Scholars Journal of Applied Medical Sciences (SJAMS) **ISSN 2320-6691 (Online)**
Sch. J. App. Med. Sci., 2015; 3(8E): 3134-3138 **ISSN 2347-954X (Print)**

(An International Publisher for Academic and Scientific Resources)
www.saspublisher.com DOI: 10.36347/sjams.2015.v03i08.076

Review Article

Play, Protect, Preserve: The Role of Sport and Physical Education in Climate Mitigation

Jackson Paul V.[1*] and Charles A. Joseph[1]
[1]Assistant Professor, Department of Physical Education, CMS College Kottayam, Kerala, India

***Corresponding author**
Jackson Paul V.
Email: jacksonpaulv@cmscollege.ac.in

Abstract: The global climate crisis demands transformative action across all sectors of society, including the pervasive and influential realm of sport. Thus, the paper posits that sport and physical education (PE) are not merely peripheral activities but constitute a powerful, yet underutilized, platform for climate mitigation and the cultivation of pro-environmental citizenship. The framework establishes a triad of influence: Play, Protect, Preserve. 'Play' represents the foundational level, where sustainable principles are embedded within the very design and delivery of sports and PE curricula which includes utilizing low-carbon equipment, adopting nature-based and low-infrastructure activities and modelling resource conservation in facilities management. 'Protect' focuses on the educational imperative, advocating for an explicit integration of climate literacy into sports coaching and PE teaching. Lessons can extend beyond physical skill development to explore concepts like systems thinking, ethical consumption related to sportswear and nutrition and the local impacts of climate change on play spaces and seasonal sports. Finally, 'Preserve' examines the role of sport as a catalyst for broader community engagement and advocacy, leveraging the social capital of teams, athletes and school programs to promote sustainable mobility, habitat restoration projects, and collective climate action. The potential impact is multifaceted. The normative power of sport can help shift public attitudes, making sustainable living more aspirational and accessible. Thus, by consciously leveraging its cultural reach, emotional resonance and educational potential, the sports sector can move from being a part of the climate problem to becoming a central protagonist in the solution, nurturing active stewards for an active planet.
Keywords: Climate Mitigation, Sustainable Sports, Physical Education, Environmental Stewardship.

INTRODUCTION

Climate change represents one of the most pressing challenges today, affecting every dimension of human life and environmental stability (IPCC, 2014). While discussions about climate mitigation traditionally focus on energy production, industrial processes and transportation systems, an often-overlooked sector - sport and physical education - possesses significant potential to address this global crisis. The sport industry, encompassing everything from local recreational activities to mega-sporting events, generates substantial carbon emissions and environmental impacts. Simultaneously, physical education and sports programs offer powerful platforms for fostering environmental awareness, behaviour change, and community engagement in climate action (McCullough *et al.,* 2015). Thus, this paper examines the dual role of sport and physical education in climate mitigation: first, as a sector that must substantially reduce its environmental footprint and second, as an educational and social tool capable of mobilizing millions toward sustainable practices and ecological stewardship.

The environmental footprint of sport

Sport, as a global industry, contributes significantly to climate change through various direct and indirect mechanism. The global sport sector produces emissions equivalent to those of a medium-sized country. This substantial impact becomes particularly evident when examining major sporting events. Various sporting events emit enormous quantities of carbon with deleterious environmental consequences. The sources of emissions in sport are multifaceted. Major contributors include the construction of sporting venues and infrastructure, the operation of facilities requiring significant energy for heating, cooling and lighting and most critically, the transportation of athletes, spectators, technical staff and equipment to and from events (Trendafilova *et al.,* 2014). Travel-related emissions represent major share of total carbon emissions from sporting events, with mass spectator transportation being a primary driver. Additionally, the production of sporting equipment, the maintenance of grass and artificial playing surfaces and the management of waste generated during competitions all contribute to the overall carbon footprint of sport.

Climate impacts on athletic performance and infrastructure

The escalating impacts of climate change present a clear and present danger to the integrity of global sports and the safety of athletes, fundamentally threatening both human performance and the physical infrastructure that supports competition. The core relationship is direct: athletic performance is exquisitely sensitive to environmental conditions and the built environment of sport is increasingly vulnerable to extreme weather events (Hayes *et al.,* 2014). This dual threat demands urgent, systemic adaptation to preserve the future of athletic endeavour. For the athlete, thermal stress is the most immediate and well-documented hazard. Rising ambient temperatures and humidity directly impair physiological function. The body's thermoregulatory system is pushed to its limits, leading to accelerated glycogen depletion, increased cardiovascular strain and a heightened risk of exertional heat illness, including potentially fatal heatstroke (Kinnafick and Thøgersen-Ntoumani, 2014). Performance metrics across endurance sports like marathon running, cycling and soccer show measurable decline in hot conditions (Nassis *et al.,* 2015). Furthermore, heat impacts cognitive function, reaction time and fine motor skills, compromising performance and safety in precision sports. Beyond heat, poor air quality from wildfires and pollution exacerbates respiratory issues, particularly for athletes with conditions like asthma and reduces aerobic capacity. The psychological burden is also significant, as training and competition in extreme conditions increase perceived exertion and anxiety, undermining mental resilience.

The infrastructure that hosts sport is equally under siege. Legacy facilities, often designed for historical climate norms, are failing. Heat renders synthetic pitches unusable and natural grass fields barren, while also creating dangerous surface temperatures for participants. Intense precipitation and flooding overwhelm drainage systems, waterlog pitches and damage critical facilities. Winter sports face an existential crisis, with shorter, less reliable seasons for natural snow, forcing an unsustainable reliance on energy-intensive artificial snowmaking that itself contributes to the problem (Burakowski and Magnusson, 2012; Wobus *et al.,* 2017). Sea-level rise and increased storm surges threaten iconic coastal venues, golf courses and marathon routes. The reliability of the sporting calendar is being shattered, with more frequent postponements, cancellations and hazardous last-minute adjustments becoming the new normal, as seen with events like the Tokyo Olympics and various tennis tournaments.

It should be noted that the climate crisis is forcing a paradigm shift in sports management, design and science. The industry can no longer view climate as a static backdrop but must treat it as a dynamic, central variable which necessitates investing in climate-resilient infrastructure, overhauling competition schedules to align with safer seasonal windows, developing advanced personal cooling technologies and implementing stricter environmental guidelines to protect athlete health. The challenge is not merely to adapt sports to a changing climate, but to fundamentally reimagine their practice to ensure they remain safe, fair, and viable for future generations.

Physical Education as a platform for climate education

Physical education occupies a unique position within educational systems as a subject that directly engages students with their bodies, physical activity and frequently with natural environments. This inherent connection to embodied experience creates exceptional opportunities for integrating environmental education and climate awareness into PE curricula. When schools deliberately incorporate environmental themes into physical education lessons and activities, they help students develop knowledge, behaviours and attitudes conducive to sustainable living while simultaneously promoting physical fitness and motor skill development. The integration of environmental education into PE can take multiple forms like outdoor physical activities like hiking, orienteering, nature walks and cycling in natural settings that directly connect students to ecological systems (Baena-Extremera and Granero-Gallego, 2014). These activities inherently teach students about their environment while developing physical competencies. Environmental themes can be explicitly embedded into lesson content, with PE teachers addressing concepts such as carbon footprints, sustainable transportation alternatives, energy conservation, water resource management and ecological restoration. Students might participate in environmental projects including tree-planting initiatives, recycling programs and campus clean-up drives, combining physical activity with tangible environmental action.

The United Nations Decade of Education for Sustainable Development (2005-2014) emphasized the importance of integrating sustainable development principles across all educational domains, explicitly recognizing education's role in promoting behavioural change toward sustainability (UNESCO, 2012). Physical education, through its focus on lifestyle choices and health practices, provides an ideal venue for fostering the values and habits necessary for sustainable living.

Developing environmental competencies and ecological literacy

Environmental education programs integrated into PE training demonstrates positive effects across three critical dimensions: knowledge about environmental issues, actual behavioural change toward sustainability and the development of pro-environmental attitudes. Students exposed to environmental education within PE contexts demonstrate increased understanding of environmental concepts, greater likelihood of

adopting sustainable practices in their daily lives, and more favourable attitudes toward environmental protection and conservation (Kerret *et al.,* 2014). Particularly significant are findings suggesting that environmental awareness substantially influences sports participation choices. Individuals demonstrating higher environmental consciousness demonstrate notably lower carbon footprints associated with their sporting activities across various sports categories. Thus, educational approaches fostering environmental awareness can directly contribute to reduced emissions within sports participation, creating a multiplicative effect where education simultaneously builds environmental literacy while reducing environmental impact. The development of ecological literacy through PE represents a departure from traditional physical education paradigms focused solely on athletic skill development and fitness. By incorporating environmental dimensions, PE programs cultivate "physical ecological literacy" - the integration of embodied physical experience with ecological understanding and stewardship. This holistic approach acknowledges that physical activity is not disconnected from environmental context but rather inextricably linked to the health and integrity of natural systems.

Behaviour changes through sport and physical activity

The relationship between sporting participation and environmental stewardship is not automatic; rather, specific conditions and types of activities appear particularly effective at fostering pro-environmental behaviours. Outdoor sports participation indicates that the specific nature of the activity determines whether environmental awareness deepens. Sports that require meaningful engagement with natural landscapes, such as mountain biking, rock climbing, cross-country skiing and backcountry sports, appear particularly effective at cultivating environmental stewardship. These sports create conditions for emotional bonding with natural environments. As athletes repeatedly engage with specific natural areas, they develop affective connections to those environments (Korpela *et al.,* 2013). This emotional attachment translates into genuine care for environmental preservation and active commitment to conservation efforts. The effectiveness of sport in fostering behaviour change toward sustainability depends partly on what might be termed the "embodied nature" of athletic experience. Through physical activity in natural settings, students and athletes develop visceral understanding of environmental conditions - air quality affecting breathing and performance, water quality impacting health, temperature variations challenging physical comfort and safety. This embodied cognition creates more persistent and personally meaningful understanding than abstract classroom instruction alone can achieve.

The London 2012 Olympic Games

The London 2012 Olympic Games represent a watershed moment in integrating sustainability principles into mega-sporting events. London 2012 was the first Olympic Games to measure its complete carbon footprint across all project phases and was the first to commit to and achieve a "zero waste to landfill" target through its comprehensive Zero Waste Games Vision (Turner and McCarthy, 2013; Dongre, 2015). The Games' sustainability framework, based on the WWF-endorsed One Planet Living sustainability concept, addressed five primary themes: climate change mitigation, waste reduction, biodiversity protection, social inclusion, and promotion of healthy living. The specific environmental achievements of London 2012 demonstrate tangible possibilities for sustainable sport operations. Games organizers minimized carbon emission through strategic sustainability practices (The London Organising Committee of the Olympic Games and Paralympic Games Ltd, 2012). London 2012's innovations established benchmarks for subsequent Olympic Games and major sporting events, demonstrating that mega-events can substantially reduce their environmental footprint through intentional planning, infrastructure innovation, and comprehensive waste management systems.

Sports organizations as environmental leaders

Sporting organizations occupy positions of significant influence within communities and broader society. Major athletic teams, events and organizations command substantial media attention and enjoy high levels of public engagement and emotional investment from fans and participants. This position of influence creates both capacity and responsibility for environmental leadership. Sports organizations that commit to environmental sustainability and actively engage their communities in environmental initiatives leverage their distinctive platforms for climate action. Effective environmental leadership by sports organizations involves transparency regarding operational environmental impacts, commitment to measurable emission reduction targets, engagement with carbon offsetting and climate projects when emissions cannot be eliminated, and active education of fans and participants regarding environmental issues and solutions. When sports organizations adopt environmental practices, they demonstrate practical possibilities for environmental action while increasing expectations that broader society will adopt similar practices.

Climate adaptation strategies within sports

As climate impacts intensify, sporting venues must evolve to withstand extreme weather events and changing environmental conditions. Flood-resistant stadium design, incorporating elevated foundations, improved drainage systems, and in some cases floating structures, protects infrastructure and allows continued operations despite increasing flood risk. Drought-resilient playing surfaces utilizing drought-resistant grass species, hybrid grass-synthetic systems, and smart irrigation technologies maintain playability during

water-scarce periods. Extreme heat adaptation measures including increased shade provision, water station availability, and modified competition schedules protect athlete and spectator health during heat waves.

These infrastructure adaptations represent investments in sport's long-term viability but also offer opportunities for technology demonstration and knowledge transfer. Climate-resilient sports facilities can showcase sustainable building practices, renewable energy systems, and adaptive management strategies that communities beyond sports can adopt.

Beyond structural changes, sports organizations must adapt operational and competition rules to address climate realities. Some sports associations have modified competition cycles, moving events from summer peaks to more temperate seasons. Rule modifications such as allowing more frequent player substitutions during extreme heat, adjusting uniform requirements to enhance heat dissipation, and modifying training schedules to avoid peak temperature periods all represent adaptive responses to climate impacts on athletes' safety and performance.

Sport and physical education in climate mitigation

Sport and physical education (PE) are traditionally framed within the contexts of health, competition and personal development. However, in the face of the escalating climate crisis, these domains must be re-envisioned as powerful, active platforms for climate mitigation. Beyond simply reducing their own operational carbon footprints, sport and PE possess a unique, transformative potential to drive widespread behavioural change, foster eco-literacy and cultivate a generation of citizens for whom environmental stewardship is an intrinsic value, seamlessly connected to physical well-being (Delaney, 2014). The mitigation potential operates on three interconnected levels. First, at the institutional level, sports organizations and educational institutions can model sustainable practices which involves decarbonizing infrastructure through renewable energy for stadiums and gyms, implementing rigorous waste and water management systems at events, prioritizing sustainable procurement for equipment and uniforms and radically rethinking travel logistics for competitions and fixtures. Second, and more profoundly, lies the pedagogical power of sport and PE where they provide an unparalleled experiential platform for climate education. Lessons can move beyond theory to embodied learning: a cross-country run can become a lesson on local ecosystems; a discussion on sports nutrition can encompass food systems and carbon footprints; team strategy sessions can parallel cooperative action needed for global challenges. Third, sport holds immense cultural influence and convening power, offering a potent megaphone for climate advocacy and norm-shifting. High-profile athletes and iconic teams serve as role models; their visible commitment to sustainable practices and vocal advocacy can shift public attitudes and consumer behaviour at scale. Community sports clubs can become hubs for local environmental action, organizing tree-planting drives, promoting active transport to facilities, and mobilizing volunteers for conservation projects.

Ultimately, integrating climate mitigation into the core mission of sport and PE represents a paradigm shift from viewing these fields as passive victims of climate change to recognizing them as active protagonists in the solution. It is a strategy that builds resilience not only in infrastructure but in civic mindset. By leveraging their universal appeal, emotional resonance and community reach, sport and physical education can move millions from awareness to action, fostering a cultural shift where protecting the planet is seen as the ultimate team sport and a fundamental aspect of a healthy, active life. This is not a distraction from their core purpose but an essential evolution of it for the 21st century.

CONCLUSION

The role of sport and physical education in climate mitigation encompasses multiple dimensions, from reducing sport's direct environmental impacts through operational changes and sustainable infrastructure, to leveraging sport's unique position in communities and society as a platform for environmental education and behaviour change. The sport sector, as a contributor to climate change, bears responsibility to substantially reduce its carbon footprint. Simultaneously, physical education's integration of environmental education, coupled with sport's capacity to foster emotional bonds with nature and mobilize communities around shared goals, positions sport and PE as powerful tools for cultivating the environmental awareness and commitment necessary for successful global climate action. Emerging initiatives from the London 2012 Games' comprehensive sustainability achievements in infrastructure reuse and emission reduction demonstrate that substantial emission reductions are feasible within sport. Commitments by major sporting organizations signal institutional recognition that environmental sustainability is inseparable from sport's future viability and social legitimacy. The challenge ahead demands integration across multiple levels where individual sporting organizations must implement concrete emission reduction measures and sustainability practices. Incorporation of environmental literacy and climate awareness into curricula are the immediate need of the hour. Sporting communities must foster norms that reward environmental stewardship and sustainable choices. The principle of "play, protect, preserve" encompasses sport and physical education's potential and responsibility: to play (engaging communities and individuals in the joy and benefits of physical activity and sport); to protect (reducing sport's environmental impacts and building resilience to climate change; and to preserve (fostering environmental stewardship and commitment to ecological sustainability for future

generations). Realizing this vision requires that sport fully embraces its role not merely as a sector facing climate challenges, but as a catalyst for the widespread behaviour change and environmental commitment necessary for global climate mitigation.

REFERENCES

- Baena-Extremera, A. and Granero-Gallego, A. 2014. Quasi-experimental study on attitudes of environmental education in physical education. *Cult. Cienc. Deporte.* 9:25-33.
- Burakowski, E. and Magnusson, M. 2012. Climate Impacts on the Winter Tourism Economy in the United States. Natural Resources Defense Council. https://uvpublichealth.org/ wp-content/uploads/2016/02/climate-impacts-winter-tourism-report.pdf.
- Delaney, B. 2014. Mastery Climate in Physical Education and the Connection to Technology. Graduate Research Papers. 4305. https://scholarworks.uni.edu/grp/4305.
- Dongre, A.P. 2015. Green Game and Societal Sustenance: A Case of London Olympic 2012. Munich Personal RePEc Archive (MPRA) Paper No. 63818. https://mpra.ub.uni-muenchen.de/63818/1/MPRA_paper_63818.pdf.
- Hayes, M., Castle, P. C., Ross, E. Z., Maxwell, N. S. 2014. The influence of hot humid and hot dry environments on intermittent-sprint exercise performance. *International Journal of Sports Physiology and Performance*. 9:387-396.
- IPCC. 2014. *Climate Change 2014 Mitigation of Climate Change Summary for Policymakers*. Technical Summary Part of the Working Group III Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. https://www.ipcc.ch/site/assets/uploads/2018/03/WGIIIAR5_SPM_TS_Volume-3.pdf.
- Kerret, D., Orkibi, H. and Ronen, T. 2014. Green Perspective for a Hopeful Future: Explaining Green Schools' Contribution to Environmental Subjective Well-Being. *Review of General Psychology*. 18(2):82-88.
- Kinnafick, F.-E. and Thøgersen-Ntoumani, C. 2014. The effect of the physical environment and levels of activity on affective states. *J. Environ. Psychol*. 38:241-251.
- Korpela, K., Borodulin, K., Neuvonen, M., Paronen, O., Tyrväinen, L. 2013. Analyzing the mediators between nature-based outdoor recreation and emotional well-being. *Journal of Environmental Psychology*. 37:01-07. https://doi.org/10.1016/j.jenvp.2013.11.003.
- McCullough, B.P., Pfahl, M.E. and Nguyenc, S. 2015. The green waves of environmental sustainability in sport. Sport in Society. http://dx.doi.org/10.1080/ 17430437.2015.1096251.
- Nassis, G.P., Brito, J., Dvorak, J., Chalabi, H., Racinais, S. 2015. The association of environmental heat stress with performance: analysis of the 2014 FIFA World Cup Brazil. *Br J Sports Med*. 49(9):609-613.
- The London Organising Committee of the Olympic Games and Paralympic Games Ltd. 2012. Delivering change. https://cleanair.london/app/uploads/CAL-190-CSL-2012-pre-games-sustainability-report-transport.pdf.
- Trendafilova, S., McCullough, B., Pfahl, M., Nguyen, S. N., Casper, J., Picariello, M. 2014. Environmental sustainability in sport: Current state and future trends. *Global Journal on Advances Pure and Applied Sciences*. 3:09-14.
- Turner, J. and McCarthy, S. 2013. Influencing design and procurement. *Environmental Scientist*. 12-15. https://www.the-ies.org/sites/default/files/journals/env_sci_feb_13. Pdf.
- UNESCO. 2012. *Education for Sustainable Development - Source Book*. UNESCO Education Sector. Learning & Training Tools N°4 – 2012. United Nations Educational, Scientific and Cultural Organization, Paris. ISBN 978-92-3-001063-8.
- Wobus, C., Small, E.E., Hosterman, H., Mills, D., Stein, J., Rissing, M., Jones, R., Duckworth, M., Hall, R., Kolian, M., Creason, J., Martinich, J. 2017. Projected climate change impacts on skiing and snowmobiling: A case study of the United States. *Global Environmental Change*. 45(July):01-14.