2014

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Andrew Bakos
University of Windsor

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Environmental sustainability of sporting events in local communities: Assessing the ecological footprint of the 2013 International Children’s Games

By

Andrew Bakos

A Thesis
Submitted to the Faculty of Graduate Studies through the Department of Kinesiology in Partial Fulfillment of the Requirements for the Degree of Master of Human Kinetics at the University of Windsor

Windsor, Ontario, Canada

2014

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Environmental sustainability of sporting events in local communities: Assessing the ecological footprint of the 2013 International Children’s Games

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26 June 2014
DECLARATION OF ORIGINALITY

I hereby certify that I am the sole author of this thesis and that no part of this thesis has been published or submitted for publication.

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ABSTRACT

Sport management literature regarding the environmental sustainability (ES) of sport events has been predominately focused on the environmental consequences of staging major events. As a result, there is little research concerned with the environmental impacts of small-scale events on host communities. The primary objective of this study was to calculate the Ecological Footprint (EF) of the 2013 International Children’s Games (ICG). Developed in the early 1990s by Wackernagel and Rees, the EF is an analysis tool that measures the resource consumption of a human population within a geographical boundary. The EF of the 2013 ICG was estimated through the creation of an EF calculator capable of measuring the environmental impact of a sporting event in Ontario, as well as data provided by various members of the Windsor-Essex ICG Organization Committee. The results from this study exhibited how the EF concept can support event organizers in staging environmentally sustainable events.
DEDICATION

This thesis is dedicated to my parents Bob and Zoi, and my brother Joe, for their endless love, support and encouragement.
ACKNOWLEDGEMENTS

First and foremost, I wish to thank my committee members who were more than generous with their support and precious time throughout this entire process. To my advisor, Dr. Scott G. Martyn, I am truly thankful. His expertise, guidance and most of all patience, made my time as an undergraduate and graduate student at the University of Windsor beyond an enjoyable experience. Special thanks to Dr. Laura Wood and Dr. V. Chris Lakhan for their encouragement, and valuable feedback throughout the research process.

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<td>ES</td>
<td>Environmental Sustainability</td>
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<td>EF</td>
<td>Ecological Footprint</td>
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<td>EP</td>
<td>Environmental Performance</td>
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<td>ICG</td>
<td>International Children’s Games</td>
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<td>LCA</td>
<td>Life Cycle Assessment</td>
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<td>GHG</td>
<td>Greenhouse gases</td>
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<td>CO(_2)e</td>
<td>Carbon dioxide emissions</td>
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<td>MWh</td>
<td>Megawatt hours</td>
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<td>O(_3)</td>
<td>Ozone</td>
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<tr>
<td>TBL</td>
<td>Triple Bottom Line</td>
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<td>CSR</td>
<td>Corporate Social Responsibility</td>
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<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
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<td>Gha</td>
<td>Global hectares</td>
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<td>SE-EPM</td>
<td>Sport Event Environmental Performance Model</td>
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<td>EPA</td>
<td>Environmental Protection Authority</td>
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<td>LCI</td>
<td>Life Cycle Inventory</td>
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<td>UN</td>
<td>United Nations</td>
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<td>WFCU</td>
<td>Windsor Family Credit Union</td>
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<td>Kg</td>
<td>Kilograms</td>
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<td>Cap</td>
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<td>UBC</td>
<td>University of British Columbia</td>
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<td>USD</td>
<td>United States Dollar</td>
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<td>Acronym</td>
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<td>FA</td>
<td>Football Association</td>
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Chapter 1

Introduction

Since its introduction in 1994, the concept known as the triple bottom line (TBL) has matured the overall vision of an organization from solely focusing on the economic value it adds, to also strongly taking into account its social and environmental impacts.\(^1\) When considering how the TBL has been applied to research in the sport management field, it is quite evident that the focus in social and economical sustainability of sport organizations dominates research concerning environmental sustainability (ES). ES has been widely studied and understood across other management fields. In comparison, the lack of ES literature in sport management has been the demise of sport managers’ ability to understand and apply it within their own organizations.\(^2\) However, there is a growing consideration for the way in which sport, specifically hallmark sport events, and the natural environment interact. Event organizers and policymakers have become increasingly interested in the environmental impact of major sporting events.\(^3\) A prominent example that highlights environmental initiatives of event organizers and policymakers is the Organizing Committee of the 2000 Summer Olympic Games in Sydney, Australia, which has been praised in literature for staging the first ‘green’ Olympic Games.\(^4\) Although ES literature has become increasingly popular in sport management, the primary focus has been on sport organizations involved with staging mega-events, leaving the ES of small sized events rarely studied.

Higham (1999) questioned the economic viability of hosting mega-sized sporting events and suggested that small-scale events provide communities with a more positive impact.\(^5\) Some of the reasons he listed, included: hallmark sporting events required significant development costs and large businesses and corporations would be the main
economic benefiters, leaving little to no opportunity for local communities to profit. In comparison, small-scale events were more likely to be beneficial for local communities because the infrastructure usually already exists to stage the event, which has less of a strain on public funds. Since large businesses and corporations are less likely to be affiliated with smaller events, the local community has a much greater opportunity to profit from the event. In order to conceptualize the scope of what characterizes a small-scale sporting event, Higham defined it as a;

Regular season sporting competitions (ice hockey, basketball, soccer, rugby leagues), international sporting fixtures, domestic competitions, Masters or disabled sports, and the like. Many of these sports are associated with travelling supporters who can be hosted by cities of any scale largely within existing infrastructure.

Implementing ES into sport events is difficult due to the fact that there is no standardized approach because the nature of most assessment tools report isolated results, which cannot be compared across events. There are a number of methods that can be applied to try and overcome this problem; one is to employ the Ecological Footprint (EF) concept. This analysis tool compares the resource consumption and waste generated by the human population in a geographical boundary with that area’s capacity to support those activities. The EF aggregates the impact of different activities (transportation, facility usage, waste/recycling, etc.) into a single measure, which makes it a useful tool to communicate the environmental impacts of sport events to event organizers and policymakers. Also, it allows for the comparison of other event’s EF, which will help future event organizers identify sustainable and non-sustainable environmental practices. In order for this tool to be able to bridge the gap between ES and sport events, there needs to be a long-term collaborative effort between policymakers, event organizers
and researchers, as well as the implementation of numerous studies that use the EF to measure the environmental impact of sport events. For this to be accomplished, the researcher created an EF calculator capable of measuring the footprint of sporting events in Ontario. Upon the conclusion of this study, the researcher plans to create an online version the EF calculator, which will be made accessible to the public by allowing users to access the tool through the International Centre for Sport and Leisure Studies at the University of Windsor.

This study examines the EF of the 2013 International Children’s Games (ICG), hosted in Windsor, Ontario, Canada. The city has a population of approximately 211,000 people, covering 146 squared kilometres of land. The ICG hosted approximately 5,000 athletes, team officials and spectators from 14 to 19 August 2013 and required the usage of numerous facilities within the city. The scope of the 2013 ICG provided Windsor-Essex the opportunity to host an international small-scale sport event. If the EF can be applied successfully to the event, it has the potential to be applied to future ICG and other sport events staged in Windsor and comparable cities.

Research Problem and Purpose Statement

Although the EF was originally designed to measure global and national activities, it has increasingly become more popular at the sub-national level. However, there is limited literature that measures the EF of various sport events. Collins and Flynn (2008) studied the EF of the United Kingdom’s Football Association (FA) Final Cup, which focused on the impact of visitor resource consumptions. There is much more literature concerned with the EF of tourism, a prominent component to any major sport event. Collins et al. (2005) estimated the EF of tourists (8.67 global hectares per tourist)
in Cardiff, Wales and compared the results to the average Cardiff resident (5.59 global hectares per capita).\textsuperscript{15} There are also studies that use different assessment tools to measure the ecological impact of sport events. Dolf (2011) conducted a Life Cycle Assessment (LCA) on a University of British Columbia (UBC) men’s basketball game and Mallen et al. (2010) assessed the environmental performance of the 2008 ICG organizing committee.\textsuperscript{16}

Research concerning the integration of the TBL into hallmark sport events was historically dominated by the economic sustainability of these events. As the concept increased in popularity, studies regarding their social and ES became more prevalent. Since scholars, like Higham (1999), changed the focus of the scope to small-scale sport events, the same pattern of research is evident. The economic sustainability of this type of events was the most dominant early on. Research concerning the ES of small-scale sport events is in its infancy and studies in this area are certainly warranted.\textsuperscript{17} Therefore, the purpose of this study is to add to the minimal research in this area by attempting to quantify and analyze the resource consumption of a small-scale sport event, in this case the 2013 ICG. This study hopes to build on previous literature regarding the ecological footprint as an effective sustainability indicator, the sustainability of small-scale sport events and their environmental impact. Based on the Victoria Environmental Protection Authority’s events calculator, the researcher has identified six main components of the event that will have an environmental impact: travel; accommodation; food and drink consumption; print and promotional items; infrastructure of the event venues; and recycling and waste.\textsuperscript{18} In order to evaluate the EF of the 2013 ICG and its main components the researcher has posed the following research question:
What was the Ecological Footprint of the 2013 International Children’s Games?

A series of sub-questions are included to help put in perspective the environmental impact of the event. They include:

1) What was the Ecological Footprint breakdown for each category of the event; travel, accommodation, food and drink consumption, print and promotional items, infrastructure of the event venues, and recycling and waste?

2) What was the average event participant’s Ecological Footprint and how does it compare to the average Ontario resident’s footprint?

3) Can the 2013 ICG be identified as an environmentally sustainable event?

A number of objectives must be achieved in order to provide resolution to the primary research question, as well as the average footprint per participant and the breakdown of each of the six components of the event. First, the researcher has developed an EF calculator that has the capabilities of measuring the primary and secondary set of questions. This objective is explained further in the methodology section. Second, the researcher acquired the necessary data that has been used to measure the event. Due to the size of the event and the lack of access to some of the required information, the researcher has used data surrogates that most closely reflect an event like the ICG, as well as converting certain data to measurements that are compatible with the EF calculator. It is argued that by minimizing the need for assumptions and manipulation of data has more accurately estimated the EF of the event. Finally, once the results were generated, the researcher used the subset of questions to compare them with other relevant studies. The EF per participant was then compared with the EF per capita in Ontario. For the purposes of this study, the event participant group refers to the 1,460 athletes and team officials of
the 2013 ICG, as well as the 3,455 out-of-town spectators who attended the event. This has helped the researcher establish whether the Games were sustainable or not.

The results of the study were then used to establish how the EF of the event could have been minimized. The discussion section examines the positive and negative aspects of the event, regarding ES and how to lower the environmental impacts of these small-scale events. This will provide future Organizing Committees of the ICG and Windsor-Essex with information beneficial for planning a sustainable small-scale sporting event. Furthermore, the results of the study can be used to determine if Windsor has the environmental resources to host events comparable to the ICG.
Endnotes


6 Ibid, 85.

7 Ibid, 87.


14 Collins, “Measuring the environmental sustainability,” 751-768.


Chapter 2

Literature Review

The literature review consists of numerous comprehensive sections, each addressing the main topics relevant to this study. The first section identifies general characteristics of sport events that contribute to their environmental impact. From there, brief overviews of the development of two environmental principles that apply to this study (sustainable development and the precautionary principle) are discussed. Next, ES and indicators used to measure sustainability from a sport event management perspective are briefly examined. The EF concept is then introduced and the benefits and limitations of the methodology are provided. This section then reviews existing literature that has implemented the EF concept on sport events. This chapter concludes with a brief history of the ICG and a review of existing literature regarding ES and the event.

The Environmental Impacts of Sport Events

The ironic truth about almost all sports is the fact that their foundations are based on the promotion of the health and wellness of the participants; however, the notion of achieving peak health through sport is usually dependent upon the degradation of the environment.¹ Sport events can have drastic ecological outcomes, especially if natural resources are not taken into serious consideration by the organizers. Issues of time and spatial scales are crucial to the study of the environmental impacts of sport events.² The time scale can be broken down into short-term and long-term periods. “Short-term refers to the period immediately before, during, and after the event.”³ The long-term period originates at the bidding for the event, if a bid is required, and ends at some point in the future yet to be determined.⁴ Spatial scale refers to the size of the event in relation to the
area supporting the event and is generally categorized as global, regional or local. The event’s spatial scale can predict its environmental and economic success. If a sport event is hosted at a location where it cannot be sufficiently supported by the social and infrastructural capacities of the area, there is a significant potential for undesirable outcomes; poor waste management, soil erosion and compaction by spectators are a few examples.\(^5\)

As a result of poor spatial scale management, direct and indirect environmental consequences can result from sport events, such as the amount of waste generated by an event. For example, an average American professional football game uses between 30,000 to 50,000 disposable cups.\(^6\) “A direct effect is a consequence of a cause-effect relationship between a project and a specific environmental component.”\(^7\) An indirect impact is “a secondary environmental effect that occurs as a result of a change that a project may cause in the environment. An indirect effect is at least one step removed from a project activity in terms of cause-effect linkages.”\(^8\) Traffic congestion is a prominent example of an indirect negative impact, which can cause a drastic spike in GHG gas emissions, relative to the daily average of the area under review.

Through an examination of a sporting event, such as the Olympic Games, the potential ecological impacts can be quantified. The environmental issues associated with the Olympic Games are due to the fact that an Olympiad is hosted in a two week time period, attracts significant numbers of tourists, is situated in a confined area, and has an operating and infrastructure cost in the billions of dollars (USD).\(^9\) Hosting an event of this magnitude, combined with a relatively small spatial and temporal scale, can lead to major environmental consequences. For example, pertaining to CO\(_2\) emissions, “the 2004
Summer Olympics in Athens produced half a million tons in two weeks—roughly comparable to what a city of 1 million people would emit over a similar period.” Even though this is a mega sport event in a sizeable city, its environmental impacts are proportional to a comparatively smaller event hosted in a medium-sized city. If the region does not have access to the natural resources, facilities and infrastructure required to absorb the influx of tourists attending, the short term event will have long term consequences for the host city. The environmental costs associated with sport events can be deductively broken down into the major components of most sport events; facilities, tourism, participants and spectators and the nature of some sports are the most prominent.

Facilities

The construction and operational phases of sport facilities lead to environmental consequences most notably in the form of greenhouse gases (GHG) in the atmosphere and generate noise, light, air, soil and water pollution. These effects are predominately due to the natural (land, water and air for example) and non-renewable resources (natural gas and metal for example) consumed during the lifespan of a facility. There are numerous examples across the globe that illustrate the environmental costs of facilities. “Britain’s national sport centres consume close to $1 million (USD) of energy per year, adding around five hundred thousand tons of CO₂ to the atmosphere.” In Canada, one million megawatt hours (MWh) of electricity were consumed annually by the 3,600 ice arenas and curling rinks across the country. The relationship between facilities and the natural environment is the easiest to criticize because of the direct observable interaction between the two and their narrow spatial scope relative to the natural environment.
Predictably, any newly constructed sport facility will draw local environmental concern. It is imperative that not only the direct impacts of facilities be taken into account, but also the potential for indirect ecological damage. The best predictor of indirect impacts of facilities is their physical location because it determines lasting transportation methods and routes. An example of poor facility location is AT&T Stadium, home to the Dallas Cowboys National Football League franchise, which finished construction in 2009 and is located in Arlington, Texas. The primary concern with the stadium is the fact that Arlington, Texas is the largest city in the United States without a public transportation system.\(^\text{15}\) Therefore, personal vehicle is by far the most dominant method of transport to the stadium. In order to produce sustainable events, owners of private facilities and government officials involved with public facilities need to consider impacts of their facility on the city as a whole, not just the immediate location of their facility.

Considering mega-events, which often require newly constructed facilities, the extent in which they are used post-event is extremely important.\(^\text{16}\) A white elephant is “a possession that is useless or troublesome, especially one that is expensive to maintain or difficult to dispose of.”\(^\text{17}\)

Montréal Olympic Stadium is the most notable Canadian white elephant. It was built for the purpose of hosting the 1976 Olympic Games and the $1.5 billion debt was paid off in 2006. The stadium truly became a white elephant in 2004, when the only main leaseholder, the Montréal Expos, relocated to Washington.\(^\text{18}\) Hallmark sport events are most definitely a luxury and risks like Montréal Olympic Park are even greater when the economy supporting the facility is weak. The Nigerian government spent approximately
US $300 million on a 60,000-seater stadium and other venues for the 2003 All Africa Games, despite the countries shortages of fuel, frequent blackouts, poor roads and high crime rate.\textsuperscript{19} Once the event concluded, there was virtually no need for a stadium that large. In South Korea, only five out of the ten newly built stadia were used consistently after the 2002 World Cup. Throughout the tournament, the reported attendance figures averaged only 3,000 people, which was a small fraction of what each stadium could hold (40,000-60,000).\textsuperscript{20} In order for a mega-event to having a positive legacy, its infrastructure needs to be supported by the surrounding economy not just during the event. This support must also be in place long after its conclusion.\textsuperscript{21}

\textit{Tourism}

Although there is no universal definition of sport tourism, for the context of this study it will be “defined as sport-based travel away from the home environment for a limited time, where sport is characterised by unique rule sets, competition related to physical prowess and play.”\textsuperscript{22} The concept of tourism-carrying capacity takes into account the maximum number of tourists a city can accommodate, without impacting the natural environment or the quality of the tourist experience and is determined by the ability of the spatial scale of the location and its ability to absorb tourists.\textsuperscript{23} Most negative consequences associated with tourists traveling to urban areas to experience sport are immediate, but not long-term. Their motive for travel may be active sport tourism in the technologised sports landscape (stadiums, squash courts and swimming pools for example), participating in improvised settings (skateboarding), participating in the unmodified (surfing) and modified (fishing in waterways) settings on the urban fringe or event sport tourism.\textsuperscript{24} The most notable impacts are carbon emissions from traffic
congestion, soil compaction from spectators and excessive waste generation. However, once the sporting experience is over, the tourists disperse from the area and there is no further damage.\textsuperscript{25}

Most sport is experienced in urban areas, where tourists’ environmental impact are not as prominent in comparison to those seeking a sport experience where the naturalness of the region is the main motivation. The closer connection between tourists and the natural environment may lead to coral reef damage, soil erosion, landslides, avalanches, the disruption of wildlife behaviours, or the overuse of energy, and resources (depending on the characteristics of the location).\textsuperscript{26} These consequences emerge when sport tourism invades an area and transitions from a few locals to a mass participation phenomenon in such a short period of time.\textsuperscript{27} The damage can be permanent if the region does not respond well to change. Specifically, a drastic increase in the human population of the area for a short period of time for the purpose of sport. Alpine ecosystems are a perfect example of damage being magnified in delicate areas. Extreme climate and altitude lead to longer recovery and regeneration timeframes, which many times is not possible due to the extensive damage in the area.\textsuperscript{28} The environmental impact of sport tourism is localised, thus easily visible, however the foundation of tourism is based on travel, which has a more damaging impact on a global scale, especially if air travel is involved.\textsuperscript{29}

“Air travel contributes, by far, the largest proportion of the growth of greenhouse gas emissions in the transport sector.”\textsuperscript{30} As of 2007, Aviation accounted for 3.4 to 6.8% of all emissions of GHG.\textsuperscript{31} Tourism trips accounted for twenty percent of all air transportation in the European Union in 2007.\textsuperscript{32} Although that may seem like a small
share, considering a number of issues clarifies why air travel is of major importance. First, less than two percent of the global population uses air travel for international transport. Second, the tourism industry is continually growing and developing, while technological advancements in aviation are comparatively much slower. Finally, “emissions from air travel are particularly harmful because they are released in the upper troposphere and lower stratosphere, where they have a larger impact on cloudiness and ozone generation.” GHG emissions form air travel are up to 5.1 times more dangerous to the atmosphere when compared to surface bound traffic, when the same amount of fuel is burnt. In order to reduce the environmental impacts of sport tourism, sustainable methods need to be adopted at the local, regional and global levels.

Participants and Spectators

The relationship between sport participants and the environment is symbiotic; therefore participants impact the environment as much as the environment impacts the participants. Participants of sport events have an impact on the natural environment from the moment they purchase apparel, begin to use the facilities and equipment. While, the footprint of a recreational runner is insignificant, the growth in numbers of runners on the same path will eventually begin to erode the soil. As the runners begin to purchase footwear and clothing, most likely imported, their impact begins to grow on a global scale. This example can be applied to any participant in any sport; as the number of participants grow, so does the need for equipment, apparel and facilities, increasing the impact of the participants on the environment.

The environment can have a significant impact on the participants. Sports engaged in urban areas, exposing the participants to air, water and noise pollution, can
lead to respiratory illness, difficulty hearing and may cause severe physiological reactions.\textsuperscript{40} Carlisle and Sharp (2001), in their study “Excersice and Outdoor Ambient Air Pollution,” found that various breathing patterns of individuals, such as respiratory frequency and rate, were altered during excersie, increasing the effect of harmfuel air pollutants on their bodies. Of the six major air pollutants studied, ozone (O\textsubscript{3}) was found to be the most damaging to athletic performance, specifically on hot sunny days, when O\textsubscript{3} atmospheric concentration levels are at their peak.\textsuperscript{41} Unpredictable and extreme weather due to climate change may pose a threat to participation in sport. Specifically, changes in climate are more likely to be detrimental to winter sports because of the risk of receding mountain snow cover, preventing skiing or snowboarding in the affected area.\textsuperscript{42} Jon Moen and Peter Fredmen (2007) projected short and long term patterns of climate change in Sweden will lead to higher temperatures, more precipitation during winter and shorter snow covered periods; thus, leading to shorter and less reliable ski season lenghts.\textsuperscript{43}

As the scope of a sporting event may lead to it being labelled as a hallmark event, the number of athletes competing may reamin the same, but the number of spectators may drastically increase.\textsuperscript{44} Spectators typically commute to events by personal vehicle, consume food and drinks, use washrooms and generate waste.\textsuperscript{45} They contribute to air and noise pollution because the number of spectators at large sporting events are disproportional to the geographical boundaries of the event. Furthermore, in natural areas, spectators can severely erode soil due to compaction.\textsuperscript{46} In a case study of disc golf, published in 2011, Sylvia Trendafilova showed that high foot traffic associated with the sport lead to soil compaction, which was so damaging that a number of courses in California had been closed due to soil erosion.\textsuperscript{47}
The Nature of Sport

Technological advancements and the professionalization of sports have led to an increase in their adverse impacts on the environment. David Chernushenko, Anna van der Kamp and David Stubbs (2001) identified four prominent sports that have enhanced their regional environmental damage. Golf, swimming, soccer and football all originated as outdoor sports on natural terrain. However, due to the sportization of these and so many other sports, the natural landscapes previously used for sport have been manipulated through technological development in order to produce a certain desirable playing surface (for example the construction of stadiums and implementation of synthetic turf). Sportization refers to the regulation of sport, including judges, timekeepers and rules across the national and international levels to produce consistency.

The impact of golf courses on natural resources is quite significant. First, a number of courses are constructed on valuable, delicate land, which forever alters the natural landscape. Second, the ecosystem is affected, potentially resulting in a loss of biodiversity. This is especially true if there is an introduction of non-native species to disrupt the biodiversity of the area. Third, the amount of water and fuel consumed by a single golf course is astounding. The Worldwatch Institute estimated that golf courses consume 2.5 billion gallons of water daily worldwide. The game of golf is rapidly globalizing, especially in developing countries, where natural resources are much more scarce. The Republic of South Africa reported that it takes 1.4 to 3 million litres of water a day to keep courses green. Every South African household is entitled to 6,000 litres of water a month. This means that the water from a single golf course could supply at least 7,000 households. Furthermore, there is much less regulation of pesticides and
fertilizers in developing countries, putting the people and the natural environment at risk.\textsuperscript{55}

In order to provide consistency to national and international swimming events, indoor and outdoor facilities were constructed. Both types of facilities impact the environment differently, with some similarities. Outdoor facilities have been known to leak hazardous chemicals into drinking water supplies from rain run-off; while, indoor facilities require more natural and economic resources during the construction and operation phases.\textsuperscript{56} High water consumption costs are associated with both types of swimming pools. Finally, there are high-energy costs due to the heat regulation of both types of swimming facilities.\textsuperscript{57}

Recent technological advancements in football and soccer fields have rapidly increased the presence of synthetic turf fields throughout North America. This has left many experts in disagreement of whether natural grass or synthetic fields are more damaging to the environment.\textsuperscript{58} Natural grass fields consume high amounts of water, requiring up to 1.5 million gallons of water per acre annually.\textsuperscript{59} They also consume high amounts of fuel and require the use of pesticides in order to maintain usable conditions.\textsuperscript{60}

Synthetic turf fields are made up of “blended polyethylene-polypropylene material woven to simulate blades of grass.”\textsuperscript{61} There is also recycled rubber pellets from tires that give extra cushioning to the turf. The issue with these rubber pellets is that some experts suggest that they contain chemicals that are known or are suspected of causing health effects (polyaromatic hydrocarbons and volatile organic compounds). However many reports, like \textit{Artificial Turf Pitches: An Assessment of the Health Risks for Football Players}, concluded that the use of synthetic turf does not cause any elevated health risk,
even in vulnerable populations. One of the major drawbacks of synthetic turf fields, which is generally accepted, is that they can get much hotter than natural grass, up to 60°F. Public and private groups deciding on the choice between natural and synthetic fields should apply the precautionary principle and only choose the synthetic option once it has been proven to be environmentally sustainable.

**Sustainable Development**

In 1987 the World Commission on Environment and Development, commonly known as the Brundtland Commission, published the report *Our Common Future*. The commission was assembled for the general purpose of recommending environmental strategies that would allow for the long-term attainment of sustainable development in the year 2000 and beyond. The most significant and controversial contribution to come out of the report was the commission’s definition of sustainable development; “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” When considering “The Brundtland Commission’s brief definition of sustainable development...” Kates et al. (2005) noted that it “is surely the standard definition when judged by its widespread use and frequency of citation.”

Although the definition popularized the use of sustainable development, a number of researchers have criticized it mainly due to its vagueness. There are common themes among a number of researchers who question; what is to be sustained and developed, what is the temporal scale for sustainable development and since there are different intergenerational and intra-generational definitions of needs, what are the primary determinants? These unanswered issues have made it difficult to develop a definition of sustainable development that could be generally accepted. There are numerous efforts in
the literature to try and improve the definition of the term (See Appendix I for further attempts at defining sustainable development). Even though there are a plethora of definitions, there are three common underlying principles: quality of life is dependent upon the health and productivity of the natural environment; basic quality of life needs to be guaranteed for the world’s population; and future generations should have an equal opportunity to harness natural resources, when compared to the current generation.\(^{68}\)

However, the different conceptions of the significance of the term are usually determined by the philosophical and political views of those proposing the definition.\(^{69}\) Certainly confusion still remains concerning what sustainable development really is, but this constructive ambiguous definition may actually be advantageous because of its ability to allow the reader to openly interpret its meaning. Any attempt to precisely conceptualize the definition of sustainable development would naturally have to exclude current perceptions of the term due to the numerous meanings that already exist.\(^{70}\)

The lack of a clear and concise definition may be politically correct because it does not exclude any perceptions of the term; however this makes it challenging from a scientific perspective because there is no generally accepted method to measure sustainable development.\(^{71}\) Parris and Kates (2003) attempted to identify themes by analyzing and comparing 12 prominent and unique sustainability indicators in order to identify the similarities in the definition of sustainable development.\(^{72}\) They found that “normative judgments as to goals and targets reified in formal agreements, treaties, and declarations,” are precisely defining the term more so than “philosophical clarification.”\(^{73}\)
The Precautionary Principle

In order to achieve sustainable development, no matter the context, the precautionary principle is a concept that needs to be applied. The term gained worldwide recognition when it was referred to in Article 15 of the 1992 Rio Declaration on Environment and Development.\textsuperscript{74}

The precautionary principle is a translation of the German concept of \textit{Vorsorgeprinzip}, which proposes, “environmental protection policy should be preventative instead of reactive, employing avoidance and reduction of emissions technology at their source.”\textsuperscript{75}

Lakhan (2011) stated that the current most accepted definition of the term was put forward in January of 1998 by the Johnson Foundation, and is known as the Wingspread statement on the precautionary principle:

“when an activity raises threats of harm to the environment or human health, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically. In this context the proponent of an activity rather than the public should bear the burden of proof.”\textsuperscript{76}

Due to the concepts widespread use in several areas (food safety, health, sport management, resource management, etc.), four dimensions are recognized in order to allow the principle to be used in any practical context; “If there is (1) a threat, which is (2) uncertain, then (3) some kind of action (4) is mandatory.”\textsuperscript{77}

From a legal perspective, the precautionary principle is applied through a moratorium, which is a temporary prohibition of an activity.\textsuperscript{78} Numerous moratorium bills have been put forth in a number of states in the United States attempting to ban the installation of synthetic turf fields.\textsuperscript{79} In May of 2008, California Senate passed a bill that required the “California Office of Environmental Health Hazard Assessment, in
conjunction with the Department of Public Health and California Integrated Waste Management Board, to conduct a study investigating the health and environmental impacts of natural versus synthetic turf fields.\textsuperscript{80} The Senate realized that the synthetic fields were being rapidly installed across the state and there was some evidence suggesting the potential health risks associated with the fields; therefore the potential risks needed to be clearly understood before the installation of fields could continue. Once the study concluded, a report was prepared and reviewed by the Attorney General who decided the future of synthetic turf fields in California.\textsuperscript{81}

**Sustainable Sport Event Management**

Sport event organizers have become increasingly internally and externally motivated to implement sustainability strategies into sport events. The main external pressures are “by the local community, by regulatory authorities, by national and international environmental groups and media, and, more recently, by sponsors who wish to be associated with positive rather than negative stories.”\textsuperscript{82} The internal motivation is chiefly due to the potential financial benefits which sustainable events can yield; increased sponsorship revenue due to appeal, capital and operating cost savings and cost savings from reduced risk.\textsuperscript{83} In the late 1980s and early 1990s, the organizers of the Winterlude triathlon held in Ottawa, Ontario implemented plans that not only were environmentally efficient, but also had positive financial implications and reduced risk for participants. Some of these initiatives included:

- Strategic mapping of courses to avoid delicate areas;
- Prohibiting smoking at the start and finish lines;
- Purchasing local products in bulk to minimize transportation and use less packaging;
- Banning the idling of vehicles;
- Producing the exact number of t-shirts for runners to avoid a
surplus.\textsuperscript{84}

The concepts of sustainable development and the precautionary principle were discussed earlier to help guide sport managers in adopting an environmental management system for sport events.\textsuperscript{85} An environmental management system provides a foundation for environmental practices to be implemented for an event. Some sustainable practices may include: pollution control, setting environmental objectives and targets, educating employees and making data publicly available.\textsuperscript{86} In sport management literature, the notion of sport managers implementing sustainable practices into their organizations is known as the TBL.\textsuperscript{87}

“The triple bottom line is the concurrent understanding of how to create, implement, and manage social, environmental, and economic policies.”\textsuperscript{88}

Created in 1994 by John Elkington, the TBL was designed for organizations to be responsible to their stakeholders, not just shareholders; it requires them to address anyone who may be affected by the actions of the organization.\textsuperscript{89} The social policies are concerned with the people of an organization or event, as well as the community as a whole and address issues such as: discrimination; cooperation; and community involvement.\textsuperscript{90} The environmental policies help quantify the natural capital of the planet, giving meaning to environmental practices rather than just being out of good will. The most efficient way to address environmental policies is to take a ‘cradle to grave’ approach.\textsuperscript{91} This strategy helps sport event organizers address issues from consumption of renewable and nonrenewable energy sources during the construction phase to proper waste disposal and recycling once the event has concluded. The final and most controversial bottom line is that of economic policies, which involve financial decisions that may include green issues and operational costs, as well as a number of other issues.
The third bottom line, economic policies, has received criticism from environmentalists due to its focus on monetary pursuits. Also, many organizations are reluctant to report organizational information to the public that was previously private, especially data concerning financial decisions or outcomes.\(^92\)

A private organization’s ability to undertake voluntary activities with the intention of operating in an economic social and environmentally sustainable manner is known as corporate social responsibility (CSR).\(^93\) Once a commitment is made to pursuing CSR, the organization can begin to develop a vision and mission for the whole organization and develop an action plan for an environmental management system. Before beginning the endeavor to try and develop a comprehensive environmental management system, it is important to note that every sporting event is unique in “size, type, geography and demographic profile of participants and spectators.”\(^94\) Therefore, the time and resource commitment involved in creating a sustainable sporting event is completely dependent on these factors. With that being said, the one common feature any bidding or organizing committee should craft is a vision and mission statement. A clear vision and mission statement allows the top-level management to establish their environmental goals clearly for all involved with the organization.\(^95\) This allows the employees and volunteers to understand what the organization is trying to achieve from an environmental standpoint.

The next step is to develop an action plan; small events or organizations that have not previously considered environmental management should develop a basic action plan that focus on core goals.\(^96\) Developing a comprehensive action plan may be too ambitious and potentially have negative implications by deterring the organization from adopting these strategies for future events.\(^97\) A comprehensive action plan is more suited for
medium-to-large sized sport events because the organizations responsible for staging these types of events will likely have more resources available and the environmental impact of larger events are more likely to be greater compared to small-scale events, on an individual basis. A comprehensive action plan may include characteristics such as: accommodations for participants and spectators; facility construction; and an extensive transportation design. The general goals of a comprehensive action plan are to:

- Define sustainability policies, goals and objectives;
- Implement an environmental management system;
- Train and educate staff and volunteers;
- Involve suppliers, donors and sponsors in the “sustainable event” initiative.

Once the action plan is developed to fit the environmental needs of the event, it is important to not lose track of these goals through audits during and after the event until the established goals are accomplished.

**Sustainability Indicators in Sport Events**

Naturally, the ambiguity of the definition of sustainable development has led to no generally accepted method to measure the sustainability of sport events or organizations. Therefore, no quantifiable factor determining what constitutes a sustainable sport event has been identified. Currently, there are a plethora of methods that can be adapted to measure the sustainability of sport events and the choice depends on what is being measured and what the manager hopes to accomplish with the results. A sufficient indicator should not only consider environmental issues, but also take into account economic and social concerns. Jasch (2000) stated that the purposes of indicators are to provide:

- A comparison of environmental performance over time;
- Highlight optimization potentials;
• Derivation and pursuit of environmental target;
• Identification of market chances and cost reduction potentials;
• Evaluation of environmental performance between firms (benchmarking);
• Communicational tool for environmental reports;
• Feedback instrument for information and motivation of the workforce.¹⁰²

Environmental auditing is a common method used by sport organizations to determine the environmental impacts of existing operational practices by systematically analyzing all aspects of an organization.¹⁰³ The most common standardized system is the International Organization for Standardization (ISO).¹⁰⁴ ISO 14000 provides practical tools for organizations to help control their environmental impact by improving their environmental performance. One of the key aspects of the ISO 14000 standards is the LCA.¹⁰⁵ The LCA method is used to quantify the environmental impacts of a product or service using a ‘cradle to grave’ approach (all stages of the product or service’s life cycle).¹⁰⁶ Dolf (2011) attempted to measure the LCA of a University of British Columbia men’s basketball game that took place on 12 February 2011, at the UBC War Memorial Gym. The study focused on climate change resulting from the game, thereby attempting to quantify the CO₂ emissions, among other data. Five tonnes of CO₂ emissions were estimated to have resulted from the event.¹⁰⁷ Although this type of analysis is extremely detailed, the main consequence with the LCA tool is that it is focused on the direct environmental effects of an event and as a result the indirect effects are usually not captured.¹⁰⁸

The Ecological Footprint

Developed in the early 1990s by Wackernagel and Rees, the EF analysis is an accounting tool that compares the resource consumption and waste generated by the human population in a geographical boundary with that area’s capacity to support those
activities. The EF analysis builds upon the concept of carrying capacity, which was used by biologists to determine the maximum number of species an area could support without deterring that area from supporting the same species in the future; the maximum number of cows that could graze on a farmer’s pasture or the number of fish that could flourish in a pond, for example. The issue with applying the concept of carrying capacity to humans is the fact that importing resources and technology have given people the ability to increase their carrying capacity. Rather than using maximum population, the carrying capacity is determined by the area’s maximum load, which takes into account the population’s per capita consumption. The EF looks at sustainable development from a different perspective; rather than attempt to quantify how many people can the Earth support, the EF is designed to calculate how much land is needed to support human activities. In order to calculate the EF in any circumstance, the Earth’s ability to produce natural resources, absorb waste and provide land for humanity to construct cities must also be quantified; this is known as biocapacity. “Biocapacity acts as an ecological benchmark against which the EF can be compared.” The common unit in which Biocapacity and EF can be associated is the global hectare (gha), where one gha “…represents a biologically productive hectare with world average productivity.”

This biologically productive land and water is categorized into five types: cropland; grazing land; fishing ground; forestland; and built-up land. Cropland is the most bioproducive of the land use types and “consists of the area required to grow all crop products, including livestock feeds, fish meals, oil crops and rubber.” Grazing land is comprised of the area to support livestock, but is much less productive than cropland. The fishing ground land type is based on calculating “the annual primary
production required to sustain a harvested aquatic species.”\textsuperscript{116} The forestland is measured based on the annual harvest of timber and fuel wood to supply forest products. Finally, the built-up land is based on land covered by human infrastructure, including: housing, industrial structures, and transportation for example.\textsuperscript{117} In order to convert these land use types into global hectares an equivalence factor needs to be applied because the different land use types are not equal in productivity. Thus, land types that are more productive than the average productivity of all biologically productive land and water have an equivalence factor greater than one. For example, an average hectare of cropland is multiplied by its equivalence factor of 2.51 to convert it to gha.\textsuperscript{118}

Another consideration that needs to be made is the fact that there is a difference in the productivity of different land use types between nations each year. For example, German cropland in 2008 was 2.21 more productive than the average world cropland. Therefore, one hectare of cropland in Germany equated too 5.6 gha once both the equivalence and yield factors were accounted for (2.22 x 2.51 = 5.6 gha).\textsuperscript{119}

According to the WWF (2012), the global EF in 2008 was 18.2 billion gha, which equates to approximately 2.7 gha per person annually. The Earth’s total biocapacity was estimated at 12.0 billion gha, or 1.8 gha per person annually, known as the fair Earth share value.\textsuperscript{120} Thus, the 2008 global average of 2.7 gha/person lead to a 50% deficit when compared to the fair Earth share, which is known as an ecological overshoot; renewable resources being used faster than they can regenerate. It would take the Earth 1.5 years to restore the resources used and recycle the CO\textsubscript{2} emissions generated in 2008 (see Appendix II for breakdown of components). Eventually, if a population uses more biocapacity than can be supplied and regenerated in a year, the biocapacity deficit will
deplete resources. The two driving forces that have led to this increase in biocapacity deficit are population growth and greater consumption rates of goods and services. The first reduces the amount of biocapacity available to every individual, while the latter increases people’s footprint.

Although the 2008 average individual’s EF was 2.7 gha, there is a massive disproportion in the share of humanity’s EF on a national scale; 10.7 gha/capita (United Arab Emirates) to 0.4 gha/capita (Timor-Leste) (see Appendix III for map of nation’s EF). If all of humanity lived like an average person from the United Arab Emirates, it would take just under six Earths to regenerate humanity’s annual demand on the planet. Thus, the country of origin plays a major role in determining an individual’s EF. Some other factors in determining an individual’s EF include; the quantity of goods and services they consume, the resources used to provide the goods and services and the waste generated from them. Conversely, just like the EF of nation’s are different, so is their total biocapacity; therefore, it is unjust to rely solely on a nation’s EF. For example, Canada (7.0 gha/cap) and the United States (8.0 ha/cap) have similar EFs; however, Canada has an ecological surplus of 7.9 gha/cap, while the United States has an ecological deficit of 4.1 gha/cap. Therefore, using the fair Earth share (1.8 gha/cap) as the determining factor of a nation’s sustainability, neither Canada nor the United States is sustainable. But, Canada is considered as an ecological creditor, while the United States is labeled as a global ecological debtor. In order for countries that are considered ecological debtors, like the United States, to live at their current standard, they must rely on the resources of other countries, likely ecological creditors, to meet their needs by importing their resources.
Benefits of the Ecological Footprint

There are a number of sustainable development topics that the EF highlights, which makes it an attractive indicator for environmental economists. One of the major reasons that researchers use the EF is because of its focus on consumption, as opposed to a number of other indicators (LCA or environmental impact analysis), which consider the production side of the economy. The EF is able to underline a number of issues with consumption; the squandering of limited resources (safe drinking water and non-renewable energy sources) and identifying which consumption patterns can be labeled as sustainable. Another major advantage is the clear-cut message that is exemplified through aggregation. Although, highly controversial, many environmental economists believe that there is a need for aggregated indicators that can provide a rough overview of sustainability at any level. The results are easy to understand, can calculate global, national, regional, local, individual and organizational EFs and can allow for comparisons (ie. between nations). This makes the EF a powerful tool in communicating sustainability to the public. Another unique aspect of the EF is that it identifies that the preservation of renewable resources is key for achieving sustainable development. Renewable resources can be depleted if misused and the consequences are difficult to predict. Finally, the EF highlights the severely unequal distribution of environmental resources when comparing countries. Even more alarming, is the fact that a number of countries that have a per capita EF average lower than 1.8 gha actually have the biocapacity to meet the fair Earth share.

When analyzing both the benefits and limitations of the EF two conclusions can be made; the EF is a tool that provides a unique static perspective on sustainable
development and that the EF is not intended to be advertised as a elaborate indicator that can identify all of the issues with sustainable development. These points are highlighted by Chambers et al. (2000) who state;

“Using such a crude simplification of nature is also a strategic feature of the model. It makes it appeal more to those reluctant to accept the ideas of ecological constraints while still getting support from other sectors of society with opposing world views… By keeping it static rather than dynamic and by making it underestimate the true ecological impact of humanity, we trust that the ecological footprint will avoid falling into some of its more speculative family members.”

Limitations of the Ecological Footprint

Although the EF provides a unique tool to measure sustainability, like most indicators, there are several limitations. First, there is no commonly accepted method to calculate the EF; which has led to drastic differences in results of studies measuring the same EF. For example, the range in the estimated EF of New Zealand was between 3.49 gha/cap and 9.6 gha/cap. The reasons for this disparity were due to “the assumptions made concerning biological productivity, the use of equivalence factors, and the calculation of energy land.” The accuracy of any given EF calculation is dependent on maximizing the quality of data in order to minimize the assumptions that need to be made.

Second, the EF receives criticism for using land as the numéraire since it is not the only scarce resource on Earth. The EF is categorized as an aggregated indicator, thus translating different pressures into quantities of land. Thus, the EF cannot capture every element of sustainable development, like intergenerational equality or technological change. Furthermore, a topic of serious discussion is the aggregation of CO₂ emissions into gha. Many criticize this because a number of subjective presumptions
must be made, such as; “for sustainable development no increase of greenhouse gas concentrations can be allowed.” Another critical issue concerning the CO₂ emissions is that the EF only takes into consideration the energy related CO₂ emissions, completely disregarding the environmental consequences of other greenhouse gases (methane, nitrous oxide, ozone, chlorofluorohydrocarbons, and water vapor).

Third, there are a few issues concerning spatial and temporal scales. The selection of spatial boundaries an EF can analyze can be calculated at the global, national, regional, local and even organizational scales. Although there are disagreements as to whether political or cultural should be included, one generally accepted critique is that the EF only takes into account global impacts and fails to recognize specific regional impacts. The issue with the temporal scale is that the EF only “provides a ‘snapshot’ of a population’s environmental requirements using current technology under prevailing management practices and social values.” This means that the EF can only report what it calculates and cannot predict future ecological consequences. Finally, maybe the most critical issue, the EF was intended to affect policy change by evaluating potential strategies in order to prevent ecological overshoot. However, a number of researchers agree with the opinion of Moffatt (2000) who states “it offers no policy suggestions apart from either including more land, reducing population, or reducing consumption per head.”

**Applying the Ecological Footprint to Sport Events**

Although the EF was originally designed to measure national EFs, this method can be applied to measure small-scale sporting events for researchers who want to measure events and can potentially provide major benefits to those who plan and
organize sport events.\textsuperscript{139} Collins and Flynn (2008) applied the EF concept to measure visitor consumptions at the 2004 United Kingdom’s Football Association Cup Final (FA Cup Final). The match was held at Millennium Stadium in Cardiff, Wales and attracted a crowd of 73,057 supporters.\textsuperscript{140} A previous study by Collins et al. (2005) showed that tourists had a much higher EF than Cardiff residents, 8.67 gha/tourist compared to 5.59 gha/cap.\textsuperscript{141}

One of the main motivating factors for using this method was that the application of the EF would provide detailed information on visitor consumption patterns at a major sporting event and relate them to a global impact.\textsuperscript{142} Another benefit from the study was that it would provide relevant information to policymakers concerning the environmental impact of different visitor activities (ie. waste generation and energy use). Thus, providing justification for the improvement of public transportation methods in the city. Finally, the EF was used as an awareness-raising tool, providing simplified and relevant information to the public concerning how their environmental impact can have consequences at the global level.\textsuperscript{143}

The total EF of the event was calculated to be 3083 gha/day (0.0422 gha/spectator). However, the average visitor EF at home was 266 gha/day (0.0052 gha/spectator). Thus, the actual EF due to the event was 2,706 gha/day (0.0371 gha/spectator).\textsuperscript{144} The most alarming footprint was the transportation, which accounted for 1,670 gha (0.0229 gha/cap) of the total EF. Car travel was the most popular method of travel accounting for 47\% of all transportation and equated to approximately 43,000,000 passenger kilometers. The second largest EF was food and drink, which accounted for 1,410 gha (0.0194 gha/spectator). Most of the food and drink footprint was attributed to
alcoholic drinks (502 gha) and meat products (654 gha). The FA Cup Final study follows the trend of a number of other studies in the sense that the researchers analyzed the environmental impacts of major sport events in large cities. However, there is little research on the EF of small-scale sport events in smaller to medium sized communities. This raises the questions as to whether or not smaller to medium sized cities are capable of sustainably hosting small-scale events?

**Type of Sport Event**

Gratton, Dodson and Shibli (2000) created a typology classifying different types of major sport events from the context of UK sports. Type A refers to major international spectator events that are irregular, one-off and generate significant economic activity and media interest (ie. Olympics and Football World Cup). Type B events include major spectator events, which generate significant economic activity and national media interest and occur on an annually (ie. FA Cup Final, Wimbledon). Type C encompasses irregular, one-off, major international competitor and spectator events that generate limited economic activity (ie. World Badminton Championships and European Junior Boxing Championships). Type D events are major competitor events that occur annually and generate limited economic activity (ie. National Championships in minor collegiate sports). In 2006, Robert Wilson proposed a Type E event be included that recognized small-scale sport events. A Type E event is characterized as a minor spectator or competitor event that generates little economic activity in comparison to major events, draws little national media interest and occurs annually. It is important to note that the term ‘major’ does not refer to the size of the event, but rather signifies the importance of the sporting events outcome.
When considering the characteristics of the 2013 ICG, the event identifies most with the Type C event recognized by Gratton et al. Type C events are one-off events that have to be planned and managed from ‘scratch’ and pose potential problems for the region hosting the event. The true costs of staging Type C events are usually greater or equivalent to the economic benefits of the event. Also, it is very difficult to predict the level of spectator interest for this type of event.\textsuperscript{152} The 2013 ICG displayed many of the characteristics that describe a Type C event. The organizing committee of the 2013 ICG spent several years in preparation for the event. Although it was reported that the event had a great economic benefit for the region, this claim has been highly scrutinized by the public.\textsuperscript{153} Finally, the 2013 ICG is classified as a Type C event because it is considered as a one-off event for Windsor-Essex. Although the ICG is held annually, it was an irregular event for the region.

\textbf{History of the International Children’s Games}

Envisioned by physical education teacher Professor Metod Klemenc, the first ICG took place in Celje, Slovenia in 1968 and was a sporting event that attracted young male and female children between the ages of 12 and 15. Klemenc foresaw the need to create an international event that would allow children of different cultures to better understand each other, thus promoting worldwide peace thru sport.\textsuperscript{154} Since this vision, the ICG have “attracted over 35, 200 participants representing 332 cities from 74 countries over 4 continents and is now believed to be the largest gathering of young people taking part in sport in the world.”\textsuperscript{155} The current headquarters of the ICG is located in Lausanne, Switzerland.

The ICG may be carried out either as a winter or summer event. The participants
must be between the ages of 12 and 15. The sporting events are chosen by the host cities, as long as they meet the requirement listed by the ICG. The overall goal of the ICG is to “enable, develop and advance the meeting, understating and friendship of students from different countries, and to advance the Olympic idea.”

The Assessment of the Environmental Performance of the ICG

Mallen et al., (2010) conducted a study assessing the Environmental Performance (EP) of the 42nd ICG hosted in San Francisco, California in 2008. The EP assessment was conducted using the Sport Event Environmental Performance Model (SE-EPM), a modified version of the more recognized Environmental Performance Model created by Xie and Hayase in 2007. The SE-EPM consisted of a number of structured questions in a survey format made up of five components: organizational system; stakeholders; environmental operational countermeasures; environmental tracking; and input/output indicators. A total of 15 participants who were labeled as upper and middle management members of the 2008 ICG host committee completed the SE-EPM survey.

The results of the study indicated a weak EP, even though there was a serious effort to implement ES within the event. There were a number of reasons for this conclusion, the most prominent being the fact that the 2008 ICG Committee was the first, in the 40-year history of the event, to formulate and implement ES practices. This led to a lack of structure in the 2008 ICG host organization’s ability to propose environmental initiatives. The second key finding was that the occurrence of a weak EP was due to the high volume work in a relatively short amount of time. The participants reported that due to the high volume of work required to prepare and stage the event, environmental initiatives became less of a priority. This, coupled with the fact most of the host
committee were volunteers meant, “accountability for the execution of various ES strategies was weak.” Third, a number of participants noted that the environmental initiative was present; however lack of funding eliminated the possibility of fulfilling a number of environmental initiatives. This case study concluded that “in order to overcome these barriers, it is recommended sport event hosts establish ES-based values early in the event preparation stage and embed these values throughout the organization on an ongoing basis.”

Summary of Literature Review

The environmental impact of staging sport events on a host city has become an increasingly relevant subject of concern amongst researchers and the general public. There has been much discussion over the need to incorporate ES practices into a sport event management context. Although literature regarding ES in sport management has increased, the primary focus has been on mega sporting events. The purpose of this study is to quantitatively explore the environmental impact, if any, of a small-scale sporting event on a medium sized city. The researcher implements the EF methodology on the 2013 ICG in order to assess the environmental impact of the event. The EF concept is an area-based sustainability indicator that measures the resource consumption and waste generated by the human population within a geographical boundary. In the context of this study, it measures the amount of resources used and waste generated that was required to stage the 2013 ICG. This study hopes to provide a foundation for other researchers interested in assessing the environmental impact of sport events, specifically those looking at small-scale sport events.
Endnotes


4 Ibid.

5 Hinch and Higham, “*Sport Tourism Development,*” 127.


9 Marco Frey, Fabio Iraldo and Michela Melis, “The Impact of Wide-Scale Sport Events on Local Development: an Assessment of the XXth Torino Olympics through the Sustainability Report” (working paper, IEFE, 2008), 4-5, http://www.iefe.unibocconi.it/wps/wcm/connect/502bc0004cadad79213fe0f7bdc7be0/WP_IEFE_10_2008.pdf?MOD=AJPERES&useDefaultText=0&useDefaultDesc=0

10 Schmidt, “Putting the Earth in Play,” A287.

11 Hinch and Higham, “*Sport Tourism Development,*” 123-128.

12 Chernushenko, van der Kamp and Stubbs, “*Sustainable Sport Management,*” 6.

13 Ibid., 7.

14 Ibid.


Barclay, “Predicting the Costs and Benefits,” 64-65.

Ibid., 65.

Ibid.


Hinch and Higham, “Sport Tourism Development,” 126-127. Active sport tourism refers to individuals who travel to a location to participate in sport.

Ibid., 126.


Ibid.
31 Ibid.

32 Ibid.

33 Ibid., 225.

34 Ibid.


37 There are a wide range of sustainable methods that can be adopted in the sport tourism industry. Implementing a sustainable management system, such as the ISO20121 would take a major commitment from event organizers, but would establish environmental sustainability as a main vision for the event organizers. A simpler method may be using technological advancements that are more sustainable, such as using water stations at events instead of bottled water.

38 Chernushenko, van der Kamp and Stubbs, *Sustainable Sport Management,* 5.

39 Ibid.


42 United Nations Environment Programme, “Impact of the Environment on Sport.”


46 Ibid.

47 Sylvia Trendafilova, “Sport Subcultures and Their Potential for Addressing Environmental Problems: The Illustrative Case of Disc Golf,” *The Cyber Journal of*
Hinch and Higham, “Sport Tourism Development,” 130.


Chernushenko, van der Kamp and Stubbs, “Sustainable Sport Management,” 7. In order to produce a golf course, many trees need to be cut down (in certain areas) and chemicals need to be used to maintain the course. This can affect the ecosystem in many ways, through increased temperatures in the summer due to lack of tree cover and the chemical use may be poisonous to some fauna and flora in the area.


Ibid.

Ibid.

Ibid.

Ibid.


Claudio, “Synthetic Turf,” 118.


71 Ibid.


73 Ibid., 581.


Ibid.


Ibid.

Ibid., 212.

Chernushenko, van der Kamp and Stubbs, “Sustainable Sport Management,” 54.

Ibid.


The social policies are designed and enforced by the organization that creates them. They are unique and reflect the mission, values and principles of the organization., Pfhal, “Sport and the Natural Environment,” 52.

The term “cradle to grave” refers to a product or service’s lifecycle, beginning with the raw material extraction to create it and ending with the disposal or recycling of that
product or service. “Natural Capital” is a term that reflects the Earth’s stock of natural assets like soil, air, water and living things.

92 Ibid.


95 Pfhal, “Sport and the Natural Environment,” 53.


97 If an action plan sets unrealistic goals, it may require the organization to dedicate financial and human resources that are not sustainable due to issues like funding and time requirements. This may cause the organization to not achieve the goals set out and may deter from future efforts.


99 Ibid.


103 Pfhal, “Sport and the Natural Environment,” 123.


107 Ibid., 4-14.


Wackernagel, Our Ecological Footprint,” 50.


Ibid.

Ibid.

Ibid.


Ibid.

Ibid., 15-16.


Ibid.


Ibid., 38-42.


Global Footprint Network, “National Ecological Footprint and Biocapacity.”

Ibid.


129 Ibid.


131 Garry McDonald and Murray Patterson, “Ecological Footprints and Interdependencies of New Zealand Regions,” *Ecological Economics* 50, no.1 (2004), 52.

132 Ibid.

133 Ibid., 52-53.


135 McDonald, “Ecological Footprints and Interdependencies,” 53.


137 McDonald, “Ecological Footprints and Interdependencies,” 54.


140 Ibid., 751-760.


143 Ibid., 755-756.


The 48th ICG will be hosted in Lake Macquarie, Australia. A list of the 47 previous host cities can be found at http://international-childrens-games.org/net/index.php/history/the-games


158 Ibid., 114-117.

159 Ibid., 117-118.
Chapter 3

Methodology

The EF has been suggested by Collin et al. (2008) as a useful approach to understand the environmental impact of sport events because the tool provides valuable insights into natural resource usage and the required land area to support the resource consumption of a sporting event.\textsuperscript{1} Since the EF is categorized as an aggregated indicator of sustainability, it presents sport event organizers, facility managers and policymakers the ability to understand and compare the “environmental impacts of different visitor activities such as transport, waste and energy use.”\textsuperscript{2} Thus, providing decision makers with valuable information, which they can interpret, and allowing them to make decisions that will assist them in planning and managing sport events with smaller environmental impacts resulting in events that can be characterized as environmentally sustainable.

This study created and implemented an EF analysis tool specifically designed for calculating the EF of the 2013 ICG, which was successfully achieved. The results of the footprint analysis were then used to analyze what components of the event had the greatest environmental impact and discuss how to adopt sustainable practices in organizing events of this magnitude. This chapter provides details concerning how the EF calculator was used for the study, the methods to acquire data and how the data was utilized to estimate the EF of the 2013 ICG. Further, it identifies the limitations and delimitations of the study.

Measuring the Ecological Footprint of the 2013 ICG

The event the researcher proposed to analyze was the 47\textsuperscript{th} ICG, hosted in Windsor, Ontario, Canada. The 2013 ICG was chosen for the study based on its potential
to produce a greater EF in comparison to other sporting events held in the city of Windsor and the researcher’s ability to access the necessary data required for the EF calculator. This international multi-sport event for male and female athletes between the ages of 12 to 15, was held from 14 to 19 August 2013. The 2013 ICG hosted 1,460 athletes and team officials from 84 cities, spanning across 32 countries and five continents and was viewed by 3,455 out of town spectators (see Appendix IV for participating cities map and sporting events). In order to measure the EF of the 2013 ICG, the researcher calculated and added the footprints of each individual component.

For the case of the 2013 ICG, the geographical boundary was the host city of Windsor. The study population was the athletes, team officials and spectators of the event. The period for which the population’s footprint was calculated was five days, from 14 to 18 of August 2013. August 14th marked the arrival of the athletes and the event concluded on August 19th, once the closing ceremonies were completed. Primary data that was anticipated to have the greatest environmental impacts on the Windsor-Essex region are categorized as:

- Travel;
- Food and drink consumption;
- Infrastructure of the event venues;
- Accommodation;
- Print and promotional items;
- Waste and recycling.

The primary data categories chosen were based on Collins and Flynn (2008) FA Final Cup study and the Environmental Protection Authority (EPA) Victoria Event EF Calculator. The FA Final Cup study calculated the EF of the visitor consumptions at the FA Cup Final using transportation, food and drink consumption, infrastructure of the event venues, and waste as the major categories. The main difference between the FA
Cup Final and the 2013 ICG is that the latter was an international event being hosted over several days, thus requiring accommodation as a main component. Furthermore, this study analyzes the EF of the event itself and not just the visitor’s EF, as in the Collins and Flynn (2008) study; therefore print and promotional items was another category that the researcher had to take into consideration. The print and promotional category most likely would not of had a great impact on the total EF of the event. The EPA Victoria Event EF Calculator was designed in 2007 to help organizers plan events, including sporting events, which would lower their EFs by identifying the main environmental impacts of an event. Although the calculator created for this study has the same general components as the EPA Calculator, the latter is based on data provided by the Australian Bureau of Statistics, and is therefore inappropriate for processing information based on an event hosted in Canada.\(^5\)

In order to capture the most accurate representation of the EF of the 2013 ICG, the researcher hired Hunter and Chance Consultant, a progressive and strategic company dedicated to guiding clients to achieve the highest level of ES, to construct an EF calculator specifically designed for the event. The end result is a hybrid EF calculator that has the similar primary categories as the EPA Calculator; however the data it generates is comparable to the FA Final Cup study in the sense that it calculates a gha and emissions footprint for the event as a whole, per participant, and for each category type (travel, infrastructure, etc.). This particular calculator also estimates the amount of CO\(_2\) emissions an event has produced, thus providing a more detailed result of the environmental impact of the event.
The essential data used to measure the EF of the 2013 ICG was gathered from the EcoInvent emissions database, a comprehensive Life Cycle Inventory (LCI) database. This world leading database contains international industrial life cycle inventory data on energy supply, resource extraction, material supply, chemicals, metals, agriculture, waste management services and transport services. The database makes use of extensive data sets largely from national and international statistical bodies, such as United Nations (UN) agencies or countries annual statistics in areas including agriculture, forest and energy. The information gathered for the 2013 ICG EF calculator reflects the unique energy, transportation and land use attributes of events conducted in Canada. For instance, a hypothetical water bottle is comprised of 20g Polyethylene Terephthalate and 2g of High Density Polyethylene. This 22g of plastic requires 40ml of crude oil input. EcoInvent breaks down the process into:

- Total Water Used: 10 Litres (required for crude oil)
- Total Fuel: 4 Litres of gasoline (required for transportation)
- Total Transport Distance: 100 km
- Transport Type: Truck
- Total Energy Used: 6000 Joules
- Total Carbon Emissions Conversion Factor: 90g CO$_2$/ water bottle
- Total Global Hectares Conversion Factor: 0.00013 gha/ water bottle.

Therefore, the total number of water bottles sold at the event multiplied by the carbon emissions and gha conversion factors expressed above, would calculate the environmental impact of water bottles being sold at the 2013 ICG. Given that the researcher did not have a license to use the EcoInvent database, the conversion factors provided by Hunter and Chance Consulting were the only accessible data points from the database; thus, minimizing transparency for accuracy of the EF results.
As the EF tool is a relatively new concept that has yet to reach its full potential, there are several fundamental assumptions that are required for the EF calculator to be implemented. These are identified by Wackernagel et al. (2002):

- The majority of the resources people consume and the wastes they generate can be tracked;
- Most of these resource and waste flows can be measured in terms of the biologically productive area necessary to maintain flows; Resource and waste flows that cannot be measured are excluded from the assessment, leading to a systematic underestimate of humanity’s true Ecological Footprint;
- By weighting each area in proportion to its bioproductivity, different types of areas can be converted into the common unit of global hectares, hectares with world average bioproductivity;
- Because a single global hectare represents a single use, and all global hectares in any single year represent the same amount of bioproductivity, they can be added up to obtain an aggregate indicator of Ecological Footprint or biocapacity;
- Human demand, expressed as the Ecological Footprint, can be directly compared to nature’s supply, biocapacity, when both are expressed in global hectares;
- Area demanded can exceed area supplied if demand on an ecosystem exceeds that ecosystems regenerative capacity (e.g., humans can temporarily demand more biocapacity from forests, or fisheries, than those ecosystems have available). This situation, where Ecological Footprint exceeds available biocapacity, is known as overshoot.  

Although the above noted assumptions prove to be a limitation of the tool, there are many benefits that show why the tool can be used as an effective method for measuring the environmental impact of sporting events. One of the main advantages of using the EF analysis is that comparisons can be drawn between events to determine why and how one sport event may be more sustainable than another. As presented in the research problem, there are very few studies that have used the EF tool in a sport context. Therefore, the researcher used the 2010 Ontario residents EF as a benchmark for comparison, which was 7.59 gha/cap. Like the EF calculator used for this study, the 2010 Ontario resident EF calculator aggregated the total resident footprint based on the
results from numerous individual consumption categories. The individual consumption categories that were similar between the two studies were then compared and analyzed.

**Data Acquisition**

The data acquisition period began on 14 August 2013, the practice day for athletes and the day of the opening ceremonies, which took place at the Windsor Family Credit Union (WFCU) Centre. Some of the information was collected through quantitative surveys of spectators attending the event. Facility managers at the venues hosting the events also completed surveys, which will be described later in this section. The Operation Committee Chair of the 2013 ICG provided data that cannot be acquired through surveying the spectators and facility managers. The remaining sections in this chapter will provide further information on both the data collected and the research process.

**Location of Data Acquisition**

The facility manager’s survey was collected through E-mail, with contact information provided by the Operations Chair. The description of the survey will be discussed later in the chapter. The spectator survey was conducted outside of the ICG venues, located throughout the city of Windsor, when events were taking place (Table 3.1). The researcher had a team of five assistants to help handout cards with the on-line survey (via FluidSurveys) information to spectators due to the overlapping time schedules of the events and the widespread locations of the venues throughout the city of Windsor. The researcher and the five assistants collected data at all of the venues included in the study by travelling in groups of two and targeting the facilities based on their scheduled competition times. The assistants were given an explanation of the study
by the researcher in order to answer questions from participants of the study. Their duties and the spectator survey will be discussed in the next section.

<table>
<thead>
<tr>
<th>Event</th>
<th>Location</th>
<th>Time and Date (August, 2013)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening Ceremonies</td>
<td>WFCU Centre</td>
<td>15th - 6:00 p.m. to 9:00 p.m.</td>
</tr>
<tr>
<td>&quot;Passport to the World&quot;</td>
<td>Riverfront Festival Plaza</td>
<td>16th - 6:00 p.m. to 11:00 p.m.</td>
</tr>
<tr>
<td>Closing Ceremonies</td>
<td>Riverfront Festival Plaza</td>
<td>18th - 7:00 p.m. (start)</td>
</tr>
<tr>
<td>Athletics - Track and Field</td>
<td>University of Windsor - Alumni Stadium</td>
<td>16th - 9:30 a.m. to 2:00 p.m.</td>
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<tr>
<td></td>
<td></td>
<td>17th - 9:30 a.m. to 3:45 p.m.</td>
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<tr>
<td></td>
<td></td>
<td>18th - 10:15 a.m. to 3:00 p.m.</td>
</tr>
<tr>
<td>Gymnastics</td>
<td>Forest Glade Arena</td>
<td>16th - 11:45 a.m. to 5:30 p.m.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>17th - 9:30 a.m. to 1:00 p.m. (finals begin)</td>
</tr>
<tr>
<td>Swimming</td>
<td>Windsor Family Aquatic Centre</td>
<td>16th - Session 1 begins at 8:30 a.m.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Session 2 begins at 2:30 p.m.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>17th - Session 1 begins at 8:30 a.m.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Session 2 begins at 2:30 p.m.</td>
</tr>
<tr>
<td>Tennis</td>
<td>Parkside Tennis Club</td>
<td>16th - 8:00 a.m. to 5:30 p.m.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>17th - 8:00 a.m. to 5:00 p.m.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18th - 8:00 a.m. to 11:00 a.m.</td>
</tr>
<tr>
<td>Basketball</td>
<td>University of Windsor - St. Denis Centre</td>
<td>16th - 9:00 a.m. to 3:15 p.m.</td>
</tr>
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<td></td>
<td></td>
<td>17th - 9:00 a.m. to 3:15 p.m.</td>
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<tr>
<td></td>
<td></td>
<td>18th - 9:00 a.m. to 3:15 p.m.</td>
</tr>
<tr>
<td></td>
<td>Assumption College High School</td>
<td>16th - 9:00 a.m. to 3:15 p.m.</td>
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<td></td>
<td></td>
<td>17th - 9:00 a.m. to 3:15 p.m.</td>
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<tr>
<td></td>
<td></td>
<td>18th - 9:00 a.m. to 2:00 p.m.</td>
</tr>
<tr>
<td></td>
<td>Century Secondary School</td>
<td>16th - 9:00 a.m. to 3:15 p.m.</td>
</tr>
<tr>
<td>Baseball</td>
<td>Mic Mac Park (Cullen, Soulliere and Ivan Fields)</td>
<td>16 to 18th - 10:00 a.m. to 3:00 p.m.</td>
</tr>
<tr>
<td>Soccer</td>
<td>McHugh Soccer Complex</td>
<td>16th - 9:00 a.m. to 3:00 p.m.</td>
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<td></td>
<td></td>
<td>17th - 10:00 a.m. to 1:00 p.m.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18th - 10:00 a.m. to 11:00 a.m.</td>
</tr>
<tr>
<td>Volleyball</td>
<td>St. Clair College</td>
<td>16th to 18th - 9:00 a.m. to 4:00 p.m.</td>
</tr>
</tbody>
</table>

Table 3.1: Location and Event Schedule
The Spectator Survey

The most efficient method to collect some of the necessary information to conduct an EF of the event was to survey those attending the event as a spectator (see Appendix V and VI for survey and letter of consent). The researcher believed that creating an on-line survey, through FluidSurveys, would be the most efficient and accessible technique for obtaining information regarding spectators for a number of reasons. First, the survey method allowed for a large amount of data to be collected and also give the researcher the ability to make a generalization of the resource consumption of all the spectators attending the event. Second, the on-line survey approach was chosen because the researcher did not have the ability to collect data inside the venues due to accessibility restrictions; therefore distributing business cards with the personal information of the investigator, a brief explanation of the study, the online address to complete the survey and the languages that it can be translated into was the most appropriate method to attract respondents and the prize draw information. Due to the international characteristic of the event, the researcher believed that providing the option of translating the survey into a number of languages would be beneficial when working towards a sufficient response rate. Finally, creating an Internet survey was a sustainable approach as opposed to creating surveys for respondents to complete on-site because it eliminated the need for paper to produce the surveys, thus reducing the environmental impact of the study. Almost all of the information that was being collected in the survey was considered quantitative data and the questions were designed to be easily understood, allowing respondents to complete the survey in five to seven minutes. The online method and the simplistic design of the survey were believed to lead to a high response rate. Five
individuals were identified to pilot test the on-line survey. One of the five surveys was translated into Greek in order to be certain that the intent of the survey would not be lost in translation. The pilot survey showed some minor issues with wording, which were then corrected.

The researcher and assistants met at the St. Denis Centre on the mornings of 15 to 18 of August. As previously noted, the assistants were provided with a brief overview of the study in order to answer questions that the participants may have had. Furthermore, the assistants had the ability to contact the researcher through their cellular device if they were in need of assistance. The group was divided into three teams of two and each had a schedule of where to recruit the survey respondents. Finally, the researcher and assistants wore University of Windsor shirts with badges expressing their name and affiliation with the University of Windsor.

The spectators were randomly approached as they entered and exited the venues. The researcher or assistant identified who they were, gave a brief description of the study, the purpose of the survey, provided details of the draw and requested their permission to participate in the study. If the spectator accepted the invitation to participate in the study, they were given the business card that had the information to guide them to the survey. The spectators had seven days to access the online survey. Once it was completed, the participants were entered into a draw for a $200 (Canadian Dollars) gift card to the Apple Store. In order to be entered into the draw they needed to complete the survey and provide contact information, which was not attached to the survey. By providing them with a monetary motivation, in the form of a $200 (USD) gift card to the Apple Store, the
researcher hoped that would lead to an increase in the response rates of the spectator survey.

In order to determine the appropriate sample size for the researcher to use, the total out-of-town spectators of approximately 3,455 people were used as the population size. Setting a confidence level of 95% and a confidence interval at 5%, it was determined that the minimum recommended sample size of the spectator survey was 349 spectators.\(^{10}\)

*The Facility Manager Survey*

Since the event required the use of multiple venues throughout Windsor, the researcher anticipated that their resource requirements would be a major contributor to the EF of the 2013 ICG. A quantitative survey was designed in order to collect the data needed for the EF calculations (see Appendix VII and VIII for facility manager survey and consent form). The facility managers of the 11 competition venues were contacted by the Operations Chair through e-mail. They were provided with a consent form and the post-event survey. The post-event survey was aimed at determining the environmental impacts the 2013 ICG had on the facilities. They were asked to e-mail the completed questionnaire back to either investigator or the Operations Chair within 14 days after the event had concluded. If they did not respond within 10 days, they were sent a reminder e-mail asking them to send the completed questionnaire within four days.

Although much of the information concerning the venues was accessible to the public, some key elements such as resource usage, waste and recyclables generated and staff changes due to the 2013 ICG could only be obtained through the facility manager survey. Another reason the researcher sought the participation of the facility managers
was to provide them with a three to five page report outlining the results of the study and information to help them implement sustainable strategies in their facilities. Furthermore, these participants were given a University of Windsor Kinesiology Research shirt as a token of appreciation for their involvement with the study.

**Estimating Resource Consumption of the 2013 ICG**

The data acquired through the methods previously listed were used to evaluate the EF of the event. This section outlines how that data was used to calculate each of the main categories. Furthermore, this section specifically demonstrates the data sources that were used for each category.

*Travel*

The travel component of the event’s footprint included journeys made by the athletes, team officials and spectators of the event. More specifically, it was comprised of travel made from the participant’s home location to Windsor and their travel from their accommodation, or residence, to a venue. The Organizing Committee of the ICG documented the athletes and team officials who arrived in Windsor (or other airport) by air travel. The Operations Chair, whom oversees the transportation of athletes and team officials, agreed to provide the researcher with this vital information. The spectator survey estimated the transportation of those who traveled to Windsor by a different form of transportation. The EF calculator took into account the type of transportation and estimated the total distance travelled to Windsor by the event participants of the 2013 ICG. This was then reported to represent the event as a whole and each participant of the event.
The Organizing Committee, in collaboration with Transit Windsor developed a schedule to drive participants, spectators and team officials staying in the designated hotels, from their accommodation to the event. Also, a loop bus system was developed to travel to each venue and designated hotels for people travelling throughout the days of the event. The Organizing Chair, once again, agreed to provide this data to the researcher. Additionally, the spectator survey generalized the number of people who traveled to events by another form of transportation and the distance they travelled.

**Accommodation**

Since the 2013 ICG lasted six days, many of the participants of the event stayed overnight in locations outside of their home. The athletes and team officials stayed in a student residence at the University of Windsor. In order to calculate this population of participant’s EF due to accommodation, the EcoInvent database calculated EF and CO₂ emissions coefficients of an average hotel.

Any participants of the event travelling to Windsor who did not stay in a student residence were provided with the option of staying at a number of specially selected hotels who offered discounts for people travelling to Windsor for the 2013 ICG. The hotels that were promoted by the event were:

- Caesar’s Windsor;
- Hilton Windsor;
- Holiday Inn & Suites;
- Holiday Inn Downtown Windsor;
- Quality Inn & Suites;
- Windsor Riverside Inn;
- Travelodge Hotel.¹¹
The spectator survey attempted to generalize how many people stayed at each hotel. The researcher also took into consideration those staying in their home, those staying with family or friends and any other place of accommodation.

*Food and Drink Consumption*

The amount of food and drink consumed was calculated using business sales data on items sold at the venues. This data was obtained through the facility manager survey, which asked for unit sales and size of the item. The EcoInvent database did not have brand specific footprint data; therefore if a 500ml of Pepsi were sold at an event, it would be inputted into the calculator as a soda. This made the assumption that the EF of soda is the same for all manufacturers. Also, the spectator survey estimated the amount of money spent on food and drinks by spectators during the duration of the event.

The athletes and team officials were provided breakfast and dinner while staying in residence at the University of Windsor. In order to calculate the footprint of this service, the researcher was provided with the meal plan for the event. Since the food was served buffet style, the researcher needed to make some basic assumptions on the amount of food each athlete consumed.

*Infrastructure of the Event Venues*

Although no venue was specifically constructed for the event, the natural resources required to host an event of this magnitude was assumed to be reflected in the EF calculation. Data acquisition for this category was difficult; specifically due to the number of venues required to stage the 2013 ICG. The venue survey was vital in providing information such as electricity (Kilowatt hours), gas (mega joules) and water bills (Litres). The survey also took into consideration any drastic increases in energy
usage due to the event. Other information needed for the EF calculation included; the size of each building and property (squared metres), when the facility was constructed and any increases in the number of employees due to the 2013 ICG.

*Print and Promotional Items*

The EF of this category accounted for goods produced because of the event. This covered a wide array of different types of goods (clothing, pens, posters, etc.). The EcoInvent database took into account the resources used throughout the lifecycle of the product. This category was calculated based on the data provided by the Operations Committee concerning the different types and amount of goods produces.

*Waste and Recycling*

The total amount of waste and recyclables generated throughout the event was calculated based on responses by the facility managers and was expressed in kilograms (kg). The recycled waste sub-categories include paper, cardboard, glass, plastic, aluminum and steel. Waste that is recycled was assigned credits, therefore positively impacting the environmental impact of the 2013 ICG. The researcher predicted that this category would produce the least accurate results because it was believed that facility managers would not collect any data regarding the quantity and type of waste produced during the event.

*Limitations of the Study*

The literature review indicates the limitations with the concept of EF; thus, in order to avoid redundancy, this section focuses on the limitations of the specific EF calculator used for the event. The most important factor in accurately determining the EF of the 2013 ICG is to have access to all the data necessary for completing the
calculations, therefore minimizing the number of assumptions that need to be made. Since the researcher was not on the Organizing Committee, or involved with the staging of the event (outside of the study), the data had to be provided by those in positions who had access to the information. This made the process of acquiring the necessary data much more difficult. Also, it must be acknowledged that the Organizing Committee did not want to share some of the information requested, due to the nature of the study and the possibility of negatively reporting the legacy of the event.

Another major limitation to the study is due to the use of the EcoInvent Database for the EF calculator. Although, using this database provided the researcher with the ability to most accurately estimate the EF of the 2013 ICG, it came at the cost of transparency. The researcher did not have a license to use EcoInvent, therefore was unable to see specifically how each conversion factor was developed.

There were also limitations with some of the data the researcher had access to. First, the transportation data needed for participants of the event travelling by air to Windsor was provided. However, the Organizing Committee did not have records of the participants travelling to Windsor by any other form of transportation. The researcher had to make estimates for this group of people. With that said, air travel was considered to be the most environmentally damaging form of travel, which made that data more significant to the study.

Furthermore, much like the previously listed limitation, the researcher did know if or how the Organizing Committee kept track of the number of local spectators at the events. The researcher had to use the figure provided by the City of Windsor in their economic impact assessment of the event. The researcher could not confirm the accuracy
of the figure. The number of total spectators significantly contributed to the total sum of participants; thus, proving to be the single most significant statistic in the study. It is acknowledged that over- or underestimating the total number of participants involved at 2013 ICG would prevent an accurate evaluation of the per capita EF of the event.

**Delimitations**

This study focused specifically on the overall EF of the 2013 ICG, as well as the EF per participant and the breakdown of each of the six main categories of the event previously listed. Since the event ended 18 August 2013 and the departure date was the following day, travelling away from Windsor was not included in the study, and was the reason the researcher did not include August 19th in the study. Also, the volunteers and paid staff of the event were not included in the “per participant” average in order to limit the quantity of data needed for the EF. This limited the amount of potential assumptions required, which lead to more accurate results.

This study strictly focused on data pertaining to the event in question. Numerous tourists travelled to Windsor, impacting both the economic and natural environment of the city. Data concerning their activity outside of the event would overestimate the EF of the ICG. For example, meals eaten at restaurants outside of the venues or any products purchased outside of the venues were not used in the EF.

This research endeavor was limited to the resource consumption needed to stage the 2013 ICG. The data sources included: the primary source data from the spectator survey; the facility manager survey; and the information received by the Operations Chair. Secondary sources included: local and national news coverage of the event; reports provided by the city of Windsor; and reports provided by Transit Windsor.
Endnotes

1 Andrea Collins and Andrew Flynn, “Measuring the environmental sustainability of a major sporting event: a case study of the FA Cup Final,” *Tourism Economics* 14, no.4 (2008), 755.

2 Ibid.


5 The EPA Victoria Events Calculator is based on data provided by the Australian Bureau of statistics. The data used to code the calculator would not be compatible for a Canadian event. For example, paper in Canada is produced domestically, while paper in Australia is mostly imported from Europe. Also, the yield factors for each country are different, which means that bioproductive land is different in each country.

6 A Life Cycle Inventory database is an inventory of flows of inputs of water, energy and raw materials for a product system and releases to air, land and water.


Chapter 4

Results

There were two types of datasets used to calculate the EF of the 2013 ICG, as well as the attributable tonnes of CO$_2$e: data used to calculate the EF and carbon emission conversion factors (CF) and data representing the material consumption of the 2013 ICG. First, since there was not an ‘off the shelf’ EF calculator accessible to the researcher in order to accurately measure the impact of the event, it was in the researcher’s best interest to hire Hunter and Chance Consulting; a company with a license to access the EcoInvent emissions database. The EF calculator was created using best available data, undertaking a comprehensive review of academic literature, industry and government reports and other relevant sources. The purpose of this was to create an EF calculator that was able to capture the unique energy, transportation and land use attributes of events conducted, specifically in Ontario. The final version of the calculator was completed approximately six weeks upon the conclusion of the 2013 ICG.

The second dataset represented the material consumption of the 2013 ICG and was used in conjunction with the first dataset to calculate the EF and tonnes of CO$_2$e of the event. Data collection began 14 August 2013 and concluded 07 March 2014, which was the date of the last meeting with a member of the ICG Organizing Committee. The data was provided by various members of the organizing committee of the 2013 ICG, as well as various City of Windsor employees and employees affiliated with a number of the facilities that staged the sport competitions (see Appendix IX). Due to the fact that various data either did not exist or the individuals who had access to the data declined to participate in the study, some data was either estimated or surrogates were used. The rest
of this chapter will report the outcomes of the event and how the data was collected and used to calculate the EF of the event.

**The Ecological Footprint of the 2013 ICG**

Based on the consumption categories listed in the methodology section, the overall EF of the 2013 ICG was 812.53 gha (0.033 gha/participant/day) and 376.75 tonnes CO\textsubscript{2}e (0.015 tonnes CO\textsubscript{2}e/participant/day) were attributable to the event. The total number of participants included in the study was 4,915. This was comprised of the 1,460 athletes and delegates who participated in the event and the 3,455 out of town spectators reported (see Appendix X). Although the event was staged from 14 to 19 of August 2013, the only scheduled event on the last day was the departure of athletes and delegates, which led to the researcher limiting the time scale of the event to five days. Thus, participant travel reflects only the distance to the 2013 ICG. As can be seen in figure 4.1, the participant travel consumption category had by far the greatest impact on the EF of the ICG, amassing 63.47\% of the total.

![Post Event Global Hectares breakdown by activity type](image)

**Figure 4.1:** Ecological Footprint Percentage Breakdown of the ICG
When analyzing the tonnes of CO$_2$e attributed to each category of the ICG, participant travel had the greatest contribution to the total emissions of the event at 59.02%. As figure 4.2 shows, the CO$_2$e attributable to the event were slightly more dispersed than the EF percentage breakdown. In order to fully comprehend the process used to generate these calculations, the next section of this chapter will be used to deductively breakdown each consumption category.

**Figure 4.2: Carbon Emissions Percentage Breakdown of the ICG**

**The Ecological Footprint and Transportation**

Participant travel to Windsor had the most significant impact on the event generating 222.36 tonnes CO$_2$e and yielding an EF of 515.73 gha (see Figure 4.3). This consumption category was comprised of both travel to Windsor and travel while in Windsor. The main reason transportation dominated all other impacts was due to the fact that the 81 represented cities spanning across 31 countries travelled 498,468 km by
airplane in order to reach Windsor (see Appendix XI for bus and air travel data for each team to Windsor). The formula for calculating the total EF and CO$_2$e of the transportation consumption category was:

$$\text{EF} = (\text{Bus Travel} * \text{Bus Travel EcoInvent CF})+(\text{Car Travel} * \text{Car Travel EcoInvent CF})+(\text{Air Travel} * \text{Air Travel EcoInvent CF})$$

$$= (2788.82 \text{ km} * 0.000027 \text{ gha})+(72000 \text{ km} * 0.00052 \text{ gha})+(498468 \text{ km} * 0.000958 \text{ gha})$$

$$= 515.73 \text{ gha}$$

$$\text{CO}_2\text{e} = (\text{Bus Travel} * \text{Bus Travel EcoInvent CF})+(\text{Car Travel} * \text{Car Travel EcoInvent CF})+(\text{Air Travel} * \text{Air Travel EcoInvent CF})$$

$$= (2788.82 \text{ km} * 0.1238 \text{ kg } \text{CO}_2\text{e})+(72000 \text{ km} * 0.20188 \text{ kg } \text{CO}_2\text{e})+(498468 \text{ km} * 0.41 \text{ kg } \text{CO}_2\text{e})$$

$$= 222360 \text{ kg } \text{CO}_2\text{e}/1000$$

$$= 222.36 \text{ tonnes } \text{CO}_2\text{e}$$

![Transportation Type Total Global Hectares Breakdown](image)

**Figure 4.3:** Ecological Footprint Percentage Breakdown of ICG Transportation

The air travel reported in this study underestimated the actual total distance flown by the teams based on the number of assumptions the researcher had to make. First, based on the flight data provided, it had to be assumed that each team flew directly from the
closest international airport of the city they represented to their designated airport in Windsor, Toronto or Detroit. Second, it was assumed that each of the 69 teams travelled together, no matter the size. Finally, the 498,468 km of air travel does not include any estimates of out-of-town spectator air travel. This is because the only accessible data regarding spectator travel was from the Sport Tourism Economic Assessment Model (STEAM) report used to calculate the economic impact of the ICG. The only relevant data that could be gathered from this STEAM report was that of the 3,455 spectators, 47.9% travelled greater than 320 km to Windsor and 622 of those spectators came from “overseas” (see Appendix X). The air transportation of teams back to their represented city was not taken into consideration because it would have only lead to duplicating existing data. If it was included the total air travel would have been 996,936 km. The increased air travel would of added 447.53 gha to the transportation category, making the total EF of the event 1290.06 gha. If the transportation category did indeed include travel back to the teams’ represented cities, this consumption category would have been 11 times greater in comparison to the Ontario resident average.

The second main contributor to the transportation consumption category was car travel. The car travel for out-of-town was estimated using the STEAM report. This estimation was imprecise due to the fact that the STEAM report produced extremely vague data regarding out of town spectator information, especially travel data. What was reported was that of the 3,455 spectators, 56% were from Canada. Of the 1,935 Canadian out of town spectators, 1,800 (or 93%) travelled 0 to 320 km. It was assumed that the 1800 spectators travelled the mean distance of that range with four people per vehicle
(450 * 160km = 72,000 km). This number was used to represent the entire out of town spectator population to ensure that car travel was not overestimated in the final results.

The final mode of transportation, which had a minimal impact on the EF was bus travel. The 27,888.82 km was comprised of two data sources; the distance travelled by the two loop bus systems provided by the City of Windsor for the ICG and estimations on team travel to and from airports. Transit Windsor only documented the distances travelled by the two loop bus systems, which summed up to 7,053km over the 5-day period (see Appendix XII). However, this figure does not take into account the bus distance travelled due to scheduling conflicts and directly transporting participants to the opening and closing ceremonies, which would of increased this total.

The assumption that the teams travelled together to Windsor has previously been mentioned. The remaining bus distance travelled was estimated by finding the distance from each cities downtown centre to the closest international airport. If one of the team’s cities had an international airport they were given a value of 0 km travelled to their airport. Since the dataset reported whether each team landed at an airport in Windsor, Toronto, or Detroit, the distances from these airports to the University of Windsor were used as the final distance travelled to Windsor. The University of Windsor was used as the final destination point for the arrival of each team because most of the teams stayed in the residence at the University and it was a central location for the ICG. If a team did not fly to Windsor, it was assumed that they travelled directly by bus to the university of Windsor and the distance from their downtown city centre to the university was calculated.
The bus travel distance used in the calculation was much smaller than the other two modes of transportation, which lead to a smaller EF. Also, bus travel had an insignificant impact because it is a much more environmentally efficient way of transportation in comparison to the other two. Therefore, the EcoInvent CFs used for bus travel were much smaller than the CFs used for car and air travel (see Appendix XIII for the list of EcoInvent CFs used in this study).

It is important to note that walking and transportation on bike were not included in the study based on the fact that these data could only be estimated, which is unnecessary because both modes of transportation produce no CO₂ (excluding the fact that materials and energy are needed to produce bicycles).

**The Ecological Footprint of the Facilities**

This consumption category represents the built environment required to stage the sport events of the 2013 ICG. The facility component represented a minor aspect of the event, accounting for 0.48% of the total EF and 5.56% of the total CO₂e. This relatively minor impact was expected since there were no facilities constructed for the main purpose of hosting this event.

As table 4.1 shows, 12 facilities throughout the Windsor area were used to host the 8 different sport events. The facility data collection was dependent upon whether or not each facility was public or private; data concerning public facilities had to be obtained from the City of Windsor, while private facility data was acquired by contacting the facility supervisors. Assumption College High School, E’cole Secondaire Michel-Gratton and Academie Ste-Cecile were excluded from the study due to the fact that the researcher could not collect the associated data for these facilities since only the gym area
of each school was used for the event. Also, developing data estimates for these facilities would have been inaccurate and the contribution to the total EF of this consumption category would have been merely minor since they were only used for two of the five days.

<table>
<thead>
<tr>
<th>Facility name</th>
<th>Sport</th>
<th>Public or Private</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alumni Stadium</td>
<td>Athletics/Track &amp; Field</td>
<td>Private</td>
</tr>
<tr>
<td>Family Aquatic Complex</td>
<td>Swimming</td>
<td>Private**</td>
</tr>
<tr>
<td>Forest Glade Arena</td>
<td>Gymnastics</td>
<td>Public</td>
</tr>
<tr>
<td>Souliiere Stadium</td>
<td>Baseball</td>
<td>Public</td>
</tr>
<tr>
<td>Cullen Field</td>
<td>Baseball</td>
<td>Public</td>
</tr>
<tr>
<td>Mchugh Soccer Complex</td>
<td>Soccer</td>
<td>Public</td>
</tr>
<tr>
<td>St. Denis Centre</td>
<td>Basketball</td>
<td>Private</td>
</tr>
<tr>
<td>Parkside Tennis Club</td>
<td>Tennis</td>
<td>Private</td>
</tr>
<tr>
<td>St. Clair College Gym</td>
<td>Volleyball</td>
<td>Private</td>
</tr>
<tr>
<td>Assumption College High School*</td>
<td>Basketball</td>
<td>Public</td>
</tr>
<tr>
<td>E’cole secondaire Michel-Gratton *</td>
<td>Basketball</td>
<td>Public</td>
</tr>
<tr>
<td>Academie Ste-Cecile*</td>
<td>Volleyball</td>
<td>Public</td>
</tr>
</tbody>
</table>

**Table 4.1: ICG Sporting Events Schedule, Retrieved from http://www.icg-windsressex2013.com/content/sporting-events-schedule**
*Not included in the study
**The construction of the Family Aquatic Complex was contracted to a private company and the facility was in the construction phase during the ICG

The EF associated with each facility was based on two key factors: the size and type (either indoor or outdoor) of each facility (see Table 4.2). The EcoInvent CFs for both the EF and carbon emissions were both based on numerous characteristics associated with indoor and outdoor facilities, such as: construction materials, number of staff and size of the building. Collecting the necessary data from these facilities to determine these characteristics would have been extremely difficult and time consuming, assuming that these datasets still existed and were accessible to the public. Therefore, it was determined that it would be advantageous to use data surrogates from 12 Brampton community centres to calculate the average EF and carbon emission CFs for both indoor and outdoor facilities. The main reason for this decision was due to the fact that the data
from these community centres were easily accessible and were much more complete than what would have been collected from the actual facilities used for the ICG. Although the use of data surrogates was not the most ideal situation, the cities of Brampton and Windsor share many similar infrastructural and demographic characteristics; most notably, both cities are located in the same province, therefore the Ontario 2012 energy grid split average used in this study is also applicable with the city of Brampton.

The formulas used to determine the EF and CO$_2$e for this consumption category were:

\[
\text{EF} = \frac{\text{Facility size (ft}^2\text{)} \times \text{EcoInvent CF (gha)}}{6}
\]

\[
\text{CO}_2\text{e} = \frac{\text{Facility size (ft}^2\text{)} \times \text{EcoInvent CF (CO}_2\text{e)} / 6}{1000}
\]

<table>
<thead>
<tr>
<th>Facility name</th>
<th>Size (ft$^2$)</th>
<th>**Kg CO$_2$e (per month, per ft$^2$)</th>
<th>**Global Hectares (per month, per ft$^2$)</th>
<th>Carbon Emissions (tonnes of CO$_2$e)</th>
<th>Ecological Footprint (gha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alumni Stadium</td>
<td>63000</td>
<td>0.1422</td>
<td>0.000054</td>
<td>1.4931</td>
<td>0.567</td>
</tr>
<tr>
<td>Family Aquatic Complex</td>
<td>144000</td>
<td>0.2141</td>
<td>0.000084</td>
<td>5.1384</td>
<td>2.016</td>
</tr>
<tr>
<td>Forest Glade Arena</td>
<td>14800</td>
<td>0.1422</td>
<td>0.000054</td>
<td>0.35076</td>
<td>0.1332</td>
</tr>
<tr>
<td>Soulliere Stadium</td>
<td>12000</td>
<td>0.0913</td>
<td>0.000002</td>
<td>0.1826</td>
<td>0.004</td>
</tr>
<tr>
<td>Cullen Field</td>
<td>12000</td>
<td>0.0913</td>
<td>0.000002</td>
<td>0.1826</td>
<td>0.004</td>
</tr>
<tr>
<td>McHugh Soccer Complex</td>
<td>740000</td>
<td>0.0913</td>
<td>0.000002</td>
<td>11.260333333</td>
<td>0.246666667</td>
</tr>
<tr>
<td>St. Denis Centre</td>
<td>63000</td>
<td>0.1422</td>
<td>0.000054</td>
<td>1.4931</td>
<td>0.567</td>
</tr>
<tr>
<td>Parkside Tennis Club</td>
<td>21000</td>
<td>0.1422</td>
<td>0.000054</td>
<td>0.4977</td>
<td>0.189</td>
</tr>
<tr>
<td>St. Clair College Gym</td>
<td>14800</td>
<td>0.1422</td>
<td>0.000054</td>
<td>0.35076</td>
<td>0.1332</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>20.95</td>
<td>3.86</td>
</tr>
</tbody>
</table>

**Table 4.2:** The EF of Facilities

* Data retrieved from www.icg-windsoressex2013.com

** Indicates EcoInvent as the data source.

Since the EcoInvent CF is weighted on a per month or 30-day basis, the result was divided by 6 in order to determine the EF and carbon emissions for the 5-day event.

Although some of the venues only scheduled events for 2 of the 5 days, the researcher
had to consider the time for setting up each venue during the 5-day period, as well as any unscheduled practice times for athletes. Furthermore, the venues were allocated for the duration of the 2013 ICG. Therefore, the results for each facility included in the study were based on a 5-day period. The carbon emissions were then divided by 1000 so that it could represent tonnes of CO$_2$e. The most notable facility was the Family Aquatic Complex, contributing an EF of 2.016 gha to the 3.86 total for this category. The aquatic complex had the largest EF because both the EF and carbon emission CFs for this facility were larger than the other facilities due to the high resource consumption associated with aquatic facilities. In order to construct and maintain large pools, aquatic facilities have higher energy requirements than the other types of sport facilities used to stage the 2013 ICG and this was added in to the standard CFs used for the indoor facilities. Since there was no data or surrogates available to calculate the CFs for aquatic facilities, the researcher accounted for the higher resource consumption of this type of facility by doubling the CFs used for the other indoor facilities. Another noteworthy statistic was the 11.26 tonnes of CO$_2$e attributed to the Mchugh Soccer Complex. Although outdoor facilities typically have a lower EF and CO$_2$ output, the sheer size of the soccer complex (approximately 17 acres) was the reason for it’s high carbon emission output.

The following section provides a breakdown of the operational results from the facilities discussed in this section. One could argue that these two aspects of the event should have been represented as one consumption category; however, isolating the EF of the physical environment required to stage the 2013 ICG was important because of the number of facilities used to stage the event.
The Ecological Footprint of Facility Operations

This particular consumption category was by far the most difficult to calculate because of the specificity of data required to collect from the 9 facilities used in this study. The facility operations were comprised of the hydro (Litres), electricity (KWh), natural gas (BTU) and gas usages (Litres) of each venue. This aspect of the ICG was the second largest contributor to the EF and CO$_2$e of the event, representing 31.59% (240.26 gha) of the total EF and 29.57% (119.03 tonnes of CO$_2$e) of the total carbon footprint (see Figure 4.4 and 4.5). It is important to note that the data was collected on a per month basis, specifically for the month of August, the reason being that energy bills are reported on a 30-day basis. More importantly, every facility supervisor who participated in the study stated that the ICG did not have any material impact on the operations of their facility; therefore, using the monthly results to calculate the 5-day energy usage for the event provided an accurate estimation.

![Ecological Footprint (gha)](image)

**Figure 4.4:** Utility Usage Ecological Footprint Breakdown
Facility supervisors from the private facilities and numerous City of Windsor employees from the Parks and Recreation Department were contacted to provide the necessary utility usage data for the 9 venues. Although most agreed to participate in the study, some of the required data was not accessible either for privacy reasons or because it did not exist (see Appendix IX for data contribution list). Furthermore, employees representing the Family Aquatic Complex and St. Clair College declined to participate in the study. As stated previously in Table 4.1, the Family Aquatic Complex was still under construction during the 2013 ICG; therefore, the data required for this study was owned by the private company building the facility and was not accessible to the researcher. To calculate the utility usage for the missing required data, a weighted average ‘utility per square foot’ was calculated using the existing data, which was then multiplied by the size of the facility being estimated. The formulas used to estimate the EF and CO$_2$e of the facilities using the ‘utility per square foot’ estimation was:

$$EF = \frac{\sum \text{EF of Reported Facility Utility Usages}}{\sum \text{Their Facility Sizes}} \times \text{Size of Facility Being Estimated}$$

**Figure 4.5: Utility Usage Carbon Emissions Breakdown**

The diagram shows the breakdown of carbon emissions across different utility usages. The data is represented as follows:

- Water usage across all facilities (Litres)
- Electrical usage across all facilities (KWh)
- Natural gas usage across all facilities (BTU)
- Gas usage across all facilities (Litres)
\[ CO_2e = (\Sigma CO_2e \text{ of Reported Facility Electricity Usages}/ \Sigma \text{Facility Sizes}) \times \text{Size of Facility Being Estimated}) \times 1000 \]

Since this method was used for the Family Aquatic Complex, the utility usage for this facility was severely underestimated due to the fact that the facilities used to estimate this facility do not take into account the extra energy requirements to maintain an Olympic-sized pool.

*Electricity Usage*

Of the four utility usage categories, the electricity usage had the most complete dataset with 6 of the 9 venues providing electricity usage for the month of August 2013. The reported and estimated electricity usage summed up to 126,788.29 KWh, ranging from 274 KWh (McHugh Soccer Complex) to 59,063.5 KWh (St. Denis Centre) respectively (see Figure 4.6). The formula used to convert the monthly electricity usage to bioproducitive land and CO\(_2\)e to represent the ICG was:

\[
\text{EF} = (\Sigma \text{ monthly facility electricity usage} \times \text{EF Conversion Factor}) / 6
\]

\[
= (760729.74 \text{ KWh} \times 0.00094 \text{ gha}) / 6
\]

\[
= 119.18 \text{ gha}
\]

\[
\text{CO}_2e = (\Sigma \text{ monthly facility electricity usage} \times \text{CO}_2 \text{ Conversion Factor}) / 6
\]

\[
= (760729.74 \text{ KWh} \times 0.52 \text{ kg CO}_2e) / 6
\]

\[
= 65976.82 \text{ kg CO}_2e /1000
\]

\[
= 65.98 \text{ tonnes of CO}_2e
\]
**Figure 4.6:** Electricity Usage of the ICG Sport Venues
*Estimated based on the weighted average of electricity per square foot of the acquired venue data from Appendix XIII.
**This dataset was proportioned from the reported 30-day electricity usage to represent the 5-day event.

*Water Usage*

Water usage for the month of August 2013 was reported by four facilities: Parkside Tennis Club, Bernie Souilliere Stadium, Father Ronald Cullen Stadium and Forest Glade Arena. This utility usage category had the highest contribution to the total EF for the operations category at 49.91%. An estimated total of 152,927L was used during the 5-day event (see Figure 4.7). This number would have most likely been drastically higher if data was collected from the Family Aquatic Complex. The formula used to convert monthly water usage to the EF for the event was:

\[
\text{EF} = \frac{(\Sigma \text{monthly facility water usage} \times \text{EF Conversion Factor})}{6} \\
= \frac{(917562L \times 0.00079 \text{ gha})}{6} \\
= 120.81 \text{ gha}
\]
\[ \text{CO}_2\text{e} = \left( \sum \text{monthly facility water usage} \times \text{CO}_2 \text{ Conversion Factor} \right) / 6 \]
\[ = (917562 \text{L} \times 0.3441 \text{ kg CO}_2\text{e}) / 6 \]
\[ = 52622.18 \text{ kg CO}_2\text{e} /1000 \]
\[ = 52.62 \text{ tonnes CO}_2\text{e} \]

**Figure 4.7:** Monthly Water Usage of the 2013 ICG Facilities

*Natural Gas usage*

The natural gas usage for the month of August 2013 was reported by three facilities: Parkside Tennis Club, Bernie Souilliere Stadium and Forest Glade Arena. As expected the EF of the natural gas usage had a minimal impact (less than 1%) on the total EF for this consumption category due to the fact that the event took place in August and the main domestic use for natural gas is the central heating of buildings. A total of 32.56 million British Thermal Units (mmBTU) was calculated for this utility usage (see Figure 4.8). The results from the three facilities were reported in cubic meters (m$^3$), but were converted to mmbtu’s in order to be compatible with the EcoInvent database. The conversion formula for m$^3$ to mmBTU is:

\[ 28.31 \text{ m}^3 = 1 \text{ mmBTU}. \]
The actual natural gas usage from the Family Aquatic Complex was much greater than the estimated figure. However, the actual figure would most likely not of had a significant impact on the overall EF of the event. The Mchugh Soccer Complex was given a value of 0 for their natural gas output during the ICG due to the fact that the massive size of the outdoor venue would most likely have overestimated it’s EF for this utility usage.

![Natural Gas Usage (MmBTU)](image)

**Figure 4.8**: ICG Facilities Monthly Natural Gas Usage

*Gasoline Usage*

None of the facilities were able to provide monthly gasoline data usage, thus data surrogates were used in place. It was determined that since the average gasoline usage for the 12 Brampton community centres was already found, using that data would represent the ICG more appropriately than excluding it from the study, thus giving it a value of 0.

The average monthly gasoline usage for the 12 Brampton community centres was 739.92 litres. The formula for estimating the 9 facilities gasoline usage during the 2013 ICG is:

\[
\text{Gasoline Usage} = \left(\frac{739.92 \text{ litres} \times 9 \text{ facilities}}{6}\right)
\]

\[= 1109.88 \text{ litres}\]
This estimation was then applied to the conversion factors to determine the EF and CO\textsubscript{2}e for the event:

\[
\begin{align*}
\text{EF} &= 1109.88 \text{ Litres} \times 0.0014 \text{ gha} \\
&= 1.55 \text{ gha} \\
\text{CO}_2\text{e} &= \frac{(1109.88 \text{ Litres} \times 2.3144 \text{ kg of CO}_2\text{e})}{1000} \\
&= 2.57 \text{ tonnes of CO}_2\text{e}
\end{align*}
\]

**The Ecological Footprint of Food and Drink**

The University of Windsor provided accommodation and meal services to 860 of the 1460 athletes and team delegates throughout the ICG. The rest of the teams were scattered across University Place, St. Clair College and Academie Ste-Cecile. The menu and order sheets from the University of Windsor were obtained and used to calculate the EF of this consumption category (see Appendix XIV). The results showed that the food and drink category had the third highest EF at 49.73 gha (6.12% of the total EF) and 5.85 tonnes of CO\textsubscript{2}e, however this was likely an underestimation in comparison to the actual total impact of meal services on the event (see Table 4.4 and Figure 4.9). The EF generated from this section represents the 8 meals (5 breakfasts and 3 dinners) provided to the 1,460 athletes and delegates. Although some of the meals were provided by other companies, most notably Subway’s donation of 8,000 6-sinch sandwiches, their EF was not included because of the limited data accessible from these meals. Furthermore, the data used in this section represents only 58.9% of the 1,460 athletes and delegates; thus, the final results were generalized to account for the rest of the teams with the assumption that the same meal services were provided to them (29.29gha/0.589 = 49.73gha).\(^2\)

The most difficult process for calculating the EF of this consumption category was converting the reported data to units that could be used in EcoInvent. For example,
fruits and vegetables were reported in the number of cases ordered. Understandably, cases are not a scientific unit of measurement and could not be processed in EcoInvent; therefore, it was estimated that one case of produce weighed 5 kg.\(^3\) Furthermore, the quantities of some food items were expressed in ‘portions’ and in order to include these items in the study assumptions were made regarding the number of grams in a portion size, depending on the item being estimated.

In order to calculate the EF of the numerous items on the menu and order sheets, they were grouped into 6 major categories: soda/juices, milk, dairy products, meat products, grain products, and fruits/vegetables.\(^4\) Milk was separated from dairy products because the conversion factors for each category were different. The total weight of each category, in kilograms, was then applied to each conversion factor (see Table 4.3).

<table>
<thead>
<tr>
<th>Food and Drink</th>
<th>Quantity Sold</th>
<th>Sizes</th>
<th>Formula</th>
<th>Unit Conversion (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Juice/Soda</td>
<td>9984</td>
<td>250ml</td>
<td>(=\frac{(9984*250)}{1000})</td>
<td>2496</td>
</tr>
<tr>
<td>Milk</td>
<td>8014</td>
<td>250ml + 24L</td>
<td>(=\frac{(8000*250)+24000}{1000})</td>
<td>2024</td>
</tr>
<tr>
<td>Dairy Products</td>
<td>6264</td>
<td>100ml + 80lbs + 5g</td>
<td>(=\frac{(864<em>100)+(80/2.2)+(5400</em>5)}{1000})</td>
<td>149.76</td>
</tr>
<tr>
<td>Meat Products</td>
<td>22400</td>
<td>113.39g + 50g</td>
<td>(=\frac{((2900<em>113.39)+(19500</em>50)}{1000})+(529/2.2))</td>
<td>1544.29</td>
</tr>
<tr>
<td>Grain Products</td>
<td>9548</td>
<td>1kg + 40g</td>
<td>(=\frac{(17064*40)}{1000}+641.4)</td>
<td>1324</td>
</tr>
<tr>
<td>Fruit/Vegetables</td>
<td>277.36</td>
<td>5kg</td>
<td>(=\frac{(277.36*5)}{1000})</td>
<td>1386.8</td>
</tr>
</tbody>
</table>

Table 4.3: Quantity of Food and Drink to Unit Conversions

The juice/soda subcategory was comprised of the 9,984 units of 250ml Tetra orange and apple juice packs, which were made accessible to all 860 athletes and delegates. The milk subcategory included 8,000 units of 250mL Natrel milk packs, 10 bags of 20L 2% milk and 4 bags of 20L 18% cream. The other dairy products consisted
of 864 units of 100ml individual yogurt packs, 80lbs of butter and 5,400 individual butter packets at 5g/per packet.

In order to simplify the formulas for the associated meat, grain and fruit/vegetable products, a mean weight was found for products of similar type and size. For the meat product subcategory, 19,500 units at 50g were comprised of 12,000 eggs, 3750 turkey sausages and 3750 pork sausages. Also, 41 cases containing 2900 pieces of chicken, estimated at 113.39g/piece (4 ounces) and 529lbs (240.45kg) of beef flats were ordered for the event. Since a majority of the fruit and vegetables were reported in cases, estimated at 5kg/case, all of the other products were calculated based on a 5kg cases in order to simplify the calculation for this subcategory. The order sheets and menu showed; 102kg of Pearls various produce, 720.45kg of potatoes, 47.75kg of green and yellow beans, 13.62kg of baked beans and 120kg of canned fruit salad all were ordered in order to provide fruits and vegetables for teams staying at the University of Windsor during the ICG.

The final and most difficult food and drink category to calculate was the grain products. Approximately 9,000 pancakes, 4,032 waffles and 4,032 pieces of various cakes were served throughout the event. Since these items were reported based on portions provided it was estimated that the mean weight of these food products was 40g/serving. Furthermore, rice was the single most popular food item and was provided at all 8 meals; however, the order sheets did not indicate how much rice was needed for the event. According to the Canadian Food Guide, a single serving of rice weighs approximately 110grams. It was assumed that half of the team members staying at the University of Windsor had 1 serving of rice at every meal. Based on these assumptions, it
was estimated that 378.4kg of rice was used throughout the event. The rest of the grain products included: 100kg of penne, 100kg of tortellini and 63kg of various cereals. Once all of the food and drink unit conversions were calculated, the EF and CO₂e were found using the conversion factors associated with each category.

Some of the items on the menu and order sheets were not included in the calculations for a number of reasons. First, some of the food items, such as bread rolls, did not include sizes or the amount served during meals; therefore, it was not possible to provide proper estimations for these items. Second, some items did not fit into any of the major categories and were not included because there material impact would have been extremely minimal (most notably condiment items). Third, in order to avoid double counting a number of food items were not included; meatloaf, coleslaw, baking potatoes and redskin potatoes.

<table>
<thead>
<tr>
<th>Catering Services</th>
<th>Unit Conversion (kg)</th>
<th>Carbon Emissions CF (kg CO₂e)</th>
<th>Ecological Footprint CF (gha)</th>
<th>Carbon Emissions (kg of CO₂e)</th>
<th>Ecological Footprint (gha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Juice/Soda</td>
<td>2496</td>
<td>0.0625</td>
<td>0.0002</td>
<td>156</td>
<td>0.4992</td>
</tr>
<tr>
<td>Milk</td>
<td>2024</td>
<td>0.1125</td>
<td>0.0014</td>
<td>227.7</td>
<td>2.8336</td>
</tr>
<tr>
<td>Dairy Products</td>
<td>149.76</td>
<td>0.1325</td>
<td>0.0061</td>
<td>19.8432</td>
<td>0.913536</td>
</tr>
<tr>
<td>Meat Products</td>
<td>1544.29</td>
<td>1.87</td>
<td>0.0157</td>
<td>2887.8223</td>
<td>24.245353</td>
</tr>
<tr>
<td>Grain Products</td>
<td>1324</td>
<td>0.0975</td>
<td>0.0005</td>
<td>129.09</td>
<td>0.662</td>
</tr>
<tr>
<td>Fruit/Vegetables</td>
<td>1386.8</td>
<td>0.0175</td>
<td>0.0001</td>
<td>24.269</td>
<td>0.13868</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3444.72</strong></td>
<td><strong>Total</strong></td>
<td><strong>Total</strong></td>
<td><strong>29.29</strong></td>
<td></td>
</tr>
</tbody>
</table>

*Table 4.4:* The EF of Food and Drink Consumption.
Figure 4.9: A percentage breakdown of the EF of Food and Drink Consumption

It was expected that the meat product category would be the largest contributor to the overall EF of the event, but not as overwhelming as the results showed. This large impact was due to the high conversion factors associated with meat products. This means that more land and energy is required to raise the livestock necessary to provide meat products, in comparison to the other food and drink categories. In general, a high food and drink EF was expected for the overall event for two main reasons. First, this was an international event, therefore it was necessary to provide a large variety of meal options for the numerous cultures represented at the ICG. Second, even though most of the meal services were provided to children between the ages of 12 to 16, they were athletes in competition and it was believed that they would have higher than average consumption rates (0.0034 gha/person). Finally, it must be noted that the food and drink orders for the ICG made by the University of Windsor Food Services were not overestimated. An emphasis was placed on using leftover items for other purposes to ensure a minimal amount of wasted food and drink items.
The Ecological Footprint and Accommodation

The EF of accommodations had a minimal impact on the overall event. Since the differences between types of accommodations would yield no significant difference in results for this study, the EF associated with this category was calculated using conversion factors based on average per night stays of European and American hotels. The number of event participants and average nights stayed were then applied to the conversion factors to determine the EF and CO$_2$e for the event:

$$EF = (4915 * 0.00012 \text{ gha}) * 5 \text{ nights}$$
$$= 2.95 \text{ gha}$$

$$CO_2e = \frac{(4915 * 0.008 \text{ kg of CO}_2e) * 5}{1000}$$
$$= 0.20 \text{ tonnes of CO}_2e$$

The participants of the ICG stayed at numerous accommodations throughout the city of Windsor for 5 nights. The 81 teams were dispersed between the University of Windsor Residence Halls, St. Clair College Residences, University Place and Academie Ste-Cecile. The 3,455 out of town spectators stayed at hotels around Windsor, including: Caesars Windsor, Hilton, Holiday Inn & Suites, Holiday Inn Downtown Windsor, Quality Inn & Suites, Windsor Riverside Inn and the Travelodge Hotel.\(^9\)

The Ecological Footprint of Waste and Recycling

The waste and recycling calculations were based on the reported and estimated per day averages (in kg) of the facilities used to stage the 2013 ICG. One of the major differences in this category is that the greater the amount of recycling, the less bioproductive land needed for the waste; thus, the recycling conversion factor is the only negative conversion factor in the study. Also, the conversion factors for this section were not generated from the EcoInvent Database. Given that, the researcher was not granted
access on the properties of the ICG venues during the event, it was not possible to conduct a waste audit. Instead, the findings from a document prepared by Hunter and Chance Consulting for Stewardship Ontario regarding the environmental impacts of the residential Blue Box program was used to develop these conversion factors. One of the products of this document was the Steward Edge emissions calculator. This emissions calculator provided average emissions output across Ontario waste mix, as well as, the average savings across all blue box materials. For privacy reasons, the researcher was not granted access to this document, sacrificing the transparency of data for accuracy of the results. This material breakdown of waste and recyclables was then applied to the average weight of waste and recyclables generated from the 9 facilities.

![Average Waste/Recylables Per Day](image)

**Figure 4.10:** ICG Facility Waste and Recyclables
* Reported data
** Estimate not based on size

It was estimated that a total of 5,159.0kg of waste and 3,469.4kg of recyclables were generated by the 9 facilities throughout the 5-day event (see Figure 4.10). Since the conversion factors for this category were expressed on a per month basis, the waste and
recyclables were multiplied by 30 days and the results were divided by 6 to represent the length of the event. The formula to calculate the EF and CO$_2$e for this category was:

$$EF = \frac{(0.0000017 \text{gha} \times (1031.80 \text{kg} \times 30)) + (-0.0000012 \text{gha} \times (693.88 \text{kg} \times 30))}{6} = 0.0046 \text{gha}$$

$$CO_2e = \frac{(2.9 \text{kg} \ CO_2e \times (1031.80 \text{kg} \times 30)) + (-1.9 \text{kg} \ CO_2e \times (693.88 \text{kg} \times 30))}{6} = 8369.24/1000 = 8.37 \text{ tonnes CO}_2e$$

Although the waste and recycling category only represented a minor aspect of the total carbon emission attributed to the 2013 ICG, it is evident that recycling has a material impact in minimizing the carbon emission attributed to the event, saving 6.59 tonnes of CO$_2$e. This positive outcome of the ICG is increased when considering the regional impact of event.

**The Regional Ecological Footprint of the ICG**

Since the main purpose of this study was to examine the environmental impact of the ICG on the Windsor-Essex region, the regional impact of the ICG must be observed. This includes every dataset used previously in this chapter and all travel except for the bus loop system. The regional EF of the ICG was 297.02 gha, but to fully comprehend the additional impact of the ICG on the city of Windsor, it must be compared to a ‘business as usual’ scenario. This scenario includes consumption categories from the event that would have occurred regardless of whether or not the city of Windsor staged the ICG.
The regional difference in the EF of the ICG was a 52.90 gha, thus an increase of 21.67% (see Figure 4.11). Although this may seem like a small increase, it does not take into account any form of regional car travel because a sufficient estimation for that impact could not be developed. The inability to include car travel is even more evident when considering the difference in carbon emissions.

**Figure 4.11:** The Regional EF Increase due to the ICG

**Figure 4.12:** The Regional CO$_2$e Increase in Windsor due to the ICG
The difference in carbon emission output between the two scenarios saw an increase of 15.41 tonnes of CO₂e or 11.0% (see Figure 4.12). When considering that recycling saved 6.59 tonnes of CO₂e throughout the event, the overall regional CO₂e could have been 4.72% higher. The regional impact of the 2013 ICG was not as high as expected for both the EF and CO₂e, but cannot be the only factor when considering the ES of the event. The next chapter aims to put the ES of the 2013 ICG into perspective through comparisons with other studies, thus providing a more complete analysis.

**Summary of Results**

The main goals of this chapter were to present the results of this study in an organized manner, the data used to develop these results and how the data was obtained or estimated. Based on the data collected and implementation of the Ecological Footprint calculator, created by the collaboration of the researcher and Hunter and Chance Consulting, the environmental impact of the 2013 ICG was analyzed. The 6 consumption categories of the event taken into account for this study were: transportation, facility, facility operations, food and drink, participant travel and accommodation.

Transportation had by far the greatest contribution to the EF of the event at 515.73gha (63.47%). This was mainly due to the ICG being an international sport event and the substantial environmental costs associated with air travel. The facility consumption category represented the built environment required to stage the event. This component had a minor impact on the event generating an EF of only 3.86gha (0.48%). The facility operations category was based on the energy requirements of the facilities used to stage the ICG. This had the second highest EF at 240.26gha (29.57%). The Food and drink consumption category was calculated from the menu and order sheets obtained
from the University of Windsor Food Services. This was the third largest contributor to the EF of the ICG at 49.73gtha (6.12%). Due to the high amount of recyclables produced from the event, the waste and recycling consumption category had an extremely minuscule EF at 0.0046gtha (0.00%). Finally, the accommodation component of the event also had a minimal impact on the overall event at 2.95gtha (0.36%). This was calculated based on the reported average stay of the 5 nights attributed to the 4,915 event participants.
Endnotes


2 Since the data provided represented 860 of the athletes and team officials, dividing the EF the consumption category by 58.9% (860/1460=0.589) provides the total EF for the 1460-team members. This calculation can also be represented as follows:
EF (per participant) = 29.29 gha/860 = 0.034 gha/per participant
EF = 0.034 gha * 1460 participants = 49.73 gha


4 The EF calculator created for this study can also provide conversion factors for chocolate bars, candy and water. Since there was not data present for these categories, they were not included in this particular study.

5 For the meat products subcategory, 50g represented the average for all the products taken into account.

6 For the meat products subcategory, 40g/serving represented the average for all the products taken into account.


8 This assumption is analyzed in the discussion section based on comparisons between the ICG and other similar studies.

Chapter 5

Discussion

The primary objective of this study was to calculate the Ecological Footprint of the 2013 International Children’s Games. Furthermore, it was to identify and provide an EF for each consumption category of the event: travel; accommodation; food and drink consumption; infrastructure of the event venues; their energy requirements; and recycling and waste. These objectives were completed in the results section of this study, but further analysis of these results in comparison to other similar studies will improve the understanding of the environmental impact of the 2013 ICG and assist in developing sustainable environmental practices in the context of tourism and event management. Therefore, this chapter will compare these results to three other relevant studies and provide direction for the ICG Organization, as well as policymakers and sport event organizers in the Windsor-Essex area.¹

Results of the 2013 ICG

Although the researcher received a substantial amount of data from the event organizers of the 2013 ICG, it was evident that a number of estimations needed to be made in order to fully evaluate the EF of the event. Some of this was due to a number of event organizers not willing to participate in the study. However, much of the data necessary for the EF did not exist because event organizers had no use for the data, and simply did not collect it (e.g. waste audits). Since the researcher did not have the ability to contact the event organizers until the event began, it was likely that more complete datasets for the consumption categories could have been obtained if event organizers knew what data to collect. Furthermore, it was unfortunate that the characteristics of the
out-of-town participants could not be taken into account during the study, beyond the minimal data collected by the event organizers. A participant survey was created to understand some of the characteristics of the spectators such as: demographics; travel information; and food and drink consumption patterns. As previously noted, the researcher sought out to have at least 349 surveys completed by spectators attending the event in order to make generalizations for all event participants. Despite significant effort, and representation outside each venue, only 49 respondents completed the survey. This was, in part, due to the researcher’s inability to secure access to the venues throughout the event. Therefore, given the low number of respondents, the completed event participant surveys could not be used in this study as it would not have been possible to generalize to the responses across all of the spectators.

The remaining data generated through surveys and discussion with various members of the organizing committee of the 2013 ICG, as well as employees at a number of the venues, showed that small-scale events have an environmental impact that can be managed properly by organizers of event. The event organizers have the ability to control the EF of a number of the consumption categories such as: transportation of the event participants while in Windsor; food and drink consumption; and proper waste management. In order to produce a lower EF for future events, organizers need to dedicate time and financial resources to reduce the overall EF of their event. Decreasing the EF of future sport events is discussed in much greater detail later in this section.

Comparison of Results to Other Ecological Footprints

In order to fully comprehend the EF results of the 2013 ICG, it is important to understand how they relate to the results conducted by other relevant studies. Three
previous studies were chosen to draw comparisons to the ICG. First, the EF of Ontario residents conducted by Stechbart and Wilson (2010) study was chosen to understand how the EF of event participants compares with those who live in the province. Second, the EF of backpackers across Ontario and Quebec study conducted by Purvis (2008) was chosen to understand how the consumption patterns of tourists travelling for sport and leisure activities compare. Finally, the EF results from a major-sporting event conducted by Collins and Flynn (2005) was chosen to understand how they compare to the results generated from the ICG.

**Ontario Resident Study**

Stechbart and Wilson (2010) estimated the household consumption EF for Ontario residents through the implementation of the CLUM process developed by the Global Footprint Network. The resulting Ontario CLUM utilized: EF data from the 2008 Global Footprint Network National Footprint Accounts; economic information from the 2003 Canadian input-output table and the 2005 Ontario input-output table published by Statistics Canada; and CO₂ emissions data from the International Energy Agency.² These data sources allow “Ontario-specific final demand data (in terms of consumer spending in each industry) to allocate the Footprint of each industry appropriately.”³ The average annual total household consumption for Ontario residents was 7.59 gha/person (see Appendix XV for breakdown). A total of 12 household consumption categories were used in the Ontario CLUM. These categories were each based on the United Nations Classification of Individual Consumption According to Purpose (COICOP) system.⁴

Since the consumption categories used for the 2013 ICG are not directly comparable with the COICOP due to the differences in time and spatial scales and a more
intricate COICOP system, a scenario was created to help compare these two studies. The study population taken into consideration for the ICG was comprised of 4,915 athletes, delegates and out of town spectators; therefore, a study population of 4,915 Ontario residents is used in this scenario. The time period for which the EF is estimated in this scenario is one day. Four of the six consumption categories from the ICG study were included; the facility operations and waste and recycling categories were not included because the Ontario CLUM does not incorporate these or any related consumption categories. The suitable Ontario CLUM categories and subcategories, along with their associated EF, were chosen based on their descriptions provided by the United Nations Statistics Division. It must be noted that since the EF conversion factors for the Ontario residents were calculated based on consumer spending in each industry, a positive correlation exists between the size of the study population and the EF of recreational services. Furthermore, the city of Windsor has the 10th highest population (210,891 people) and 11th highest population density per square kilometre for a city or town in Ontario, which represents almost the exact demographic for the average Ontario resident consumption expenditures.

![Figure 5.1: ICG EF in Comparison to 2010 Ontario Residents Average](image)

* Population of 1460 people for both studies.
** Consumption categories and subcategories used for Ontario Residents are highlighted in Appendix XV.

As shown in Figure 5.1, the greatest contributor to the difference in EF’s is the transportation consumption category. This difference is mainly attributed to the immense distances travelled through air transportation by the ICG participants, while car travel was by far the most used mode of transportation for Ontario residents. Even though ICG participants travelled from various cities throughout the world to partake in the event, their EF was only 5.5 times greater than Ontario residents. A greater difference was expected for this consumption category; however, two factors may have influenced this outcome. First, the loop bus system implemented for the ICG may have played a significant role in reducing the EF for this category, especially when considering it’s regional impact. The overall positive influence this may have had will be speculated later in this chapter. Second, transportation while in Windsor beyond the loop bus system was not included in the study because of the researcher’s inability to determine proper estimations for car travel from the lack of data available.

The ICG food and drink consumption average was also larger than Ontario residents. The ICG participants had a higher EF by 1.03 gha/day in comparison to the Ontario residents; however, the ICG result only accounted for eight meals over the five-day period, while the Ontario residents EF accounted for 15 meals over the same time period. Unfortunately, comparisons between the types of food and drink consumed between the two groups could not be made, as the Ontario Resident’s EF does not breakdown the food and drink into subcategories.

The two other consumption categories being compared both showed a greater EF for Ontario residents. This most likely was due to the description of what was being
calculated for these consumption categories in both studies. The facility category in the ICG study used the type and size of each facility to determine the conversion factors for both the EF and carbon emissions; therefore, an increase in population size would not affect the EF of this category from this perspective (if the scenario was based on a per person EF, it would actually decrease as the population increased). The consumption subcategory used in this scenario for Ontario residents was the recreational services EF conversion factor. This subcategory includes services provided by various types of sport and leisure facilities such as: skating rinks; golf courses; and swimming pools. Since the EF conversion factor was derived based on consumer spending in these types of facilities, the population size was the main factor for Ontario residents having almost twice the EF in comparison to the ICG participants in this scenario. Nevertheless, this shows that the ICG participants used far fewer facilities to stage the event than are accessible to the average Ontario resident. Assuming that residents from the city of Windsor have a similar EF for this category compared to Ontario residents, the comparison of these two EF results show that the city of Windsor has the infrastructure to host sport events like the ICG.

Accommodation service was the final consumption category compared between the two studies with Ontario residents producing an EF 10 times greater than the ICG participants. However, the conversion factor for Ontario residents included both accommodation and restaurant services taking into account both consumer expenditures at restaurants and hotels. The ICG study only takes into account the accommodation services provided to teams and out of town spectators. Although a large portion of these participants consumed food and beverages at restaurants throughout the city of Windsor,
this data was not collected or estimated for two reasons; it was not a direct impact of the ICG and sufficient data estimated could not be determined. Furthermore, it is suspected that restaurant services were a greater contributor than accommodation services to the EF conversion factor for Ontario residents due to the greater likelihood an average resident would spend more money at restaurants throughout the year. Since it is unclear how much of an impact accommodation services had on the EF for Ontario residents, and restaurant services was not a consumption category included in the ICG study, conclusions for the accommodation services provided to ICG participants cannot be made through this comparison. Based on this comparison, the Windsor-Essex region has more than enough resources to support the participants of an event like the ICG. Finally, the Ontario resident EF study supports the notion that the city of Windsor has the infrastructural capabilities in terms of sport venues to host and a bus transit system to transport the people involved with an event of this size.

Purvis (2008) conducted a study that estimated the EF of 123 backpackers staying at various hostels throughout Ontario and Quebec. This study used the Household EF Calculator version 3.2, developed by Redefining Progress in 2003. Since this EF calculator was produced prior to creation of the CLUM, the compound approach was used to measure five consumption categories for the backpacker tourists: transportation; accommodation; activity; food; and waste.

The study found that the EF of this particular population had an overall average of 0.038 gha/day. In comparison, the ICG participants were found to have a very similar, but slightly smaller, EF of 0.033 gha/day (812.53 gha/4915 participants/5 days). The average
overall breakdown for each consumption category for the backpackers was:

transportation having the greatest impact at 81.05%, accommodation accounting for 5.26%, food and drink for 9.47%, activities for 5.26% and waste representing 5.26%.9

This overall breakdown was also similar to the ICG participants if one only considers the comparable consumption categories, thus eliminating facility and facility operations from the ICG study and activities from the backpacker study (see Figure 5.2).

![EF Percentage Breakdown](image)

**Figure 5.2**: EF Percentage Breakdown for ICG Participants and Backpackers

The backpacker tourists represented 24 different countries, which rationalizes why transportation, specifically air travel, had such a dominant EF for this study as well.10 The increase in the number of different countries represented by the ICG participants may have been the influencing factor that lead to the ICG participants having a greater EF for this consumption category. The backpacker tourists had a greater EF on average per person for the three remaining consumption categories. Since food and drink was provided to the teams participating in the ICG, their meals were prepared in bulk and choices were limited to what was available. Despite being on a limited budget, this was different for the backpackers as they had the ability to consume whatever they chose. The much wider variety of food choices for the backpackers is most likely the greatest
influence on the EF increase for this group. The accommodation category increase for backpackers is largely attributed to the backpacker hostels supporting a much smaller number of guests than the average sized American and European hotel stay that was used for the EF conversion factor in the ICG study. Since the hostels support a smaller number of guests, the space and energy use is likely increased on a per person basis when compared to hotel guests at an average sized hotel.\textsuperscript{11} Finally, the difference in waste footprints is due to the fact that the recyclables in the ICG study had a positive environmental impact; the greater the amount of waste recycled, the less of an EF attributed to waste. The backpacker study only accounted for waste in the calculation and did not include the negative correlation associated with recyclables and their environmental impacts.

\textit{FA Cup Final Study}

As previously mentioned in the literature review, Collins and Flynn (2008) estimated the EF of the 2004 FA Cup Final. When comparing the other EF studies to the ICG, two important considerations must be taken into account: the perspective of both studies and the host cities for the sport events (see Table 5.3 for comparison of results). Although both measured the environmental impact of a sport event on a host city, the FA Cup Final study was not only a much larger event, but also focused on the environmental impacts generated by visitor consumption patterns. Since the ICG study’s objective was to account for the natural resources necessary to host the event, facilities and their energy requirements were an integral component of the EF, along with the visitor consumption patterns. Furthermore, the ICG study mainly focused on environmental impacts that were directly attributable to the event; while the FA Cup Final EF was largely determined by
secondary impacts. Specifically, the food and drink consumption by visitors at restaurants outside of the event was a much larger contributor to the total EF when compared to any secondary impact in the ICG study. Second, as illustrated in Tables 5.1 and 5.2, the host cities were located in countries with very different populations, biocapacities and consumption patterns. Since the origin of subnational EF calculators were based on national biocapacity and consumption patterns, differences exist between regional EF calculators. In other words, a sporting event hosted in one city would produce a different EF than the exact same event being hosted in another city in a different country.

Therefore, it is important to understand that the differences between the FA Cup Final and ICG EF results were attributed to both the consumption patterns of the visitors, as well as, the different biocapacities of the countries hosting each event.

<table>
<thead>
<tr>
<th>Ecological Footprint of Consumption (g/h/cap)</th>
<th>Cropland Footprint</th>
<th>Grazing Footprint</th>
<th>Forest Footprint</th>
<th>Fishing Ground Footprint</th>
<th>Carbon Footprint</th>
<th>Built-up Land</th>
<th>Ecological (Deficit) or Reserve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>7.0</td>
<td>0.95</td>
<td>0.26</td>
<td>1.59</td>
<td>0.12</td>
<td>4.03</td>
<td>0.05</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>4.9</td>
<td>0.87</td>
<td>0.27</td>
<td>0.61</td>
<td>0.13</td>
<td>2.87</td>
<td>0.15</td>
</tr>
</tbody>
</table>

**Table 5.1:** Comparison of EF between UK and Canada (2010)  

<table>
<thead>
<tr>
<th>Population (million)</th>
<th>Total Biocapacity (g/h/cap)</th>
<th>Cropland</th>
<th>Grazing Land</th>
<th>Forest</th>
<th>Fishing Ground</th>
<th>Built Land</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>32.9</td>
<td>14.9</td>
<td>2.61</td>
<td>0.24</td>
<td>8.43</td>
<td>3.59</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>61.1</td>
<td>1.3</td>
<td>0.49</td>
<td>0.10</td>
<td>0.11</td>
<td>0.50</td>
</tr>
</tbody>
</table>

**Table 5.2:** Comparison of Biocapacity Between UK and Canada (2010)  

Even though the two sport events took place in different countries, the characteristics of each event were very diverse. The 2013 ICG was a mid-sized sport
event that took place in a city with a moderate population (210,891) and land area (146.32 \text{ km}^2); while the 2004 FA Cup Final was a major sporting event held in a city with a similar land size area (140.4 \text{ km}^2), but larger population (346,100).^{12} Although the FA Cup Final was a much larger event, attracting approximately 73,000 visitors to the city to the ICG’s 4,915 visitors, the overall EF comparison was much closer than one would expect between a small-scale and major sport event. This can be attributed to the fact that the ICG took place over a five-day period, while the FA Cup Final lasted only one day.\(^{13}\)

<table>
<thead>
<tr>
<th>Event</th>
<th>2013 ICG</th>
<th>2004 FA Cup Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Visitors</td>
<td>4,915</td>
<td>73,000</td>
</tr>
<tr>
<td>Number of Days</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Total EF</td>
<td>812.53 gha (162.51 gha/day)</td>
<td>3083 gha</td>
</tr>
<tr>
<td>EF Per Visitor*</td>
<td>0.033 gha/day</td>
<td>0.0422 gha/day</td>
</tr>
<tr>
<td>Food and Drink</td>
<td>9.946 gha/day (0.0068 gha/visitor/day)</td>
<td>1413 gha/day (0.0194 gha/visitor)</td>
</tr>
<tr>
<td>Transportation</td>
<td>103.15 gha/day (0.021 gha/visitor/day)</td>
<td>1670 gha/day (0.0229 gha/visitor)</td>
</tr>
</tbody>
</table>

Table 5.3: Event Characteristics Comparison
* Accommodation, Waste and Facility data was not included in the comparison

Only the food and drink consumption category and transportation category were compared between the events. Similar to the ICG, the meat products subcategory for the FA Cup Final was the main contributor to the food and drink consumption category at 46.3\% (612 gha).\(^{14}\) The reason it was not as prevalent in comparison to the meat products consumed by the ICG participants was because of alcohol consumption, which contributed 35.5\% (502 gha) to the total EF for this category.\(^{15}\) Since alcohol was not sold at the ICG venues, this was a major factor in the difference between average visitor food and drink consumption patterns. Furthermore, another factor that may have contributed to the large difference was the restaurant service aspect. This allowed FA
Cup Final visitors to have more food choices than the ICG teams, which would likely increase their food and drink impact.

The transportation consumption categories were quite similar on a daily average basis; however, two consideration need to be made. First, this was calculated based on a daily average, which lowered the average for ICG visitors. Second, the FA Cup Final included travel to Cardiff, Wales, UK, as well as the return trip.\textsuperscript{16} This approach was avoided in the ICG because it would consist of simply duplicating existing data. The FA Cup Final visitor’s transportation was dominated by car travel at 68.2%. A total of 43,000,000-passenger km were attributed to the 73,000 visitors.\textsuperscript{17} The average car trip to and from Cardiff was approximately 589 km. If one takes into consideration that the travel data for the FA Cup Final took into account both transportation to and from Cardiff, the ICG visitors realistically had an average transportation consumption almost twice the amount of the FA Cup Final. The reason for this higher average was due to air travel being a less sustainable method of transportation and average trips for ICG visitors were longer in length on average in comparison.

The accommodation category was not included in the comparison because the FA Cup Final took place within a one-day period and this accommodation was not included in the study, even though a large proportion of the visitors most likely stayed in Cardiff for longer than one day. The waste categories could not be compared because the regional environmental impact of waste from the ICG was mostly accounted for in the carbon emission component of the calculator, measured in CO\textsubscript{2}e, while the FA Cup Final’s waste impact was measured in global hectares. Finally, as previously mentioned, the infrastructure component was not a major factor in the FA Cup Final study because
the EF attributed to this category was based on the temporal length and number of
visitors attending the event and its impact on the overall lifespan of the facility.\textsuperscript{18}

\textbf{Summary of Comparisons}

Valuable information was gained that would both support and discourage the city
of Windsor from hosting future small to mid-sized sport events through the comparative
analysis between the ICG EF and three other EF studies. First, the ICG teams consumed a
higher volume of food and beverages than the average Ontario resident. While there is no
doubt that there are more than enough resources in Windsor to support the participants of
an event similar to that of the ICG, the financial burden of providing food and drinks to
these athletes and delegates may not be worthwhile for the city in future events.
Conversely, the Ontario resident EF study supports the notion that the city of Windsor
has the infrastructural capabilities in terms of sport venues to host and a bus transit
system to transport the people involved with an event of this size.

The comparison between ICG participants to the backpacker tourists investigated
by Purvis (2008) provided two facts: the average footprint of an ICG participant was
0.005 gha/day lower than the average backpacker; and the breakdown of comparable
consumption categories were very similar between the two studies. This was due to the
greater average food and drink, accommodation and waste EF for the backpackers. It is
suspected that the collaborated effort by the ICG Organizing Committee to provide the
food and drinks for the teams was the main reason for this smaller average EF. The
backpacker tourists had individual choice, which led to a larger footprint for the food and
drink consumption category.
The number of days required to stage the sporting event has a major role in determining the overall EF. Although the 2013 ICG was a much smaller event compared to the FA Cup Final, the overall EF difference was much closer than expected. This can easily be overlooked when analyzing the ES of events, as the impact of the size of an event is much more visible than the impact of time period. Finally, the fact that transportation was the greatest consumption category for the ICG, FA Cup Final and backpacker tourist’s EF and the second greatest for Ontario residents, shows that a concerted effort should be placed on minimizing the transportation environmental impacts of future sport events.

**Decreasing the Ecological Footprint of Future Sport Events**

Determining the categories of consumption allow one to recognize the aspects of a sporting event that contribute most to the environmental impact of the event. Those consumption categories can then be targeted to develop plans to minimize their impact. However, implementing a plan that would substantially decrease the EF of an event is highly unlikely due to the fact that the greatest consumption categories in this study are coincidentally the most difficult to reduce. The following section will discuss how each consumption category identified in this study can be reduced, if at all, in order to help guide future organizing committees in reducing their regional and global EF.

**Reducing the Environmental Impact of Transportation**

*Transportation to Windsor: Air Travel*

The transportation consumption category took into consideration both travel to the city of Windsor and travel while in Windsor. The main reason transportation was the greatest contributor to the EF in this study was due to the immense air travel kilometres
required for teams to reach Windsor. Although many of the teams and spectators travelled to Windsor by personal motor vehicle, this section focuses on air travel because it was by far the most dominant mode of transportation to the host city. When considering initiatives to reduce the impact of air travel, one must take into account three different perspectives: the Windsor-Essex Organizing Committee; the ICG Organization itself; and individuals who travel for the purpose of either participating or spectating the event (traveller’s guardian in the case of the ICG). This section will provide input on how these three groups can lower their environmental impacts regarding air travel for future sport events.

Unfortunately, there was very limited opportunity for Windsor-Essex to reduce the environmental impact of air travel for the 2013 ICG. As a host city the primary objective for the organizing committee is to successfully stage the event, therefore, the responsibilities of the host city are limited to the region in which the event will take place. The burden of travel to the host city and strategies to reduce the environmental impact associated with travel is placed on the teams themselves in this case, as well as the ICG Organization for choosing the host city. However, Windsor-Essex must recognize that one of the advantages of hosting small-scale sport events is that they should produce a lower environmental impact in comparison to larger events because a majority of the participants are local and regional (within a four hour drive). The primary issue with hosting the ICG is that the international characteristic of the event draws participants from all around the world, which requires travel by air to the host city. Since participants of the ICG are between 12 to 16 years of age, parents and guardians are much more likely to travel great distances as spectators to support them; thus, increasing the amount of air
travel that is uncharacteristic of small scale events.\textsuperscript{20} In order to reduce the EF of future sport events hosted in the city, Windsor-Essex should consider targeting small-scale sport events that draw regional participants to the city of Windsor. This would eliminate the need for air travel and would have a significant impact on minimizing the EF of future events. There are also a number of advantages with this tactic when considering the holistic definition of sustainability, which will be discussed in the section concerning the future direction for Windsor-Essex.

When considering strategies to lower the EF of air travel from the ICG’s perspective, one must recognize that the ICG simply cannot exist without the extensive use of air travel. The event itself has become increasingly global ever since the first ICG was held in 1968 in Celje, Slovenia. Developing into a truly global event was a fundamental principle of the ICG from its conception. Professor Metod Klemenc, the founder of the ICG, stated,

“This childhood suffered from the 2\textsuperscript{nd} World War. It destroyed my family. I – within my possibilities – wanted to create a better world based on friendship, sport seemed to be one of the best means to bring together young people from different countries.”\textsuperscript{21}

There are two strategies that would directly reduce the impact of air travel for future ICG events: central host city locations and the purchase of carbon offsets. First, the ICG Organization must consider the location of potential host cities in relation to the cities where teams are located. The host city that would produce the least amount of air travel needed for teams to reach the event needs to be a major factor considered for the selection process of future ICG events. The teams that took part in the 2013 ICG flew almost 500,000 km to reach Windsor, which is an underestimate as it is based on the fact that this study had to assume that all flights were direct. In comparison, the 48\textsuperscript{th} ICG will
be held in Lake Macquarie, Australia and the air travel associated with this event will undoubtably be much greater than the 2013 ICG and most likely any other previous ICG event.

The second strategy that the ICG Organization should consider is purchasing carbon credits to offset the emissions associated with air travel to ICG events. Carbon offsets take a market-based approach to reducing the carbon footprint of an individual, business or organization. They are simply credits purchased in a voluntary market that fund reductions made at another location.\textsuperscript{22} For the most part, carbon credits support renewable energy, forestation, energy efficiency and methane capture projects.\textsuperscript{23} There are approximately 140 offset vendors in the voluntary carbon market and using standards, such as The Gold Standard, to choose an offset program to fund is extremely important in ensuring that the buyer is purchasing a high-quality offset.\textsuperscript{24} A carbon credit is typically measured in tonnes of CO\textsubscript{2} equivalents and many companies and organizations run carbon credit programs.\textsuperscript{25} Even some major sporting events have already purchased carbon offsets: the Super Bowl; FIFA World Cup; and the Olympic Games.\textsuperscript{26} There is no standard price for carbon offsets, but in 2007 the average was approximately $25 (USD) per tonne of CO\textsubscript{2}.\textsuperscript{27} This study estimated that 200 tonnes of CO\textsubscript{2} emissions were produced from air travel to the city of Windsor; therefore, carbon offsets for air travel to Windsor for the 2013 ICG would have cost approximately $5,000 (USD).

The travellers themselves also have a responsibility of reducing their individual environmental impact, especially when flying. The David Suzuki Foundation highlighted five air travel strategies to reduce a traveller’s environmental impact:

- Fly the most direct route possible, since takeoffs and landings use the most fuel;
• Fly during the daytime, because studies have shown that flights taken at night have a greater impact on the climate;
• Fly economy, because more people per plane means fewer emissions per person;
• Pack light, because lighter planes mean less fuel is burned;
• Purchase carbon offsets to account for the emissions from your flight.\textsuperscript{28}

Flying the most direct route possible may be more expensive in comparison to connections, but they are more costly with respect to time and environmental impacts. Takeoffs and landings use more fuel and according to Prairie (2010), “one connection on a 2000-mile flight increases carbon emissions by 10% or more – and that’s assuming the stop is directly on route.”\textsuperscript{29} Daytime flights are more sustainable than flying at night because the carbon emissions produced by contrails formed by the jet emissions are partially offset during the day since they also reflect sunlight. Obviously, at night there is no sunlight to reflect to partially reduce the carbon emissions produced from the contrails.\textsuperscript{30} Packing lighter and flying economy are strategies that both minimize the environmental impact of flying and can save the traveller money. Higher-class seats can take up to twice as much space as economy class seats, doubling the environmental impact on a per person basis. Packing lighter may not seem like an effective strategy to reducing the environmental impact of air travel, but if every passenger on a United States domestic flight packed five pounds less, over a year it would save 64 million gallons of jet fuel.\textsuperscript{31} Finally, travellers can also purchase carbon credits to offset aircraft emissions. Although there is no standard cost for the purchase of a carbon credit, organizations such as Carbon Planet offer a flight calculator to determine flight offset costs. For example, a flight from Los Angeles to Windsor is approximately 3,200 km and produces 0.7 tonnes of CO\textsubscript{2} emissions per person if flying economy class. If an ICG team member from the city of Los Angeles wanted to offset their carbon emissions through the purchase of a
carbon credit to Carbon Planet, the flight would cost an extra $16.10 (USD). Although the strategies listed for travellers would not have had any direct impact on the EF of the ICG in this study, they are habits that all air travellers should develop in order to make air travel as environmentally sustainable as possible.

*Transportation While in Windsor: Car and Bus Travel*

Participants and spectators of future sport events hosted in the city of Windsor will continue to predominately travel to the city by personal motor vehicle, unless it is an international event. Promoting environmentally sustainable initiatives for car travel, such as carpooling and the use of fuel-efficient cars, are obvious strategies that go beyond this study. The goal of this section is to give some direction to improve the use of Windsor Transit for future sport events and hopefully encourage more participants and spectators of events this size to use public transit instead of their personal motor vehicle throughout their stay in Windsor.

The data used to estimate the EF of bus travel for the 2013 ICG was based on the distances travelled by the two bus loop systems developed for the event and bus travel to and from airports. With that said, Transit Windsor provided more bus services that could not be included in the EF calculation because it was not possible to collect the associated data, including: transportation to social events (Riverfront Plaza Cultural Event and the Opening and Closing Ceremonies) and some of the sport venues for specific competition times. Through informal dialogue with the Operations Director from Transit Windsor, some of the issues associated with the bus transportation services were discussed. It was no coincidence that the majority of the problems concerning the transportation of teams and spectators were based on the fact that transportation was the last planned aspect of
the event. It was clear that the bus transportation services provided were a reactive aspect of the event rather than a planned and executed aspect. This was evident in the Transit Windsor Report made to its Board of Directors, which stated,

“No matter what degree of planning and organizing takes place, when it comes to operations, being prepared to adjust plans is necessary and requires continued review of schedules and the ability to adjust.”

The transportation plan could not be completed until every event scheduled for the ICG was finalized. The schedule of events for the 2013 ICG was finalized much later than anticipated due to difficulties associated with some of the international teams visas. This shortage of time led to a lack of communication between sport venues regarding the competition schedule, which minimized the effectiveness of the loop bus system and led to more direct service bus travel than necessary. The Transit Windsor Report also confirmed this stating,

“Each sporting venue had different finish times and better communication of the expected finish times may have reduced costs by understanding the anticipated finish times. For example, fewer buses could have been used because some finished at 2 p.m., some at 3 p.m., and some at 4 p.m., and buses could have completed return trips from multiple venues.”

An example of this issue was the competition schedules for the gymnastics and soccer events. Both of these venues were located within close proximity of each other on the East side of Windsor (see Appendix XII). However, when comparing the schedules for both events, it was clear that the teams had to be transported at different times throughout the days of the event. In order to save financial and environmental costs associated with the transportation of athletes within the city, future sport event organizers need to finalize the schedule of events with sufficient time to allow for better communication between the different parties associated with staging the event.
Another prominent issue regarding the bus transportation services provided by Transit Windsor was the lack of visitor bus passes sold. The ICG Status Report published by the Office of the City Treasurer in the Finance Department stated that visitor bus passes were available for spectators and provided them with the same transportation services as the teams throughout the event for only $20 (CDN) per pass. However, the researcher was informed by the Transit Windsor Director of Operations that of the 3,455 out of town visitors who spectated the event, approximately 100 purchased a bus pass (or 2.9%). The low number of spectators who took advantage of the public transit system means that many relied on their own personal vehicle to travel throughout the city.

Implementing a public transportation plan was a great decision by the ICG Organizers as it promotes the use of public transportation, minimizes the EF and carbon emissions of the event by limiting the need for personal vehicle use, provides an opportunity for visitors to explore the city of Windsor beyond the event, and allows for profit to be made from the purchase of visitor passes. In order to take better advantage of these benefits, a few strategies will help future event organizers increase this number for future small-scale sport events in Windsor. First, event organizers must advertise the opportunity for visitors to purchase a bus pass more efficiently. There was no indication of the availability of the visitor bus passes on the social media pages created for the 2013 ICG and the website created for the event. Second, the bus loop system only made stops at the venues staging the sport competitions and a number of hotels. With the average out of town spectator staying in Windsor on average for five nights, the loop bus system should allow the opportunity for visitors to explore the city beyond the event. This would not only increase the overall experience for future visitors, but also allow the opportunity for
them to spend money at local businesses. This would obviously increase the need for bus transportation services, but if a more efficient loop bus system is achieved, the increased EF would be offset and a more worthwhile experience could be provided to the participants and spectators of future sport events. Furthermore, if the loop bus system presents an opportunity for spectators and participants to explore the Windsor-Essex region beyond the event, these visitors would not have to rely on their personal vehicles to travel outside of the event, thus reducing the EF of car travel while in Windsor. A more efficient loop bus system could be created by not only directly targeting this consumption category, but as a secondary impact of targeting other categories, such as accommodation.

**Considerations for Accommodation Services**

Since the EF associated with accommodation services proved to be a relatively minor aspect of the ICG, it would be difficult to have a direct impact on this consumption category for future events. The EF of any accommodation is calculated based on the many characteristics of the facility itself, but more importantly the built space available per person. The conversion factors used for the accommodation services provided to the teams and out of town spectators was based on average European and American hotel characteristics, including average built space. Therefore, a smaller built area provided to the participants associated with a sport event would produce a smaller the EF.

Although accommodation services are unlikely to have a smaller impact on the EF of future events, the location of the accommodations relative to each other and the event venues may prove to have a sizeable impact on the transportation category (see Appendix XII for location of St. Clair College and University of Windsor residences, as
well as numerous hotels throughout the city). The ICG teams were placed in residences around both the University of Windsor and St. Clair College, which required two loop bus systems to be created because of the distance between the two. It was unclear why the teams were placed in the two different areas and whether or not the University of Windsor had the space to accommodate all of the teams. Furthermore, the majority of the hotels where out of town visitors were accommodated were located in close proximity to the University of Windsor. Depending on the size of future events, it would be beneficial for event organizers to accommodate teams and visitors in a smaller area, most likely at or around the University of Windsor. This would eliminate the need for a second loop bus system or allow an opportunity to use a second loop bus system to travel to worthwhile sites within the city, which could benefit the economic and social impacts of future events.

**Decreasing the Environmental Impact of Food and Drink**

The food and drink consumption category had the third highest EF in this study, but this could have been much higher considering some of challenges that the Windsor-Essex Organization Committee had to overcome. They had to work within the allowed budget to supply teams with nutritious meals, while also meeting special dietary needs and restrictions due to food allergies. The fact that this was an international event made it all the more difficult due to the cultural and religious differences between the athletes, which required Windsor-Essex to serve both Kosher and Halal meals. Some of the plans carried out by the event organizers proved to lower the environmental impact of the ICG for this. The comparison between the EF’s for the 2013 ICG participants and Ontario residents showed that supplying meals led to reduced individual choices, which likely
contributed to the lower average EF for the ICG participants. In order to reduce the EF of teams for future events, organizers should also provide food services to future event participants, even if the teams are funding themselves. The reduction of individual choices, less transportation required to restaurants, and unnecessary use of restaurant services would all contribute to a lower EF and may also prove to be less expensive on average from an economic perspective, since food and drinks would be provided in bulk. Another notable strategy that unfortunately was not captured in the EF calculation due to lack of data, but greatly reduced the environmental impact of the event, was the use of water stations. Instead of providing participants and spectators with bottled water, they were given refillable water bottles and water stations were placed at every sport venue. This strategy proved to be less expensive than supplying all of the teams with bottled water and is a more environmentally sustainable practice that should be implemented for future small-scale events. Although the food services component of the event proved to be a success, there are some considerations for event organizers to take into account to reduce the EF of future events.

It was clear that meat products were the greatest contributor to the EF of the food and drink consumption category due to their high conversion factors. Meat products are much more resource intensive in comparison to other types of food, requiring on average four kilograms of grain to make one kilogram of meat.\textsuperscript{39} Future event organizers should provide a less meat-intensive based menu and focus on fueling athletes with more grain products instead. A less meat intensive menu would not only be more environmentally sustainable, but would also have a lower financial cost as well. Realistically, it is unlikely that a vegetarian diet would be provided if future event organizers had to supply
participants with food services; however, common meat products from pork and beef should be avoided, as they require high-energy inputs in order to produce (see Appendix XVI). Furthermore, event organizers should emphasize the use of local and organic food and drink products, as they both can contribute to lower environmental impacts. Local foods require less transportation, yielding a smaller EF and also have the extra value of providing local businesses with the opportunity to profit from the event as well. While, organic foods promote environmentally sustainable farming practices that have the added benefit of being more nutritionally valuable for athletes because of the lack of chemicals present in the products. These two options may be more expensive, but event organizers should consider the advantages to both for future events.

**Using Sport to Advocate Environmental Sustainability**

Since there were no major issues with waste and recycling for the event, there is not much of an opportunity to lower the EF of future events. The city of Windsor already has the necessary waste and recycling waste management programs in place required to manage a small-scale event. However, future event organizers can use sport as a platform to advocate for sustainable waste and recycling practices, especially events staged for youth participants. In 2011, The ICG was held in Lanarkshire, Scotland and the objective of the Legacy Plan for this event was, “to take responsibility for the environmental impact of the Games.” The event organizers accomplished this by first recognizing the opportunity to use the event as a platform to raise awareness amongst those participating and attending of global environmental issues. The organizers then identified and successfully completed the following five commitments:

- Avoid environmental impacts of construction by using existing buildings for Games events and living accommodation;
• Encourage teams travelling to the Games by air to reduce the climate impact of their transport emissions through recognized international carbon offsetting schemes;
• Adopt sustainable development principles in our procurement decisions for the Games by maximizing local supply of food, specifying recyclable materials, and avoiding the use of bottled water;
• Support the national drive for carbon sequestration through 12 tree planting peat bog restoration projects involving local environmental volunteers across Lanarkshire, as a specific Games legacy for the Lanarkshire Games;
• Work with cities and regions’ participating in the 2011 Children’s Games to prepare an online exhibition of environmental issues and challenges in their areas and will make this available to all via the Lanarkshire International Children’s Games website.41

Future organizing committees of the ICG and sport events held in the Windsor-Essex area should adopt a legacy plan similar to the one implemented in Lanarkshire. Educating young athletes on issues such as the importance of proper waste management, current global issues concerning the environment, and how they can lower their environmental impact, is a crucial step towards integrating ES and sport. These objectives can be accomplished by placing signs and banners at event venues and through the use of social media affiliated with the event. Also, implementing ES projects that have a positive impact on the community would ensure the positive legacy of future events. As indicated in the literature review, there is currently a large disconnect between sport and its impact on the natural environment and educating young athletes is an important step to help bridging this gap.

The Future of Sport Facilities in Canada

The strategies mentioned for the previous consumption categories were made from a short-term, event specific perspective. However, the discussion of considerations for sport facilities themselves must be more general for three reasons: so that it can be
applicable to all types of sport facilities; environmental issues concerning sport facilities will require a national collaborative effort within the industry; and it will require more time to overcome these issues in comparison to the other consumption categories. This section focuses on the first goal supported by Mallen and Chard (2012) regarding the need for an ES strategy plan for Canadian sport facilities, which states:

1) That Canadian sport facilities become “world leader(s) in innovative ways of living sustainably and protecting the environment.”

This goal was based on the National Sustainable Development Strategy for Canada created by Gunton and Joseph (2007) and adapted to apply to sport facilities in Canada. It focused on setting measurable targets for Canadian sport facilities concerning:

A. Efficient and effective use of energy and resources;
B. Modifying production and consumption patterns to mimic nature’s closed loop cycles;
C. Becoming a leader of the global clean energy revolution, while reducing fossil fuel production, use, and export and harnessing low-impact energy sources;
D. Becoming a world leader in air quality by reducing air pollution;
E. Protecting and restoring the quantity and quality of fresh water in Canadian ecosystems; and
F. Conserving, protecting and restoring the health and diversity of its ecosystems.

A number of measurable targets were suggested for each of these areas that were also established in Gunton and Joseph’s National Sustainable Development Strategy (see Table 5.4). The targets associated with each of these sustainable issues were to be accomplished within short- (one to three years), medium- (five to ten years) and long-term (25 years) timeframes.
<table>
<thead>
<tr>
<th>Goal</th>
<th>Short-Term Targets (1-3 years)</th>
<th>Medium-Term Targets (5-10 years)</th>
<th>Long-Term Targets (25 years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Energy use reduction of 10%.</td>
<td>Energy use reduction of 30%.</td>
<td>Energy use reduction of 50%.</td>
</tr>
<tr>
<td>B</td>
<td>10% reduction in materials use, 20% reduction in toxic substances, 100% reduction in primary sewage treatment.</td>
<td>20% reduction in materials use, 50% reduction in general waste, 100% tertiary sewage treatment, and a 60% reduction in toxic substance use.</td>
<td>A further 30% reduction in materials use.</td>
</tr>
<tr>
<td>C</td>
<td>10% reduction in transit energy use and a 10% increase in renewable energy use.</td>
<td>25% reduction in transit energy use and 25% increase in the use of renewable energy for electricity.</td>
<td>50% reduction in transit energy use and a 50% increase in the use of renewable energy.</td>
</tr>
<tr>
<td>D</td>
<td>30% reduction in nitrogen emissions and a 15% reduction in greenhouse gas emissions.</td>
<td>80% reduction in nitrogen emissions and a 30% reduction in greenhouse gas emissions.</td>
<td>50% reduction in greenhouse gas emissions and a 75% reduction in sulphur emissions.</td>
</tr>
<tr>
<td>E</td>
<td>10% reduction of water use.</td>
<td>30% reduction of water use.</td>
<td>50% reduction of water use.</td>
</tr>
<tr>
<td>F</td>
<td>30% improvement in the land base.</td>
<td>100% improvement in the land base.</td>
<td></td>
</tr>
</tbody>
</table>

Table 5.4: Sustainability Targets for Canadian Sport Facilities

The ambitious targets for Canadian sport facilities called for by Mallen and Chard (2012) will require a number of changes and improvements if they are to be attained. A collaborative effort within sport facilities and between all sport facilities in Windsor and all of Canada needs to be achieved for these targets to become a realistic possibility. Sport facility managers need to establish ES as a primary vision for their facility and need to train and educate employees on how they can help achieve these goals. In order to develop a collaborative effort between sport facilities, Mallen and Chard (2012) proposed that a Canadian sport facility advisory council be created to govern and provide leadership to help all sport facilities achieve ES. The primary role of this council would be to provide the communication of ES strategies in the form of day-to-day operations for
Canadian sport facilities. The council could also create a standard for sport facility managers concerning their progress monitoring and provide education in ES areas, such as: carbon offsets and Green Chemistry. The researcher of this study agrees with the targets called for by Mallen and Chard (2012) with respect to sport facilities located in Windsor- Essex and also believes that an advisory council is needed for the environmental targets to be achieved by sport facilities in their respected timeframes.

**Reducing the Environmental Impacts of Consumption Categories**

The goal of this section was to target the specific consumption categories of the 2013 ICG and discuss how future sport events in Windsor and future ICG events could reduce their EF in these areas. For example, developing a more efficient bus loop system may reduce the kilometres travelled by bus for an event, which would have a direct impact on the EF. Conversely, a number of the strategies provided might not have a direct impact on the EF of future events because it would not be possible for the EF calculator created for this study to take them into account. For example, out of town participants of an event may seek to adopt sustainable air travel practices that cannot be reflected in the EF calculator. Nevertheless, all of the strategies listed were identified with the intention of guiding sport events held in Windsor-Essex to become more environmentally sustainable, regardless of their ability to be taken into account in the EF calculator.

**Recommendations for Organizations Staging Future Sport Events**

Since the late 1990s, researchers have promoted the economic benefits for communities in hosting small-scale sport events. This in turn, has led to their increase in popularity. Through the creation and application of the EF calculator for the 2013 ICG,
along with results from other relevant studies, it is clear that although one small-scale event may not have as large of an environmental impact as a mega-event, there are many more small-scale events staged throughout a given year. Organizations that are responsible for the planning, hosting and staging of small-scale sport events must take into consideration their ES. In order to achieve CSR, these organizations must develop and implement a sustainability plan throughout their entire organization. The 2013 ICG offers the opportunity to consider the perspectives of both the city hosting the event and the organization responsible for creating and preserving the event. The researcher has identified one major requirement for organizations responsible for future staging small-scale sport events, such as Windsor-Essex and the ICG, which will ensure they produce environmentally sustainable events: meeting the standard of ISO 20121.

ISO 20121: Event Sustainability Management System

It is generally accepted that sporting events of all sizes generate some sort of economic, social and environmental impact. As global issues concerned with ES became more prevalent over recent years, practitioners within the events industry became more aware of the benefits and importance of implementing sustainable practices within their own organizations. Specifically, David Stubbs, the Head of Sustainability at the London 2012 Games, was responsible for demonstrating the Olympic Movement’s promise towards becoming more environmentally responsible.\(^{49}\) This led to the creation of the ISO 20121, which was published in 2012. The main goal of ISO 20121 is to provide organizations with specific requirements of event sustainability management systems to help improve the sustainability of events. It is applicable for all types of organizations “involved in the design and delivery of events and accommodates diverse geographical,
cultural and social conditions,” including: event organizers; event owners; workforce; supply chain; participants; attendees; regulatory bodies; and communities. 50 This management system is extremely detailed and challenges an organization,

“to improve its process and thinking to lead to continual performance improvement and allows the organization the flexibility to be more creative about the delivery of event-related activities without detracting from the aim of the event.” 51

One of the main advantages of the ISO 20121 is that it takes into account all three aspects of sustainability, helping organizations become: financially successful; socially responsible; and reduce their environmental impact. Furthermore, this standard is not limited to organizations that stage mega-events, but can also be applied to those involved with small-scale sport events, such as the ICG. It is important to note that this standard is not a checklist or reporting framework, but rather a complex document that describes the elements of a management system that an organization needs to establish (see Appendix XVII for the event sustainability management system model). 52

The ICG study provides a brief description of the process that allows an organization to integrate the event sustainability management system. The first stage of the standard is to identify the context of the organization regarding its internal and external issues in relation to its ability to achieve the intended outcome of the event sustainability management system. 53 An example of an internal issue may be staff training, while an example of an external issue may be business impacts on the local community. Once this is achieved the organization will then identify the needs and expectations of the event’s stakeholders, which is referred to as ‘stakeholder engagement’. 54 These two steps will help determine the scope of the event’s sustainability management system. The most crucial stage for the top management of an organization is developing sustainable
development principles, which then determine the purpose and values of the organization. Principles should include, but are not limited to: stewardship; inclusivity; integrity; and transparency.\textsuperscript{55} The purpose of the organization is then stated and is based on its relation to the event, whether it be the organization running the event or supplying a product or service for the event. The values of the organization should promote the types of behavior the organization wants to be known for.\textsuperscript{56} This provides a framework for the organization to then develop sustainable policies, objectives and targets.\textsuperscript{57} These are based on the organizations sustainable development issues, which may include:

\begin{itemize}
  \item A. Environmental issues: resource utilization; materials choice; resource conservation; emissions reduction; biodiversity and nature preservation; releases to land; water; and air;
  \item B. Social issues: labor standards; health and safety; civil liberties; social justice; local community; indigenous rights; cultural issues; accessibility; equity; heritage; and religious sensitivities;
  \item C. Economic issues: return on investment; local economy; market capacity; shareholders value; innovation; direct and indirect economic impact; market presence; economic performance; risk; fair trade; and profit sharing.\textsuperscript{58}
\end{itemize}

It is then the top management’s responsibility to ensure the organization’s commitment to achieving sustainability by monitoring, assessing and continually improving these objectives. Top management must act as leaders by motivating and empowering employees and stakeholders to contribute to the event sustainability management system.\textsuperscript{59} The objectives need to be consistent with the sustainable development policy, reflect the purpose and values of the organization, while also being specific, measurable, achievable and time-bound.\textsuperscript{60} The organization must then create an action plan that answers the following questions:

\begin{itemize}
  \item What needs to be done?
  \item What resources will be required?
  \item Who will be responsible?
  \item When will it be completed?
\end{itemize}
• How will the results be evaluated?\textsuperscript{61}

Once the action plan is established, top management must clearly communicate expectations to employees and relevant stakeholders to ensure it is carried out. Top management can then review the organization’s performance based on the event management system and make any necessary changes to improve this system. This is a dynamic process that is dependent on current global and regional environmental issues.

Once the organization feels that it has met the requirements for ISO 20121, it can then seek certification. It is important to note that it is not the event itself seeking certification, but the organization as a whole. The certification process entails a certifier who inspects the organization’s management system and conducts interviews with key personnel.\textsuperscript{62} If sufficient evidence demonstrates that the event management system is an integral part of the organization as a whole, it will be issued a Certificate of Conformance to ISO 20121.\textsuperscript{63} The main benefit for seeking certification is that it will differentiate the organization in the marketplace, which will increase the chance of receiving new business opportunities. The overall goal of the ISO 20121 and its certification is that demonstrating compliance to this standard becomes the minimum requirement for an organization to operate in the events industry, whether it is the organization responsible for staging the event or supplying a product or service for the event.

One sport-related organization that has benefited from ISO 20121 certification is the Weymouth and Portland National Sailing Academy.\textsuperscript{64} This sailing venue was responsible for hosting the London 2012 Olympic and Paralympic sailing events. The facility has already achieved 15% cost savings due to improved efficiency in waste management and electricity usage. The organization is also anticipating commercial
benefit from attracting more business as a conference facility, since many organizations seek to affiliate themselves with ‘green’ organizations. Windsor-Essex and the ICG can also benefit by seeking ISO 20121 certification. This study has shown areas in which the 2013 ICG had potential to cut costs in most of the consumption categories and meeting this standard would help drive the costs down for future events affiliated with both Windsor-Essex and the ICG.

**Recommendations for Windsor-Essex**

It is clear that Windsor-Essex wants to showcase the region’s tourism assets through the hosting of more small-scale sport events. The 2014 Tourism Windsor Essex Pelee Island (TWEPI) marketing strategy states:

Our goal will be to position this region as a Sports Event Hub. TWEPI will work to market and promote Windsor Essex as the premiere location for sporting events in southwestern Ontario, with the largest range of venues for events and competitions, whether they be regional, provincial, national or even international. TWEPI will aggressively pursue opportunities in this area by continuing to make bids for events, meets and competitions.

Windsor Essex has already shown recent success by winning bids to host a number of unique events, most notably: the 2016 Canadian Adult Recreational Hockey Association (CARHA) World Cup; the 2016 International Swimming Federation (FINA) 25 metre World Championships; and the 2014 Ontario Summer Games. When taking into consideration these event’s environmental impacts, Windsor-Essex should target regional events like the Ontario Summer Games.

The 2014 Ontario Summer Games will be the largest event of the three: hosting more than 3,000 athletes, almost two-dozen events and will require the use of facilities across Windsor and Essex county. In comparison, the FINA 25 metre World Championships is expected to host 240 athletes, officials, and out of town spectators;
while 2,000 athletes will participate at a number of ice rinks in the Windsor-Essex area for the 2016 CARHA World Cup. Although the Ontario Summer Games may prove to have a larger EF for the event as a whole in comparison to the other two events, the average per participant EF will be significantly lower if Windsor-Essex takes the event’s environmental impact into serious consideration. The reason for this is that air travel will be the primary transportation method for participants of the CARHA and FINA events, which was by far the single greatest environmental issue with the 2013 ICG. Although this is a global environmental impact, Windsor-Essex should bid to host future sport events that target regional participants. Since the Ontario Summer Games is a provincial event, it is likely that teams will travel by bus to Windsor, which is a much more sustainable method of transportation.

The Ontario Summer Games, as well as the other two events, have the potential to pose environmental issues if Windsor-Essex does not use the experiences from the 2013 ICG to improve its sustainability initiatives. Creating an event management system that meets the requirements of ISO 20121 would ensure the ES of future sport events like these. The most fundamental issue with the 2013 ICG was the lack of transparency in the reporting of data that made the general public question the economic viability of small-scale events hosted in the city of Windsor. The STEAM report produced by Windsor-Essex claimed that the 2013 ICG generated $6.3 million in economic activity, but failed to illustrate how that number was calculated. One of the core principles of the ISO 20121 event management system is that the organization accurately conveys information pertaining to all three components of sustainability to interested parties, like the local community. Furthermore, using ISO 20121 to create environmental targets for the
event, comparable to those illustrated by Mallen and Chard (2012), will help in the planning and executing of any future bus loops systems, accommodation and catering services of these events. Sufficient planning and execution of these consumption categories will not only lower the EF of future events, but also drive down the costs of staging them. Finally, if Windsor-Essex dedicated the necessary resources in hopes of obtaining ISO 20121 certification, it would allow Windsor to be the first city in Ontario to be certified in sustainable event management. This would provide the city with a major marketing tool when bidding to host future sport events.

**Recommendations for the ICG**

Future ICG events will likely have a higher EF compared to most small-scale sport events because of the international characteristic of the event. Previous ICG events had initiatives in place to reduce their environmental impact, but difficulties existed which prevented those plans from being executed throughout the entire event.\(^{73}\) Two notable barriers found from the 2008 ICG study by Mallen et al. (2010) was a shortage of funding to carry out the environmental program and a lack of accountability to execute the program.\(^{74}\) The ICG organization needs to establish ES as an important value for future events, so that event organizers are obligated to dedicate the necessary resources to carry out environmental programs. Although the ICG is not the organization responsible for staging the actual ICG events, they should still attempt to achieve ISO 20121 certification. This would certainly instill sustainability as a significant value for the ICG and will ensure that all future ICG events are environmentally sustainable. It is recommended that the ICG go further by enforcing a requirement for future host cities to have ISO 20121 certification.
Once the ICG has created environmental targets for future events based on their values, strategies can be put in place to fulfill these goals. As alluded to earlier in the air travel section, the ICG could purchase carbon offsets and choose a central host city to help drive down the environmental impact of future events. The obvious issue with carbon-offset programs is that it would cost the ICG money that the organization might not necessarily have to fund these types of programs. Also, central host cities defeat the purpose of achieving a truly global event, which the ICG has clearly demonstrated as a goal with choosing Lake Macquarie as the next host city. An alternative strategy to help achieve ES would be to decrease the frequency of the games from annual to biennial or quadrennial, similar to the Olympic Games. This would clearly be the most effective strategy for reducing the environmental impact of the ICG by cutting the EF of events by 50% or 75%. These are three very different and drastic strategies for lowering the environmental impact of the ICG and the organization would have to consider its mission and values for determining what would best, or if other alternative strategies could be put in place to lower the EF of future ICG. Ultimately, the ICG organization must have a fundamental change in order to produce environmentally sustainable events.

Was the 2013 ICG an Environmentally Sustainable Event?

Given the fact that there are no current standards for determining the ES of small-scale sport events using the EF methodology, it is very difficult to determine whether or not the 2013 ICG was environmentally sustainable. The only current standard that exists for the EF is the fair Earth share, which is currently at 1.8 gha per person annually. The average visitor EF for this study was 0.033 gha per day, or 12.05 gha per year. Clearly, when using the fair Earth share as the sustainability indicator, the 2013 ICG would not be
considered a sustainable event. The problem with using the fair Earth share as the sustainability indicator is that air transportation and the facility usage were unique aspects of the event, which means that the participants and out-of-town spectators would not maintain these consumption habits beyond the event. Therefore, it is unrealistic to apply the fair Earth share as the sustainability indicator of sport events.

A more appropriate approach is to develop a sustainability indicator for the EF of sport events, through the implementation of this method on numerous sport events. If an EF standard did exist for small-scale sport events, it is likely that the 2013 ICG would be higher than the standard because of the large transportation EF required for the event. Most small-scale sport events are regional, eliminating the need for air transportation, which means a lower EF would be expected for small-scale sport events. Since this standard does not currently exist, it is currently not possible to objectively determine whether the 2013 ICG would be characterized as environmentally sustainable. Until this standard exists, one must consider the EF results in comparison to the definition of sustainable development to determine if it is an environmentally sustainable event or not. The Brundtland Commission (1987) provided the definition of sustainable development as; “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”\textsuperscript{76} Although this definition is vague and ambiguous, it was also used by the ISO for events in ISO 20121.\textsuperscript{77} When considering this from a sport event perspective, one must ask, “does the staging of this sport event impede the ability of the event organizers to stage future sport events?” The term ‘development’ requires one to take into account sport events staged by an organization over time, not on an individual basis, which determines if the organization is taking the appropriate steps
towards achieving environmentally sustainable events. In the case of Windsor-Essex, EF studies need to be conducted on future sport events (e.g. 2014 Ontario Summer Games, 2016 CARHA World Cup and 2016 FINA World Championships) to determine if Windsor-Essex is producing sport events with lower EFs.

Given the current predicament, the results from this study cannot claim that the 2013 ICG was or was not environmentally sustainable. However, based on the definition of sustainable development and the results from this study, Windsor-Essex has the ability to produce environmentally sustainable sport events if proper action is taken and would be encouraged to host future small-scale sport events. If the event organizers do not improve inter-organizational communication between those involved with staging potential sport events, instill ES as a key factor in decision making and deter from targeting international sport events, Windsor-Essex will not be able to achieve ES in hosting small-scale sport events. The main reason this was determined was because the city of Windsor demonstrated the infrastructural support that is capable of hosting future small-scale sport events. Although the teams represented were made up of 1,460 participants and the event attracted 3,455 out-of-town spectators, they were spread out across a number of sport facilities within the city of Windsor. These sport facilities were all capable of staging the sport events without increasing their operational and maintenance activities, beyond some facilities being accessible for a few more hours than normal and requiring a small increase in the number of staff present during the event. In other words, the facility operations, which accounted for 29.57% of the total EF of the event, would have occurred whether or not the 2013 ICG took place in Windsor.
The city of Windsor also clearly demonstrated its ability to accommodate, provide food services and properly dispose of waste generated by the 4,915 out-of-town visitors. The city has numerous hotels and school residences to accommodate the out-of-town visitors associated with an event of this size; however, event organizers need to develop and execute a more efficient plan for accommodation to lower the environmental impact associated with transportation throughout the city. Windsor also has the resources to provide, not necessarily fund, food and drink consumption for an event of this size, whether it be through catering services or the numerous restaurants located in the city. The 2013 ICG provided an opportunity for a number of local businesses to benefit from the event, as the out-of-town spectators had to travel to restaurants and grocery stores throughout the city since event organizers were not responsible to fund their food and drink consumption. Since the teams and spectators were spread out across a number of facilities, residences and hotels throughout the city, the waste generated at each venue was not greater than what the locations were accustomed to managing for a busy occasion. Furthermore, Windsor is a sizeable city that already has a waste management system in place that is capable of managing small-scale sport events without increasing operational activity.

Although, the transportation consumption category did produce the greatest EF, it was mainly due to air travel, which did not directly impact the region that hosted the 2013 ICG. Nevertheless, there is still a global environmental impact associated with air travel and Windsor-Essex should be environmentally responsible and deter from hosting future international sport events for this reason. The event organizers from Windsor-Essex should target sport events where they can control and minimize the event’s
environmental impact, whether global or regional, and the transportation EF due to air travel is out of the event organizer’s control. If Windsor-Essex continues to mainly target international sport events, the environmental impact of the small-scale sport events will be too great to be considered environmentally sustainable.

Summary of Discussion

The main goal of this chapter was to understand the implications of this study’s findings through a comparison to other relevant EF studies. This was a difficult task given the fact that there were major differences between the EF methodologies used in the other studies. Once the 2013 ICG EF results were put into perspective as they related to the other studies, strategies were developed that attempted to guide future sport event organizers to lower their event’s environmental impact. Based on the consumption categories defined in this study, the greatest determinant of the ES of a small-scale sport event is the origin of the participants and spectators of an event being targeted.

Nevertheless, the development of the ISO 20121 certification has provided an opportunity for any organization involved with staging a sport event to do so, while also being environmentally responsible. Furthermore, this section discussed whether the ICG was or was not an environmentally sustainable event. The issue with using the EF results to identify whether or not the 2013 ICG was sustainable is the fact that there is currently no generally accepted process for measuring the EF of sporting events, and no standard exists to objectively evaluate the EF of events.

The main goal of the ICG states,

“The goal of the International Children’s Games is to enable, develop and advance the meeting, understanding and friendship of students from different countries, and to advance the Olympic idea. In this sense, sports competitions are arranged for students. The International Children’s Games
pursue their goals in a non-political, non-denominational and non-racist
way.”

Since the ICG is an IOC-sanctioned event, the ICG organization is responsible for
aligning its mission, values and goals with that of the IOC. It is evident that the IOC has
taken measures regarding the recognition of the environmental impact of the Olympic
Games. This was demonstrated by the inclusion of the environment as the third pillar of
the Olympic Movement. Therefore, pursuing ES practices adheres to the Olympic idea
and is an action that the ICG must take. ES will help assure that the ICG can enable,
develop and advance future ICG events, while adhering to the same mission, values and
goals of the Olympic Movement. Finally, although this study focused on future ICG and
Windsor-Essex events, the results and discussion of this study can be applied to other
small-scale events in other cities.
Endnotes

1 The first comparison is to the 2010 Ontario Resident EF study, which estimated the annual household consumption patterns of Ontario residents. The second comparison is to the EF study of Ontario and Quebec Backpackers in 2008, which provides a study that is comparable in terms of its geographical region and its relevancy in tourism literature. The third comparison is to the 2004 FA Cup Final study, which used the EF concept to calculate the environmental impact of the major sporting event on the region it was staged.

2 Meredith Stechbart and Jeffrey Wilson, “Province of Ontario: Ecological Footprint and Biocapacity Analysis,” Global Footprint Network (Oakland, CA: Global Footprint Network, 2010), 41-42.

3 Ibid., 41.


5 Ibid.


8 Claire Purvis, "The Ecological Footprint of Hostel Tourists in Ontario and Quebec," (Master’s Thesis, University of Waterloo, 2008), 45.

9 Ibid., 69.

10 Ibid., 96.

11 In the context of this study, an average size hotel has 100 rooms that are each 350 square feet in size.

Although there were obvious pre-event issues regarding the staging of the 2004 FA Cup Final, the Collins et al. (2008) study calculated the EF of the event based on one day (the day of the Cup Final).


Ibid., 760.

Ibid., 759.

Ibid., 761.

Ibid., 761.


Ibid., 167-169. This study found that the primary reason for adults travelling to youth sport events was “supporting my child.”


Carlson and Lingl, “Purchasing carbon offsets,” 4-19. The Gold Standard is considered as one of the highest standards in the world for carbon offset programs. Only energy-efficiency and renewable-energy projects are considered for this standard because these projects aim to shift away from fossil fuel use.


27 Anja Kollmuss, Helge Zink and Clifford Polycarp, “Making sense of the voluntary carbon market: A Comparison of carbon offset standards,” WWF Germany (Stockholm Environment Institute and Tricona, 2008), 44.


30 Ibid.

31 Ibid.


34 Ibid., 2.


37 The primary loop bus system would be dedicated to accommodations for participants and spectators, as well as, the venues staging the event. A secondary loop bus system could be created to allow future out of town participants and spectators to places of interest throughout the city, such as: Jackson Park, Windsor Riverfront, Devonshire Mall, Windsor Community Museum and so on.


41 Ibid.


43 Ibid., 238-239.

44 Ibid., 237-240.

45 Ibid., 240.

46 Ibid., 241.

47 Green Chemistry is chemical research and engineering that demands the design of products and processes that eliminate the use and generation of hazardous substances.


51 Ibid., V and 8.


54 Ibid., 20.

55 Ibid., 23

56 Ibid.

57 Ibid., 8.
58 Ibid., 11.

59 Ibid., 24.

60 Ibid., 8-9.

61 Ibid., 12.


63 Ibid.


65 Ibid., 1.


67 Some small-scale sport events held or to be held in the Windsor-Essex beginning in 2013 include: four year contract as a North American stop for the FINA Diving World Series; the 2016 CARHA World Cup; Swim Ontario team championships in December of 2013; the 2014 Ontario Summer Games; the 2016 FINA 25 metre World Championships; and the 2014 Ontario 55+ Games. Ibid and Ontario Summer Games, “Windsor 2014,” Accessed on May 1st 2014, http://osgwindsor.com


Mallen et. al, “International Multi-Sport Event,” 117.


Chapter 6

Conclusion

In recent years, researchers have suggested that indicators of environmental impacts of small-scale events were warranted for studies investigating the ES of events of this type. The EF methodology developed and used for this study allowed the opportunity for the environmental impact of the 2013 ICG to be quantified and analyzed. Like all indicators of sustainability, the EF concept did display a number of constraints when implemented in a practical situation. However, it also demonstrated great potential and has the ability to fill the void of a lack of literature regarding ES and sport management.

The findings of this study have identified that small-scale sport events do have a substantial environmental impact and there is an opportunity for event organizers, such as Windsor-Essex, to lower this impact and stage environmentally sustainable events. The 2013 ICG generated an EF of 852.53 gha. This result was much closer than expected when compared to the EF of a major sporting event, which shows that small-scale events can generate a substantial environmental impact. Since there is minimal literature in this area of research, especially concerning small-scale sport events, this study provides a foundation from which further sport event studies with an environmental impact focus can be conducted.

Recommendations For Future Research: Possibilities and Barriers

As a relatively new approach to measuring the environmental impact of sport events, there are a number opportunities for further research and development of the EF methodology in the realm of sport management that would decrease a majority of the
barriers associated with this method. The EF’s main concept of adding up all of the environmental costs associated with a sport event into a single unit of measure is a limitation and an advantage in itself. It is a limitation because it requires assumptions and accuracy constraints. However, the assumption and accuracy issues are due to the EF concept being a simple yet powerful communication tool. This is an extremely important feature of the EF because the individuals of organizations involved with staging sport events, who have the ability to access and collect the necessary data for the EF calculations, can easily conceptualize the EF method. Over time, this will lead to an increase in knowledge of what data is important to collect regarding EF calculations and likely increase data accessibility for researchers.

Another barrier that would cease to exist with an increased use of this methodology is the development of a standard EF that would determine whether or not a sport event would be considered environmentally sustainable. Future suggestion regarding a standardized EF is consistent with Mallen and Chard’s (2012) recommendation of progress monitoring and reporting, which states, “a component of progress is noted as movement to consistent evaluation and measurement process between sport facilities to allow for comparison purposes.” In order for an EF standard to be developed for small-scale sport events, researchers must conduct EF studies on numerous and different types of events. It is undeniable that sport events are unique in terms of their spatial and temporal scope, which makes it very difficult to determine an indicator of sustainability and to compare different sport events. The number and types of facilities needed to host sport events are also very different and depend on a number of characteristics of the event, such as: the region in which the event is taking place, what
sports are being played and the number of participants and spectators expected to attend. The temporal scope for a sport event can be as short as one day, or as long as multiple days. The EF could also take into account the number of days and environmental costs required to setup an event. In order for an EF standard to be developed for sport events, spatial and temporal scales need to also be standardized so that the EF of different sport events can be fairly compared to one another on a per day per visitor basis. Once the EF methodology has been implemented on numerous events, a standard can be determined for global, national, or provincial small-scale sport events. The area in which the standard applies would be dependent upon who sets the standard and the region in which they have authority over.

When focusing on the region in which this study took place, there are also a number of opportunities to conduct EF studies on future sport events. It is quite evident that Windsor-Essex has great ambitions of hosting future small-scale sport events. The city has already won the bid for three sport events that will be held over the next two years: the 2014 Ontario Summer Games, the 2016 CARHA World Cup and the 2016 FINA World Swimming Championships (25 metre). Conducting EF studies on these sport events and any other future events within the region would be greatly beneficial for numerous reasons. First, it will help Windsor-Essex identify sport event characteristics, related to a smaller EF, are most beneficial for host communities and should be targeted for future events. Conversely, it will identify what sport event characteristics to avoid for some of these characteristics include: event type, size, duration, number of spectators, number of participants and origin of visiting participants and spectators. Second, conducting EF studies on these events will identify whether or not Windsor-Essex is
making progress in producing environmentally sustainable events. These studies will identify which consumption categories have increased or decreased and most likely will help determine why the result has occurred. Finally, the EF calculator can be made accessible to organizations interested in determining the environmental impact of their sport event at no cost. Since Windsor-Essex could conduct these studies with very little extra cost, there would be very little risk in using this tool for future events.

While this study examined the ES of the 2013 ICG, it would be beneficial for future studies to not only consider the social and economic sustainability of a future sport event as well, but also how these three characteristics of sustainability relate to each other. This study does not have the ability to determine whether or not the environmental impact of the 2013 ICG was worthwhile for the city of Windsor because it does not consider the social or economic impacts of the event. Some questions that need to be considered when determining if the environmental impact of the sport event was worthwhile are: Did the event create jobs?; Was it financially profitable for the city?; Did visitors have an enjoyable time?; and Were residence proud to host the event? It is important for future researchers to realize that sustainability is comprised of three aspects and they have a direct impact on one another; therefore, a comparative analysis of all three components should be considered.
Endnotes


Appendix I
Definitions of Sustainable Development

Box 1.1 Some Further Attempts at Defining Sustainable Development

Friends of the Earth: ‘Meeting the twin needs of protecting the environment and alleviating poverty’

UK Government: Social progress which recognizes the needs of everyone, effective protection of the environment, prudent use of natural resources, maintenance of high and stable levels of economic growth and employment.

Sir Crispin Tickell: Sustainable Development is ‘treating the earth as if we meant to stay’

The Body Shop: ‘Sustainability and sustainable development remain elusive concepts. They have variously been referred to as, for instance, “vision expression”, “value change”, “moral development”, “social reorganization”, or “transformational process”.

Steve Goldfinger (on ecological sustainability): ‘Turn resources into junk no faster than nature can turn junk back into resources’.

See also Pearce, D, Markandya, A, and Barbier, E, 1989, Blueprint for a Green Economy. Earthscan, London.

Appendix II
Global Ecological Footprint by Component, 1961-2008

Figure 21: Global Ecological Footprint by component, 1961-2008
The largest component of the Ecological Footprint is the carbon footprint (55%). At a national level the carbon footprint represents more than half the Ecological Footprint for one-quarter of the countries tracked. It is the largest component for approximately half the countries tracked (Global Footprint Network, 2011).

Key
- Built-up land
- Fishing
- Forest
- Grazing
- Cropland
- Carbon

Appendix III
Map of Global Ecological Footprint (per capita), 2008

Appendix IV
Map of Cities Competing in the 2013 ICG and List of Sport Events

Appendix V  
Spectator Survey

2103 International Children’s Games Spectator Questionnaire

1) How many kilometers did you travel to and from the events from your place of stay using the following modes of transport? Please enter total km to represent all travel.

<table>
<thead>
<tr>
<th>Mode of Transport (i.e. Car)</th>
<th>Kilometers Traveled to Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking</td>
<td></td>
</tr>
<tr>
<td>Bus</td>
<td></td>
</tr>
<tr>
<td>Car</td>
<td></td>
</tr>
<tr>
<td>Truck</td>
<td></td>
</tr>
<tr>
<td>Other (Please Specify)</td>
<td></td>
</tr>
</tbody>
</table>

2) How many bed nights did you stay (or plan to stay) in the following types of housing over the event’s length?

<table>
<thead>
<tr>
<th>Accommodation</th>
<th>Nights Stayed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Residence</td>
<td></td>
</tr>
<tr>
<td>Visiting friends or relatives</td>
<td></td>
</tr>
<tr>
<td>Hotel/Motel</td>
<td></td>
</tr>
<tr>
<td>Other (Please Specify)</td>
<td></td>
</tr>
</tbody>
</table>

3) Throughout the event, how much was spent (or is planned to be spent) on the following food items?

<table>
<thead>
<tr>
<th>Food Type</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat and meat products</td>
<td></td>
</tr>
<tr>
<td>Dairy</td>
<td></td>
</tr>
<tr>
<td>Fruits and vegetable products</td>
<td></td>
</tr>
<tr>
<td>Flour and cereal foods (bread, pasta etc)</td>
<td></td>
</tr>
<tr>
<td>Bottled Water/Juice/Soda</td>
<td></td>
</tr>
<tr>
<td>Other (Please Specify)</td>
<td></td>
</tr>
</tbody>
</table>

Were there any added expenses encountered from attending the event? See list below.

<table>
<thead>
<tr>
<th>Food Type</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clothing</td>
<td></td>
</tr>
<tr>
<td>Sporting equipment</td>
<td></td>
</tr>
<tr>
<td>Other (Please specify)</td>
<td></td>
</tr>
</tbody>
</table>
Appendix VI
Spectator Consent Form

2013 International Children’s Games Spectator

CONSENT TO PARTICIPATE IN RESEARCH

Title of Study: Assessing the ecological footprint of the 2013 International Children’s Games

You are asked to participate in a research study conducted by Andrew Bakos from the Department of Kinesiology in the Faculty of Human Kinetics at the University of Windsor as part of Mr. Bakos’ thesis, which is a requirement of the Masters of Human Kinetics program. This research is funded by the Social Sciences and Humanities Research Council of Canada (SSHRC).

If you have any questions or concerns about the research, please feel to contact Dr. Scott G. Martyn through e-mail: smartyn@uwindsor.ca or by phone: 519-253-3000 ext. or Andrew Bakos through e-mail: bakosa@uwindsor.ca.

PURPOSE OF THE STUDY

The purpose of this research is to quantify the natural resources of the 2013 International Children’s Games and to analyze its environmental impact on the Windsor-Essex region.

PROCEDURES

If you volunteer to participate in this study, you will be asked to complete the on-line questionnaire. The questionnaire will take 5 minutes of your time to complete and your participation for the study will be completed once you have finished the questionnaire. Once the questionnaire is completed you will have the option to enter your contact information into a draw to win a $200 Apple Store gift card.

POTENTIAL RISKS AND DISCOMFORTS

Answering the questionnaire involves minimal risk, as these questions will not be psychologically harmful. You will be asked to answer questions pertaining to your energy consumption during the Children's Games. The questions will be based on food consumption, accommodation and other additional expenses. If you do not feel comfortable answering the series of questions, you may drop out of the study at any time.

POTENTIAL BENEFITS TO PARTICIPANTS AND/OR TO SOCIETY

The knowledge gained through this study will assist in understanding ecological foot-printing from a sporting event perspective.

COMPENSATION FOR PARTICIPATION

Once the questionnaire is complete you will be given the opportunity to provide your contact information to be entered into a draw to win a $200 Apple Store gift card. It is important to note that your contact information will not be part of the study in anyway.
CONFIDENTIALITY

Any information that is obtained in connection with this study and that can be identified with you will remain confidential. Specifically, only Mr. Bakos and his advisor, Dr. Martyn, will have access to the information you provided. All data will be kept secure on Mr. Bakos’ personal laptop for one year. Only group data will be published or presented.

PARTICIPATION AND WITHDRAWAL

You can accept the invitation to participate by checking the “agree to terms” box, which will lead you to the questionnaire. You do not have to answer any question you don’t feel comfortable with. Also, you may withdraw from this study at any time by either not completing the survey or notifying Mr. Bakos of your decision to withdraw from the study. Once the survey is submitted you cannot withdraw your data from the study because there is no way to identify which survey belongs to you.

FEEDBACK OF THE RESULTS OF THIS STUDY TO THE PARTICIPANTS

A 3-5 page report will be written upon the conclusion of the study. If you want to obtain a copy, e-mail Mr. Bakos your request and you will be given a summary of the findings.

SUBSEQUENT USE OF DATA

These data may be used in subsequent studies, in publications and in presentations.

RIGHTS OF RESEARCH PARTICIPANTS

If you have questions regarding your rights as a research participant, contact: Research Ethics Coordinator, University of Windsor, Windsor, Ontario, N9B 3P4; Telephone: 519-253-3000, ext. 3948; e-mail: ethics@uwindsor.ca

SIGNATURE OF INVESTIGATOR

These are the terms under which I will conduct research.

__________________________  __________________
Signature of Investigator               Date
Appendix VII
Facility Manager Survey

International Children’s Games: Post-event Facility Manager Survey

*General Information*
1) Were any additional staff hired during the International Children’s Games (ICG), if yes, how many?
2) Were there staff members that worked overtime during this period?

*Operations Questions*
2) What was your monthly hydro usage for the month of August (Liters)?
3) What was your monthly electrical usage for the month of August (KWh)?
4) What was your monthly natural gas usage for the month of August (MBTU)?
5) What was your monthly gasoline usage for the month of August (if any) (Liters)?

*Maintenance Questions*
8) Estimate the amount of waste generated by your facility during the ICG (Kg)
9) Estimate the amount of recyclables generated by your during the ICG (Kg)

*Staff Specific Questions*
11) How many kilometers has ICG staff travelled to and from the events using the following modes of transport? Please enter total km to represent all delegate travel

<table>
<thead>
<tr>
<th>Mode of Transport (i.e. Car)</th>
<th>Kilometers Traveled to Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking</td>
<td></td>
</tr>
<tr>
<td>Bus</td>
<td></td>
</tr>
<tr>
<td>Car</td>
<td></td>
</tr>
<tr>
<td>Truck</td>
<td></td>
</tr>
<tr>
<td>Air Plane</td>
<td></td>
</tr>
<tr>
<td>Train</td>
<td></td>
</tr>
<tr>
<td>Other (Please Specify)</td>
<td></td>
</tr>
</tbody>
</table>
Appendix VIII
Facility Manager Consent Form

2013 International Children’s Games Facility Manager

Consent to Participate in Research

Title of Study: Assessing the ecological footprint of the 2013 International Children’s Games

You are asked to participate in a research study conducted by Andrew Bakos from the Department of Kinesiology in the Faculty of Human Kinetics at the University of Windsor as part of Mr. Bakos’ thesis, which is a requirement of the Masters of Human Kinetics program. This research is funded by the Social Sciences and Humanities Research Council of Canada (SSHRC).

If you have any questions or concerns about the research, please feel to contact Dr. Scott G. Martyn through e-mail: smartyn@uwindsor.ca or by phone: 519-253-3000 ext. or Andrew Bakos through e-mail: bakosa@uwindsor.ca.

PURPOSE OF THE STUDY

The purpose of this research is to quantify the natural resources of the 2013 International Children’s Games and to analyze its environmental impact on the Windsor-Essex region.

PROCEDURES

If you volunteer to participate in this study, you will be asked to complete two questionnaires, via e-mail. The questionnaire will each take 10 minutes of your time to complete and your participation for the study will be completed once you have finished the second questionnaire. Due to time constraints, it is asked that you have the first questionnaire completed within a 7-day time period.

POTENTIAL RISKS AND DISCOMFORTS

Answering the questionnaire involves minimal risk, as these questions will not be psychologically harmful. You will be asked to answer questions pertaining to your facility’s average energy consumption and any changes due to the Children’s Games. If you do not feel comfortable answering the series of questions, you may drop out of the study at any time.

POTENTIAL BENEFITS TO PARTICIPANTS AND/OR TO SOCIETY

The knowledge gained through this study will assist in understanding ecological footprinting from a sporting event perspective.

COMPENSATION FOR PARTICIPATION

You will not receive compensation for your participation.

CONFIDENTIALITY
Any information that is obtained in connection with this study and that can be identified with you will remain confidential. Specifically, only Mr. Bakos and his advisor, Dr. Martyn, will have access to the information you provided. All data will be kept secure on Mr. Bakos’ personal laptop for one year. Only group data will be published or presented.

PARTICIPATION AND WITHDRAWAL

Please respond to this e-mail to state whether or not you would be willing to participate in this study. You do not have to answer any question you don’t feel comfortable with. Also, you may withdraw from this study at any time by either not completing the survey or notifying Mr. Bakos or Dr. Martyn your decision to withdraw from the study. If you do decide to withdraw from the study, your information will be excluded from the study.

FEEDBACK OF THE RESULTS OF THIS STUDY TO THE PARTICIPANTS

A 3-5 page report will be written upon the conclusion of the study and will be e-mailed to you.

SUBSEQUENT USE OF DATA

These data may be used in subsequent studies, in publications and in presentations.

RIGHTS OF RESEARCH PARTICIPANTS

If you have questions regarding your rights as a research participant, contact: Research Ethics Coordinator, University of Windsor, Windsor, Ontario, N9B 3P4; Telephone: 519-253-3000, ext. 3948; e-mail: ethics@uwindsor.ca

SIGNATURE OF RESEARCH PARTICIPANT/LEGAL REPRESENTATIVE

I understand the information provided for the study [insert title] as described herein. My questions have been answered to my satisfaction, and I agree to participate in this study. I have been given a copy of this form.

____________________________________
Name of Participant

____________________________________  ____________________
Signature of Participant                  Date

SIGNATURE OF INVESTIGATOR

These are the terms under which I will conduct research.

____________________________________  ____________________
Signature of Investigator                  Date
Appendix IX
Data Contribution List

<table>
<thead>
<tr>
<th>Job Title and/or Organization</th>
<th>Data Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chef - University of Windsor</td>
<td>Food/drink order sheets</td>
</tr>
<tr>
<td>Tourism Windsor Essex Pelee Island</td>
<td>Team arrival information</td>
</tr>
<tr>
<td>Facility Supervisor - Parkside Tennis Club</td>
<td>Facility data</td>
</tr>
<tr>
<td>Facility Supervisor - University of Windsor</td>
<td>Facility data</td>
</tr>
<tr>
<td>Facility Supervisor - Forest Glade Arena</td>
<td>Facility data</td>
</tr>
<tr>
<td>Facility Services - University of Windsor</td>
<td>Utility usage</td>
</tr>
<tr>
<td>Director of Operations - Transit Windsor</td>
<td>Bus travel data</td>
</tr>
<tr>
<td>Energy Initiatives - City of Windsor</td>
<td>Public facility utility usage</td>
</tr>
<tr>
<td>Operations Chair - ICG</td>
<td>Schedule data</td>
</tr>
<tr>
<td>Office of the Mayor</td>
<td>Spectator travel and accommodation</td>
</tr>
<tr>
<td>Hunter and Chance Consulting</td>
<td>City of Brampton data surrogates</td>
</tr>
<tr>
<td>U of W Service Master Supervisor</td>
<td>Waste/recycling data for St. Denis Centre and Alumni Stadium</td>
</tr>
</tbody>
</table>
Appendix X
Steam Report for the 2013 ICG

**Ontario STEAM - Spectator Input**

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of unique out of town spectators</td>
<td>3,455</td>
</tr>
<tr>
<td>% of out of town spectators staying overnight (0-100)</td>
<td>100</td>
</tr>
<tr>
<td>Overnight Spectators (0-100)</td>
<td></td>
</tr>
<tr>
<td>% of overnight spectators from Canada</td>
<td>56</td>
</tr>
<tr>
<td>% of overnight spectators from U.S.</td>
<td>25</td>
</tr>
<tr>
<td>% of overnight spectators from Overseas</td>
<td>18</td>
</tr>
<tr>
<td>Total (must sum to 100)</td>
<td>100</td>
</tr>
<tr>
<td>Overnight Domestic Distance (0-100)</td>
<td></td>
</tr>
<tr>
<td>% of Canadian Spectators travelling from out of town up to 320km, regardless of province of origin</td>
<td>93</td>
</tr>
<tr>
<td>% of Canadian Spectators travelling from more than 320km and the same province as the event</td>
<td>6</td>
</tr>
<tr>
<td>% of Canadian Spectators travelling from more than 320km and a different province as the event</td>
<td>7</td>
</tr>
<tr>
<td>Total (must sum to 100)</td>
<td>100</td>
</tr>
<tr>
<td>Average overnight length of stay</td>
<td>5.0</td>
</tr>
<tr>
<td>Importance of event for spectators (on a scale of 0-100)</td>
<td></td>
</tr>
<tr>
<td>Overnight Domestic</td>
<td>100</td>
</tr>
<tr>
<td>Overnight USA</td>
<td>100</td>
</tr>
<tr>
<td>Overnight Int.</td>
<td>100</td>
</tr>
<tr>
<td>Same Day Spectator</td>
<td></td>
</tr>
<tr>
<td>Average number of day trips taken by each spectator</td>
<td>4.0</td>
</tr>
</tbody>
</table>

---

**Ontario STEAM - Participant Input**

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of unique out of town participants</td>
<td>7,460</td>
</tr>
<tr>
<td>Percentage of out of town participants staying overnight (0-100)</td>
<td>100</td>
</tr>
<tr>
<td>Overnight participants (0-100)</td>
<td></td>
</tr>
<tr>
<td>% of overnight participants from Canada</td>
<td>13</td>
</tr>
<tr>
<td>% of overnight participants from U.S.</td>
<td>9</td>
</tr>
<tr>
<td>% of overnight participants from Overseas</td>
<td>72</td>
</tr>
<tr>
<td>Total (must sum to 100)</td>
<td>100</td>
</tr>
<tr>
<td>Overnight Domestic Distance (0-100)</td>
<td></td>
</tr>
<tr>
<td>% of Canadian participants travelling from out of town up to 320km, regardless of province of origin</td>
<td>73</td>
</tr>
<tr>
<td>% of Canadian participants travelling from more than 320km and the same province as the event</td>
<td>6</td>
</tr>
<tr>
<td>% of Canadian participants travelling from more than 320km and a different province as the event</td>
<td>27</td>
</tr>
<tr>
<td>Total (must sum to 100)</td>
<td>100</td>
</tr>
<tr>
<td>Average overnight length of stay</td>
<td>5.0</td>
</tr>
<tr>
<td>Age of Participants (0-100)</td>
<td></td>
</tr>
<tr>
<td>% of participants under 19</td>
<td>84</td>
</tr>
<tr>
<td>% of participants 19-44</td>
<td>12</td>
</tr>
<tr>
<td>% of participants 45 and over</td>
<td>4</td>
</tr>
<tr>
<td>Total (must sum to 100)</td>
<td>100</td>
</tr>
<tr>
<td>% of participants under 19 who are staying in commercial accommodation</td>
<td>100</td>
</tr>
<tr>
<td>Same Day participant</td>
<td></td>
</tr>
<tr>
<td>Average number of day trips taken by each participant</td>
<td>1.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TEAM NAME</th>
<th>TOTAL FEMALE ATHLETES</th>
<th>TOTAL FEMALE COACHES</th>
<th>TOTAL NUMBER OF TEAM</th>
<th>ARRIVAL DATE/TIME</th>
<th>ESTIMATED ARRIVAL TIME IN WINSTED</th>
<th>MODE OF TRANSPORT</th>
<th>DEPARTURE DATE/TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake Macquarie, AUSTRALIA</td>
<td>6</td>
<td>9</td>
<td>13</td>
<td>Aug 14</td>
<td>?</td>
<td>bus</td>
<td>Aug 19 / 6:25 pm</td>
</tr>
<tr>
<td>Graz, AUSTRIA</td>
<td>3</td>
<td>11</td>
<td>1</td>
<td>Aug 14</td>
<td>4:00 pm in Windsor</td>
<td>airport arrival</td>
<td>Aug 19 / 9:45 am</td>
</tr>
<tr>
<td>Ansbach, AUSTRIA</td>
<td>9</td>
<td>3</td>
<td>1</td>
<td>Aug 14</td>
<td>8:05 am in Windsor</td>
<td>bus</td>
<td>Aug 19 / 10:45</td>
</tr>
<tr>
<td>Brantford, CANADA</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td>Aug 14</td>
<td>2:00 pm in Windsor</td>
<td>bus</td>
<td>Aug 19 / 10:00</td>
</tr>
<tr>
<td>Hallau, CANADA</td>
<td>12</td>
<td>4</td>
<td>1</td>
<td>Aug 14</td>
<td>2:30 pm in Windsor</td>
<td>bus</td>
<td>Aug 19 / 10:00</td>
</tr>
<tr>
<td>Hamilton, CANADA</td>
<td>12</td>
<td>4</td>
<td>1</td>
<td>Aug 14</td>
<td>11:00 am pm in Windsor</td>
<td>bus</td>
<td>Aug 19 / 10:00</td>
</tr>
<tr>
<td>Kielce, POLAND</td>
<td>4</td>
<td>8</td>
<td>1</td>
<td>Aug 14</td>
<td>1:00 pm in Windsor</td>
<td>#1st arrival</td>
<td>Aug 19 / 5:14 pm</td>
</tr>
<tr>
<td>Kitchener, CANADA</td>
<td>6</td>
<td>5</td>
<td>1</td>
<td>Aug 14</td>
<td>11:30 am in Windsor</td>
<td>bus</td>
<td>Aug 19 / 11:00</td>
</tr>
<tr>
<td>London, CANADA</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Aug 14</td>
<td>4:00 pm in Windsor</td>
<td>?</td>
<td>Aug 19 / ?</td>
</tr>
<tr>
<td>six nations of the Grand River Territory, CANADA</td>
<td>4</td>
<td>6</td>
<td>1</td>
<td>Aug 14</td>
<td>6:00 pm in Windsor</td>
<td>car</td>
<td>Aug 19 / 6:00 pm</td>
</tr>
<tr>
<td>Waiofa, CANADA</td>
<td>10</td>
<td>1</td>
<td>1</td>
<td>Aug 14</td>
<td>11:30 am in Windsor</td>
<td>bus</td>
<td>Aug 19 / 11:00</td>
</tr>
<tr>
<td>Windsor-Bers, CANADA</td>
<td>10</td>
<td>1</td>
<td>1</td>
<td>Aug 14</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Churham</td>
<td>?</td>
<td>Aug 14</td>
<td>?</td>
<td>Aug 19 / ?</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hong Kong, CHINA</td>
<td>6</td>
<td>6</td>
<td>1</td>
<td>Aug 14</td>
<td>8:05 pm in Windsor</td>
<td>airport arrival</td>
<td>Aug 19 / 6:00 pm</td>
</tr>
<tr>
<td>Beijing, CHINA</td>
<td>7</td>
<td>1</td>
<td>2</td>
<td>Aug 14</td>
<td>midnight in Windsor</td>
<td>Airport arrival</td>
<td>Aug 19 / 12:10 pm</td>
</tr>
<tr>
<td>San Marcos, COSTA RICA (working on list)</td>
<td>10</td>
<td>1</td>
<td>2</td>
<td>Aug 14</td>
<td>?</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Debrecen, CROATIA</td>
<td>6</td>
<td>8</td>
<td>1</td>
<td>Aug 14</td>
<td>1:00 pm in Windsor</td>
<td>?</td>
<td>Aug 19 / ?</td>
</tr>
<tr>
<td>Coventry, ENGLAND</td>
<td>5</td>
<td>9</td>
<td>2</td>
<td>Aug 14</td>
<td>5:00 pm in Windsor</td>
<td>bus</td>
<td>Aug 19 / 12:00</td>
</tr>
<tr>
<td>Luton, ENGLAND</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>Aug 14</td>
<td>8:00 pm in Windsor</td>
<td>bus</td>
<td>Aug 19 / 12:15</td>
</tr>
<tr>
<td>Dortmund, GERMANY</td>
<td>8</td>
<td>8</td>
<td>1</td>
<td>Aug 14</td>
<td>4:00 pm in Windsor</td>
<td>#1st arrival</td>
<td>Aug 19 / 5:14 pm</td>
</tr>
<tr>
<td>Traralgon, GERMANY</td>
<td>6</td>
<td>8</td>
<td>1</td>
<td>Aug 14</td>
<td>7:00 pm in Windsor</td>
<td>bus</td>
<td>Aug 19 / 7:00 pm</td>
</tr>
<tr>
<td>Kempton, GERMANY</td>
<td>13</td>
<td>3</td>
<td>1</td>
<td>Aug 14</td>
<td>4:00 pm in Windsor</td>
<td>bus</td>
<td>Aug 19 / 4:00 pm</td>
</tr>
<tr>
<td>Werribee, GERMANY</td>
<td>6</td>
<td>4</td>
<td>1</td>
<td>Aug 14</td>
<td>3:30 pm in Werribee</td>
<td>shuttle</td>
<td>Aug 19 / 3:30 pm</td>
</tr>
<tr>
<td>Ipswich, GERMANY</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>Aug 14</td>
<td>8:00 pm in Windsor</td>
<td>airport arrival</td>
<td>Aug 19 / 8:00 pm</td>
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<tr>
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<td>9</td>
<td>1</td>
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<td>10:00 pm in Werribee</td>
<td>bus</td>
<td>Aug 19 / 9:00 pm</td>
</tr>
<tr>
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<td>bus</td>
<td>Aug 19 / 9:00 pm</td>
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<tr>
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<td>12</td>
<td>1</td>
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<td>bus</td>
<td>Aug 19 / 1:00 pm</td>
</tr>
<tr>
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<td>Aug 19 / 10:00</td>
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<td>Aug 19 / 10:00</td>
</tr>
<tr>
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<td>1</td>
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<td>Aug 19 / 4:00 pm</td>
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<td>6</td>
<td>2</td>
<td>Aug 14</td>
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<td>bus</td>
<td>Aug 19 / 4:00 pm</td>
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<tr>
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<td>Aug 19 / 10:00</td>
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<tr>
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<td>4</td>
<td>1</td>
<td>Aug 14</td>
<td>10:00 pm in Sydney</td>
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<td>Aug 19 / 10:00</td>
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<tr>
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<td>Aug 19 / 10:00</td>
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<td>Aug 14</td>
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<td>Aug 19 / 10:00</td>
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<tr>
<td>From City, Country</td>
<td>To City, Country</td>
<td>Connection Code</td>
<td>Arrival Time</td>
<td>Departure Time</td>
<td>Duration (h:m:s)</td>
<td>Stopovers</td>
<td>Notes</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-----------------</td>
<td>----------------</td>
<td>--------------</td>
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<td>-----------------</td>
<td>-----------</td>
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<td>2h:00m</td>
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<td><em>0</em></td>
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<td>2h:00m</td>
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<td>2h:00m</td>
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<td>6:00 AM</td>
<td>2h:00m</td>
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<td>Denver, CO</td>
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<td>10:00 AM</td>
<td>12:00 PM</td>
<td>2h:00m</td>
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Appendix XII
Green and Blue Loop Bus Systems
## Appendix XIII
Data Conversion Factors Derived From the Ecoinvent Database

<table>
<thead>
<tr>
<th>Facility Information</th>
<th>kg CO2e (per month, per square foot)</th>
<th>Global Hectares (per month, per square foot)</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total square footage of Alumni Stadium</td>
<td>0.1422</td>
<td>0.000854</td>
<td>Ecoinvent</td>
</tr>
<tr>
<td>Total square footage of Windsor Family Aquatic Complex</td>
<td>0.1343</td>
<td>0.000896</td>
<td>Ecoinvent</td>
</tr>
<tr>
<td>Total square footage of Forest Glade Arena</td>
<td>0.1422</td>
<td>0.000854</td>
<td>Ecoinvent</td>
</tr>
<tr>
<td>Total square footage of Bernie Soulliere Stadium</td>
<td>0.0813</td>
<td>0.000802</td>
<td>Ecoinvent</td>
</tr>
<tr>
<td>Total square footage of Farther Ronald Gullen Stadium</td>
<td>0.0813</td>
<td>0.000802</td>
<td>Ecoinvent</td>
</tr>
<tr>
<td>Total square footage of Michigan Soccer Complex</td>
<td>0.0813</td>
<td>0.000802</td>
<td>Ecoinvent</td>
</tr>
<tr>
<td>Total square footage of St. Denis Centre</td>
<td>0.1422</td>
<td>0.000854</td>
<td>Ecoinvent</td>
</tr>
<tr>
<td>Total square footage of Parkside Tennis Club</td>
<td>0.1422</td>
<td>0.000854</td>
<td>Ecoinvent</td>
</tr>
<tr>
<td>Total square footage of St. Clair College</td>
<td>0.1422</td>
<td>0.000854</td>
<td>Ecoinvent</td>
</tr>
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</table>

| Total # of staff across all facilities | | | |

<table>
<thead>
<tr>
<th>Operations Questions</th>
<th>kg CO2e</th>
<th>Global Hectares</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total monthly hydro usage across all facilities (litres)</td>
<td>0.3441</td>
<td>0.00079</td>
<td>Ecoinvent</td>
</tr>
<tr>
<td>Total monthly electrical usage across all facilities (KWh)</td>
<td>0.5837</td>
<td>0.00095</td>
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</tr>
<tr>
<td>Total monthly natural gas usage across all facilities (mmbtu)</td>
<td>0.2655</td>
<td>0.00061</td>
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</tr>
<tr>
<td>Total monthly gas usage across all facilities (KWh)</td>
<td>2.3144</td>
<td>0.00034</td>
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<table>
<thead>
<tr>
<th>Maintenance Questions</th>
<th>kg CO2e, per kg</th>
<th>Global Hectares</th>
<th>Source</th>
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<tr>
<td>Total waste generated across all facilities in a given day (kg)</td>
<td>1.3</td>
<td>0.0000087</td>
<td>Ecoinvent</td>
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<tr>
<td>Total amount of recyclables generated across all facilities in a given day (kg)</td>
<td>-1.3</td>
<td>-0.0000087</td>
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<table>
<thead>
<tr>
<th>Concession Sales</th>
<th>kg CO2e (per kg, per litre)</th>
<th>Global Hectares</th>
<th>Source</th>
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<tbody>
<tr>
<td>Chocolate Bars</td>
<td>0.1225</td>
<td>0.00038</td>
<td>Ecoinvent</td>
</tr>
<tr>
<td>Candy (Skittles etc)</td>
<td>0.0725</td>
<td>0.00080</td>
<td>Ecoinvent</td>
</tr>
<tr>
<td>Soda</td>
<td>0.0625</td>
<td>0.00070</td>
<td>Ecoinvent</td>
</tr>
<tr>
<td>Water</td>
<td>0.225</td>
<td>0.00013</td>
<td>Ecoinvent</td>
</tr>
<tr>
<td>Milk</td>
<td>0.1235</td>
<td>0.00034</td>
<td>Ecoinvent</td>
</tr>
<tr>
<td>Dairy Products (Non Milk, i.e. Ice Cream)</td>
<td>0.1325</td>
<td>0.00061</td>
<td>Ecoinvent</td>
</tr>
<tr>
<td>Meat Products (Hamburger, hotdogs etc)</td>
<td>1.81</td>
<td>0.00017</td>
<td>Ecoinvent</td>
</tr>
<tr>
<td>Grain Products (Bunns etc)</td>
<td>0.0975</td>
<td>0.00060</td>
<td>Ecoinvent</td>
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<tr>
<td>Vegetables</td>
<td>0.0275</td>
<td>0.00001</td>
<td>Ecoinvent</td>
</tr>
<tr>
<td>Utensils (Paper and plastic cups, knives and forks)</td>
<td>0.875</td>
<td>0.0142</td>
<td>Ecoinvent</td>
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<table>
<thead>
<tr>
<th>Staff Specific Questions</th>
<th>kg CO2e (per km)</th>
<th>Global Hectares</th>
<th>Source</th>
</tr>
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<tbody>
<tr>
<td>Total number of kilometers travelled by staff to and from work using the following modes of transport (Across all facilities):</td>
<td></td>
<td></td>
<td>Ecoinvent</td>
</tr>
<tr>
<td>Walking</td>
<td>0</td>
<td>0</td>
<td>Ecoinvent</td>
</tr>
<tr>
<td>Bus</td>
<td>0.1238</td>
<td>0.00027</td>
<td>Ecoinvent</td>
</tr>
<tr>
<td>Car</td>
<td>0.2038</td>
<td>0.00402</td>
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</tr>
<tr>
<td>Truck</td>
<td>0.6744</td>
<td>0.00054</td>
<td>Ecoinvent</td>
</tr>
<tr>
<td>Bike</td>
<td>0.0010</td>
<td>0.00002</td>
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</tr>
<tr>
<td>Air</td>
<td>0.41</td>
<td>0.00038</td>
<td>Ecoinvent</td>
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<table>
<thead>
<tr>
<th>Hotel Stay</th>
<th>kg CO2e</th>
<th>Global Hectares</th>
<th>Source</th>
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<td>Average per night stay (Average of US and European Hotels)</td>
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<td>0.00012</td>
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Appendix XIV
ICG Menu and Order Sheets – University of Windsor

WINDSOR ESSEX 2013
International Children’s Games 2013

Breakfast Offerings
Served with Breakfast Daily
Cold Cereal
Fruit Salad
Assorted bran/ whole wheat muffins
Individual yogurts
Whole Fruit
Assorted bottle juice and milk

Dinner Offerings
Served with dinners daily
Rolls and butter
Garden salad
Fruit salad
Assorted bottle juice and milk

Wednesday August 14 Dinner
Chickpea and cucumber salad (GF)
Roast chicken (GF, Halal)
Tortellini with sauce (Vegetarian)
Roasted redskin potatoes (Vegetarian, GF)
Steamed rice/ Vegetable fried rice (Vegetarian)
Green and yellow beans
Chocolate cake
Vanilla cake

Thursday August 15 Breakfast
Scrambled Eggs
Beef sausage/ turkey sausage
Pancakes
Steamed Rice
Home Fried Potatoes
Baked Beans
Thursday August 15 Dinner
Coleslaw
Beef pot roast (GF, Halal)
Penne with tomato sauce (Vegan)
Vegetable stirfry with tofu (Vegan)
Roasted potatoes
Steamed rice/ Vegetable fried rice (Vegetarian)
Corn
Assorted brownies/ carrot cake

Friday August 16 Breakfast
Scrambled Eggs
Beef sausage/ turkey sausage
Waffles
Steamed Rice
Home Fried Potatoes
Baked Beans

Friday August 16 Dinner
Dinner will be served at an offsite location

Saturday August 17 Breakfast
Scrambled Eggs
Beef sausage/ turkey sausage
Pancakes
Steamed Rice
Home Fried Potatoes
Baked Beans

Saturday August 17 Dinner
Marinated 4 bean salad (GF)
Grilled chicken (GF, Halal)
Meat loaf
Macaroni and cheese (Vegetarian)
Mashed potatoes
Steamed rice/ Vegetable fried rice (Vegetarian)
Italian mixed vegetables
Assorted squares
Sunday August 18 Breakfast
Scrambled Eggs
Beef sausage/ turkey sausage
Waffles
Steamed Rice
Home Fried Potatoes
Baked Beans

Sunday August 18 Dinner
Dinner will be served at an offsite location

Monday August 19 Breakfast
Scrambled Eggs
Beef sausage/ turkey sausage
Pancakes
Steamed Rice
Home Fried Potatoes
Baked Beans
<table>
<thead>
<tr>
<th>Item</th>
<th>Used</th>
<th>Portions</th>
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<tr>
<td>Rice Krispies</td>
<td>600</td>
<td>pt/</td>
</tr>
<tr>
<td>Cheerios bulk</td>
<td>600</td>
<td>pt/</td>
</tr>
<tr>
<td>Raisin bran bulk</td>
<td>600</td>
<td>pt/</td>
</tr>
<tr>
<td>Fruit cocktail canned</td>
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<td>300 pt/</td>
</tr>
<tr>
<td>Danone Yogurt creamy variety</td>
<td>6</td>
<td>288</td>
</tr>
<tr>
<td>Danone Yogurt silhouette variety</td>
<td>6</td>
<td>288</td>
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<tr>
<td>Danone Activia variety</td>
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<td>Sugar Packets</td>
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<tr>
<td>Ranch dressing portion</td>
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<td>Chickpeas</td>
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<td>tortellini</td>
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<td>100 kg</td>
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<td>Rice</td>
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<td>Peas and carrots</td>
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<tr>
<td>Green Beans</td>
<td>5</td>
<td>100 lb</td>
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<tr>
<td>Yellow beans</td>
<td>5</td>
<td>132 lb</td>
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<td>Chocolate slab cake</td>
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<td>672 slices</td>
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### Appendix XV
#### Ontario Ecological Footprint Results

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<th>Built-up Land</th>
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Appendix XVI
Energy Inputs for Plant and Animal Proteins

Appendix XVII
Event Sustainability Management System Model

Figure 1 — Event sustainability management system model for this International Standard

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<tr>
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