

# Environmental Sustainability and Sports: An Evaluation of Sports-Induced Adverse Effects on the Environment

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## ABSTRACT

The United Nations Sustainable Development Goals are grouped under three main titles; economic development, environmental sustainability, and improvement of social well-being. Environmental sustainability is one of the most important components of sustainable development goals because it is obvious that without a sustainable environment, economic and social development goals will be abandoned. While the unplanned use of the environment and natural resources threatens environmental sustainability, it can be said that one of the most important actors in this process is sports. Mass production and consumption, facility-establishment, and increase in organizations in sports accelerate environmental and natural destruction. The sustainability of sports is directly proportional to environmental sustainability. Therefore, reduction of the sports-induced negative environmental impacts will make great contributions to environmental sustainability. In this way, it will be possible to transfer both the natural environment and sports to future generations. This study was limited to environmental sustainability, which is one of the three main titles set for sustainable development goals and the effects of sports on environmental sustainability were evaluated in the light of available literature. Again, regarding the existing literature, suggestions were developed to reduce the negative environmental impacts of sports.

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## 1. INTRODUCTION

### 1.1. Sustainable Development Goals Environmental Sustainability and Sports

Sustainable Development Goals (SDGs) were put into practice by the United Nations (UN) in September 2015 due to the increasing urgency for sustainable development (SD) on a global scale (Kanapathy, et al. 2019). Composed of seventeen goals, the SDGs are the basic components of a sustainable world goal in every field from poverty to food, health, energy, soil, air and fresh water needs. The SD processes of societies are gathered under three main titles by the UN. These are economic development, environmental sustainability (ES), and improvement of social well-being. All world societies aim at a combination and harmony of economic development, ES and social welfare (Sachs, 2012). People and societies are at the center of sustainable development goals because the need to set these goals has emerged as a result of human behavior. While the economic consumption process exceeds the natural

resource stock, the negative environmental effects have become evident and the social welfare balance in the access of societies to natural resources has been disrupted.

Environmental sustainability is one of the most important components of sustainable development goals. Unlimited needs of humans consume limited natural resources day by day, and the harmful gases emitted during this consumption process have devastating effects on the environment. Therefore, the conservation of the environment and natural resources and their transfer to future generations are the problems that humanity needs to find a solution to. It is obvious that without a sustainable environment, economic and social development goals will be abandoned. It can be said that the industrialization process puts the sustainable world goal at risk with its negative effects on the environment. Since the necessary measures have not been taken, the production, consumption and transportation processes in all sectors come to the fore with their negative effects on the environment. In fact, one of these sectors is sports, which is also industrialized.

Sports events, organizations and facility-establishment steps have negative environmental effects. It can be said that mass participation in sports organizations accelerates the consumption process of environmental and natural resources. During the facility-establishment process, unplanned construction, the use of chemicals that will cause soil and water pollution, and carbon dioxide and greenhouse gas emissions due to high energy consumption threaten environmental sustainability goals.

This study was limited to environmental sustainability, which is one of the three main titles set for sustainable development goals. In addition, the effects of sports on environmental sustainability were evaluated in the light of available literature. While the unplanned use of the environment and natural resources threatens environmental sustainability, it can be said that one of the most important actors in this process is sports. Mass production and consumption, facility-establishment, and increase in organizations in sports accelerate environmental and natural destruction. Therefore, the environmental effects of sports activities and organizations have been understood in recent years, and the studies conducted on this subject have increased qualitatively and quantitatively (Mallen et al. 2010).

## **1.2. Sustainable Development**

Sustainable Development (SD) is defined as the realization of the development required by today's needs in a way that does not eliminate the ability to meet the needs of future generations (Triantafillidis, 2018). Sustainable development, which is based on not consuming global resources while ensuring the development of today's societies and transferring these resources to future generations, not only aims at the present development but also includes the construction of a sustainable future. Rogers et al. (2008: 23) states that the concept of sustainable development has been popular for more than 30 years and has been an important topic of discussion in recent years. At the center of sustainable development are the protection of the natural environment and the quality of life of humanity, while increasing the level of economic growth and welfare (Özmehmet, 2008).

The World Commission on Environment and Development (WCED) has had the understanding of sustainable development accepted and spread widely and has comprehensively discussed sustainable development with its report titled "Our Common Future" (Saraç & Alptekin, 2017). Rogers et al. (2008), on the other hand, states based on the WCED report that sustainable development includes three sub-headings, which are economic, social and ecological. They explain the relationship of these subheadings with sustainable development as follows:

- Economic: Increasing revenues while maintaining the capital stock (natural resources).
- Social: Ensuring the continuity of social and cultural systems.
- Ecological: Preserving and maintaining the biological and environmental system (Rogers et al., 2008: 23)

Specific to the economic subheading, first, individual and social expectations and needs are expected to be met efficiently. Economic conditions should support individual conditions and focus on the interests of present and future generations (Ergün & Çobanoğlu, 2012). Rogers et al. (2008:63) mention the three main components of the economic subheading, which are production, consumption and distribution. The main goal of sustainable development is that these three components meet the needs of people by protecting the environmental balance and natural resources without exceeding the resource stock.

Specific to the social subheading, one of the basic conditions for talking about sustainable development is to see economic progress in the social field, too (Ergün & Çobanoğlu, 2012). Equal and balanced access to natural resources by people all over the world without any discrimination can be considered as the most important element of the development of societies.

In the ecological (environmental) subheading, on the other hand, prevention of environmental pollution, reduction of greenhouse gas emissions, preservation of ecological balance, energy and resource efficiency (Triantafyllidis, 2018) emerges as the priority of a sustainable world. Besides, protecting the environment and natural resources and transferring them to future generations is one of the priorities of humanity. That is because, although human needs are unlimited, it is obvious that natural resources are limited and consumed rapidly.

To achieve sustainable development goals throughout the world, the three sub-headings in question should be handled together and complement each other. While increasing economic welfare, protecting the environment and natural resources, and establishing social balances equally and fairly stand out as the basic conditions of the development process. Sustainable development in general and the operationalization of the three sub-headings in particular and the construction of the desired future can be achieved with the determined principles. Sustainable development principles were compiled by Saraç and Alptekin (2017) and presented in the table below:

**Table 1:** Sustainable Development Principles

Economic	While ensuring economic development and progress, not to consume unsubstituted resources, not to harm
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	the natural environment, and to ensure social justice and equality on a global scale.
Social	Equal access to existing natural resources by all humanity, to transfer these resources to future generations while today's societies benefit from these resources.
Ecological (Environmental)	To reduce carbon dioxide and greenhouse gas emissions, to reduce emissions that will harm the atmosphere, to reduce the actions that will pollute soil, water, and air in a planned way.

**Source:** Saraç and Alptekin (2017).

The United Nations (UN) is working with all countries to provide a sustainable environment for both humanity and the world and to transfer this to future generations. Based on this purpose, the UN determines sustainable development goals under 17 titles and puts into effect separate action plans for each title. The UN sustainable development goals are presented in the table below:

**Table 2:** The United Nations Sustainable Development Goals

No Poverty	Zero Hunger	Good Health and Well-Being	Quality Education	Gender Equality
Clean Water and Sanitation	Affordable and Clean Energy	Decent Work and Economic Growth	Industry Innovation and Infrastructure	Reduced Inequalities
Responsible Consumption and Production	Sustainable Cities and Communities	Climate Action	Life Below Water	Life On Land
Peace Justice and Strong Institutions			Partnership For The Goals	

**Source:** <https://www.tr.undp.org/content/turkey/tr/home/sustainable-development-goals.html>

The 17 goals mentioned above are built on the achievements of the "Millennium Development Goals" and include priority areas such as climate change, economic inequalities, innovation, responsible consumption, peace and justice (<https://www.tr.undp.org/content/turkey/tr/home/sustainable-development-goals.html>). It is also known these issues are discussed in the United Nations' "Transforming Our World: the 2030 Agenda for Sustainable Development" and emergency action plans that are critical for humanity and the planet for the next 15 years have been planned (Bebbington & Unerman, 2018).

### 1.3. Environmental Sustainability

The problem of meeting unlimited needs with limited resources is an area of economics studies (Önder & Ağca, 2018). However, it can be said that this problem has ceased to be a problem that only concerns the economic field, and has become one of the main problems of environmental science. That is because while the limited resources of the world are being exhausted, it is inadequate to handle this process

within a purely economic framework, and the arising problems make the negative effects on the environment more pronounced. Today, the effort to meet unlimited needs has revealed the concept of environmental sustainability and has become the main cause of many environmental problems, especially climate change.

Environmental sustainability has been defined in the Bruntland Report of the United Nations as the protection and inheritance of the natural environment for/to present and future generations. It became an international concept that became effective with the Kyoto Protocol signed in 1997 (World Economic and Social Survey, 2015). On the other hand, environmental sustainability is considered as leaving vital products and services such as food and nutrition and a clean and livable world to the next generations, and the availability of today's natural resources equally in all societies (Fantana & Ferruci, 2014). Environmental sustainability can be considered an important problem for both today's humanity and future generations. As stated above, the equal and balanced use of existing natural resources and transfer of these resources to the future are at the center of the understanding of environmental sustainability. Therefore, the protection of the environment and natural balance, and the balanced processing of limited resources can be accepted as the basic condition of a livable world. For this, Morelli (2011) stated that more importance should be attached to the understanding of environmental sustainability for the continuity of nature and its transfer to future generations. For this purpose, he proposed 5 main principles supporting environmental sustainability. These principles are presented in the table below (Morelli, 2011).

**Table 3: Principles Supporting Environmental Sustainability**

<b>Social Needs</b>	<ul style="list-style-type: none"> <li>• Not to produce anything that will cause the next generations to act prudently,</li> <li>• To design products and services that will contribute to a sustainable economy,</li> <li>• To support the local workforce,</li> <li>• To support fair competition,</li> <li>• To consider environmental sustainability a necessity for new products and services.</li> </ul>
<b>Protection of Biodiversity</b>	<ul style="list-style-type: none"> <li>• To select natural resources that protect biodiversity,</li> <li>• To use environmentally friendly and sustainable energy resources,</li> <li>• To improve energy efficiency.</li> </ul>
<b>Improvement Capacity</b>	<ul style="list-style-type: none"> <li>• To increase renewable resource input in production,</li> <li>• To increase renewable resource substitution</li> </ul>
<b>Reuse and Recycling</b>	<ul style="list-style-type: none"> <li>• To develop reuse and recycling designs,</li> <li>• To reduce emissions and wastes to zero in production and work processes and to develop designs for this.</li> </ul>

<b>Non-Renewable Resource and Waste Restriction</b>	<ul style="list-style-type: none"> <li>• To establish the best transportation system and infrastructure in terms of environmental damage,</li> <li>• To keep emissions from waste at an acceptable level,</li> <li>• To develop criteria for low-impact transportation systems,</li> <li>• To develop an approach that considers environmental effects in all production processes.</li> </ul>
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Environmental sustainability has become one of the primary problems of modern societies. Today's technology, construction and modernization movements are on the agenda with their facilitating effects on human life on one hand, and their negative environmental effects, on the other. Mann et al. (2017) state that while carbon dioxide emissions due to human activities cause the natural environment and resources to deteriorate, climate scientists try to draw attention to this situation. It can be said that negative environmental effects occur in all individual and social actions and activities. All vital actions from plastic bottles and materials to fossil fuels used, from individual and public transportation vehicles to huge production facilities, cause great damage to the environment where life exists. As a result of all these vital processes, the fact that energy resources begin to be depleted rapidly on a global scale, and thus the problems related to the environment increase makes ecology and energy problems a current issue (Civan, 2006: 1).

In recent years, environmental sustainability and climate change issues have become a public debate in all societies (Mallen & Chard, 2011). That is because climate change and the deteriorating environmental tissue accordingly, are the leading common and fundamental problems of humanity. While Klein (2011:159) states that climate-change brings along global warming, adding that this situation has many negative effects on the planet. In fact, today's societies are faced with an unprecedented environmental change (IPCC, 2007) and the most important thing this change tells societies is that the resources of the world are not unlimited (Diamond, 2005: 497). This is a serious warning in terms of understanding the importance of the concept of environmental sustainability. This negative change and transformation in the environment necessitate urgent solutions (Fraj-Andres et al. 2009: 268), and it is stated that the most important solution in this process is the radical and fundamental changes in the attitude towards the environment (Senge et al. 2008: 59). We live in a period where there is a dominant culture of production and consumption. The consequences of this dominant culture cause the world to become more exhausted and pose an important threat to the sustainability of the planet (Şenocak & Bursalı, 2018).

There is an important relationship between the behaviors of people and the changes in the environment (Balteanu and Dogaru, 2011: 1). Therefore, all the behaviors that people exhibit in the environment they live in are actually the main cause of environmental problems (Keleş, 2015: 134). The rise of production and consumption societies, where the future is not well planned, resources are consumed as if they are unlimited, and that will harm the natural balance causes the fall of the world we live in. Continuous and

unplanned consumption of limited resources brings along many negative environmental consequences, especially climate change.

With the industrialization process and technological development, the negative and destructive effect of people on the environment increases. In addition, urbanization and population growth in parallel with industrialization accelerate environmental problems (Menteşe, 2017). Unal and Bağcı (2017) state that the carbon footprint should be reduced on a global scale against these environmental problems, which are a major threat to both the present and future. Carbon footprint is a general concept used for environmental pollution caused by individuals, institutions, enterprises, and organizations, and carbon dioxide and greenhouse gas emissions into the atmosphere (Executive Summary: Turkey's Ecological Footprint Report, 2007). For environmental sustainability, it is essential to reduce the carbon footprint on a global scale, both individually and socially. It can be said that it is one of the primary goals of humanity for a more livable world and to hand down this world to future generations. It would be appropriate to give an example in the scale of Turkey to further understand the importance of the concept of carbon footprint. It takes 2 years to substitute for the natural resources consumed and compensate the carbon dioxide emitted in Turkey in a year. The carbon dioxide emissions in Turkey are also almost twice the existing biodiversity (Executive Summary: Turkey's Ecological Footprint Report, 2007). Turkey's ecological carbon footprint report data show that the existing natural resources in Turkey are consumed two times faster and the environmental adverse effects continue destructively.

#### **1.4. Aim of This Study**

Even though environmental sustainability had previously been discussed in the context of the Olympics (Lenskyj, 1998), a decade passed before more depth and diversity in empirically derived publications on environmental sustainability made an appearance. The aim of this research is to reveal the concepts of environmental sustainability and sports in the light of current literature. It also evaluates the negative environmental effects of sports.

#### **1.5. Method**

In a traditional systematic review and meta-analysis, the best available evidence is sought, systematically identified, critically appraised and synthesized, in order to try answer some clinical or research question (Murad, et. al., 2014). Systematic reviews and meta-analyses are also increasingly being used in the context of research programs, in which they form the first step and are used to identify and highlight uncertainties and unanswered research areas where additional knowledge is warranted (Scoglio & Fichera, 2014). In this research, a systematic review and meta-analysis was conducted and reported, based on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) statement.

Research was carried out between January-March 2021 covered literature ranging from 2000 to 2020. In this context, some keywords are used, these; “Sustainability development”, “environmental sustainability”, “sports and environmental sustainability”, “sports facilities”. Keywords for research

criteria were selected after analyzing the purpose of the study and brainstorming with peers to explain this search. The use of multiple searches using multiple search terms, different combinations of search terms and search term synonyms also improves the effectiveness of an electronic literature search. (Bown & Sutton, 2010). Good quality systematic reviews necessitate good quality literature searches, and accurate reporting of these searches. Searching of single databases will only identify a maximum of one third of all relevant articles and searching multiple databases still only identifies half of all available articles. (McManus, et. al., 1998) We started a high-level search using common best-fit words that reveal a large number of sources. Each of the above keywords were applied to the different databases. These databases: Scopus, EBSCO, Researchgate, Academia, Google Scholar, and Web of Science. The necessary literature was accessed and classified through these databases.

## **2. ENVIRONMENTAL SUSTAINABILITY and SPORTS**

### **2.1. Environment and Sports**

Sport can be considered as a global phenomenon with its physical, spiritual, social, cultural and economic effects in individual and social terms. Today, there is almost no one who does not have sports experience at any stage of his/her life (Tekin & Karakuş, 2018). It can be said that everyone participates in sports actively or passively and has a sportive experience (Bester et al.2015).

Sport is one of the rapidly growing sectors in the economic and commercial climate of the modern world (Akşar, 2006: 54). The primary goal of sports, which has become a unique sector, is customer satisfaction. Depending on the service quality, customer satisfaction is the primary goal of the sports industry (Chelladurai & Chang, 2000; Kyle et al. 2004). Today, building healthy individuals and strong societies can be associated with the sports industry. Meeting the increasing demand effectively and creating the expected benefit and satisfaction in this process can be considered as a part of industrialization. However, mass attention such as service diversity and meeting the intense demand constantly nurtures and strengthens the industrial side of sports.

In the process, the economic volume of sports has grown. The number of public and private sector representatives providing sports services has increased. Accordingly, the ratio of facility building has increased and the events and organizations organized have been enriched in terms of quality and quantity. Supply and demand balance has been created and increasing demand diversity has been met. However, with these mutual developments in sports, negative outcomes have begun to be discovered gradually. Especially the damage caused by facility building and sports events and organizations to the environment and natural resources has been frequently discussed in recent years. The environmental effects of sports-induced carbon dioxide and greenhouse gas emissions have begun to be evaluated in theory and practice. The adverse effects of sports on the environment have become so widespread that global organizations such as the United Nations and the International Olympic Committee, in particular, point out that the necessary measures should be taken and emergency action plans should be prepared in this regard.



Increasing environmental concerns have also been linked to sports over time. That is because the negative environmental effects caused by sports have become evident and it has become an area where precautions should be taken for. The relationship between sports and environmental awareness emerged in 1994 when the United Nations Environment Program and the International Olympic Committee began working together to reduce the environmental impacts of the Olympic and Paralympic games (Kellison & Hang, 2015). Today, interest in the environment is now at the center of management debates in large sports organizations. Environmental sustainability is accepted in these discussions (Ciletti et al. 2010). Paquette et al. (2011), who draw attention to the strengthening of the relationship between sports and the environment, state that the International Olympic Committee included environmental sustainability in the Olympic ground. Therefore, environmental sustainability has become important not only for recreational and health sports activities but also for professional organizations (Lokimidis, 2008). After these important and serious steps of the International Olympic Committee, organizations in other branches started to develop environmental sustainability strategies (Wicker, 2009). For example, sports clubs, which are one of the important actors in the sports system, consider the environmental sensitivity of their members to a large extent when creating environmental sustainability strategies (Steg & Vlek, 2009).

Environmental problems and climate change are accepted as bad problems on a global scale, and especially the actors in sports should be included in the solution to this problem (Winn et al. 2011). It can be accepted that the sports sector is responsible for the pollution of the environment and the consumption of natural resources due to both the facility building and organizations held. Steffen et al. (2015) state that the main factor that causes climate change by disrupting the natural balance is human behaviors. At the center of sport is the human. Intense mobility, mass participation, and the facility-establishment steps to meet these participations reveal the relationship between sports and environmental effects.

Any sports facility meeting the qualifications for an international organization directly contributes to the brand recognition of the host city or country (Hu et al.2016). Therefore, Ünal and Bağcı (2017) state that one of the qualifications required for facilities today is compliance with environmental sustainability. That is because the International Olympic Committee takes the relationship between sports and the environment very seriously. For this reason, it has implemented a series of criteria below to reduce the negative environmental impacts of any organization. These criteria are listed as follows:

- Conservation of biological diversity,
- Conservation of the ecosystem,
- Correct land use and landscape studies,
- Prevention of pollution (soil, air, water),
- Resource and waste management
- Health and safety measures,

- Reduction of environmental disturbances,
- Protection of cultural heritage (IOC, Manuel on Sport and The Environment, 2009).

Policymakers are increasingly interested in the wider consequences of major sporting events, including their environmental impacts (Collins & Flynn, 2008). For example, The 2012 London Olympics were declared as an environmentally friendly Olympics and have provided a direction for sustainable development that the world must follow. The environment has emerged as one of the most significant issues of global social policy, as reflected in the initial IOC's response to environmental policy statements (Duck Kim, 2013). The International Olympic Committee expects the host countries to fulfill the abovementioned criteria for the environmental sustainability goals in sports to be achieved. These criteria are required for hosting because large-scale sports organizations cause alarming environmental effects for host cities or countries (McCool, 2015: 228). In fact, Triantafyllidis et al. (2018) states that even the city infrastructures of host countries have negative environmental impacts.

The literature reveals the relationship between sport and the environment. Sports-induced negative environmental impacts can be considered as an important part of the big problem for a sustainable world. In line with the United Nations Sustainable Development Goals, it is necessary to reduce the effects of human behavior on the environment and nature. These effects are also quite intense in sports where people are at the center. There are many negative environmental consequences, especially climate change, that threaten the natural balance in sports. In this context, the question of what are the adverse effects of sports on the environment should be handled sensitively both in theory and in practice.

## **2.2. Sports-induced Adverse Environmental Impacts**

The International Olympic Committee has gathered the adverse effects of sports on the environment under two main headings. These are negative effects caused by sports organizations and building facilities. Adverse environmental impacts arise from production, consumption, transportation and accommodation due to organizations. It is reported that air, water and soil pollution, carbon dioxide and greenhouse gas emissions resulting from the energy use of new and existing facilities occur due to facility establishment (IOC, Manuel on Sport and The Environment, 2009).

The Protection Foundation (ACF), which divides sports into three categories according to their damage levels:

- Sports that are largely ecologically sustainable but can still be developed in some way;
- sports that are largely ecologically sustainable but can be significantly improved in sustainability as their core activities are not unsustainable in nature;
- sports that are not ecologically sustainable or significantly more sustainable due to the nature of their core activities (Dingle, 2009).

Consumption of fossil fuel energy obtained from oil, coal, and natural gas causes greenhouse gas emissions, which cause air pollution (Chard & Mallen, 2013). Major sports events consume considerable

amounts of electricity, much of which is produced by burning fossil fuels, such as coal and oil (Schmidt, 2006). Electricity produced from fossil resources such as coal and oil is used in major and large sports organizations (Global Environment Outlook 4, 2007). Why are fossil fuels and their environmental effects important specific to sports? For example, an international sports organization such as the FIFA World Cup causes consumption of 3 million kilowatt-hours of electricity produced from fossil fuels, which is equivalent to the annual electricity need of 700 households (Schmidt, 2006). The environmental impacts of the electricity consumed in a one-month organization can be quite devastating. Especially in football, the excessive energy consumption, a significant amount of water use, and the fact that it results in negative environmental consequences that cause high pollution are worrisome (Collins et al. 2007). Ünal and Bağcı (2017) state that due to the unplanned consumption of natural resources, the ecological footprint within sports is growing day by day. It is necessary to detail the environmental effects of sports. While the greenhouse gas emission caused by a large sports organization held in 2005 was calculated as 210,000 tons, it was reported that the athletes in the organization caused a total of 60,000 tons of emission (Ahmed & Pretorious, 2010). Again, it was reported that nearly 70 thousand tons of waste was generated due to a sports organization and only 1% of these were recyclable (Thibault, 2009). These reported numerical data are considered to be high compared to the UN environmental sustainability criteria. It is also stated that air pollution, especially as a result of these environmental effects, seriously affects vital functions (Environmental Governance Update - October 2020).

The extensiveness of facilities is very important in the popularity, marketing and consumption of sports. Increasing active and passive participation and obtaining the expected benefit from sports is possible with the existence of facilities. Sports facilities contribute to the area where they are built in terms of architecture and aesthetics. On the other hand, it is an important risk factor for environmental sustainability goals due to the environmental problems it causes (Barghchi et al.2010). For example, it is known that the ecosystem is severely damaged due to the wastewater used for artificial snow production on a ski run (Schmidt, 2006). Besides, the destruction of the natural vegetation and habitat during the construction of a golf course brings enormous negativities for the ecological balance (Thibault, 2009). It is, of course, possible to increase these examples. Balcı and Koçak conducted a comprehensive literature review on the environmental impact of sports facilities. In their research, they revealed in detail the negative effects of sports facilities in some branches on the natural environment. The negative effects of sports facilities on the environment by branches are presented in the table below (Balcı & Koçak, 2014):

**Table 4:** Negative Effects of Sports Facilities on the Environment

<b>Branches</b>	<b>Environmental Effects</b>
<b>Golf</b>	<ul style="list-style-type: none"> <li>• Use of fertile land (agricultural land, natural habitat, etc.)</li> <li>• Destruction of natural vegetation and deforestation</li> <li>• High water consumption</li> </ul>

	<ul style="list-style-type: none"> <li>• Soil and water pollution caused by the use of unsuitable pesticides and fertilizers</li> <li>• Soil and water pollution due to fuels and chemicals</li> <li>• Disturbance of habitat</li> <li>• Noise from the use of ground maintenance vehicles</li> </ul>
<b>Skiing</b>	<ul style="list-style-type: none"> <li>• Destruction of natural vegetation</li> <li>• Deterioration of the integrity of and thinning of the forests under protection</li> <li>• Soil compaction</li> <li>• Chemical pollution in soil caused by fuel leaks</li> <li>• Landslides, soil erosion, avalanches</li> <li>• Use of forest land for infrastructure and superstructure works (parking lots, roads, hotels, etc.)</li> <li>• Generation of solid waste</li> <li>• Noise pollution</li> <li>• Deterioration of wildlife</li> </ul>
<b>Swimming</b>	<ul style="list-style-type: none"> <li>• High water consumption</li> <li>• Use of harmful chemicals</li> <li>• High energy consumption</li> </ul>
<b>Ice Sports</b>	<ul style="list-style-type: none"> <li>• High energy consumption for ice-cooling and heating processes</li> <li>• The release of liquid wastes that cause carbon emissions damaging the ozone layer into nature</li> <li>• High water consumption</li> <li>• Water and soil pollution from pesticide use</li> <li>• Water and soil pollution from the use of chemicals and the fuels of ground maintenance vehicles</li> </ul>
<b>Football</b>	<ul style="list-style-type: none"> <li>• Soil pollution</li> <li>• Noise from the use of ground maintenance vehicles</li> <li>• High energy use for lighting</li> <li>• Noise pollution</li> <li>• Air pollution from spectator vehicles</li> <li>• Environmental pollution caused by fossil fuels</li> <li>• Environmental pollution caused by waste on match days</li> </ul>
<b>Car Races</b>	<ul style="list-style-type: none"> <li>• Destruction of natural habitats for the construction of racecourses</li> <li>• Damage to flora and fauna due to the destruction of forest areas</li> <li>• High energy use for lighting</li> <li>• Energy consumption of support services used in the realization of the races</li> <li>• Air pollution caused by harmful gas emissions</li> <li>• Noise pollution</li> </ul>

	<ul style="list-style-type: none"> <li>• Opening new areas for parking lots</li> </ul>
<b>Recreational Areas</b> <b>(Large parks,</b> <b>natural and artificial</b> <b>lakes, amusement</b> <b>parks and aqua</b> <b>parks)</b>	<ul style="list-style-type: none"> <li>• Noise pollution</li> <li>• Destruction of natural vegetation</li> <li>• Damage to habitat</li> <li>• Air pollution from burning fossil fuels</li> <li>• High energy use for operating machines in amusement parks</li> <li>• Generation of solid waste</li> <li>• High energy and water consumption in water parks</li> </ul>

**Resource:** Balcı and Koçak (2014)

A closer look at the table above reveals that sports facilities cause air, water, and land use, threaten the ecological system, and natural resources are consumed in an unplanned manner. It is observed that soil fertility and wildlife are put at risk due to the use of chemicals in the facilities. Besides, it is predicted that the atmosphere may be adversely affected by greenhouse gas emissions due to high energy use. Mallen and Chard (2011), while drawing attention to the destructive environmental impacts caused by sports facilities, list the general environmental problems caused as follows:

- Sound and lighting pollution,
- Consumption of non-renewable resources,
- Consumption of natural resources,
- Electricity- and fuel-induced greenhouse gas emissions,
- Soil, air and water pollution,
- Soil erosion,
- Waste consumption (Mallen & Chard, 2011).

There is a need to shift to practices that support environmental sustainability (ES) or the safeguarding of the natural environment (Mallen & Chard, 2011). One of the main actors in the realization of environmental sustainability goals is sports. It can be said that the current literature agrees on the negative environmental impacts of sports organizations and facilities. The behaviors of the people taking part in organizations cause harm to the environment and nature. Again, it can be stated that there is no environmentally friendly approach in mass behaviors related to production, consumption, transportation and accommodation in these organizations. In facilities, carbon dioxide and greenhouse gas emissions, especially from fossil fuels, threaten the environment and natural resources.

### **3. CONCLUSION and RECOMMENDATIONS**

The sport industry has a tremendous impact on the natural environment just like any other industry. According to recent estimates, the four major sport leagues in North America contribute 35,000 metric tons of carbon emissions on an annual basis while others estimate one league's (NHL) total greenhouse emissions at 550,000 metric tons (Hulac & Cusick, 2014).

The landscape of sport organizations has changed dramatically over the past years. The trend is for organizations to increasingly implement more and expand on current environmental initiatives. This

focus on the environment will continue to be on the agenda of various sport organizations not only because of shift in social values, but also because of new expectations from a variety of stakeholders. Sustainable efforts allow sport organizations to reduce the ecological footprint of sport and the associated activities. (Trendafilova, et. al, 2014).

The sports industry is one of the most important actors in global environmental pollution. To take this dangerous process under control, strategic management skills and new policies must be developed in sports (Triantafyllidis, 2018), because environmental threats are increasing due to the intense interest in sports worldwide. Mann et al. (2017) state that human activities are the basis of the disruption of natural balance, while Dosumu et al. (2017) state that people participating in sports generate large amounts of carbon dioxide emissions. Particularly, the global interest and demand for sports increase these environmental effects day by day, reaching a level that will disrupt the natural balance.

In addition to sports organizations, the environmental effects of sports facilities can also hamper the goals of a sustainable world. Fossil-fuel-based energy consumption, tools and chemicals used in the facilities pollute the soil and water resources. Again, carbon dioxide and greenhouse gas emissions due to energy use also cause air pollution. Sport clubs should make environmentally friendly investments that contribute to the clubs' environmental quality. Investing in environmentally friendly devices like green electricity or solar cells does not only reduce costs in the long-term, but might also encourage members to behave environmentally friendly. Lastly, clubs should promote the usage of public transportation or car sharing opportunities. (Thormann and Wicker, 2020). For this, partnerships with local stakeholders can help bridge the gap between a club's small resource base and its pro-environmental ambitions (McCullough, 2018).

Sport facilities are operated by sport organization personnel at all levels of sport and have an environmental impact. In the end, it is important to note that all aspects of sport have a link with the natural environment. While sport personnel can take action to address adverse environmental issues, they cannot do everything (Porter and Reinhardt 2007). Sport is one of the most important phenomena in the modern world. It is a social institution that will reach future generations with its social, cultural and economic existence. However, the sustainability of sports is directly proportional to environmental sustainability. It has been noted that sustainability principles have been applied to the design of sport facilities over the last several decades (Erten & Özfiliz, 2006), and that sport facility managers have the discretion to participate in leading advances in environmental sustainability (Mallen & Chard, 2012). Also sport organizations are facing an increasing number of calls to reduce negative impacts of their facilities and events on the natural environment (Kellison et. al., 2015).

Therefore, reduction of the sports-induced negative environmental impacts will make great contributions to environmental sustainability. In this way, it will be possible to transfer both the natural environment and sports to future generations. In this context, the measures to be taken by and recommendations for sports facilities and organizations to create a sustainable environment can be listed as follows:

- Instead of using fossil-fuel-based energy resources in sports facilities, consumption of renewable energy should be encouraged,
- Consequently, carbon dioxide and greenhouse gas emissions can be restricted,
- Chemicals and clean water resources used in facilities can be limited,
- Ecological balance can be taken into account in the construction of facilities,
- Measures to protect biodiversity can be taken,
- The stakeholders of sports can be encouraged to save natural resources,
- Active and passive sports participants can be informed about the consumption of the environment and natural resources,
- Sound and light pollution can be prevented during events,
- Consumption of products suitable for recycling can be encouraged.

## REFERENCES

- Erten, S. & Özfiliz, S. (2006), “Stadium construction and sustainability: The review of mega-event stadiums (1990-2012), 1st International CIB Endorsed METU Postgraduate Conference Built Environment & Information Technologies, Ankara, Turkey.
- Ahmed, F. and Pretorius, L. (2010), “Mega-events and environmental impacts: The 2010 FIFA World Cup in South Africa”, *Alternation*, Vol. 17 No. 2, pp. 274 – 296.
- Akşar, T. (2006), *Futbol Ekonomisi*, İstanbul, Literatür Yayınları.
- Balcı, V. and Koçak, F. (2014), “Spor ve rekreasyon alanlarının tasarımında ve kullanımında çevresel sürdürülebilirlik”, *Spor ve Performans Araştırmaları Dergisi*, Vol. 5 No. 2, pp. 46-58.
- Bălteanu D. and Dogaru, D. (2011), “Geographical perspectives on human-environment relationships and anthropic pressure indicators”, *Rom. Journ. Geogr.*, Vol. 55 No. 2, pp. 69-80.
- Barghchi, M., Omar, D. and Aman M.S. (2010), “Sports facilities in urban areas: Trends and development considerations”, *Pertanika Journal of Social Sciences & Humanities*, Vol. 18 No.2, pp. 427–435.
- Bebbington, J. and Unerman, J. (2018), “Achieving the United Nations Sustainable Development Goals: An enabling role for accounting research”, *Accounting, Auditing & Accountability Journal*, Vol. 31 No. 1, pp. 2-24.
- Bester, P., Botha, E., Joubert, Y., Serra, P., Steynberg, L. and Van Eeden, T. (2015), “The sociology of sport”, In S. Rudansky-Kolppers and J. Strydow (Eds.), *Principles of Sport Management*, Oxford Press, England, pp. 57-94.
- Bown, M.J. & Sutton, A.J. (2010), “Quality control in systematic reviews and meta-analyses”, *Eur J Vasc Endovasc Surg*, No, 40, pp, 669-677.

- Chard, C. and Mallen, C. (2013), "Renewable energy initiatives at Canadian sport stadiums: A content analysis of web-site communications", *Sustainability*, Vol. 5 No. 12, pp. 5119-5134. <https://doi.org/10.3390/su5125119>
- Chelladurai, P. and Chang, K. (2000), "Targets and standards of quality in sport services", *Sport Management Review*, No. 3, pp. 1-22. [https://doi.org/10.1016/S1441-3523\(00\)70077-5](https://doi.org/10.1016/S1441-3523(00)70077-5)
- Ciletti, D. Lanasa, J. Ramos, D. Luchs, R. and Lou, J. (2010), "Sustainability communication in North American professional sports leagues: Insights from web-site self-presentations", *International Journal of Sport Communication*, Vol. 3 No. 1, pp. 64-91. <https://doi.org/10.1123/ijsc.3.1.64>
- Civan U. (2006). Akıllı binaların çevresel sürdürülebilirlik açısından değerlendirilmesi, İstanbul Teknik Üniversitesi, Fen Bilimleri Enstitüsü Mimarlık Ana Bilim dalı Yüksek Lisans Tezi, İstanbul, Turkey.
- Collins, A. & Flynn, A. (2008), "Measuring the environmental sustainability of a major sporting event: A case study of the FA Cup Final", *Tourism Economics*, Vol, 14, No, 4, pp, 751-768. doi:10.5367/000000008786440120.
- Collins, A., Flynn, A., Munday, M. and Roberts, A. (2007), "Assessing the environmental consequences of major sporting events: The 2003/04 FA Cup Final", *Urban Studies*, Vol. 44 No. 3, pp. 457-476. <https://doi.org/10.1080/00420980601131878>
- Diamond, J. (2005), *Collapse: How Societies Choose to Fail or Succeed*. Penguin Group, New York, NY.
- Dingle, G. (2009), "Sustaining the race: a review of literature pertaining to the environmental sustainability of motorsport", *International Journal of Sports Marketing and Sponsorship*, Vol. 11 No. 1, pp. 75-91. <https://doi.org/10.1108/IJSMS-11-01-2009-B006>
- Dosumu, A., Colbeck, I. and Bragg, R. (2017), "Greenhouse gas emissions as a result of spectators travelling to football in England", *Scientific Reports*, Vol. 7 No. 1, pp. 1-7. DOI: [10.1038/s41598-017-06141-y](https://doi.org/10.1038/s41598-017-06141-y)
- Duck Kim, H. (2013), "The 2012 London Olympics: Commercial partners, environmental sustainability, corporate social responsibility and outlining the implications", *The International Journal of the History of Sport*, Vol, 30, No, 18, pp, 2197-2208, DOI: 10.1080/09523367.2013.845171.
- Ergün, T. and Çobanoğlu, N. (2012), "Sürdürülebilir kalkınma ve çevre etiği", *Ankara Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, Vol.3 No. 1, pp. 97-123. DOI: 10.1501/sbder\_0000000041
- Executive Summary: Turkey's Ecological Footprint Report. (2007), available at: [https://www.footprintnetwork.org/content/images/uploads/Turkey\\_Ecological\\_Footprint\\_Report\\_Executive\\_Summary-Conclusion.pdf](https://www.footprintnetwork.org/content/images/uploads/Turkey_Ecological_Footprint_Report_Executive_Summary-Conclusion.pdf)
- Fantana, R., and Ferrucci, M. (2014), "Environmental sustainability as indicator of social quality: The new opportunities offered by communication", *International Journal of Social Quality*, Vol. 4 No. 1, pp. 41-56. doi:10.3167/IJSQ.2014.040104



- Fraj-Andre's E., Martinez-Salinas, E. and Matute-Vallejo, J. (2009), "A multidimensional approach to the influence of environmental marketing and orientation of the firm's organizational performance", *Journal of Business Ethics*, No. 88, pp. 263–286. DOI 10.1007/s10551-008-9962-2
- Global environment outlook 4: "Summary for decision makers" (2007), available at: [https://wedocs.unep.org/bitstream/handle/20.500.11822/7728/GEO4\\_Summary.pdf?sequence=1&isAllowed=y](https://wedocs.unep.org/bitstream/handle/20.500.11822/7728/GEO4_Summary.pdf?sequence=1&isAllowed=y)
- <https://stillmed.olympic.org/media/Document%20Library/OlympicOrg/Factsheets-Reference-Documents/Sustainability/2017-03-21-IOC-Sustainability-Strategy-English-01.pdf>
- <https://www.tr.undp.org/content/turkey/tr/home/sustainable-development-goals.html>
- Hu, K.H., Chen, F.H. and Tzeng, G.H. (2016), "Evaluating the improvement of sustainability of sports industry policy based on MADM", *Sustainability*, Vol. 8 No. 7, pp. 606, <https://doi.org/10.3390/su8070606>
- Hulac, B. & Cusick, D. (2014), "The National Hockey League shoots for zero carbon emissions -a goal for other sports"? E&E Publishing, LLC.
- Intergovernmental Panel on Climate Change (IPCC). (2007), "Climate change 2007: The physical science bases", available at: [https://www.ipcc.ch/site/assets/uploads/2018/05/ar4\\_wg1\\_full\\_report-1.pdf](https://www.ipcc.ch/site/assets/uploads/2018/05/ar4_wg1_full_report-1.pdf)
- Ioakimidis, M. (2008), "Green sport: A game everyone wins", *The Sports Journals*, 10.
- IOC. (2009), "Manual on Sport and The Environment", available at: <https://www.olympic.org/en/Home/Documents/Documents/Olympism%20in%20Action/Olympism%20in%20Action/Environment/Manual%20on%20Sport%20and%20the%20Environment>
- Kanapathy, S., Lee, K.E., Sivapalan, S., Mokhtar, M., SyedZakaria, S.Z. and Zahidi, A.M. (2019), "Sustainable development concept in the chemistry curriculum:An exploration of foundation students' perspective", *International Journal of Sustainability in HigherEducation*, Vol. 20 No. 1, pp. 2-22, <https://doi.org/10.1108/IJSHE-04-2018-0069>
- Keleş, R. (2015), 100 Soruda Çevre, Çevre Sorunları ve Çevre Politikası, Yakın Kitabevi, İzmir.
- Kellison, T.B., Trendafilova, S. & McCullough, B.P. (2015), "Considering the social impact of sustainable stadium design", *International Journal of Event Management Research* Vol, 10, No, 1, pp, 63-83.
- Kellison, T.B. and Hong, S. (2015), "The adoption and diffusion of pro-environmental stadium design", *European Sport Management Quarterly*, Vol. 15 No. 2, pp. 249-269. <https://doi.org/10.1080/16184742.2014.995690>
- Klein, R.J.T. (2011), "Adaptation to climate change. More than technology.", In Linkov, I. and Bridges, T.S. (Eds.), *Climate: Global Change and Local Adaptation*, Springer, Dordrecht, pp. 157-168.
- Kyle, G., Graefe, A., Manning, R. and Bacon, J. (2004), "Predictors of behavioral loyalty among hikers along the appalchion trail", *Leisure Science*, No. 26, pp. 99-118. <https://doi.org/10.1080/01490400490272675>

- Lenskyj, H.J. (1998), "Sport and corporate environmentalism: The case of the Sydney 2000 Olympics", *International Review for the Sociology of Sport*, Vol, 33 No, 4, pp, 341-354.
- Mallen, C. and Chard, C. (2011), "A framework for debating the future of environmental sustainability in the sport Academy", *Sport Management Review*, Vol. 14 No. 4, pp. 424–433.
- Mallen, C., Stevens, J., Adams, L. and McRoberts, S. (2010), "The assessment of the environmental performance of an international multi-sport event", *European Sport Management Quarterly*, Vol. 10 No. 1, pp. 97-122. <https://doi.org/10.1080/16184740903460488>
- Mann, M.E., Rahmstorf, S., Kornhuber, K., Steinman, B.A., Miller, S.K. and Coumou, D. (2017), "Influence of anthropogenic climate change on planetary wave resonance and extreme weather events", *Scientific Reports*, No. 7, pp. 1-10.
- Mann, M.E., Rahmstorf, S., Kornhuber, K., Steinman, B.A., Miller, S.K. and Coumou, D. (2017), "Influence of anthropogenic climate change on planetary wave resonance and extreme weather events", *Scientific Reports*, No. 7, pp. 1-10. DOI: 10.1038/srep45242
- McCool, S. (2015), "Sustainable tourism: Guiding fiction, social trap or path to resilience"? In Singh, T.V. (Ed.), *Challenges in Tourism Research Channel View*, Bristol, pp.224-234.
- McCullough, B. (2018), "Industry-academic collaborations to advance sustainability", *Sport and Entertainment Review*, Vol, 4, No, 3, pp, 64–69.
- McManus, R.J., Wilson, S., Delaney, B.C., Fitzmaurice, D.A., Hyde, C.J., Tobias, R.S., et al. (1998), "Review of the usefulness of contacting other experts when conducting a literature search for systematic reviews", *the BMJ*, No, 317, pp. 1562-1563.
- Menteşe, S. (2017), "Çevresel sürdürülebilirlik açısından toprak, su ve hava kirliliği: Teorik Bir inceleme", *Uluslararası Sosyal Araştırmalar Dergisi*, Vol. 1 No. 53, pp. 381-389. <http://dx.doi.org/10.17719/jisr.20175334127>
- Morelli, J. (2011), "Environmental sustainability: A definition for environmental professionals," *Journal of Environmental Sustainability*, Vol. 1 No1, pp. 1-9. DOI: 10.14448/jes.01.0002
- Murad, M.H., Montori, V.M., Ioannidis, J.P., Jaeschke, R., Devereaux, P.J., Prasad, K., Neumann, I., Carrasco-Labra, A., Agoritsas, T., Hatala, R., Meade, M.O., Wyer, P., Cook, D.J. & Guyatt, G. (2014), "How to read a systematic review and meta-analysis and apply the results to patient care: users' guides to the medical literature". *JAMA*, No, 312, pp,171–179
- Önder, Ş. and Ağca, A. (2017), "İşletmelerin risk gruplarına göre çevresel sürdürülebilirlik uygulamaları: BIST 100 endeksinde bir uygulama", *İnsan ve Toplum Bilimleri Araştırmaları Dergisi*, Vol. 7 No. 1, pp. 77-89.
- Ozmehmet, E. (2008), "Dünyada ve Türkiye sürdürülebilir kalkınma yaklaşımları", *Journal of Yaşar University*, Vol. 3 No. 12, pp. 1853-1876.
- Paquette, J., Stevens, J. and 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*, Vol. 14 No. 3, pp. 355–369.  
<https://doi.org/10.1080/17430437.2011.557272>
- Porter, M. & Reinhard, F. (2007), “A Strategic Approach to Climate Change.” *Harvard Business Review*, No, 85 Vol, 10, pp, 22-26.
- Rogers, P.P., Jalal, K.F. and Boyd, J.A. (2008), *An Introduction to Sustainability Development*, Glen Educational Foundation, London.
- Sachs, J.D. (2012), “From millennium development goals to sustainable development goals”, *The Lancet* (London, England), Vol. 379 No. 9832, pp. 2206-2211. DOI:[https://doi.org/10.1016/S0140-6736\(12\)60685-0](https://doi.org/10.1016/S0140-6736(12)60685-0)
- Saraç, B. and Altekin, N. (2017), “Türkiye’de illerin sürdürülebilir kalkınma göstergelerine göre değerlendirilmesi”, *Uluslararası Yönetim İktisat ve İşletme Dergisi*, Vol.13 No.1, pp. 19-49.
- Scoglio, D. & Fichera, A. (2014), “Establishing a successful clinical research program”, *Clin Colon Rectal Surg*, No, 27 pp, 65–70.
- Schmidt, C. (2006), “Putting the earth in play: Environmental awareness and sports”, *Environmental Health Perspect*, Vol. 114 No. 5, pp. A286–A295. doi: [10.1289/ehp.114-a286](https://doi.org/10.1289/ehp.114-a286)
- Senge, P., Smith, B., Kruschwitz, N., Laur, J. and Schley, A. (2008), *The Necessary Revolution: Working Together to Create a Sustainable World*. Broadway Books, New York, NY.
- Şenocak, B. and Bursalı, Y.M. (2018), “İşletmelerde çevresel sürdürülebilirlik bilinci ve yeşil işletmecilik uygulamaları ile işletme başarısı arasındaki ilişki”, *SDÜ İktisadi ve İdari Bilimler Fakültesi*, Vol. 23 No. 1, pp. 161-183.
- Steffen, W., Richardson, K., Rockström, J., Cornell, S. E., Fetzer, I., Bennett, E.M. and Sörlin, S. (2015), “Planetary boundaries: Guiding human development on a changing planet”, *Science*, Vol. 347 No. 6223, pp. 736–748. DOI: [10.1126/science.1259855](https://doi.org/10.1126/science.1259855)
- Steg, L. and Vlek, C. (2009), “Encouraging pro- environmental behaviour: An integrative review and research agenda”, *Journal of Environmental Psychology*, Vol. 29 No. 3, pp. 309–317.  
<https://doi.org/10.1016/j.jenvp.2008.10.004>
- Tekin, Z. and Karakuş, Z. (2018), “Gelenekselden akıllı üretime spor endüstrisi 4.0”, *İnsan ve Toplum Bilimleri Araştırması Dergisi*, Vol. 7 No. 3, pp. 20103-2117.
- Thibault, L. (2009), “Globalization of sport: an inconvenient truth”, *Journal of Sport Management, Human Kinetics*, No. 23, 1-20.
- Thormann, T.F. & Wicker, P. (2020), “Determinants of pro-environmental behavior among voluntary sport club memeber”, *Ger J. Exercise Sport Res*, No. 51, pp, 29-38.
- 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 in Pure & Applied Sciences*, No, 3, pp, 09-14.
- Triantafyllidis, S. (2018), “Carbon Dioxide Emissions Research and Sustainable Transportation in the Sports Industry”, *Journal of Carbon Research*, Vol. 4 No. 57, pp. 1-5.

- Triantafyllidis, S., Ries, R.J. and Kaplanidou, K. (2018), “Carbon dioxide emissions of spectators’ transportation in collegiate sporting events: comparing on-campus and off-campus stadium locations”, *Sustainability*, Vol. 10 No. 1, pp. 241. <https://doi.org/10.3390/su10010241>
- Ünal, H. and Bağcı, E. (2017), “ Sports organizations in the light of environmental sustainability and ecologic footprint”, *Journal of Human Science*, Vol. 14 No. 3, pp. 3006-3021. doi:10.14687/jhs.v14i3.4597
- UNEP. (2020), “Environmental Governance Update October” available at: <https://www.unep.org/resources/report/environmental-governance-update-october-2020>
- Wicker, P. (2019), “The carbon footprint of active sport participants”, *Sport Management Review*, Vol. 22 No. 4, pp. 513–526. DOI:[10.1016/j.smr.2018.07.001](https://doi.org/10.1016/j.smr.2018.07.001)
- Winn, M.I., Kirchgeorg, M., Griffiths, A., Linnenluecke, M.K. and Gunther, E. (2011), “Impacts from climate change on organizations: A conceptual foundation”, *Business Strategy & Environment*, No. 20 No. 3, pp. 157–173. <https://doi.org/10.1002/bse.679>
- World Economic and Social Survey 2014/2015. Available at: [https://www.un.org/development/desa/dpad/wpcontent/uploads/sites/45/publication/2015wess\\_ch5\\_en.pdf](https://www.un.org/development/desa/dpad/wpcontent/uploads/sites/45/publication/2015wess_ch5_en.pdf)