

The botanic gardens & ecological city - case study of Shanghai Botanic Gardens

Hu Yonghong

Shanghai Botanic Gardens, China

The difficult problems in Shanghai's ecological urban construction

Shanghai is located on the lower reaches of the Yangtze River delta alluvial plain. The physical features of the area are low lying and flat, the original vegetation is lost and also lacks the heterogeneous habitat for natural species diversity.

The plants also do not grow well in these disadvantaged natural conditions, such as the high water level, the glue-heavy soil, the sea waves and soil which is contaminated and has a high salt content.

The climate belongs to the subtropic monsoon climate area with an annual average air temperature of 15.5°C, and average relative humidity of 80%. The summer temperature and humidity are high, sometime reaching 40.2°C; winter is freezing, and the lowest is -12°C. Subtropical plants are difficult to grow through the winter; temperate plants are difficult to maintain over the summer, which leads to a decrease of screening space. The summer and autumn typhoon can bring about damage to shallow-rooted plants.

Shanghai is facing rapid development, the natural ecosystem has been disturbed, indigenous plants have been destroyed, and the original habitat is reduced day by day. The original plant species are hardly evident as it limits ecological urban construction and development in Shanghai.

The goal of Shanghai's ecological urban plan

Shanghai urban development changes every day; the urbanization is accompanied by some urban sickness, such as the dense housing, traffic jams, worsening environment, habitats destroyed and the ecological equilibrium out of balance. After 1980, with the ecological city theory developing, it was considered to be a future city model. Urban greening contributes a great deal to the ecological city construction. Shanghai is aiming to become an ecological city. Plants, plant communities, and plant ecosystems in the city is a framework of the ecology.

As the resources of natural ecosystems have suffered injury, indigenous plants should be restored, plant introduction and domestication extended to enrich the green planting.

To improve the greening of the city, the viaduct, the roofs, walls and the balconies in Shanghai have been fully utilized.

The integrative green network is being constructed between the city and countryside which will increase the heterogeneity of the city landscape.

Shanghai Botanical Gardens (SBG) has put forward new theories and technology for greening the city to resolve urban sickness, meet people's requirement for leisure and activity, and illustrate its ecological functions for improving climate, relieving heat island effect, reducing noise and preventing disasters.

Case study of Shanghai Botanical Gardens

Shanghai Botanical Gardens (SBG) covers an area of 81.86 hectares, started in 1974 and began as a small nursery, called Longhwa nursery. The mission of the botanic gardens focuses on research on plants and their utilization, public education, and entertainment, especially important in an urban area. Being a city botanic gardens, the main function is to provide correct plant materials for urban greening.

According to "climate similarity theory" and "acclimatization", a large number of indigenous trees and excellent plants were introduced into the city by plant collecting and seed exchange. This has enriched city biodiversity and helps build a sustainable city.

According to the statistics, since 1973, from primary data more than 33,000 accessions were grown. By the end of 2003, 19,000 trees were introduced and the greenhouse plants reached 14,000 accessions. At present, the botanic gardens has 1,336 taxa in the field and more than 3,700 greenhouse plants with the entire gardens collection of more than 5,000 of both native and introduced plants.

SBG also holds some rare and endangered species numbering 60, with more than 100 accessions. These taxa include three species of primary concern, 23 species of secondary concern, and 35 species of tertiary concern such as, *Neolitsea sericea*, *Tapiscia sinensis*, *Pteroceltis tatarinowii*, *Cinnamomum japonicum*, *Phoebe chekiangensis*.

Since the 1980s, on the basis of commonly introducing varieties, special families were given priority for introduction such as, Magnoliaceae, Araceae, Aceraceae. Since the 1990s, ground cover plants, perennials, bulbs, plants for foliage, vertical greening plant, water plants, and coloured-leaf plant have been introduced.

More than 600 plants from China and abroad have been introduced and about 300 kinds were selected and recommended. Now 40 demonstrations in eight districts have been established with more than 240 species such as *Cinnamomum camphora*, *Choerospondias axillaris*, *Michelia chapensis*, *Elaeocarpus sylvestris*, *Pistacia chinensis*, *Farfugium japonicum*.

Scientific research achievements have influenced and guided government policy

The government policy of tree planting, plant conservation, plant arrangement, and green system planning and the concept of an ecological city may be influenced by the botanic gardens and its achievements.

Botanic gardens guide urban tree planning

Following the theory of landscape ecology, indigenous plants and the near zonal plants were introduced and some special and excellent cultivars from other places were also moderately introduced. The aim is to construct the pattern of urban biodiversity which has regional flora and vegetation features.

Conservation genetics progress affects the protection of urban biodiversity

Conservation genetics was developed in the 1980s. Botanic gardens are the main base for protecting biodiversity and sustainably utilizing the plant resources. SBG undertakes research on biodiversity conservation and inheritance as its main task, followed by *ex-situ* conservation of rare and endangered plants, and has introduced almost one hundred nationally protected plants. The first stage is to protect the plants and then use them in urban planting which promotes urban biodiversity protection.

Affect city planting arrangement style

The landscape is designed for people, to satisfy people's physiological and mental needs. SBG attaches special importance to the ecological service function and building a sustainable future. It has been beneficial to resolve urban environmental problems, especially to relieve the heat island effect. Beautiful, fit for purpose and the ecology are essential ingredients for green space construction.

Produce many kinds of green style and promote urban vertical greens

Research on the technique of spatial three-dimensional use of planting living material on roofs and walls has enriched the urban green style, improved the ecological benefit and landscape effect. New styles of plant arrangements have been developed, such as a wind path induced by plants to prevent the hot-island effect in an urban area to achieve a green city. There is a demonstration of roof and wall plants in SBG.

Botanic Gardens influence urban greening and promote ecological urban construction

A mass of ornamental flowers, fruit and foliage plants were introduced and used, which laid the foundation for transforming the green city to the coloured city, from the two season scenery city to the four season scenery city. Green needs to optimize the spatial, transform from the pure landscape demands to the omni-directional ecological construction, finally steps into humanist, harmonious and beautiful ecological city.

The scientific research in botanic gardens should closely support the ecological city development. However, it should be unceasingly innovative to guide the development of the urban greenspace.