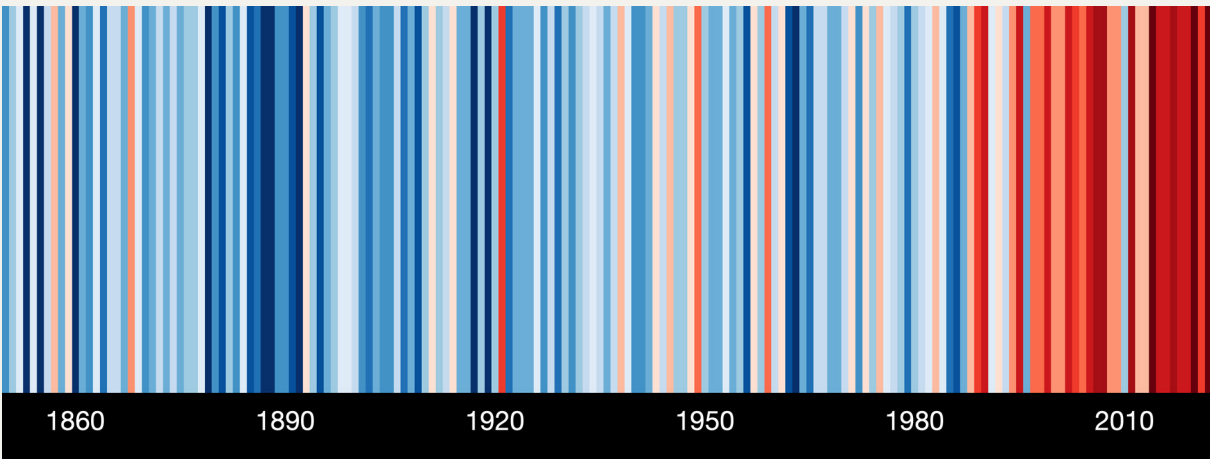


Figure 4: Climate Stripes showing the temperature change in Cardiff since 1850.<sup>61</sup>



## RECOMMENDATIONS



The unpredictability of the elements is an intrinsic part of outdoor sport, especially in the UK. However, there is a point at which the disruption caused by the increasing regularity of extreme weather patterns seriously undermines rather than enhances competitive integrity and the enjoyment for participants, fans and organizations. Five years after the publication of the first Game Changer report, it feels like we are hurtling towards that tipping point at an inexorable pace.

The rise in applications to Sport England’s emergency flood relief funding (from 132 in 2016 to 460 in 2022)<sup>62</sup> further underlines how the burgeoning financial impacts of flooding are being felt forcefully in the semi-professional and grassroots sphere. In addition to the social and cultural loss this would present for individuals and communities, this also threatens to create an existential crisis for a key part of the sporting pyramid in this country: if grassroots sports topple, elite sport is poised to find itself on barren foundations.

We have seen the progressive steps taken by some organisations, such as the R&A, in seeking to take the front foot in the fight against the consequences of climate change.

However, [as outlined by Sport England in their current moves](#)<sup>63</sup> to make funding contingent on fighting the climate crisis, sustainability must be properly planned, actioned and delivered upon. There has never been a greater imperative for the various stakeholders in sport to take pragmatic strides, centred around organized data collection, to track, assess and respond to the growing challenge.

To achieve this and honour [the rallying call](#)<sup>64</sup> of late cricketing legend Shane Warne to be “proactive, not reactive” in this field, the following core recommendations should be implemented by the end of 2024:

### DATA COLLECTION

1. The governing bodies of all sports in the UK to lead the world in adopting a systematic approach to collecting data on the impacts of climate change on their sport at all levels.

### TRANSPARENCY

2. The governing bodies of all sports in the UK to publish an annual Climate-Sport Risk Register, based on this data, outlining impacts and mitigation strategies.

### FUNDING

3. The Government to work with the statutory agencies and all governing bodies to ensure there are specific funds available to enable sports to manage the impacts of climate change.

### COOPERATION

4. All governing bodies in sport to commit to working in partnership to share knowledge, experience and expertise in managing the impacts of climate change in sport.

### REGULATION

5. Parliament to ensure that football’s proposed Independent Regulator is given a clear mandate to monitor and make provisions for the long-term impacts of climate change on the sport.



## REFERENCES

- 1 Glamorgan County Cricket Club historian. Data direct from source.
- 2 Professor of Data Science, Bond University, Queensland. Data direct from source, compiled for the ICC.
- 3 <https://www.theguardian.com/sport/2023/oct/11/sport-england-tells-sports-fight-climate-crisis-or-youll-get-no-funding>
- 4 <https://www.metoffice.gov.uk/weather/climate-change/what-is-climate-change>
- 5 <https://showyourstripes.info/l/europe/unitedkingdom/all>
- 6 <https://www.thesun.co.uk/sport/football/10502957/real-madrid-all-green-kit-espnyol-climate-change/>
- 7 [https://www.thefa.com/news/2023/jul/06/new-five-year-sustainability-strategy?utm\\_source=substack&utm\\_medium=email](https://www.thefa.com/news/2023/jul/06/new-five-year-sustainability-strategy?utm_source=substack&utm_medium=email)
- 8 <https://www.zurich.co.uk/media-centre/football-and-climate-change>
- 9 [https://www.mirror.co.uk/news/uk-news/grassroots-football-risk-extinction-weather-25011077#google\\_vignette](https://www.mirror.co.uk/news/uk-news/grassroots-football-risk-extinction-weather-25011077#google_vignette)
- 10 [https://www.mirror.co.uk/news/uk-news/grassroots-football-risk-extinction-weather-25011077#google\\_vignette](https://www.mirror.co.uk/news/uk-news/grassroots-football-risk-extinction-weather-25011077#google_vignette)
- 11 [https://www.mirror.co.uk/news/uk-news/grassroots-football-risk-extinction-weather-25011077#google\\_vignette](https://www.mirror.co.uk/news/uk-news/grassroots-football-risk-extinction-weather-25011077#google_vignette)
- 12 <https://committees.parliament.uk/oralevidence/12939/html/>
- 13 <https://www.theguardian.com/football/2023/jul/13/womens-world-cup-players-launch-footballs-biggest-climate-campaign>
- 14 <https://www.wvfc.com/news/2023/february/02/david-wheeler-pfa-champion/>
- 15 <https://committees.parliament.uk/oralevidence/12939/html/>
- 16 [https://brandirectory.com/rankings/football/?utm\\_source=substack&utm\\_medium=email](https://brandirectory.com/rankings/football/?utm_source=substack&utm_medium=email)
- 17 [https://www.capgemini.com/news/press-releases/69-of-fans-prefer-to-watch-sports-outside-the-venue-especially-younger-generations/?utm\\_source=substack&utm\\_medium=email](https://www.capgemini.com/news/press-releases/69-of-fans-prefer-to-watch-sports-outside-the-venue-especially-younger-generations/?utm_source=substack&utm_medium=email)
- 18 <https://footballforfuture.org/blog/government-must-incorporate-environmental-sustainability-into-fan-led-review-next-steps>
- 19 <https://www.wolves.co.uk/news/sustainability/20230127-fan-survey-feeds-one-pack-one-planet-project/>
- 20 [https://news.railbusinessdaily.com/4000-tonnes-of-co2-emissions-savings-available-for-premier-league-away-fans-who-leave-the-car-and-take-the-train/?utm\\_source=substack&utm\\_medium=email](https://news.railbusinessdaily.com/4000-tonnes-of-co2-emissions-savings-available-for-premier-league-away-fans-who-leave-the-car-and-take-the-train/?utm_source=substack&utm_medium=email)
- 21 <https://showyourstripes.info/l/europe/unitedkingdom/scotland>
- 22 [https://static1.squarespace.com/static/58b40fe1be65940cc4889d33/t/5a85c91e9140b71180ba91e0/1518717218061/The+Climate+Coalition\\_Game+Changer.pdf](https://static1.squarespace.com/static/58b40fe1be65940cc4889d33/t/5a85c91e9140b71180ba91e0/1518717218061/The+Climate+Coalition_Game+Changer.pdf)
- 23 [https://static1.squarespace.com/static/58b40fe1be65940cc4889d33/t/5a85c91e9140b71180ba91e0/1518717218061/The+Climate+Coalition\\_Game+Changer.pdf](https://static1.squarespace.com/static/58b40fe1be65940cc4889d33/t/5a85c91e9140b71180ba91e0/1518717218061/The+Climate+Coalition_Game+Changer.pdf)
- 24 <https://edition.cnn.com/2021/12/08/golf/climate-change-sustainability-spt-intl-cmd/index.html>
- 25 <https://www.theguardian.com/sport/2023/apr/07/miraculous-escape-for-spectators-as-three-trees-are-blown-over-at-masters>
- 26 <https://www.foxweather.com/weather-news/will-rain-impact-the-masters-tournament>
- 27 <https://www.sportskeeda.com/golf/news-it-absolute-carnage-justin-thomas-enjoying-watching-senior-open-affected-extreme-weather>
- 28 <https://edition.cnn.com/2021/12/08/golf/climate-change-sustainability-spt-intl-cmd/index.html>
- 29 <https://edition.cnn.com/2021/12/08/golf/climate-change-sustainability-spt-intl-cmd/index.html>
- 30 <https://assets-us-01.kc-usercontent.com/c42c7bf4-dca7-00ea-4f2e-373223f80f76/925194a4-4d9d-4aee-b6cf-c1926aceaaff/Coastal%20Management%20for%20Golf%20Courses.pdf>
- 31 <https://assets-us-01.kc-usercontent.com/c42c7bf4-dca7-00ea-4f2e-373223f80f76/ec770df8-b44b-490d-9bc0-2f69c13f6e6d/Climate%20Impact%20of%20Golf%20Courses.pdf>
- 32 <https://www.sportinginsights.com/case-studies/>
- 33 <https://www.itv.com/news/wales/2023-09-24/golf-club-flooded-for-second-time-in-three-years-calls-for-better-defences>
- 34 <https://www.bbc.co.uk/news/uk-wales-66882303>
- 35 [https://twitter.com/ed\\_hawkins/status/1715093147712192626](https://twitter.com/ed_hawkins/status/1715093147712192626)
- 36 <https://www.walesonline.co.uk/news/wales-news/gallery/devastated-golf-club-left-almost-27762881>
- 37 <https://www.walesonline.co.uk/news/wales-news/gallery/devastated-golf-club-left-almost-27762881>
- 38 <https://www.bbc.co.uk/news/uk-wales-66882303>
- 39 <https://www.thegolfbusiness.co.uk/2023/09/it-is-total-devastation-as-welsh-golf-club-hit-by-flooding/>
- 40 <https://www.itv.com/news/wales/2023-09-24/golf-club-flooded-for-second-time-in-three-years-calls-for-better-defences>
- 41 <https://apnews.com/article/ashes-cricket-england-australia-old-trafford-weather-7bf6e57c6d82cbf6e28f6f40a73dadfc>
- 42 <https://www.mirror.co.uk/sport/cricket/manchester-weather-live-ashes-test-30532880>
- 43 <https://www.theguardian.com/sport/2022/feb/03/the-climate-crisis-is-wreaking-havoc-but-sport-can-be-a-part-of-the-solution>
- 44 <https://showyourstripes.info/l/europe/unitedkingdom/manchester>
- 45 <https://www.skysports.com/cricket/news/12123/12970390/england-vs-ireland-final-odi-in-bristol-abandoned-to-rain-to-see-hosts-clinch-series-1-0>
- 46 <https://www.telegraph.co.uk/cricket/2023/10/06/england-cricket-world-cup-defence-preparation/>
- 47 <https://edition.cnn.com/2023/10/15/sport/afghanistan-england-cricket-world-cup-spt-intl/index.html>
- 48 <https://basis.org.uk/resource/hit-for-six/>
- 49 <https://www.theguardian.com/sport/2019/sep/13/shane-warne-cricket-climate-crisis-dangers>
- 50 <https://www.theguardian.com/sport/2019/sep/13/shane-warne-cricket-climate-crisis-dangers>
- 51 <https://rapidtransition.org/resources/playing-against-the-clock/>
- 52 <https://www.bbc.co.uk/sport/cricket/59166403>
- 53 <https://www.theguardian.com/sport/2022/feb/23/the-spin-stormy-weather-cricket-clubs-battling-new-season>
- 54 Bond University Professor of Data Science Steve Stern for international matches and Andrew Hignell, leading archivist and historian at Glamorgan County Cricket Club, for domestic matches.
- 55 Professor of Data Science, Bond University, Queensland. Data direct from source, compiled for the ICC.
- 56 Professor of Data Science, Bond University, Queensland. Data direct from source, compiled for the ICC.
- 57 Professor of Data Science, Bond University, Queensland. Data direct from source, compiled for the ICC.
- 58 Glamorgan County Cricket Club historian. Data direct from source.
- 59 [https://static1.squarespace.com/static/58b40fe1be65940cc4889d33/t/5a85c91e9140b71180ba91e0/1518717218061/The+Climate+Coalition\\_Game+Changer.pdf](https://static1.squarespace.com/static/58b40fe1be65940cc4889d33/t/5a85c91e9140b71180ba91e0/1518717218061/The+Climate+Coalition_Game+Changer.pdf)
- 60 <https://www.espn.com/story/how-the-duckworth-lewis-stern-method-works-1102000>
- 61 <https://showyourstripes.info/l/europe/unitedkingdom/cardiff>
- 62 Sport England, emergency flood relief fund. Data direct from source.
- 63 <https://www.theguardian.com/sport/2023/oct/11/sport-england-tells-sports-fight-climate-crisis-or-youll-get-no-funding>
- 64 <https://www.theguardian.com/sport/2019/sep/13/shane-warne-cricket-climate-crisis-dangers>