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Author *Borokini T.I*

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Review Paper

Overcoming Financial Challenges in the Management of Botanic Gardens in Nigeria: A Review

Borokini, T.I

Plant Genetic Resources Unit, National Centre for Genetic Resources and Biotechnology (NACGRAB), Ibadan, Nigeria

Abstract

Agricultural research development in Nigeria was initiated with the establishment of a botanic garden station in the 19th century. Today, there are more than 33 botanic gardens in Nigeria, most of which are concentrated in South-western part of Nigeria. Majority of these botanic gardens are owned by Government-established academic and research institutions. Botanic gardens in Nigeria are synonymous with field genebanks, orchards, medicinal gardens and arboretum. Dwindling funds was identified as a major challenge, not only to research and development activities in these Government institutions, but also to the management of their botanic gardens. This article was written to express ideas on ways of reducing dependence of botanic gardens on the government funding and to attain some level of financial independence. The ideas shared in this paper are expected to help ensure effective management of Nigerian botanic gardens at very little or reduced operational costs. The focal areas for the botanic gardens are public awareness and community services, which will make the public appreciate the gardens the more and contribute to their management.

Keywords: Botanic gardens, arboretum, Medicinal garden, field genebank, orchards, Nigeria, research funding.

Introduction

It is generally recognized that the most effective way to ensure the long-term survival and evolution of tree species, and the ecological communities of which they are a part, is to maintain viable populations in their native environment (Kramer et al., 2011). This is referred to as *in situ* conservation. Typically this is achieved through the designation and management of some form of protected area, such as national parks, wilderness areas and nature reserves (Newton, 2007), as well as forest reserves, game reserves, wildlife sanctuaries among others. The extent of the global network of protected areas continues to increase, with nearly 133,000 areas now designated, representing 12% of the Earth's terrestrial surface (Butchart et al., 2010). Despite the substantial efforts being made to support the development and management of protected areas, many are currently under threat from human activities such as urban encroachment, infrastructural development, habitat conversion, illegal harvesting and fire (Chape et al., 2005). Additional problems include policy-related issues such as weak government institutions, conflicting policies and resource tenure (Brandon et al., 1998).

Therefore, *ex situ* conservation, which literally means, "off-site conservation" is applied as an additional measure to supplement *in situ* conservation. Biological diversity conservation *ex situ* is therefore complementary to *in situ* conservation and can act as an "insurance policy" when species are threatened in their natural habitats. The purpose of *ex situ* conservation stands is to keep genetic resources in a secure area for future utilisation (Ida, 2003). *Ex situ* conservation provide the opportunity to study the biology of, and understand the threats to, endangered species in order to eventually consider successful species recovery programmes, which would include restoration and reintroduction. It also has the advantage of preserving plant material and making it available for research purposes, without damaging the natural populations. Furthermore, *other* purposes of *ex-situ* conservation include rescuing threatened germplasm, to produce material for conservation biology research, to bulk up germplasm for storage in various forms of *ex situ* facility, to supply material for various purposes to remove or reduce pressure from wild collecting, growing those species with recalcitrant seeds that cannot be maintained in a seed store, to make available material for conservation education and display and to produce material for reintroduction, reinforcement, habitat restoration and management (Heywood & Iriando, 2003).

A botanical garden, as a prominent example of *ex situ* conservation, is a controlled and staffed institution for the maintenance of a living collection of plants under scientific management for purposes of education and research, together with such libraries, herbaria, laboratories, and museums as are essential to its particular undertakings (Bailey & Bailey, 1978). A botanic garden is an institution holding documented collections of living plants for the purposes of scientific research, conservation, display and education (Wyse Jackson, 1999).

Botanic gardens around the world have been involved in the study and cultivation of medicinal plants for over 500 years. Botanic gardens play a major role in the conservation of plant genetic resources (Sharrock, 2006). They are often perceived as places for recreation alone, but they are very much more than that. They are involved in many structured activities focused in the fields of horticulture, science, education and conservation. For example, botanic gardens are estimated to keep at least 100,000 species as living plants (nearly 30% of the world's plant diversity), and to maintain 250,000 seed bank accessions (Wyse Jackson, 1999).

Many of these species are, or are related to, economically important species (Waylen, 2006). Generally, they provide an important repository for medicinal plants and the associated knowledge about these important species (Hawkins, 2008). Collectively botanic gardens cultivate over 300,000 taxa, representing around 100,000 species (almost one third of all known plant species). Representatives of nearly 90% of all vascular plant families and 54% of vascular plant genera can be found in botanic garden collections (Cullen & Wyse Jackson, 2008). Botanic garden collections are particularly rich in groups such as orchids, cacti and other succulents, palms, bulbs, conifers and temperate trees and shrubs. Many gardens also include extensive collections of medicinal plants and other species of socio-economic importance and in recent years, there has been an increasing focus on the conservation and display of native flora and threatened species. In addition, botanic gardens have a wealth of other collections, such as herbaria and seed banks.

The idea of active role of botanical gardens in conservation of endangered plant species has been enunciated at the first and second International Congresses for Nature Protection held in 1923 and 1931 (Heywood, 1991). The first development of this idea into the concept of using ex situ collections in botanical gardens to explicitly address conservation issues has been done by Cugnac (1953), who suggested creation of specific ex situ conservation facilities, *jardin conservatoire*, closely associated with protected areas. In the 1970s, the working objective for botanical gardens holding collections of endangered species, was the "Noah's Ark" paradigm, the idea of preserving stocks of threatened species during a period of habitat destruction/degradation, with a hope for a future change in human demography and attitude towards nature. However, this perception was quickly realized as too utopian and was replaced by a concept of complementary use of ex situ and in situ conservation, i.e. use of botanical gardens and arboreta to help solve problems of population management and restoration of biodiversity (Falk, 1987; Given, 1987; Millar & Libby, 1991; Hurka, 1994; Pavlik, 1997). The recognized purposes of off-site collection for any species that requires conservation include (i) serving a germplasm backup should current or past in situ conservation fail; (ii) preserving in the most representative way the species genetic diversity; and (iii) propagating germplasm for in situ actions (Prance, 1997; Maunder et al., 2001; IPGRI, 2004; Guerrant et al., 2004).

The history of botanical gardens is closely linked to the history of botany itself. Botanical gardens, in the modern sense, developed from physic gardens, whose main purpose was to grow herbs for medicinal use. Such gardens have a long history. In Europe, for example, Aristotle (384 BCE – 322 BCE) is said to have had a physic garden in the Lyceum at Athens, which was used for educational purposes and for the study of botany, and this was inherited, or possibly set up, by his pupil Theophrastus, the "Father of Botany" (Hill, 1915; Dalley, 1993). The origin of modern botanical gardens can be traced to European medieval medicinal gardens known as physic gardens, the first of these being founded during the Italian Renaissance in the 16th century. This early concern with medicinal plants changed in the 17th century to an interest in the new plant imports from explorations outside Europe as botany gradually established its independence from medicine (Williams, 2011).

There are about 3000 botanic gardens in the world (Table 1). There are now very few countries without at least one botanic garden. New botanic gardens are being established throughout the world – often as botanical resource centres supporting native plant conservation (Botanic Gardens Conservation International [BGCI], 2012). These gardens attract about 150 million visitors a year, so it is hardly surprising that many people gained their first exciting introduction to the wonders of the plant world in a botanical garden. A useful database cataloguing the world's botanic gardens can also be found on BGCI website. With over 800 participating botanical gardens, BGCI forms the world's largest network for plant conservation and environmental education.

Table 1: Global distribution of botanic gardens as at August 2012

Region	Number of botanic gardens
Africa and Indian Ocean	162
Asia	490
Central America and Caribbean	74
Central Asia	26
Europe	929
Middle East	38
North America	792
Russia Federation	109
South America	173
TOTAL	2,951

Source: BGCI (2012)

Botanic Gardens in Nigeria

The role played by the Botanic gardens in Agricultural development in Nigeria is significant. This is due to the fact that Agricultural research in Nigeria was initiated with the establishment of a botanical garden station in Lagos in 1893 (Roseboom et al., 1994). This garden was part of a network of gardens established under British rule, focusing on the introduction of new crops. In 1903, the Forestry and Botanical (later Agricultural) Department for southern Nigeria was created (Roseboom et al., 1994). However, the first botanic garden to be established in Nigeria was in University of Ibadan, established in 1948. In Nigeria, other ex-situ protected areas that are similar to botanic gardens include field genebanks, arboreta, medicinal gardens and orchards. In a

recent unpublished survey, a total of 33 botanic gardens were identified in Nigeria, as listed on Table 2. However, there could be more botanic gardens in Nigeria that are yet to be identified, while many other Institutions were planning to establish one.

Table 2: List of some botanic gardens in Nigeria as at May 2013

S/N	Name of Botanic Garden	Location
1	University of Ibadan Botanic Garden	Ibadan
2	NACGRAB Field Genebank	Ibadan
3	Kano Botanic Garden, Bayero University, Kano	Kano
4	Abubakar Tafawa Balewa University, Bauchi	Bauchi
5	University of Nigeria, Nsukka	Nsukka
6	University of Lagos Botanic Garden	Lagos
7	Murtala Mohammed Memorial Botanic Garden	Lagos
8	NNMDA Medicinal gardens	Lagos and other locations
9	Ahmadu Bello University, Zaria	Zaria
10	NIPRD Medicinal garden	Abuja
11	Federal University of Technology, Minna	Minna
12	Sarius Palmetum and Botanic Garden, Abuja	Abuja
13	NIHORT Orchard	Ibadan
14	FRIN Medicinal gardens	Ibadan
15	Shodex Botanic Gardens	Lagos
16	University of Port Harcourt Botanic Garden	Port Harcourt
17	Calabar Botanic Garden and Conservation Centre	Calabar
18	RRIN Orchard	Benin City
19	NIFOR Orchard	Benin City
20	IITA Arboreta	Ibadan and Onne
21	Nigeria Montane Forest Project	Mambilla Plateau
22	Usman DanFodio University Botanic Garden	Sokoto
23	Federal University of Agriculture Arboretum	Abeokuta
24	CRIN Orchard	Ibadan
25	Makurdi Botanic Garden	Makurdi
26	University of Calabar Botanic Garden	Calabar
27	Medicinal Garden, OAU Pharmacognosy Department	Ile-Ife
28	National Council for Arts and Culture	Several locations
29	Medicinal Garden of Lagos State Traditional Medicine Board	Lagos
30	Arboreta of ENPOST Agroforestry Farm Ltd	Ilesha
31	Agodi Botanic and Zoological Gardens	Ibadan
32	Getso Botanic Garden	Kano
33	Ondo State Biological Garden	Akure

Botanic Garden Management in Nigeria

Most of the botanic gardens in Nigeria are owned by Government-funded institutions (Academic and Research Institutions), and very few privately-owned gardens. Majority of these gardens in the academic institutions were established for academic purposes, while those held by the research institutions were mainly for conservation and research purposes. Most of the gardens located in academic institutions were mainly established and managed by the Department of Botany (or Biological Sciences in some Universities). In addition, State Governments also established gardens as centres of public recreation.

With exception of privately-owned gardens, the main source of funding for the rest of the gardens is from the Government. However, poor funding was identified as the main challenge facing the management and expansion of the gardens. Several previous literatures have identified inadequate funding as one of the fundamental challenges facing academic and research institutions in Nigeria, including those holding botanic gardens (Idachaba, 1998; Beintema & Ayoola, 2004; Adegbite, 2007; Oyeneeye, 2006; Donwa, 2006, Okecha, 2008; Ragasa et al., 2010). Unfortunately, inadequate funding has led to inadequate technical manpower, abandoned research projects, stalled capital projects for the gardens, lack of modern equipment and poor management of the garden. One important aspect of botanic garden management is frequent exploration and collection trips around the country to collect different plant species for establishment in the gardens. However, most of the institutions have not been funded to carry out this activity, and as a result, most institutions have not gone on plant exploration for many years.

Nigeria's budget process has been described as complex and lacking in transparency (Ayoola & Abdullahi, 2011). Worse still, the budgeting system merged capital projects and research spendings, meaning that any capital projects (for example, construction of a building) will hinder research projects. Several labour strike actions have been carried out by academic staff of the research and academic institutions in Nigeria for increased funding of the sector, with relatively poor results. Hardly is there a year between 1999 and 2013 that there was not a strike in research and academic institutions in Nigeria. As a result, most botanic gardens in Nigeria lacked the proper maintenance it requires, little or no new plant additions through explorations, invasion by exotic species,

inadequate staffing and capacity building. For example, Borokini (2011) identified 25 invasive species in a 12hectare field genebank established for the conservation of indigenous plant species in Nigeria.

Suggested Alternative income sources to botanic gardens in Nigeria

It has become apparent that diversification of income sources to botanic gardens and their parent institutions is crucial to the effective management of these gardens. From personal experience to several botanic gardens in other parts of the world, especially the United States of America, I have compiled a number of ways through which botanic gardens can be managed and financed with less dependence on government funding.

Community involvement

Most botanic gardens in Nigeria, especially the government-owned, do not have cordial relationship with their immediate communities. Such relationship should be cultivated through the establishment of management boards for the garden and adding members of the public in the immediate environment in the board. Some of the remaining points can also help improve the relationship of the botanic gardens with the public.

Volunteering

There are hundreds of thousands of jobless graduates in Nigeria, including those that studied Botany, Forestry and other related disciplines. Such people could be encouraged to volunteer to work freely for the botanic garden in their area. Apart from the fact that the botanic garden benefits from their free services, job opportunities can open from such services while they also boost their work experience, enrich their CV (or Resume) and keep themselves busy as they wait for a paid job.

Internship

Inadequate staffing can be overcome not only through volunteering, but also through internship by college students in relevant departments. This is common in many botanic gardens in Nigeria.

Garden exhibitions

Botanic gardens need to have a date for public garden shows and flower exhibitions. In this way, they can create more awareness on their existence and services to the community. The number of floriculturists and flower lovers in Nigeria keeps increasing and plant exhibitions are definitely a place to visit for them. Fees may be charged for the exhibitions as additional income source for the garden.

Sales of garden products

Most gardens sell flowers, seeds, seedlings, cuttings and other plant products to the public. However, patronage has been very poor because the society is not aware of the services these botanic gardens offer. As more community and public awareness is created, patronage will definitely increase.

Toll

Most gardens collect toll fees at the garden entrances, but visits to the gardens are very low compared to zoological gardens. Botanic gardens need to learn from their zoological counterparts on community and public awareness of plant conservation.

Garden membership/school clubs

Part of community involvement is creating opportunities for garden membership with some benefits and incentives to members, which may include free visits to the garden. But of course, members would pay membership fees, which are a source of income to the garden, and such members will have souvenirs which can also help advertise the garden the more. Furthermore, students of secondary schools in the communities can be organised into Nature clubs or Garden clubs, who may be allowed to visit the garden frequently on academic excursion and participation in garden management. Nigeria Conservation Foundation (NCF) is the only institution that I am aware of that does this. Recently, Agricultural Research Council of Nigeria (ARCN) initiated a concept by which the agricultural research institutes adopt some secondary schools in their localities for agricultural education. Botanic Gardens need to follow suit. There are hundreds of protected areas in the developed countries with associate groups made up of members of the community who are involved in their activities. Such groups are often called Friends of the XYZ garden.

Community service

The best way to increase community awareness for botanic garden is to provide free gardening services for members of the public. The Garden/Nature clubs and interns can be used to do this. They will visit homes of interested members of the public and help clean and cultivate plants in their home gardens. This initiative can help build a strong relationship between the botanic gardens and the society, who will in turn, respond to the financial needs of the gardens.

Donations

Botanic gardens have never given an impression to the public that they need financial assistance. However, as donations come, the donors should be given "thank you" souvenirs. These souvenirs help in promoting the garden, as the friends of those using the souvenirs get to know about the garden through it.

Social events

The patronage of gardens for social events, especially in South-western Nigeria is encouraging. Members of the public should be encouraged to use the botanic gardens for social functions such as marriage. This of course, provides funds to the garden through rental fees.

Souvenirs

Tee-shirts, caps, bags, postcards, wallets, books and other products can be manufactured as customised souvenirs for the garden and sold at an established “Welcome Centre” to the garden. Virtually every protected area in the US has a Visitor Centre where wide varieties of souvenirs were displayed for sale, bringing high income to those protected areas.

Research services

Plant collections, information, plant identification and other related services can be provided by the gardens for students and members of the public for a fee. Moreover, many botanic gardens are associated with herbarium, which makes such services easy. For example, the medicinal uses of plants are gaining global attention in recent times; therefore, botanic (and medicinal) gardens can provide such information to the public.

Training programmes

Botanic gardens can provide paid educational services in form of weekend or evening classes to interested members of the public on home gardening, medicinal plants, plant cultivation techniques and other related courses.

Students' contributions

Academic department with botanic gardens may encourage their students to pay some levies towards the development of the garden. These same students pay levies to their departmental students' associations; therefore, these student associations should be considered a strong stakeholder in the management of the botanic gardens.

Payment for Ecosystem Services

Relevant international conservation bodies developed an initiative called Payment for Ecosystem Services (PES), in which companies that release green house gases can pay conservation institutions as compensation for their industrial releases. These include oil companies, cement industries among others. Furthermore, many companies have Corporate Social Responsibility (CSR) units, through which the companies contribute to community development. These are good avenues for botanic gardens to access financial support for their conservation activities.

International donors

There are many international funding institutions willing to fund research in plant conservation activities, plant taxonomy and botanic garden management. These include the CBD, International Association of Plant Taxonomy, Moabi Foundation and many others.

Public and Community Awareness

From the 14 points raised in previous section, it could be noted that public awareness is pivotal to their success. In addition, many of those funding sources – community service, school/garden clubs, garden exhibitions and community involvement – can act as means of creating public awareness on the existence and services of the garden. However, there are several other means by which public awareness can be created for the garden. These include:

Urban greening and land management

Through its community service, botanic gardens can contribute to urban greening, urban tree planting campaigns and management of urban forestry. Garden volunteers can help provide these services freely at little or no cost to the garden, while at the same time; help create awareness about the garden.

Home garden management

Botanic gardens can encourage and help members of the society to establish home gardens. This help to consolidate a cordial relationship between the garden and the beneficiaries of these free community services, which of course, the garden interns and volunteers can do.

Public campaigns

Public campaigns such as “Walk for Nature” or Marathon races can be organised annually to create awareness for the botanic garden as well as for plant conservation. This has been organised annually by the Taraba State Government in collaborations with NCF, Nigerian Montane Forest Project and other stakeholders.

Articles in Local Newspapers

The botanic garden officers can write articles for columns in local newspapers on the uses of plants to the environment, their medicinal uses and other areas that might interest the public. This is a subtle but effective means of advertising the garden, as the

name and address of the author of such articles are published as well. Many newspapers in Nigeria today have columns for scientific articles, especially medicinal uses of plants, and welcome articles to be published in these columns free of charge.

Ecological restoration projects

The role of botanic gardens in the ecological restoration projects have been emphasised by Hardwick et al. (2011). Botanic gardens can be involved with public projects such as removal of invasive species on public lands and ecological restoration of degraded lands. As the public appreciates such free community services, awareness and patronage to the garden will increase rapidly.

Flyers and posters

Perhaps the most common form of advertisement in Nigeria is through posters and flyers. There are companies in Nigeria, that are dedicated to distribution of those flyers, while of course, garden volunteers, members and interns can help distribute the flyers as well. The mass media can also be used for advertisements on the garden; however, they may be expensive.

Website hosting

Most botanic gardens in Nigeria do not have a website, while only few have a webpage dedicated to the garden within their institution's website. This only limits the global reach and networking potentials of the garden and reduces their chances of accessing international funding.

Promotion of Ecotourism

By promoting ecotourism, botanic gardens are the protected sites that will get the highest benefits from it. This is because most botanic gardens in Nigeria are located in close proximity to or within cities, unlike in-situ conservation sites which are mostly located in the wild areas. By promoting ecotourism, botanic gardens are indirectly advertising themselves to the public and increase their patronage.

Documentaries

PowerPoint presentations and multimedia documentaries on the botanic gardens can be produced and sold to the public as souvenirs and give to Media houses to help televise. The fact remains that the most effective means of advertisement in Nigeria is through television and radio. These media houses can be approached with ideas of discounted charges on advertisements for the gardens.

Networking with other botanic gardens

The Botanic Gardens Conservation International (BGCI) is the biggest – and perhaps, the only – network of botanic gardens in the world, with over 900 botanic gardens. In recent times, they have been compiling the names, plant lists and contacts of botanic gardens in Africa with the development of a Garden search website and database, which helps in networking among all the botanic gardens in the world. Likewise, there exists African Botanic Gardens Network, with administrative office in South Africa. Through networking, botanic gardens can exchange technical information on effective management of their gardens, experiences that can help others, funding opportunities and plant germplasms.

Conclusion

In the wake of revival of medicinal plant uses and climate change issues in the world, this is a great opportunity for Nigerian botanic gardens to establish good relationships with the public through community services and public enlightenment. The public, in return, will appreciate the gardens the more and contribute financially and non-financially to their development.

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