

Plantation future of bamboo in China

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Abstract: In the past, utilization of bamboo resources in China has been traditionally dominated by direct consumption of local farmers as minor forest products with weak linkage with market. In recent years, the over-supply of grains and rapid degradation of agricultural environment call for alternative crops that can be developed through integrating the environmental plantation with the market demands. Closely associated with forestry and agriculture, bamboo is able to deal with the new challenges which China's agriculture is facing. Of 534 documented bamboo species in China, 153 species produce edible-shoots and of which 56 species are recommended for agricultural plantation; 139 species provide timbers and of which 58 species recommended; 116 species can be split as good strips for weaving and of which 22 species recommended; 88 species are considered as garden bamboos and of which 34 species recommended; 45 species are able to produce paper pulp and of which 18 species recommended.

Key words: Agriculture, Bamboo, Edible shoot, Timber, Weaving, China

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Historical importance of bamboo

Bamboo is the long-lived, woody-stemmed perennial grass (Liese 1985; McClure 1966). There exist approximately 87 genera and over 1 500 species of bamboo exist (Ohrnberger 1999) in the world, with roughly 100 species comprising those of economical importance (Diver 2001). Bamboo is native to all continents except Europe and Antarctica (McClure 1966; Liese 2001). They are found especially in Asia and South America, primarily in China (39 genera and 500 species; Zhu *et al.* 1994; Keng and Wang 1996), India (18 genera and 128 species; Tewari 1992; Seethalakshmi and Kumar 1998), Southeast Asia (20 genera and 200 species; Dransfield and Widjaja 1995), and Latin America (20 genera and 429 species; Londoño 2001).

Before the advent of industrialization and cash-based transactions, bamboo had played a significant role in the self-sustaining economies in many nations that are now grouped together as developing countries (Quintans 1998). For centuries, bamboos have been closely related to agriculture, cottage industries, arts, culture and day-to-day life of more than half of the world's population (Tewari 1992; Quintans 1998; Liese 2001). In southern Asia, bamboo was named "timber of the poor", an inferior substitute for wood products for poor people with low income and purchase power (Liese 1991, 2001).

China has the richest bamboo diversity in the world in terms of number of species (ca. 500 species) and area of plantation (3.5 million hm², Zhu 1985; Keng and Wang 1996). Bamboo played an indelible role in China's agriculture and traditional cultures for thousands of years (Wu and Ma 1985). Archaeological evidence suggests that some 5 300 years ago, during the New Stone Age, bamboo had already been used to weave mats, baskets and other articles in eastern China (Wu and Ma 1985). Up to 3 500 years ago, bamboo culms were split into slices for recording and writing, and "books" were made by stringing the bamboo slices together (Zhu 1985); since 1 700 years ago, bamboo has been applied for making paper (Xiao *et al.* 1999; Xiao and Yang 2000).

Wen Tian Xiang (1236-1282), a Prime Minister of the Song Dynasty, before he was killed by the Mongol conquerors wrote a poem: "Whoever could be alive without death? But my loyalty will be shining on the bamboo forever". Another famous poet, Su Dongpo (1037-1101), wrote, "Meals can be without meat, but living cannot be without bamboo. The lack of meat makes one thin; the lack of bamboo makes one vulgar." He commented: "There are bamboo houses for living, bamboo hats for shading, bamboo paper for writing, bamboo rafts for carrying, bamboo shoes for wearing, bamboo shoots for eating and bamboo fuel for heating. Indeed, we cannot live without bamboos for a single day."

New challenges to Chinese agriculture

Plantation adjustment

With one-fifth of the world's population and a limited endowment of arable land, China was once suffered with severe shortages of farm product supplies especially the

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grains (Du 2000). In early 1990s, Lester Brown in his book "Who will feed China?" predicted alarmingly high rate of growth in food imports associated with higher rates of Chinese per capita consumption (Brown 1995), debating on whether China has ability to feed itself or not. However, in recent years, the food and agricultural sector in China may see the most dramatic changes and today there is occasionally over-supply of agricultural products including grains. Now China accounting for just 3 % of world agricultural trade, is largely self-sufficient in food production, and is a major exporter of many agricultural items (Fang *et al.* 2002). The challenge of "Who will feed China" is no longer a serious problem, but how to adjust the plantation to meet the market demands is emerging as a new challenge to Chinese agriculture.

WTO impacts

Another challenge is the impacts of accession World Trade Organization (WTO). After 15 years of effort, China has finally become a formal member of WTO on December 10, 2001. Agriculture is the most sensitive issue in the WTO negotiations and caused the most difficult in reaching an agreement, as it has with other WTO member countries. Current prices of grain in Chinese markets are already close to or even exceed world market prices. Now the door is opened and the grain may be consequently much easier for importing. Therefore, cash-oriented plants are needed to create working chances and to increase farmers' incomes and enable the rural people to maintain their survivorship.

Policy changes

In the summer of 1998, the Yangtze River basin of China suffered some of the worst flooding in its history. An estimated 120 million people were driven from their homes by the floodwaters. This flooding - with damages totaling US\$30 billion - came in a year when rainfall, though well above average, was not close to being a record. The fact was that by 1998, the Yangtze River basin had lost fully 85 % of its original forest cover, leaving little to hold the above-normal monsoon rainfall. In August 1999, the State Council of China decided to strengthen the ecological reconstruction efforts at the middle and upper reaches of the Yangtze and Yellow Rivers. Therefore, new policies were proposed to protect the forests in upper stream areas. Accordingly, overall protection is given to the natural and artificial forests in the river reaches starting from the origins of the rivers to the middle and upper reaches of the Yangtze River and the Yellow River as well. Tree felling is completely banned in these areas, while efforts are being made to reforest the barren mountains, and farmlands on mountain slopes (>25°) are being planted with trees or grasses. As a national policy, the farmers in the mountain regions are encouraged to claim compensates from the government when they "return grain to green". But what plants should be planted is still problematic.

Bamboo – Challenge matching

Easing the timber shortage - match the market

Although there is a problem of over-supply of grains in recent years, China has a serious problem of shortage of timber supply. Compared with trees, bamboo is fast growing and gives higher yields. Generally, 3-5 year old bamboo is ready for use, and properly managed bamboo forests will be productive for many years once they are planted. The growth cycle of bamboo is only about 1/3 that of the ordinary fast growing trees, while the yield is twice that of the fast-growing trees (Liese 1985).

Bamboo timber has extensive use in housie-making, truck compartments, formwork, packaging and flooring. It is estimated that the demand for steel-framed bamboo ply boards may reach 40 million m² in the next 10 years (Zhu 2001), but China is presently producing only 15-20 million m² of such boards (Zhu 2001), which can hardly meet the market demand. Bamboo boards are now becoming a kind of high-grade flooring material, as they not only have the texture of marble slabs and the elegance of wood boards but also are hard, durable, smooth, clean, anti-skidding and moisture-resistant. In line with the booming real estate industry in China, the demand for flooring materials has picked up, and bamboo floorboards will find extensive use in this sector.

Enrich the food diversity: match the plantation adjustment

Since ancient times, the Chinese people have favored bamboo shoots, 500 g of which contain about 15 g of protein - twice the concentration in potatoes - and 18 kinds of amino acids. The fiber-rich bamboo shoots are also good for health. Bamboo juice is possibly the best drink among the "green beverages" because it contains several of micronutrients (Wu and Wu 2000). The bamboo mushroom, a by-product of bamboo forests, is acclaimed as the "king of mountain-based foods" for its rich nutrient content and delicious taste. With steadily improving living standards, people are also showing increasing awareness of their health and look for health benefits when selecting food. Therefore, the vigorous development of the food-use bamboo industry is important for optimizing people's diet.

Increasing international trade: match the WTO impacts

Bamboo handicraft items are traditional products of China (Zhu 2001). Bamboo carving, calligraphy and paintings are ideal indoor decorations, and add to the beauty of interior decoration. Bamboo handicrafts are steeped in cultural traditions and may command very high prices. They are important items for earning foreign exchanges and occupy a prime place among tourist-oriented products. With its cylindrical shape and excellent physical qualities, bamboo is the most important material for making musical instruments. The bamboo music has always been an im-

portant component of the Chinese civilization, and bamboo musical instruments play a vital role in people's cultural life (Austin *et al.* 1972).

Bamboo plantation may lead an increase of international trade in agricultural products. In China, in the past two decades bamboo plantation increased by 30 % , while bamboo exports increased 650 % , from US\$ 46.1 million in 1981 to US\$ 300 million in 2000 (Lu 2001). Australia has five native bamboo species, but they do not produce edible shoots. Increasing consumption of bamboo shoots in Australia has created a domestic market to the amount of US\$ 10-20 million, which completely depends on the import of canned products (Midmore 1997, 1998; Barnes *et al.* 1999). This situation is stimulating the establishment of bamboo plantations in Australia to supply fresh shoots to replace imports, and also the development of an export market for fresh shoots to Asian countries during the Northern Hemisphere winter (Midmore 1998; Barnes *et al.* 1999). Both international and domestic demands may lead a high increase of bamboo plantation in the coming years.

Curbing soil erosion and improving the ecological environment: match the policy of "return grain to green"

Soil erosion ranks first among the environmental problems of China. To date, areas associated with soil erosion have added up to 3.67 million km², constituting 38.2 % of the Chinese territory. On average, the areas suffering soil erosion increase each year by 10 000 km². Along the Yangtze River reaches, soil erosion affects 562 000 km², and 2.24 billion tons of soil is washed away each year (Xie 2000). The Yangtze River is now becoming another huge "hanging river" next to the Yellow River. Riverbed of the Jingjiang segment of the Yangtze in Hubei Province is now more than 10 m higher than the ground. This river segment has thus become a great impending peril haunting socio-economic development.

With numerous rhizomes and evergreen leaves, bamboo is a valuable ally in the fight against soil erosion and water loss (Liese 1991, 2001). The root system of bamboo can create an effective mechanism for watershed protection, stitching the soil together along fragile riverbanks, deforested areas, and in places prone to earthquakes and mud slides (Shoch and Stoney 2001). The plant is thus ideal for shelter forests, as each hectare of bamboo forest can retain about 1,000 t of water. In contrast to most trees, the bamboo plant is not killed by proper harvesting so topsoil is held in place.

Recommend of bamboo species for plantation

China has the richest bamboo resource and has long been known as the "Kingdom of Bamboo" (Yi 1997). In the past decades, contrasting to the fact of shrinking in the area of arable land and forestry areas, the areas of bamboo land increased from 3.20 million hm² in the period of

1979-81 to 3.79 million hm² in the period of 1989-93, up by 18.4 %.

Bamboo utilizations are generally classified as primary usages (poles, timbers, shoots and stumps), secondary or semi-processed (splits, sticks, boards) and finished products (handicraft, furniture and ready-to-cook/eat shoots). The first two groups are generally used as raw materials for various industries including housing, fishing, gardening and manufacturing while the last group are channeled directly to the end-users both domestic and export for direct consumption. The purpose of bamboo plantation is to produce raw materials for above usage. Accordingly, we cataloged the bamboo species into 5 groups for its plantation, i.e., (1) bamboo species for edible shoot (vegetable); (2) for timber (for housing, furniture, board, and etc.); (3) for weaving (commercial articles and household appliances); (4) for gardening; and (5) for papermaking.

Bamboo species for edible shoots

The international trade in bamboo shoots from China started in the mid 1980s. It is now worth more than US\$150 million per year (Chen 2003). From 534 bamboo species (varieties) in China, we suggested 153 species as the edible-shoot bamboos by reviewing the compendia such as "Compendium of Chinese bamboo" (Zhu *et al.* 1994), "Flora republicae popularis Sinicae" (Keng and Wang 1996), "Compendium of bamboo species in Sichuan" (Yi 1997), and other documents. According to the quality and market potentials of the shoot of the individual bamboo species, we classified the edible-shoot bamboos into three grades: Grade I (17 species) indicates the bamboo shoots having highest quality and international market demands; Grade II (39 species) indicates the bamboo shoots having high quality and domestic market demands; Grade III (97 species) indicates the bamboo shoots having good quality but mainly be consumed by the local farmers. (see Appendix 1, Fig. 1)

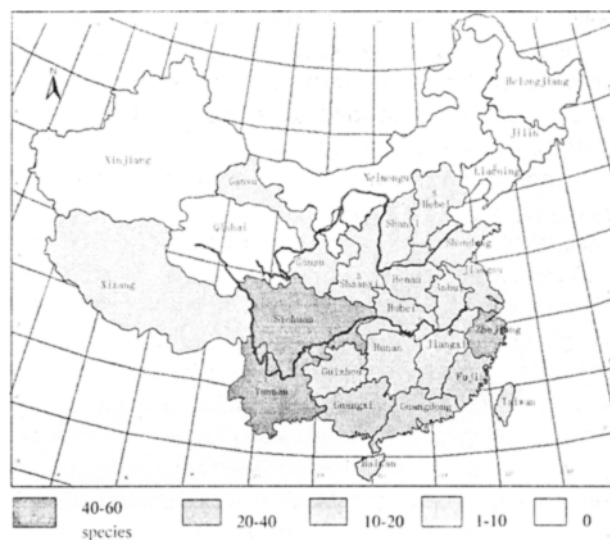


Fig. 1 Species richness of the edible-shoot bamboos in China

Bamboo species for timber

Some bamboo species can attain tree size, as high as 15 meters. The stems (culms) of large bamboo are considered the most useful materials in China. The bamboo timbers are usually used for making house, boat, bridge, furniture, charcoal, board, and other wood-replacing appliances. According to the size and wood quality of the culms, we classified the timber bamboo species into three grades: Grade I (12 species) includes the bamboo species which are taller than 15 m, hold the highest wood quality, and have been widely cultivated; Grade II (46 species) includes the bamboo species which are taller than 10 m, have high wood quality, and are traditionally considered as timber bamboos; Grade III (81 species) indicates the bamboo species being taller than 10 m and having good wood quality but not being used as timber yet (see Appendix 2. Fig. 2).

Bamboo species for weaving

Bamboo skin can be split into very thin, narrow, and long strip, which are ideal for weaving armatures to make a wide variety of articles. Of Chinese bamboos, about 116 species are qualified for splitting and weaving. Based on the strip quality and usage ranges, three grades are recognized as followings: Grade I (9 species) indicates the bamboo strips having top quality and being used for weaving high quality commercial articles; Grade II (13 species) indicates the strips having high quality and being used for weaving marketable articles such as baskets, winnows, rain-hats, trays, mats, and etc.; Grade III (94 species) indicates the strips being good enough for weaving but mainly consumed by the local farmers for their everyday use and agricultural purposes (see Appendix 3, Fig. 3).

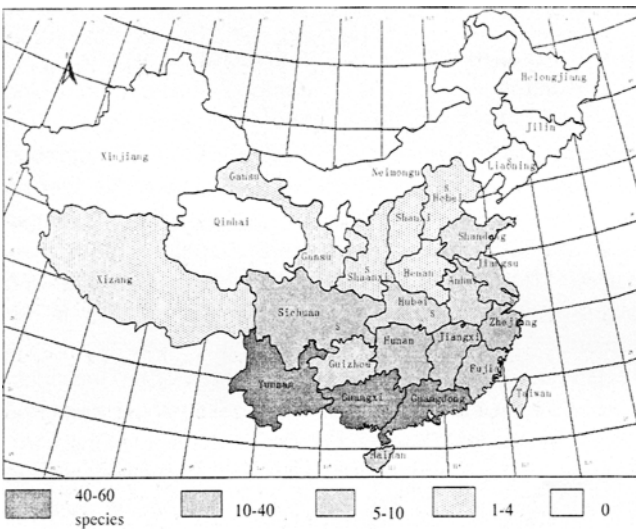


Fig. 2. Species richness of the timber bamboos in China

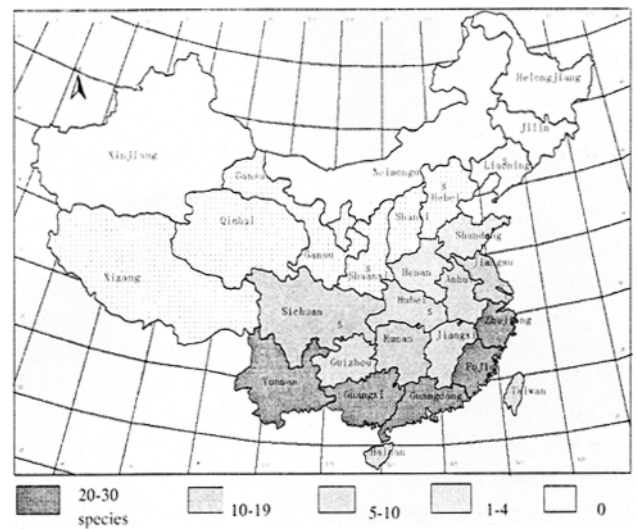


Fig. 3. Species richness of the weaving bamboos in China

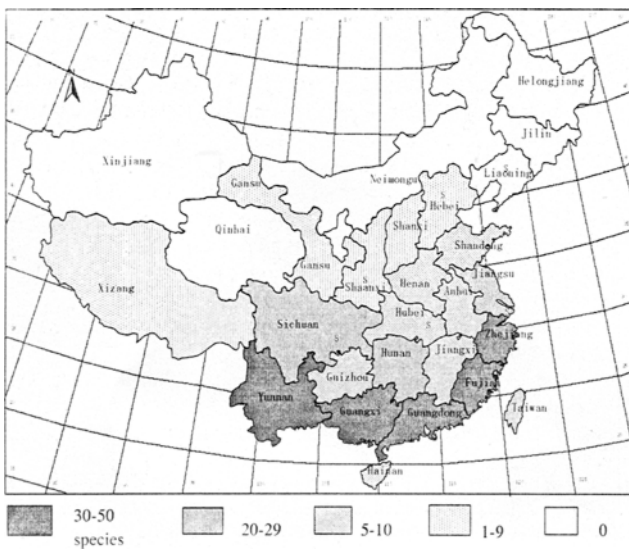


Fig. 4. Species richness of the garden bamboos in China

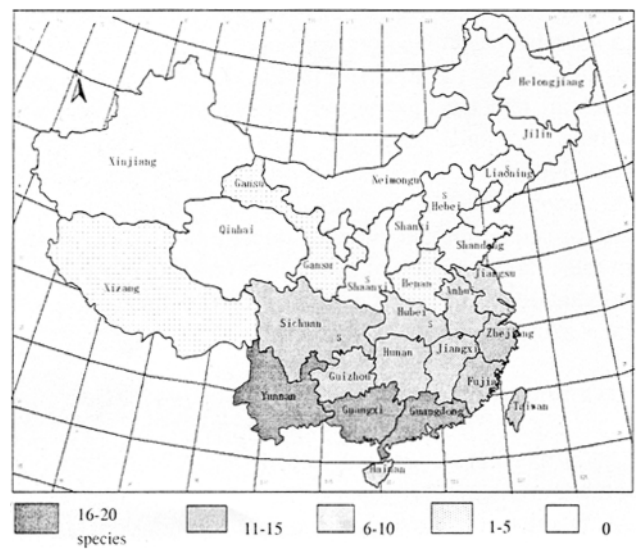


Fig. 5. Species richness the papermaking bamboos in China

Bamboo species for garden

The bamboos have been cultivating as garden plant since the Qin Dynasty (259-210 B.C.) (Wang and Shen 1987). Chinese people enjoy the bamboo not only for its ornamental value, but also for its elegance. Bamboo is one of the four noble plants – the others being orchid, the plum tree, and the chrysanthemum – and again and again through the centuries it forms the subject of the pictures which use its straightness to illustrate a moral: elegance. Therefore bamboos are widely planted as house-round plants for thousands of years in China (Austin *et al.* 1972). Based on the ornamental value and cultivated history in China, we suggested 89 bamboo species (cultivated varieties excluded) for garden uses and classified them into three grades: Grade I (10 species) indicates the bamboos having highest ornamental value and being widely planted in the gardens; Grade II (24 species) indicates the bamboos having high ornamental value and being locally planted; Grade III (54 species) indicates the bamboos having good ornamental value but planted mainly in the rural places (see Appendix 4, Fig. 4).

Bamboo species for paper-making

Bamboo has been made into paper for more than 1700 years in China (Xiao and Yang 2000). Rough bamboo paper has been also made and used in India for many years. More recently paper mills have begun to make laser printer and photocopier standard paper out of bamboo. At present, China produces bamboo pulp about 200,000 tons and imports pulp and paper valued US\$ 5 billion annually. Bamboo plantation is largely need for China's paper manufactures (Chen 2003)

However, the paper making materials must meet a number of criteria, such as a high rate of pulp output, desirable fiber pattern, good fiber length, ideal tenacity, optimum cellulose content, and optimum length-to-width ratio. China holds about 45 bamboo species for pulp making, although it seems that some other species are also qualified for making paper. We roughly classified the species into three grades: Grade I (3 species) includes the bamboo species which have a highest suitability for pulp-making; Grade II (15 species) includes the bamboos which having good quality for pulp-making; Grade III (27 species) includes the bamboos which have acceptable quality and currently are mainly used by the rural paper mills (see Appendix 5, Fig. 5).

Beside the mentioned usages above, bamboo may have more importance application in the future. For instance, bamboo can provide renewable energy. In the past century most of our fuel demands have been met with fossil fuels, including petroleum and natural gas. However, the availability of fossil fuels is not indefinite. Given the large amounts of biomass that bamboo can produce it provides a very interesting source of bioenergy which may partially replace the fuel energy.

Although bamboo has a high potential, there are some scientific barriers which obstruct the bamboo becoming a practicable crop. One problem is that the lifespan of most bamboo species is as long as 30-120 years (Janzen 1976), so the bamboo seeds are rare, resulting in a difficulty in propagation and establishment of bamboo plantations in large scale as an intensive crop. The other is that some bamboo species have a gregarious flowering habit, which threatens the bamboo plantation seriously due to the bamboo groves may die back after such flowering. Therefore, Scientific researches are urgently needed to make a sound understanding of biology and ecology of the bamboo.

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Appendix 1. Species list of the edible-shoot bamboos in China

(Abbreviations: FJ = Fujian, JX = Jiangxi, ZJ = Zhejiang, GX = Guangxi, GD = Guangdong, HN = Hunan, YN = Yunnan, HA = Hainan, SC = Sichuan, GZ = Guizhou, SA = Shaanxi, TB = Xizang, HU = Hubei, TW = Taiwan, GS = Gansu, SD = Shandong, SX = Shanxi, HB = Hebei, AH = Anhui, NX = Ningxia, QH = Qinhai, JS = Jiangsu, HE = Henan, SYR = south of Yellow River, SCR = south of Yangtze River)

| Species | Shoot Grade | Height (M) | Distribution (Province) | Species | Shoot Grade | Height /m | Distribution (Province) |
|---------------------------------------|-------------|------------|-------------------------|--|-------------|-----------|--------------------------------|
| Acidosasa | | | | <i>F. tenuilignea</i> | III | 4-7 | YN |
| <i>A. edulis</i> | I | 8-12 | FJ, JX, ZJ | <i>F. utilis</i> | III | 2-4 | YN |
| <i>A. hirtiflora</i> | II | 2-3 | GX, FJ, HN | <i>F. yulongshaensis</i> | III | 5-7 | YN |
| <i>A. lingchuanensis</i> | III | 2-4 | GX | <i>F. yunnanensis</i> | II | 4-10 | YN |
| Bambusa | | | | Gigantochloa | | | |
| <i>B. gibboides</i> | I | 10-12 | GD, GX, YN | <i>G. albociliata</i> | III | 6-10 | YN |
| <i>B. pallida</i> | III | 6-10 | YN | <i>G. felix</i> | III | 9-13 | YN |
| <i>B. sinospinosa</i> | III | 8-24 | FJ, GD, HA, SC, GZ | <i>G. levis</i> | III | 12-15 | YN, GD |
| Bashania | | | | <i>G. ligulata</i> | II | 10-15 | YN |
| <i>B. fangiana</i> | III | 0.5-1 | SC | Indosasa | | | |
| Chimonobambusa | | | | <i>I. angustata</i> | II | 10-14 | GX |
| <i>C. angustifolia</i> | III | 1-2 | GX, SA, HU, SC | <i>I. glabrata</i> | III | 1-3 | GX |
| <i>C. armata</i> | III | 5-7 | TB, YN | <i>I. ingens</i> | III | 4-6 | YN |
| <i>C. grandifolia</i> | III | 3-4 | YN | <i>I. patens</i> | III | 8-12 | GX |
| <i>C. hejiangensis</i> | III | 1-2 | SC, GZ | Melocalamus | | | |
| <i>C. lactistriata</i> | III | 4-5 | GZ | <i>M. fimbriatus</i> | III | 40(L) | YN |
| <i>C. marmorea</i> | II | 2-3 | GX, GD | Neohouzeaua | | | |
| <i>C. microfloscula</i> | III | 4-5 | YN | <i>N. coradata</i> | III | 13(L) | GD, GX |
| <i>C. neopurpurea</i> | III | 5-8 | SC, SA, HU | Oligostachyum | | | |
| <i>C. pachystachys</i> | III | 3-6 | SC, YN | <i>Q. lubricum</i> | III | 3-5 | ZJ, JX, FJ |
| <i>C. quadrangularis</i> | II | 3-8 | ZJ, JX, FJ, HN, SC, GX | Phyllostachys | | | |
| <i>C. szechuanensis</i> | III | 2-4 | SC | <i>P. acuta</i> | II | 6-9 | ZJ, JS, FJ, AH |
| <i>C. szechuanensis var. flexuosa</i> | III | 2-4 | SC | <i>P. angusta</i> | III | 6-8 | ZJ, FJ, JS, AH, HE |
| <i>C. utilis</i> | III | 6-10 | SC, GZ | <i>P. arcana</i> | III | 5-7 | JS, ZJ, AH, SC, SA, GS |
| <i>C. yunnanensis</i> | III | 6-10 | YN | <i>P. atrovaginata</i> | III | 5-7 | ZJ, JS |
| Chimonocalamus | | | | <i>P. aurea</i> | II | 3-5 | SYR |
| <i>C. delicatus</i> | II | 7-10 | YN | <i>P. aurita</i> | III | 3-6 | HE, ZJ, HU, GX |
| <i>C. dumosus</i> | I | 1.5-3 | YN | <i>P. bambusoides</i> | II | 7-13 | SYR |
| <i>C. dumosus var. pygmaeus</i> | II | 2-3 | YN | <i>P. bambusoides var. castillonis</i> | II | 5-10 | HN, HU, JX, ZJ, AH |
| <i>C. fimbriatus</i> | II | 5-8 | YN | <i>P. bissetii</i> | III | 5-6 | SC, ZJ |
| <i>C. longiligulatus</i> | II | 5-8 | YN | <i>P. concava</i> | III | 5-7 | ZJ, FJ, JS |
| <i>C. longiusculus</i> | II | 3-6 | YN | <i>P. dulcis</i> | I | 6-8 | ZJ, FJ, JS |
| <i>C. makuanensis</i> | II | 3-6 | YN | <i>P. elegans</i> | I | 4-7 | ZJ, FJ, HN, GD |
| <i>C. montanus</i> | II | 3-5 | YN | <i>P. fimbriigula</i> | II | 4-7 | ZJ, JX, HN, JS |
| <i>C. pallens</i> | III | 5-8 | YN | <i>P. flexuosa</i> | I | 4-5 | HE, SA, SX, HB, JS, ZJ |
| <i>C. tortuosus</i> | III | 6-10 | TB | <i>P. glauca</i> | I | 6-14 | JS, HE, ZJ, SD, SX, SA, AH, HU |
| Dendrocalamopsis | | | | <i>P. glauca var. variabilis</i> | III | 6-12 | HE |
| <i>D. beecheyana</i> | II | 8-12 | GX, GD, HA | <i>P. heteroclada</i> | III | 3-6 | HE, SA, SD, SCR |
| <i>D. beecheyana var. pubescens</i> | II | 8-10 | GX, GD | <i>P. heterocyclus</i> | III | 6-15 | SCR |
| <i>D. bicatricata</i> | III | 8-10 | HA, GD, GX, YN | <i>P. incarnata</i> | II | 4-6 | ZJ, FJ |
| <i>D. daii</i> | III | 10-15 | GX, GD | <i>P. iridescens</i> | I | 8-12 | ZJ, JS, AH, HN, HU |
| <i>D. edulis</i> | II | 10-20 | TW | <i>P. kwangsiensis</i> | III | 6-12 | GX, HN, ZJ |

Continue Appendix 1

| Species | Shoot Grade | Height (M) | Distribution (Province) | Species | Shoot Grade | Height /m | Distribution (Province) |
|-------------------------|-------------|------------|--------------------------------|------------------------------|-------------|-----------|------------------------------------|
| <i>D. oldhami</i> | I | 6-9 | ZJ, FJ, TW, GD, GX, HA | <i>P. makinoi</i> | III | 6-10 | TW, FJ |
| <i>D. stenoaurita</i> | I | 10-12 | GD, GX, SC | <i>P. manni</i> | III | 5-8 | SYR, TB |
| <i>D. validus</i> | II | 12-16 | GX, GD | <i>P. meyeri</i> | III | 6-11 | ZJ, AH, HN, FJ, HU |
| <i>D. vario-striata</i> | II | 5-12 | GD, GX, FJ, ZJ | <i>P. nidularia</i> | II | 4-8 | HE, SD, SA, SCR |
| Dendrocalamus | | | | <i>P. nigella</i> | II | 5-8 | ZJ |
| <i>D. asper</i> | I | 10-20 | YN | <i>P. nigra</i> | III | 4-10 | SYR |
| <i>D. brandisii</i> | I | 12-15 | YN, GD | <i>P. nigra var. henonis</i> | III | 3-8 | HE, ZJ, JS, SD, SA, SC, HU, HN |
| <i>D. farinosus</i> | III | 8-12 | GX, YN, GD, SC | <i>P. nuda</i> | I | 5-10 | ZJ, JS, AH, SA, HN, FJ |
| <i>D. fugongensis</i> | III | 15-20 | YN | <i>P. parvifolia</i> | I | 8-12 | ZJ, AH |
| <i>D. giganteus</i> | III | 20-30 | YN, GD, GX, TW | <i>P. platyglossa</i> | II | 6-9 | ZJ, JS |
| <i>D. hamiltonii</i> | II | | | <i>P. praecox</i> | II | 7-11 | JS, ZJ, AH, FJ, HN, JX |
| <i>D. latiflorus</i> | I | 18-25 | GD, GX, YN, GZ, FJ, TW, ZJ, JX | <i>P. prominens</i> | II | 7-11 | ZJ |
| <i>D. membranaceus</i> | III | 10-15 | YN | <i>P. propinqua</i> | III | 6-9 | GX, GZ, HU, JX, FJ, ZJ, JS, HE, AH |
| <i>D. pachystachys</i> | II | 8-12 | YN | <i>P. pubescens</i> | I | 10-20 | SA, SC, HU, SCR |
| <i>D. semiscandens</i> | III | | | <i>P. rigida</i> | III | 4-6 | SC, ZJ |
| <i>D. sikkimensis</i> | II | 15-18 | YN | <i>P. rivalis</i> | III | 3-4 | GD, FJ, ZJ |
| <i>D. tibeticus</i> | III | 18-25 | TB, YN | <i>P. robustiramea</i> | III | 5-7 | ZJ, FJ |
| <i>D. yunnanicus</i> | II | 20-25 | YN, GX | <i>P. rubromarginata</i> | III | 3-6 | ZJ, GX |
| Fargesia | | | | <i>P. rutila</i> | III | 6-10 | ZJ, JS |
| <i>F. angustissima</i> | III | 4-7 | SC | <i>P. sulphurea</i> | III | 6-10 | SCR |
| <i>F. brevissima</i> | III | 3-5 | SC | <i>P. tianmuensis</i> | III | 4-7 | ZJ, AH |
| <i>F. canaliculata</i> | II | 3-5 | SC | <i>P. virella</i> | III | 3-6 | ZJ |
| <i>F. denudata</i> | III | 3-5 | SC | <i>P. viridi-glaucescens</i> | III | 4-9 | JS, ZJ, FJ |
| <i>F. dracocephala</i> | III | 3-5 | SC, GS | <i>P. vivax</i> | II | 6-12 | ZJ, JS, FJ, HE, SD |
| <i>F. edulis</i> | III | 5-8 | YN | <i>P. yunhoensis</i> | II | 4-7 | ZJ |
| <i>F. emaculata</i> | III | 2-4 | SC | Pseudosasa | | | |
| <i>F. ferax</i> | III | 3-5 | SC | <i>P. longiligula</i> | III | 5-8 | GX |
| <i>F. fractiflexa</i> | III | 2-3 | SC, YN | Qiongzhusa | | | |
| <i>F. fungosa</i> | III | 4-6 | YN, SC | <i>Q. communis</i> | III | 3-7 | SC, HU, GZ |
| <i>F. jiulongensis</i> | III | 3-5 | SC | <i>Q. macrophylla</i> | II | 3-6 | SC |
| <i>F. lincangensis</i> | III | 4-8 | YN | <i>Q. rigidula</i> | II | 2-6 | SC |
| <i>F. mairei</i> | III | 3-5 | YN | <i>Q. tumidinoda</i> | I | 4-6 | SC, GZ, YN |
| <i>F. muriei</i> | III | 2-5 | HU | Schizostachyum | | | |
| <i>F. nitida</i> | III | 2-5 | SC, GS, NX, QH | <i>S. annulatum</i> | III | 7-12 | YN |
| <i>F. obliqua</i> | III | 2-4 | SC, GS | Yushania | | | |
| <i>F. orbiculata</i> | III | 4-6 | YN | <i>Y. brevipaniculata</i> | III | 1-2 | SC |
| <i>F. pegyriifera</i> | III | 6-8 | YN | <i>Y. cava</i> | III | 2-3.5 | SC |
| <i>F. pauciflora</i> | III | 4-6 | SC | <i>Y. crassicollis</i> | III | 3-5 | SC, YN |
| <i>F. pleniculmis</i> | III | 4-8 | YN | <i>Y. glauca</i> | III | 3-6 | SC |
| <i>F. porphyrea</i> | III | 3-5 | YN | <i>Y. lineolata</i> | III | 2-4 | SC |
| <i>F. qinlingensis</i> | III | 1-3.5 | SA | <i>Y. mitis</i> | III | 3-4.5 | YN |
| <i>F. robusta</i> | III | 3-5 | SC | <i>Y. oblonga</i> | II | 4-5 | YN |
| <i>F. ruta</i> | III | 2-4 | SC, GS | <i>Y. qiaojiaensis</i> | III | 0.5-0.6 | YN |
| <i>F. scabrida</i> | III | 2-4 | SC, GS | | | | |

Appendix 2. Species list of timber bamboos in China

| Species | Grade | Height /m | Distribution | Species | Grade | Height /m | Distribution |
|---------------------------------------|-------|-----------|------------------------|-------------------------|-------|-----------|--------------------------------|
| Acidosasa | | | | <i>D. fugongensis</i> | II | 15-20 | YN |
| <i>A. chienouensis</i> | III | 5-13 | FJ, HN | <i>D. giganteus</i> | I | 20-30 | YN, GD, GX, TW |
| <i>A. edulis</i> | III | 8-12 | FJ, JX, ZJ | <i>D. jianshuiensis</i> | II | 10-18 | YN |
| <i>A. gigantea</i> | III | 8-17 | ZJ, FJ | <i>D. latiflorus</i> | I | 18-25 | GD, GX, YN, GZ, FJ, TW, ZJ, JX |
| Bambusa | | | | <i>D. liboensis</i> | III | 12-15 | GZ |
| <i>B. albo-lineata</i> | III | 4-10 | GD, FJ | <i>D. membranaceus</i> | II | 10-15 | YN |
| <i>B. angustiaurita</i> | III | 8-10 | GD | <i>D. pachystachys</i> | III | 8-12 | YN |
| <i>B. angustissima</i> | III | 5-9 | GD | <i>D. parishii</i> | III | 6-10 | YN |
| <i>B. arundinacea</i> | I | 10-24 | SCR | <i>D. patellaris</i> | III | 6-10 | YN |
| <i>B. blumeana</i> | II | 8-20 | TW, GD, FJ, HA, YN | <i>D. peculiaris</i> | II | 12-18 | YN |
| <i>B. burmanica</i> | III | 8-15 | YN | <i>D. pulverulentus</i> | III | 8-10 | GD |
| <i>B. chungii</i> | II | 3-10 | FJ, GD, GX, ZJ, SC, HN | <i>D. semiscandens</i> | III | 8-18 | YN |
| <i>B. chunii</i> | III | 10-12 | GD | <i>D. sikkimensis</i> | II | 15-18 | YN |
| <i>B. cornigera</i> | III | 8-10 | GX, GD, ZJ | <i>D. sinicus</i> | I | 20-30 | YN |
| <i>B. dissemulator</i> | III | 10-15 | GD, GX, FJ | <i>D. strictus</i> | II | 5-15 | YN, GD, TW |
| <i>B. dissemulator var. hispida</i> | III | 10-15 | GD, FJ | <i>D. tibeticus</i> | II | 18-25 | TB, YN |
| <i>B. dissimilis</i> | III | 8-13 | GD, GX | <i>D. tomentosus</i> | II | 16-20 | YN |
| <i>B. distegia</i> | III | 6-10 | SC, FJ, GX, YN | <i>D. yunnanicus</i> | I | 20-25 | YN, GX |
| <i>B. dolichoclada</i> | III | 10-20 | FJ, TW, JX, ZJ | Fargesia | | | |
| <i>B. duriuscula</i> | III | 6-12 | HA | <i>F. altior</i> | III | 4-10 | YN |
| <i>B. eutuldooides</i> | III | 6-12 | FJ, GD, GX, YN | Ferocalamus | | | |
| <i>B. eutuldooides basistriata</i> | III | 6-12 | GX, GD | <i>F. strictus</i> | II | 5-10 | YN |
| <i>B. eutuldooides viridi-vittata</i> | III | 6-10 | GD | Gigantochloa | | | |
| <i>B. funghomii</i> | III | 10-15 | GD, GX, FJ | <i>G. albociliata</i> | II | 6-10 | YN |
| <i>B. gibba</i> | III | 8-10 | GX, GD | <i>G. felix</i> | II | 9-13 | YN |

Continue Appendix 2

| Species | Grade | Height /m | Distribution | Species | Grade | Height /m | Distribution |
|---|-------|-----------|--------------------|-----------------------------------|-------|-----------|------------------------------------|
| <i>B. gibboides</i> | III | 10-12 | GD, GX, YN | <i>G. levis</i> | III | 12-15 | YN, GD |
| <i>B. indigena</i> | III | 10-14 | GD | <i>G. ligulata</i> | II | 10-15 | YN |
| <i>B. lapidea</i> | II | 8-10 | GD, GX, SC, YN | <i>G. parviflora</i> | III | 12-14 | YN |
| <i>B. lenta</i> | III | 5-10 | FJ | <i>G. pseudoarundinacea</i> | II | 7-30 | YN, GD |
| <i>B. malingensis</i> | II | 8-10 | HA, GD | <i>G. rostrata</i> | III | 8-12 | YN |
| <i>B. nutans</i> | II | 7-12 | YN | <i>G. scortechinii</i> | III | 7-12 | YN |
| <i>B. pervariabilis</i> | III | 10-15 | GD, GX, FJ | Indosasa | | | |
| <i>B. polymorpha</i> | III | 12-20 | YN | <i>I. patens</i> | III | 8-12 | GX |
| <i>B. prominens</i> | III | 10-15 | SC, GD | <i>I. sinica</i> | III | 6-10 | GX, YN, GZ |
| <i>B. ramispinosa</i> | III | 8-10 | GX, SC | Neosinocalamus | | | |
| <i>B. remotiflora</i> | III | 6-12 | GX, HA | <i>N. affinis</i> | I | 5-10 | GX, HN, HU, YN, SC, SA |
| <i>B. rigida</i> | II | 6-12 | GD, GX, FJ, SC, JX | <i>N. recto-cuneatus</i> | II | 10-14 | GD |
| <i>B. rutila</i> | III | 8-12 | FJ, GD, GX, SC | <i>Oligostachyum</i> | | | |
| <i>B. sinospinosa</i> | I | 8-24 | FJ, GD, HA, SC, GZ | <i>O. spongiosum</i> | III | 7-10 | GX |
| <i>B. subaequalis</i> | III | 8-12 | SC, GD | Phyllostachys | | | |
| <i>B. surrecta</i> | III | 6-10 | GX, GD | <i>P. bambusoides</i> | I | 7-13 | SYR |
| <i>B. textilis</i> | II | 6-10 | GD, GX, FJ, ZJ, JX | <i>P. bambusoides castillonis</i> | III | 5-10 | HN, HU, JX, ZJ, AH |
| <i>B. tulda</i> | III | 10-15 | GD, GX | <i>P. glauca</i> | II | 6-14 | JS, HE, ZJ, SD, SX, SA, AH, HU |
| <i>B. utilis</i> | III | 3-14 | TW | <i>P. glauca var. variabilis</i> | III | 6-12 | HE |
| <i>B. ventricosa</i> | III | 8-10 | GX, FJ, GD | <i>P. guizhouensis</i> | II | 10-16 | GZ |
| <i>B. vulgaris</i> | III | 7-12 | GD, GX, YN | <i>P. heterocyclus</i> | I | 6-15 | SCR |
| <i>B. wenchouensis</i> | II | 10-16 | ZJ, FJ | <i>P. iridescens</i> | I | 8-12 | ZJ, JS, AH, HN, HU |
| <i>B. xiashanensis</i> | III | 12-13 | GD | <i>P. kwangsiensis</i> | II | 6-12 | GX, HN, ZJ |
| Bashania | | | | <i>P. lithophila</i> | III | 3-12 | TW |
| <i>B. fargesii</i> | III | 3-10 | SC, HU, SA, GS | <i>P. makinoi</i> | II | 6-10 | TW, FJ |
| Cephalostachyum | | | | <i>P. manni</i> | II | 5-8 | South of Yellow River, TB |
| <i>C. fuchsianum</i> | III | 10-15 | YN | <i>P. meyeri</i> | II | 6-11 | ZJ, AH, HN, FJ, HU |
| <i>C. pallidum</i> | III | 10-15 | YN | <i>P. nigra</i> | III | 4-10 | SYR |
| <i>C. pergracile</i> | III | 9-12 | YN, GD | <i>P. nigra henonis</i> | II | 3-8 | HE, ZJ, JS, SD, SA, SC, HU, HN |
| <i>C. virgatum</i> | III | 10-15 | YN | <i>P. nuda</i> | II | 5-10 | ZJ, JS, AH, SA, HN, FJ |
| Chimonobabusa | | | | <i>P. parvifolia</i> | III | 8-12 | ZJ, AH |
| <i>C. utilis</i> | III | 6-10 | SC, GZ | <i>P. praecox</i> | III | 7-11 | JS, ZJ, AH, FJ, HN, JX |
| <i>C. yunnanensis</i> | III | 6-10 | YN | <i>P. prominens</i> | II | 7-11 | ZJ |
| <i>C. delicatus</i> | II | 7-10 | YN | <i>P. propinqua</i> | II | 6-9 | GX, GZ, HU, JX, FJ, ZJ, JS, HE, AH |
| <i>C. tortuosus</i> | III | 6-10 | TB | <i>P. pubescens</i> | I | 10-20 | SA, SC, HE, SCR |
| Dendrocalamopsis | | | | <i>P. rutila</i> | III | 6-10 | ZJ, JS |
| <i>D. basihirsuta</i> | III | 7-12 | GD, FJ, GX, JX | <i>P. sulphurea</i> | I | 6-10 | SCR |
| <i>D. beecheyana</i> | II | 8-12 | GX, GD, HA | <i>P. vivax</i> | III | 6-12 | ZJ, JS, FJ, HE, SD |
| <i>D. beecheyana pubescens</i> | III | 8-10 | GX, GD | Pseudosasa | | | |
| <i>D. bicatricata</i> | II | 8-10 | HA, GD, GX, YN | <i>P. amabilis</i> | II | 7-13 | GD, FJ, HN, GX, JX, JS, ZJ |
| <i>D. daii</i> | II | 10-15 | GX, GD | <i>P. amabilis var. convexa</i> | III | 6-12 | FJ |
| <i>D. edulis</i> | III | 10-20 | TW | Pseudostachyum | | | |
| <i>D. stenoaurita</i> | III | 10-12 | GD, GX, SC | <i>P. polymorphum</i> | III | 5-10 | YN, GD, GX |
| <i>D. validus</i> | III | 12-16 | GX, GD | Schizostachyum | | | |
| <i>D. vario-striata</i> | III | 5-12 | GD, GX, FJ, ZJ | <i>S. brachycladum</i> | III | 10-13 | TW |
| Dendrocalamus | | | | <i>S. chinense</i> | III | 5-8 | YN |
| <i>D. asper</i> | II | 10-20 | YN | <i>S. pseudolima</i> | II | 5-10 | HA, GD, GX, YN |
| <i>D. bambusoides</i> | II | 8-12 | YN, GD | Sinobambusa | | | |
| <i>D. barbatus</i> | II | 15-20 | YN | <i>S. dushanensis</i> | III | 6-10 | GZ |
| <i>D. barbatus var. intermediiradicatus</i> | II | 10-18 | YN | <i>S. striata</i> | III | 5-10 | JX |
| <i>D. birmanicus</i> | III | 10-15 | YN | <i>S. tootsik</i> | III | 5-12 | GD, FJ, GX |
| <i>D. brandisii</i> | II | 12-15 | YN, GD | Thyrostachys | | | |
| <i>D. calostachyus</i> | II | 20-25 | YN | <i>T. oliveri</i> | II | 8-12 | YN, GD |
| <i>D. farinosus</i> | III | 8-12 | GX, YN, GD, SC | <i>T. siamensis</i> | II | 7-13 | YN, GD, GX, FJ |

Appendix 3. Species list of the weaving bamboos in China

| Species | Grade | Height /m | Distribution (Province) | Species | Grade | Height /m | Distribution (Province) |
|------------------------|-------|-----------|-------------------------|------------------------|-------|-----------|-------------------------|
| Bambusa | | | | <i>M. scandens</i> | II | 20(L) | HA, YN, GD, GX |
| <i>B. arundinacea</i> | III | 10-24 | SCR | Neohouzeaua | | | |
| <i>B. burmanica</i> | III | 8-15 | YN | <i>N. coradata</i> | III | 13(L) | GD, GX |
| <i>B. cerosissima</i> | III | 3-7 | FJ, HN, GD, GX, YN, JX | Neosinocalamus | | | |
| <i>B. chungii</i> | II | 3-10 | FJ, GD, GX, ZJ, SC, HN | <i>N. affinis</i> | II | 5-10 | GX, HN, HU, YN, SC, SA |
| <i>B. disseminator</i> | II | 10-15 | GD, GX, FJ | Oligostachyum | | | |
| <i>B. distegia</i> | III | 6-10 | SC, FJ, GX, YN | <i>O. sulcatum</i> | III | 6-8 | FJ |
| <i>B. gibba</i> | III | 8-10 | GX, GD | Phyllostachys | | | |
| <i>B. gibboides</i> | III | 10-12 | GD, GX, YN | <i>P. acuta</i> | III | 6-9 | ZJ, JS, FJ, AH |
| <i>B. guangxiensis</i> | III | 2-3 | GX | <i>P. angusta</i> | I | 6-8 | ZJ, FJ, JS, AH, HE |
| <i>B. intermedia</i> | II | 7-12 | YN, SC, GZ | <i>P. atrovaginata</i> | II | 5-7 | ZJ, JS |
| <i>B. lenta</i> | I | 5-10 | FJ | <i>P. aurea</i> | II | 3-5 | SYR |
| <i>B. multiplex</i> | II | 2-8 | SCR | <i>P. bambusoides</i> | I | 7-13 | SYR |
| <i>B. mutabilis</i> | III | 5-7 | HA, GD, GX | <i>P. bissetii</i> | III | 5-6 | SC, ZJ |

Continue Appendix 3

| Species | Grade | Height /m | Distribution (Province) | Species | Grade | Height /m | Distribution (Province) |
|----------------------------------|-------|-----------|-------------------------|----------------------------------|-------|-----------|--------------------------------|
| <i>B. pallida</i> | II | 6-10 | YN | <i>P. concava</i> | III | 5-7 | ZJ, FJ, JS |
| <i>B. papillata</i> | III | 3-6 | GX | <i>P. flexuosa</i> | II | 4-5 | HE, SA, SX, HB, JS, ZJ |
| <i>B. pervariabilis</i> | III | 10-15 | GD, GX, FJ | <i>P. glauca</i> | I | 6-14 | JS, HE, ZJ, SD, SX, SA, AH, HU |
| <i>B. polymorpha</i> | III | 12-20 | YN | <i>P. glauca var. variabilis</i> | II | 6-12 | HE |
| <i>B. remotiflora</i> | III | 6-12 | GX, HA | <i>P. guizhouensis</i> | III | 10-16 | GZ |
| <i>B. surrecta</i> | II | 6-10 | GX, GD | <i>P. heteroclada</i> | I | 3-6 | HE, SA, SD, SCR |
| <i>B. textilis</i> | I | 6-10 | GD, GX, FJ, ZJ, JX | <i>P. heterocycla</i> | III | 6-15 | SCR |
| <i>B. textilis var. glabra</i> | II | 6-8 | GD, GX | <i>P. incarnata</i> | III | 4-6 | ZJ, FJ |
| <i>B. textilis var. gracilis</i> | III | 3-5 | GD, GX | <i>P. iridescens</i> | III | 8-12 | ZJ, JS, AH, HN, HU |
| <i>B. tuldooides</i> | III | 6-8 | GD, GX, YN, FJ | <i>P. kwangsiensis</i> | II | 6-12 | GX, HN, ZJ |
| <i>B. wenchouensis</i> | III | 10-16 | ZJ, FJ | <i>P. lithophila</i> | II | 3-12 | TW |
| Cephalostachyum | | | | <i>P. mannii</i> | I | 5-8 | SYR, TB |
| <i>C. fuchsianum</i> | III | 10-15 | YN | <i>P. meyeri</i> | II | 6-11 | ZJ, AH, HN, FJ, HU |
| <i>C. pallidum</i> | III | 10-15 | YN | <i>P. nidularia</i> | III | 4-8 | HE, SD, SA, SCR |
| Chimonocalamus | | | | <i>P. nigella</i> | III | 5-8 | ZJ |
| <i>C. delicatus</i> | III | 7-10 | YN | <i>P. nigra</i> | III | 4-10 | SYR |
| Dendrocalamopsis | | | | <i>P. nigra var. henonis</i> | II | 3-8 | HE, ZJ, JS, SD, SA, SC, HU, HN |
| <i>D. oldhami</i> | III | 6-9 | ZJ, FJ, TW, GD, GX, HA | <i>P. nuda</i> | II | 5-10 | ZJ, JS, AH, SA, HN, FJ |
| Dendrocalamus | | | | <i>P. parvifolia</i> | III | 8-12 | ZJ, AH |
| <i>D. farinosus</i> | III | 8-12 | GX, YN, GD, SC | <i>P. platyglossa</i> | III | 6-9 | ZJ, JS |
| <i>D. minor</i> | III | 6-8 | GD, GX, GZ, YN, ZJ | <i>P. praecox</i> | II | 7-11 | JS, ZJ, AH, FJ, HN, JX |
| <i>D. patellaris</i> | III | 6-10 | YN | <i>P. pubescens</i> | III | 10-20 | SA, SC, HE, SCR |
| <i>D. pulverulentus</i> | III | 8-10 | GD | <i>P. rigida</i> | III | 4-6 | SC, ZJ |
| Drepanostachyum | | | | <i>P. robustiramea</i> | III | 5-7 | ZJ, FJ |
| <i>D. microphyllum</i> | III | 2-6 | SC, YN | <i>P. rubromarginata</i> | I | 3-6 | ZJ, GX |
| <i>D. saxatile</i> | III | 3-6 | SC, YN | <i>P. rutila</i> | III | 6-10 | ZJ, JS |
| Fargesia | | | | <i>P. sulphurea</i> | III | 6-10 | SCR |
| <i>F. acuticontracta</i> | III | 3-7 | YN | <i>P. vivax</i> | III | 6-12 | ZJ, JS, FJ, HE, SD |
| <i>F. altior</i> | III | 4-10 | YN | <i>P. yunhoensis</i> | III | 4-7 | ZJ |
| <i>F. angustissima</i> | III | 4-7 | SC | Pseudostachyum | | | |
| <i>F. collaris</i> | III | 2-6 | TB | <i>P. polymorphum</i> | I | 5-10 | YN, GD, GX |
| <i>F. communis</i> | III | 4-8 | YN | Qiongzhueta | | | |
| <i>F. edulis</i> | III | 5-8 | YN | <i>Q. communis</i> | II | 3-7 | SC, HU, GZ |
| <i>F. fungosa</i> | III | 4-6 | YN, SC | <i>Q. puberula</i> | III | 4-5 | GZ |
| <i>F. gongshanensis</i> | III | 3-4 | YN | <i>Q. rigidula</i> | III | 2-6 | SC |
| <i>F. hygrophila</i> | III | 3-5 | YN | Schizostachyum | | | |
| <i>F. jiuolongensis</i> | III | 3-5 | SC | <i>S. annulatum</i> | II | 7-12 | YN |
| <i>F. lincangensis</i> | III | 4-8 | YN | <i>S. chinense</i> | III | 5-8 | YN |
| <i>F. mairei</i> | III | 3-5 | YN | <i>S. funghomii</i> | III | 7-12 | GD, GX, YN |
| <i>F. mali</i> | III | 3-6 | SC | <i>S. hainanense</i> | III | 20(L) | HA |
| <i>F. subflexuosa</i> | III | 3-6 | YN | <i>S. pseudolima</i> | III | 5-10 | HA, GD, GX, YN |
| <i>F. tenuilignea</i> | III | 4-7 | YN | Sinobambusa | | | |
| <i>F. wuliangshanensis</i> | III | 3-7 | YN | <i>S. seminuda</i> | III | 2-4 | FJ, YN |
| <i>F. yulongshaensis</i> | III | 5-7 | YN | <i>S. striata</i> | III | 5-10 | JX |
| Gigantochloa | | | | <i>S. tootsik</i> | III | 5-12 | GD, FJ, GX |
| <i>G. albociliata</i> | III | 6-10 | YN | <i>Yushania</i> | | | |
| <i>G. felix</i> | III | 9-13 | YN | <i>Y. flexa</i> | III | 1-3 | SC |
| <i>G. levis</i> | III | 12-15 | YN, GD | <i>Y. levigata</i> | III | 2-4.5 | YN |
| <i>G. ligulata</i> | II | 10-15 | YN | <i>Y. mitis</i> | III | 3-4.5 | YN |
| Indosasa | | | | <i>Y. oblonga</i> | III | 4-5 | YN |
| <i>I. spongiosa</i> | III | 5-8 | HN | <i>Y. qiaojaensis</i> | III | 0.5-0.6 | YN |
| Melococalamus | | | | <i>Y. straminea</i> | III | 2-4 | YN |
| <i>M. arrectus</i> | III | 10-15 | YN | <i>Y. vigena</i> | III | 3-6 | YN |
| <i>M. elevatissimus</i> | II | 20(L) | TB | | | | |

Appendix 4. Species list of the garden bamboos in China

| Species | Grade | Height /m | Distribution (Province) | Species | Grade | Height /m | Distribution (Province) |
|-----------------------------------|-------|-----------|-------------------------|--|-------|-----------|--------------------------------|
| Acidosasa | | | | Neosinocalamus | | | |
| <i>A. gigantea</i> | II | 8-17 | ZJ, FJ | <i>N. affinis</i> | I | 5-10 | GX, HN, HU, YN, SC, SA |
| <i>A. venusta</i> | III | 1-1.5 | GD | <i>N. recto-cuneatus</i> | III | 10-14 | GD |
| Ampelocalamus | | | | Oligostachyum | | | |
| <i>A. actinotrichus</i> | III | 1-1.5 | HN | <i>O. oedogonatum</i> | II | 3-5 | FJ, JX, ZJ |
| Bambusa | | | | <i>O. shiuyingianum</i> | III | 4-6 | GD |
| <i>B. albo-lineata</i> | II | 4-10 | GD, FJ | Phyllostachys | | | |
| <i>B. aurinuda</i> | | 2-4 | HA | <i>P. arcana</i> | III | 5-7 | JS, ZJ, AH, SC, SA, GS |
| <i>B. chungii</i> | I | 3-10 | GD, FJ, GX, ZJ, SC, HN | <i>P. aurea</i> | I | 3-5 | SYR |
| <i>B. disseminator</i> | III | 10-15 | GD, GX, FJ | <i>P. aureosulcata</i> | II | 4-6 | HB, ZJ |
| <i>B. flexuosa</i> | III | 6-7 | GD | <i>P. bambusoides var. castillonis</i> | II | 5-10 | HN, HU, JX, ZJ, AH |
| <i>B. gibba</i> | III | 8-10 | GX, GD | <i>P. heteroclada</i> | III | 3-6 | HE, SA, SD, SCR |
| <i>B. indigena</i> | III | 10-14 | GD | <i>P. heterocycla</i> | I | 6-15 | SCR |
| <i>B. macrotis</i> | III | 6-7 | GD | <i>P. incarnata</i> | III | 4-6 | ZJ, FJ |
| <i>B. multiplex</i> | II | 2-8 | SCR | <i>P. nidularia</i> | III | 4-8 | HE, SD, SA, SCR |
| <i>B. multiplex incana</i> | III | 2-6 | JX, HN | <i>P. nigra</i> | I | 4-10 | SYR |
| <i>B. multiplex var. shimadai</i> | III | 1-3 | GD, GX, FJ, HN, JX | <i>P. nigra var. henonis</i> | III | 3-8 | HE, ZJ, JS, SD, SA, SC, HU, HN |

Continue Appendix 4

| Species | Grade | Height /m | Distribution (Province) | Species | Grade | Height /m | Distribution (Province) |
|--|-------|-----------|--------------------------------|--|-------|-----------|---------------------------------|
| <i>B. sinospinosa</i> | III | 8-24 | FJ, GD, HA, SC, GZ | <i>P. platyglossa</i> | III | 6-9 | ZJ, JS |
| <i>B. ventricosa</i> | I | 8-10 | GX, FJ, GD | <i>P. prominens</i> | III | 7-11 | ZJ |
| Chimonobambusa | | | | Pleioblastus | | | |
| <i>C. grandifolia</i> | II | 3-4 | YN | <i>P. amarus</i> | III | 3-5 | YN, GZ, SCR |
| <i>C. microfloscula</i> | III | 4-5 | YN | <i>P. chino</i> | II | 3-4 | ZJ, FJ |
| <i>C. quadrangularis</i> | I | 3-8 | ZJ, JX, FJ, HN, SC, GX | <i>P. gramineus</i> | I | 3-4 | GD, FJ, JS, ZJ |
| <i>C. szechuanensis</i> | III | 2-4 | SC | <i>P. linearis</i> | III | 3-4 | TW |
| <i>C. szechuanensis</i> var. <i>flexuosa</i> | II | 2-4 | SC | <i>P. longifimbriatus</i> | III | 3-4 | GD |
| Dendrocalamus | | | | <i>P. maculatus</i> | II | 3-4 | GX, SC, YN, HN, JX, FJ, ZJ, JS, |
| <i>D. asper</i> | III | 10-20 | YN | Pseudosasa | | | |
| <i>D. barbatus</i> | II | 15-20 | YN | <i>P. amabilis</i> | III | 7-13 | GD, FJ, HN, GX, JX, JS, ZJ |
| <i>D. farinosus</i> | III | 8-12 | GX, YN, GD, SC | Qiongzhusa | | | |
| <i>D. giganteus</i> | III | 20-30 | YN, GD, GX, TW | <i>Q. macrophylla</i> | III | 3-6 | SC |
| <i>D. latiflorus</i> | III | 18-25 | GD, GX, YN, GZ, FJ, TW, ZJ, JX | <i>Q. tumidinoda</i> | I | 4-6 | SC, GZ, YN |
| <i>D. membranaceus</i> | III | 10-15 | YN | Sasa | | | |
| <i>D. minor</i> | III | 6-8 | GD, GX, GZ, YN, ZJ | <i>S. argentea striatus</i> | III | 0.3-0.5 | ZJ, JS |
| <i>D. minor amoenus</i> | II | 6-8 | GD, GX | <i>S. auricoma</i> | III | 0.2-0.8 | ZJ, JS |
| <i>D. peculiaris</i> | II | 12-18 | YN | <i>S. pygmaea disticha</i> | II | 0.2-0.4 | JS, ZJ |
| Fargesia | | | | Schizostachyum | | | |
| <i>F. demissa</i> | II | 1-1.5 | GS, QH, NX | <i>S. annulatum</i> | III | 7-12 | YN |
| <i>F. muriei</i> | III | 2-5 | HU | <i>S. dumetorum</i> | III | 4-5 | GD, GX |
| <i>F. nitida</i> | III | 2-5 | SC, GS, NX, QH | Shibataea | | | |
| <i>F. robusta</i> | III | 3-5 | SC | <i>S. chiangshanensis</i> | III | 0.3-0.5 | ZJ |
| Gelidocalamus | | | | <i>S. chinensis</i> | II | 0.6-1 | ZJ, JS, JX, FJ, AH |
| <i>G. stellatus</i> | III | 1-2 | JX | <i>S. chinensis</i> var. <i>gracilis</i> | II | 0.5-1 | JS, ZJ |
| Gigantochloa | | | | <i>S. hispida</i> | III | 0.6-1 | AH |
| <i>G. parviflora</i> | III | 12-14 | YN | <i>S. kumasasa</i> | III | 1-2 | TW, FJ |
| <i>G. rostrata</i> | II | 8-12 | YN | <i>S. lanceifolia</i> | II | 0.4-1 | ZJ, FJ |
| Indocalamus | | | | <i>S. nanpingensis</i> | III | 1-1.7 | FJ |
| <i>I. barbatus</i> | III | 1-1.5 | GX | <i>S. nanpingensis</i> var. <i>fujianica</i> | III | 0.3-1 | FJ |
| <i>I. herklotsii</i> | II | 1-2 | GD, GX, HN, ZJ, JX | <i>S. strigosa</i> | III | 0.3-0.5 | ZJ |
| Indosasa | | | | Sinobambusa | | | |
| <i>I. glabrata</i> | III | 1-3 | GX | <i>s. tootsik</i> | II | 5-12 | GD, FJ, GX |
| <i>I. glabrata</i> var. <i>albo-hispida</i> | III | 2-4 | GX | <i>S. tootsik</i> var. <i>dentata</i> | III | 3-8 | FJ |
| <i>I. ingens</i> | III | 4-6 | YN | <i>S. tootsik</i> var. <i>tenuifolia</i> | III | 3-6 | GX |
| <i>I. shibataeoides</i> | I | 1-2 | GD, ZJ | Thyrosostachys | | | |
| <i>I. spongiosa</i> | III | 5-8 | HN | <i>T. oliveri</i> | II | 8-12 | YN, GD |
| Monstruocalamus | | | | <i>T. siamensis</i> | II | 7-13 | YN, GD, GX, FJ |
| <i>M. sixhuanensis</i> | II | 2-5 | SC | | | | |

Appendix 5. Species list of the papermaking bamboos in China

| Species | Grade | Height (m) | Distribution (Province) | Species | Grade | Height (m) | Distribution (Province) |
|--|-------|------------|-------------------------|---|-------|------------|-------------------------|
| Bambusa | | | | Gigantochloa | | | |
| <i>B. arundinacea</i> | I | 10-24 | SCR | <i>G. rostrata</i> | III | 8-12 | YN |
| <i>B. chungii</i> | II | 3-10 | FJ, GD, GX, ZJ, SC, HN | Indosasa | | | |
| <i>B. distegia</i> | III | 6-10 | SC, FJ, GX, YN | <i>I. glabrata</i> | III | 1-3 | GX |
| <i>B. multiplex</i> | II | 2-8 | SCR | <i>I. glabrata</i> var. <i>albo-hispida</i> | III | 2-4 | GX |
| <i>B. multiplex</i> var. <i>incana</i> | III | 2-6 | JX, HN | Melocanna | | | |
| <i>B. multiplex</i> var. <i>shimadai</i> | III | 1-3 | GD, GX, FJ, HN, JX | <i>M. baccifera</i> | II | 8-12 | GD, GX |
| <i>B. papillata</i> | II | 3-6 | GX | Monocladus | | | |
| <i>B. rigida</i> | II | 6-12 | GD, GX, FJ, SC, JX | <i>M. amplexicaulis</i> | II | 2-5 | GX |
| <i>B. textilis</i> | II | 6-10 | GD, GX, FJ, ZJ, JX | <i>M. levigatus</i> | II | 1-5 | HA |
| <i>B. textilis</i> var. <i>glabra</i> | III | 6-8 | GD, GX | <i>M. saxtilis</i> | II | 1-4 | GD, GX |
| <i>B. textilis gracilis</i> | III | 3-5 | GD, GX | <i>M. saxtilis</i> var. <i>solidus</i> | II | 1-3 | GX |
| Bashania | | | | Neosinocalamus | | | |
| <i>B. fargesii</i> | II | 3-10 | SC, HU, SA, GS | <i>N. affinis</i> | II | 5-10 | GX, HN, HU, YN, SC, SA |
| <i>C. neopurpurea</i> | III | 5-8 | SC, SA, HU | Phyllostachys | | | |
| <i>C. szechuanensis</i> | III | 2-4 | SC | <i>P. makinoi</i> | II | 6-10 | TW, FJ |
| Dendrocalamopsis | | | | <i>P. mannii</i> | III | 5-8 | SYR, TB |
| <i>D. daii</i> | III | 10-15 | GX, GD | <i>P. meyeri</i> | III | 6-11 | ZJ, AH, HN, FJ, HU |
| <i>D. edulis</i> | III | 10-20 | TW | <i>P. pubescens</i> | I | 10-20 | SA, SC, HE, SCR |
| <i>D. oldhami</i> | II | 6-9 | ZJ, FJ, TW, GD, GX, HA | Qiongzhusa | | | |
| Dendrocalamus | | | | <i>Q. communis</i> | III | 3-7 | SC, HU, GZ |
| <i>D. calostachyus</i> | III | 20-25 | YN | <i>Q. puberula</i> | III | 4-5 | GZ |
| <i>D. strictus</i> | I | 5-15 | YN, GD, TW | <i>Q. rigidula</i> | III | 2-6 | SC |
| Drepanostachyum | | | | Schizostachyum | | | |
| <i>D. microphyllum</i> | III | 2-6 | SC, YN | <i>S. funghornii</i> | III | 7-12 | GD, GX, YN |
| <i>D. saxatile</i> | III | 3-6 | SC, YN | <i>S. pseudolima</i> | II | 5-10 | HA, GD, GX, YN |
| Fargesia | | | | Thyrosostachys | | | |
| <i>F. concinna</i> | III | 4-6 | YN | <i>T. siamensis</i> | III | 7-13 | YN, GD, GX, FJ |
| <i>F. edulis</i> | III | 5-8 | YN | Yushania | | | |
| <i>F. pagyriifera</i> | III | 6-8 | YN | <i>Y. levigata</i> | III | 2-4.5 | YN |
| <i>F. tenuilignea</i> | III | 4-7 | YN | | | | |