

The theory and practice exploration of the Eco-botany Garden in Zhejiang Forestry College

Zhong Tailin, Shi Bolin, Li Genyou & Ye Xiyang

The Botany of Zhejiang Forestry College, Lin'an, China

Introduction

The Eco-botanical Garden of Zhejiang Forestry College, built in the year 2001, located in Lin'an—a nationwide eco-city on the west suburb of Hangzhou, is the main branch of the University. It is constructed in accordance with the great-leap-forward development of this university and covers 150 ha. Situated in the national forest garden—Qingshan, with the ground rising from the north and falling at the south around 20 meters above sea level, the Garden displays its characteristic natural scenery of mountains and lakes in the south of the Yangtze River. Such favourable geographical position and the environments around are very suitable for the growth of the plants and the development of a botanical campus. Many people have explored the construction of the university campus in the 21st century; how the new campus should be built and what the botanical campus will be are always the goals of leaders and experts. In the past five years, the construction centred on the buildings and planting. Now, it includes eco-issues and refers to the whole optimization of the eco-environments, which is a hot topic in the current society. It is an important factor that can't be ignored in social development and sound living environments are the basis for living things. Education as the basic activity of humans involves ecology as well. In light of this, Qinghua University first proposed its idea of “eco-campus construction” in 1997. In the 21st century, the university should be the core of local culture and the provision of an ecological campus is a good example for modern civilization. Good cases in point are Qinghua University, Beijing University and Harvard University which are well-known to us both for their scenery and human landscape (Xiong Qing-nian, 2000). Therefore, it is safe to say that constructing the campus into a botanical garden can solve the ecological problem of the campus and provide the basic infrastructure in one way and make full use of the research superiority in Zhejiang Forestry College in another. At the same time, more rare and endangered species being conserved and studied will make a solution to the species shortage, the difficult introduce of rare plants as well as fund shortage, advance the research and improve the contemporary gardening (Meng Xian-min, 2004; He Shan-an, 1996, 2002a, 2002b; Ling & Xie, 2004).

Comparatively, successful examples can be easily seen in single botanical garden construction or single campus construction with the theories of ecology and restoration ecology when the plants are cultivated and organized according to their ecological behaviour, community laws and soil condition (Hao *et al.*, 2003). Further, this combination of the new campus and botanical garden constitutes an attempt for further education (Chen, 2002). In the meantime, as the base for talents, technology and scientific invention, the starting-point of the development of society, economy, culture and science, the universities embodying all elements of modern technology to support sharing information, landscaping and ecology (Lin *et al.*, 2003). The combination

construction of the campus and the botanical garden in Zhejiang Forestry College hereby will be helpful to the social harmony and development, be able to make the most of its own unique characteristics to the full. The overall design is a combination of the new campus and a botanical garden which is devised into 29 specific gardens (Figure 1). After five years, 11 are completed, 8 are under construction, another 10 have started. Subprojects of a digital botanical garden such as “Digital Plant Specimens” and “Plants Information Management System” have also been accomplished. The campus together with its natural scenery, local culture and unique style is particularly atmospheric for learning and teaching and generally acknowledged distinctive among the national campuses. It is hailed by leaders from the State Council and Zhejiang Provincial committee as “a wonderful place to study in and to pursue an academic career” (Figures 3-4).

1 The construction idea and principles

1.1 The design logos and idea

In light of the spirit of Ten-year Reformation and Development of Zhejiang Forestry College, the design of the botanical garden takes account of the essence and the characteristics as well as the actual needs of teaching and research in the university. The botanical campus now has become a vital carrier of the campus culture. It is built not only as the nucleus of scientific research but a beautiful leisure place for the staff, students and visitors. When students enter the gate of the campus, they will begin to feel the evolution of the plants on earth. Such a campus can meet the needs of teaching and research on plant evolution and plant development and enable the students to observe plants at any time. Through the idea of the combination of teaching, research and tourism and a first-class modern botanical campus construction, the design idea was proposed as “to respect nature, to optimize the environment, to suit local conditions, have unique-features, be people oriented in harmony-with people-and-nature”. “To respect nature is to develop with nature, to fully utilize the features of the natural terrain such as the celebrated forest garden of Qingshan Lake retaining large parts of the hills and returning it to its original state. To optimize the environment is to humanize the artificial environment with nature and thus surpass it, to represent diverse artificial landscaped, to unite nature’s beauty with art according to the harmony principle. To suit the measures to local conditions deals with the integration with the whole local design of the city including lakes and hills. Unique-feature oriented indicates its own specific features. People oriented constitutes the stress of the idea, implying people are the core, making people’s life convenient and comfortable thus promoting the harmony of people and nature. Harmony-of people-and-nature oriented conveys the synthesis of eco-campus, which expresses that nature is the ultimate source of humans and humans are a part of nature which should adapt itself to the inherent law of nature(Chen Jing-you,2002).

1.2 The design principles and objective

Following the Botanical Campus Environment Design of Zhejiang Forestry College, the gross area is 1,352,673 m², of which plants cover 748, 044 m² and the total number of species is 2,188. The project will be carried out in 3 phases. The first two years saw the foundation of the development scheme of the botanical garden from the year 2003 to 2020, which points out the main tasks “to serve teaching”, “to conserve biological diversity” and “to set an example of technology and science”. This scheme embodies the idea of “people-oriented” and the union of nature and humans. The great respect to the natural growth of plants and relationships between ecological communities reflects the emphasis on living identities. In the long run, the botanical garden is to be an organic whole with the 334 ha mountain forest at the rear of the campus and incorporated into forest recreation site, experimental site and natural succession area. The gene pool of plant varieties, ornamental plants in the cultivation centre, rare and endangered species conservation centre, green

technology and science centre will find their place. On the premise of this, the development of the botanical garden is devised on the culture, art, ecology, education and science principle. The culture principle refers to the campus culture with stress on the education atmosphere and harmony of mountains, water, buildings, and human landscape. The art principle reflects the rhythmic landscape by way of the artistic treatment of species, colours and the overall arrangement. The ecology principle emphasizes the species diversity in accordance with the ecological requirements and reasonable arrangements of primary phytocoenosis. In terms of the education principle, our objective and demands covers the scientific arrangement of plants and the design of them on different classification system, for example, the Pteridophyta is classified on Qin Renchang System, the Gymnospermae on Zheng Wanjun System and the Angiospermae on Cronquist System. Such construction of the campus can really meets the function requirements of the botanical garden (Chen Jing-you,2002). The synthetic implementation of the above principles will contribute to some specific sections or techniques and thus help to promote the campuses international influence and competitiveness.

2 The process and contents

2.1 Sections design and species introduction plan

Based on the construction idea and principles, and different classification systems, 2188 species are covered in the 29 specific sections embodying the evolution of plants from lower to higher and single to complex. Each section is composed of communities of trees, shade trees and systematic representative trees according to different landscape features. At present, the frame of the botanical garden has basically come into being making a feature of “the union of the campus and the botanical garden”, “planting ecologically”, “joint teaching and demonstration” and “unique collection of species”. Among the 11 sections the Magnoliales and the Rosales are preliminarily completed. Now the 8 classified gardens are constructed: Jequirity forest, *Osmanthus* garden, Aquatic plants area, Lily garden, Herb garden, Rare species garden, Bonsai garden, International friendship forest. The other 10 gardens are not constructed: Fern garden, Pink garden, Peony garden, *Chrysanthemum* garden, Palm garden, Orchid garden, locally-named (Tianmu) plant garden, Rock garden, Fragrant grass garden, Wild flower border garden. Currently, the introduced species are more than 1560, among which there are about 70 rare plants. In order to meet the needs of teaching, research, experiments, science education and sightseeing, the university is making a great effort for the eco-construction and increase the species to achieve the landscape effect. After 3 to 5 years, the species will reach to 3000 and thus the campus will create a more favourable environment for the staff and students.

2.2 The construction of the specified sections

The construction of the specified sections reflects in the mass the level of a botanical garden. Zhejiang Forestry College attach great importance to the construction of the specified sections. A team of relevant experts was founded to take charge of the details of designing and carry-out. In the present day, it centres on five sections, namely, the rare species section, the medicine plants section, the scented section, the bonsai section and the bamboo section. The first section is a crucial part as one feature of our campus, mainly displaying the achievement of the allochthonous rare and endangered plants in Zhejiang Province. It is linked with the authorized project by State Forestry Bureau —Zhejiang Forestry College Gene Pool of Plants and Rare and Endangered Species Breeding Center. Through the scientific introduction, cultivation, conservation, breeding and domestication of the rare species, the endangered plant status is reduced and the diversity is positively protected. At the same time, we are trying to cultivate rare seeds, plants and flowers to gain the proprietary intellectual property rights, enable the garden to have multi-functions of conservation of the allochthonous rare

and endangered plants, breeding research, science and technology education, plantlet cultivation and sightseeing (Lin, 2003; Zhang *et al.*, 2006). 70 introduced rare and endangered plants such as *Carpinus putoensis*, *Brotschneidera sinensis*, *Shaniodendron subaequale*, *Taxus chinensis* var. *maieri*, *Ginkgo biloba* and *Ostrya rehderiana* which represent 54.5% of the most threatened plants with state protection in Zhejiang Province. The medicine section primarily project the medicine value and ornamental value by means of the collection of breeds, conservation, domestication and their cultivation considering the ecological requirements and landscaping. This section has collected more than 260 species. The scented flowers are those which have been popularized and studied at the present time. Our scented section focuses mostly on the collection and demonstration of the fragrant and blooming flowers. The fourth section take is that of bonsai providing the predominant green cover, condensing the nature beauty into bonsai to express the wonderful art and crafts of humans. The last section has over 160 ornamental or rare bamboo species from Zhejiang Province, Japan and Taiwan.

2.3 The digital botanical garden

Nowadays, with the development of newly-emerging science and technology, numerous botanical gardens in the world begin to make use of information which advance their own sustainable development. For instance, they adopt new techniques to record plants electronically, monitoring and management of these plants, tissue cultivation, molecular biology and other methods to study and conserve the genetic diversity of plants. Drawing on the digital management experiences of Xianhu botanical garden and the South botanical garden, we are trying to realize an overall digitalization of species conservation, daily management, resources exploitation and academic researches (Qi *et al.*, 2001; Gao *et al.* 1996; Ren *et al.*, 2004; Lin *et al.*, 2005). The project consists of five parts. The first part is the management information system based on data-assisted and virtual system technology, the second is the network demonstration system based on space technology, website, digital maps, investigation statistics and digital modeling which is helpful for the description and analysis of the plants resources. The ultimate objective is to build an e-Science lab from two aspects (space and time) to convey digital expression of the entities of plants and provide the digital platform and e-searching system for the academic research at different levels. The third one is the e-searching system. The last two are the digital specimen museum and the digital timber museum.

2.4 Social support

In the course of construction, the botanical garden of Zhejiang Forestry College received help from all walks of life. The secretary of BGCI Peter Wyse Jackson, Mr Chen Junyu an Academician of the Chinese Academy of Engineering autographed our garden respectively. Officials from State Forestry Bureau, leaders from Zhejiang provincial committee and government have come to our garden on several occasions to guide the construction and they planted trees personally as a memoriam (Figure 2). We also establish a good relationship with Shanghai Botanical Garden, Hangzhou Botanical Garden and other organizations. Zhoushan Forestry Research Institute, Lin'an Forestry Bureau, Zhejiang Tianrun Landscape Co. Ltd. and many individuals who have donated *Carpinus putoensis*, *Shaniodendron subaequale*, *Neolitsea sericea* and other rare plants.

3 Prospects

In the short-term of 5 years, the botanical garden of Zhejiang Forestry College have founded a gene pool of species and collected many species and conserved them successfully, it was also certified with the Nationally Designated Eco-demonstration Model (Figure 5), but the work of botanical gardens at home and abroad has

become furious. With the decrease of wild species, it is necessary for us to strengthen the exchange and cooperation with large-scale botanical gardens and the support from international and state projects, enhance the penetrating researches on rare and endangered plants and digital simulation (Li *et al.*, 2004) to build our garden into an influential famous one in the next 10 years.

4 Parts of the achievements and Figures 1-6



Figure 1 The plan of the botanical campus environment



Figure 2 Director Jia Zhibang from the State Forestry Bureau (Left 3), Deputy-Governor Mao Linsheng (Right 1) from Zhejiang Province, President Chen Jingyou (Right 3), Academician Zhang Qinsheng (Left 1) from the Chinese Academy of Engineering are planting trees



Figure 3 The spring scenery of the garden

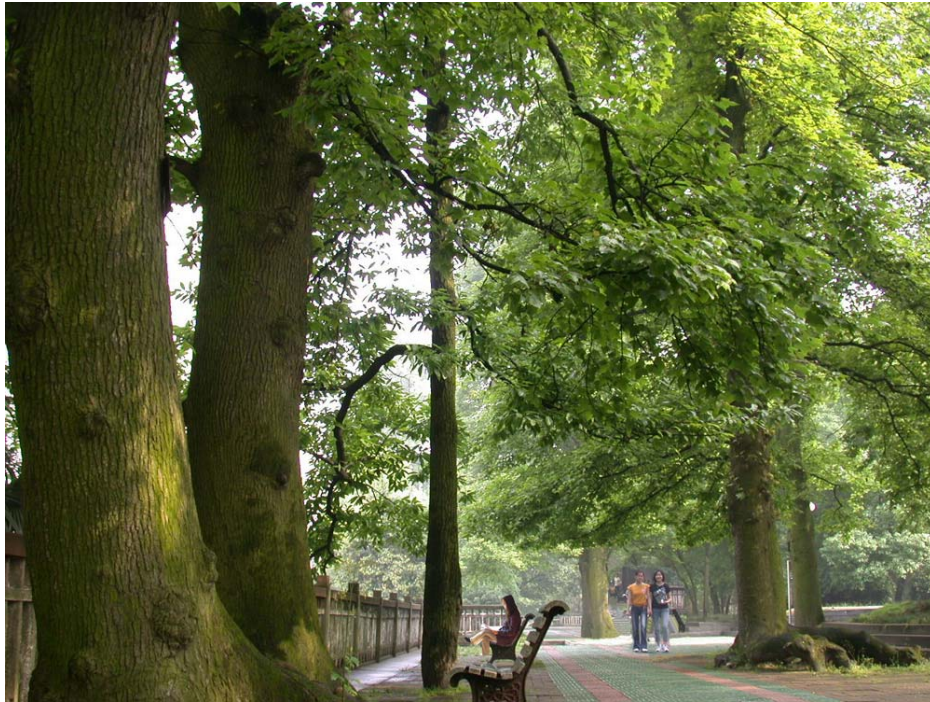


Figure 4 Towering old tree in garden



Figure 5 Panorama of the botanical campus



Figure 6 Certificate of Nationwide Landscaping Model

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