

## ENVIRONMENTAL SUSTAINABILITY OF OLYMPIC GAMES: A NARRATIVE REVIEW OF EVENTS, INITIATIVES, IMPACT AND HIDDEN ASPECTS

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**Abstract:** Sustainability has been coined ‘one of the most successful concepts in tourism and event studies and has experienced exponential growth since the mid-1980s’ (Hall, 2010). Despite its emergence as a popular concept, sustainability is a complex issue that has been poorly understood by stakeholders, policy makers and organisers of Olympic Games. Lohman and Dredge (2012) have noted that even though humans are a fundamental part of the natural environment leading policy makers such as the International Olympic Committee have created policies that solely consider impacts on the physical environment (i.e. transportation and pollution) while omitting other equally significant environmental impacts such as community displacement (Porter et. al., 2009), use of facilities after the event (Hiller, 2006) and uneven distribution of benefits within the host community (Gaffney, 2010). The aim of this review is: a) to present a historical account of the evolution of sustainability as a concept, b) to discuss the issues surrounding environmental sustainability of those Summer and Winter Olympic Games that have had an impact (positive or negative) on the natural environment and c) to discuss ‘hidden’ aspects of environmental sustainability e.g. population displacement, human rights, and changes to host city residents’ quality of life. An overview of key events and developments to improve sustainability, including the Olympic Charter (IOC, 2007), the International Standards Organisation (ISO, 2010) and the Sustainable Sourcing Code (LOCOG, 2012) will be presented providing also an overview of the Tokyo 2020 Olympic Games environmental agenda. Even though the review focusses on Olympic Games, there are obvious implications for other mega-sport events such as the Commonwealth Games and the FIFA World Cup.

**Keywords:** Olympic Games, Environmental Sustainability, Positive and Negative Impact

### Introduction: Defining Sustainability

According to the United States Environmental Protection Agency (EPA), sustainability is based on a simple principle: everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment. *Sustainability* creates and maintains the conditions under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic and other requirements of present and future generations. *Sustainability* is important in making sure that we have, and will continue to have, the water, materials, and resources to protect human health and our environment. (<http://www.epa.gov/sustainability>).

Sustainability has been coined ‘one of the most successful concepts’ in tourism and event studies. It is a concept that has experienced exponential growth since the mid-1980s (Hall, 2011). In the tourism literature, this growth is evident in the number of papers published on sustainability; just two papers were published in 1989 and over 60 papers were published in

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2009. In event studies, sustainability has increasingly become part of the discourse of mega-sport events (MSE's; Hall, 2012). A report of the World Commission on Environment and Development (WCED), also known as the Brundtland Report defines sustainability as '*the ability to meet the needs or the present without compromising the ability of future generations to meet their own needs*' (WCED, 1987). The WCED report highlights five basic principles: a) holistic planning and strategy-making (linking economic, environmental and social concerns), b) preservation of essential ecological processes, c) protection of biodiversity and human heritage, d) intergenerational equity and e) a better balance of fairness and opportunity between nations. Intergenerational equity is central to the WCED definition of sustainability. This principle stipulates that no avoidable environmental burdens should be inherited by future generations. This is because humans are not an entity that is separate from the natural environment but an integral part of it.

Humans and nature must co-exist in harmony. More specifically, Hall (2012) argues that sustainable development must have an eco-centric perspective to consider the impact on natural ecosystems and that separating humans from their natural environment is largely anthropocentric. An eco-centric perspective is reflected in the joint report published in partnership with the World Conservation Union (IUCN), the United Nations Environment Programme (UNEP) and the World Wide Fund for Nature (WWF) that specifically states: '*sustainability is about improving the quality of human life, while living within the carrying capacity of supporting ecosystems*' (IUCN et. al., 1991). Hall (2012) continues that the eco-centric approach must be based on the acknowledgement that the capacity of the environment to improve living conditions is limited and hence it depends on the capacity of the surrounding natural environment to absorb sustainable activities. This approach may contradict the views of those that suggest there are few limits to economic growth and natural capital, which is often the case with mega-sport events. It is widely recognised that mega sport events that have not considered the eco-centric approach have resulted in environmental disasters (e.g. Albertville 1992 Winter Olympic Games).

Despite its emergence as a popular concept, sustainability is a complex issue that has been poorly understood by stakeholders, policy makers and organisers of mega-sport events. The aim of this narrative review is three-fold. First, the review aims to present an overview of environmental sustainability and how it evolved as a key concept in the planning of policies pertaining to Olympic Games organisation. Second, the review aims to compare and contrast sustainability strategies among a range of Olympic Games and highlight areas of positive and negative environmental impact on the host city's natural environment. Third, the review aims to discuss 'hidden' aspects of environmental sustainability i.e. population displacement, human rights and changes to host city residents' quality of life.

## **The Evolution of Environmental Sustainability at Olympic Games**

Sustainability has evolved as a dimension of the Olympic Movement. Pierre de Coubertin, the founder of the modern Olympic Games, created the Olympic Movement which was first established within the remit of the International Olympic Committee (IOC) on 23 June 1894 at the Paris International Congress in Sorbonne, France (IOC, 2013). The IOC is an international, non-governmental, non-profit organisation of unlimited duration in the form of an association

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with the status of a legal person, recognized by the Swiss Federal Council (ruling of 17<sup>th</sup> September 1981). Under the supreme authority and leadership of the IOC, the Olympic Movement encompasses organisations, athletes and other persons who agree to be guided by the Olympic Charter that provides the foundation of the Olympic Movement:

*'The Olympic Movement is the concerted, organised, universal and permanent action, carried out under the supreme authority of the IOC, all individuals and entities who are inspired by the values of Olympism. [...]. Belonging to the Olympic Movement requires compliance with the Olympic Charter and recognition by the IOC. The goal of the Olympic Movement is to contribute to building a peaceful and better world by educating young people through sport practiced in accordance with Olympism and its values.'*

Olympic Charter (2013), Fundamental Principles

Since its inception in 1894, the Olympic Movement has included two dimensions of Olympism; **sport** and **culture**. It was not until the 1990s, that the IOC recognised the importance of the environment and sustainable development. The trigger for this shift towards recognition of the importance of environmental sustainability was the Winter Olympic Games of Albertville 1992. The staging the 1992 Winter Olympic Games in Albertville was grossly mismanaged and resulted in irreversible environmental damage to the Savoie mountainous region of France (Cantelon and Letters, 2000). Due to Albertville, the environment became the focus of attention and emerged as an issue of global social policy at the Earth Summit Conference in Rio de Janeiro (United Nations, 1992). The IOC could ill afford a replication of Albertville in subsequent games for it was a short conceptual link to associate local games mismanagement to the IOC as the transnational agent responsible for widespread environmental destruction (Cantelon and Letters, 2000). A monumental change following the Earth Summit was IOC's announcement to change the sequence of Winter and Summer Olympic Games. This meant that Lillehammer in Norway would stage another Winter Olympic Games in 1994, just two years after Albertville. This was a strategic decision aimed at restoring confidence in IOC's association with the Olympic Games and its role in ensuring environmentally friendly games since Norway is an environmentally conscious country. The Lillehammer 1994 games were, indeed, an environmental success, which was reinforced by the personal involvement of the mayor of Lillehammer, Gro Brundlandt, and his commitment to produce 'green games' as a member of the United Nations World Commission on the Environment and Development. However, establishing environmental policies linked to hosting the Olympic Games was needed. In 1994, the IOC introduced an environmental policy within its requirements for cities aiming to host an Olympic Games. This new policy clearly stated that 'candidate cities must be evaluated on environmental consequences of their Olympic Games plans' (Gold and Gold, 2013).

In 1995, the IOC organised the first World Conference on Sport and the Environment in Lausanne, Switzerland, which has since been held every two years. The conference was supported by the United Nations Environment Programme (UNEP) and aimed to address four major issues: a) governmental responsibilities, b) duties of the Olympic Movement, c) education and the environment, and d) sports industries' responsibilities. A practical outcome of the conference was the launch of the 'Eco-wave' movement by the Federation of the European Sporting Goods Industry (FESI). Eco-wave introduced 14,000 International Standard Organisation (ISO) ecological standards for businesses.

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In 1996, the IOC set up the Sport and Environment Commission to oversee submitted bids and environmental sustainability of Olympic Games host cities. The Commission reviewed the information in the Olympic Charter and added a new paragraph defining the importance of environmental protection. The Commission also changed the dimensions of the Olympic Movement to include the ‘**environment**’ as a third dimension alongside sport and culture (IOC, 2009: 1)

*‘The IOC has acknowledged its particular responsibility in terms of promoting sustainable development and regards the environment as the third dimension of Olympism, alongside sport and culture. This led to its decision in 1995 to create an IOC Sport and Environment Commission. Furthermore, NOCs are encouraged to establish a Sport and Environment Commission on a local level.’*

<http://www.olympic.org/sport-environment-commission>

In 1998, the Nagano Winter Olympic Games in Japan marked the first Games at which the IOC had a clearly articulated environmental protection policy that was to be followed by the organising committee. In 1999, the IOC committed the Olympic Movement to the concept of sustainable development (The Global Plan Agenda 21). In this agenda, the IOC provides a reference tool for environmental protection to be used by host cities in order to encourage and support responsible concern for environmental issues and promote sustainable development (IOC, 2009). Among other policies, the IOC developed a list of environmental requirements concerning the cities bidding to host the Olympic Games. These policies, in theory, demand more responsibility and accountability from the Olympic Games Organising Committees (OGOC), and bind them to co-operate with respective agencies, to plan and implement environmentally safe projects (Girginov and Parry, 2005). However, as will be described in this review, policies are always good on paper, but their implementation is challenging and requires careful consideration of a wide range of factors pertaining to sustainability that alas, not all Olympic Games organisers can manage successfully. The environmental sustainability developments and their associated outcome are presented in Table 1.

**Table 1.** Key events, governing bodies and outcomes shaping the Environmental Sustainability framework of Olympic Games

<b>Event / Governing Body</b>	<b>Year</b>	<b>Outcome</b>
Albertville, France, Winter Olympic Games	1992	Environmental destruction of the Savoie mountainous region
Rio de Janeiro, Brazil, Earth Summit	1992	Worldwide attention to environmental issues of Olympic Games
IOC	1992	Sequence of Winter/Summer Olympic Games changed
IOC	1994	1 <sup>st</sup> environmental policy published
Lillehammer, Norway, Winter Olympic Games	1994	Environmentally friendly games; Brundlandt Report
1 <sup>st</sup> World Conference on Sport & Environment, Lausanne, Switzerland (IOC; UNEP)	1995	‘Eco-wave’ (FESI); 14,000 ecological standards for businesses (ISO); education and environment – a key issue
Sport & Environment Commission (IOC)	1996	To oversee environmental aspect of bids; ‘environment’ added as 3 <sup>rd</sup> dimension of the Olympic Movement
Nagano, Japan, Winter Olympic Games	1998	1 <sup>st</sup> Olympic Games for OGOC to follow environmental protection policy
Global Plan Agenda 21 (IOC)	1999	Reference tool for host cities to ensure environmental protection in hosting an Olympic Games

### **Historical Account of the Positive and Negative Environmental Initiatives at Olympic Games**

The first environmental initiative in the history of modern Olympic Games was set by the organisers of the Munich 1972 Summer Olympic Games. The Munich Olympic Games organisers invited all participating national Olympic Committees to plant a shrub from their country in the Olympic Park, and coined the slogan ‘*certatio sana in natura sana*’ (healthy competition in an intact environment; Girginov and Parry, 2005). Sadly, the environmental initiative and goodwill of the Munich Olympic Games organisers was short-lived and overshadowed by the terrorist attack of Palestinian activists on the Olympic Village and the subsequent killing of eleven members of the Israeli sports team.

The Albertville 1992 Winter Olympic Games in France were panned as an ‘environmental disaster’ because of the destruction they caused to the natural environment. These Olympic Games were highly regionalised with competition venues located in thirteen alpine communities spread over 1657 km<sup>2</sup> at the Savoie region of France (Girginov and Parry, 2005). This model of organising the Games necessitated an ambitious construction programme comprising sports facilities, hotels and roads. The new infrastructure was not carefully considered and was built on once-heavily forested areas, which resulted in destruction and irreversible losses of massive forest areas that were filled with vulnerable wildlife (Horst, 2012). The Albertville 1992 Olympic Games marked the beginning of a series of events and developments culminating in establishing environmental sustainability policies by key stakeholders and primarily by the International Olympic Committee.

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The Lillehammer 1994 Winter Olympic Games in Norway were an excellent example of co-ordinated activities between the Olympic Games Organising Committee, the Norwegian government, the local community and private enterprises. These Games were truly a collective effort involving also environmental agencies, the military and countless volunteers (Cantelon and Letters, 2000). They were an outstanding success, organisationally, and for the outstanding support the Norwegian population extended to the athletes, but mostly because of the strict reverence shown to, and the preservation of, the natural environment (Cantelon and Letters, 2000). From the outset, Lillehammer made environmental issues a priority and committed in their bid to deliver a sustainable Games (Girginov and Parry, 2005). The promise was reinforced by the personal involvement of the Norwegian Prime Minister, Gro Harlem Brundtland, who at the time was also chair of the United Nations World Commission on the Environment and Development. The Lillehammer 1994 Winter Olympic Games were labelled ‘environmentally conscious green games’ and will go down in history as ‘an environmental-political showcase’ (Girginov and Parry, 2005).

The Atlanta 1996 Summer Olympic Games in the United States of America managed modest changes to the city’s environment and infrastructure while focussing on the construction of major sports facilities (Olympic Stadium, Aquatic Centre, Basketball and Equestrian Venues, and Hockey Stadium; Girginov and Parry, 2005). These Games presented an articulated plan of environmental considerations that included: a) *environmental protection* (e.g., the Centennial Olympic Park replaced derelict buildings in downtown Atlanta with a 21-acre urban park, including 650 new trees and plants), b) *resource management* (photovoltaic energy system comprising 2856 solar panels covering the roof of the Atlanta Aquatic Centre and energy efficient lighting installed in all competition venues), c) *transportation* (approximately 1.3 million spectators used buses or subway and electric trams in the Olympic Park to protect air quality), d) *waste management* (recycling initiatives produced a remarkable 82% diversion during the best eight days). These Games scored high in environmental sustainability, but were rated low in other aspects such as the social sustainability aspect (Minnaert, 2012).

The Nagano 1998 Winter Olympic Games in Japan marked the first Games at which the IOC had a clearly articulated environmental protection policy that was to be followed by the organising committee (Cantelon and Letters, 2000). Building on the legacy of Lillehammer, the Nagano Games organisers incorporated a comprehensive environmental strategy at every stage of the preparations. Conservation of the natural environment was the key driver of environmental initiatives. The decision was made to utilise existing venues and courses wherever possible in order to reduce the need for new construction. A series of extensive conservation measures including comprehensive recycling programmes was implemented to ensure that environmental impacts were minimised ([www.olympic.org](http://www.olympic.org)).

The Sydney 2000 Summer Olympic Games in Australia placed environmental sustainability at the forefront of Olympic developments. The Sydney Olympic Park Authority published a 68-page ‘State of Environment Report’ where they outlined a framework for environmental sustainability including environmental guidelines, policy and strategy which paid attention to biodiversity, resource conservation and social and economic sustainability ([www.sopa.nsw.gov.au](http://www.sopa.nsw.gov.au)). According to IOC’s (2013) fact sheet on the Olympic Games Legacy,

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Sydney's Green Games strategy saw the successful remediation and restoration of approximately 160 hectares of badly degraded land and the creation of one of the largest urban parklands in Australia (425 hectares). Land restoration included conservation and enhancement of remnant wetlands and forest, and native flora and fauna (i.e., protection of the endangered green and golden bell frog). The venues were also designed with a strong focus on energy and water conservation, use of sustainable materials, pollution control, and waste management. Particularly, the waste management strategy resulted in the establishment of Australia's first large-scale urban water recycling system, which saves approximately 850 million litres of drinking water each year and the extensive use of renewable energy across the Sydney Olympic Park. The Park has also since developed environmental education, interpretation and research programmes (IOC, 2013-Legacy).

The Athens 2004 Summer Olympic Games in Greece presented a well defined environmental policy. The environmental policy featured four important elements: a) the location of the Olympic venues was in full alignment with the land use and sustainability plan for the metropolitan area of Athens, b) in all Olympic venues, the post-Olympic use excluded the construction of hotels, offices, private houses, casinos and nightclubs/restaurants (Law 2730/99), c) in all Olympic venues the number of construction permits was kept very low, and d) all temporary constructions for the Olympic Games would be removed at the latest six months following the completion of the Games (included in Law 2819/2000 on the establishment of a private company for the Olympic Village, protection of Olympic symbols and other provisions; Girginov and Parry 2005). Unfortunately, this clearly articulated and legally substantiated environmental policy was not implemented properly or with due consideration. Following the Games, the 2004 Athens Olympic Games organisers were heavily criticised for making the natural environment an afterthought. Horst (2012) reported that poor planning left the city stuck with paying maintenance bills for poorly designed stadiums that were vastly underused following the Games. In addition, the construction of Olympic facilities did not account of open spaces, which were carelessly destroyed instead of being retained as green spaces (Reyes, 2005).

The Beijing 2008 Summer Olympic Games in China catalysed a major project of urban transformation and new infrastructure development. Most of the capital invested in the 2008 Olympic Games was in fact spent on infrastructure that helped shape and foster greater environmental awareness among the public and was an opportunity to showcase China's commitment to growing in an environmentally sustainable manner (Aichi Expo, 2005). The Beijing 2008 Olympic Games highlighted a number of environmental issues, including the city's poor air quality (Busa et. al., 2010). During the bid phase in 2000, Beijing set ambitious goals to improve the city's environment. The goals ranged from addressing air and water quality and waste management to introducing environmental considerations in the development of new infrastructure. As specified in the UNEP environmental report on the 2008 Games, in order to accelerate the achievement of environmental goals, Beijing decided to move forward the deadlines of a number of existing environmental targets in the Beijing 'Environmental Master Plan'. The outcomes became visible even before the Games started through: new wastewater treatment plants (waste reduction and recycling schemes at the venues), expanded solid waste processing facilities, increased forestation and green belt areas and an improved public transportation fleet (sustainable transport during the Games). These initiatives were achieved due

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to cooperation with sponsors on environmental sustainability and dialogue with environmental National Governing Organisations (NGO's; Busa et. al., 2010).

The London 2012 Summer Olympic Games in the United Kingdom presented a meticulous sustainability plan. This sustainability plan outlined a commitment to ensuring the 2012 Games were managed in a way that remained economically viable but was also environmentally sound, alongside being socially and ethically responsible. The London Olympic Games Organising Committee (LOCOG) intended to engage in businesses with suppliers and licensees who were best placed to deliver outstanding value for money while ensuring sustainability. This meant that London 2012 organisers engaged in business with responsible suppliers and licensees who were committed to the Sustainable Sourcing Code (2011). Moreover, the Sustainable Sourcing Code was reinforced by a complaints mechanism (Institute for Human Rights and Business [IHRB], 2013). For the first time, an independent commission was established to monitor and publicly evaluate sustainability efforts. The code was based upon the following four principles:

1. *Responsible sourcing* - ensuring that products and services are sourced and produced under a set of internationally acceptable environmental, social and ethical guidelines and standards.
2. *Use of secondary materials* - maximising the use of materials with reused and recycled content, minimising packaging and designing products that can either be reused or recycled.
3. *Minimising embodied impacts* - maximising resource and energy efficiency in the manufacturing and supply process in order to minimise environmental impacts.
4. *Healthy materials* - ensuring that appropriate substances and materials are used in order to protect human health and the environment (LOCOG Sustainable Sourcing Code, 2011).

In addition, LOGOC made environmental sustainability a top priority keeping permanent construction to a minimum and opting to use existing venues and temporary ones wherever possible (Horst, 2012). In situations where new venues were needed, as with the Olympic Park, building took place on reclaimed areas of contaminated industrial land with plans that minimised construction supplies and used lightweight steel and recycled materials. It is estimated that more than 98% of the demolition waste was recycled and 62% of Games operational waste was reused, recycled, or composted (IOC, 2013-Legacy). Olympic structures were built to *last*, designing them to accommodate sports, entertainment, cultural and community events. Organisers developed 45 hectares of habitat, with a 10-year ecological management plan to encourage biodiversity. Approximately 300,000 plants were planted in the Olympic Park's wetlands area and over 1,000 new trees were planted in East London. London 2012 were the first Olympic Games to open up to scrutiny by an independent assurance body, the Commission for Sustainable London 2012 (IOC, 2013-Legacy).

London 2012 was the inspiration for BS 8901, which received a high level of interest internationally. It was decided to create an international version of the standard, ISO 20121, the first fully certifiable International Sustainability Management System standard (IOC, 2013-Legacy). In simple terms, ISO 20121 describes the building blocks of a management system that will help any event-related organisation to: a) continue to be financially successful, b) become more socially responsible and c) reduce its environmental footprint. ISO 20121 applies to all types and sizes of organisations involved in the events industry, from caterers, lighting and sound engineers, security companies, stage builders and venues to independent event organisers and corporate and public-sector event teams ([www.iso20121.org](http://www.iso20121.org)).

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For all of these reasons, some hailed the London 2012 Olympic Games as the ‘greenest’ Games up to that point in Olympic Games history. Perhaps one of the few areas that was overlooked during these Games was the carbon footprint as London officials ended up abandoning their attempt to offset carbon emissions. A study projected the carbon footprint of the London 2012 Olympic Games estimated the Games would produce 3.4 million tons of carbon (Horst, 2012).

The Sochi 2014 Winter Olympic Games in Russia were truly an unpleasant surprise especially following the success of the London 2012 Games and were heavily criticised for their negative impact on the natural environment. One study investigating the pre-Games perceptions of local residents four years prior to the Games showed that the residents were seriously concerned about environmental damage, waste of public resources and increasing crime levels (Müller, 2011). Residents’ concerns about environmental damage were unfortunately confirmed as stated in Gazaryan and Shevchenko’s (2014) report. The most serious environmental issues that occurred in connection with the Olympic Games during the years 2006-2013 can be found in Caucasian Knot (2014) which shows Sochi 2014 as the ‘most costly Games ever’ in terms of damage done to nature up to that point in time.

The Sochi region is well known for its ecological uniqueness. It includes the Sochi National Park to the north (established in 1983 as the first national park in the Russian Federation) and the Western Caucasus Reserve to the northeast (inscribed into the UNESCO World Heritage List in 1999; Petersson and Vamling, 2016). In the years prior to the Sochi Games, the Organising Committee collaborated with the United Nations Environment Programme (UNEP). This collaboration involved six expert meetings to Sochi and Moscow. Among the concerns voiced in the first mission report were that all the buildings and infrastructure had to be built from scratch with resultant high environmental impact - with the added uncertainty as to whether these brand-new structures would ever be adequately used after the Games (Sochi 2014 - UNEP Mission Report). The expert visits culminated in the formulation of action plans for the ecological development and environmental preservation in four key areas: a) Zero Waste Games, b) Climate Neutral Games, c) Games in Harmony with Nature and d) Enlightenment Games (Sochi 2014 - UNEP Mission Report). However, with a few minor exceptions (i.e., the sliding venues and the Olympic Mountain Village being located away from the UNESCO World Heritage site and a restoration plan for the Mzymta river basin) these plans were not implemented.

The Olympic project included the building of both a highway and a railroad, from Adler to Krasnaya Polyana, connecting the coastal and alpine Olympic complexes. In this process, boxwood forests were cut down to make way for the modern highway. Vast forest areas were cut down with devastating consequences for the Caucasian boxwood tree. In addition, the waste from the huge building sites was disposed off illegally at different places around the city (Digges 2014). Moreover, Sochi did not have sufficient capacity to take care of all its sewage, which meant that some of the polluted water was flushed directly into the Black Sea (Kravchenko 2014a). It is worth noting that, apart from UNEP, two other environmental organisations were initially involved in the planning of the Sochi 2014 Games; Worldwide Fund for Nature (WWF-Russia) and Green Peace. In 2010, both organisations decided to discontinue their involvement with the Games due to strong disagreement about the choice of areas to be used for Olympic venues and the lack of a careful assessment of those areas before decisions were reached. WWF

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stated on their website:

*Due to lack of basic environmental information about the area (ungulate concentration sites, migration routes), Sochi-2014 organisers did not implement any activities to at least partly compensate the damage. [...] Under the pretext of Olympic needs, the nature conservation legislation was significantly weakened, especially parts concerning protected nature areas and environmental assessment of construction projects. [...] The Government refused to fund the post-Olympic environmental rehabilitation program [...].*

WWF-Russia. Undated. 'Mistakes of Sochi-2014.  
<http://wwf.ru/about/positions/sochi2014/eng>.

The Rio de Janeiro 2016 Olympic Games in Brazil were held under the motto 'Green Games for a Blue Planet' (Trusen, 2011). The Games were based, according to the bid document, on the three sustainability pillars of 'planet, people and prosperity'. For the Games, a suitable 'Sustainability Framework' was developed that also defined an institutional framework for the sustainability agenda (Ministerio do Esporte, 2009). The core of the sustainability framework was the *Sustainability Management Plan* (SMP) which also ensured participation of other stakeholders (NGOs, private businesses, and scientific institutions). Rio's application document mentioned the following with regard to the objectives of the plan:

*'The SMP core objective is to support the delivery of the Games and to create, with Government engagement and integration, the means for a definitive transformation in the city. This co-ordinated plan will set a new standard for urban transformation and sustainability in South America, and will create a foundation for the integration of sustainable events and environmental regeneration.'*

The SMP was intended to ensure that the Games were in line with the development priorities of the city and included: **water conservation** (construction of river treatment units and expansion of sewage network); **renewable energy** (implementing Brazilian state-of-the-art hydrogen energy cells and generators in all venues); **carbon neutral** (reforestation of 24 million trees in strategic rainforest areas before 2016 with 3 million trees planted in the National Park Pedra Branca aka 'Carbon Park'); **waste management and social responsibility** (100% of solid waste produced at all phases of the event to be recycled through a sustainable chain with direct social benefits to surrounding communities). Additionally, the Organising Committee and the Brazilian Federal Government decided to implement some very innovative environmental-technological pilot projects, for example in the field of green construction and the use of renewable energy resources in public transport. A testing and monitoring system was to be established to minimise possible negative environmental effects (Trusen, 2011). In the bid 'green Games for a blue planet' the government committed itself to improving air and water quality. However, a study conducted independently by Reuters analysing government data found that 'Rio de Janeiro's air was dirtier and deadlier than portrayed by authorities and the Olympic Games promised legacy of cleaner winds that has not remotely been met' (Brooks, 2016).

The Rio de Janeiro 2016 Olympic Games were also held under the threat of potential explosive spread of the Zika virus (ZikV). A study focusing on the epidemiology of ZikV and the outbreak

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in the Americas warned about the public health implications and epidemic potential of the virus at mass gatherings event events such as the Olympic Games and issued recommendations (Petersen et al., 2016). The World Health Organisation confirmed in September 2016 that there had been no ZikV cases reported in Brazil either among athletes, spectators or visitors. Other 'hidden' aspects associated with the Rio Games are discussed later in this review.

Table 2 presents the most notable environmental initiatives at Olympic Games and their impact (positive or negative) .

**Table 2.** Environmental impact and initiatives of summer and winter Olympic Games (1992-2016)

<b>Host city/ country</b>	<b>Year</b>	<b>Impact</b>	<b>Description of environmental initiatives</b>	<b>Source</b>
<b>Albertville, France</b>	1992	-ve	Environmental disaster; destruction of large forest areas and wildlife	Horst (2012)
<b>Lillehammer, Norway</b>	1994	+ve	Environmentally conscious, green games; environmental-political showcase	Girginov & Parry (2005)
<b>Atlanta, United States of America</b>	1996	+ve	Re-usage of derelict buildings; photovoltaic energy; bus/subway/electric train transport; 82% waste recycled	Minnaert (2012)
<b>Nagano, Japan</b>	1998	+ve	1 <sup>st</sup> IOC clearly articulated environmental policy; nature conservation; games ascribing to Sotoyama concept	Cantelon & Letters (2000)
<b>Sydney, Australia</b>	2000	+ve	'State of Environment 68-page pre-Games Report'; biodiversity preserved; 425 hectares restored parkland; successful water /waste recycling	IOC (2013-Legacy)
<b>Athens, Greece</b>	2004	-ve	Poor implementation of well-defined environmental pre-Games policy; Olympic facilities built on open green spaces; environment ignored	Reyes (2005)
<b>Beijing, China</b>	2008	+ve	Beijing 'Environmental Master Plan'; improved air and water quality; recycling at venues, sustainable transport; increased forestation	Busa et. al. (2010)
<b>London, United Kingdom</b>	2012	+ve	LOGOC Sustainable Sourcing Code; Commission for a Sustainable London 2012; re-used buildings; 96% of construction material recycled; 300,000 plants at Olympic Park & 1000 trees in London; ISO 20121	Horst (2012) IOC (2013-Legacy)
<b>Sochi Russia</b>	2014	-ve	Deforestation of Mzymta mountains: Caucasian boxwood tree and habitat destruction; river contamination with toxic waste; river course altered; infrastructure built as new; no existing facility re-use; most environmentally costly games ever!	Digges (2014), Kravchenko (2014a), Caucasian Knot (2014)
<b>Rio de Janeiro, Brazil</b>	2016	-ve	Poor implementation of Sustainability Management Plan; poor air and water quality; threat of ZikV; Guanabara bay polluted with human sewage	Petersen et al. (2016), Brooks (2016)

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### **Environmental Sustainability - The 'Hidden' Aspects**

All the cases of environmental sustainability described here have the natural environment at the core of environmental policies and strategies are designed to deliver sustainable Olympic Games. However, Lohman and Dredge (2012) have noted that even though humans are a fundamental part of the natural environment, leading policy makers of mega sport events tend to focus their strategies and policies on minimising the impacts to the physical environment (i.e., natural resources such as air and water, event-related pollution from construction of facilities and transportation and management of waste). This is often the case with most of the aforementioned environmental policies. Nevertheless, there are other areas within the general concept of Olympic Games sustainability that are often overlooked in the interest of preserving the natural environment in the run up to, and also during, the event. For example, other equally significant environmental impacts that are concerned with the host community such as community displacement (Porter, 2009), uneven distribution of benefits (Gaffney, 2010; Wolfe, 2013), Olympic spending compromising spending for the community (Lenskyj, 2000), quality of life for residents (Scheissel, 2013), use of facilities after the event (Hiller, 2006), and human rights (IHRB, 2013).

According to Porter (2009), population displacement is a defining feature of mega sport events that every few years use a new venue and a new city. Population displacement is part of the legacy of such events that go almost unreported. It is considered either unimportant or unfortunate, but necessary by-product of the urban redevelopment needed to make a successful event. Policy makers and planners state that population displacement is inevitable and, while perhaps unfortunate, just a 'natural' part of the cycle of urban development. However, little consideration is given to the personal cost and experience of being at the 'receiving end' of the policy and planning processes designed to to achieve population displacement (i.e., tenant evictions and forced purchase of land; Porter, 2009). Gaffney (2010) reported that Beijing 2008 very clearly demonstrated that low income neighbourhoods were 'cleared' in order to make way for mega-event infrastructures and renovation. Tens of thousands were displaced, either through the physical destruction of their homes or through market mechanisms, such as rent inflation. According to estimates, as many as 1.5 million people were displaced for the 2008 Beijing Olympic Games (COHRE, 2007).

Gaffney (2010) discusses the distribution of public money in Rio de Janeiro's run up to the 2016 Olympic Games. He points out that the Organizing Committees that are responsible for funding and managing Olympic Games budgets are autonomous entities comprised of national elites that are not subject to any sort of democratic accountability. Organising Committees have access to tens of billions of dollars of public money, keep their own books, and award contracts for everything from stadium building to concessions, to contracting private and public security forces. After the Olympic Games have passed, the committee dissolves, leaving behind political, economic, and socio-spatial legacies that promote neo-liberal forms of governance. There is no legal recourse for those displaced or otherwise aggrieved by the Olympic Games - the massive debt is assumed by the city and with time the corruption scandals fade (Gaffney, 2010). A frequent criticism is that in many cases, a large share of public money is invested in hosting the Olympic Games, thus threatening 'core spending in health, education, welfare and transport' (Lenskyj, 2000). Indeed, the costs involved in staging the Games are now so high that host cities can often only justify the expenditure when it is seen as leading to a major programme of regeneration and improvement (Essex and Chakley, 1998).

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Rio was also at the forefront of exploiting labourers to build Olympic facilities. Gaffney (2010) commented that ‘Olympic mega-structures arose from the toil of migrant workers whose own homes were fetid barracks and desolate encampments.’ Rio de Janeiro fully engaged in the process of making itself into an Olympic City where the workers streamed down from the favelas (a Brazilian shack or shanty town; a slum) to build sportive constellations that were intended for use by the international tourist class and the upper strata of Brazilian society (Gaffney, 2010). The Rio Organising Committee publicised that ‘*it is through sport that young people and children learn to overcome obstacles, respect rules, work within a team and demonstrate solidarity. Values that come from the field of play help to encounter difficulties and provide strength to fight for a better life*’ but this statement was criticised that the programs aimed at developing disciplined minds and bodies that served, in part, to exacerbate instead of ameliorate social and spatial inequalities.

Cases of uneven distribution of benefits among the host community have been reported in the literature. Wolfe (2013) discusses the developments in the run up to the Sochi 2014 Winter Olympic Games in Russia and the divergence caused between two villages (Kazachiy Brod and Akhshtyr), which was amplified due to uneven distribution of resources. The existence of a historical, paved road represented the critical difference between the villages and was the reason why the village of Kazachiy Brod had been the recipient of investment and attention for having direct access to the road, whereas Akhshtyr (being on the opposite side of the river) was left with no water, no reliable transit links, and the promise of becoming an Olympic dump once construction was complete. No doubt Akhshtyr found itself in the role of victim. While much of the infrastructure development was needed and welcomed, many locals nonetheless felt significantly marginalised, excluded from the discussion, and not benefiting from their region’s development (Wolfe, 2013).

The quality of life of local residents in the host community is also seriously affected by an Olympic Games. Schissel (2012) reported that today’s sporting mega-events are a globally recognised urban spectacle for their capacity to stimulate economic growth, revitalise urban cityscapes and promote their respective metropolis to a transnational audience. Yet in spite of the ubiquitous enthusiasm touted by Olympic stakeholders, there is a growing literature documenting the negative impacts that sporting mega-events have on the quality of life of host city residents. They are seriously concerned about environmental pollution and congestion associated with sport event-related developments (Tatoglu and Erdal, 2002) and they often feel disenfranchised by the planning process which may result in forming negative perceptions toward the event (Fredline and Faulkner, 2002).

In order for residents to tolerate the inconveniences associated with hosting an Olympic Games (e.g. queuing for services, sharing local facilities, overcrowding, traffic congestion, and route disruption), the perceived rewards should equal their willingness to carry the infrastructure costs, extending friendliness, courtesy and hospitality to tourists (Waite, 2003). Coackley and Lange Souza (2013) have noted that fair and equitable legacies and developmental outcomes are achieved only when the voices and interests of the general population are taken into account and given priority during the process of planning, funding and implementation.

From the perspective of human rights, Olympic Games bring both opportunities and risks (IHRB, 2013). They precipitate massive public and private investment needed to create new jobs and boost employability, along with the potential for improving essential infrastructure, regenerating urban areas, developing housing and promoting increased participation in sport

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and healthy living. At the same time, an Olympic Games (particularly the Beijing 2008) have come under repeated scrutiny from human rights experts and campaigners over a gamut of concerns. Apart from the community displacement in Beijing, at the height of Olympic construction, at least 10 people were killed, and some 17,000 workers complained of workplace exploitation (Human Rights Watch, 2008). In addition, the Playfair Campaign recorded instances of child labour, excessive working hours and abuses of health and safety laws in the supply chains of several Olympic licensees (PlayFair, 2008).

Human rights have also come to the fore during the events themselves (IHRB, 2013). Media revelations during the London 2012 Olympic Games identified cases of migrant worker exploitation among temporary agency staff working at two hotels used by Olympic delegations and referees. A BBC Newsnight report claimed that Jani-King, the agency used by the Hilton Waldorf, altered workers' hourly rates without warning and threatened them with unfair dismissal. London 2012 was criticised by PlayFair (2012) in that, corporate discourses of 'ethics' and 'sustainability' set by the Games organisers were an 'empty' promise. In its campaign to ensure a 'sweat free' Olympics, Play Fair connected the production of major sporting events to wider issues of global inequality, poverty and structural problems in transnational labour markets (Timms, 2012). According to Timms (2012), London 2012 Olympic mascots were made in sweatshops in Hong Kong. Equally, during the Vancouver 2010 Winter Olympic Games, civil liberties groups and journalists complained of limits on free speech and assembly imposed by host authorities and events' organisers ostensibly to safeguard brand rights (IHRB, 2013).

The London 2012 Olympic Games laid down several significant benchmarks in addressing human rights related challenges (IHRB, 2013). London was the first Summer Olympic Games to embed sustainability from the outset and to place an emphasis on leaving a positive legacy for the city, sport in the UK, and for the wider Olympic Movement. It was also the first Olympic Games to open itself to scrutiny by an independent assurance body, the Commission for Sustainable London. London's Olympic Delivery Authority set a new bar too, by completing venue construction without any construction worker dying in an accident (Commission for Sustainable London, 2011). London arguably went further than any previous Olympic Games organiser in terms of commitment to sustainability and socially responsible policies and practices and made advances which the Olympic Movement and other Olympic Games organisers can build. Yet, more than one year after the London 2012 Olympic Games, debates around homophobia in Russia and mass protests in Brazil drew attention to the next Olympic host cities. It is unclear if, and by what means, the lessons learnt from London were carried forward to these events.

### **The Future of Environmental Sustainability at Olympic Games**

The Tokyo 2020 Olympic Games in Japan have already got plans for an environmental agenda. The Organising Committee of Tokyo 2020 joined forces with Climate Action and UNEP in 2014 to produce a strategy of environmental sustainability (Climate Action and UNEP, 2014). Tsunekazu Takeda, member of the IOC and President of Tokyo 2020 reported that:

*'All competition venues or facilities for the 2020 Games will be required to meet strict energy-efficiency building certification standards. Including the new National Stadium itself, all competition venues or facilities being constructed or renovated for the 2020 Games will be required to meet strict energy-efficiency building certification standards*

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*under the CASBEE system (the Japanese system equivalent to the certification standards) and in accordance with the Tokyo Metropolitan Government Tokyo Green Building Program. Recycled construction material will be used wherever possible. In addition, the Olympic Village will become a new model for sustainable inner-city housing. Energy consumption will be minimised through the use of renewable energy sources including solar power, a seawater heat pump, use of surplus heat generated by waste treatment plants, and biogas power generation using food waste. The Olympic Village will become an urban residential 'smart city pioneer model,' using a wide range of Japanese sustainability technologies. It is anticipated that Tokyo 2020 will deliver a sustainability legacy with long-term benefits for the city and Japan'.*

The three pillars of the 2020 Tokyo Games Sustainability Strategy are: *P1-minimal environmental burden; P2-urban environment plans harmonising with nature; P3-a sustainable city through sport.* Tokyo 2020 is currently looking into the implementation of the ISO 20121. The city of Tokyo's 2020 strategy includes a long-term development plan aimed at a vast increase in green areas. The overarching objective of the strategy is to make Tokyo the 'world's most environmentally friendly low-carbon city' and the revitalisation of Tokyo as a 'beautiful city surrounded by water and greenery'. Specific examples include the creation of some 537 hectares of new green space in Tokyo by 2020 and plans to further extend the green road network through the planting of more roadside trees. Tokyo aims to become a city in harmony with nature, with more open spaces and greenery integrated into its long-term development plans. Another example may be seen with the Sea Forest zone in Tokyo Bay, which will further connect the city and the sea to increase cooling breezes in urban areas (Climate Action and UNEP, 2014).

## **Conclusion**

Event-greening has been defined as the process of incorporating environmental dimensions into the planning, organising and implementing an event. It involves incorporation of sustainable development principles and practices at all levels of the event organisation. The London 2012 and the Rio de Janeiro 2016 Olympic Games each adopted event-greening measures. Their respective sustainability agendas differed however in the degree of institutional integration and thoroughness (Ackermann, 2011). In overall, minimising the impact to the natural environment features at the core of Olympic Games sustainability initiatives. Nevertheless, its implementation seems to be problematic in most cases as it requires careful consideration and assessment of long-term damage to the natural environment.

Environmental sustainability has become a standard requirement and mandate for running successful Olympic Games. Strategies and policies such as, the International Standards Organisation Environmental Agenda (ISO20121), and the Sustainable Sourcing Code introduced by LOCOG for the London 2012 Olympic Games were all excellent examples of steps taken to reduce the Olympic Games impact on the natural environment. However, there are other aspects of environmental sustainability that some countries are overlooking and have still a long way to go to ensure that these aspects of environmental sustainability are also considered as an integrated part of the event. More specifically, it is the aspects that pertain to population displacement, distribution of benefits, disruption to local residents' lives, workplace exploitation and human rights. Even though these aspects are mentioned in the sustainability agendas of Olympic Games lack of resources is often the reason for which social programmes pertaining to the legacy of the events are not implemented.

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More support is needed from international organisations such as Climate Action and the United Nations Environmental Programmes to raise awareness of the ‘hidden aspects’ of environmental sustainability. The engagement of all stakeholders alongside the establishment of an open and inclusive organisation is key to achieving the promotion of the overlooked areas of environmental sustainability, i.e., the ‘soft’ aspects which bear on the social fabric, the cultural vibrancy, the ability to innovate, an environmentally aware public, and an enhanced international image (Busa et. al., 2010). Environmental sustainability is not only about waste management at the venues or planting trees in an Olympic Park. It should include consideration of aspects related to the ‘human element’ and safeguard the rights of all stakeholders to host a truly successful Olympic Games.

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