

Urban Forestry in China: Status and Prospects

Urban forestry management has been accepted by both scientists and policy makers as one important strategy to improve living and working environments (Jiang 2003). In the middle of the 1980s, Shen et al. introduced the term "urban forestry" to China (see Li et al. 2004), and Gao (1984) published the book *Urban Forest in Chinese*. In recent years, research projects have been initiated to better plan the development of urban forests in some cities (Chinese Academy of Forestry Sciences & Huadong Normal University, 2002), education programmes on urban forestry have been launched in some colleges, and a special research journal, *Journal of Chinese Urban Forestry*, was established (in Chinese in 2003).

Over the last 20 years, a rapid process of urbanisation has taken place in China due to increasing economic development. Between 1983 and 2003, the number of cities and towns in China increased 2.5 times to about 50,000, and the urban population reached the level of about 40% of the total population in the country.



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Temples near a city are commonly important parts of its urban forest: Daming Temple, Yangzhou, Jiangsu Province.

With the increase in the number of urban areas and in the total urban population, environmental problems have become more and more serious, e.g. in terms of too few outdoor leisure areas for city dwellers, mass destruction of natural landscapes, loss of biodiversity, water source pollution, CO₂ emission, and so forth. This paper gives a brief introduction to the development of urban forestry in China, highlighting common problems and potential ways to solve them.

HISTORICAL DEVELOPMENT

In historical China, city dwellers primarily used the natural forests and trees within and around a city for hunting, gathering fruits and plants, collecting fuelwood, and the like. On the other hand, in ancient Chinese cities, it was also very popular to plant trees along the rivers and streets and maintain a small patch of tree stands around the houses. These trees and small areas of forest were managed for multiple purposes, e.g., for shade, to serve as a

windbreak, as beautiful scenery, to provide food sources with fruits and leaves, etc. Traditionally, some people also planted trees or a stand around their houses to create or keep a good *Feng-Shui* for the houses. In addition, there is a long tradition of establishing gardens and parks for the imperial family and higher-ranking officials. For instance, in the Summer Palace in Beijing, the most famous imperial park remaining in China, the Wanshou Hill is almost fully covered with two of the most common evergreen conifers in northern China, Chinese pine (*Pinus tabulaeformis*) and *Platycladus orientalis*. Even today, these forests are still important parts of the city's urban forest.

At the beginning of the 20th century, some Chinese scholars who had studied abroad brought the ideas of modern forestry as practised in Western countries to China. With a better understanding of forest functions in terms of environmental protection and recreation, these Chinese scholars began an attempt to establish forests in the areas around

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Several years ago, the Shanghai government started to rent out land for urban forestry purposes to private companies based on a contract. According to the contract between the government and a company, 60% of the land rented by the company must be used to grow forest, and the remaining 40% can be used for establishing a tree seedling and flowers nursery which can bring commercial benefit to the company within a short period of time. In addition, in order to support private companies in establishing urban forests, the government also provides certain economic supplements to the companies according to the area of the land rented. After 10 years, the government will get these forests back from the companies. In this way, the government can solve the issue of a shortage of funds.

Beijing and Nanjing with the purpose of conserving water and soils, as well as to provide opportunities for recreation. Starting in 1949, the new Chinese government launched a movement of massive afforestation in areas near cities as well as in remote areas. In Beijing, the new capital of China, for instance, many plantations were established around the city aimed at water and soil conservation and at offering recreation opportunities for city dwellers (see article by Jianming et al. on page 26).

In the 1980s, with a rapidly growing economy, urbanisation intensified in China, causing new environmental challenges. In this context, modern urban forestry was introduced to China as the country opened up to the outside world, and terms such as “urban forest” and “urban forestry” became popular in scientific literature and the news media (Li et al., 2004). In order to improve urban

environmental conditions, long-term planning of urban forestry was made part of a national development strategy during the 1990s (Gao, 2003). According to the planning of China’s urban forest development, the overall goal is to expand the cover of urban forests and trees to 45% in 70% of cities by the year 2050. Today there are some cities, e.g. Changchun, Nanjing and Guangzhou, with a forest cover of more than 40%.

Since the 1980s, developing urban forests has become an important part of municipal planning as a whole, and urban forests have been established according to a design which is based on the need for recreation opportunities and environmental protection. In 1989, Changchun, the capital of Jilin province, began to carry out a programme of developing a “forest city”, thus being the first city to have this as a goal of city development (Jiang, 2003). In 2001, the planning of urban forest development was worked out for Shanghai, the biggest city in the country, with the goal of reaching a 35% forest coverage by 2020. This figure was calculated based on O₂ emission, CO₂ sequestration, water sources protection, recreation, etc. (Chinese Academy of Forestry Sciences & Huadong Normal University, 2002). In 2002, a plan for urban forest development was made for the capital city of Huaining county (Jiang, 2003). This means that not only big cities but

also medium and small cities have become involved in the planning and development of their urban forests.

A second change that has occurred since the 1980s is that urban forests are now being managed for multiple purposes, so that they can fulfil their potential roles in recreation, water sources protection, biodiversity conservation, atmospheric CO₂ sequestration, air pollution reduction, and so forth. Of course different cities located in different parts

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of the country may emphasise different functions of urban forests. Due to the heavy air pollution in most Chinese cities, however, all of the trees and forests in a city are expected to have a high capability of retaining dust and absorbing SO₂, NO₂, and other pollutants (Guan & Liu, 1999; Wu et al., 2004).

A third change is that private companies have become involved in developing urban forests, just as they are engaged in other commercial activities in China. In the past governments had to call for and organise people to establish forests, but now this work can be done as a kind of commercial activity, which has added a new driving force for urban forest development in China.

The Yanzhong Green-space with an area of 210,000 m², located at the city centre, is the largest public green-space in Shanghai. For this green-space, 306 units, 165 privately owned enterprises and 6736 households have been moved.



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The fourth feature of China’s new urban forestry policies is that managing urban forest is done as a way of reducing poverty in local areas. In Beijing, for instance, forests in suburban areas have been attracting more and more tourists, especially during weekends and holidays (Qu, 2003). These visitors not only create many jobs at local hotels, restaurants, and the like, but provide an opportunity for farmers to sell their agricultural produce, such as fruits, vegetables, and handicrafts mostly made of wood and stone. At the same time, this opens a window for the exchange of information between people living in urban areas and those living in rural areas. This stimulates the enthusiasm of local people to get involved in urban forestry.

PROBLEMS

In China, the major share of funding for

managing urban forests comes from governments. However, governmental funding alone is not enough to satisfy the urgent need for planting new trees and forests in many cities. Generally, private companies are not interested in forest management, mainly because it does not deliver direct and fast economic benefits.

In order to get a fast “greening effect” along streets or in open areas people prefer to transplant “big trees” rather than plant seedlings. These big trees are usually more than 20 and sometimes even up to 100 years old. Unfortunately, they are at greater risk of dying due to water deficits during the transportation period or because they cannot adapt to the new environment; and even if they survive their growing potential is not as good as that of the trees grown from seedlings.

Due to easier operations in silviculture and a lack of techniques for planting mixed stands, most of the Chinese urban forests, and especially those established during recent years, are monocultures. These pure stands are susceptible to the outbreak of pests and they have a negative impact on the landscape aesthetic. In Beijing, for instance, the urban forest landscape is dominated by the evergreen conifers *Pinus tabulaeformis* and *Platycladus orientalis* and the deciduous broadleaves *Quercus variables* and *Robina pysesdocasia*. During the period from late autumn to early spring, the canopy of deciduous trees looks a bit ugly without leaves. Aside from the natural secondary mixed stands on Sheshan Hill in Shanghai, almost all urban forests established in China during the last 10 years are monocultures, although there are plenty of sources for selecting other tree species in silviculture.

Uneven distribution of urban trees and stands is another problem. In Chinese cities, it is rare to see a large area of forest within a city. More trees and patches of stands need to be planted within the city limits.

DEVELOPING URBAN FORESTRY

Developing urban forests in China requires strengthening research on urban forestry theory, technology, and policy making. The following aspects are important: 1) the ecophysiological properties of trees; 2) possible responses

the most important task is to raise awareness about the role of forests

of urban trees and urban forests to global change, e.g. acid rain, ozone, ultraviolet radiation, global warming, etc.; 3) technology for establishing multipurpose forests; 4) the mixture of tree species in urban forests; 5) control of diseases and insects harmful to the trees and forests; 6) application of GIS (geographic information system), RS (remote sensing) and GPS (Global Positioning System) technology in urban forestry. Policies, laws and regulations concerning urban forestry should be changed or developed to adapt to the current needs and mentioned problems. Studies are also needed on how to account for urban forests' induced economic benefit, and how to levy taxes to compensate urban forestry. In addition, the practice and experience of developing urban forests commercially as done in Shanghai should be studied further in order to find more ways to generate funding for urban forestry.

From a research perspective, some long-term observation stands should be established so that a set of complete data on urban forests can be compiled. In addition, based on different conditions in terms of climate, species composition, and urban environment, it is good to establish demonstration forests. Results from studies and experiments in these areas can then guide future urban forestry practice. In European and American cities, there is a longer tradition of establishing and managing urban forests as an approach to tackling environmental problems (Konijnendijk, 1997; Hunter, 2001). It is necessary to strengthen the exchange of silvicultural and other knowledge, as well as policy-making experiences between China and these countries.

There is also a need to increase the involvement of the public and local inhabitants and tourists in particular in the development of urban forests in China, a country with a rather short history of modern urban forest management. In this aspect, the most important task is to raise awareness about the role of forests in improving the environment by means of newspapers,

magazines, TV, etc. In addition, it is also important for researchers and managers to assist with preparing information materials aimed at tourists and local inhabitants such as leaflets or posters about their projects or specific urban forest stands.

In China, generally, one important limiting factor for developing urban forests in a city is shortage of funds, mainly because these forests do not produce direct economic benefits, and they thus do not attract private companies. It is necessary for the government to invest in urban forestry, as one aspect of a city's infrastructure, but diversification of fund raising should also be advocated. Due to the exceptional position of Beijing as the capital city, several international cooperation programmes support its urban forest development. In addition, as discussed above, the government's policy of providing economic compensation to private companies in Shanghai might be considered for other municipalities as a way of raising funds for developing urban forests.

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REFERENCES

- Chinese Academy of Forestry Sciences & Huadong Normal University. 2002. Development Planning of Modern Urban Forests in Shanghai. Project 3, Studies on Development of Modern Urban Forests in Shanghai. Key Project financially supported by Ministry of Science and Technology of People's Republic of China and Committee of Science and Technology of Shanghai. (In Chinese)
- Gao F. 2003. Development strategy of China urban forestry. *Journal of Chinese Urban Forestry* 1: 12-13. (In Chinese)
- Gao Q. 1984. Urban Forest. National Institute for Compilation and Translation, Taipei, China. (In Chinese?)
- Guan, D. & Liu, Q. 1999. The Role of Guangzhou Urban Vegetation in Removing Atmospheric Sulfur. *Acta Scientiarum Naturalium Universitatis Sunyatseni* 38: 109-113. (In Chinese)
- Jiang Z. 2003. Urban forest development and ecologically sound urban development. *Journal of Chinese Urban Forestry* 1: 4-11. (In Chinese)
- Hunter I. R. 2001. What do people want from urban forestry?—The European experience. *Urban Ecosystems* 5: 277-284.
- Konijnendijk, C.C. 1997. A short history of urban forestry in Europe. *Journal of Arboriculture* 23: 31-39.
- Li H., He X., Chen, W. & Xu W. 2004. Current situations and trend of investigations on urban forests in China. *Chinese Journal of Ecology* 23: 55-59. (In Chinese?)
- Qu H. 2003. Forest tourism in Beijing. *Journal of Chinese Urban Forestry* 1: 52-54. (In Chinese)
- Wu Z., McBride J. R., Nowak D. J., Yang J. & Cheng S. 2004. Effects of urban forest on air pollution in Hefei city. *Journal of Chinese Urban Forestry* 1: 39-43. (In Chinese)
- Zhang L., Wu J., Zhen Y. & Shu J. 2004. A GIS-based gradient analysis of urban landscape pattern of Shanghai metropolitan area, China. *Landscape and Urban Planning* 69: 1-6.