ENDANGERED SPORTS

CLIMATE ADAPTATION & THE U.S. SPORTS SECTOR

An executive summary of the series: Extreme Cold, Rising Heat, Declining Snowfall, Storms & Flooding, and Persistent Drought

PREPARED BY

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WITH SUPPORT FROM

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SCHOOL OF KINESIOLOGY
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01 | SPORT IS ALREADY ADAPTING TO A CHANGING CLIMATE

Climate change is no longer a distant risk for American sport. It is changing when, where, and how games are played: hotter and longer heat seasons, cold snaps that arrive where few are prepared, snow that can no longer be counted on, heavier storms and flooding, and deeper droughts.

These hazards reach every level of sport, from youth leagues and high school programs to collegiate athletics, professional franchises, and the ski towns and recreation economies built around them. They put athletes at risk, damage fields and facilities, upend schedules, and add cost to budgets that are already stretched.

Much of the conversation about sport and climate has centered on emissions. The **Endangered Sports** series focuses on the other half of the challenge: adaptation, or how to keep athletes safe and sport playable as conditions change. Produced by student researchers at the University of Michigan Center for Sport & Sustainability, the five reports map where each hazard is concentrated, which sports are most exposed, and what organizations can do about it, with the benefits and limitations of each option weighed side by side.

5	5	27	681	113
INDEPENDENT REPORTS	CLIMATE HAZARDS EXAMINED	ADAPTATION STRATEGIES ASSESSED	CITED SOURCES	PAGES OF ANALYSIS

02 | FIVE REPORTS, FIVE HAZARDS

Each report stands on its own and follows the same structure: an overview of the hazard, its regional patterns, the sports most affected, a set of adaptation strategies with real-world examples, and a conclusion.

EXTREME COLD & THE U.S. SPORTS SECTOR

29 PAGES · 155 SOURCES

Cold snaps, freeze-thaw cycles, and athlete safety

LEAD AUTHOR · ALLIE BULL

Cold events are becoming less frequent but more unpredictable and, in many cases, more disruptive. The greatest exposure falls on regions unaccustomed to severe cold, such as parts of the Southeast, where infrastructure, experience, and response protocols are limited.

7 ADAPTATION STRATEGIES

Indoor facilities · Cold-weather clothing & gear · Heated fields · Winterizing facilities · Bubble chairlifts · Windscreens · Cold safety protocols

RISING HEAT & THE U.S. SPORTS SECTOR

27 PAGES · 190 SOURCES

Extreme heat, air quality, and athlete safety

LEAD AUTHOR · JACOB KENNEDY

Rising temperatures, longer heat waves, and deteriorating air quality threaten athlete health at every level of sport, compounded by drought, wildfire smoke, humidity, and urban heat. Coordinated policies, such as those of the Georgia High School Association, show how clear protocols and enforcement can substantially reduce heat-related fatalities.

6 ADAPTATION STRATEGIES

Heat island mitigation | Heat training | Time-based mitigation | Facility innovations | Cooling systems | Heat safety protocols

DECLINING SNOWFALL & THE U.S. SPORTS SECTOR

16 PAGES · 93 SOURCES

Shorter seasons, snow reliability, and winter recreation

LEAD AUTHOR · AIDEN FELTY

Declining snowpack, earlier snowmelt, shorter seasons, and greater snowfall variability threaten snow-dependent sports across the Northeast, Upper Midwest, and Rocky Mountains, along with the communities and economies built around them. No single strategy can fully address these challenges.

5 ADAPTATION STRATEGIES

Artificial snow | Snow farming | Windbreaks | Dry ski slopes | Diversifying recreational activities

STORMS, FLOODING & THE U.S. SPORTS SECTOR

20 PAGES · 119 SOURCES

Heavy rainfall, flooding, and facility resilience

LEAD AUTHOR · AIDEN FELTY

Coastal areas face storm surge, nuisance flooding, and erosion, while inland regions face intense rainfall, flash flooding, and riverine flooding. These hazards damage playing surfaces and facilities, cancel events, and create substantial financial and operational burdens across the Southeast, coasts, and river valleys.

5 ADAPTATION STRATEGIES

Green infrastructure | Permeable pavements | Rooftop designs (blue & green roofs) | Water squares | Storm & flooding protocols

PERSISTENT DROUGHT & THE U.S. SPORTS SECTOR

21 PAGES · 124 SOURCES

Water scarcity, water rights, and playing surfaces

LEAD AUTHOR · AIDEN FELTY

Persistent dryness and groundwater depletion in the West, and flash droughts in the Midwest and Great Plains, strain the water needed to maintain playing surfaces. Water rights law shapes what organizations can do, particularly in the West, where senior users may receive priority during shortages.

4 ADAPTATION STRATEGIES

Turf fields | Planting vegetation | Water harvesting | Conjunctive water management

03 SIX LESSONS THAT CUT ACROSS EVERY HAZARD

01 **The impacts are already here, and they are uneven.**
Exposure depends on region and sport. Places with the least experience of a hazard, such as parts of the Southeast facing severe cold, are often the least prepared for it.

02 **There is no single fix.**
The most resilient organizations combine infrastructure, operational protocols, and individual preparation into a portfolio rather than relying on one technology or investment.

03 **Protocols deliver outsized value.**
Clear thresholds, consistent weather monitoring, defined responsibilities, and staff training protect athletes across heat, cold, and storms, often at far lower cost than capital projects.

04 **Every option carries trade-offs.**
Snowmaking demands water and energy; synthetic turf saves water but retains heat and creates waste; green infrastructure depends on site, design, and maintenance. Decisions should weigh lifecycle costs, not just upfront price.

05 **Proactive beats reactive, for safety and for the budget.**
Planned investment reduces long-term damage, shortens recovery, and limits cancellations, while repeated emergency repairs and closures cost more over time.

06 **Adaptation has limits.**
Not every sport will continue in its traditional form. Some will need new seasons, schedules, venues, or formats, which also opens room for innovation and wider access.

04 VALUE FOR PRACTITIONERS AND ACADEMICS

FOR PRACTITIONERS

Athletic directors, league and club operations, facility and venue managers, coaches and sports medicine staff, event organizers, parks and recreation departments, and planners.

A regional risk scan
Where each hazard is concentrated and which sports and facilities are most exposed.

A menu of 27 options
Each with benefits and limitations, so options can be compared against budget, site, staffing, and sport.

Proven examples
Real-world cases, from heat policies in Georgia high school sports to a rooftop garden at Fenway Park and a bubble chairlift at Okemo Mountain Resort.

FOR ACADEMICS

Researchers and educators in sport management, kinesiology, sport ecology, sustainability, and environmental policy.

A consolidated evidence base
681 sources spanning climate science, sports medicine, facility engineering, water law, and management.

A common framework
Hazard, region, sport, adaptation option, and trade-offs, applied consistently and transferable to other hazards and settings.

A research agenda
Open questions on the measured effectiveness and cost of adaptation in sport, who can afford it, why organizations adopt it, and where adaptation reaches its limits.

Protocol building blocks
Thresholds, monitoring, communication, and training elements for heat, cold, and storm policies.

Support for capital decisions
Guidance on lifecycle costs and on legal constraints such as water rights.

Evidence for the boardroom
Sourced findings to make the case to boards, funders, and municipal partners.

Adaptation and mitigation together
Several strategies, such as snowmaking and cooling, carry energy and water costs, a tension that invites further study.

A teaching resource
Case-rich material for courses in sport management, facility operations, and sustainability.

A model for applied training
Practice-ready research produced by students, linking the classroom to industry need.

05 | WHERE TO START

IF YOU ARE A…	START WITH
Athletic director or league operations lead	The safety protocol sections: Cold 4.7, Heat 4.6, and Storms & Flooding 3.5
Facility or venue manager	Cold 4.1–4.6 · Heat 4.1, 4.4, 4.5 · Storms & Flooding 3.1–3.4 · Drought 4.1–4.4
Coach or sports medicine professional	Heat 4.2–4.3 and 4.6 · Cold 4.2 and 4.7
Ski resort or winter recreation operator	The full Declining Snowfall report · Cold 4.5
Municipal leader or urban planner	Heat 4.1 · Storms & Flooding 3.0 · Drought 3.0–4.0 (water rights and adaptation)
Researcher or educator	The regional considerations and conclusion sections of each report, and the full source lists

06 | CITATION AND ACKNOWLEDGMENTS

PREFERRED CITATIONS (APA 7TH ED.)

Center for Sport & Sustainability. (2026). *Endangered sports: Executive summary of the climate adaptation report series* [Report]. University of Michigan. https://doi.org/10.7302/dspace/30368

Center for Sport & Sustainability. (2026). *Endangered sports: Extreme cold & the U.S. sports sector* (A. Bull, Ed.) [Report]. University of Michigan. https://doi.org/10.7302/dspace/30370

Center for Sport & Sustainability. (2026). *Endangered sports: Rising heat & the U.S. sports sector* (J. Kennedy, Ed.) [Report]. University of Michigan. https://doi.org/10.7302/dspace/30372

Center for Sport & Sustainability. (2026). *Endangered sports: Declining snowfall & the U.S. sports sector* (A. Felty, Ed.) [Report]. University of Michigan. https://doi.org/10.7302/dspace/30373

Center for Sport & Sustainability. (2026). *Endangered sports: Storms, flooding & the U.S. sports sector* (A. Felty, Ed.) [Report]. University of Michigan. https://doi.org/10.7302/dspace/30375

Center for Sport & Sustainability. (2026). *Endangered sports: Persistent drought & the U.S. sports sector* (A. Felty, Ed.) [Report]. University of Michigan. https://doi.org/10.7302/dspace/30375

About. The Center for Sport & Sustainability at the University of Michigan School of Kinesiology turns the cultural power of sport into measurable climate action through research, education, and community partnership. The Endangered Sports series was produced by the Center's student research team, led by Allie Bull (Extreme Cold), Jacob Kennedy (Rising Heat), and Aiden Felty (Declining Snowfall; Storms & Flooding; Persistent Drought), with funding from the Center for Sport & Sustainability and the Frederick A. & Barbara M. Erb Institute.