Exploring the Financial Implications of Extreme Heat on the California Magic Soccer Club

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alma economics

Contents

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All conclusions in this report are those of Alma Economics and do not necessarily represent those of partners.

1. Introduction

The California Magic Soccer Club commissioned Alma Economics to explore the impact of climate change on the club. Using data provided by the California Magic Soccer Club, regional climate data, and evidence from the literature, we developed a financial model to calculate the impact of extreme heat on the club through (i) increased facility maintenance costs and (ii) reduced revenues due to event or session cancelations. We also explored the potential adverse costs passed onto players due to an increased incidence of heat-related illnesses associated with playing in hot weather.

Rationale

Climate change is already having a significant effect on California's residents. Extreme heat days in the region have been increasing, with a predicted average of seven extreme heat days per year by mid-century, compared to only three historically[1]. While the Bay Area is typically cooler than other parts of California, this makes it more vulnerable to the effects of extreme heat. San Francisco has a lower rate of air conditioning ownership compared to anywhere else in the country, and has experienced a large increase in heat-related hospitalizations in recent years[2].

While Contra Costa County has adopted climate change adaptation strategies[3], climate change will nevertheless have an impact on local sports clubs. An increase in extreme heat events will require increased irrigation of grass-based pitches and increased cooling costs for artificial pitches. Further, an increased incidence of extreme heat days could lead to clubs running shorter sessions or having to cancel sessions altogether. These increased costs and lost revenue streams place an additional financial burden on local sports clubs.

The current research, using the California Magic Soccer Club as a case study, provides additional insight into these increases in costs in the short and long term, providing sports clubs with further resources to plan and adapt to the impacts of climate change.

Report structure

The remainder of the report is structured as follows:

- **Section two** outlines our approach to the research, providing details on the data sources and climate scenarios used to estimate the financial implications of session cancelations and facility maintenance due to extreme heat.
- **Section three** provides an overview of our key findings under different climate scenarios and a qualitative assessment of the potential financial impact on players.
- **Section four** concludes the report, providing key conclusions from the research and areas for further study.

[1] *Extreme Heat and Health*, City and County of San Francisco, last modified May 17, 2023. Available at: https://www.sf.gov/reports--may-2023--extreme-heat-and-health

[2] Ibid

[3] *Contra Costa County 2024 Climate Action and Adaptation Plan*, adopted November 5, 2024, Contra Costa County Department of Conservation and Development, Envision Contra Costa 2040. Available at: https://envisioncontracosta2040.org/wp-content/uploads/2025/01/ContraCostaCo-2024CAAP-AdoptedFinal-November-2024.pdf

2. Methodology

We developed a model to estimate the current and projected financial impacts of climate change on the California Magic Soccer Club. The model focuses on two primary channels: (i) increased pitch maintenance costs and the resulting higher rental costs due to extreme heat and low precipitation, and (ii) financial losses from session cancelations or shortenings due to extreme heat.

The model quantifies the club's current adverse weather-related costs and projects their evolution over the next 25 years under two climate scenarios: a moderate emissions pathway (RCP 4.5) and a high emissions pathway (RCP 8.5). Our model utilizes data provided by the California Magic Soccer Club alongside publicly available online sources.

Our modeling approach consists of three steps:

1. **Baseline estimation**: We first estimated current costs to the club linked to extreme heat and low precipitation. This includes (i) weather-related pitch maintenance, such as irrigation for grass pitches and water cooling for artificial turf, and (ii) financial losses in pitch rental costs paid when sessions are canceled or shortened.
2. **Climate projections**: Using climate change projection tools from Cal-Adapt[4], we estimated changes in extreme heat days and precipitation levels under the moderate and high emissions scenarios over the next 25 years.
3. **Future impact projections**: These weather shifts were used to inform projections of how costs to the club related to pitch maintenance costs and session disruptions will evolve under the two climate scenarios.

For further details on the methodological approach used for the financial model, see the technical annex.

[4] Cal-Adapt. Available at: https://v2.cal-adapt.org/

3. Key findings

The financial impact of extreme heat on clubs

Table 1 and Figure 1 below present modeling estimates of the current and projected costs of adverse weather (extreme heat and low precipitation) on the California Magic Soccer Club.

Our model estimated that currently, the club incurs over $18,000 per year in weather-related costs. This is split roughly evenly between higher pitch maintenance costs and subsequent higher rents ($9,350) and losses from canceled or shortened sessions where rents are still paid ($9,000). It should be noted that adverse weather conditions, including extreme heat days and low precipitation, have historically occurred in California, and baseline costs should not be interpreted as costs arising solely from climate change.

Our model estimates that the two cost categories are likely to increase by mid-century as adverse weather is likely to become more prevalent. Climate predictions suggest that in the Orinda area, where the club is based, days of extreme heat (temperatures over 90°F) in particular are likely to increase significantly. There are also likely to be some decreases in annual precipitation, although these changes are negligible in the context of the model.

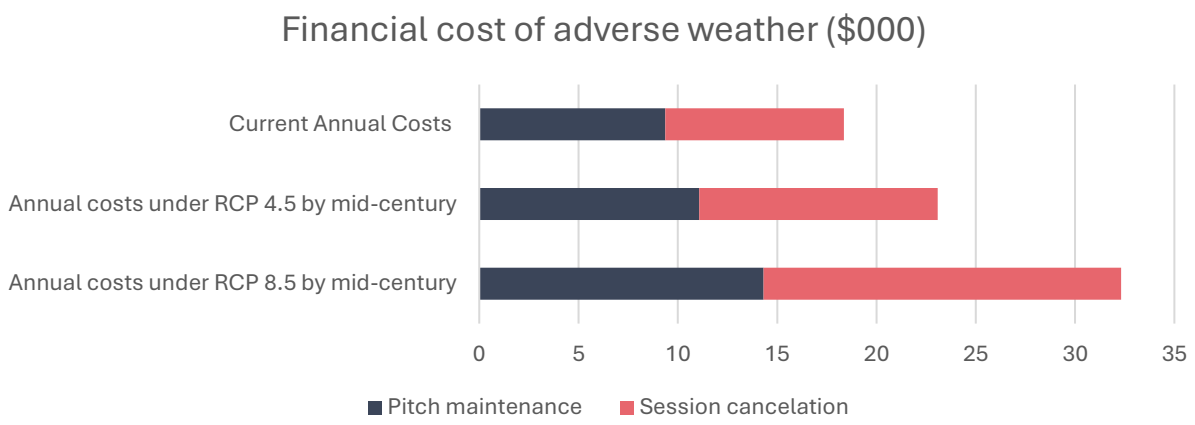
Under RCP 4.5, our model suggests that pitch rental costs rise by an additional $1,700 (18% increase), while session cancelation losses grow by $3,000 (33% increase). Under RCP 8.5, these climb to $3,100 (53% increase) and $9,000 (100% increase), respectively. This would raise the club's annual weather-related costs from the current $18,000 to $23,000 under an RCP 4.5 scenario (a 26% increase) and to $32,300 under an RCP 8.5 scenario (a 76% increase).

Table 1. **Pitch maintenance and session cancelation costs under differing RCP scenarios**

	Pitch maintenance	Session cancelation	Total
Current Costs	$9,364	$9,003	$18,368
Costs under RCP 4.5 by mid-century	$11,072	$12,005	$23,077
Percentage increase under RCP 4.5 by mid-century	18%	33%	26%
Total costs under RCP 8.5 by mid-century	$14,310	$18,007	$32,317
Percentage increase under RCP 4.5 by mid-century	53%	100%	76%

Source: Alma Economics analysis, 2026

Figure 1. Financial costs of adverse weather under differing RCP scenarios



Source: Alma Economics analysis, 2026

The impact of extreme heat on players

As temperatures rise, athletes at all levels also face an increased risk of heat-related illness. Heat-related illnesses can include milder presentations, such as heat cramps, as well as more severe presentations, such as heat exhaustion and heat stroke. Authorities such as US Soccser have introduced regional guidelines and recommendations to prevent and mitigate the impacts of heat-related illnesses, including canceling training and games above a certain temperature, implementing more frequent breaks, and ensuring unlimited access to water[5]. However, even with these guidelines, the incidence and severity of heat-based illness are expected to increase with changing temperatures, potentially leading to (i) an increased financial burden on players and their families from increased medical costs and (ii) worsened well-being and health outcomes.

While there is limited quantitative evidence to support credible financial estimates of costs associated with increased incidence of heat-related illness, there are some studies exploring heat-related illness amongst youth athletes. For example, in a paper examining the incidence of exertional heat illnesses (EHIs) amongst a sample of approximately 118 football teams, Yeargin et al. (2016)[6] found that 198 EHI events were recorded across the study, equating to 0.6% of youth athletes and 0.5% of high school athletes in one year. The most commonly reported EHI events were heat cramps, followed by heat exhaustion and dehydration. Of the reported EHI events, the authors also found that between 2.6% and 5.7% of EHI events required emergency transport, associated with a cost of more than $3,000 per journey[7].

Further, using data on Grand Canyon National Park visitors, Buttke et al. (2023)[8] predicted that for every one-degree increase in maximum temperature (holding all other factors constant), the expected

[5] USA Soccer Heat Guidelines. Available at: https://cdn.sanity.io/files/oyf3dba6/production/f45720c82a0be4de712b55823cfe73dc6f0496d9.pdf

[6] Epidemiology of Exertional Heat Illnesses in Youth, High School, and College Football, Medicine & Science in Sports & Exercise. Available at: https://journals.lww.com/acsm-msse/fulltext/2016/08000/epidemiology_of_exertional_heat_illnesses_in.12.aspx

[7] Emergency Ambulance Transportation Rates, Contra Costa Health. Available at: https://www.cchealth.org/about-contra-costa-health/divisions/ems/ambulance-operations/ambulance-rates

[8] Predicting climate-change induced heat-related illness risk in Grand Canyon National Park visitors. PLOS ONE. Available at: https://journals.plos.org/plosone/article?id=10.1371%2Fjournal.pone.0288812

number of heat-related illnesses increases amongst visitors by 3%. Based on the predicted increase in the maximum temperature in Contra Costa County, the incidence of heat-related illness would increase between 2.2 and 5.8 percentage points by mid-century (dependent on the age group and RCP scenario). In turn, the associated increase in heat-related illnesses requiring hospitalization could result in increased costs for players and their families.

While mitigations such as those introduced by US Soccer could reduce future incidence of heat-related illness, this could result in a reduction in playing time for youth athletes and an increase in other adverse health outcomes, anxiety, and depression. While beyond the scope of this work, Martinez et al. (2023)[9] found significant economic benefits associated with increasing youth sports participation, through cost savings from reduction in weight-related diseases, increased productivity, and reduced poor mental health. Therefore, ensuring a balance between offering adequate playing time and implementing relevant heat mitigations is crucial to minimizing future costs.

[9] Benefits of Meeting the Healthy People 2030 Youth Sports Participation Target, American Journal of Preventive Medicine. Available at: https://pubmed.ncbi.nlm.nih.gov/38416089/

4. Conclusion

The California Magic Soccer Club commissioned this study to understand how a changing climate, and extreme heat specifically, will affect the future costs for the club and the families it serves. Drawing on club data, regional climate projections, and evidence from the literature, our analysis shows that extreme heat and low precipitation are already increasing costs for the club. These pressures are also likely to intensify under both moderate and high-emissions scenarios.

Currently, the club faces an estimated weather-related cost of around $18,000 per year, split roughly between increased pitch maintenance and rental costs and losses from canceled or shortened sessions in which pitch hire has still been paid. As climate change drives more frequent days above 90°F in the Orinda area and modest declines in precipitation, these two cost channels are projected to rise significantly, pushing total annual weather-related costs to about $23,000 under RCP 4.5 and $32,300 under RCP 8.5 by 2050. These findings underline that climate change is not a distant or abstract issue for community sport; it is already translating into higher operating costs and greater revenue volatility.

In Contra Costa County, adaptation strategies are beginning to address these risks, but even with such plans in place, local sports organizations will still face higher irrigation costs for grass pitches, increased cooling demands on artificial turf, and more frequent disruptions to scheduled activities. For a club like California Magic, this means that maintaining safe, playable facilities will demand greater investment at the same time as hot weather cancelations potentially reduce income from training fees and events.

Beyond club finances, the study highlights important risks to players and their families. Existing evidence suggests that, at present, the incidence of heat-related illnesses among youth and high school athletes is relatively low, yet a nontrivial share of recorded events requires costly emergency transport and hospital care, and empirical work in other high heat contexts indicates that even small increases in maximum temperature can translate into measurable growth in heat-related illness. For players and their families, this can mean higher out-of-pocket medical costs. At the same time, reducing playing time to manage heat risk must be weighed against the substantial long-term benefits associated with youth sports participation.

Finally, the modeling framework developed in this project offers a practical tool that can be refined and extended in future work. This could include incorporating additional climate hazards such as wildfire smoke and poor air quality, or quantifying player-level health costs more precisely, and can be adapted for use by other youth sports organizations. By making the financial implications of extreme heat visible and measurable, this research equips the California Magic Soccer Club and other stakeholders with evidence to inform funding decisions, advocate for targeted climate adaptation support, and design policies that safeguard both the club's financial sustainability and the health and development of members.

Technical Annex

The following section provides further details on the approach used within our modeling to quantify the impact of adverse weather and climate change on the California Magic Soccer Club.

The model was split into three main steps:

1. Estimate current baseline financial costs attributable to adverse weather.
2. Obtain climate projections detailing how adverse weather events are likely to evolve in the future in Orinda, California, under different emissions scenarios.
3. Estimate how financial costs to the club are likely to evolve under the different climate scenarios.

Baseline costs

Pitch maintenance

We estimated the current costs of pitch maintenance likely attributable to adverse weather conditions. The primary costs identified were irrigation for natural grass pitches during periods of low precipitation and water cooling for artificial pitches on extreme heat days. Data from the Sports Turf Managers Association[10] and the Costa Mesa City Council[11] provided annual cost estimates for grass pitch irrigation and artificial pitch water cooling, respectively. These figures were adjusted to 2025 prices using Consumer Price Index data from the US Bureau of Labor Statistics. We then assume that these costs were fully passed on through higher rent costs. The increase in hourly rents was determined[12] from Soma Action. We then used data from the California Magic Soccer Club covering pitch usage and type (natural grass versus artificial) to estimate the total annual rental costs likely attributable to adverse weather.

Session cancelation

Current session cancelation and shortened sessions were derived from data collected by the club on the number of sessions canceled and shortened due to extreme heat in the period from March 2024 to December 2025. This was used to determine annual average session hours lost due to extreme heat. We combined this with club data on pitch usage and rental costs to calculate the resulting unrecoverable costs from pitch rentals when sessions are canceled or shortened due to extreme heat.

[10] *Natural Grass Athletic Fields*, Sports Turf Managers Association. Available at: https://www.stma.org/sites/stma/files/STMA_Bulletins/NaturalGrassFields.pdf

[11] *City Council Study Session Report*, City of Costa Mesa. Available at: https://www.synturf.org/images/FN10and20_CostaMesa_www.ci.costa-mesa.pdf

[12] Soma Action. Available at: https://www.somaaction.org/playing-fields

Climate change scenarios

We examined two climate change projections based on Representative Concentration Pathways (RCPs), which model future conditions driven by greenhouse gas emissions through the end of the century. RCP 4.5 represents a moderate scenario, with emissions peaking around 2040 before declining, whilst RCP 8.5 depicts a high-emissions pathway with continued rises without major mitigation.

Using a tool developed by Cal-Adapt, we first quantified current extreme heat days and precipitation levels in Orinda, California. Extreme heat days were defined as days that reach over 90°F, which is roughly the cut-off temperature for session cancelation, as per guidelines by US Soccer. We then projected changes in extreme heat days and precipitation for mid-century (2041–2060) under both RCPs, calculating the percentage changes relative to present-day baselines.

Future costs

Using climate change projections, we estimated how current costs would evolve under the two scenarios. We assumed costs would change in line with weather shifts: water-cooling costs increasing with more days of extreme heat, irrigation costs rising with lower precipitation levels, and session cancelations or shortenings growing in line with changes in extreme heat days. This approach allowed us to quantify changes and their total financial impact from adverse weather under each scenario. We then aggregated these to project total costs to the club by mid-century.

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