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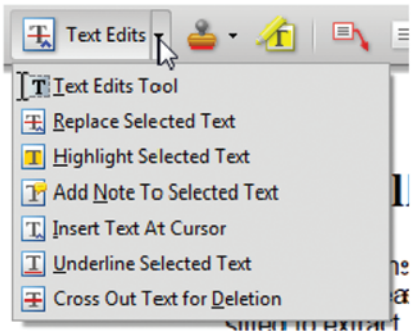

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Latin American and Caribbean botanic gardens: advances and challenges at national and regional levels

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Background: The Association of Latin American and Caribbean Botanic Gardens (ALCJB) is a non-governmental organisation, dedicated to the investigation and conservation of plant diversity, and to the provision of outreach and education.
Aims: The state of the art of the current conservation action of the ALCJB and its members are presented, and advances in achieving targets and further challenges are described.
Results and conclusions: National Botanic Gardens (BGs) networks have played an important role in the conservation of national and regional biodiversity by consolidating existing gardens and supporting the creation of new ones, collaborating in the identification of flora, and in ex situ and in situ conservation. BGs promote education and implement mitigating actions at the ecosystem level to counter climate and land use change impacts on plant diversity. Such activities undertaken emphasise the new roles through which BGs can participate in conservation and promote sustainable ecosystem use. BGs have been implementing their action strategies based on a holistic vision of biodiversity that includes human activities and environmental changes. Motivated by significant progress of the national networks, the ALCJB has launched a new set of tasks to reach goals beyond the BGs integrating various dimensions of the environment.

Keywords: botanic gardens; Caribbean; conservation; cooperation; Latin America; sustainability

Introduction

Latin America and the Caribbean encompass a broad array of vegetation formations, ranging from many types of forest to grasslands and deserts. It contains areas of rich biodiversity and the region is estimated to hold ca. 180,000 plant species (Chacón et al. 2011). It also includes some hotspots which are characterised by the concentration of high numbers of endemic species, some of which are extremely threatened by habitat loss, such as the Atlantic Forest and the Cerrado in Brazil, the Caribbean, Mesoamerica, Western Ecuador, Tropical Andes and Central Chile (Myers et al. 2000).

To respond to the biodiversity challenges that have arisen from the dynamic economic and social changes in Latin American and Caribbean countries, botanic gardens (BGs) have changed their work strategies and functions to better contribute to environmental sustainability. All BG networks, based on the International Agenda (Wyse Jackson and Sutherland 2000), encourage their members to act regionally, focusing on the local flora, and produce technical knowledge for the conservation of species in their locality of origin, or in ex situ cultivation. Moreover, BGs have assumed the role of providing technical advice for authorities who plan national and local strategies for conservation and sustainable use of biological diversity. In so doing, BGs have become key actors in the implementation of International Agendas, such as the Convention on Biological Diversity (CBD 2002), the Framework Convention on Climatic Change (IPCC 1992), and Agenda 21 (1992).

BGs are supporting the Global Strategy for Plant Conservation (GSPC), which grew out of the CBD with the aim to halt the current loss of plant diversity. The GSPC in its first phase adopted 16 measurable targets grouped under five objectives to be met by 2010. Some countries have already developed national targets and several advances have been made; however, the efforts to safeguard plant diversity need to be further improved (Wyse Jackson and Kennedy 2010). The revision of the GSPC, approved at the Conference of the Parties to the CDB in 2010, brought new challenges for countries and regions with high biodiversity, such as Latin America and the Caribbean, where progress in the development of greater capacity, resources and conservation programmes are necessary to ensure that the targets can be achieved by 2020 (CBD 2010).

To co-ordinate sustainable natural resource use and conservation, the Latin American and Caribbean Association of Botanic Gardens (ALCJB) was founded in 1990 in Havana under the auspices of Botanic Garden Conservation International (BGCI) and the Latin American Botanical Association. The primary objective of the ALCJB was to encourage the development of BGs within the region, especially in those regions where biodiversity is threatened. Nowadays the ALCJB consists of eight national networks

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Figure 1. Distribution of botanic gardens from the ational networks which are members of the Association of Latin American and Caribbean Botanic Gardens. Year of foundation and number of botanic gardens: Argentina (1996; 53), Brazil (1991; 36), Chile (2009; 8), Colombia (1998; 17), Cuba (1990; 11), Ecuador (2000; 6), Mexico (1983; 40), Venezuela (1994; 10), Dominican Republic and Uruguay (represented by individual BGs).

(Figure 1). It also includes individual BGs from countries that have not yet developed a network, as the National BG from Dominican Republic and the Montevideo Museum and BG from Uruguay. The ALCJB vision statement, "Work together to ensure that regional resources are conserved and sustainable used" guides the association actions towards its mission: "Strengthen BGs for conservation, to generate knowledge and promote sustainable use of Latin American and Caribbean plants".

The ALCJB meeting at the 10th Latin American Botanical Congress in La Serena, Chile, 2010, assessed the advances made towards the GSPC targets of 2010. The principal achievements and challenges for national BG networks in the context of the strategy and principal tasks of the ALCJB are discussed below.

Advances of Latin American and Caribbean BGs networks

An assessment conducted in 2006 showed that the fulfilment of GSPC by the Latin American and Caribbean BGs was moderate (Table 1). Most targets had compliance levels below 50%, apart from building awareness of the importance of plant diversity. The contribution of Latin American BGs to GSPC appears to have followed the same pattern observed for BGs in others regions: the targets most frequently implemented were related to educational and public awareness programmes about the importance of plant diversity, ex situ conservation of threatened species and the establishment of networks for plant conservation activities (Williams et al. 2012). In general, limited progress has been observed for targets concerning the sustainable use of economic plants, although work on this issue is underway in the Mexican BGs.

Initiatives since 2006 highlight the engagement of the Latin American networks to address the requirements of the GSPC and the related targets for BGs established in 2005 (www.bgci.org). The BGs have developed national Action Plans, encouraging important improvements in their primary objectives, such as knowledge about plants, conservation, sustainable use, education and capacity building (Pereira et al. 2004; RAJB 2006; Linares et al. 2009).

Some contributions related to flora and vegetation studies have enabled relevant progress in the accomplishment

Table 1. The contribution of some Latin American botanical networks and Caribbean botanical gardens (BGs) to the ***Global Strategy for Plant Conservation*** (GPSC) targets for 2010 (UNEP 2002). Information is based on a review conducted in 2006. Values are percent achievement of the various targets (T1–T16).

GSPC 2010 targets	Mexican Association	Brazilian Network	Argentine Network	Chilean Network	Caribbean BGs*
Understanding and documenting plant diversity					
T1 working list of known plant species	70	20	50	0	85
T2 conservation status of plant species	5	10	10	10	50
T3 conservation and sustainable use protocols	10	10	10	50	10
Conserving plant diversity					
T4 conservation of ecological regions	5	0	5	75	25
T5 protection of important areas for plant diversity	5	50	5	45	30
T6 management of production lands	10	10	10	10	15
T7 in situ conservation of threatened species	5	40	15	55	70
T8 ex situ conservation of threatened species	15	10	5	0	30
T9 conservation of genetic diversity	15	40	15	10	40
T10 management for alien species	0	5	5	0	5
Using plant diversity sustainably					
T11 international trade	10	0	0	0	50
T12 management of plant-based products	25	10	5	5	50
T13 plant resources and local knowledge	90	0	15	0	35
Promoting education and awareness about plant diversity					
T14 awareness programmes	90	90	90	10	85
Building capacity for the conservation of plant diversity					
T15 trained people and appropriate facilities	15	10	10	0	65
T16 networks for plant conservation	80	40	10	0	100

*Data related to the Cuban National Botanic Garden and the Lancetilla Botanic Garden, Honduras

of Targets 1 (working list of known plant species) and 2 (conservation status of plant species), such as publication of the Brazilian Catalogue of Plants and Fungi and the List of Endangered Species of the Flora of Argentina (MMA 2008; Forzza et al. 2010; PlanEAR 2011). BGs have concentrated on improving the systematisation and computerisation of living collections, and have collaborated in establishing priority species for conservation and strengthening the links between BGs and other scientific institutions. They made a significant contribution to ex situ conservation, maintaining in their collections many threatened and endemic species of the native flora. Fifteen BGs in Mexico keep 379 of the 951 species considered at risk by the Official Mexican Norm for Environmental Protection (SEMARNAT 2002; Kramer et al. 2011).

The IUCN listed 9156 threatened species at the global level and 4492 species for Latin America and Caribbean (IUCN 2011). Accordingly to this list, five of the 15 countries with the greatest number of threatened species are in the Latin American region: Ecuador, Brazil, Peru, Mexico and Colombia (see Table 2 for figures for Argentina, Brazil and Mexico). An issue of concern is that the full extent of conservation status of species is not yet known. Only ca. 5% of all plant species described have been evaluated, and the number of threatened species tends to increase as the evaluation process continues. This poses a major challenge for Latin American BGs with regard to the updated GSPC Target 2 and Target 8 (at least 75% of threatened plant species in ex situ collections, preferably in the country of origin, and at least 20% available for recovery and restoration programmes). Despite the advances, the ex situ conservation of threatened species need to be enhanced to meet the national and international strategies and action plans targets (see León et al. 2012). Many gardens have assumed a strong role in protection of species in the original habitats and restoration of habitats, based on their scientific and technical capabilities (Fernandes et al. 2007; Mendonça et al. 2007). They have maintained nature reserves; in some

Table 2. Plant species diversity and the number of threatened species in Argentina, Brazil and Mexico in national and international red lists.

	Area (km^2)	Known plant species	National red list	Percentage of red list	IUCN red list (2011)
Argentina	2,780,400	9690[a]**	1660[d]***	17.13	44
Brazil	8,514,880	40,989[b]*	472[e]	1.15	392
Mexico	1,964,380	23,424[c]**	1033[f]	4.4	254

[a]Zuloaga et al. (1999), [b]Forzza et al. (2010), [c]Villaseñor (2004), [d]PlanEAR list, [e]MMA (2008), [f]SEMARNAT (2010)
*algae, bryophytes, vascular plants, fungi; **only vascular plants; ***Argentine Red List includes all endemic vascular plants

cases conserving large fragments of natural vegetation in urban centres (Pinheiro et al. 2006).

Initiatives, such as the celebration of a 'National Day of Botanic Gardens', by the Mexican and the Argentine networks help reinforcing the message to citizens that biodiversity conservation can be achieved as long as it is known, valued and used rationally. Environmental education, one of the top priorities, along with conservation in the Argentine and Brazilian Action Plans (Schwarck 2011) is fundamental to the long-term success of conservation efforts. However, it is recognised that additional human and financial resources are required to ensure that conservation and environmental education objectives are achieved.

BG networks are recognised as important agents creating a social infrastructure capable of transmitting information and technical assistance across organisational and regional boundaries (Maunder 1994; Miller et al. 2004; Stanley Price et al. 2004; Havens et al. 2006; Sorenson and Singh 2007). BG networks have designed and implemented their strategies to conserve biodiversity at the levels of genes, species and ecosystems. There is an important consensus among BG networks that while conservation strategies need to be based on scientific knowledge, they should at the same time address social, economic and political aspects in the promotion of an adequate environmental behaviour (Fischer et al. 2012). BGs, by engaging in community and environmental activities, have had positive effects, especially at the municipal level, where decision makers have shown interest in the improvement of urban green and conservation of natural areas.

The contribution of national networks to the ALCJB network has raised the profile of conservation actions at the regional level and allowed the networks to work together and to present themselves globally as a well-coordinated community that is able to work effectively and efficiently (Wyse Jackson and Sutherland 2000). This demonstrated ability to work as a regional entity meets the terms of the Objective V, target 16, decision adopted in 2010 by the CDB conference at its 10th meeting ('Institutions, networks and partnerships for plant conservation established or strengthened at national, regional and international levels to achieve the targets of this Strategy'). In addition, as such a recognised entity, the ALCJB – in accordance with Rovere's (2000) assertion about the benefits of network – could readily interact with relevant bodies to coordinate and implement conservation policies highlighting the importance of BGs.

Despite the advances in the adoption of multidisciplinary activities related to conservation, research, education and public awareness, the Latin American and Caribbean BGs continue to face critical challenges to achieve the major goal of the GSPC. The ALCJB should play the leading role to generate dialogues and actions that create conditions for joint actions and strengthen membership. The conservation of Latin American and Caribbean resources and the formation of an increasingly committed society are the conditions for the sustainable development of the region. This requires overcoming the hurdle of spontaneity and will that often characterises environmental organisations, and building strategic network partnerships that are proactive in the implementation of International Agendas.

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Notes on contributors

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