The use and appreciation of botanical gardens as urban green spaces in South Africa

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Abstract

There are few formal studies on the contribution of botanical gardens as urban green spaces, particularly within developing countries. Therefore, this paper reports on an assessment of the use and appreciation of botanical gardens as urban green spaces in South Africa. Users and staff were surveyed in six national botanical gardens. The gardens provided numerous benefits in terms of conservation, education and recreation. However, the people using the gardens were not demographically representative of the general population of the surrounding city or town. Generally, most of the visitors were middle- to old-aged, well-educated professionals with medium to high incomes. Most were white and English was their home language. There was an even gender representation. Most visited only a few times per year. The majority of users visited the gardens for recreation and psychological reasons rather than educational ones. However, the staff of each garden placed emphasis on education in the gardens and amongst surrounding schools. Most visitors appreciated the conservation dimensions of botanical gardens, and felt that there was insufficient public green space in their town or city. Understanding how people perceive and use the botanical gardens of South Africa is important to inform future research and strategies regarding the conservation of urban green space within a developing country.

Introduction

Over the last century, human society has witnessed a rapid movement of people into urban areas in Europe, North America and Latin America (Sandström et al., 2006; UN-Habitat, 2006). More recently, this trend has shifted to developing countries, with the highest annual urban growth rates currently found in sub-Saharan Africa (UN-Habitat, 2006). Whilst urbanisation enhances opportunities for economic growth, access to services and infra-structural development, it also frequently has marked impacts on the quality of local and regional environments (Lundqvist et al., 2003), such as land-use change, pollution, loss of habitat and biodiversity, population change and increasing resource demands (Wilby and Perry, 2006). In particular, the decline in sufficient areas of green or natural spaces within urban areas has led to a decrease in ecosystem services and benefits vital for sustainable living within towns and cities (Pyle, 2003; Chiesura, 2004). Preserving and maintaining green spaces in urban environments is thus a crucial aspect of fulfilling environmental quality goals and attaining a ‘liveable’ city – one that is environmentally, economically and socially sustainable (Schopfer et al., 2004; Rotenberg, 2008).

It is well appreciated that these spaces serve important social, psychological, health, aesthetic and ecological functions within urban areas (Forsyth, 2003; Chiesura, 2004; Tyrväinen et al., 2005). Environmental services performed by urban green spaces include air and water purification, wind and noise filtering, microclimate stabilisation, mitigation of storm water flow, erosion control, habitat provision, and water table enhancement (Bonsignore, 2003; Chiesura, 2004; Grove et al., 2006; Knuth, 2006). Urban green spaces also provide social and psychological services to urban inhabitants thereby improving the liveability and quality of cities and towns, as green spaces provide relief from crowded, stressful urban lifestyles (Chiesura, 2004; Sanesi et al., 2006). Benefits of green spaces to human well-being include livelihood provision, health improvements, stress reduction, rejuvenation and recreational activities, as well as providing a sense of peace and tranquillity (Chiesura, 2004; Barbosa et al., 2007; Saz-Salazar and Rausell-Köster, 2008). In the context of urban green areas, an important role can be identified for botanical gardens and similar botanical institutions such as arboreta.

Botanical gardens are unique public green spaces as they are “shop windows of biodiversity” (SANBI, 2006, p. 28). The Botanic Gardens Conservation International (BGCI) defines botanical gardens as “institutions holding documented collections of living plants for the purposes of scientific research, conservation, display and
education” (Wyse Jackson and Sutherland, 2000, p. 12). Ballantyne et al. (2008) report that BGCI estimated there are over 250 million visitors annually to public gardens globally. Botanical gardens also offer other benefits additional to the recognised benefits of urban green space mentioned above. The economic benefits associated with attracting tourists to the region can be significant for well-known public gardens (Sharpley, 2007). Whilst the greatest appreciation of botanical gardens relates to their psychological, restoration, and recreational benefits, some visitors value the educational experiences and opportunities to view unusual or rare flora (Connell, 2004; Ballantyne et al., 2008), and others value their role in maintaining local traditions and community identity (Kuzevanov and Sizykh, 2006). The education and conservation roles are typically seen as vital by management and staff of botanical gardens (Miller et al., 2003; Pinheiro et al., 2006; Ballantyne et al., 2008). Lastly, larger and national gardens frequently support research programmes ranging from horticulture and conservation to climate change (Primack and Miller-Rushing, 2009).

There are approximately 2500 registered botanical gardens worldwide (Wyse Jackson and Sutherland, 2000; Willis, 2004; Waylen, 2006), with an intriguing positive correlation between number of botanical gardens within a country and the human development index of the country (Kuzevanov and Sizykh, 2006). Despite the high levels of both biodiversity and rates of urbanisation in sub-Saharan Africa, the BCGI inventory lists only 98 botanical gardens within the African and Indian Ocean regions. South Africa boasts many botanical gardens, nine of which have national status and which are managed by a national authority, i.e. the South African National Biodiversity Institute (SANBI). These national botanical gardens (NBGs) in South Africa are described as havens of biodiversity that aim to portray the significance of biodiversity and ecosystem services, whilst providing recreational and educational services for the public (SANBI, 2006).

Despite the widespread emphasis placed by garden management agencies on the conservation, recreational and education benefits, both Connell (2004) and Ballantyne et al. (2008) have commented on the surprising dearth of information regarding use of botanical gardens as public green spaces. This applies to both developed as well as developing countries (Pinheiro et al., 2006). Visitor numbers may be known for some gardens because of gate receipts, but the profiles of who frequents botanical gardens, the primary reasons for visiting, the levels of satisfaction they obtain from the various offerings, and how they compare to other public green spaces is largely unreported. The work of Connell (2004) for 13 botanical gardens in the United Kingdom, Ballantyne et al. (2008) for a single one in Australia, and an overview by Pinheiro et al. (2006) in Brazil are noteworthy exceptions.

Within the context of the above, the objective of this study was to determine the profile of botanical garden users within South Africa, as a developing country, and to broadly ascertain the role that botanical gardens play as public green spaces. Key questions related to ascertaining (i) what broad functions botanical gardens in South Africa serve in terms of conservation, education, and recreation, (ii) a profile of botanical garden users/visitors, and (iii) reasons for visiting gardens and the activities in which they engage once there.

Study sites

There are nine NBGs spread throughout South Africa, of which we sampled six, namely Harold Porter, Kirstenbosch, Karoo Desert, Free State, Walter Sisulu and Pretoria NBG (Table 1). The study sites were selected based on their geographic location, with Harold Porter, Kirstenbosch and the Karoo Desert NBGs falling under the Mediterranean climatic region with winter rainfall, whilst the Free State, Walter Sisulu and Pretoria NBGs fall under the highveld climate region with summer rainfall (van Zyl, 2003). Brief details of each are provided in Table 1, as summarised from brochures of the Botanical Society of South Africa (2007) and Willis and Morkel (2007).
Table 1. Overview of the six National Botanical Gardens sampled (adapted from Willis and Morkel, 2007).

<table>
<thead>
<tr>
<th>Botanic garden</th>
<th>City/town and population</th>
<th>Proportion of city/town as formal public green space</th>
<th>Size</th>
<th>Natural vegetation</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harold Porter (34°21′01.6″S 18°55′37.4″E)</td>
<td>Betty’s Bay (+12,000)</td>
<td>Unknown</td>
<td>10 ha of cultivated fynbos garden and 100.5 ha of natural fynbos</td>
<td>Kogelberg Sandstone Fynbos, Western Cape Talus Forest, Fynbos Riparian Vegetation, Hangklip Sand Fynbos, Overberg Dune Strandveld and Western Cape Afrotemperate Forest,</td>
<td>The garden forms part of the Kogelberg Biosphere. Over 95 bird species and a diverse variety of wildlife have been recorded</td>
</tr>
<tr>
<td>Kirstenbosch (33°59′19.3″S 18°25′52.3″E)</td>
<td>Cape Town (+3.5 million)</td>
<td>19% (2002) (which includes Cape Peninsula National Park)</td>
<td>582 ha</td>
<td>Peninsula Granite Fynbos, Cape Winelands Shale Fynbos, Peninsula Sandstone Fynbos and Southern Afrotemperate Forest</td>
<td>Over 125 bird species have been listed and the garden supports a wealth of wildlife, ranging from a variety of amphibians and reptiles to mammals such as Grysbok and Caracal</td>
</tr>
<tr>
<td>Karoo Desert (33°36′ Worcester 48.5″S 19°27′01.9″E) (+80,000)</td>
<td>&lt;5% (2007)</td>
<td>154 ha</td>
<td>Breede Shale Fynbos, Breede Shale Renosterveld and Robertson Karoo</td>
<td>It is the only succulent garden in the southern hemisphere. It hosts over 300 endangered plant species</td>
<td>Over 140 bird species occur in this garden, but still little known on the amphibian, reptilian and mammalian fauna</td>
</tr>
<tr>
<td>Free State (29°03′05.9″S 26°12′48.5″E)</td>
<td>Bloemfontein (+0.4 million)</td>
<td>8.6% (2003)</td>
<td>60 ha</td>
<td>Winburg Grassy Shrubland and Bloemfontein Karroid Shrubland</td>
<td>Some 240 bird species have been recorded in the garden, along with a resident pair of Verreaux’s</td>
</tr>
<tr>
<td>Walter Sisulu (26°05′16″S 27°50′36.4″E)</td>
<td>Johannesburg (+7.2 million)</td>
<td>16.2% (2004) but declining with urban densification</td>
<td>300 ha</td>
<td>Gold Reef Mountain Bushveld</td>
<td></td>
</tr>
</tbody>
</table>
Pretoria (25°44′10.8″S 28°16′34.6″E) Pretoria. (±2.3 million) No city figure; Eastern District Council Area is 5% 76 ha Marikana Thornveld

Eagles, as well as 25 species of mammalian and reptilian fauna
Over 220 bird species of birds occur in this garden and it has a diverse range of fauna and flora

Note: estimates of the proportion of green space per city are from local State of the Environment Reports or Integrated Development Planning reports.

The functions of the six botanical gardens are divided between four broad goals, namely conservation, education, recreation and services to the public (Willis, personal communication). The gardens fulfil conservation functions such as the preservation of threatened and rare indigenous South African plant species, scientific research programmes, managing and maintaining plant collections and the estate, information services such as herbaria and libraries, rescuing plants from areas of development, as well as interpretative signboards and theme walks. Seed conservation, in conjunction with the Millennium Seed Bank Project (based in the United Kingdom), is also promoted, particularly in Kirstenbosch NBG. The gardens engage in ex-situ and in-situ conservation practices and are classified as Conservation Gardens. Staff participate in broader initiatives, such as planting indigenous gardens at schools, developing community nurseries and Greening of the Nation projects.

There are five education centres run by SANBI, four of which were in sampled gardens, namely Kirstenbosch, Free State, Pretoria and Walter Sisulu NBGs. All engage in educational activities focussed on local schools. The programmes are usually inclusive of all school levels and linked to the national school curriculum. Some gardens also offer workshops for teachers professional development programmes that link topics such as biodiversity and sustainable development. Many of the gardens train local guides for walks and talks.

Methods

The majority of the data were collected through surveys and interviews of visitors to the gardens as well as population data available from the national census. This was supplemented by qualitative interviews with the manager/curator at each garden (six), the education officer at each garden (five, because Harold Porter and Karoo Desert NBG share an education officer), as well as the SANBI Chief Director and the Kirstenbosch NBG Estate Manager.

Visitor surveys

The surveys for the garden visitors consisted of a structured questionnaire with both closed and open-ended questions to ascertain demographics, as well as the use and perceptions of botanical gardens as urban green space. An opportunistic approach was utilised, which entailed interviewing any garden visitors were willing to participate over 4 days of sampling at each garden. Because not all people approached agreed to be interviewed, the sample size per garden was not equal, varying from 50 to 76. The interview schedule was piloted in Makana.
botanical gardens (a municipal botanical garden) and fieldwork was subsequently carried out in June and July 2008.

The visitors were surveyed on Saturday, Sunday, Monday and Tuesday at each garden. The sample unit is days and consisted of visitors who utilise the garden over the weekend period, on a weekday (Monday) and on a Tuesday (when entrance for pensioners is free in the majority of the gardens). These specific days were selected to gain a representative profile of garden visitors and an adequate sample size. Harold Porter, Worcester, Free State and Pretoria NBG had a sample size of 50 visitors per garden, whilst Kirstenbosch and Walter Sisulu had a sample size of 60 and 76, respectively, giving a total of 336.

The gardens were not uniform in their entrance fee and facilities available to the public. The entrance fee varied between gardens from one to three Euro (€), and one garden did not charge a fee. Two gardens did not have a pensioner’s day on Tuesday and another two gardens held concerts during the time users were surveyed. Other than Kirstenbosch, the sampled NBGs were not located along major routes serviced by public transport.

Census data collection

Census data were obtained for the 2001 census from Statistics South Africa (STATSSA) (2003) to determine the demographic profile of the population residing in the urban areas surrounding each garden. This was done for the city or town as a whole, as well as the specific area of the town, termed a ward, in which the garden is situated. Thus, the profiles of the garden users were compared against the census data of the particular urban area at both town and ward level to assess the demographic representivity of the garden visitors.

Data analysis

The data for the six gardens were pooled. Income categories from the census data were determined through occupation, based on a combined estimation of household income per year. To compare the area’s population profile to the demographic profile of the garden users, average frequencies were calculated across all the demographic categories (age, education, gender, language and population group) to graphically illustrate differences between the municipal, ward and garden user data. Delimitation of the classes within the user data corresponded to those used by the 2001 census so to permit direct comparison. A Pearson’s Chi-squared test was undertaken to determine if there were significant differences between the various demographic categories in terms of the municipal, ward and garden user data. All the statistical tests were run in Statistica 8 and only significant results are discussed. At the time of the fieldwork the currency exchange rate was taken as 1 Euro (€)=10.00 Rand (R).

Results

Garden visitor profiles

The garden visitors were representative in terms of gender, 51% female and 49% male. Just over half fell into the middle age category (30–59 years old), whilst 32% and 17% fell into the old (60 years old and over) and young (0–29 years old) age categories, respectively. None of the garden users had less than secondary school level education and the large majority (83%) had a post-secondary school education qualification.

As reflected in the education findings, none of the garden visitors came from the ‘no income’ or low income (0–7680€ per annum) brackets. The majority (48%) fell into the high income (30,720€ p.a. and more) bracket, whilst 39% fell into the ‘not applicable’ (pensioner, student, scholar and self-employed) bracket and 13% were middle income (7680–30,720€ p.a.).
Of South Africa’s 11 official languages, the general public garden users’ first language included English (50%), Afrikaans (39%), ‘other’ such as German and French (9%), isiXhosa (1%) and Sesotho (1%). The overwhelming majority (90%) came from the white population group, whilst 4% were Indian/Asian and Coloured, respectively, and 1% black African.

Garden visitor demographics relative to town population

The demographic profile of the garden users was compared to their corresponding urban area population in terms of both wards and the whole town or city in which the garden was situated. A large proportion (73%) of the general public garden visitors resided within the immediate urban areas surrounding the gardens.

The results for age, education level and population group were all significantly different at the 5% significance level, which illustrated that the public using the gardens were not demographically representative of the broader population found within the wards and towns in which they were situated. There was no significant difference in gender, as there was a representative portion of males and females across the municipal, ward and garden categories. However, there were significant differences within age ($\chi^2=32.73; df=4; p<0.05$) and language ($\chi^2=94.52; df=22; p<0.05$) categories. The garden users were predominately middle- and old-aged relative to the wards and municipalities (Fig. 1).

![Fig. 1. Average age group frequencies for botanical garden users, ward and city populations for six national botanical gardens in South Africa.](image)

There were highly significant differences within the different education brackets of no schooling, some primary schooling, completed primary schooling, some secondary schooling and completed Grade 12 (school leaving certificate) ($\chi^2=135.27; df=10; p<0.05$). The majority of the garden visitors were well educated relative to the general population at ward and municipal levels (Fig. 2). There was also a significant difference within the population group category ($\chi^2=120.00; df=6; p<0.05$). The majority of general public garden users fell into the white population bracket, although most residents in the wards and cities were of the black African population group (Fig. 3).
Garden visitor activities

The visitors surveyed in the six gardens were asked to specify reasons why they visited the gardens and the activities in which they engaged. They were not restricted and could give any number of reasons why they used the gardens. People surveyed generally visited the gardens infrequently (chosen from categories of daily, weekly, monthly, few times a year, once a year or less, and first time), with 30% of the users visiting a few
times a year and 20% visiting for the first time. The most frequent reasons given for why people did not visit the gardens more often included no time, far distance to travel or physically incapable. The garden users main mode of transport to the gardens was by private car.

Activities such as enjoyment of the garden’s natural beauty, exercise and get a breath of fresh air were the primary reasons given for using the gardens (Fig. 4). The second ranked reason (other) was a collection of activities which were not specified in the questionnaire such as functions (including weddings, birthdays and parties), an interest in plants and birds, and holiday. The lowest ranked reasons included to bring out of town visitors; attend a concert or function; or purchase books, souvenirs and plants. Not all the gardens hosted events during the study period; nor had equal standards of facilities available to the public such as nurseries and souvenir shops, which may have influenced the lower ranked reasons.

![Fig. 4. Reasons provided by the general public user as to why they visit botanical gardens in South Africa.](image)

Perceived user benefits of botanical gardens

Almost all the garden visitors (99%) thought that urban green space was important and 67% of them agreed that the gardens effectively promoted conservation. However, 55% of the garden users felt that there was insufficient green space within the urban areas in which the gardens are located. The people surveyed at the study sites were asked why botanical gardens are important as urban green space and the following reasons were given: “green lungs”, open space and habitat corridors; recreational outlets for relaxation, appreciation and exercise; conservation; enhance quality of life; escapism and breathing space; preservation for future generations; education, awareness and research purposes; air purification; spiritual and moral functions; and to provide safe green areas.

Other benefits

The importance of botanical gardens as education tools within urban areas was repeatedly stressed by the staff. Through projects such as the greening of schools and surrounding urban areas, the gardens were seen as a means to impart a sense of community pride and value in their natural environment. Other benefits mentioned by management and education staff included environmental services such as noise and pollution reduction, as well as wildlife sanctuaries within urban areas. Events, concerts and alternative displays (such as earthworm
farming) were also seen as a drawcard to bring people to the gardens and expose them to the environment and education the gardens have to offer.

Discussion

Botanical gardens fulfil multiple functions. Of particular interest in this study is their role as public green space and consequently how urban residents use and perceive them. This is necessary as there is a scarcity of work reporting on such from both developed and developing countries (Connell, 2004; Ballantyne et al., 2008).

The majority of respondents (55%) in this study stated that there was insufficient public green space within the town or city in which the botanical garden was situated, and that 99% regarded public green space as an important facet of making urban areas liveable. They readily listed a range of benefits from public green space and botanical gardens, which covered the psychological, recreational, quality of life and ecological dimensions well-recognised internationally (Tyrväinen et al., 2005). Given the high incidence of crime in South Africa (Altbeker, 2005), safety is also a key criterion in choosing and using public green space, paralleling work in developed countries such as England (Jorgensen and Anthopoulou, 2007). The education and conservation initiatives of the botanical gardens were well appreciated, being acknowledged by two-thirds (67%) of respondents. The outreach and research activities of botanical gardens are not readily visible to the visitors to the gardens and hence were not mentioned by them, although emphasised by the garden staff.

Results from this study show that most of the respondents visited the botanical gardens to enjoy the outdoor environment, the beauty of the gardens and the restorative experience it offers, frequently along with family or friends. Relatively few cited education or horticultural reasons. This echoes the findings of Ballantyne et al. (2008) for Mt. Coot-tha botanical garden in Brisbane, Australia. This was especially so for returning visitors, whereas first time visitors would make more use of the education and information offerings available. The same applied to visitors to botanical gardens in Britain (Connell, 2004), although there was a greater interest in gardening and horticulture as the primary reasons for their visits.

Relative to the immediate ward and city population, visitors to the NBGs tended to be middle- to old-aged, well educated, in high income brackets, and from the white population group. The younger, poorer or black groups were relatively poorly represented within the visitor population. The staff of the NBGs are aware of this, and have targeted much of their external education initiatives (especially in schools) at such groups. Some staff argue that the absence of regular public transport links to the gardens is a major limiting factor in attracting these groups. However, this visitor profile does not seem at odds with those in other countries where public transport links are better. Connell (2004) showed the same for visitors to public botanical gardens in Britain, who were largely middle- to old-aged people of professional backgrounds with a high income earning capacity. However, use of public green space more generally is highly variable depending upon the attributes of the space, surrounding populations as well as its accessibility (Forsyth, 2003; Grove et al., 2006; Barbosa et al., 2007; Sugiyama and Thompson, 2008). Thus, various authors have reported differences in user profiles relating to gender, age, ethnicity, affluence, and location within the city. For example, Barbosa et al. (2007) found that the proximity to public green space was least for wealthy groups and highest for older households and more welfare dependent households in Sheffield in England. In contrast, work in small towns in South Africa has shown public green space to be most spacious in wealthy towns (McConnachie et al., 2008) and wealthier suburbs within those towns ([18] and [18]). A similar pattern was reported by Iverson and Cook (2000) for public and private green space in the Chicago region, USA.

Most botanical gardens were established decades if not centuries ago to assess the flora of different regions of the world. Many were associated with universities or colonial interests to assess and propagate plants with potential medicinal or economic uses (Garrod et al., 1993). Whilst some of these functions remain, there is increasingly an emphasis on education, conservation, research and recreation (Wyse Jackson and Sutherland, 2000; Connell, 2004; Kuzevanov and Sizyk, 2006; Waylen, 2006; Primack and Miller-Rushing, 2009).
Linking of the education and recreation dimensions within a public green space paradigm would be useful, but has been little studied. On the one hand, many botanical gardens are not managed by city authorities and so are excluded from broader strategic plans regarding green space provision and use. On the other hand, the growing conservation mandate of botanical gardens (Miller et al., 2003; Pinheiro et al., 2006), means that their role as public green space for recreation and psychological benefits is also underdeveloped. For example, the BGCI constitutes one the largest plant conservation networks by linking botanical gardens worldwide (Wyse Jackson and Sutherland, 2000). It offers botanical gardens a common framework, aids in the creation of new gardens, and supports the further development of established ones (Wyse Jackson and Sutherland, 2000), all within a conservation agenda rather than a public green space one.

Yet their potential is clear. Over 600 new botanical gardens have been created worldwide during the past two decades (Chang et al., 2008). It is estimated that some 250 million people globally visit botanical gardens every year (Ballantyne et al., 2008; Chang et al., 2008). South Africa is part of this. With 58% of the population urbanised, and rapidly increasing, the demand for public urban green space will increase. Indeed, between 2006 and 2007, the South African NBGs received their highest recorded number of visitors of 1,258,032 people, showing the potential for the gardens to promote the use and appreciation of green space (SANBI, 2007). Botanical gardens are also used to tackle social problems through improving urban environments and this is demonstrated in South Africa through greening projects run by the NBGs (Waylen, 2006).

Users of public green space are attracted to attributes such as the diversity of natural scenes, functions, activities, flora and fauna, safety, accessibility and the overall aesthetic quality of urban green space (Burgess et al., 1988; Forsyth, 2003; Chiesura, 2004). The appreciation of nature and aesthetics are highly regarded amongst the garden users surveyed in the six NBGs, and Chiesura (2004) reflected similar results in a study assessing the role of urban parks. The gardens also provided an escape for urban residents to engage in recreational activities as, in general, natural settings provide restorative experiences for users (Chiesura, 2004; Pedretti and Soren, 2006). This information can inform and assist decision makers in formulating strategies to improve and maintain botanical gardens in South Africa according to the needs and expectations of the public (Forsyth, 2003; Chiesura, 2004).

Conclusion

It is appreciated that urban green spaces serve important social, psychological, health, aesthetic and ecological functions. However, these functions are frequently taken for granted, by the public and city authorities, and only after green spaces are destroyed or reduced are their positive effects on well-being recognised. With over one million visitors annually (and increasing), it is clear that the NBGs in South Africa are a vital component of the urban green space system. However, the historical development of the cities and the location of the botanical gardens has resulted in them being located far from certain sectors of the population. Disparities between green space users within societies such as South Africa also cannot be ignored, as this influences people’s perceptions of urban green space and how they value natural resources. New approaches to social inclusion for the botanical gardens and green space planning within these cities generally should be encouraged.

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