

Education Function of Botanical Gardens

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Abstract—Botanical gardens are very significant organizations which protect the environment against the increasing environmental problems, provide environmental education for people, offer recreation possibilities, etc. This article describes botanical gardens and their functions. The most important function of botanical garden is to provide environmental education for people and improve environmental awareness. Considering this function, some botanical gardens were examined and opinions were suggested about the subject.

Keywords—Botanical garden, environment, environmental education, recreation.

I. INTRODUCTION

BOTANICAL gardens are locations and organizations where herbaceous and woody plants are cultivated, exhibited, and various scientific researches on these plant species are made, where endangered and extinct plant species are protected, environmental education given to the public, and their recreational needs are met. Arboretums, on the other hand, are sites where only woody plant species are cultivated and exhibited. Arboretums might be a part of a botanical garden or can be planned and designed apart from botanical gardens.

Botanical gardens were initially designed for the cultivation of medicinal plants. Later on, these gardens, where other plants were also cultivated, were defined as collections of living plants and designed accordingly. Whereas in the past botanical gardens were designed and implemented usually by universities and local governments, nowadays this task is also realized by private enterprises resulting with private botanical gardens.

II. FUNCTIONS OF BOTANICAL GARDENS

The functions of botanical gardens are studied under four headings:

A. Research Function

While botanical gardens are designed and implemented, first of all the kinship of the plants actually in the area and plants to be planted and cultivated are studied. In line with the relationship between plant species in the area, according to the botanical classifications made, herbaceous and woody plants gardens are implemented. Subsequently, the plant species in these gardens are labeled. On these labels, the botanical name of the plants, its family, endemic origin, etc. are written. Any visitor of the botanical garden will receive the necessary information about a particular plant through these labels.

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Among the research topics are whether different plant species, endemic to some certain regions, are able to grow up far away from their place of origin, and if these are able to adapt or not. Thus, the adaptive capabilities of the plants are determined. Moreover, botanical gardens serve the function of research centers by enabling studies in the scientific field of botany, by determining plant species under the threat of extinction in the world, by protecting the diversity of plant species, and enabling the continuity of habitats and biological diversity [1], [2].

B. Recreational Function

Together with urbanization, the rate of concretion increases decreasing thus the rate of green spaces available. Concrete structures erected without a prior city planning make cities void of green space. The separation of man from nature increases their yearning to nature and results with the need for open - green space in urban areas defined also as breathing spaces.

Open-green space can be planned and designed in many ways. The open-green spaces designed and implemented as botanical gardens enable people to spend time in nature and answer their recreational needs. These sites, enabling the psychological relief of people who feel the need to move away from their environment due to reasons such as intensive work, contribute to the formation of a healthy society.

C. Educational Function

Environmental education is a multidisciplinary field of study referring to organized efforts to teach how natural environments function, and particularly, how human beings can manage behavior and ecosystems to live sustainably and thus establish a citizenship concept sensitive to nature. Sensitivity and awareness about the environment should be maintained so as to form public awareness with an intellectual background able to solve the dilemma between environmental problems and values and to prevent the rise of novel environmental problems. Moreover, environmental education has to improve the questioning, problem solving, and decision-making processes of people. Hence environmental education, by preparing a high quality of environment, has to contribute to the realization of high quality living standards [3], [7].

Botanical gardens play also an important role in the realization of environmental education and its goals. It instills people the love for nature with the seminars related with environmental education and with a hands-on individual education on one to one basis.

Botanical gardens, with a mission to promote the natural flora of their region by providing information visitors about endemic as well as about plants growing in different regions

of the world, contribute to formation of environmental and awareness for environmental conservation by providing information about plants to people in all age groups and by introducing the richness of plant life [1], [2].

Natural resources are disappearing rapidly due to natural or manmade causes. One of the methods that can be practiced to avoid this situation is to disseminate environmental education and develop environmental awareness. Botanical gardens, serving also purposes such as organization of various educational conferences, make corporate publications, and create documents, help to make such environmental problems ineffective to conserve natural resources.

D. Other Functions

- They provide the physical stability of the city and put the city from an aesthetic aspect to the fore.
- Prevent the pollution of the city air by producing oxygen.
- Enable the city to have a microclimatic feature through an impact on the urban climate.
- Enable the import of new plants into that area and thus increase the economic importance and attractiveness of the region [6].

III. BOTANICAL GARDENS

A. Royal Botanical Garden, Kew

Kew Royal Botanical Gardens, dating back to the 16th century, located 10 km south-west of London, and placed on an area of 121 square hectares, was incorporated in 2003 by UNESCO into the "World Heritage List". This world famous garden displaying the art of gardening of the 18th and 20th century hosts 45,000 plant species. 650 scientists continue their scientific work in there. This large facility bearing more than 750,000 books and periodicals in its library also publishes four scientific journals regularly every year.



Fig. 1 Royal Botanical Garden, Kew [5]

Kew Royal Botanical Garden in collaboration with various universities UK –wide and other scientific institutions provides seminars, workshops, and research possibilities for tertiary level students. Moreover, it gives many courses open to the general public. These are; Conservation courses, Plant Science courses, Horticulture courses, etc. [5].

1. Palm House

Experts consider Kew's Palm House to be the most important surviving Victorian iron and glass structure in the world. It was designed by Decimus Burton and engineered by Richard Tanner to accommodate the exotic palms being collected and introduced to Europe in early Victorian times. The project was pioneering, as it was the first time engineers used wrought iron to span such large widths without supporting columns. This technique was borrowed from the shipbuilding industry and from a distance the glasshouse does resemble an upturned hull. The result is a vast, light, lofty space that can easily accommodate the crowns of large palms and which boasts 16,000 panes of glass.

Heating was an important element of the glasshouse's design, as tropical palms need a warm, moist environment to thrive. Originally, basement boilers sent heat into the glasshouse via water pipes running beneath iron gratings in the floor. A tunnel ran between the Palm House and the Italianate Campanile smoke stack that stands beside Victoria Gate. This 150-metres-long (490 ft) passage served the dual purpose of carrying away sooty fumes to be released from the chimney and enabling coal to be brought to the boilers by underground railway. Today, the glasshouse is heated using gas and the tunnel houses the Palm House Keeper's office. Originally, palms, cycads and climbers were planted in large teak tubs or clay pots that sat atop benches above the iron gratings. However, in 1860, two large central beds were dug and the tallest palms planted in them. Subsequently, most of the glasshouse's plants were dug into beds to form a miniature indoor tropical rainforest.

The Palm House was first restored between 1955 and 1957 when its glazing bars were cleaned and the entire house re-glazed. At this time the boilers were converted to oil and moved close to the Italianate Campanile. Between 1984 and 1988 a more comprehensive overhaul was undertaken. The Palm House was emptied for the first time in its history, with most plants moved to other glasshouses. Those that were too large were cut down and used to make specimens for the Herbarium and Museum. Under direction of the Property Services Agency, this building was completely dismantled, restored and rebuilt. Ten miles of replica glazing bars made of stainless steel were put in place to hold new panes of toughened safety glass. The restoration took as long to finish as the glasshouse took to build.

Highlights in the South Wing, which contains plants from Africa and the Indian Ocean Islands, include the African oil palm (*Elaeis guineensis*) the most important oil-producing plantation palm in the Tropics and the rare triangle palm (*Dypsis decaryi*) from Madagascar.

The main central section houses plants from the Americas, including many economically important species. Cocoa, rubber, banana and papaya plants growing here alongside the Mexican yam (*Dioscorea composita*) which was used to develop the contraceptive pill.

The North Wing showcases plants from Asia, Australasia and the Pacific, the region that contains the world's greatest

diversity of palms. Also, there are several Asian fruit trees including mango, starfruit, breadfruit and jackfruit [5].

2. Water Lily House

Located opposite the northern entrance of the Palm House, this square glazed structure encloses a circular pond spanning 36 feet. It was completed in 1852 specifically to showcase the giant Amazon waterlily (now called *Victoria amazonica*), first encountered by European botanists in South America at the beginning of the 19th century. With ironwork by Richard Turner, who had built the Palm House in the preceding decade, the Waterlily House was at that time the widest single-span glasshouse in the world.



Fig. 2 Royal Botanical Garden Palm House [5]



Fig. 3 Royal Botanical Garden Palm House [5]

Although other waterlilies and lotus thrived in the new house, its intended inhabitant fared less well. Within six years of installation the *V. amazonica* was moved elsewhere and the Waterlily House became a tropical habitat displaying red, white and blue waterlilies, ferns, papyrus and hanging gourds. When Joseph Hooker became Director of Kew in 1865 he replanted the glasshouse to showcase plants of medicinal and culinary value. It was converted back to its original use in 1991. Today it is Kew's hottest and most humid environment, housing a wide range of tropical ornamental aquatic plants and climbers and a spectacular display of gourds in the autumn months.

The Waterlily House is also home to a collection of gourds. These climbing plants are members of the *Cucurbitaceae* family, along with cucumbers, melons and marrows. The

species grown depend on the seed available. Some recent exhibits include the wax gourd (*Benincasa hispida*) and the spiny-fruited hedgehog gourd (*Cucumis metuliferous*). The former has a layer covering its mature fruits that is used in Asia to make candles. Its fruits are also often cooked to make vegetable curry. The latter has reddish fruits filled with seeds in a jelly-like pulp. It is grown commercially in New Zealand and marketed as 'Kiwiano', following the success of the kiwi fruit.

Gourds were one of the earliest fruits to be domesticated by humans. They have been used for centuries to make cups and bowls, musical instruments and bird-houses. In Neolithic times gourd skins were used to replace missing portions of skulls during surgery. Kew has many items made from gourds in its Economic Botany Collection [5].



Fig. 4 Royal Botanical Garden Waterlily House [5]



Fig. 5 Royal Botanical Garden Waterlily House [5]

B. Nezahat Gökyiğit Botanical Garden

Nezahat Gökyiğit Botanical Garden (NGBB) was established 1995 by Ali Nihat Gökyiğit on behalf of his wife as a commemorative park and hence the initial planting and reforestation plan was implemented for commemorative park purposes. The garden which was decided to be redesigned as a botanical garden was opened to the public in 2002 and took in 2003 the name "Nezahat Gökyiğit Botanical Garden". The garden, providing a 12% green area to Istanbul, is a spot to breathe for the people of Istanbul and also a center of research, education, and training center.

There are 5,000 books and publications in the library of the garden providing a habitat for 2,000 plant species. Moreover, each year 6 scientific journals are published.

There are many courses, projects, and activities for children and adults in Nezahat Gökyiğit Botanical Garden. For children

there is; “Gardener Children Project, Useful Plants Project, and Summer Camp Activities”. For adults there are courses such as “Plant Drafting, and Horticulture Courses” University students enrolled at plant and design related departments can work here as an intern and can partake in scientific research [4].



Fig. 6 Nezahat Gökyiğit Botanical Garden [4]

1. Rock Garden

A Rock Garden is an area dedicated for plants which in their wild habitat live amongst rocks and in rocky places. They are resistant to extreme conditions and can survive with a limited amount of soil and resources as the rocks protect them from the heat and grazing animals. Visitors can see a range of species on the Rock Garden which grow naturally in the wild in rocky places, either on or between the rocks along with some ornamental garden cultivars.



Fig. 7 Nezahat Gökyiğit Rock Garden [4]

There are almost a hundred species growing including ten endemics. *Allium goekyigitii*, *Allium karacae* and *Allium koyuncui* are amongst the endemic bulbous species. There are also a number of conifers [4].

2. The Medicinal and Aromatic Plants Collection

Today, more than 6,000 plant species are being used worldwide for their medicinal value. Some 75-90% of people in developing countries depend only on these medicinal plants as a source of traditional medicine for their ailments. Herbal drugs and herbal mixtures that are commonly used and are known as “folk remedies” are also known as ethnobotany. The

science of ethnobotany investigates all kinds of traditional uses of plants along with their medicinal usages. When the side effects of synthetic drugs and the interactions of different drugs with each other and other factors are revealed, many people have returned to herbal remedies that were once scorned as just “folk remedies” and today alternative medicine is more popular than ever.

NGBB aims to introduce traditionally used medicinal and aromatic plants to everybody who is interested in plants, especially to the local and new residents of Istanbul as well as foreigners. The medicinal and aromatic plants found in the Garden are grown and improved with the help of NGBB staff from seed or plants collected by scientists in the wild. Some medicinally important plants that do not grow in Turkey naturally are also grown from seed [4].



Fig. 8 The Medicinal and Aromatic Plants [4]

IV. CONCLUSION

The continuity and transfer of botanical gardens to future generations is one of the greatest contributions of mankind to the world. Throughout history, these gardens have contributed to the cultural progress of the region, realization of scientific discoveries, economic growth, and commercial development.

In line with the above mentioned functions, these botanical gardens existing in line with scientific findings, they must be improved, protected, and their number increased. Only in this way the rapidly diminishing natural resources can be conserved and measures can be taken against the rapidly growing environmental problems.

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