

GUEST ESSAY

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Stephen Blackmore is Chair of Botanic Gardens Conservation International (BGCI), the world's largest network for plant conservation. He feels a strong personal connection with Hong Kong, where he went to school for four years in the 1960s. He later lived and worked in Seychelles and Malawi before spending almost 20 years as a botanist at the Natural History Museum in London. From 1999 to 2013 he served as the Regius Keeper of the Royal Botanic Garden Edinburgh where he is now the Queen's Botanist and an Honorary Fellow. He is a Fellow of the Royal Society of Edinburgh and has been awarded both the Scottish Horticultural Medal, by the Royal Caledonian Horticultural Society, and the Victoria Medal of Honour, by the Royal Horticultural Society. His 2009 book, *Gardening the Earth*, argues that horticulture is a key skill for the sustainable management of the planet. He sees botanic gardens as powerful agents for change in society with enormous potential to tackle many of the most challenging issues of our times.

CITIES: THE FINAL FRONTIER FOR ENDANGERED PLANTS?

ABSTRACT

Now that more than half of humanity lives in cities, urban greenspace and Urban Green Infrastructure (UGI) have never been more important. Although the health benefits and ecosystem services provided by urban greenspace are now widely appreciated, the potential for cities to provide refuges for native flora in general and threatened plants in particular, is not. The United Nations Sustainable Development Goals provide an internationally agreed framework for tackling the world's greatest challenges including the biodiversity crisis, climate change and the need to make cities and human settlements inclusive, safe, resilient and sustainable. This article explores the opportunity provided by these Global Goals for botanic garden horticulture to make cities havens for endangered plants and better places for people to live in. It identifies botanic gardens as the only organisations with the potential to overcome the barriers to conservation in the city.

URBAN GREENSPACE – UNFULFILLED POTENTIAL

When visiting the Pearl River Delta Metropolitan Region (PRD) of China in 2017 to take part in the International Botanical Congress, I saw many ambitious and architect-

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turally excellent urban greenspaces in Hong Kong and Shenzhen (Figs 1–3). This was especially heartening because, following the most rapid urban expansion in history, the PRD is now home to over 120 million people, the greatest concentration of human beings anywhere on the planet (World Bank, 2015). As more than a dozen major cities including Guangzhou, Shenzhen, Dongguan, Foshan and Hong Kong have expanded and merged, effectively forming a megalopolis, the PRD is pushing the boundaries of how the megacities (defined as having more than 10 million inhabitants) of the future will function.

What I was seeing reflected a global surge in engagement with urban greenspace, by governments and city planners, underpinned by a relatively new understanding of the potential of plants in Ecosystem-based Adaptation (EbA) (see, for example, Colls *et al.*, 2009; Elmqvist *et al.*, 2013; Hunt *et al.*, 2014; Müller *et al.*, 2013; Threlfall & Kendal, 2018). The concept of Urban Green Infrastructure (UGI) is being adopted around the world and is now firmly enshrined in European policy (Davies & Laforteza, 2017) because it delivers both ecosystem services and health benefits to citizens. It remains to be seen how effectively cities in the PRD and elsewhere in our increasingly urbanised planet can interact with their ever more distant agricultural and natural or semi-natural hinterlands and whether they can deliver a high quality of life for their inhabitants. With the number of megacities set to grow significantly, especially in Asia, the blueprint for their development is very important. The design and realisation of the hard landscapes and the water features associated with them, which I saw in the PRD, was truly impressive and every bit as stylish and striking as I have seen anywhere. What struck me quite forcefully, however, was the depressingly narrow range of mainly exotic, pantropical garden plants with which these greenspaces were planted. Species which can be seen anywhere warm enough dominated: bougainvillea (*Bougainvillea* spp.), frangipani (*Plumeria* spp.), figs (*Ficus* spp.), traveller's palms (*Ravanea madagascariensis*), Chinese hibiscus (*Hibiscus rosa-sinensis*), Madagascar periwinkle (*Catharanthus roseus*) and other overly familiar flora. The inclusion of two native tree species, coast cottonwood or sea hibiscus (*Hibiscus tiliaceus*) and the Hong Kong orchid tree (*Bauhinia blakeana*), stood out as notable exceptions against a backdrop of exotics. The former is an attractive tree, widespread in the tropics, and the latter, which provides the floral emblem for the flag of the Hong Kong Special Administrative Region, is a sterile endemic of hybrid origin (Mak *et al.*, 2008). Why, however, were so few other native species in evidence? It seems to me that while the architecture of futuristic cityscapes has advanced enormously, their horticulture lags far behind. This is especially apparent in tropical and subtropical countries, the very places expected to see the greatest growth in megacities in the future. Paradoxically, those regions are, of course, high in biodiversity, with many more plants potentially available for introduction into horticulture than the world's temperate regions.

This caused me to reflect on the compelling reasons to strengthen the horticultural focus on native species in urban greenspace and, beyond this, to make urban greenspaces arenas of plant conservation. Doing so would make powerful use of the expertise,



Fig. 1 Urban greenspace in Shenzhen, host city of the International Botanical Congress in 2017, with Madagascar almond (*Terminalia mantaly*) as a shade tree over a mixed planting of Caribbean agave (*Agave angustifolia* 'Marginata'), Japanese sago palm (*Cycas revoluta*) and various evergreen shrubs. Photo: S. Blackmore.



Fig. 2 The buildings around the Forum at Exchange Square in Hong Kong, each with its own distinctive architecture, are surrounded by a landscape featuring unique sculptural artworks and well-presented but botanically mundane pantropical ornamental plants. Photo: S. Blackmore.



Fig. 3 In recent years the elevated pedestrian walkways of Central district, Hong Kong, have been greatly enhanced as urban greenspaces, mainly featuring exotic plants with a few native trees, including coast cottonwood or sea hibiscus (*Hibiscus tiliaceus*). Photo: S. Blackmore.

collections and even the location of botanic gardens in support of the United Nations Sustainable Development Goals (SDGs). In this article, I want to make the case for seeing cities as the final frontier in plant conservation and fulfilling the potential of urban greenspace.

BOTANIC GARDENS AND THE SUSTAINABLE DEVELOPMENT GOALS

The 17 SDGs, known collectively as the Global Goals for 2030, were adopted by the United Nations in 2015 as the successors to the Millennium Development Goals (UNDP, 2015). In the future, despite the continuing importance of the Convention on Biological Diversity (CBD) and the Global Strategy for Plant Conservation (GSPC), I expect the SDGs to assume even greater importance to strategic thinking in botanic gardens (Blackmore, 2017). In a recent issue of *BGjournal* that featured articles focusing on the SDGs, Sharrock (2018) provided examples of botanic garden activities in support of each of the 17 goals. The theme of this article, urban greenspace, is central to Goal 11, which aims to make cities and human settlements inclusive, safe, resilient and sustainable.

The fact that many botanic gardens have an urban setting and in many cities were the first urban greenspace has seen a growing number of them engage with the educational, health and social needs of their local communities (Shaw & Schwarz Ballard, 2017). A key theme has been the importance of favouring native species rather than inappropriate exotics. Russell (2018) described how Cranbourne Gardens, situated in the urban growth corridor south-east of Melbourne and focusing on native Australian plants, is already shaping the delivery of SDG 11. By protecting existing habitat corridors, or biolinks, and creating new ones, Cranbourne Gardens is conserving plant and animal diversity and contributing to regional planning through scientifically robust advocacy. Similarly, Auckland Botanic Garden has demonstration sites pioneering the use of newly selected native species in the construction of bioswales, Low Impact Design (LID) buildings and other EbA landscape features (Hobbs & Stanley, 2014). These have now become a showcase for the techniques for storm water management and climate change adaptation while a Native Plant Ideas garden displays native plants suitable for cultivation in private gardens.

Nevertheless, as I observed in the PRD, the drive towards using native species in urban greenspace still has a long way to go, especially in tropical regions, where the need is perhaps greatest. Müller *et al.* (2013) pointed out that, compared to temperate regions, much less has been published on decorative ornamental plants in the tropics. In fact, as they noted, over 77 per cent of urban trees in Bangalore, Rio de Janeiro and Bandung, Indonesia were exotics. There are some broader movements in landscape architecture that might be expected to increase the focus on native plants. Ignatieva & Ahrné (2013) have, for example, introduced the concept of 'biodiversinesque' landscapes intended to break the stranglehold of picturesque-gardenesque plantings which they see as part of an increasingly homogenised global culture. Their vision of

biophilic cities aims to mimic ecological processes through biodiverse lawns, green roofs and green walls. Such movements will hopefully increase the biodiversity of urban greenspaces although they may not go far enough to bring plant conservation fully into the urban environment.

BARRIERS TO CONSERVATION IN THE CITY

Two of the main obstacles to using endangered plants in urban greenspace are lack of knowledge about which threatened native plants are appropriate and, even more critically, where to obtain living plants. It was a lack of readily accessible knowledge about threatened plants which motivated the first two targets of the GSPC (Wyse Jackson & Kennedy, 2009). There has already been much progress towards achieving target 1, for example through efforts such as the World Flora Online (Wyse Jackson & Miller, 2015). However, in relation to target 2, a recent analysis, Bachman *et al.* (2018), noted that the conservation status of the majority of plant species remains unassessed. Following recently published analysis of the world's trees and their distribution (Beech *et al.*, 2017), BGCI has prioritised completing the conservation assessment of all 60,065 tree species by 2020. This will empower the nations of the world to know which trees are native or endemic to their territories and intensify the effort to conserve the most threatened taxa. Ideally, this will lead to consideration of conserving threatened native trees in urban settings, as well as in more traditional settings for conservation.

Overcoming these key gaps in underpinning information for plant conservation may be within reach, but access to living material of threatened plants remains a greater challenge. Speaking at workshops on urban greenspace in Hong Kong and Shenzhen, I was repeatedly told that very few native species are available in nurseries within the PRD, and that large specimens to provide immediate impact were not available at any price. Clearly, as is too often the case in reforestation programmes, the use of inappropriate exotic plants often continues in urban greenspace simply because native species are not available from commercial nurseries and seed stocks. Even when clients and designers of urban greenspace set out to use interesting native species, they are thwarted by the lack of supply. This is something that is only likely to change if botanic gardens take up the challenge.

For botanic gardens to broaden the palette of plants grown in urban greenspace requires them to begin to sell native plants and seed derived from their living collections, perhaps supplemented by additional wild-origin material. Of course, for this to make a meaningful contribution to conservation requires not only that populations established in urban greenspace are of known provenance, but that records are kept, enabling onward use in, for example, species recovery programmes. Fortunately, this is starting to happen in places as diverse as Seychelles and Hong Kong (through Kadoorie Farm and Botanic Garden). Focusing on native species avoids the complexity of international access and benefit-sharing issues but growing threatened species requires careful consideration of national legislation.

Even in an increasingly urban world, the best places for plant conservation will always be in the wild, but we should not neglect the importance of anthropogenic landscapes including urban environments (Corlett, 2016; Threlfall & Kendal, 2018). Botanic gardens are uniquely placed to accelerate urban conservation. In so doing they can interpret and explain their role to wider society and help broaden public understanding of the need for plant conservation and how it can be achieved.

REFERENCES

- BACHMAN, S., NIC LUGHADA, E.M. & RIVERS, M.C. (2018). Quantifying progress toward a conservation assessment for all plants. *Conservation Biology*, 32(3): 1–9.
- BEECH, E., RIVERS, M., OLDFIELD, S. & SMITH, P. (2017). GlobalTreeSearch: The first complete global database of tree species and country distributions. *Journal of Sustainable Forestry*, 36(5): 454–489.
- BLACKMORE, S. (2017). The future role of botanic gardens. *Scientia Danica. Series B*, 6: 285–297.
- COLLS, A., ASH, N. & IKKALA, N. (2009). *Ecosystem-based Adaptation: A Natural Response to Climate Change*. IUCN, Gland.
- CORLETT, R.T. (2016). Restoration, reintroduction and rewilding in a changing world. *Trends in Ecology and Evolution*, 31(6): 453–462.
- DAVIES, C. & LAFORTEZZA, R. (2017). Urban green infrastructure in Europe: Is greenspace planning and policy compliant? *Land Use Policy*, 69: 93–101.
- ELMQVIST, T., FRAGKIAS, M., GOODNESS, J., GÜNERALP, B., MARCOTULLIO, P.J., MCDONALD, R.I., PARNELL, S., SCHWENIUS, M., SENDSTAD, M., SETO, K.C. & WILKINSON, C. (eds) (2013). *Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities*. Springer. doi 10.1007/978-94-007-7088-1
- HOBBS, J. & STANLEY, R. (2014). Garden Profile: Auckland Botanic Garden. *Sibbaldia*, 12: 11–24.
- HUNT, W.F., LORD, B., LOH, B. & SIA, A. (2014). *Plant Selection for Bioretention and Stormwater Treatment Practices*. Springer. doi: 10.1007/978-981-287-245-6
- IGNATIEVA, M. & AHRNÉ, K. (2013). Biodiverse green infrastructure for the 21st century: From ‘green desert’ of lawns to biophilic cities. *Journal of Architecture and Urbanism*, 37(1): 1–9.
- MAK, C.Y., CHEUNG, K.S., YIP, P.Y. & KWAN, H.S. (2008). Molecular evidence for the hybrid origin of *Bauhinia blakeana* (Caesalpinioideae). *Journal of Integrative Biology*, 50(1): 111–118.
- MÜLLER, N., IGNATIEVA, M., NILON, C.H., WERNER, P. & ZIPPERER, W.C. (2013). Patterns and trends in urban biodiversity and landscape design. In: ELMQVIST, T., FRAGKIAS, M., GOODNESS, J., GÜNERALP, B., MARCOTULLIO, P.J., MCDONALD, R.I., PARNELL, S., SCHWENIUS, M., SENDSTAD, M., SETO, K.C. & WILKINSON, C. (eds) *Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities*. Springer, doi: 10.1007/978-94-007-7088-1, pp. 123–174.

- RUSSELL, C. (2018). SDG11: Sustainable cities and communities from backyards to biolinks: Royal Botanic Garden Victoria's role in urban greening. *BGjournal*, 15(1): 31–33.
- SHARROCK, S. (2018). Botanic gardens and the 2030 Sustainable Development Agenda. *BGjournal*, 15(1): 14–17.
- SHAW, S. & SCHWARZ BALLARD, J. (2017). Cultivating the power of plants to sustain and enrich life. In: BLACKMORE, S. & OLDFIELD, S. (eds) *Plant Conservation, Science and Practice. The Role of Botanic Gardens*. Cambridge University Press, Cambridge, pp. 192–199.
- THRELFALL, C.G. & KENDAL, D. (2018). The distinct ecological and social roles that wild spaces play in urban ecosystems. *Urban Forestry and Urban Greening*, 29: 348–356.
- UNITED NATIONS DEVELOPMENT PROGRAMME (2015). *Transforming our World: The 2030 Agenda for Sustainable Development*. United Nations, New York.
- WORLD BANK (2015). *East Asia's Changing Urban Landscape: Measuring a Decade of Spatial Growth*. Urban Development Series. World Bank, Washington, DC. doi: 10.1596/978-1-4648-0363-5
- WYSE JACKSON, P.S. & KENNEDY, K. (2009). The Global Strategy for Plant Conservation: A challenge and opportunity for the international community. *Trends in Plant Science*, 14(11): 578–580.
- WYSE JACKSON, P.S. & MILLER, J.S. (2015). Developing a World Flora Online – a 2020 challenge to the world's botanists from the international community. *Rodriguésia*, 66: 939–946.