

Routledge Research in Sport Business and Management

SPORT AND ENVIRONMENTAL SUSTAINABILITY

RESEARCH AND STRATEGIC MANAGEMENT

Edited by
Greg Dingle and Cheryl Mallen



Sport and Environmental Sustainability

Drawing on recent work in sport studies, business and management, health, science, and law, this book offers a critical examination of the latest published research on sport and environmental sustainability. It examines how strategic management, policy and education influence the relationship between sport and the natural environment, and how the transmission and advancement of knowledge via research journals can, and should, have an impact on policy and practice.

Covering sport at all levels, from professional to non-profit, and across all sectors of sport management, from marketing and events to facilities and communications, *Sport and Environmental Sustainability* makes a powerful argument for an awareness of, and need for, environmental sustainability in sport. Chapters outline the research and methods used, expose gaps in the literature and encourage opportunities for future inter-disciplinary research. Topics include sport and climate change, sport and safeguarding air and water quality, education for sustainability, and sport policy.

This is an invaluable resource for researchers in sport and environmental sustainability, and academics working in sport management, business, recreation and leisure studies, and sustainability programs, as well as sport policymakers and industry practitioners.

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Research and Strategic
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Edited by Greg Dingle
and Cheryl Mallen

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Contents

<i>List of contributors</i>	vii
<i>Acknowledgements</i>	x
1 Introduction to research on sport and environmental sustainability GREG DINGLE AND CHERYL MALLEN	 1
PART I	
Impacts of sport on the natural environment	15
2 Sport and safeguarding air quality JONATHAN CASPER	 17
3 Sport and the safeguarding of water resources CHERYL MALLEN AND GORD WATKIN	 32
4 Major sport events and environmental sustainability JULIE STEVENS	 47
5 Major sport facilities and environmental sustainability SHEILA NGUYEN AND CHERYL MALLEN	 86
PART II	
Impacts of the natural environment on sport	105
6 Environmental impacts on sport: vulnerability, risk, resilience, and adaptation GREG DINGLE	 107
7 Summer sport and climate change PAUL JURBALA AND CHERYL MALLEN	 126

8	Winter sports and climate change NATALIE KNOWLES, DANIEL SCOTT AND ROBERT STEIGER	140
PART III		
	Strategic management, policy and education for the sport-environment relationship	163
9	Sport and environmental policy EFTHALIA (ELIA) CHATZIGIANNI	165
10	Sport environmental measurement tools, certification, and reporting CHERYL MALLEN	183
11	Sport environmental awareness, perceptions, behaviour, motivations, and promotions SCOTT MCROBERTS AND TRISTIAN REID	201
12	Sport partnerships, relationships, and marketing for environmental sustainability SCOTT MCROBERTS AND TRISTIAN REID	221
13	Sport and education for environmental sustainability GREG DINGLE AND CHERYL MALLEN	243
14	Conclusions: envision the future in sport environmental sustainability (sport-ES) CHERYL MALLEN AND GREG DINGLE	261
	<i>Index</i>	268

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Introduction to research on sport and environmental sustainability

Greg Dingle and Cheryl Mallen

Research on the topic of *sport environmental sustainability* (sport-ES) is an important dimension of the global sport academy. This reflects, as McCullough, Pfahl, and Nguyen (2015) have noted, a “conversation about sport and the natural environment [that] cuts to the core of sport operations and planning” (p. 1044). The aim of this text is to inspire, promote, and guide researchers, including students and faculty members, to understand the current state of the research, to complete research projects that can fill in the gaps to expand our knowledge on the topic, and to work with practitioners to move sport-ES forward.

This text provides the most comprehensive assessment of peer-reviewed research on sport-ES available. In total, 13 contributing authors revealed 229 sport-ES manuscripts published across 88 journals. Every chapter focuses on an environmental-related topic, including: the safeguarding of our air and water resources; major sport events and facilities; summer and winter sport and climate change; sport environmental policy; sport measurement tools, certification, and environmental reporting; sport environmental awareness, perceptions, behaviour, motivations, and promotions; sport partnerships, relationships, and marketing for sport-ES; and, finally, sport and environmental education.

Chapter 1 is designed to outline the parameters for the research examined for each topic discussed in the subsequent chapters. The parameters are outlined below and involve a working definition of sport and sport-ES, along with other requirements, such as language, competitive sport, years of publication, and breadth of topics and journals examined. The outline of parameters is followed by a discussion on sport’s dependence on the natural environment, sport and damage to our natural world, debates on sport-ES, and enacting sport-ES.

Parameters for the research manuscripts examined

The parameters for the selection of journal manuscripts reviewed in this text were multi-faceted and, importantly, began with meeting the requirement of being a sport, and a sport-ES, manuscript. Beginning with the concept of sport, sociologist Klaus Meier (1981) observed that sport has had a variety of

definitions. These include: “all physical activities” that are “not necessary for the survival of the individual” (McIntosh, 1970); a “challenge” taken on before crowds; “any free open-air activity”; and “physical exercises”. In light of developments in recent decades, such as globalization, institutionalization, corporatization, and digital technologies (Maguire, 2000; Smith & Stewart, 2010; Thibault, 2009), definitions have at the same time become more specific, and more inclusive. For example, the electronic phenomena of fantasy sport (Billings & Ruibley, 2013) and eSports (Jenny et al., 2017) have expanded contemporary notions of sport.

For the purpose of this text, a widely accepted definition of sport is adopted which has three components: (1) competition; (2) physical activity; and (3) structures that accord with rules or laws (Guttmann, 1978, 2004; Nicholson, Kerr, & Sherwood, 2015). Given the physical dimension to sport in this definition, fantasy sport and eSports were excluded from consideration. Furthermore, non-competitive activities such as tourism and leisure were also not considered. Extreme sports (Brymer, Downey, & Gray, 2009; Brymer & Oades, 2009), though clearly physical activities, are also excluded, given the typical absence of competitive and/or rule-based structures.

The natural environment concept is also a notion without a single, universal definition. To illustrate this point, the natural environment has been referred to in non-academic literature as “nature”, “natural habitat”, or “the part of the Earth that has not been built or formed by humans” (Collin, 2011, p. 143). Alternatively, scholars such as Parkin (2000) contended that the natural environment is the “biophysical limits” of life on planet Earth consisting of soils, air, water, and ecological systems upon which the social and economic dimensions of such life depend. Consistent with these definitions, it has also been argued that humans have an inextricable relationship with the natural environment. As noted by Brymer and Oades (2009, p. 197), humans often forget that:

We are born in nature; our bodies are formed of nature; we live by the rules of nature. As individuals, we are citizens of the natural world; as societies, we are bound by the resources of our environment; as a species, our survival depends on an ecological balance with nature.

(p. 197)

Sport is therefore constrained by nature’s geophysical limits, and exposed to its extremes. For the purpose of illustrating these relationships in this book, the terms *natural environment*, *nature* and *natural world* will be used interchangeably.

Next, environmental sustainability (ES) is defined by the authoritative United Nations (UN) Brundtland Report (1987) as the safeguarding of the natural environment for current and future generations. Further, Mazurkiewicz (2005) argued that sustainability had environmental implications that encompassed “an organization’s operations, products and facilities; to eliminate waste and emissions; maximize efficiency and productivity of resources; and

minimize practices that adversely affect enjoyment of resources by future generations” (p. 35). Meanwhile, Bateh, Horner, Broadbent, and Fish (2014) established that the issues of sustainability “impact all business and non-business organizations, as well as the long-term sustainability of international business relations and quality of life issues worldwide ... [and] required expanding beyond conventional thinking” (p. 35).

An application of these positions was utilized to define sport-ES for this text as safeguarding the critical natural environment for current and future generations of sporting participants. It is the responsibility of all members within sport to act to ensure safeguards are in place to maximize all practices for the enjoyment of the natural resources by sport into the future. This responsibility is shared by groups such as the athletes, coaches, team management, game officials, sport organization administrators, members of the sport manufacturing industry, facility and event managers, and so forth. The authors of this chapter promote that in order to meet the demands of sport-ES, we must enact environmental safeguards that support current sporting endeavours and the future of sport.

It is important to note that manuscripts that focused on corporate social responsibility (CSR) that encompassed financial, social, and ES were excluded from review in this text. Exceptions were made if there was a key environmental focus within the manuscript. This positioned sport-ES as important enough to be a stand-alone topic.

Additional parameters included that the manuscripts examined were English-language academic peer-refereed journal publications published from 1994 to June 2019. The publications were found within (1) a sport-related journal (see examples below); (2) or was a sport management manuscript published outside of sport management specific journals (see examples below); (3) or was presented as an example from a management publication that can underscore future sport research topics. The breadth of the manuscripts examined were open to encompass the full range of topics within sport, including the multiple areas of sport (i.e. professional, amateur, or not-for-profit sport) and the multiple sectors of sport (i.e. marketing, sponsorship, event production, facility management, sporting goods, finance, etc.).

Sport management research manuscripts examined were found in sport-related journals (see www.nassm.org/journals/), such as:

- *European Sport Management Quarterly*;
- *Event Management Journal*;
- *International Journal of Sport Communication*;
- *International Journal of Sport Finance*;
- *International Journal of Sport Management*;
- *International Journal of Sport Management and Marketing*;
- *International Journal of Sports Marketing and Sponsorship*;
- *International Review for the Sociology of Sport*;
- *Journal of Applied Sport Management*;

- *Journal of Hospitality, Leisure, Sport and Tourism Education*;
- *Journal of Sport Behavior*;
- *Journal of Sport Economics*;
- *Journal of the Philosophy of Sport*;
- *Journal of Sport and Social Issues*;
- *Journal of Sport and Tourism*;
- *Journal of Sport Management*;
- *Sociology of Sport Journal*;
- *Sport in Society*;
- *Sport Management Education Journal*;
- *Sport Management Review*; and
- *Sport Marketing Quarterly*.

Sport management research manuscripts examined that were found to be published outside of sport-related journals involved refereed research outlets, such as the following:

- *Current Opinion in Environmental Sustainability*;
- *Energy & Building*;
- *Environment and Energy Report*;
- *Environmental Education Research*;
- *Environmental Health Perspectives*;
- *International Journal of Environment and Sustainable Development*;
- *International Journal of Justice and Sustainability*;
- *Journal of Business Ethics*;
- *Journal of Cleaner Production*;
- *Journal of Contemporary Athletics*;
- *Journal of Environmental Planning and Management*;
- *Journal of Management and Sustainability*;
- *Journal of Sponsorship*;
- *Journal of Sustainability Management*;
- *Sustainable Futures: An Applied Journal of Technology, Environment & Society*; and
- *Urban Studies*.

An examination of the sport-ES manuscripts within a wide range of journals is necessary to obtain an understanding of the literature on the important topic of sport and the natural environment.

A dependence on the natural environment as a place for sport

Beyond a requirement for life; the natural environment is critical as the place of sport (McCullough & Kellison, 2016). This includes the provision of natural

settings as sport training and competition sites. Examples include sports use of snow-topped mountains and cross-country ski trails for the multiple skiing and snowboarding events; clean bodies of water for canoeing, kayaking, sailing, surfing, swimming, and water polo; and water for the ice needed for ringette, ice hockey, and curling; healthy grass spaces (indoors and outdoors) for baseball, cricket, golf, and European football or soccer; as well as areas of sand for beach volleyball. Further, our natural resources are needed as raw materials in the manufacturing of sporting wear and equipment, such as bats for cricket, curling, hurling, and baseball, along with balls for American football, baseball, field hockey, netball, and rugby. Importantly, our natural resources are also critical for the health of athletes (Donnelly et al., 2016; Dyjack, 2016). Damage to our natural resources, thus, impacts sport.

Sport and damage to our natural world

Patterns of behaviour around the world exhibit human actions that have caused unprecedented damage to our planet Earth (Intergovernmental Panel on Climate Change, 2014; United Nations Environment Programme, 2012;) at all levels – including the local, regional, and global levels (United Nations Environment Programme, 2007). The capacity of humans to damage planet Earth's ecological systems has been widely acknowledged by scientists (United Nations Environment Programme, 1997, 1999, 2002, 2007, 2012, 2019a). The global scale of the impacts on the natural environment are now so pervasive, and it is “well established” (United Nations Environment Programme, 2019a, p. 24) that human activities are the primary “drivers of environmental change” (United Nations Environment Programme, 2019a, p. 24; 2019b). Humanity's imprint on natural systems is now so extensive that geologists have coined a new term – the *Anthropocene* – to encapsulate the extent, magnitude and duration of such impacts (Lewis & Maslin, 2015; Steffen et al., 2015; Zalasiewicz et al., 2015).

No region of the world can expect to be left out of the environmental damage (United Nations Environment Programme, 2007). Given the scale of global environmental change (GEC), there is little evidence to suggest that sport is immune from such impacts. Determining whom to blame is difficult as the damage is not being caused by one particular group within society, organization, or particular action, but is “driven by expanding flows of goods, services, capital, people, technologies, information, ideas and labour” (United Nations Environment Programme, 2007, p. 364). Sport, too, has been noted as contributing “a significant impact on the environment” (Thibault, 2009, p. 11).

There is a growing body of literature in sport-ES (Mallen, 2017) that has noted the capacity of sport activities to adversely affect the natural environment (e.g. Collins & Roberts, 2018; McCullough, Pfahl, & Nguyen, 2015; Trendafilova et al., 2014). One example of sport impacting the natural environment stems from the clearing of land (e.g. Inoue & Kent, 2012; Thibault,

2009; Trendafilova et al., 2014; Wheeler & Nauright, 2006) for sports fields and parking lots. Another example involves solid wastes generated at sport venues (e.g. Dolles & Soderman, 2010; McCullough & Cunningham, 2011; Thibault, 2009). This includes the food and beverage service at sport facilities that utilize plastics in the form of beverage cups and lids, food containers, straws, and so forth that generate waste (Collins et al., 2007). Sports demand for plastic contributes to the world's plastics pollution from an estimated overall production of "a mere 9.2 billion tons of the stuff" (Parker, 2016, para. 4) that can be biodegraded in an estimated "450 years to never" (Parker, 2016, para. 4). The plastic fills landfill, is scattered by wind in natural settings, and, all too often, has entered the world's waterways. An estimated 8 million tonnes of plastics end up in the oceans annually (World Economic Forum, 2016) and it has been predicted that by 2050 there will be a 1:1 "ratio of plastics to fish in the ocean (by weight)" (World Economic Forum, 2016, p. 14).

A further example involves sport's contribution to climate change with greenhouse gas emissions from fossil fuel use for travel and energy for sport facility heating and cooling demands (Chard & Mallen, 2012; Collins et al., 2007; Collins & Roberts, 2018; Dolf & Teehan, 2015; Dolles & Soderman, 2010; Otto & Heath, 2010; Wicker, 2018). Fossil fuel use contributes to contemporary climate change due to causing a rise in carbon dioxide, along with "other heat-trapping 'greenhouse' gases" (Trenberth, 2018, p. 467). As the carbon builds up in the atmosphere, the Earth warms (Trenberth, 2018) and is associated with extreme weather events that have been noted as impacting sport with intense rainfall, strong winds, longer droughts, extreme heat or cold events, along with new turf diseases (Mallen & Dingle, 2017), and heat that affects the health of athletes (Seto, Way, & O'Connor, 2005). Additionally, the airborne fossil fuel pollutants can impact athletes' lung function (Brocherie, Girard, & Millett, 2015). Importantly, it has been argued that sports environmental effects specifically occur at a "much larger scale" (DeChano-Cook & Shelley, 2017, p. 67) due to the size of mega-events.

The relationship between sport and the natural environment has been the basis of two key debate topics within the sport academy. The first debate topic concerns the environmental impacts or "footprint" of sport (Collins & Flynn, 2008; Collins & Roberts, 2018; Dolf & Teehan, 2015), especially its extent, how to measure it, and how to reduce it. The second topic for debate is focused on impacts of nature on sport. The former debate has a much longer history and wider scope, while the latter is much more recent and is less well-developed. Such debates are significant in the process of realizing sport-ES despite that it has been deemed difficult to achieve as "vague", "context-specific", and "complex" (Mallen & Chard, 2011, p. 425). Mallen and Chard (2011) provided a framework for guiding debates and argued that they needed to conclude with a "vision" (p. 427). Additionally, Mallen and Chard (2012) offered a vision of "what could be in sport-ES" (p. 230) and suggested that one's imagined future can guide efforts moving forward in sport-ES.

Enacting sport-ES

A growing movement to advance sport-ES has begun (Szathmari, 2017), but sport has much more work to be completed before it can be declared as being entrenched with environmental actions. Examples of this movement include declarations, the establishment of commissions and sport environmental organizations, conferences, research centres, and actions in sports-ES. For instance, in the 1990s, the International Olympic Committee (IOC) introduced environmental protection as the third pillar of Olympism alongside the already existing two pillars of sport and culture (Cantelon & Letters, 2000), and established the *IOC Sport & Environment Commission* – later renamed the *Sustainability and Legacy Commission* (International Olympic Committee, 2017b). Further, the *IOC Sustainability Strategy* (International Olympic Committee, 2017a) was released with environmental plans through to 2030.

Sport-specific environmental organizations have emerged, including: the *Green Sports Alliance* (<http://greensportsalliance.org/about/>); *Sports Environmental Alliance* (#SEA_the change, <https://sportsenvironmentalliance.org>); *Sports for Climate Action* (<https://unfccc.int/climate-action/sectoral-engagement/sports-for-climate-action>); *Sport and Sustainability International* (<https://www.sporttechie.com/sport-sustainability-international-new-organization-founded-help-protect-environment-sports/>); and *The United Nations, Sport and the Environment* (<https://www.thenewfederalist.eu/the-united-nations-sport-and-the-environment>).

Examples of sport-specific environmental conferences include: the *Green Sports Alliance Summit* (<https://greensportsalliance.org/summit/>); *Sustainable Innovation in Sport Conference* (<http://www.sustainableinnovationinsport.org>); and the *World Conference on Sport and the Environment* (<https://www.olympic.org/news/10th-ioc-world-conference-on-sport-and-the-environment-kicks-off-in-sochi>).

The state of sport-ES

The state of sport-ES, as outlined by Trendafilova and McCullough (2018), has shifted to where sport “organizations at all levels have begun to place considerable importance on becoming more environmentally conscientious” (p. 1). Multiple researchers have examined sport organizations and their progress in sport-ES – for example, in professional sport (Francis, Norris, & Brinkmann, 2017; Johnson & Ali, 2017; Nguyen, Trendafilova, & Pfahl, 2014) and the Olympic Games (McLeod, Pu, & Newman, 2018; VanWynsberghe, 2015; Walker & Leopkey, 2017). Additionally, McCullough, Pfahl, and Nguyen (2016) examined the progression of sport-ES and concluded that there have been three waves of development. Their three waves are interpreted to involve the primary, secondary, and advanced stages of awareness and action. Importantly, these authors indicated that the momentum for sport-ES is growing. This growth is not without its challenges as Trendafilova, McCullough,

Pfahl, Nguyen, Casper, and Picariello (2014) outlined that communication management and sport organization resources are key to success. Despite issues within the process, greater advances in sport-ES organizational practices have been promoted as necessary by Sartore-Baldwin and McCullough (2018). This movement is key for safeguarding sport, but also has been noted as important as an educational platform for society (Trendafilova & McCullough, 2018).

The authors of this chapter promote that sport-ES needs to be entrenched within every strategy and action to ensure the safeguarding of the natural environment for sporting participants today and into the future. We are capable of reaching this goal and such actions will positively impact our collective future. As a key step in moving forward in sport-ES, this text seeks to aid in understanding current research publications, and particularly the gaps in the literature that need to be filled.

The upcoming chapters

This text lays out a comprehensive overview of the sport research manuscripts published in refereed journals. The upcoming chapters are organized around three themes: Theme 1, impacts of sport on the natural environment; Theme 2, impacts of the natural environment on sport; and Theme 3: strategic management, policy, and education for the sport–environment relationship. Themes 1 and 2 reflect the duality of the relationship between sport and the environment. Theme 1 recognizes the harms that sport has on nature, that are typically adverse. Theme 2 adopts the reverse perspective of the sport–environment relationship. Whilst nature is typically an enabler of sport activity, extremes of nature can adversely impact sport events, facilities, and participants.

Theme 1 comprises four chapters. In Chapter 2, Casper focuses on research on sport and safeguarding air quality, and contends that sport’s relationship with air quality occurs through participant travel to sport events, sport events themselves, and spectator activities. In Chapter 3, Mallen reviews research pertaining to sport and water resources. In doing so, the global context of water resources is outlined, and the crucial role that water plays in enabling sport participation and events is discussed. In Chapter 4, Stevens explores research on the relationship between major sport events and sport-ES. A substantial body of research is examined, and three key research themes are identified. In Chapter 5, Nguyen and Mallen look at research focused on major sport facilities and sport-ES.

In Theme 2, three reviews of research pertaining to impacts of the natural environment on sport are presented. In Chapter 6, Dingle considers research contemplating how nature affects sport. In doing so, five key concepts are considered: impacts, vulnerability, risks, resilience, and adaptation. In Chapter 7, Jurbala and Mallen consider research on the topic of summer sport and climate change. They review the small yet growing body of pioneering research literature, and identify key gaps for researchers to pursue in future. Next, in

Chapter 8, Knowles, Scott and Steiger examine the topic of winter sport and climate change. They outline the global context of climate change, and an extensive body of research documenting the impacts of climate change on winter sport, and major risks. Implications for winter sport participation, and opportunities for adaptation, are then considered.

Theme 3 encompasses five chapters. In Chapter 9, Chatzigianni reviews the research pertaining to the relatively new topic of sport and environmental policy. She highlights the critical role of governmental and non-governmental factors to the formulation of environmental sport policy at the global level, and evaluates opportunities for future research in a globalizing world. In Chapter 10, Mallen examines research on the three key environmental measurement tools outlined by Kuhndt (2004), and the use of such tools in sport for advancing certification and reporting. In Chapter 11, McRoberts and Reid review research on sport environmental awareness, perceptions, interactive behaviour, industry motivations, and marketing promotions. This chapter highlights the key role that sport communications can play in achieving environmentally sustainable sport. In Chapter 12, McRoberts and Reid review research on sport partnerships/relationships and sport marketing for ES. This chapter illustrates the value of research that is either sport, or not sport, focused, and sport's potential for making positive social and environmental contributions. Lastly, in Chapter 13, Dingle and Mallen review research pertaining to sport and education for ES. This chapter highlights the potential of sport-specific education to teach ES to sport professionals, and thereby develop a sustainable sport industry.

In the final section of this book, we present our Conclusions chapter. In Chapter 14, we assess the current state of research for sport and ES and provide our perspective on 'what could be' in sport-ES.

This Routledge book, *Sport and Environmental Sustainability: Research and Strategic Management*, is a comprehensive and interdisciplinary text that presents, details, critiques, and celebrates research focused on sport and ES. It is intended to complement the *Routledge Handbook of Sport and the Environment*, published in 2018. Overall, sport is not exempt from its shared societal responsibility of being part of the solution for safeguarding the natural environment. Let's work to understand current research on sport-ES, move quickly to fill in the research gaps, and advance knowledge that supports action that safeguards the natural environment for current and future sporting participants.

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Part I

Impacts of sport on the natural environment



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Sport and safeguarding air quality

Jonathan Casper

Research pertaining to air pollution resulting from conducting sport operations and associated spectator activity has been noticeably limited, even though it is a vital environmental sustainability (ES) component related to human health and climate change risk mitigation. Air pollution is a global problem, estimated to account for 4.2 million deaths per year (World Health Organization, 2018a). Pollutants with the strongest evidence for public health concern include particulate matter (PM), ozone (O₃), nitrogen dioxide (NO₂), and sulphur dioxide (SO₂), all linked to adverse health effects ranging from increased hospital admissions and emergency room visits, to increased risk of premature death (World Health Organization, 2018b).

In addition to human health impacts, air pollution contributes to climate change and affects ecosystems. Greenhouse gas (GHG) emissions due to human activities are one of the leading causes of environmental degradation. Greenhouse gases trap heat and make the planet warmer. The burning of fossil fuels to generate electricity and heat, and for transportation, are responsible for almost all of the increase in greenhouse gases in the atmosphere over the last 150 years (United States Environmental Protection Agency, n.d.b).

While sport event operations may have only a minimal effect on air pollution, sport-related transportation for participants and spectators poses a substantial concern. When vehicles are used for the purpose of sport, such as for travel to compete in sporting contests or to attend a sport event, sport participants are culpable for contributing to air pollution (Chard & Mallen, 2012). There is, therefore, a need for recognition, understanding, and accountability of the extent to which sports contribute, as well as proactive measures to mitigate air pollution impacts.

Sport has exhibited an initial recognition of the issue. For instance, at a global level, international governing agencies, such as the United Nations (UN) and the International Olympic Committee (IOC), have begun to acknowledge and encourage action concerning the impact of sport on the environment, with the UN developing a program on Sport and the Environment (Schmidt, 2018). The ecological footprint of sport events is indicated as one of the concerns of United Nations Environment Programme, including the impact of air pollution and greenhouse gas emissions (Bunds, Casper, & Frey, 2018).

As ES policies and practices gain momentum, considerations of air pollution, and associated air quality resulting from sport events and the health of athletes and spectators, becomes a prominent area to address. This chapter will examine the current research on air pollution and sport, most of which comes from non-sport management journals. Summarized are two major themes; the first is air pollution due to transportation/travel to sport events/programs; the second is associated with air pollution at events that can impact spectator and athlete health. Recommendations based on this research review, as well as addressing research gaps, will then be discussed.

Air pollution associated with sport participation

Travel, mostly using personal automobiles, is necessary for “sport parents” to get their children to sport practices and games. Research on transportation behaviour for participatory sport has found that there are serious adverse consequences to the environment attributable to transportation associated with practices and sporting contests (Chard & Mallen, 2012).

Travel to sporting contests

In a seminal study published in *Sport Management Review*, Chard and Mallen (2012) surveyed the car travel behaviours of a small group of ice hockey parents when travelling to competitions that were not at their home sport facility (e.g. away games). The objectives of the study were to describe the carbon footprint as well as generate ideas about ways to reduce and offset carbon impacts. Participants in their study ($n = 32$) were asked to provide details on the type of car they typically used to transport their child to sport competitions and what “away” games they attended. Their results indicated that sport parents travelled a combined 78,000 km, emitting approximately 20 tons of CO₂ in the course of attending only away games for their child’s hockey team. The research team concluded that a reduction in the environmental impact of away games could be achieved through car-pooling, inter-parent coordination, or hiring a bus versus multiple individual vehicles. Additionally, the data showed that individual players could mitigate their environmental impacts for under \$30 per player through the purchase of carbon offsets. The research team provided several recommendations, including for organizations to better coordinate game scheduling, adjusting game schedules, and possibly even considering league realignment. A summary of this study is included below.

Chard & Mallen (2012)

Research topic: Car travel behaviours of ice hockey parents travelling to competitions

Method: Qualitative interviews