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RESEARCH PAPER

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The Role of Botanical Gardens in the Maintenance of Biodiversity

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ABSTRACT

Botanical gardens are botanical institutions containing wide range of plants labeled with their names. They maintain the living plants collections of different variations of plants, including the ornamental and cultivated ones, wild, medicinal etc. They are not merely there for display, though that is an important aspect of the work of botanical gardens, they are there for education as well as recreation. Botanical gardens can play a role of the "mother" teaching kids how to use plants in the day-to-day life which is an important issue in the environment. In visitor's motivation, the most important reasons given for visiting the Botanical gardens were: To enjoy oneself, to admire the garden's scenery; to spend quality time with friends or family and to enjoy being outdoor. Some of the threats that affect botanical gardens include Heavy downpour, invasive plants, pests, diseases etc. The roles of Botanical gardens were also mentioned which includes; Botanical Gardens provides information in food plants, ornamental and medicinal plants, Garden practices provide training for the conservation of nature etc.

Keywords: *Botanic Gardens, Diversities, Biodiversity Conservation, ornamental and medicinal plants*

INTRODUCTION

A botanical garden is a garden dedicated to the collection, cultivation and display of a wide range of plants labeled with their

botanical names. It may contain specialist plant collection such as cacti, succulent plants and herb plants. There may be green house, shade houses again with

special collections such as botanical plants or other exotic plants. Visitors' services at a botanical garden might include tours, educational displays, art exhibitions, bookrooms, open-air theatrical and musical performances and other entertainment. Botanical gardens are often run by Universities or other specific research organizations and often have associated herbaria and research programmes in plant taxonomy or some other aspect of botanical science. Vegetables, fruit and flower gardens are always associated with the sense of peace

and peaceful life. The gardening is one of the most peaceful businesses in the world. It is possible that people collecting and raising plants were the most peaceful group in a community unlike hunters who used their weapons not only for hurting animals but also against humans. In human evolution, gardens were crucial factors for the survival of communities, source of food and medicinal herbs, shelter and clothing. Biodiversity is the totality of genes, species and ecosystems of a region.

Table 1. Main activities of botanical gardens.

Biodiversity conservation and related studies	Development of scientific basis for the rational use of plant resources	Education and public awareness promotion
1. Studies on biology of introduced plants in culture	Cultivation of diverse plant collection	Environmental educational programs
2. Establishment of gene banks of indigenous plants including seed banks and plant tissue cultures	Research on ethno botany and traditional use of plants	Professional development internship in botany horticulture and ecology
3. Development of herbaria and research on plant systematic	Research on horticulture and gardening	Public libraries and information centers
4. Re introduction of plant species back to nature and research on restoration of their natural habitats	Integrated pest and disease managements (IPM)	Facilities for recreation and rehabilitation
5. Monitoring and assessment studies of the environmental pollution influence on vegetation and plants	Laboratory research, including plant propagation in vitro (tissue culture)	Teacher training (training of trainers)
6. Scientific studies of indigenous plants, conservation of rare and endangered species	Evaluation and introduction of new genetic resources of edible plants in culture	Promotion of ecological tourism
7. Involvement of local community in environmental conservation and decision making on plant protection	Ornamental horticulture and floriculture	Publication of special and scientific popular literature

Source: Kuzevanov *et al.* (2005)

Biological diversity is the variety and variability of animals, plants and micro-organisms at the genetic, species and ecosystem levels and is necessary to sustain key functions of the ecosystem (Agbogidi, 2011; Agbogidi and Adolor, 2014; Agbogidi and Aghojore, 2014, Agbogidi and Okonta, 2014). Biodiversity is of direct importance in application such as food, fibre, medicine and biological control and the indirect importance include atmospheric regulation, nutrient cycling and pollination (Agbogidi and Eshgebeyi, 2008).

Botanical gardens of the world were developed mostly as a result of strong demand from the public and from very influential people interested in exotic, medicinal and beautiful plants collected from remote regions and countries. Gardens vary widely in their design, purpose and features, and so it is not surprising that research has identified a wide variety of factors motivating garden visitation. These motives include appreciation of the aesthetic and rare qualities of plants, interest in garden design and landscaping techniques used in different periods of history; admiration of gardens scenery and "ambience", and pleasure in being outdoors (Connell and Meyer, 2004). Other reasons for visiting gardens include recreation, playing games and social interaction (Darwin, 2000), and the opportunity to relax and read (Crilley and Price, 2005).

They made important contributions in understanding how the mankind benefits from plants and from biodiversity. Only recently heads of five (5) biodiversity related conversions came to conclusion that "Biodiversity can indeed help alleviate hunger and poverty can promote human health and be the basis for ensuring freedom and equity for all" (September, 2005). As a result, the world largest international plant conservation

network, the Botanical gardens International (BGCI), based in the United Kingdom Stated the world wide project review of the role of Botanical gardens in linking biodiversity with four (4) selected; (edible, medicinal, ornamental and others) provides resources for the survival and improvement of human well-being.

Botanical gardens in the maintenance of biodiversity

The list of the main directions and functions of botanical gardens activities is extremely wide (Table 1) and it includes alongside with scientific studies, all possible measures on the organization of rational and sustainable use of plants resources as outlined in the international agenda for botanical gardens in conservation (2000).

Using public demands and needs addressed from the local community towards the botanical gardens resource and staffs as much wider and more complex than the rather narrow remit of the botanical gardens supervising institution (University governmental company, academy etc). From the late 20th century, the role of Botanical gardens resources has began to grow due to their involvement in developments in economic botany, home gardening and an agriculture, rational use of bio-diversity, improvements of habitats/ environment and environmental education for local people. For instance, the Botanical gardens of Irkutsk state University is the only botanical garden in the whole region of Baikalian Siberia, and holds a collection of about 3000 species and varieties of plants, representing the floral of Baikal region and different biomes of the world (Kuzevanov *et al.*, 2005). The special attention is given to introduction and cultivation of tolerant and production plants capable to survive and grow well and sustainably in the service climate in

Siberia. Such policy includes special measures for accumulation and

proportion of rare and endangered species of regional flora.

Table 2. Some examples of how botanical gardens Tangible and intangible resources can be related to the main aspects of human well being.

Aspects of Human well-being	Main resources of Botanical gardens Tangible resources	Intangible Resources
1. Nutrition	Genetic resources of edible plants (seeds and seedlings for gardeners), Demonstration plots. Evaluation gardens and nurseries	Basic and traditional knowledge and skills about edible plants and how to grow them. Keeping of horticultural traditions of the religion
2. Healthcare	Genetic resources and medicinally and cosmetically valuable plants (Indigenous and introduced) Demonstration plots.	Scientific knowledge and traditional rituals, skills and recipes about cultivation and use of medicinal plants
3. Financial poverty alleviation	Establishment of new "green" businesses based on plant genetic resources	Knowledge and skills on management of "green" businesses including case studies enabling local livelihood alternatives, boosting income.

Source: Kuzevanov *et al.* (2004)

The garden's staff and volunteers working for Botanical gardens usually provide year-round thematic excursions and guided tours in the open collections and in the educational green house. The employees of the garden are always ready to provide a free of charge advice and consultations about growing, protection, and use of favorite plants. For instance, Botanical gardens attract and involve citizens, especially young ones, and tourists in an atmosphere of freshness, an appreciation of nature, in all seasons of the year such experiences gives long lasting and unforgettable life experience for functioning as a gate to the virgin and beautiful nature for citizens who spend most of their time in urban environment.

The wide spectrum of different forms of educational and cultural activities includes; Thematic holidays, creative festivals, exhibitions, competitions etc. There is a broad spectrum of practical exercises and extended activities training courses, field works and productive practical training, ecological games etc. so, students from universities and colleges from the youth educational centre and from secondary public schools participate in work-study programs and in on-job trainings. Secondary school teachers are taking special classes, training and tours at the Botanical gardens for their extended professional development, exchanges of students within the network of world Botanical Gardens promotes a sharing of

expertise, knowledge and skills for further use in other national developed for special groups of visitors (orphaned children, disabled, kids at risk with criminal past, older people, and families and children) which became a part of Botanical Gardens functions for the improvement of human well-being. In case of orphaned children, the Botanic garden can play a role of the "Mother" teaching kids how to use plants in the day-to-day life which is an important issue in the frontier environment (Sizykh, 2001). The "Horticultural Therapy" could be a good example of the implementation of non-traditional educational programs for kids at risk who had a criminal behavior (10-14 years old) and kept in a special isolated school. Special psychological studies since 1999 revealed that the horticultural therapy has positive effect on social adoption and rehabilitation of criminal children participating in the project (Sizykh and Kuzevanov, 2004).

Botanical gardens provide an opportunity to construct ecologically functional landscapes on a large scale while at the same time educating individuals, professionals and organizations about sustainable green infrastructure. Because of their large scale and their role as educational facilities, they hold a unique potential to significantly influence the direction and pace of urban green space design and planning. In addition, to the numerous ecological and informal educational opportunities available in large urban parks, Botanical Gardens provide the following opportunities;

Education: Botanical gardens are usually committed to some level of public education. This function is usually carried out through the combined use of demonstration gardens and displays, informal and formal instruction through classes, tour and web-based resources outreach using publications such as

newsletters, and by making the most of passive experiential learning opportunities.

Research: Botanical gardens, whether public, private or associated with an academic institution, usually contain as part of their mission an aim to improve the understanding of plant biology, the role of plants in the environment and the relationship between people and plants. This often includes efforts to extend research networks and expand collaborations on both global and local scales. Botanical gardens often serve as both informational and physical databases (Housing seed, live plant and herbarium specimen collection) for professional and amateur plant researchers.

Recreation: Like large public parks, botanical gardens provide healthy recreational opportunities and an escape from the urban infrastructure.

Users: The typical audience and users of botanical gardens include the general public as well as the professionals responsible for shaping urban landscapes.

Context: Botanical gardens have traditionally been landscape of learning. Whether through passive or active opportunities, visitors to botanical gardens expect to be presented with new information, new sights and new experiences. When combined with the large scale of botanical gardens, their traditional role as educational landscapes puts them in a unique position to significantly influence the urban green infrastructure currently, through physical means and into the future, through demonstration and education.

Other uses of botanical gardens Botanical gardens as spatial and informational hubs

Spatial: Most cities can only support one botanical garden. However, they are often composed of multiple landscapes, or associated with partner gardens, all with different foci and located in different

environments. The large, diverse landscapes of the botanical gardens and its satellite partners provide multiple opportunities for developing diverse, ecologically functional systems. They can serve as source landscapes and refuges for biological organisms at multiple scales as well as filter and store water in the urban landscape.

Informational Systems: Botanical gardens can serve as a city's informational database for ecologically sustainable design by actively educating the public through classes and the construction of demonstration landscapes as well as by serving as a clearing house for information about sustainable design.

Access: Botanical gardens should make a significant effort to ensure accessibility to the entire public and to develop and aggressive outreach campaign to attract people to the gardens and to distribute information about sustainable designs.

Essential elements

Local landscapes: Demonstration gardens highlighting local landscapes serve to teach visitors about the complex environment in which they live and the role plants plays in maintaining a healthy functioning system.

Global landscapes: Demonstration gardens highlighting different landscape types from around the globe illustrate the relationship between the local landscape and the larger, global environment.

Demonstration beds: living examples of design approaches to addressing current challenges in urban landscape illustrate alternatives to the traditional approaches to urban landscapes; demonstration beds include information about the application of demonstration technologies to residential and other urban spaces.

Experimental landscapes: New approaches to constructing a green urban infrastructure are explored and explained in the garden.

Way finding and information: Botanical gardens should have a clear easily accessible way finding system that provides information in multiple formats and clearly illustrates the relationship between plants, people and their environment.

Relaxation and escape: The entire landscape should be designed with the intent to provide opportunities for escape from the built environment.

Conservation: Preservation of species diversity through maintenance of living collections as well as seed collections and herbarium specimens. More practically, **botanical gardens provide the following services**

1. Botanical gardens provide information of local flora and are used in the preparation of monographs
2. Several gardens supply seeds and material for botanical investigations.
3. They provide information on food plants, ornamental plants, medicinal plants etc.
4. Modern gardens supply living plant resources for research in systematic, horticulture, ecology and genetics.
5. Big botanical gardens provide training facility to younger students providing them laboratory, classroom, green house, nursery etc.
6. They supply facility for course in local flora, horticulture, hybridization plant propagation etc. their educational programme includes workshops and training sessions for teachers, students, naturalists etc.
7. They also provide information on the protection of endangered species and propagation of rare plants.
8. Gardens practice and provide training for the conservation of nature.
9. They provide instructions for home gardening, and care of plants winter and summer.

10. Botanical gardens provide aesthetically pleasing environment and they play a major role in providing sound mental health.

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CONCLUSION

Botanical gardens play complementary roles in biodiversity conservation and ecological innovations for the improvement of human well being. It is necessary to emphasize that botanical gardens can transfer skills and experience connected with traditions and best practices in certain religions.

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