Social, environmental, economic and health benefits of botanic gardens

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Introduction

By 2015 in excess of 80% of the North American, European and Australasian populations will be living in urban areas (State of the Worlds Cities 2006-7). Within this framework of a structure we call a 'city'" there is going to be an increased demand for energy sources and greater use made on our non-renewable natural resources (Hirano 1999). These population pressures, in association with the significant issues associated with climate change start to raise concerns, not only for our biological systems and the broader natural environment, but how these conditions will impact on our quality of life. Some scenarios may include the continued degradation of our natural systems, a loss in function of these natural green spaces and ecosystems, and in other cases a loss of biodiversity and possible extinction of plant and animal species. The major threats to human health and wellbeing could include poor nutrition and disease in the less developed countries and in the case of the more highly developed countries increasing obesity, declining physical activity, and growing rates of mental illness. Theorists, such as Wilson (1984) have shown that "humans are dependent on nature – not just for their material needs but also for their psychological, emotional and spiritual needs". Research now shows the psychological, physiological, economical, social and health benefits of humans coming in contact with the natural environment (Pretty and Ward 2001). Parks, public nature reserves and other green spaces are often the only possible sources of connecting with the natural world (Maller *et al.*. 2002; 2006).

For a botanic garden to be sustainable and to make best use of the benefits that natural green space provides, managers are now beginning to understand that their agency is linked to their social, environmental and financial performance in the market place. The objective of this paper is to discuss a range of benefits offered by nature and the natural green space of botanic gardens and how these benefits can be sustained in terms of triple bottom-line reporting.

Functions of botanic gardens

Today much of the natural environment in and around our urban and peri-urban areas is considered as part of the "green web of society" (Glasgow and Clyde Valley Green Space Trust 2005). These green spaces take on many forms that can range from transport corridors, drainage areas and wetlands, to urban forests through to the more formal sport and recreation facilities of parks and reserves and botanic gardens. More specifically botanic gardens see themselves as sources of "growing plants for public enjoyment, scientific, horticultural, conservation, or educational purposes, and have a local, national or international role (Botanic Gardens Australia and New Zealand Inc. (http://www.anbg.gov.au/chabg/constitution/index.html). Willis (2005) sees botanic gardens as "providing professional skills in horticulture and tourism and supporting national, regional and international networks for the conservation, sustainable use and appreciation of native and naturalized flora".

Benefits of botanic gardens

The green spaces associated with botanical gardens are often seen as providing "health, employment, education, recreation, aesthetic and landscape benefits, as well as building civic pride and community spirit, and reducing crime" (The Green Cities, Sustainable Cities Conference 2003). More specifically botanic gardens are seen as protectors and conservers of plants and biodiversity, educators of the environment, providing for sources of economic business opportunities and tourism destinations, and providing programs and service that impact on the social and cultural health of the community.

Plant conservation and protection of biological diversity

Jorgensen (1986) showed that natural green space provides suitable habitat to conserve wildlife as well as protect biological diversity. The latter in particular, leads to an appreciation of the natural habitat, to an improved understanding of the threats and consequences in changing biodiversity, and to the range of measures that can be taken. Botanic gardens have been shown to play a key role in the conservation of plant species, their communities and the wider natural and contrived landscapes, raise public awareness on biodiversity issues, as collectors of living and preserved plants, and advocates in the saving rare or threatened species of plants, many of which are now rare or threatened in the wild.

Education and environmental awareness

Education and training is a strength of botanic gardens that allows them to communicate the message of plant conservation, as well as reaching out to diverse audiences on issues of environmental awareness. In many countries this is often achieved through park wardens, park rangers and educational officers, employed by the agency, that host a range of walks and talks with local schools and associations to raise awareness and appreciation of their surrounding environment. Opened in 2004 the Ian Potter Foundation Children's Garden, is located in Melbourne's Royal Botanic Gardens and is a major environmental education garden specifically designed for children with the aim to educate children about plant life through play, discovery and adventure using a range of key environmental learning themes and outdoor classroom structures.

Environmental benefits

Natural green spaces have been shown to play an important part in counteracting the 'heat island' effect in urban communities by ameliorating climate (Finnigan *et al.* 1994), improving the hydrological processes (Carne 1994), absorbing pollutants (Nowak *et al.* 2002), as well as providing shelter and restoring biodiversity (Xinian 1999). Stable vegetative surfaces can also provide benefits in controlling soil erosion and stabilising dust (Fatahi, cited in O'Keefe, 2006), reducing glare, noise and visual pollution, and improving the safety of transport on roadsides (Beard and Green 1994). The holistic environmental benefits of green space have been recently quantified by Xinian (1999) for the City of Beijing, P.R. of China. Nearly 2 billion m^2 of residential, public, roadside and urban forest "greenland" was found to absorb nearly 4 million tonnes of CO_2, and release 3 million tonnes of O_2 and 439 million tonnes of water vapour back into the atmosphere on an annual basis. Natural green space acts not only as a fuel source and sink for atmospheric carbon, but can assist in reducing global warming, by slowing down the accumulation of atmosphere carbon (Nowak *et al.* 2002).

Economic benefits

Although natural green spaces have long contributed to a region's economy in the form of income (general entry fees, cafes or restaurants for visitors, merchandise in garden shops, or fee-for-service income for a range of horticultural or landscaping advice), as well as employment, botanical gardens have been known to contribute to the region's economic stability by attracting residents, businesses, partnerships, and tourism activities. Jenner and Smith, cited in Goodwin (1996), valued the USA ecotourism market at some $US50 billion in 2000. In SE Asia, international garden shows, like the Malaysian International Landscape and Garden Festival (2006) and the International Garden and Horticulture Exhibition, Pacific Flora (2004) attracted some 500,000 and 5 million visitors respectively into their respective regions. Closer to home, turnstile counts recorded 180,000 visits to Canberra's Floriade 2000 with total direct expenditure being A$9.6 million (up from A$7.5 million in 1999). The Melbourne International Flower and Garden Show annually generate in excess $3 million and attract some 122,000 visitors into the City of Melbourne.

Direct economic benefits of natural green space are often associated with energy costs, with natural green space lowering local air temperatures by transpiring water and shading surfaces, resulting in a reduction in building energy use and cooling costs. McPherson (1992) estimated that the cost-benefit implications, of a single Arizona tree plantation, could provide up to $US236.5 million in net environmental benefit over a 40-year time frame. In addition researchers Bauman and co-workers (2001) and McKenna (2003) have demonstrated an economic link between the high cost of health and the potential use of natural green space in reducing these health costs.

Social and cultural health

From the social perceptive, working with/in natural green space is more likely to develop closer friendships with neighbours (Dunnett and Qasim 2000); provide for a more active lifestyle (Waliczek *et al.* 2005), provide for "green exercise" (Pretty *et al.* 2005), improve worker productivity (Lohr *et al.* 1996), reduce staff turnover costs and absenteeism (Wood 2003), and reduce domestic violence and crime (Kuo and Sullivan 2001). However the impact of such green space in preventative health care has only recently been acknowledged. Recent studies have looked at the human response to plants in relation to health has shown a more quicker recovery from mental fatigue (Bennett and Swasey 1996), improvements in self-esteem (Smith and Aldous 1994), the alleviation of stress (Kaplan 1992), reductions in the potential for anger (Ulrich and Parsons 1992), the number of headaches (Kaplan *et al.* 1988), and the risk of dementia (Simon *et al.* 2006), and well as providing for less time recovering in hospital (Ulrich 1984). Natural green space can embrace some aspects of community culture. In Melbourne Australia, community activities such as the Australian Open Tennis Tournament, cricket, and the Australian Grand Prix provide for community cohesion in sports and recreation. Botanic gardens often have a key involvement in organising and delivering a range of cultural events from local sports sessions, to summer play activities offering visual arts, music and cinema. More recently The Royal Botanic Gardens in Melbourne has been involved with the Australian Shakespeare Company presenting "A Midsummer Night's Dream" over summer out under the stars.

Botanic gardens, sustainability and the triple bottom-line

In terms of the triple-bottom-line the different elements of 'environmental sustainability', 'social sustainability' and 'economic sustainability' need to be incorporated into a holistic model. Therefore for a botanic garden to be sustainable, in the medium to long-term, it must be financially secure (economic performance); it must minimize its negative environmental impacts (environmental performance); and conform to the communities' expectations (social performance). Increasing numbers of agencies are now incorporating these principles and practices as part of the reporting process in their management programs. Some of the agencies in Australia where the triple bottom-line approach has been adopted are The City of Melbourne's parks group (Anon. 2002), and the National Botanical Gardens, in Canberra, Australian Capital Territory (http://www.environment.gov.au/about/publications/tbl/04-05/pubs/summary-report.pdf). To sustain such development, botanic gardens, associated municipalities, communities and individuals need to work together to improve the economic, social and environmental performance of their own triple bottom-line. The concept of the triple bottom-line reporting process will enable agencies to achieve real and lasting change which can have a positive impact on the well being and prosperity of their organization.

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