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Policy Forums

Tropical botanical gardens play an under-emphasized role in animal conservation



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Introduction

Botanical gardens hold a large potential for biodiversity conservation (Ashton, 1988), a topic which has been on international agendas (Maunder, 1994; Wyse Jackson and Sutherland, 2000) for decades. Tropical botanical gardens (TBGs) in particular hold unutilized conservation potential, as they are usually located in hotspots of biodiversity that undergo rapid degradation (Chen et al., 2009). However, by nature, the emphasis of botanical gardens—and researchers who use botanical gardens as their study sites—lies on ex situ and in situ conservation of plants (Hurka, 1994; Chen et al., 2009; Donaldson, 2009; Cibrian-Jaramillo et al., 2013). In addition, the role of botanical gardens in environmental education and raising conservation awareness has received substantial interest (e.g., Suh and Samways, 2001; He and Chen, 2012). Yet, despite the notion that botanical gardens play a role in the conservation of habitat remnants (Pinheiro et al., 2006), the role of botanical gardens for conservation of fauna goes largely unaddressed. Here, I highlight the potential that TBGs hold for animal conservation by providing a case study and pointing out questions we might address on this topic. Ideally,

this will invite discussion on the direct role botanical gardens could play in animal conservation, and perhaps even stimulate explicit inclusion of this topic on international agendas. As such, this paper adds one particular point—the role for animal conservation—to a previous assessment on the potential of TBGs for in situ and ex situ conservation of plants; taxonomic, botanical and horticultural research and activities; and public education on natural history and conservation issues (Chen et al., 2009).

Methods and results

I searched the ISI Web of Science and Scopus for all literature (regardless of publication date) that addresses ‘a link’—however broad or indistinct this link may be—between animal richness, diversity or conservation and botanical gardens, using a combination of the terms *botanic(al) garden* and either *fauna* or *animal*. In order to increase the number of results, I also searched with *botanic(al) garden* and one of the taxonomic groups *reptiles*, *birds*, or *insects* as search terms.

Relevant results were sparse. Many of the search results related to topics irrelevant to this review (e.g., parasite

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Table 1 – Examples of studies on some aspect of animal diversity or richness in tropical botanical gardens (TBGs). None of these studies includes a systematic assessment of animal richness or diversity in the entire TBG that served as study site, but rudimentary numbers illustrate the potentially high levels of biodiversity that may be supported by TBGs.

Study	Country	Taxon/taxa	Purpose	Method	Results
Clark and Samways (1997)	South Africa ^a	Arthropoda	Compare Arthropod richness on native and exotic vegetation and provision of recommendations for ecological landscaping of a botanic garden	Pitfall traps, sticky traps, sweep netting, Malaise traps and visual sampling	A total of 821 arthropod species from ≥11 orders
Dzulhelmi and Norma-Rashid (2014)	Malaysia	Arachnida	Investigate seasonal variation of spider assemblages in a botanical garden	Manual sampling by two collectors	A total of 96 spider species from 65 genera and 19 families. The authors claim that “the species richness of spider is relatively high for a 40-ha size area botanical garden”
Khairiyah et al. (2012)	Malaysia	Odonata	Study of temporal variation in species richness of Odonata	Sweep netting	Four Odonata families and 23 morphospecies
Fernandez et al. (2001)	Cuba	Arthropoda	Determine insect visitor species on flowers in nine weeds species	Manual sampling	A total of 140 species from 37 families, mainly Hymenoptera, Diptera, Coleoptera and Lepidoptera

^a The study Botanical Garden was located in Pietermaritzburg, which at 29°36' S lies in the subtropics and is thus not truly a TBG.

infection risk of domestic dogs as a result of botanical garden visits). Thus, I manually filtered the search results for relevance and found not one systematic study on the topic of faunal diversity, richness or conservation in botanical gardens (ergo, not one on ‘tropical’ botanical gardens either). Some more rudimentary (or taxon limited) aspects of animal richness or diversity in TBGs can be inferred from at least four peer-reviewed publications (Table 1).

Discussion

I acknowledge that some relevant articles might have gone unnoticed due to the fact that a lot of research in tropical countries is published in local journals that are not indexed in Scopus or Web of Science, or because they are written in other languages. It is, however, obvious that there are very few studies published on the matter. This is surprising because many of us are intuitively aware of the wealth of biodiversity often found in botanical gardens. In fact, we regularly choose these places as our study sites for research on animals (but not necessarily on richness, diversity or conservation topics; e.g., Shang-Yao et al. (2010) on bird breeding biology). Moreover, we are aware that botanical gardens can be of importance in maintaining ecological processes and preserving habitat (Pinheiro et al., 2006; Chen et al., 2009) and that that urban areas are not wildlife wastelands. Rather, with the right focus (e.g., in landscape design), gardens and green spaces in urban areas can serve as habitat for many animal species (Koh and Sodhi, 2004; Goddard et al., 2010).

Green spaces in cities can serve as *de facto* sanctuaries for certain animal species (Hunter and Hunter, 2008), and these areas play an increasingly imperative role in the maintenance of global biodiversity considering current exurban growth. Compared to other urban green spaces, botanical gardens in general are usually high in plant species richness, and animal species richness—which often correlates with plant richness—is also therefore expected to be high (Fernandez et al., 2001). If we then consider that native plant species richness is highest in tropical regions, and that TBGs have the potential to conserve many native plant species within their native climate and range (Chen et al., 2009), we could conclude that these TBGs hold vast potential to accomplish something that is often considered secondary to their mission in plant conservation: conservation of large numbers of native animal species.

One illustrative example of a TBG, the Dr. Rafael Ma. Moscoso National Botanical Garden (JBSD) in Santo Domingo, Dominican Republic, seems to provide habitat for a large number of species (Box 1). Moreover, many species found here are actually endemics (e.g., twenty observed bird species are endemic to the island of Hispaniola). This may not seem surprising, as this TBG includes a fairly large (~0.8 km²) remnant of natural vegetation (the importance of such an area in TBGs is discussed in Pinheiro et al. (2006)) and levels of endemism of small-sized taxa are relatively high on tropical islands (Ricklefs and Bermingham, 2008). TBGs on islands (like the JBSD) may thus be in a particularly unique position to form sanctuaries for endemics, especially when located in a biodiversity hotspot like the Caribbean (Myers et al., 2000). Unfortunately, such hypotheses largely go untested due to the lack of studies on the topic.

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