



Playing Against the Clock: Global Sport, the Climate Emergency and the Case For Rapid Change

David Goldblatt

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Introduction: Playing against the clock

Like every other industry and cultural sector, global sport has been brought to a shuddering halt by the coronavirus pandemic; leagues and competitions have been in suspended animation, mega events from the Tokyo Olympics to Euro 2020 have been postponed, the suspension of ticket sales and broadcasting deals have placed many institutions and their staff in penury.

Although some professional leagues are returning to empty stadia, the longer term fate of mass sporting crowds is opaque. Yet devastating as this has been, something even more problematic is waiting in the wings for the sporting circus.

Climate change is touching every aspect of human life and global sport is no exception: in 2019, the Rugby World Cup was disrupted by unprecedented pacific typhoons; in early 2020, the Australian Tennis Open was disrupted by the smoke blowing in from the country's devastating bush fires. The Tokyo 2020 Olympics were forced to move long distance running events north of the capital as the city's sweltering summer weather now makes them impossible to run.

Coronavirus is not climate change, but there are a number of clear lessons from the current crisis: take the science seriously and assume the worst-case scenario can happen, act now not later, and act radically. The international community in the form of the Paris Climate agreements, is committed to limiting global heating to 2°C with the ambition of going further to keep temperatures below 1.5°C, and achieving carbon neutrality by 2050. However, the IPCC, whose job it is to advise governments, argues that if we are to mitigate the worst aspects of climate change then we need to aim for the 1.5°C limit, and make most of our carbon reduction in the next decade. In 2018, they concluded that this meant 'rapid, far-reaching and unprecedented changes in

all aspects of society.' If sport moved on this agenda, what kind of changes would it make?

In **Section 1, The Stadium's on Fire!** I review the many ways in which climate change is already taking its toll on global sport, and the scale of the risks and difficulties ahead. Needless to say, it's not looking good: climatological and economic demise for winter sports awaits; heatwaves and heat strokes for players and public alike, extreme weather that floods stadiums and grassroots playing fields; sea level rises that will inundate football grounds and sweep away golf links.

Sport is not just a victim of change, however, but an important contributor too. The IOC has a carbon footprint close to that of Barbados, global football's is even larger. Sporting events are responsible for massive levels of aviation, carbon heavy stadium construction, and mountains of unrecycled garbage, all making a significant contribution to the catastrophe now engulfing us.

If the sports world is to make its own contribution to climate change action, then it needs to acknowledge its own role in creating the problem and radically reduce its carbon footprint, and thus it needs to know how much carbon it is actually producing. No one currently knows, and the research that has been done on different sporting events and institutions is very patchy. In **Section 2: Putting up a Big Score**, I work with what is available and offer my best estimates of global sport's carbon emissions, which, if the order of magnitude I had calculated

is correct, make sport the equivalent of nations as large and populous as Angola or Tunisia, and that is at the low end of estimates.

The sports world, to its credit, has not been entirely oblivious to environmental issues over the last quarter of a century. The IOC, FIFA, and the more innovative global and national federations, leagues and clubs, have begun to take notice and even, on occasion, act. The UN has now included sport in its global climate action framework and is aiming for carbon neutrality for sport by 2050. However, as even our cursory survey in **Section 3, Playing Catch Up**, shows, the state of sport's environmental commitment and governance is woefully inadequate. Only a tiny fraction of the world's thousands of sporting bodies, federations, tournaments, leagues and clubs have signed up to the UN Sport for Climate Action Framework, even fewer have actual carbon targets and plans to deliver on these commitments. At the same time, the petrochemical and aviation industries have a huge foothold in sport through their multiple global sponsorships.

We are in extra time already. The Paris Agreements and the UN Sport for Climate Action Framework think we still have 30 years on the clock and we can just leave the team to sort it out by 2050, but as the IPCC has argued, we really only have a decade or so to pull this game out of the hat. So the time is now and the world of sport needs to begin massive and immediate carbon reductions. In the **Conclusion: No Normal Sport in an Abnormal World**, I outline some suggestions for beginning this process.

Doing so is a matter of money, politics, and elite administration, of course, but it is also a matter of mass mobilisation, behavioural change and emotional commitment. We are not going to come anywhere near our global carbon reduction targets without a transformation in our everyday habits of production and consumption, without decarbonisation

becoming the common sense of every day action, and without a shot of hope that we are not too late in starting. Sport's social reach could help catalyse the former, its emotional currencies could inform the later. As the great New York Yankee catcher Yogi Berra said, "It ain't over till it's over."

1. The Stadium is on fire! The impact of climate change on global sport

In the bid document for the Tokyo 2020 Olympics, the organisers blithely claimed that the city had "many days of mild and sunny weather," during the proposed games' timetable in late July and early August. This would provide, they wrote, "an ideal climate for athletes to perform at their best."¹ Maybe that was true back in 1964, when the city last hosted the games, but that Olympics took place in October and there has been nearly half a century of rising temperatures since. Thus, in July 2018, as the city sweltered in record levels of humidity and heat, at its peak touching 41°C, and experienced dozens of deaths from heat stroke, the plan to run the marathon and distance walking events at a similar time of year were sharply questioned. Yuriko Koike, Mayor of Tokyo, when quizzed on the matter responded by pointing to the wet towel wrapped around her neck, "This will make you feel cooler if you wear it. I would like to use

things like this." Since then the organising committee, apparently dissatisfied with the towel solution, has toyed with starting the events in the middle of the night, spraying the entire course with water, asking businesses on the route to turn on their air conditioning and open their doors, before finally and thankfully abandoning the charade and shifting the marathon and the distance walking events to Sapporo, over a 1,000 kilometres north.²

Tokyo 2020 is, of course, not the only sporting organisation that has tried to remain oblivious to the threats of climate change, and to prevaricate when faced by them. Nor will it be the last to have to bow to reality and shift its schedules. To paraphrase Greta Thunberg, "The stadium is on fire!", and no amount of air conditioning and wet towels is going to deal with it. Rising temperatures, prolonged periods of drought, forest fires,

new patterns of precipitation, extreme storms and rising seas levels are all, already making their presence felt in sport, and there will a lot more of this to come. Doing something about it requires that we stare these threats in the eye, right now.

Rising temperatures and winter sports

Climate change is, of course, not uniform, but one almost universal consequence of our current course is that average temperatures will rise everywhere, and in mountainous regions, home to most winter sports, that will mean less snow, falling less often, and melting more quickly. The organisers of the 2010 Vancouver winter games wrote that, “the warmest weather on record... challenged our ability to prepare fields of play for athletes in the venues at Cypress Mountains.”³ Sochi 2014 was warmer still. Many competitors complained about the lack of snow, and the slow, wet, heavy snow that was available was difficult to manoeuvre on. These poor course conditions meant that most medal winners came from amongst the first ten athletes to start in each competition, who had the huge advantage of racing on drier snow that was quickly degraded for those that followed them. In Alpine skiing, freestyle skiing and snowboarding events there was, compared to the 2010 games, a five per cent drop in athletes actually finishing their event, and a nine per cent increase in competitor injuries.⁴ The Sochi Paralympics saw a six fold increase in injury rates compared to Vancouver.⁵

Sochi is unlikely to hold another winter games. Indeed, according to predictions

made by researchers at the University of Waterloo, it is just one of many former hosts that are unlikely, for climatological reasons, to be able to do so. Of nineteen prior locations, only ten will still be reliable winter sports hosts in 2050, and just six in 2080.⁶

Heat waves, athlete health and sporting performance

In January 2018, England cricket Captain Joe Root was hospitalised at the end of the fourth day of play in that year’s fourth Ashes test match. He was unable to continue batting the next day and was laid low by a combination of gastroenteritis and searing 40 degree temperatures. There is more of this on the way. The heatwave that swept across the northern hemisphere in summer 2019 saw the cancellation of the New York Triathlon, other running events, and many horse races in New York, Maryland, Pennsylvania and Kentucky, as temperatures threatened human and equine health alike. At both the Women’s World Cup in France, and the African Cup of Nations in Egypt, additional water breaks during matches were introduced in sweltering conditions.⁷

The physiology of overheating is complex, but once you start hitting 33 to 35 centigrade and you are playing sport, it’s all bad news, and there are going to be a lot more days like that in the global sporting calendar in the next few decades. Memory, eye hand coordination, and concentration all start suffering, then there are the heat cramps, the heat exhaustion, and the heat stroke. When

you combine these kinds of temperatures with increasing humidity, which will be an increasing reality for much of the world the impact on sport and public health is going to be devastating.⁸

The Australian cricket authorities are one of the few sports organisations to be sufficiently worried about future heat waves that they have commissioned research on the subject. Looking at grassroots cricket, the Red Cliffs Cricket Association in the Mildura region has, over the last forty years, experienced an average temperature increase of 2.7°C during its matches and, can now expect at the height of the season five and half more days during which temperatures will exceed 38°C compared to 1980. This kind of weather is already forcing the foreshortening of games and even requiring match cancellations. At the very pinnacle of the game, the traditional Melbourne Boxing Day Test has got some fearsome days ahead of it. In the coming decades, the city is likely to experience an average of 26 days that exceed 35°C with high summer maximums of 50°C. Other test match hosts, like Adelaide and Perth, will see a 60 per cent increase in 40°C plus days by 2030. Calls have already gone out to shift the Boxing Day Test to November or March.⁹

The Australian and US Tennis Opens have given us a very clear sense of what sport in these kinds of temperatures is going to look like. The 2014 Australian Open was played in the middle of a harsh heat wave that saw four consecutive days of temperatures above 41°C. Under old hot weather rules the tournament would have been stopped, but recent changes

that allowed for play to continue if humidity was sufficiently low prevailed. The organisers were happy with this, the players less so. Frank Dancevic actually began hallucinating on court before vomiting and departing, one of a record nine players that retired during the first round of play. One of them, Ivan Dodig, recalled that on court he was thinking "I could maybe even die." Daniel Gimeno-Traver carried off a ball boy who collapsed in the heat, Caroline Wozniacki saw her plastic water bottles melt, as did Wilfred Tsonga's sneakers. Number 13 seed, John Isner, thought the wind on court was like, "when I open the oven and the potatoes are done." During the whole tournament over 1,000 fans were treated for heat exhaustion.¹⁰

Things were even hotter at the 2018 US Open where temperatures on court peaked at 49°C. Officials mandated the first use of the tournament's extreme heat policy, allowing more and longer breaks during matches. Nonetheless, five players retired from matches for heat-related reasons. One of those, Richard Berankis, remarked, "They should have cancelled the matches. It was not healthy... We are fit, but this was too much. It is dangerous out there. The ATP doesn't have a heat rule but they should stop the matches. They will not make a change until someone dies."¹¹

Drought

One inevitable consequence of more hot weather is less rain, and in many parts of the world that means more droughts. So far, cricket has been amongst the worst

effected sports. In 2016, for example, thirteen IPL games were moved from Maharashtra due to the worst drought for 100 years. More recently, as water shortages continued, the Mumbai high court forbade the Maharashtra Cricket Association from receiving water from the Pavana dam for its matches in Pune.¹² The prolonged drought in Cape Town in 2018 saw water use at sports grounds, professional and amateur, severely restricted. The visiting Indian cricket team was told to shower for no more than 90 seconds while club and school cricket was cancelled half way through season across the whole Western Cape.¹³ Reports of pitches cracking were widespread.¹⁴ Droughts also effect rivers' rates of flow. Lower water flow will have an impact on multiple riverine sports (canoeing for example) both in terms of sporting performance and the cleanliness of water.

Fires and air pollution

Another joker in the climate change pack is fire. Many habitats, like the Australian bush, need periodic fires to clear dead wood, germinate seeds and return nutrients to the soil. However, these ecological systems are being turned into unstoppable conflagrations overwhelmed by longer periods of drought, hotter and longer summers, and large scale and inappropriate human developments. The scale of the fires produced in the last few years has begun to impact on the world of sport.

The 2020 Australian Tennis Open was played with air quality so poor that players were struggling to breathe on

court, while a violent coughing fit forced Dalalia Jakupovic to retire from the qualifying competition. New South Wales spinner Steve O'Keefe, playing in Sydney at the time, described breathing the air while playing cricket, "like smoking 80 cigarettes a day."¹⁵ Even without forest fires, breathing the air while playing sport can be a real problem. During a peak air pollution episode in Delhi in 2017 cricketers playing in the India v Sri Lanka game were vomiting on the pitch, necessitating repeated breaks in play and the installation of oxygen cylinders in their dressing rooms. England may not boast pollution levels quite on the scale of India's mega cities, but it remains the case that ten county cricket grounds have pollution levels that exceed World Health Organisation (WHO) recommendations. Increasing temperatures also lead to higher levels of ozone at ground level which has a serious impact on pulmonary functioning. Air pollution researchers have found that high exposures diminish the athletic ability of football players, and the quality of baseball official's judgements.¹⁶

Storms, rains and event cancellation

Extreme weather is not confined to hot and dry seasons. On the contrary, the last thirty years have seen a steady increase in the numbers of hurricanes and storms, and an increase in their average severity, while many parts of the world are experiencing greater levels of precipitation, and new geographical and seasonal patterns of rainfall.

Caribbean cricket has, perhaps, been the sport most severely impacted by these shifts. In 2017 James Ronald Webster Park in Anguilla was seriously damaged by Hurricane Irma, and just two weeks later Windsor Park cricket stadium in Dominica was devastated by the category 5 Hurricane Maria.¹⁷ In 2019, Typhoon Hagabis came ashore in Japan with such torrential rain and winds that three games at the Rugby World Cup were cancelled. Less apocalyptic in scale but even more disruptive was Storm Ciara in 2020 which saw the cancellation, in England, of one Premier League game, six Women's Super League matches and widespread postponements in Dutch football and the top two levels of Belgian football.¹⁸

Less spectacular than hurricane and storms, normal wind patterns will also be subject to change, with implications for sailing and windsurfing that are already being registered. Simultaneously, a general increase in the level of precipitation is playing havoc with sporting schedules. In English cricket, for example, 27 per cent of England's home One Day Internationals since 2000 were played with reduced overs because of rain disruptions, and the number of rain affected matches has doubled since 2011; 5 per cent of matches have been abandoned altogether over the last decade. Glamorgan County Cricket Club, always the wettest outpost of the game, has experienced even greater precipitation in the last twenty years. 1,300 hours of play, were lost to rain between 2000 and 2016, which is equivalent to 217 days in total and more than a dozen a season. In addition, the club's grounds have been flooded six times. Across the whole county championship, 175 days

play has been lost in five of the last ten years.¹⁹ Even English football, a game not unused to rainy playing conditions, saw more than twenty football league fixtures cancelled in the 2015/16 season.²⁰ This kind of weather doesn't only affect professional sport, but amateur and grassroots sport as well. In England in 2014, the average grassroots pitch lost five weeks per season to bad weather, and a third of these pitches lost between two and three months in a season.²¹

Sea level rises, land erosion and flooding

Beaches are amongst our most important natural sports fields. Sea level rises and the inevitable land erosion that goes with them threaten professional and recreational sport alike. For example, the islands and archipelagos of the south Pacific are amongst the landscapes most threatened by sea level rises, and their rich rugby cultures, nurtured on their beaches, are equally imperilled.²² California's beaches and their surfing culture are also looking insecure. One recent study predicted that 18 per cent of the state's most popular breaks will be lost by 2050, another 16 per cent will be in decline, and that two thirds of all beaches in the southern half of California will be gone by the end of century.²³

In more immediate danger from sea level rises and coastal erosion are seaside golf links. The R&A reports that one in six of the British Open championship courses, including St Andrews, Troon and Carnoustie, are unlikely to last out the century. Scotland's Montrose golf course,

one of the five oldest in the world where records of the game date back to 1592, has been forced to sacrifice its third tee, to provide sufficient rock defences for the even more threatened first and second holes. It expects to lose more in the near future. The Royal North Devon golf club, entirely flooded by Storm Deirdre in 2018, has seen the eighth hole disappear into the shingle beach. The golf courses of even Donald Trump – the climate denier in chief – are taking action, like Doonsberg in the Republic of Ireland where the organisation has sought planning permissions to build a huge rock barrier to protect three of its holes from sea level rises.²⁴

In 2015, English football got a glimpse of the future when the torrential rain accompanying Storm Desmond saw Carlisle United's Brunton Park flooded and the club forced out of the stadium for seven weeks, at considerable financial cost.²⁵ There really is going to be more of this in sport. Using mapping technology and mainstream climate change and sea level models, we can see that Bordeaux's Matmut Atlantiq stadium will, by 2050, be completely flooded on an annual basis, while Werder Bremen's Weserstadion can expect annual partial floods. In the United States the NFL's Jacksonville Jaguars and their TIAA Bank Field, and the NBA's Miami Heat and their American Airlines Arena, can expect the same. The New York Giants & New York Jets' MetLife Stadium and the New York Mets' Citi Arena will be completely flooded every year. In Canada, the Edmonton Oilers' Rogers Place and Toronto FC's BMO Field will be part flooded on an annual basis. However, this is as nothing to the fate awaiting the football stadiums of England and the Netherlands.²⁶

Of the 92 league teams in England, 23, almost one in four, can expect partial or total annual flooding of their stadiums by 2050. The four under threat in the current Premier League are Southampton's St Marys, Norwich's Carrow Road, Chelsea's Stamford Bridge and West Ham's Olympic Stadium. Seven are at risk in the Championship including Hull City and Cardiff City's grounds which will both be entirely under water by 2050. Middlesborough's Riverside, which will itself avoid flooding, will nonetheless require a flotilla of boats to get fans to the ground across the wide-flooded plains of the city. Doncaster, one of five clubs at risk in League One, will suffer the same fate. League Two will also see five clubs flooded out, including Grimsby Town's Blundell Park which will sit beneath the new North Sea. Things will be wet in Netherlands too where the stadiums of Alkmaar Den Haag, Groningen, Heerenveen and Utrecht can look forward to total annual flooding with partial floods for Ajax and Feyenoord.

2. Putting up a big score: Sport's contribution to climate change

Given how obsessed the world of sport is with counting and statistics, it is remarkable how little counting of carbon has been conducted. The only reasonably thorough and rigorous studies have been commissioned by the IOC, FIFA and UEFA in relation to the Olympics, the World Cup and the European Football championships, alongside a small body of work on individual football clubs, the lower leagues of English football and North America's National Hockey League. However, the carbon emissions of most sports in most countries, and most events and leagues, let alone grassroots sports, are a mystery.

In addition two important ancillary components of the global sports circuit, the broadcasting industry and the sportswear industry, both of which have a substantial carbon footprint are absent for these calculations. Neither is simple to calculate as the sportswear industry is rather coy about its carbon emissions, and we have only just been to calculate the carbon costs of different kinds of digital sports consumption (on TV/tablets/ phones etc). Their absence means that the round figure for sport's carbon footprint generated in this paper is a significant understatement.

Generating a figure, then, for the carbon footprint of global sport is going to require a lot of assumptions, guesses and estimates, but there is, I would argue, just enough information for us to begin that

process and suggest a figure for sport's carbon emissions that is at least the right order of magnitude.

Estimating the emissions of the Olympic games, World Cups and the global sporting circuit

Consider this:

Estimates of the carbon emissions from the Summer Games – including both the Olympics and the Paralympics – since 2008 have been:²⁷

Beijing 2008	1.2 MT
London 2012	3.4 MT
Rio 2016	3.6 MT

(MT = Million tonnes CO₂e)

Beijing's emissions were calculated without including spectator travel and accommodation and are, therefore, significantly lower than its successors. All the estimates include venue construction, but London and Rio added the carbon emissions associated with at least some of the transport and other urban infrastructure built alongside the games and are thus, our best guides.²⁸

Estimates for the Winter Games since 2010 have been:

Vancouver 2010	0.25 MT
Sochi 2014	0.52 MT
Pyeongchang 2018	1.59 MT

Vancouver did not include the emissions associated with new transport infrastructure, which were very considerable, while Sochi's estimates in this regard were considered very low.

Estimates for the FIFA World Cup (which includes the Confederations Cup held the year prior to the World Cup as well as associated events, like draws and banquets) since 2010 are:

South Africa 2010	2.75 MT
Brazil 2014	2.27 MT
Russia 2018	2.16 MT

The Brazilian and Russian estimates did not include stadium construction carbon and are thus on the low side. Athlete and spectator travel accounted for 67 per cent of South African emissions, 83 per cent in Brazil and 74 per cent in Russia, which offers a useful rule of thumb for calculating spectator carbon emissions at other international events.²⁹

I wonder, in the case of the summer and winter Olympics, if we could allow the games to stand proxy for the carbon footprint of world sport over the four year cycle during which they take place? After all, they are, in effect, multiple

sporting world championships which occur themselves on a biannual or annual basis. Given events on the global sports circuit have less infrastructure costs than an Olympic games, and fewer international spectators, and therefore smaller carbon footprints, we could add in the continental competitions, international circuits/tours, youth games, that most sports put on beyond their singular world championships. A similar proxy could perhaps be suggested for the World Cup and the world of international football (qualifiers and continental tournaments, continental club competitions, youth world cups, women's World Cups). So, each year global sports produce the same carbon emissions as a hypothetical year in which both Olympics and the World Cup take place.

Taking a rough average of the estimates above, that is around 7-8 million tonnes for the Olympics and the World Cup and then, if we add in the other major international sporting circuits - F1, cricket, tennis, golf, rugby league etc - a ball park figure might be 10 million tonnes a year for global sport.

Another way of coming at this is to look at the research in Sportcal's 2017 *Global Sporting Impact* report which, over a four year cycle 2013-2106, compiled a list of the leading 317 global sporting events.³⁰ They found that there were 54 million spectators at them, of which the World Cup and the winter and summer Olympics accounted for 10 million. So that's about a fifth of the total spectatorship, but given their greater carbon intensity, at least a quarter of emissions, which would give us a similar figure to the first estimate.

Professional sports leagues

The data here is a lot less satisfactory. The single best study of carbon emissions for a football club is for Fluminense, from Rio, in 2014. This calculated that the club's activities (all teams, aviation and spectator travel included) emitted 2,500 tonnes. If this were the average for the Brazilian top division teams (many have bigger crowds than Fluminense, so it may be an underestimate) then the league as whole would be emitting 50,000 tonnes a season.³¹

Translating this into emissions for other other leagues, in richer countries which generally emit more carbon, generate more waste etc, we can adjust by looking at the ratio of per capita emissions between Brazil and another country. In the case of the English Premier League (EPL), the ratio would be 2.37/5.59. So we can assume that an EPL club produces approx 2.35 times as much carbon as a Brazilian club. So that gives a figure for the EPL of 110,793 tonnes a year.

However, the EPL has a lot more spectators than the Brazilian championship, and spectators are the biggest carbon emitters in this situation. So, again, a ratio needs to be calculated:

Brazilian Championship Spectators	8.5 million
EPL Spectators	14.5 million

This makes an estimated carbon total for the EPL of $110,793 \times 1.7 = 200,117$ tonnes.

This would mean an average for each club of about 10,000 tonnes a year, which squares very well with one of the few other carbon footprint calculations – for VfL Wolfsburg in the Bundesliga.³²

Coming at it another way we can look at the work done on the lower tiers of English football which calculates that spectator transport produces, in a season, 55,000 tonnes of carbon from around 11 million spectators. The EPL has 14.5 million spectators, a simple ratio here suggests that EPL spectators are emitting at least 72,500 tonnes a year from transport alone.³³ A second study on carbon emissions from food, drinks and waste at lower league football in England gives an annual total of around 30,000 tonnes. Applying the same logic as above that is around 40,000 tonnes a year from the EPL.³⁴ From a third study we can add on another 1000 for the carbon emitted by EPL squads transport arrangements and that gives estimate of around 103-104,000 tonnes.³⁵

The first two numbers are both likely to be underestimates as Premier League clubs attract spectators from a much greater geographical area than the lower leagues (including international travellers) and consume more food and more energy while going to the game. If one made a 50 per cent increase on waste and spectator emissions that gives us a figure of around 150,000 tonnes. Note there is no calculation here for the emissions created by other stadium operations, construction, training, women's teams, youth teams etc. Looking at the kinds of contributions these make in Brazil, an increase of 10-20,000 tonnes a year gives us an estimate of 170,000 tonnes for the EPL which is

of the same order of magnitude as our first estimate of 200,000 tonnes a year. An average of the two would be 185,000 tonnes of carbon a year.

If the EPL, on these calculations, were a yardstick for professional sport in the global north, we can hazard a guess at the footprint of other leagues by taking a ratio of EPL spectators to their own attendance figures and then allowing for the different carbon footprints of different countries with a ratio of per capita carbon outputs.

So a calculation for American baseball's MLB would be:

MLB/EPL Spectators

$68.5 \text{ million} / 14.5 \text{ million} = 4.72$

US/UK emissions:

$16.1 / 5.6 = 2.875$

MLB Emissions:

$4.72 \times 2.875 \times 185,000 = 2.5 \text{ million}$

This would give a figure of 2.5 million tonnes for MLB and approximately 0.75 million tonnes for NHL, NBA and the NFL. The NHL has calculated its 2016 stadium carbon footprint at 182,355 tonnes, and that does not include spectator or team travel, and for international and domestic events this makes up 65–80 per cent of carbon emissions. So, a figure of around three quarters of million a year, calculated by our estimates, is not entirely implausible.³⁶

Similar back of the envelope calculations give us figures of around 140,000 tonnes a year for La Liga and Serie A, 570,000 tonnes for Japanese baseball, and a total for the top 17 professional leagues of 7.9 million tonnes of carbon per annum on a total attendance of 280 million. The next 20 or so leagues are responsible for around two million tonnes of carbon. The total global attendance at national sport events is hard to calculate but it seems to be that these big leagues in big countries probably account of about half of the world's sports attendance. So that gives a ball park figure of around 20 million tonnes and a total for global sport of around 30 million tonnes – approximately the same as the whole of Denmark or twice that of Ethiopia.

Large as these figures may seem, they are almost certainly a considerable underestimate. Consider this. The size of the global sports industry has been calculated at around \$500 billion a year.³⁷ Global GDP is \$85 trillion which means that sport is about 0.6% of the global economy which is responsible for 50 to 60 billion tonnes of CO₂e. Sport may be less carbon intensive than some economic sectors – like concrete production – but it also very heavy on aviation, so its 0.6 per cent of global GDP is probably something close to generating 0.6 per cent of global emissions, which makes it responsible for 300–350 million tonnes; that means sport is not the equivalent of Bolivia or Angola, but of Spain or Poland. Either way, or somewhere in the middle, at this perilous moment in our climate and planetary history, this is too much.

3. Playing catch up: Global sporting federations and environmental policy

Sport and environmental policy

The longest standing, and perhaps most important trigger for the sports world's engagement with the environment has been the Winter Olympics. Since their inception in 1924 the games have invariably served as an opportunity to advertise winter sports facilities in fragile mountain ecosystems, as well as build the transport and tourism infrastructure that delivers the paying public. As early as 1932, the proposed bobsleigh run for the Lake Placid games, which required the cutting down of numerous trees, was successfully opposed by local residents. The 1968 Grenoble games were notorious for sports facilities that were unsuited to or degraded their surroundings. The ski jump was too exposed to the wind, disrupting training. The downhill ski runs were at an altitude too low for snow cover to be guaranteed. The luge run was too low to guarantee ice. All were later abandoned, a fact noted by a coalition of environmentalists and low tax republicans who forced and won a referendum opposing Denver holding the 1976 games.

Nonetheless, it took till the early 1990s, and more environmental controversy around the 1992 Albertville games, for the IOC to really take the issue seriously.

Then IOC President Samaranch first spoke on the matter at Davos in 1991, but the main energies pushing the IOC came from outside. In the realm of international politics the UNEP conference in Rio in 1992 set a new, baseline environmental agenda for every international and national organisation, in every sector of economy and society. Beyond the games the 1990s saw an outburst of anti-golf protest, particularly in fragile rural ecosystems in China and South East Asia where local farmers were dispossessed by developments.³⁸ In the realm of international sport the local organisers of the Lillehammer winter games of 1994 and the Sydney summer games of 2000s, pressured by their local environmental movements set new standards for environmental engagement at mega-events in terms of venue design, energy and water use and recycling.

After Lillehammer, the IOC and UNEP convened a sport and environment commission, and in 1999 the principles of environmental sustainability were written into the Olympic charter. The following year the IOC developed its first set of environmental protocols for bidding and staging Olympic events, requiring prospective and actual hosts to closely monitor their environmental impact. They have been recently updated in the IOC's Agenda 2020 strategy document and, the organisation has now announced that

from 2030 the games will not be merely carbon neutral, but carbon negative. However, the IOC's power to influence local organisers once a bid has been allocated has proved very limited, and nothing in its current practice suggests this is likely to change.³⁹ Athens failed to meet almost every single environmental objective it set itself, as well as leaving the largest legacy of empty and unusable stadiums. Beijing's air pollution was worse at the end of its Olympic programme than when it began. London promised to offset its carbon emissions, and then failed to do so.⁴⁰ Amongst the winter games Vancouver, Sochi and Pyeongchang, environmental degradation took many forms: building on sacred Native American land in Canada, tearing up a national park in Russia, and felling ancient and spiritually revered forest in South Korea.⁴¹ As we know from decades of environmental and climate policy implementation any credible governance system needs serious compliance and sanctioning mechanisms. This is what happens in their absence.

That said, at least the IOC has been engaged. Very few sports organisations, greenwash aside, have had any kind of serious environmental programme, beyond installing recycling bins at events, and certainly not in the field of climate change. The only real exception has been international football and it has hardly begun. The game's engagement with climate change was initiated by the German organisers of the 2006 men's World Cup, who, together with the German government, invested half a million euros in energy and water saving technologies and offsetting 100,000 tonnes of emissions from spectator aviation (likely a massive underestimate). FIFA paid for

some offsets in relation to the emissions from the 2010 and 2014 World Cups, and incorporated environmental criteria into the bidding rounds for the 2018 and 2022 World Cups. Qatar 2022 will, according to the organisers, be a carbon neutral World Cup, though quite how this accounts for the hydrocarbon soaked wealth that has made the show possible is unspoken. UEFA had planned to foot the entire offsetting bill for spectator aviation emissions generated by the now postponed Euro 2020 European Football Championships.

The trouble with offsetting

Offsetting is not in itself a panacea. Some schemes have been shown to be worse than useless, either not working or even increasing emissions. Other offsets schemes may fund projects which are in themselves good, and might absorb carbon, but not in a like-for-like way. Fossil fuels are a stable long term way to store carbon, but if you plant trees to offset the use of oil for example, a tree might live for only a few years or decades, not store carbon for millions of years. So, first and foremost, sport needs to reduce its absolute emissions by minimising its use of fossil fuel energy, switching to renewable energy where possible and cutting out unnecessary travel and choosing lower carbon transport options. Then, when it hits the wall of cuts that can be made in these ways, it should alongside investing in carbon capture, choose to compensate rather than just offset for its remaining emissions, including making payments communities who are most vulnerable to the climate emergency.

While all of these initiatives have been a useful start they remain a fragmented and very incomplete package. In an effort to bring some systematic thinking and political urgency to the problem, the UNFCCC and some of the leading world sports organisations launched, in 2016, the UN Sport for Climate Action Framework and invited the sporting world to sign up.⁴²

The framework requires organisations to take systematic measures to reduce their carbon emissions and reach climate neutrality by 2050. Along the way they are asked to educate their athletes, clubs and spectators on climate change issues, and advocate for sustainable solutions. There are, however, no targets in the framework, and no mechanisms of control, and, above all, an inadequate sense of urgency. The climate science is increasingly clear: the “limit temperature rises to 2°C by 2050” model will be pretty catastrophic in its own right, and that we have to do the vast majority of our decarbonisation in the next decade. If the past two decades of environmental policy in sports organisations is anything to go by then saying to global sport that 2050 is the target is a sure fire guarantee of nothing being done for another generation.

The state of play: Sports federations, leagues and the environment

It is now almost twenty-five years since the IOC made environmental sustainability a pillar of the Olympic movement, and two decades since the Sydney Olympics claimed to be “the greenest games ever.” There has been no shortage of

environmental slogans in the sports world since, but there has been precious little action, especially amongst the governing bodies of sport and the leading professional and commercial leagues.

In 2018, Arnout Geeraert and *Play the Game* published a remarkably detailed survey of global and national sporting institutions, in which environmental issues were one of 52 minutely detailed and researched dimensions of governance.⁴³ Geeraert examined, *inter alia*, whether organisations had a published environmental policy and a staff member centrally concerned with the issue; whether their bidding process for tournaments and the staging of games had environmental targets; whether they encouraged their national and local affiliates to engage with the issue; and whether they cooperated with other organisations on environmental policies? Hardly the most rigorous or demanding of tests? Yet, despite such a low bar, he found that only one of the five global organisations he examined – FIFA – was up to this minimal mark, while FINA (Aquatic sports), the IHF (Hockey) and the ITF (Tennis) couldn’t manage even twenty percent of these minuscule requirements. The results for national sports associations in Europe was dismal, with the average national body in athletics, swimming, tennis and handball just as bad, and only as high as it was because of the exceptional records of Danish and Norwegian associations. In a follow up survey conducted in 2019 on six additional world sports federations, only two – FEI (Equestrianism) and FIS (Skiing) had all the environmental governance measures in place, but the FIVB (Volleyball), and IIHF (Ice Hockey) have almost none, and the

FIG (Gymnastics) and IBU (Biathlon) were a long way short of a minimum standard of environmental good governance.⁴⁴

Our own quick survey of global sporting and bodies and national leagues (the details of which are in the appendix) suggests that things haven't moved on very much. Given the really very minimal commitments entailed in signing up to the UN Sports and Climate Action Framework it is remarkable just how few have taken the plunge.⁴⁵ The IOC, FIFA, UEFA and the IPC (Paralympics) were early signatories and have been joined by World Athletics, World Rugby, the UCI (Cycling) and the global bodies for taekwondo, wrestling and sailing. But this leaves the majority of sports federations represented at the Olympics outside the framework. From amongst winter sports, only the world ice hockey and skiing federations have joined, which makes one wonder what the people in charge of luge and bobsleigh think they are going to be sliding on in the future.

The four major tournaments of the world tennis circuit are all signatories, yet cricket, which is equally, if not more, at risk from extreme heat is barely present. Two clubs from Melbourne are there but no sign of the ICC or the big national cricket boards. Golf, the US Golf Association aside, is conspicuous by its absence. Amongst the biggest professional commercial leagues there are major gaps. In North America the NFL, the NBA and MLS have signed but not NHL or MLB. In Europe, from the five biggest football nations, the DFB and the English FA are in, but neither the Bundesliga nor the Premier League are. In Spain La Liga has joined, but not Spain's football federation, and neither federation or league from France or Italy is present.

Bringing up the tail there is a miscellany of marathons, organising committees, reasonably esoteric sports bodies – Bowls Australia and the International Rafting Federation, for example – the Mets and the Yankees, three clubs from MLS, VfL Wolfsburg and Forest Green Rovers. A merry band, perhaps, but hardly a comprehensive squad.

Of course signing up to the UN Framework is no guarantee that a sports federation or club will have environmental policies and plans consummate with their newly acquired commitments. There have been, as we shall see in more detail below, many one-off environmental, low carbon initiatives in global sport, and in the fields of stadium design and waste management some developments. However, tackling climate change clearly requires more than one-off ventures and well-meaning guidelines. At the very least organisations require a written, strategic, long term plan that looks to make their sport carbon neutral by 2030. Currently, among sports federations, only the IOC and World Athletics have such a document, while amongst professional leagues and events only Formula 1 and the NHL have made serious carbon commitments. FIFA are planning carbon neutral World Cups and UEFA plans a carbon neutral European Championship, but this leaves great swathes of their activities unaccounted for. The rest, even those that have signed up to the framework, have either strategies that fall short of this or none at all.

Perhaps more telling than the presence or absence of any document or policy framework, is the very real presence of petrochemical companies, airlines

and vehicle manufactures as sponsors and advertisers in the global sport. Gazprom are top tier sponsors of FIFA, UEFA and world bobsleigh; Total sponsors badminton, triathlon and the Confederation of African Football; Esso pairs with the International Ice Hockey Federation, the Azerbaijani state oil company, SOCAR, is another UEFA sponsor, while its Italian equivalent, ENI, sponsors Serie A. Airlines are equally enmeshed in global sport with their own portfolios of promotion: Qatar Airlines (FIFA); Lufthansa (the DFB, Modern Pentathlon); Air Canada (Ice Hockey); and Emirates (Asian Football Confederation, the English Football Association).

Both these hydrocarbon sectors are present in the top leagues of European football, where petrochemical sponsorships include: Total at RB Leipzig and Union Berlin, Gazprom at Schalke 04, Suncor at Liverpool, Ineos at Nice, and AVAV Energieisa at Eibar in Spain. Airline sponsorships include: Emirates (Arsenal, AC Milan, Real Madrid), Etihad (Manchester City), Qatar Airlines (Roma, PSG) and smaller carriers at Verona, Reims, Real Valladolid, Newcastle United, West Ham United and Norwich City.

This is not to suggest that some sports organisations aren't beginning to make real changes, and below I list some of the more innovative and important developments, but they are, as yet, too limited in their scope, and too few in their number and we are getting very close to the final whistle.⁴⁶

First steps: Sport and carbon emissions

UEFA

Perhaps the biggest challenge for global sport is dealing with the carbon emissions from spectator attendance, especially at international events, which generate huge amounts of air traffic. UEFA experimented at the 2016 European Football Championships with a campaign and app that would allow fans to offset their own carbon emissions when attending the tournament; but the take up was lamentably low. Consequently, UEFA decided to absorb the entire costs of offsetting the aviation emissions for EURO 2020 themselves. If global sport is to continue in anything close to its current form this has, at the minimum and taking account of the weaknesses of offsetting, to be the default model for every single international sporting event.⁴⁷

World athletics

In 2019 World Athletics unveiled its environmental strategy and it is the first really serious attempt to go carbon neutral amongst sports federations.⁴⁸ It does not, as yet, commit to dealing with the emissions generated by spectators, but it does commit to transforming the emissions of the organisation itself, the hosts of the global events it is involved with, and all the sponsors it works with. All are expected to be carbon neutral by 2030 based on a ten per cent reduction per year, year on year, over the next decade. This is the bare minimum that every other sports organisation needs to devise for itself.

World sailing

World Sailing's *Sustainability Report 2030*, is one of the few other documents from amongst Olympic sports federations that commits to a carbon reduction target, with a plan to cut emissions at events by 50 per cent by 2024, as well introducing higher environmental standards for boats themselves: for example, to participate in the 2028 Olympic Games, 90 per cent of a boat must be recyclable, and waste from the production process must be halved compared to 2018.⁴⁹

Formula 1

Hitherto the world's number one advert for burning carbon and unsustainable lifestyles, Formula 1, has undergone something of a Damascene conversion and pledged, spectator travel aside, to be carbon zero by 2030. Racing the cars themselves is a minuscule 0.7 per cent of the quarter of a million tonnes of carbon the events and the teams emit each year. The real issues, as usual, are the transport costs of moving teams, cars, sponsors and spectators around the world, primarily by air, which F1 plans to offset, but with all the attendant issues outlined above, by investing in carbon capture and reforestation.⁵⁰

Forest Green Rovers

Forest Green Rovers, in Nailsworth in the west of England, play in League Two, the fourth level of English professional football, but they are the first UN certified carbon zero football club in the world. The club uses 100 per cent renewable energy, has switched to vegan food for staff and fans, installed extensive rainwater recycling, a solar powered lawn mower and plenty of electric vehicle charging points. It now has planning permission

to build the first new wooden stadium in Britain for over a century, and the first carbon zero stadium ever.⁵¹ More recently Forest Green have been joined by Real Betis from Sevilla in their commitment to carbon neutrality

German football

The Bundesliga itself has not signed up to the UN Sports for Climate Action Framework, but many of its member clubs have been taking action. Both Mainz FC and SC Freiburg have almost a decade of environmental work behind them, pioneering recycling, green waste management and the use of renewable energy in football. Werder Bremen has built one of the largest solar panel arrays in football, introduced ferry services to the stadium to cut down on car use, and has actually banned car parking around the stadium on match days. All three of these clubs encouraged their staff to attend the Friday for Future climate strikes. TSG Hoffenheim, has been investing in African forestry, sustainable textile and environmental education projects. Augsburg FC invested heavily in a geothermal energy system to make their new stadium carbon neutral while VfL Wolfsburg has signed up to the UN Framework, and, almost uniquely in the world game, calculated its carbon footprint. Given this kind work, and widespread support for these issues amongst German fans, the Bundesliga has the opportunity to create a framework that would make the Bundesliga the first carbon zero league in the world.⁵² The French authorities have recently launched their own collective effort – the NGO **Football Ecologie France**, to make French football carbon zero.⁵³

4. Conclusions: No Normal Sport in an Abnormal World

The rallying cry of the anti-apartheid sports movement of the late twentieth century calls to us now. Then, there could, morally and politically, be no normal sport if one played with the representatives of a violent and authoritarian regime where race determined who you could play with and how. Racism and exclusion in sports has not gone away, but now it is joined by a new abnormality – the risks, dangers and disruptions posed by climate change to playing sport, to playing safely and happily on this planet. It's worth adding that the climate emergency places a disproportionate burden on people with low incomes in the global South, and black and minority ethnic communities in the global North. The sports world needs to make some fundamental changes, now.

In 2020 the world has been given a master class in the dynamics of catastrophe. The impact of the coronavirus pandemic on sport has demonstrated the fragility of our institutions, but also the possibility of radical, rapid change. Our rationed exercise and limited access to open space reminds us of the inequalities of access to sport facilities and activities, but also of our profound and universal need to move and play. The eerie silence of football games played behind closed door games has spoken to our loneliness and separation, and, in its absence, to the power and the joy of human crowds. These insights are worth preserving. Above all the idea that our need to play is an essential component of the good life,

and though we may find our way through the pandemic, this will still be threatened by climate change. It is no surprise that sport did not predict and prepare for coronavirus, but with climate change there is no excuse; we have had the pre-match brief, the dossier, the video play back and all the data. What time is it? It's game time.

- All global sporting federations and their national members, and all professional sports leagues and tours need to sign the UN Sport for Climate Action Framework.
- Of course, the framework needs to be tougher. At a minimum, all signatories must commit, within one year of signing, to draw up and publish a comprehensive ten year plan that will ensure that their own operations and that of their sport, including spectator travel, are carbon zero by 2030.
- These documents need to be drawn up to a standard of at least the detail of World Athletics, setting very clear annual targets and steps to achieve them. Presidents and CEOs need to take personal responsibility for their delivery.
- This requires an entirely new level of monitoring and reporting from sports bodies which must be externally reviewed by an independent body created and funded by the global sports industry.

- After 2030, any global sports events or tours that are not carbon zero should be cancelled or postponed until they are. Sports federations that are not carbon zero should be excluded from the Olympics. National federations that had not made sufficient progress could be excluded from international competition by their sports federations.
 - The leading professional and commercial tours and leagues should do the same, and membership of that tour or that league, for clubs and franchises, should become dependent on them doing the same as well. Progress on carbon reduction could be part of the annual audit that clubs undergo and a precondition of their participation. Host venues for tours like the European Golf Tour or the ICC's test matches and ODI competitions, for example, should make similar demands on their hosts and events.
 - The same strictures should be applied to any company that wants to be a sponsor or broadcaster of any signatory to the framework. They need to sign up, have a carbon zero commitment, and show how their business, including all the activation events and advertising conducted around sports, is reducing and compensating for its emissions.
 - It goes without saying that global sport needs to wean itself of petro-chemical and aviation sponsorship as soon as possible.
 - Nonetheless, across the board, there needs to be a recognition that if international sport is going to continue in anything close to its current form, it will be using a lot of aviation.
- Fewer tournaments and competitions, held less often, might be part of the solution. Either way, the sports world must commit to the very highest standards of carbon offset programme for their own and their spectators emissions.
- Government and other public bodies, from sports ministries to the European Union, that fund sporting organisations must make carbon zero plans a precondition of any future monies.
 - All sports federations, global and national, need to survey the impact of climate change on grassroots sport, and establish funding mechanisms to support its response to these problems. Perhaps most important of all, the global sports industry needs to reprioritise grassroots and local sport (low carbon) over professional and global sport (high carbon).
- Achieving this will involve a monumentally complex and demanding set of tasks. It is well beyond the reach of this paper to outline all the ways which sporting organisations and events could decarbonise, but they would certainly include: new stadiums and other facilities adopting entirely new building standards and zero carbon materials, served overwhelmingly by walking, cycling and public transport; every event needs to minimise its energy consumption, transform its food and waste cultures, cut out plastic, recycle everything, decarbonise its use of transport, including athletes, spectators and officials, and offset or compensate for what they must.
- In truth, these kinds of changes need to happen in every economic and social

sector, in every sphere of our collective lives. Sport may be just big enough to register, in terms of carbon emissions, as a small nation state, or a single mega city, but its own efforts are just a fraction of a percentage point of the world total. Yet few human practices offer such an extraordinarily large, global, and socially diverse constituency as those playing and following sport. Making a carbon zero world the common sense priority of the sports world would make a huge contribution to making it the common sense priority of all politics.

And then there is the question of hope. In short supply I note, and with many, many calls upon it. Sport, from the street to the stadium, generates hope: that hard work yields the possibility of development; that no cause is lost until the game is actually at an end; that the past tells us miraculous recoveries, turnovers and rallies are possible; that human beings, individually and collectively, have the heart and the wit, when the time comes, to make it happen. That is a precious set of cultural treasures to hold in trust for the world. If global sport is ready to adopt and pursue really radical change in the field of climate action, it might be able to offer them, in all good faith, to humanity... and then you just never know.

Appendices

Abbreviations:

UNSCAF United Nations Sports for Climate Action Framework

ST Stadium

TG Training Ground

Table 1: Summer Olympic Associations

Association	UNSCAF	Carbon Promise	Sustainability Guideline	Sustainability Strategy	Fossil Fuel Sponsorship
International Swimming Federation (FINA)	X	X	✓	X	
World Archery Federation (WA)	X	X	X	X	Hyundai
World Athletics	X	Carbon Neutral by 2030	X	✓	
Badminton World Federation (BWF)	X	X	X	X	Total S.A.
International Basketball Federation (FIBA)	X	X	✓	X	
International Boxing Association (IBA)	X	X	✓	X	
International Canoe Federation (ICF)	X	X	✓	X	
International Cycling Union (ICU)	✓	X	X	X	Mercedes-Benz
International Federation for Equestrian Sports (FEI)	✓	X	✓	X	
International Fencing Federation (FIE)	X	X	X	X	
International Federation of Association Football (FIFA)	✓	Carbon Neutral 2022 WC	X	for Qatar WC 2022	Gazprom, Qatar Airways, Hyundai, Kia
International Golf Federation (IGF)	✓	X	✓	X	

Association	UNSCAF	Carbon Promise	Sustainability Guideline	Sustainability Strategy	Fossil Fuel Sponsorship
International Gymnastics Federation (IFG)	X	X	X	X	
International Handball Federation (IHF)	X	X	X	X	
International Hockey Federation (FIH)	X	X	X	X	
International Judo Federation (IJF)	X	X	X	X	
International Modern Pentathlon Union (UIPM)	X	X	✓	X	Lufthansa
International Rowing Federation (FISA)	✓	X	✓	X	
World Rugby (WR)	✓	X	✓	X	
World Sailing	✓	50% reduction by 2024	X	✓	
International Shooting Sport Federation (ISSF)	X	X	✓	X	
International Table Tennis Federation (ITTF)	X	X	X	X	
World Taekwondo (WT)	✓	X	X	✓	
International Tennis Federation (ITF)	X	X	X	X	
International Triathlon Union (ITU)	✓	X	X	X	Texaco
International Volleyball Federation (FIVB)	X	X	✓	X	
International Weightlifting Federation (IWF)	X	X	✓	X	
United World Wrestling (UWW)	✓	X	✓	X	

Table 2: Winter Olympic Associations

Association	UNSCAF	Carbon Promise	Sustainability Guideline	Sustainability Strategy	Fossil Fuel Sponsorship
International Biathlon Union (IBU)	X	X	✓	X	BMW
International Bobsleigh and Skeleton Federation (IBSF)	X	X	X	X	Gazprom, Ford
World Curling Federation (WCF)	X	X	X	X	
International Ice Hockey Federation (IIHF)	✓	X	✓	X	ESSO, Air Canada, Chevrolet
International Skating Union (ISU)	X	X	X	X	
International Luge Federation (FIL)	X	X	X	X	BMW
International Ski Federation (FIS)	✓	X	✓	X	

Table 3: Non-Olympic Associations

Association	UNSCAF	Carbon Promise	Sustainability Guideline	Sustainability Strategy	Fossil Fuel Sponsorship
International Cricket Council (ICC)	X	X	X	X	
The England and Wales Cricket Board (ECB)	X	X	✓	X	Kia
Board of Control for Cricket in India	X	X	X	X	Hyundai
Formula 1 (F1)	X	Carbon Neutral by 2030	X	X	Aramco, Petronas, Emirates
National Association for Stock Car Auto Racing (NASCAR)	X	X	X	X	Chevrolet, Ford

US Professional Golfers' Association Tour (USPGA)	X	X	X	X	NetJets, United Airlines
European Professional Golfers' Association Tour	X	X	X	X	Emirates, BMW
United States Tennis Association (USTA)	✓	X	X	X	Mercedes-Benz
All England Lawn Tennis Club (Wimbledon)	✓	Carbon Neutral by 2030	X	✓	Jaguar, Land Rover
French Tennis Federation (FFT)	✓	X	X	✓	Emirates, Peugeot
Tennis Australia	✓	X	X	X	Emirates, Kia

Table 4: Major US Associations

Association	UNSCAF	Carbon Promise	Sustainability Guideline	Sustainability Strategy	Fossil Fuel Sponsorship
National Football League (NFL)	✓	X	✓	X	Ford, Genesis
National Basketball Association (NBA)	✓	X	X	X	
Major League Baseball (MLB)	X	X	X	X	Chevrolet
National Hockey League (NHL)	X	X	X	✓	Honda
Major League Soccer (MLS)	X	X	X	X	Audi

Table 5: Football Associations

Association	UNSCAF	Carbon Promise	Sustainability Guideline	Sustainability Strategy	Fossil Fuel Sponsorship
International Federation of Association Football (FIFA)	✓	Carbon Neutral WC 2022	X	for Qatar WC 2022	Gazprom, Hyundai, Kia, Qatar Airways
Union of European Football Associations (UEFA)	X	X	for Euro 2020	for Euro 2020	Gazprom, SOCAR, Nissan, Volkswagen
South American Football Federation (CONEMBOL)	X	X	X	X	Qatar Airways, Ford
Confederation of North, Central American and Caribbean Association Football (CONCACAF)	X	X	X	X	
Confederation of African Football (CAF)	X	X	X	X	Total S.A.
Asian Football Confederation (AFC)	X	X	X	X	Emirates
Oceania Football Confederation (OFC)	X	X	X	X	
La Liga	✓	X	X	vague	
Royal Spanish Football Federation (RFEF)	X	X	X	X	Iberia, Seat
Premier League	X	X	X	X	
English Football Association (FA)	✓	X	X	vague	Emirates
Bundesliga	X	X	X	X	
German Football Association (DFB)	✓	X	X	X	Lufthansa, Volkswagen
Ligue 1	X	X	X	X	
French Football Federation (FFF)	X	X	X	X	Volkswagen
Serie A Tim	X	X	X	X	Volkswagen
Italian Football Federation (FIGC)	X	X	X	X	ENI, Fiat

Table 6: Premier League Clubs Sustainability Performance

Club	UNSCAF	Clean Energy	Energy Efficiency	Single Use Plastics (SUPs)	Waste Management	Water Management	Low Carbon Food	Fossil Fuel Sponsorship	Ownership
AFC Bournemouth	X	X	LEDs	reusable cups 2020	X	X	X		Maxim Denim (Petrochemicals)
Arsenal	X	100%	Octopus Energy	reusable cups, some SUPs removed	90% MD recycled	TG recycling	X	Emirates	
Aston Villa	X	X	LEDs	some SUPs removed	X	recycling on roofs	X		Wes Edens (oil & gas), Nassef Sawiris (nitrogen fertilizer)
Brighton and Hove Albion	X	100%	BREEAM 'very good'	some SUPs removed	0 waste to landfill	X	vegan option		
Burnley	X	100%	LEDs	TG plastic bottles removed	X	X	50% local		
Chelsea	X	X	ESOS compliant	reusable cups	X	TG recycling	vegan option	Hyundai, MSC Cruises	Roman Abramovich (oil)
Crystal Palace	X	X	X	reusable cups, some SUPs removed	X	X	vegan option		
Everton	X	partial	LEDs	reusable cups, some SUPs removed	90% MD recycled	waterless urinals	X		
Leicester City	X	X	X	X	X	X	vegan option		
Liverpool	X	X	LEDs, efficient driers	reusable cups, some SUPs removed	99% recycled	AC borehole, ST water savings	X	MG, Suncor Energy	

Club	UNSCAF	Clean Energy	Energy Efficiency	Single Use Plastics (SUPs)	Waste Management	Water Management	Low Carbon Food	Fossil Fuel Sponsorship	Ownership
Manchester City	X	partial, CHP at ST	many examples	reusable cups, some SUPs removed	0 waste to landfill	TG recycling	X	Etihad, Nissan	Sheikh Mansour (oil)
Manchester United	X	partial	many examples	some SUPs removed	0 waste to landfill	TG and ST recycling	vegan option	Gulf Oil, Aeroflot, Chevrolet	
Newcastle United	X	solar panels at TG	LEDs, improved boilers	some SUPs removed	X	TG borehole, ST water savings	vegan option	Loganair, Volkswagen	(in process) Mohammad Bin Salman (oil)
Norwich City	X	solar panels at TG	X	X	X	TG recycling, ST borehole	X	Loganair, Loftus	
Sheffield United	X	solar panels at AC	LEDs, light sensors	some SUPs removed	0 waste to landfill	TG & ST borehole	local & vegan		
Southampton	X	X	LEDs	some SUPs removed	X	X	local & vegan		
Tottenham Hotspurs	X	10% at TG	LEDs, green roofs, water tanks	some SUPs removed	X	TG recycling & borehole, ST water savings	local & vegan	Audi	
Watford	X	100%	LEDs	reusable cups, some SUPs removed	60% recycled	TG borehole	vegan option		
West Ham United	X	100%	decentralised energy system	some SUPs removed	X	ST recycling & water savings	vegan option	Eva Air	
Wolverhampton Wanderers	X	X	LEDs, improved boilers	some SUPs removed	85% recycled	ST water savings	vegan option		Fosun International (owns Roc Oil)

Table 7: Bundesliga Clubs Sustainability Performance

Club	UNSCAF	Clean Energy	Energy Efficiency	Single Use Plastics (SUPs)	Waste Management	Water Management	Low Carbon Food	Fossil Fuel Sponsorship	Ownership
FC Augsburg	X	geothermal at ST	climate-neutral ST	X	X	X	X	Audi	
Bayer Leverkusen	X	100%	X	reusable cups	X	well water for irrigation	X		
Bayern Munich	X	partial	X	reusable cups	X	X	X	Qatar Airways, Audi	
Borussia Dortmund	X	solar panels at ST	LEDs	reusable cups	X	TG recycling	X	OPEL	
Borussia Mönchengladbach	X	partial	LEDs	reusable cups	X	X	local		
Eintracht Frankfurt	X	X	X	reusable cups	X	X	X		
Fortuna Düsseldorf	X	X	X	reusable cups	X	X	X	Düsseldorf Airport	
SC Freiburg	X	solar & CHP at ST	X	reusable cups	X	ST water savings	X		
Hertha BSC	X	X	X	X	X	X	X	Hyundai	
TSG 1899 Hoffenheim	X	solar panels at ST	X	X	X	X	X	Audi	
1. FC Köln	X	X	efficient pitch heating	X	X	X	X	Ford	
RB Leipzig	X	X	X	X	X	X	X	Total S.A., Volkswagen	
1. FSV Mainz 05	X	100%	X	X	X	X	X	OPEL	

SC Paderborn 07	X	solar panels at ST	X	reusable cups	X	X	X	
Shalke 04	X	X	X	eliminated plastic products at ST	X	ST water savings	X	Gazprom
Union Berlin	X	X	X	reusable cups	X	X	local	Total S.A.
Werder Bremen	X	solar panels at ST	X	X	X	X	X	Volkswagen
VfL Wolfsburg	✓	100%	LEDs	X	X	water sourced from nearby canal	X	Volkswagen

Table 8: Ligue 1 Clubs Sustainability Performance

Club	UNSCAF	Clean Energy	Energy Efficiency	Single Use Plastics (SUPs)	Waste Management	Water Management	Low Carbon Food	Fossil Fuel Sponsorship	Ownership
Amiens	X	X	X	X	X	X	X		
Angers	X	X	X	X	X	X	X		
Bordeaux	X	X	X	X	X	X	X	Fiat	
Brest	X	X	X	X	X	X	X		
Dijon	X	X	X	X	X	X	X		
Lille	X	X	X	X	X	X	X	Hyundai	Gerard Lopez (oil trading)
Lyon	X	X	LEDs	X	TG and AC waste scheme	TG and AC recycling	X	Hyundai	
Marseille	X	X	ST 100% LED	X	X	X	X	Toyota	

Club	UNSCAF	Clean Energy	Energy Efficiency	Single Use Plastics (SUPs)	Waste Management	Water Management	Low Carbon Food	Fossil Fuel Sponsorship	Ownership
Metz	X	X	X	X	X	X	X		
Monaco	X	X	X	X	X	X	X	Toyota, FEDCOM	Dmitry Rybolovlev (potash/fertilizer)
Montpellier	X	X	X	X	X	X	X		
Nantes	X	X	LEDs	X	X	X	X		
Nice	X	solar panels at ST	natural air conditioning	X	ST waste scheme	ST recycling	X	Hyundai, INEOS	Sir Jim Ratcliffe (petrochemicals)
Nîmes	X	X	X	X	X	X	X		
Paris Saint-Germain	X	X	TG bioclimatic design	X	TG on site waste scheme	TG recycling	X	Qatar Airways, Renault	Tanim bin Hamad Al Thani (oil & gas)
Reims	X	X	X	X	X	X	X	Eva Air, Kia	
Rennes	X	X	X	X	X	X	X	Mercedes-Benz	
Saint-Étienne	X	solar panels at ST	ST ultra efficient heating	X	X	ST recycling	X		
Strasbourg	X	X	X	X	X	X	X		
Toulouse	X	X	X	X	X	X	X		

Table 9: Serie A Clubs Sustainability Performance

* information refers to planned buildings

Club	UNSCAF	Clean Energy	Energy Efficiency	Single Use Plastics (SUPs)	Waste Management	Water Management	Low Carbon Food	Fossil Fuel Sponsorship	Ownership
Atalanta	X	X	X	X	X	X	X	Volvo	
Bologna	X	X	X	X	X	X	X	Renault	
Brescia	X	X	X	X	X	X	X		
Cagliari	X	X	X	X	X	X	X	OPEL	
Fiorentina	X	X	X	X	X	X	X	Renault	
Genoa	X	X	X	X	X	X	X		
Hellas Verona	X	X	X	X	X	X	X	Air Dolomiti	
Internazionale	X	ST 50%*	ST LEED certified*	X	X	ST recycling*	X		
Juventus	X	100%	LEDs, energy management	X	X	X	X	Jeep, Ferrari	Agnelli Family (autocar companies)
Lazio	X	X	X	X	X	X	X	Renault	
Lecce	X	X	X	X	X	X	X	Moby (ferries)	
Milan	X	ST 50%*	ST LEED certified*	X	X	ST recycling*	X	Emirates	
Napoli	X	X	X	X	X	X	X		
Parma	X	X	X	X	X	X	X		
Roma	X	X	X	X	X	X	X	Qatar Airways, Hyundai	
Sampdoria	X	X	X	X	X	X	X		

Club	UNSCAF	Clean Energy	Energy Efficiency	Single Use Plastics (SUPs)	Waste Management	Water Management	Low Carbon Food	Fossil Fuel Sponsorship	Ownership
Sassuolo	X	X	X	X	X	X	X	Volvo	
SPAL	X	X	X	X	X	X	X		
Torino	X	X	X	X	X	X	X	Suzuki	
Udinese	X	X	X	X	X	X	X		

Table 10: La Liga Clubs Sustainability Performance

* information refers to planned buildings

Club	UNSCAF	Clean Energy	Energy Efficiency	Single Use Plastics (SUPs)	Waste Management	Water Management	Low Carbon Food	Fossil Fuel Sponsorship	Ownership
Alavés	X	X	X	X	X	X	X		
Athletic Bilbao	X	X	ST LEED certified	X	X	X	X		
Atlético Madrid	X	use solar to heat water	ST 100% LED	X	X	ST recycling	X	Hyundai	
Barcelona	X	ST, TG, AC solar*	ST LED, efficient heat/cooling*	X	X	ST recycling*	X		
Celta Vigo	X	X	X	X	X	X	X	BMW	Carlos Mouriño (petrol stations)

Club	UNSCAF	Clean Energy	Energy Efficiency	Single Use Plastics (SUPs)	Waste Management	Water Management	Low Carbon Food	Fossil Fuel Sponsorship	Ownership
Eibar	X	X	X	X	X	X	X	AVIVA Energias (petrol stations)	
Espanyol	X	solar panels at ST	ST features energy saving	X	X	X	X		
Getafe	X	X	X	X	X	X	X		
Granada	X	X	X	X	X	X	X		
Leganés	X	X	X	X	X	X	X		
Levante	X	X	X	X	X	X	X	Volkswagen	
Mallorca	X	X	X	X	X	X	X	AirEuropa	
Osasuna	X	X	X	X	X	X	X		
Real Betis *	X	solar panels at TG*	LEDs*	X	waste collection system*	TG recycling*	X	Mercedes-Benz	
Real Madrid	X	100%	LEDs	X	X	uses council recycling network	X	Emirates, Audi	
Real Sociedad	X	X	X	X	X	X	X		
Sevilla	X	X	X	X	X	X	X		
Valencia	X	X	X	X	X	X	X	Skoda	Peter Lim (background in oil)
Valladolid	X	X	X	X	X	X	X		
Villarreal	X	X	X	reusable cups	X	X	X	Audi	

Table 11: English Football League Stadia Flood Threat

* = The club's stadium will be surrounded by flooded area annually

Club	Stadium	Complete Flood from SLR	Partial Flood from SLR	Complete Annual Flood	Partial Annual Flood
Blackpool	Bloomfield			✓	
Cardiff City	Cardiff City Stadium	✓			
Charlton Athletic	The Valley				✓
Chelsea	Stamford Bridge				✓
Doncaster Rovers *	Keepmoat Stadium				✓
Fleetwood Town	Highbury			✓	
Fulham	Craven Cottage			✓	
Grimbsby Town	Blundell Park			✓	
Hull City	KCOM Stadium		✓	✓	
Ipswich Town	Portman Road			✓	
Leyton Orient	Brisbane Road				✓
Lincoln City	Sincil Bank			✓	
Middlesbrough *	Riverside Stadium				✓
Millwall	The Den			✓	
Morecambe	Globe Arena			✓	
Newport County	Rodney Parade	✓			

Norwich City	Carrow Road		✓		
Peterborough United	London Road				✓
Portsmouth	Fratton Park		✓		
Queens Park Rangers	Loftus Road		✓		
Scunthorpe United	Glanford Park	✓			
Southampton	St Mary's		✓	✓	
West Ham United	London Stadium		✓		

Table 12: Eredivisie Stadia Flood Threat

Club	Stadium	Complete Flood From SLR	Partial Flood From SLR	Complete Annual Flood	Partial Annual Flood
Ajax	Johan Crujff Arena		✓		
AZ Alkmaar	AFAS Stadion	✓			
ADO Den Haag	Cars Jeans Stadium	✓			
Feyernoord	De Kuip				✓
FC Groningen	Hitachi Capacity Mobility Stadion		✓	✓	
SC Heerenveen	Abe Lenstra Stadion		✓	✓	
Sparta Rotterdam	Het Kasteel				✓
FC Utrecht	Stadion Galgenwaard			✓	

Endnotes

- 1 L. Lewis, 'Threat-to-life' Japan heatwave menaces Tokyo 2020 Olympics', *Financial Times*, 24 July 2018.
- 2 J. McCurry, "2020 Olympics: Tokyo accepts 'painful' decision to move marathon to Sapporo", *The Guardian*, 1 Nov 2019.
- 3 VANOC (2010) Vancouver 2010 Sustainability Report, 2009–2010, p.5.
- 4 R. Guisado (2017) "The Effect of Warm Temperatures on Skiing & Snowboarding Safety – Expert Presentation", at <https://www.robsonforensic.com/?/articles/warm-temperatures-skiing-snowboarding-safety-expert>
- 5 Derman, W., Blauwet, C., Webborn, N., Schwellnus, M., Van de Vliet, P. and Lazarovski, D., 2018. "Mitigating risk of injury in alpine skiing in the Pyeongchang 2018 Paralympic Winter Games: the time is now!.", *British Journal of Sports Medicine* 2018;52:419–420.
- 6 Pierre-Louis, K., Popovich, N. (2011, January 11). *Of 21 Winter Olympic Cities, Many May Soon Be Too Warm to Host the Games*. Retrieved <https://www.nytimes.com/interactive/2018/01/11/climate/winter-olympics-global-warming.html>; Ruttly, M., Scott, D., Steiger, R. and Johnson, P., 2015. Weather risk management at the Olympic Winter Games. *Current Issues in Tourism*, 18(10), pp.931-946; Scott, D., Steiger, R., Ruttly, M. and Johnson, P., 2015. The future of the Olympic Winter Games in an era of climate change. *Current Issues in Tourism*, 18(10), pp.913-930; Scott, D., Steiger, R., Ruttly, M. and Fang, Y., 2019. The changing geography of the Winter Olympic and Paralympic Games in a warmer world. *Current Issues in Tourism*, 22(11), pp.1301–1311.
- 7 G. Hondrop, "New York City Triathlon Among Races Cancelled Due to Dangerous Heat Wave", *Runners World*, 19 Jul 2019.
- 8 See the analysis, for example of B. McGuire (2020), *Responsible Science 2*, <https://www.sgr.org.uk/publications/responsible-science-no-2> "In its 5th Assessment Report, published in 2017, the IPCC notes that "it is very likely that heat waves will occur with a higher frequency and duration.' It does not, however, say anything about the terrifying prospect of so-called humid heat waves. These arise when the wet bulb temperature – a measure of the combination of heat and humidity – reaches 35°C. Such conditions, if sustained, are unsurvivable, so that even a fit and healthy human in the shade has only about six hours to live. The required combination of heat and humidity has not been encountered in modern times, but the conditions were almost met in parts of Iran in July 2015. Looking ahead, the second half of the century is forecast to see humid heat waves affecting the Ganges and Indus valleys of South Asia, the Persian Gulf and China. Most at risk is the North China Plain, where widespread irrigation is predicted to contribute to the occurrence of humid heat waves later this century that could affect up to 400 million people under a business as usual emissions scenario."
- 9 Australian Conservation Foundation (2019), Caught behind: Climate change, extreme heat and the Boxing Day Test, at https://www.acf.org.au/caught_behind_climate_change_extreme_heat_and_the_boxing_day_test
- 10 AP, "Heat wave hits Australian Open", 14 Jan 2020.
- 11 B. Graham, "'It's dangerous out there': Players suffer despite heat policy as US Open swelters", *The Guardian*, 29 August 2018.
- 12 "High Court bans use of Pavana water for IPL 2018 matches in Pune" 4 May 2018, <https://www.hindustantimes.com/cricket/high-court-bans-use-of-pavana-water-for-ipl-2018-matches-in-pune/story-w7KKT36K5mGSmuwR1yoQFK.html>
- 13 T. Aldred, "Drought in southern Africa means cricket must look hard in the mirror", *The Guardian*, 28 Jan 2020.
- 14 M. Safi, "Pollution stops play at Delhi Test match as bowlers struggle to breathe", *The Guardian*, 3 Dec 2017.
- 15 C. Nicolussi, 'Like smoking 80 cigarettes a day': Cricketers battle through SCG smog", *Sydney Morning Herald*, 10 December 2019.
- 16 M. Campelli, "Air pollution: Tackling sport's invisible threat", <https://sustainabilityreport.com/2020/04/23/air-pollution-tackling-sports-invisible-threat/>; Lichter, A., Pestel, N. and Sommer, E., 2017. Productivity effects of air pollution: Evidence from professional soccer. *Labour Economics*, 48, pp.54–66; Archsmith, J., Heyes, A. and Saberian, S., 2018. Air quality and error quantity: Pollution and performance in a high-skilled, quality-focused occupation. *Journal of the Association of Environmental and Resource Economists*, 5(4), pp.827–863.

- 17 BASIS (2019) *Hit For Six: The Impact of Climate Change on Cricket*, BASIS, <http://basis.org.uk/wp-content/uploads/2019/09/Hit-for-Six-The-Impact-of-Climate-Change-on-Cricket.pdf>
- 18 BBC Sport, "Storm Ciara: Man City v West Ham, rugby, WSL matches, horse racing all off", 9 Feb 2020, <https://www.bbc.co.uk/sport/football/51428615>
- 19 *Op cit*, BASIS, (2019).
- 20 The Climate Coalition (2018) *Game Changer: How Climate Change is Impacting Sports in the UK*, https://static1.squarespace.com/static/58b40fe1be65940cc4889d33/t/5a85c91e9140b71180ba91e0/1518717218061/The+Climate+Coalition_Game+Changer.pdf
- 21 Sports and Recreation Alliance (2014) *Alliance Survey: Bad Weather and the lack of facility investment is impacting participation figures*.
- 22 UNEP, "Climate change is wiping out the secret to Fiji's international rugby success", <https://www.unenvironment.org/news-and-stories/story/climate-change-wiping-out-secret-fijis-international-rugby-success>
- 23 Dan R. Reineman, Leif N. Thomas, Margaret R. Caldwell, "Using local knowledge to project sea level rise impacts on wave resources in California", *Ocean & Coastal Management*, Volume 138, 15 March 2017, Pages 181–191.
- 24 T. Kershaw, "St Andrews, Carnoustie and Donald Trump's Doonbeg: The golf courses gasping for breath against rising tide", *The Independent*, 22 May 2019.
- 25 J. Welsh, "Carlisle United and their two-year battle to get over Storm Desmond", 18 Feb 2018, <https://www.planetfootball.com/in-depth/carlisle-united-two-year-battle-get-storm-desmond/>
- 26 Data calculated at https://coastal.climatecentral.org/map/11/-0.118/51.4848/?theme=sea_level_rise&map_type=coastal_dem_comparison&contiguous=true&elevation_model=best_available&forecast_year=2050&pathway=rcp45&percentile=p50&return_level=return_level_1&slr_model=kopp_2014. All risks are relevant to both medium and high emission scenarios unless stated otherwise. Annual flood: Local sea level projection plus the added height of a local annual flood. An annual flood's height above sea level is exceeded once per year on average. Middle range scenario risk from: Kopp *et al.* (2014). "Probabilistic 21st and 22nd century sea level projections at a global network of tide gauge sites.", *Earth's Future*, 2(8), 383–406.; High range scenario risk from: Kopp *et al.* (2017). Evolving understanding of Antarctic ice-sheet physics and ambiguity in probabilistic sea-level projections. *Earth's Future*, 5(12), 1217–1233.; Flood height increments outside US from: Muis *et al.* (2016). "A global reanalysis of storm surges and extreme sea levels". *Nature Communications* 7:11969.; Flood height increments inside US from: Buchanan *et al.* (2016), "Allowances for evolving coastal flood risk under uncertain local sea-level rise", *Climatic Change*, 137(3-4), 347–362.
- 27 Note, these estimates are of CO₂e, (CO₂ equivalent) as greenhouse gas emissions are made up of CO₂ and other gases, and are conjoined in the data to give a figure that is equivalent to the atmospheric consequences of all of these gasses combined if it was all CO₂.
- 28 UNEP (2009) *Independent Environmental Assessment: Beijing 2008 Olympic Games* <https://www.unclearn.org/sites/default/files/inventory/unep36.pdf>; IOC (2010) London 2012 – Carbon Footprint Study https://www.mma.gov.br/estruturas/255/_arquivos/carbon_footprint_study_relac_255.pdf; Rio Organising Committee for Olympic and Paralympic Games [ROCOGP] (2014) *Carbon Footprint Management Report Rio 2016 Olympic and Paralympic Games*, <https://nachhaltigersport.files.wordpress.com/2016/04/carbon-footprint-management-report-rio-2016.pdf>
- 29 Econ Pöyry (2009) *Feasibility study for a carbon neutral 2010 FIFA World Cup in South Africa*, https://www.environment.gov.za/sites/default/files/docs/carbonneutralwc_feasibility_study.pdf; FIFA (2013) *Summary of the 2014 FIFA World Cup Brazil™ Carbon Footprint*, <https://resources.fifa.com/image/upload/summary-of-the-2014-fifa-world-cup-brazil-carbon-footprint-2835150.pdf?cloudid=kcvvlnivbq3gs9ksnag>; FIFA (2016) *Greenhouse Gas Accounting Report: 2018 FIFA World Cup*; <https://resources.fifa.com/image/upload/greenhouse-gas-accounting-report.pdf?cloudid=bs36nsonccbtfs5v7ppu>
- 30 Sportcal (2017) *The Global Sports Impact Report*, https://www.sportcal.com/PDF/GSI/Report/GSI_Report_2017_Sample_Pack_v1.pdf
- 31 *Fluminense GHG Inventory Report* (2014) http://www.fluminense.com.br/site/futebol/wp-content/uploads/2016/06/Report_Fluminense-FC_version4-1.pdf. This however, seems like a gross underestimate. If, for example, Fluminense played a Copa Libertadores game in Santiago and took fifty people, let alone any fans, that would account for 50 tons of carbon alone. If they took just 1000 fans that's 1,000 tonnes – a fifth of the club's supposed annual emissions.
- 32 See VfL Wolfsburg annual CST report, here for example, http://emag.vfl-wolfsburg.de.s3.amazonaws.com/CSR_Progress_Report_2018/page_26.html.
- 33 *Greenhouse gas emissions as a result of spectators travelling to football in England* (Dosomu, Colbeck & Bragg, 2017) <https://core.ac.uk/download/pdf/86412956.pdf>

- 34 GHG Emissions: Contributions Made by Football Clubs in England (Dosumu, Bragg & Colbeck, 2014) https://www.researchgate.net/publication/266678664_Greenhouse_Gas_Emissions_Contributions_Made_by_Football_Clubs_in_England
- 35 Pereira, Filimonau & Ribeiro, (2019) 'Score a goal for climate: Assessing the carbon footprint of travel patterns of the English Premier League clubs', <https://www.sciencedirect.com.ezproxy.sussex.ac.uk/science/article/pii/S0959652619312181>
- 36 See: <http://sustainability.nhl.com/report/#1/innovate/reducing-emissions>
- 37 The Business Research Company, (2020) *Sports Global Market Opportunities And Strategies To 2022*.
- 38 On the anti golf movement see, *inter alia*, Stolle-McAllister, J. (2004). Contingent Hybridity: The Cultural Politics of Tepoztlán's Anti-Golf Movement. *Identities. Global Studies in Culture and Power*, 11(2), 195-213; Pleumarom, A. (2016). Fighting Toxic Greens: The Global Anti-Golf Movement (GAG'M) Revisited. In *Sport, Protest and Globalisation* (pp. 151-179). Palgrave Macmillan, London.
- 39 The many mechanisms by which hosts evade the IOC's environmental targets, as well as the IOC's own culpability in the process, are covered in: Geeraert, A., & Gauthier, R. (2018) "Out-of-control Olympics: Why the IOC is unable to ensure an environmentally sustainable Olympic Games", *Journal of Environmental Policy & Planning*, 20(1), 16-30. The article emphasises the degree to which the IOC does not seriously monitor requirements and does not impose any sanctions in the case of hosts do not live up to environmental requirements. See also, on how definitions of sustainability are so vague that the IOC's environmental commitments are undermined, Caratti, P., & Ferraguto, L. (2012) "The Role of Environmental Issues in Mega-Events Planning and Management Processes: Which Factors Count?", In *Olympic Games, Mega-Events and Civil Societies* (pp. 109-125). Palgrave Macmillan, London ; Gauthier, R. (2016) "Olympic game host selection and the law: A qualitative analysis", *Jeffrey S. Moorad Sports LJ*, 23, 1; Paquette, J., Stevens, J., & Mallen, C. (2011) "The interpretation of environmental sustainability by the International Olympic Committee and Organizing Committees of the Olympic Games from 1994 to 2008.", *Sport in Society*, 14(03), 355-369.
- 40 Environmental Assessment of the Athens 2004 Olympic Games (WWF, 2004) <https://wwf.panda.org/?14215/environmental-assessment-of-the-athens-2004>; Independent Environmental Assessment: Beijing 2008 Olympic Games (UNEP, 2009) <https://www.unclearn.org/sites/default/files/inventory/unep36.pdf>; London 2012 - Carbon Footprint Study (IOC, 2010).
- 41 Vancouver 2010 Sustainability Report https://stillmed.olympic.org/Documents/Games_Vancouver_2010/VANOC_Sustainability_Report-EN.pdf; J. McCurry and E. Howard, "Olympic organisers destroy 'sacred' South Korean forest to create ski run", *The Guardian*, 16 Sep 2015.
- 42 The UN Sports for Climate Action Framework can be seen here: https://unfccc.int/sites/default/files/resource/Sports_for_Climate_Action_Declaration_and_Framework_0.pdf
- 43 Geeraert, A., 2018. *Sports Governance Observer 2018. An assessment of good governance in five international sports federations*. Play the Game/Danish Institute for Sports Studies.; Geeraert, A., 2018. *National Sports Governance Observer. Final report*. Play the Game/Danish Institute for Sports Studies.
- 44 Johansen, C. F. (2019), *Sports Governance Observer 2019*, Play the Game/Danish Institute for Sports Studies.
- 45 The full list of current signatories can be seen here <https://unfccc.int/climate-action/sectoral-engagement/sports-for-climate-action/participants-in-the-sports-for-climate-action-framework>
- 46 An informative, if somewhat over-glossy, survey of these kinds of initiatives can be found in UEFA/WWF (2018) *Playing for Our Planet: How Sports Wins by Being Sustainable*.
- 47 See, "UEFA's pledge towards an environmentally conscious UEFA EURO 2020", 27 Nov 2019, <https://www.uefa.com/insideuefa/news/newsid=2634011.html>
- 48 World Athletics Sustainability Strategy 2020-2030, can be found here: <https://www.worldathletics.org/development/sustainable-development>
- 49 World Sailing Sustainability Agenda 2030 can be seen here: https://www.sailing.org/about/Sustainability.php#XtTo2C2ZM_U
- 50 F1's sustainability strategy can be seen at: <https://corp.formula1.com/wp-content/uploads/2019/11/Environmental-sustainability-Corp-website-vFINAL.pdf>
- 51 S. Morris, "Forest Green Rovers named world's first UN certified carbon-neutral football club", *The Guardian*, 30 Jul 2018.
- 52 A. Sten-Ziemons, "Bundesliga: United against climate change?", 14 Jan 2020, <https://www.dw.com/en/bundesliga-united-against-climate-change/a-51944194>
- 53 <https://sustainabilityreport.com/2020/06/04/world-champions-and-sustainability-champions/>

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Biography

David Goldblatt is a writer, journalist and academic. His books include *Social Theory and the Environment* (1996), *The Ball is Round: A Global History of Football* (2006), *The Game of or Lives: The Making and Meaning of English Football* (2014), *The Games: A Global History of the Olympics* (2016) and most recently *The Age of Football: The Global Game in the Twenty First Century* (2019). He is a visiting Professor at Pitzer College, Los Angeles. He can be found on twitter at @davidsgoldblatt.





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