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CASE STUDY

Climate protection in mega-event greening: the 2010 FIFA™ World Cup and COP17/CMP7 experiences in Durban, South Africa

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The implementation of ‘event greening’ initiatives that address the social, ecological, climate and legacy impacts of ‘mega-events’ is now accepted global practice. Since 2006, measuring, reporting and offsetting climate impacts have become central elements of such greening programmes. Without a standardized approach, however, host city governments and local environmental champions play a key role in determining the scope and scale of climate protection interventions, making comparisons between mega-events and host cities difficult. Recently, the city of Durban in South Africa was responsible for developing and implementing greening programmes for two mega-events: the Durban 2010 FIFA™ World Cup and the United Nations Framework Convention on Climate Change COP17/CMP7 in 2011. These experiences have highlighted the high cost of mitigating the climate impacts of mega-events, but also underscored the significant opportunities such events offer to promote investments in resource-efficient local infrastructure and to establish local climate protection projects that deliver long-term social and ecological co-benefits. The analysis of the ecological footprint of COP17/CMP7 also demonstrated that while climate protection has received substantial attention in mega-event greening, a broader set of global environmental change priorities need to shape the focus of future greening efforts.

Keywords: climate change; mega-event; carbon offset; Durban; greening

Introduction

Mega-events are large-scale sports events, conferences, conventions or exhibitions that are publicized globally and that offer host cities a unique opportunity to promote economic growth (especially tourism), infrastructure development, international visibility and support political and policy agendas (Death, 2011; Getz, 1989; GIZ, 2013). The positive and negative impacts of mega-events on local communities, economies and the environment are receiving increasing attention by the public and research community alike (Hall, 2012; Reis & DaCosta, 2012). This has contributed to the emergence of mega-event sustainability or greening programmes in an attempt to improve the social and environmental sustainability of these events (Hall, 2012; Konrad-Adenauer-Stiftung [KAS], 2011). The first such programmes appeared in the mid-1990s associated with the Olympic Games and a similar approach was subsequently adopted by the United Nations (UN), FIFA™ and other organizations. This was followed by the emergence of national event sustainability standards, such as the British BS8901:2009 and Canadian Z2010-10 in 2009–2010, while 2011–2012 saw the

launch of international standards such as the Global Reporting Initiative (GRI) Event Organisers Sector Supplement and International Organization for Standardization (ISO) 20121:2012 Standard for Sustainable Events Management (Hall, 2012). These standards advance comprehensive event greening approaches, but do not set performance standards for event sustainability and are not yet universally applied. Greening approaches therefore vary between events and the outcomes are strongly influenced by policy frameworks in the host cities and local environmental champions, leaving ‘the content or meaning of sustainability quite open and mutable’ (Death, 2011). It is therefore difficult to compare the efficacy of greening interventions between mega-events and between host cities.

In this regard, the city of Durban in South Africa offers an unusual opportunity for a comparative evaluation of greening approaches, as it has recently hosted two mega-events in short succession: the Durban 2010 FIFA™ World Cup and the United Nations Framework Convention on Climate Change (UNFCCC) COP17/CMP7¹ in 2011. EThekweni Municipality (the local government responsible for planning and managing the city of Durban) was responsible for the development and implementation of both

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greening programmes, a process which was led by Dr Debra Roberts of the Environmental Planning and Climate Protection department, with support from Ms Nicola Diederichs of FutureWorks. In each case, event-related environmental sustainability requirements specified by FIFA™ and the UNFCCC were limited and as a result eThekweni Municipality relied on its own environmental policies and the input from local environmental champions to develop the greening programmes. Climate protection was a central element in both programmes and as a result carbon footprinting, mitigation and adaptation were key considerations, with a ‘carbon neutral’ target being set for both events. Both greening programmes were also incorporated into the Municipal Climate Protection Programme (Roberts, 2008) in order to mainstream a concern for climate change within municipal operations and to highlight the need for environmental sustainability.

Despite the two mega-events being different at a number of levels, such as purpose, type and number of participants, activities and infrastructure requirements, many of the issues associated with the greening processes were similar. These included the high cost of mitigating the climate impacts of these mega-events, but also the significant opportunities such events offer to promote investments in resource-efficient local infrastructure and to establish local climate protection projects that deliver long-term social and ecological co-benefits.

Changing approaches

The 1994 Olympics in Lillehammer (Norway) was the first mega-event to undertake a focused greening effort, largely as a result of the widespread environmental damage caused by the 1992 Albertville and Savoie Region Winter Olympic Games (Cantelon & Letters, 2000). This first Olympic greening effort included ecological protection, energy efficiency and sustainable waste management interventions, but did not specifically report on the climate impact of the event. In 1996, the International Olympic Committee (IOC) included environment as the third strand of Olympism alongside sport and culture and amended the Olympic Charter to acknowledge the role of the IOC in promoting sustainable development in line with the provisions of Agenda 21 (Cantelon & Letters, 2000; Hall, 2012; KAS, 2011). The Olympic Charter remains unclear, however, on how the environment is to be protected, stating only that the aim is to ‘encourage and support a responsible concern for environmental issues’ and ‘to promote sustainable development in sport’ (International Olympic Committee [IOC], 2011).

Subsequent mega-event greening initiatives have continued to increase in scope and scale, but it was the UNFCCC’s COP10 held in Buenos Aires in 2004 that was the first to report its carbon footprint (Sancha & Bannister, 2012). In the following year, the Montreal-based

COP11/CMP1 became the first global event to claim carbon neutrality through the offsetting of its carbon footprint. In 2006, the Torino Olympics in Italy became the first Olympic event to report its carbon footprint (IOC, 2012) and the German FIFA™ World Cup became the first FIFA™ event to report and offset its event carbon footprint (Stahl, Hochfeld, & Schmied, 2007). As a result, climate protection has become a central theme in mega-event greening programmes, with a focus on estimating, minimizing, measuring and offsetting event-related carbon emissions. While goals vary from ‘low carbon’ to ‘climate neutral’, for many of the events reporting ‘carbon neutrality’, only a portion of the event’s total carbon footprint is generally offset due to sources such as international travel being excluded from the offset calculations (United Nations Environment Programme [UNEP], 2009b). The more pragmatic goal of hosting ‘low-carbon’ events is increasingly being preferred (e.g. the London 2012 Olympic bid included a ‘carbon neutral’ target, but this shifted to ‘low-carbon’ target during the event organization phase; London 2012, 2010; London Organising Committee of the Olympic Games and Paralympic Games, 2011) as this allows host cities to invest in local infrastructure, technologies and systems that increase adaptive capacity and provide mitigation opportunities, rather than having to invest in offsets that are often located outside the host city or country. ‘Carbon neutrality’, however, remains a requirement for UN events, due to UN’s goal of becoming carbon neutral (UNEP, 2012).

Experiences in Durban

The city of Durban (South Africa) is the largest port and city on the east coast of Africa and was one of nine cities to host the South African 2010 FIFA™ World Cup and also hosted the 2011 UNFCCC COP17/CMP7. EThekweni Municipality played a central role in organizing both of these events and was responsible for the development and implementation of both local event greening programmes. The UNFCCC specified that COP17/CMP7 must be ‘carbon neutral’, but neither FIFA™ nor the South African national government set specific requirements for event greening during the World Cup (Death, 2011) (Table 1). For both events, national government’s greening plans were developed late in the preparatory process and thus had limited impact on the host city’s plans (Death, 2011).

Greening the 2010 FIFA™ World Cup in Durban

The Greening Durban 2010 Programme for the Durban component of the 2010 FIFA™ World Cup was the first mega-event greening programme developed by eThekweni Municipality. Eight focal areas were addressed: (1) climate

Table 1. Sustainability requirements prescribed by FIFA™ and the UNFCCC for the 2010 FIFA™ World Cup and the UNFCCC's COP17/CMP (2011) hosted in Durban and the associated national- and local-level responses.

	FIFA™	UNFCCC
Policy-level requirements for event sustainability	The host city agreement included an environmental protection clause, promoting the adoption of: '... the concept of sustainable development that complies with applicable environmental legislation and serves to promote the protection of the environment' (Diederichs & Roberts, 2010)	The UNFCCC Host Country agreement required that: <ul style="list-style-type: none"> • the event carbon footprint must be reported, • the event must be carbon neutral. It was further suggested that the UNEP Green Meetings Guide (UNEP, 2009a) should be used to inform the hosting of the event
Host country and host city response	A number of the nine South African host cities, including Durban, developed locally focused event greening programmes. National government later established a coordinating structure for greening of the 2010 FIFA™ World Cup, intending to support resource-poor smaller host cities, and a National Greening 2010 Framework that detailed six focus areas of waste, energy, transport, water, biodiversity and responsible tourism, together with four cross-cutting themes of carbon offsetting and emissions reductions, sustainable procurement, job creation, and communication and outreach (Department of Environmental Affairs and Tourism, 2009)	EThekweni Municipality developed an event greening plan. Representation of the greening team in the local event organizing structure ensured the integration of sustainability into all aspects of the event planning and operations. National government focused its efforts on reporting the national carbon footprint of the event and hosting a Climate Change Response Expo for delegates and the public

protection (mitigation and adaptation); (2) biodiversity conservation; (3) energy efficiency and renewable energy; (4) water conservation; (5) waste management; (6) sustainable transportation systems; (7) communications; and (8) monitoring and evaluation. Of these, climate protection was the central concern and the work plans of the other focal areas were designed to also contribute to this goal. Durban was the only host city to commit to hosting a carbon neutral event due to the municipal team's sound understanding of climate change science, growing awareness of existing local climate variability and anticipated climate change impacts, review of the outcomes of previous event greening programmes, and a desire to demonstrate leadership in contributing to the establishment of an ambitious national benchmark for 'climate responsible eventing'.

At the outset of the greening process an external consultant was appointed to estimate the carbon footprint of the Durban 2010 FIFA™ World Cup activities. This included an assumptions-based estimation of energy use at stadia, training venues and in accommodation facilities; spectator transport within Durban; spectator transport from other South African cities to Durban; and the full embodied emissions footprint of materials used in building a new 60,000-seater stadium and upgrading 3 smaller training stadia in Durban. The embodied emissions in construction materials made up 63% of the total local event carbon footprint of 307,208 tonnes CO₂e² (Spalding-Fecher, 2009). For the 2006 FIFA™ World Cup, the embodied emissions associated with stadia construction were apportioned across the lifespan of the stadia (Stahl et al., 2007), resulting in a significantly reduced emissions footprint for the event

itself. If this approach had been used in Durban, the estimated local event carbon footprint would have been 118,143 tonnes CO₂e.

The carbon footprint estimate also took into account carbon emissions minimized by reducing waste sent to landfill, the use of climate-friendly design and management of new infrastructure (including the new stadium), and the provision of shuttles and non-motorized public transport. The most significant achievement was a 30% reduction in energy demand at the new stadium accomplished through design and technology choices, resulting in energy savings of 1.2 million kilowatt hours per year. The inclusion of water-efficient fittings, rainwater capture and intelligent irrigation systems also reduced the water footprint of the stadium by 74%, resulting in an annual water savings of 49,000 m³.

In reviewing the options available to offset the local carbon footprint of 307,208 tonnes CO₂e, an early decision was made not to purchase carbon credits but to develop local offset projects that delivered a range of local co-benefits including job creation, renewable energy provision, biodiversity protection and watershed management. Offset opportunities were also sought that enhanced adaptive capacity, biodiversity and ecological infrastructure³ (South African National Biodiversity Institute [SANBI], 2012) because of the strong adaptation focus (particularly ecosystem-based adaptation) of Durban's Municipal Climate Protection Programme (Carmin, Roberts, & Anguelovski, 2012; Roberts et al., 2012). The end result was the identification of two reforestation projects on degraded and deforested areas, and a set of renewable energy generation projects.

The development of the reforestation initiatives was informed by a prior but unrelated review of potential reforestation opportunities that had resulted in two sites being shortlisted: a 757 hectare municipal-owned buffer zone around the Buffelsdraai Landfill Site in the north of the city; and 372 hectares of community-owned rural land on the slopes of Inanda Mountain in the west of the city. Funding secured from the Danish International Development Agency (DANIDA) (as part of its South African Urban Environmental Management Programme) allowed both reforestation projects to be initiated (one by the Municipality and one by a local non-governmental organization (NGO)) as part of Durban's 2010 FIFA™ World Cup offset programme, and facilitated the establishment of a partnership with the NGO as the implementing agent of the projects.

Given the significant social and economic challenges in the city (Durban is the metropolitan area with the highest percentage of people living in poverty in South Africa; eThekweni Municipality, 2013), both projects aimed to maximize community benefits and have to date created 81 permanent full-time jobs, 16 part-time jobs and 452 temporary jobs. Some 823 community 'Trepreneurs' grow trees and plants at home for the projects. The trees and plants are traded for credit notes that can be used at 'Tree Stores' for goods (such as food and clothing) and services (such as school fees and driving lessons). The total value of goods and services traded since project inception in 2008 is more than ZAR 3 million (approximately US \$293,000⁴). These projects have so far cost over ZAR 25 million to implement (over US\$2 million), with the Municipality now overseeing both projects and contributing the majority of the funding, and with the remaining funds having been provided by DANIDA, the Royal Danish Embassy and South African National Government. Together both projects are expected to sequester 61,008 tonnes CO₂e⁵ over a 20-year period and to increase the delivery of other important ecosystem services such as freshwater supply and biodiversity protection. These projects will offset 20% of the Durban 2010 FIFA™ World Cup carbon footprint, provided that the reforested areas are protected from fire, degradation and loss in perpetuity. This creates a substantial long-term financial commitment for the Municipality, whose budgeting cycles do not extend beyond five-year terms. Gold Standard certification from the Climate, Community and Biodiversity Alliance (CCBA) has been achieved for the Buffelsdraai Landfill Site Community Reforestation Project, but given the high cost and administrative burden of formal project certification, the Municipality is evaluating a range of verification approaches for the Inanda Mountain project.

To offset the remaining 80% of the World Cup™ carbon footprint, suitable renewable energy projects were identified and evaluated. Of the more than 80 municipal infrastructure projects screened, 5 projects were shortlisted.

These involved mini-hydropower, composting and anaerobic digestion, and household solar water heaters. The original intention was to register all five as Clean Development Mechanism (CDM) Projects under the Kyoto Protocol, but the Water and Sanitation Unit concluded after its own feasibility assessment that the hydropower projects were financially viable without support from carbon trading. The composting and anaerobic digestion of organic waste project at a municipal landfill site was also not supported by the Solid Waste Unit due to a lack of resources to administer the CDM process and a preference for the project be operated by a third party. In both cases prior CDM experience contributed to a reluctance to deal with the transaction costs and other associated bureaucratic challenges of the CDM process. As a result, only the solar water heater project was eventually registered. It was determined that this project was capable of offsetting the remaining 246,200 tonnes CO₂e of the Durban 2010 FIFA™ World Cup carbon footprint, but this could only be achieved through the cancellation of approximately US\$300,000⁶ worth of Certified Emissions Reduction (CER) credits. The income from the sale of the CERs was needed to maintain the solar water heaters installed in low-income housing units, so cancelling the credits would create knock-on costs for the Municipality and threaten the sustainability of the initiative. This highlights the potentially high and unrealistic costs of locally mitigating the global climate impacts of mega-events, especially given that event organizers, participants, spectators and others benefitting from the hosting of the event do not provide financial support for climate protection efforts. As a result the head of the Municipality's Environmental Planning and Climate Protection Department set aside the original carbon neutral target in 2013.

Greening the UNFCCC COP17/CMP7 2011

The hosting of COP17/CMP7 in Durban in 2011 provided an opportunity to extend the work of the Greening Durban 2010 Programme. The Durban COP17/CMP7 Greening Programme was strongly influenced by the UNFCCC's climate neutrality requirement (Table 1) and the desire to showcase Durban's climate protection work to an international audience. As the event involved international climate change negotiations, the commitment of the local organizing committee to greening the COP17/CMP7 was more readily secured than was the case for greening of the Durban 2010 FIFA™ World Cup sports events.

As with the greening of the Durban 2010 FIFA™ World Cup, carbon emissions associated with the core infrastructure of COP17/CMP7 (including the existing International Convention Centre Durban) and the operational systems servicing the event (such as transportation and waste management systems) were minimized. A retrofit of the convention centre resulted in a 7% reduction in energy

demand and the resultant savings prompted investigations into further potential energy efficiency options. In analysing the Durban 2010 FIFA™ World Cup carbon footprint, it became apparent that energy usage in delegate accommodation was the second highest contributor to the event's carbon footprint, and as a result the Durban COP17/CMP7 Greening Programme prioritized accommodation greening. In addition, a delegate bicycle sharing programme was implemented for the first time in Durban.

An external consultant was again appointed to calculate the event's carbon footprint using data collected for energy and water usage in event venues and delegate accommodation; delegate transport within Durban and transport of event-related equipment, materials and waste. This contrasted with the Durban 2010 FIFA™ World Cup carbon footprint which was estimated rather than measured. The total local event carbon footprint was reported as 9289 tonnes CO₂e (Arup, 2012), while the national carbon footprint (which included international travel for delegates and COP-related activities of the South African government) totalled 36,815 tonnes CO₂e (Carbon Calculated, 2012), resulting in an overall carbon footprint of 46,104 tonnes CO₂e for COP17/CMP7.

Following the challenges experienced with the Durban 2010 FIFA™ World Cup, eThekweni Municipality opted to use a 'cost and control' boundary approach to define its COP17/CMP7 carbon offset responsibilities. This meant that only emissions associated with activities and venues controlled by the Municipality, paid for by the Municipality or that formed part of the host city agreement were defined as being the direct responsibility of the Municipality and amounted to 36% of the total local event carbon footprint, or 3303 tonnes CO₂e. EThekweni Municipality subsequently put out a public call for potential offset options, but of the five submissions received, none were regarded as suitable. The evaluation process used the United Nations Development Programme's Millennium Development Goals Carbon Safeguard Principles to assess the environmental and social sustainability of the proposed offset projects and the sustainability track record of the organizations involved. The negative outcome highlighted that carbon offsetting potential and sustainability are not necessarily synonymous and that the full range of benefits and disbenefits of any offset option must be carefully reviewed.

In the absence of suitable externally sourced offset options, the Municipality expanded the carbon sequestration work undertaken for the Durban 2010 FIFA™ World Cup through the initiation of a third community-based reforestation project (Figure 1). This is located adjacent to Paradise Valley Nature Reserve on 210 hectares of municipal-owned land and will sequester approximately 16,000 tonnes CO₂e over a 10–20-year period, and will allow the Municipality to offset the full local event carbon footprint of 9289 tonnes CO₂e rather than just

the portion it was directly responsible for (i.e. 3303 tonnes CO₂e). Over and above carbon sequestration, the project also helps improve the ecological health of the Umbilo River Catchment, an important local watershed with high levels of urban development and many poor communities, all of whom rely to some extent on the ecosystem services delivered within the catchment. Project implementation has occurred in partnership with local communities, NGOs, the private sector and provincial government, and has employed 101 local people in invasive alien plant clearing, ecosystem restoration, fire protection and as community facilitators supporting 160 'Treepreneurs'.

The project is also significant in that it resulted in the development of the Community-Ecosystem Based Adaptation (CEBA) concept (Roberts et al., 2012). This looks to eventually expand the original reforestation approach to embrace a more complete understanding of the link between communities and the ecosystems that underwrite their welfare and livelihoods, by creating cleaner and greener neighbourhoods that are less dependent on costly utilities and services (e.g. through water recycling and the use of renewable energy). The Paradise Valley CEBA project was promoted as the official COP17/CMP7 offset and each 'Durban CEBA credit' cost US\$11 and paid for one 'green person day', that is, a day's wage for a local person to undertake ecosystem restoration and greening work within the project area.

Aside from funds invested by the Municipality, a donation of US\$46,700 was received from a local corporation towards the first phase of the Durban CEBA project, while the South African National Government purchased US\$5600 worth of CEBA credits to offset the South African COP17/CMP7 delegation's footprint. Durban CEBA credit sales to individuals, however, amounted to only US\$2350. By comparison, the carbon offset programme for the London (2012) Olympics, which allowed participants and spectators to offset their transport emissions footprints for free, saw significantly greater participation. These differing experiences suggest that most mega-event participants and spectators do not regard themselves as financially responsible for the climate-related externalities of their activities, or are not aware of the greening initiatives being undertaken.

A new innovation for the Durban COP17/CMP7 Greening Programme was a purpose-built Ecological Footprinting Model developed to explore the full impacts of the resource consumption and waste production associated with the event. The model demonstrated that approximately 9500 hectares of natural area and productive farmland were needed, from between a few days to 20 years, to produce the food and water used during the 2 weeks of COP17/CMP7 and to treat the associated wastes. This is the first time that the ecological impacts of a mega-event have been characterized in this manner and reinforced the need

for event greening activities to focus on restoring ecological infrastructure in order to reduce the ecological footprint of these events.

Reflections on Durban’s experiences

Reviewing Durban’s experiences the question arises: ‘Does the greening of mega-events provide local governments

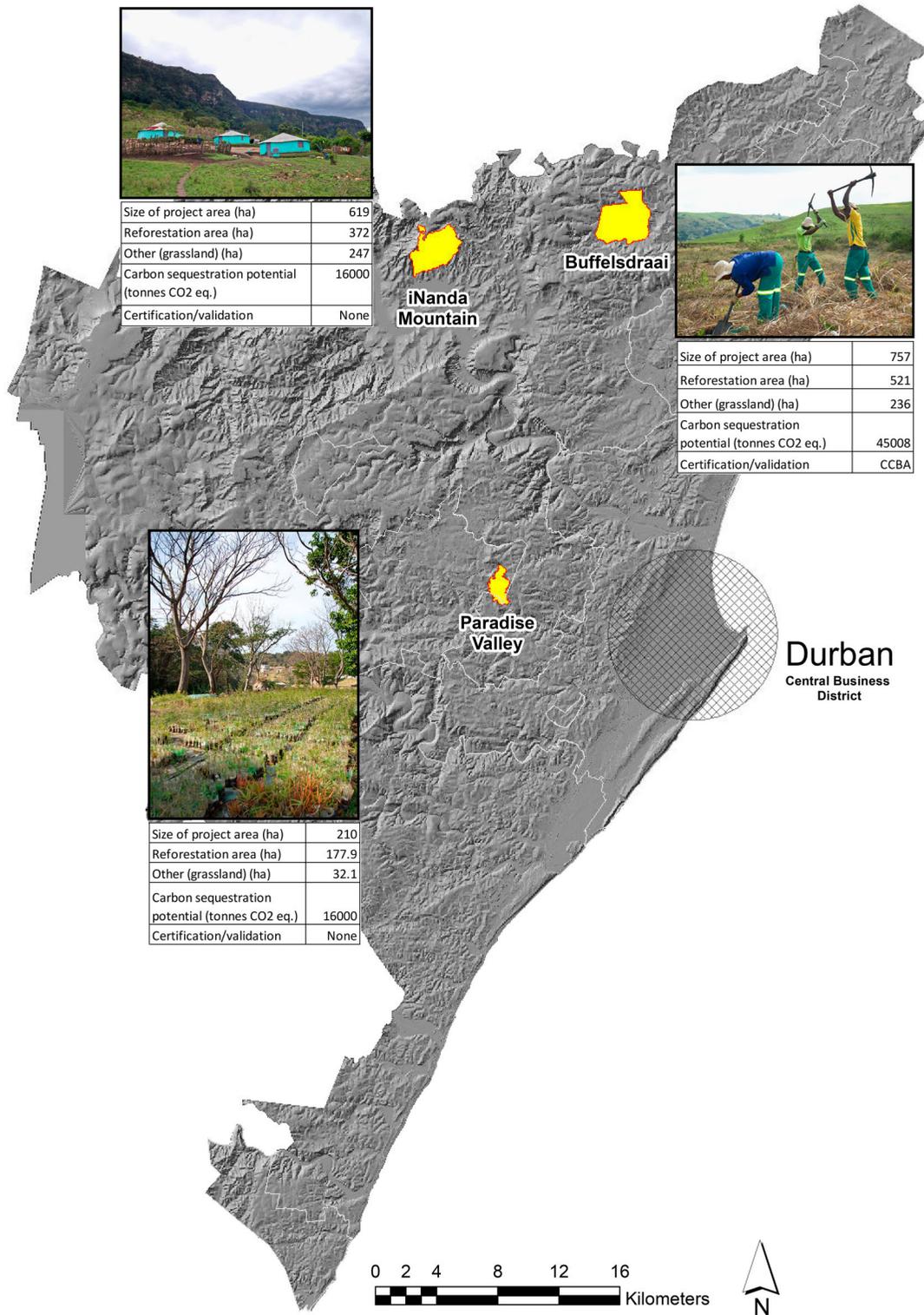


Figure 1. Location and key facts about the three community reforestation projects established by eThekweni Municipality to address the climate change effects of two mega-events hosted in Durban in 2010 and 2011.

with an effective tool for responding to the challenges of global climate protection while still addressing local sustainability imperatives?’ The failure to meet the ambitious carbon neutrality target set for the Durban 2010 FIFA™ World Cup and the success in meeting the more conservative target for COP17/CMP7 provide important insights into the feasibility of achieving ‘carbon neutral’ mega-events.

Firstly, it is not possible to measure, report and offset all carbon emissions associated with the planning and hosting of mega-events, particularly those that require new, large-scale infrastructure developments. Based on a review of global experiences, even where ‘carbon neutrality’ has been claimed, in most cases not all elements of the carbon footprint had been included in the calculation and offset. For example, international travel is a common omission from mega-event carbon offset targets (KAS, 2011; UNEP, 2009b). The real climate impacts of mega-events thus remain poorly understood, and the costs associated with comprehensive mitigation largely unaffordable for most cities, particularly those in the global South where local development remains a priority (Death, 2011; GIZ, 2013). The choice of carbon standard used in offset validation (e.g. CDM or a voluntary standard) may also significantly compound the cost of mitigation. For most local governments, a low-carbon goal is therefore a more pragmatic and realistic objective. While this does not address the urgent need for ambitious climate mitigation, its long-term contribution to climate protection and the awareness-raising benefits of emissions reduction investments in sectors such as energy efficiency, renewable energy and efficient public transport systems do contribute to the establishment of a more sustainable, low-carbon development path.

Secondly, there are major differences in the scope and boundaries of activities included in carbon footprint reports. In Durban, for example, the carbon footprinting approach adopted for the 2010 FIFA™ World Cup and the COP17/CMP7 events differed substantially. The variability in the number of event participants and spectators, length of the event and extent of event hosting infrastructure constructed/used between different types of mega-events also make it difficult to compare carbon footprints directly. In this regard, the standardization of mega-event carbon footprint calculations and reporting would assist with the development of climate impact benchmarks and standards that could be used to inform and assess the effectiveness of climate mitigation interventions.

Thirdly, given that organizations such as the IOC, FIFA™ and the UN are unlikely to accept the responsibility for funding carbon offsets in the short term, local mitigation ambitions will continue to be strongly influenced by local financial resources, especially in the global South where resources are limited (KAS, 2011). Under such conditions all mitigation investments will tend to target interventions

that maximize local co-benefits. A significant contribution to improving this situation would be the development of an international protocol for mega-events that ensures a more equitable distribution of mitigation responsibility (including the associated costs) among key stakeholders, from organizers to participants. This is important as some of the costs are long term, for example, in Durban, the scale of offset projects has necessitated institutional change in order to create dedicated project management capacity within the Municipality and the securing of new funding streams. Such a protocol will require methodological advancement in order to allow for more complete assessments of carbon footprints and the apportionment of offsetting responsibilities. A more structured approach to identifying acceptable and sustainable emissions reductions and offsets must also be developed. Without this, the critique by Hall (2012) that ‘mega-events are symbolic of an unsophisticated approach towards sustainable development’ providing ‘substantial corporate benefits with the costs accommodated by the wider public’ is likely to continue to ring true. The work done on the ecological footprint of COP17/CMP7 also highlighted the fact that while climate protection has received substantial attention in event greening, a broader set of global environmental change priorities need to shape the focus of future greening efforts.

Conclusion

Despite the ‘truly extraordinary challenges’ (GIZ, 2013) experienced in hosting mega-events, it is clear that greening offers host cities a number of opportunities to address climate protection requirements through investments in local projects with long-term social, ecological and climate benefits. In Durban, these included the creation of jobs, carbon sinks and improved ecological infrastructure, watershed restoration, resource-efficient and low-carbon event infrastructure, and renewable energy generation. The opportunity to use mega-events to showcase new approaches to climate protection and to leverage the interest around the event to build awareness of the climate change challenge and how it can be addressed should also be used to maximum benefit.

As approaches to climate protection evolve, the need for the development of a standardized climate impact reporting and management approach will increase. Mega-event greening policy must also embrace the full set of emerging global change issues, including biodiversity protection, water resources protection and sustaining biogeochemical cycles (Hall, 2012) in order to shape more comprehensive event greening approaches and reporting frameworks. This will require greater corporate accountability from event organizers in contributing financially towards the mitigation of the global environmental change impacts that can be ascribed to their events,

especially in the global South where vulnerabilities and development deficits are high. Greater emphasis must also be placed on facilitating knowledge transfer between host cities and ensuring that the post-event phase is not neglected in order to maximize the long-term benefits of these once off events (GIZ, 2013).

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes

1. The 17th Conference of the Parties (COP17) to the UNFCCC and the 7th Session of the Conference of the Parties serving as the Meeting of the Parties (CMP7) to the Kyoto Protocol.
2. The estimated national carbon footprint, which included international spectator travel and emissions from all 9 host cities activities, was 2.25 million tonnes CO₂e (Econ Poyry, 2009).
3. Ecological infrastructure refers to functioning natural ecosystems that deliver a sustained supply of ecosystem services. It is the nature-based equivalent of built or hard infrastructure and includes, for instance, healthy mountain watersheds, rivers, wetlands, coastal dunes, and nodes and corridors of natural habitat, which together form a network of interconnected structural elements in the landscape (SANBI, 2012).
4. The rate of currency exchange used in this paper is US\$1: ZAR 10.70, which is an approximate average rate of exchange for the first half of 2014.
5. Buffelsdraai Landfill: 45,008 tonnes CO₂e; Inanda mountain: 16,000 tonnes CO₂e.
6. Average price per CER on the global market of US\$1.2/ carbon credit at 4 December 2012, when this decision was taken (www.eex.com).

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