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Source: Mountain Research and Development, 24(2) : 157-165

Published By: International Mountain Society

URL: https://doi.org/10.1659/0276-4741(2004)024[0157:BDATUI]2.0.CO;2

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Mountain Research and Development Vol 24 No 2 May 2004: 157–165

Yang Yuming, Wang Kanglin, Pei Shengji, and Hao Jiming

Bamboo Diversity and Traditional Uses in Yunnan, China

Bamboo is a giant grass that takes on tree-like functions in forest ecosystems. Around 75 genera and 1250 species of bamboo are known to exist throughout the world. Five hundred species in 40 genera are recorded in China, mostly in the monsoon areas of south and southwest China. Of these, 250 species in 29 genera grow naturally in the mountainous province of Yunnan, in the Chinese Himalayan region. Bamboo has a long history of being used for multiple purposes by various mountain communities in China. Among others, bamboo has served—and still serves—as construction material, fiber, food, material for agricultural tools, utensils, and music instruments, as well as ornamental plants. Yunnan as a landlocked mountain province in southwest China holds a great number of species in its natural bamboo forests. This article presents the diversity of bamboo species and of their utilization in Yunnan Province, China.

Keywords: *Bamboo; species diversity; ethnobotany; traditional resource uses; forest conservation; Yunnan.*

Peer reviewed: *August 2003* ***Accepted:*** *October 2003*

Introduction

In terms of taxonomy, bamboo is considered a giant grass. Ecologically, bamboo plants have tree-like functions in forest ecosystems. Bamboo has traditionally been used for multiple purposes by various mountain societies in the warmer regions of China and other Asian countries. The importance of bamboo in mountain ecosystems and mountain societies is reflected in the diversity of the species and their utilization. Bamboo has thus been—and will continue to be—an important factor in mountain development in these regions.

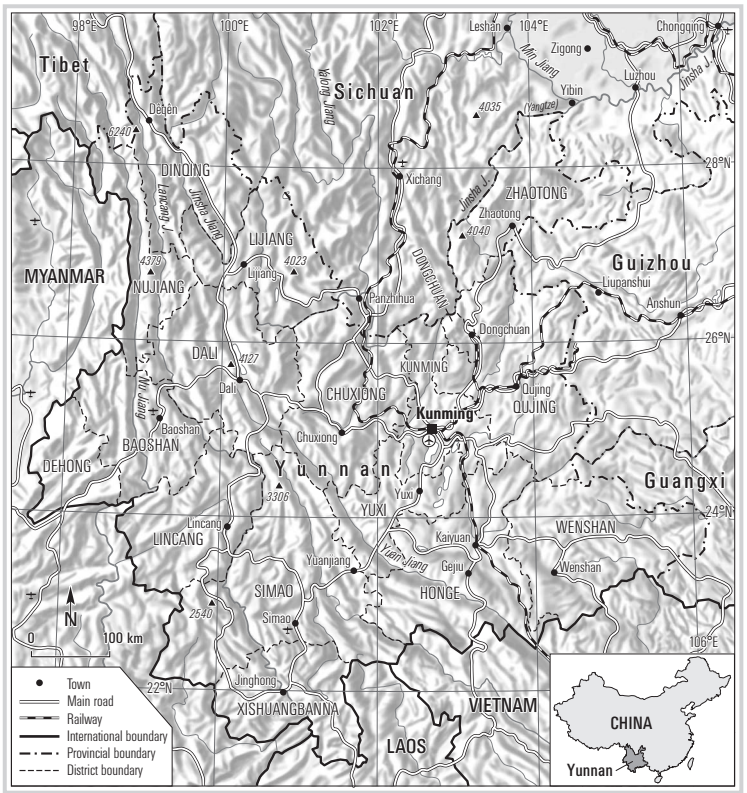
Various advantages such as a short rotation period, powerful regeneration ability, and good properties for wide use, similar or even superior to those of wood, make bamboo a suitable substitute for wood. The potential for saving wood through proper utilization of bamboo resources in the tropical and subtropical areas of China is remarkable. Bamboo is also significant with regard to combating degradation of mountain environments, ecosystems, and natural resources.

The inland mountain province of Yunnan is known as the region with the greatest number of bamboo species and the most abundant natural bamboo forests in the world. This article reports on the diversity of bamboo species and their utilization in this province, and evokes the interrelations between bamboo utilization and rural development, as well as strategic approaches towards sustainable use of bamboo and conservation of mountain ecosystems in Yunnan. The authors hope that the research presented here will contribute to poverty alleviation and mountain development, to ecological rehabilitation and conservation, and more specifically, to the development of social forestry.

Description of the area

The province of Yunnan is situated in southwest China. It covers an area of 394,000 km^2. It neighbors Guizhou and Guangxi provinces in the east, Sichuan province in the north, and Tibet in the northwest, and has state borders with Myanmar in the west and southwest, as well as Laos and Vietnam in the south (Figure 1). Yunnan is a transition area between south China and the eastern Himalayas. In Yunnan, 3 major Asian climate zones come together: the tropical monsoon zone of South Asia, the subtropical monsoon zone of East Asia, and the Qinghai–Tibetan Plateau zone. This accounts for Yun-

FIGURE 1 Map of Yunnan Province. (Map by Andreas Brodbeck)



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FIGURE 2 Dai food-basket weaver in Southeast Yunnan. The material used for such baskets, sold on the local market for approximately US$ 0.50, is *Dendrocalamus brandisii* or *D. membranaceus*, with rattan cane or plastic for decoration. *D. barbatus* and *D. giganteus* were used to build the house, and *D. membranaceus* for the terrace flooring. (Photo by Wang Kanglin)





FIGURE 3 Dai women cooking rice in *Cephalostachyum pergracile* containers. (Photo by Wang Kanglin)

nan's varied environments, which provide excellent growing conditions for bamboo. There are about 75 genera and 1250 bamboo species in the world. Of the nearly 500 species in 40 genera present in China, mostly in the monsoon areas south of the Changjiang River, over 250 bamboo species in 29 genera occur naturally in Yunnan.

Yunnan is inhabited by 26 different ethnic groups. One third of the total population of 42 million live in mountain areas and have preserved their traditional lifestyle and subsistence economy up to the present day. Their livelihoods largely rely on forest products and other plant resources. Mountain societies have rich traditional knowledge of the use and management of bamboo resources; this is put to practice by rural farmers in their day-to-day life to secure survival and development.

Methods

Data collection and review of literature

A considerable amount of information presented here is based on field investigations undertaken by the authors of this paper. Results were partly published by several authors (Xue et al 1995; Geng and Wang 1996; Wang 1999; Wang 2000; Wang et al 1993; Wang et al 2000; Yang et al 2000; Ma and Zhang 2002) to enrich and support the objectives of conservation and sustainable utilization of species, as well as preservation of traditional uses in Yunnan province.

Interviews with local inhabitants

Interviews with local inhabitants provided an important source of information on distribution, habitat, ecological conditions, and regeneration of bamboo, as well as on indigenous knowledge systems concerning classification, utilization, management, and conservation of bamboo. Interviews with local inhabitants were conducted in 3 phases:

Phase 1: Collection of information on bamboo from local villages, to obtain general information on species that are being used and on the various uses. Personal interviews and questionnaires were employed.

Phase 2: In order to identify the key species of bamboo used in local communities and to assess their potential for cultivation and development, the second phase consisted in selecting information at individual level in the case study area.

Phase 3: Semi-structured interviews and group interviews were conducted to cross-check data and information obtained during phases 1 and 2.

Field survey and specimen collection

A field survey was carried out based on the information obtained from the interviews. Information on habitat, rhizome types, culm characteristics, culm sheaths, leaves, and inflorescence was recorded. This investigation also included accurate and detailed information on local names and their meaning, characteristics used to recognize species, distribution, special utilization, and conservation practices. Furthermore, the study involved the collection of more than 500 specimens of bamboo

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species that were either new to the study area, or could not be identified on site during the field investigations, due to their being rare or otherwise unknown.

Herbarium identification and inventory

Herbarium material of bamboo species related to the specimens collected was examined at botanical institutions, among others at the Forestry Colleges in Kunming and Xishuangbanna. The collected specimens were thus identified based on folk classification and scientific taxonomic knowledge. An inventory including scientific and vernacular names, uses, distribution, and specimen number was established based on the study of plant systematics and ethnobotany. All specimens are currently stored in the herbaria of the Kunming Institute of Botany, the Southwest Forestry College, and the Xishuangbanna Tropical Botanical Garden.

Results and discussion

Inventory of bamboo species diversity in Yunnan

Over 250 bamboo species belonging to 29 genera are found in Yunnan. In southern Yunnan, bamboo flora includes Indo-Malayan genera, such as *Dendrocalamus*, *Cephalostachyum*, *Melocalamus*, *Gigantochloa*, *Thyrsostachys*, *Pseudostachyum*, which are major Southeast Asian elements. In eastern Yunnan, southern Chinese genera such as *Indosasa*, *Schizostachyum*, *Sinobambusa* and *Bambusa* are intermingled with local ones. Both sympodial and monopodial species, including *Phyllostachys* and *Neosinocalamus*, are widely distributed in central Yunnan. The subalpine area in northwestern Yunnan is a center of diversity and development of alpine bamboo species including *Fargesia*, *Yushania*, and *Gaoligongshania*. Eight genera found in Yunnan (*Ampelocalamus, Bashania, Drepanostachyum*, *Ferrocalamus, Gaoligongshania*, *Neomicrocalamus, Neosinocalamus,* and *Qiongzhuea*) are endemic to China (in the case of *Drepanostachyum*, endemicity extends to Nepal and Bhutan). *Ferrocalamus* and *Gaoligongshania* are found in Yunnan only, and nearly 100 species altogether are endemic to Yunnan (Table 1).

Bamboo forests

Yunnan hosts not only a great diversity of bamboo species, but is also rich in various types of bamboo forests. There are natural bamboo forests, mixed forests of bamboos and trees, and bamboo plantations. Altogether, more than 30 types of bamboo forests are found throughout the province, especially in southern Yunnan. Forest types include tropical, cold temperate, sympodial, monopodial, mixed, scansorid, and other types of bamboo forests with various ecotypes. Bamboo forests cover a total area of 331,000 ha (Table 2). Total green culm stockings amount to 18,000,000 t, the annual culm output reaches 5,000,000 t, and annual bamboo shoot outputs of these bamboo forests total over 100,000 t.



FIGURE 4 Bamboo pavilion in a Kunming garden. This ornamental house is in the Han architectural style. Material used: *Dendrocalamus giganteus* and *D. sinicus* for support structures; *D. membranaceus*, *D. barbatus*, *Bambusa sinospinosa* and *B. lapidea* (durable and smooth culms) for walls and roof; *Chimonobambusa quadrangularis*, *Thyrsostachys siamensis* and *Gigantochloa nigrociliata* (small diameter, thick-walled and more durable culms) for rafters. (Photo by Wang Kanglin)

Yunnan's natural bamboo forests account for 90.3% of the total area in Yunnan covered by bamboo forests

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TABLE 1 Distribution of bamboo genera found in Yunnan, with reference to their distribution in the world and China; percentage of endemicity of genera in the province; and main uses. (Sources: Xue et al 1995; Geng and Wang 1996; Wang 2000; Ma and Zhang 2002)

Genus	Number of species[a)]			Endemicity[b)] (%)	In the world	In China[c)]	In Yunnan[d)]	Uses[e)]
	W	C	Y					
Acidosasa	6	5	1	20%	China, Vietnam	GZ, YN	Subtrop. area	B, W, S
Ampelocalamus	3	3	1	33%	China	GZ, YN	Subtrop. area	B, W, S
Bambusa	70	64	28	44%	Asia, Africa, Oceania	S & W of China	Trop. to subtrop. area	B, W, S
Bashania	4	4	2	50%	China	YN, SC, HB, SX	KM	B, O
Cephalostachyum	20	5	5	100%	China, India, Myanmar, Philippines, Malaysia	YN	BN, DH, BS, LC	W, F, O, S
Chimonobambusa	20	20	8	40%	China, Japan, SE Asia	SE, E, S & W of China	NJ, BS, ZT, QJ, HH, WS, BN, DH	W, S, O, F
Chimonocalamus	10	9	8	89%	China, India, Myanmar	YN, XZ	WS, HH, BN, LC, DH, BS	W, O, S
Dendrocalamus	50	30	24	80%	Asia	YN, GD, GX, SC, GZ, FJ, TW	Trop. to subtrop. area	S, B, W, T
Dinochloa	20	2?	2?	100%	China, SE Asia	YN, HaN	Southern border	W, T
Drepanostachyum	10	6	3	50%	China, Nepal, Bhutan	YN, SC, GZ, TW	ZT	W, P
Fargesia	81	80	41	51.3%	China, Nepal, Sikkim	YN, XZ, GZ, SC, HN	Wild mountains of Yunnan	S, F, T
Ferrocalamus	1	1	1	100%	China	YN	HH	W, Ba
Gaoligongshania	1	1	1	100%	China	YN	NJ	T
Gigantochloa	30	7	7	100%	China, SE Asia	YN, HK	BN, DH, LC	S, B, W
Indocalamus	30	22	2	9.1%	China, SE and S Asia	YN, SC, JX, GZ, GD, GX	SM, WS, LJ	S, T, F
Indosasa	15	15	5	33.3%	China, Vietnam	GZ, YN, ZJ, FJ, GD, GX	WS, HH, SM, BN, LC, DH	P, F, S, B
Melocalamus	5	4	4	100%	China, India, Myanmar	YN, GX, XZ	BN, DH, LC, HH, SM	W, T
Melocanna	2	1	1	100%	Myanmar, Bangladesh, India, China	GD, GX, YN	WS	W, P
Neomicrocalamus	3	3	2	67%	China	XZ, YN	NJ, DH	
Neosinocalamus	2	2	1	50%	China	SC, YN, GD	Subtrop. area	
Phyllostachys	70	48	14	29%	Asia	S part of Yangtze river	Subtrop. area	S, O, W, T
Pleioblastus	20	18	3	17%	China, Japan	YN, FJ, GZ, ZJ, GD, SC	KM, ZT	B, F, W

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TABLE 1 continued.

Pseudostachyum	5	1	1	100%	China, India, Myanmar, Bangladesh, Sri Lanka, Nepal, Bhutan	YN	BN, DH, BS, LC	W, F, O, S
Qiongzhuea	8	8	1	13%	China	YN, GZ, SC, HB	ZT	S, O, A
Schizostachyum	60	11	4	36.4%	SE Asia, Madagascar, New Guinea	YN, GD, HN, TW, JX	WS, HH, SM, BN, DH, LC, QJ	S, W, P, O
Sinobambusa	13	13	2	15%	China, Vietnam, Japan	GZ, YN, SC, ZJ, FJ, GD, GX, JX, HN	WS, QJ	B, W, O
Teinostachyum	6	2	2	100%	India, China, Sikkim	YN	WS, HH, BN	W, T
Thyrsostachys	2	2	2	100%	Thailand, China, Laos, India, Myanmar	YN, FJ, GD, TW	BN, DH	B, T, O, S
Yushania	60	57	22	39%	China, India	YN, ZJ, FJ, SC, GX, GZ	LP, HH, WS, BN, LC, DH, BS, LJ, DL	B, S, T

[a] W-World; C-China; Y-Yunnan.

[b] Ratio in %: number of species in Yunnan/number of species in China × 100.

[c] Provinces in China: FJ-Fujian, GD-Guangdong, GX-Guangxi, GZ-Guizhou, HB-Hubei, HaN-Hainan, HK-Hong Kong, HN-Hunan, JX-Jiangxi, SC-Sichuan, TW-Taiwan, XZ-Tibet, YN-Yunnan, ZJ-Zhejiang.

[d] Districts in Yunnan: BN-Xishuangbanna, BS-Baoshan, CX-Chuxiong, DH-Dehong, DL-Dali, DQ-Diqing, HH-Honghe, KM-Kunming, LC-Lincang, LJ-Lijiang, NJ-Nujiang, QJ-Qujing, SM-Simao, WS-Wenshan, YX-Yuxi, ZT-Zhaotong.

[e] Uses: A-Art; B-Building; Bo-Bow and Arrow; F-Furniture; O-Ornament; P-Papermaking; S-Shoot; T-Tool; V-Substitute for Vine; W-Weaving.

TABLE 2 Area and stocking of bamboo forests in Yunnan. (Source: Xue et al 1995)

Types of bamboo forest	Area covered (ha)	Stocking (million t)	Percentage (%)
Natural forests with large and medium bamboos (diameter ≥ 2 cm)	189,000	19	57.10
Natural forests with small bamboos (diameter < 2 cm)	110,000	4.8	33.20
Total natural bamboo forests	299,000	23.8	90.30
Bamboo plantations	32,000	3.85	9.70
Total	**331,000**	**27.65**	**100**

(Table 2). For instance, *Dendrocalamus membranaceus* forests, as the largest-scale big-sized sympodial type of natural bamboo forest in China, occur chiefly in the lower basin of Lancang (Mekong) river and cover an area of 70,000 ha. Natural bamboo forests composed of *Schizostachyum funghomii* and *Indosasa sinica* in the mid to lower Red River Basin in southeastern Yunnan cover about 10,000 ha. In northwestern Yunnan, there are alpine bamboo forests that consist mainly of *Fargesia* species.

Traditional uses of bamboo in Yunnan

The mountainous province of Yunnan is inhabited by many ethnic minorities. Throughout history, these peoples have accumulated a rich knowledge on the use of bamboo. Their daily life and work is closely linked with bamboo. They live in bamboo houses, eat bamboo shoots, wear bamboo hats and shoes, cook food in utensils made of bamboo culm internodes, walk over bamboo bridges or cross rivers on bamboo rafts, and farm with bamboo tools (Figures 2 to 4). In most farmers'

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TABLE 3 Bamboo species chosen for high-quality edible shoots in Yunnan. (Source: this study)

Species	Area	Type of culm	Remarks
Dendrocalamus hamiltonii	S, SW, SE	Large, sympodially clustered	Sweet shoots for fresh cooking (also *D. brandisii, D. asper, D. pachystachyus*); shoots in summer
Qiongzhuea tumidinoda	NE	Small, multiaxially scattered	Fragrant shoot for fresh cooking; shoots in spring
Fargesia yunnanensis	C, W, NW	Medium, sympodially scattered	Fragrant shoot for fresh cooking; shoots in summer
Chimonocalamus fimbriatus	W, SW	Medium and small, sympodially clustered	Fragrant shoot for fresh cooking (also 8 other species of this genus); shoots from summer to fall
Dendrocalamus latiflorus	C, SE	Large, sympodially clustered	Shoots in summer
Dendrocalamus giganteus	W to S	Large, sympodially clustered	Suitable for dried and soured shoots (also *D. membranaceus*, *D. barbatus*); shoots in summer
Schizostachyum funghomii	SE, S, SW	Large and medium, clustered	Suitable for fresh and dried shoots; shoots from summer to fall
Schizostachyum pingbianensis	SE	Small, clustered	Fragrant shoot for fresh cooking; shoots in spring, summer, and fall
Chimonobambusa yunnanensis	NE, SE, SW, W	Small, multiaxial type	Fragrant shoot for fresh cooking (also 8 other species of this genus); shoots in fall

houses, the majority of everyday utensils are made of bamboo, such as bowls, chopsticks, various types of spoons and ladles, steaming utensils, rice cookers, tables and chairs, various types of containers, carrying tools, and many more. In rural areas, bamboo is planted around homes and villages, along roads and river banks, or next to fields. In addition to material uses, bamboo plants embellish the rural environment and fill the minority people's life with vigor and vitality based on the spiritual value of bamboo in their culture.

Nutritive and medicinal value

Of the 250 bamboo species found in Yunnan, at least 100 produce edible shoots that are both delicious and nutritious, thus meeting the people's food and health needs. The following criteria are used for selecting bamboo species for shoot production:

- Biological characteristics, such as shooting season, ratio of producing shoots, duration of shooting, rate of shoot growth, size of shoots, and convenience of harvest;
- Ecological characteristics, such as good environmental adaptability;
- Nutritional characteristics, such as nutritional quality and contents of fresh bamboo shoots;
- Taste characteristics, such as crispness, taste, and suitability for cooking;
- Yield per unit area.

Comparison among species in Yunnan based on the above criteria has led to selection of key bamboo species for shoot production and cultivation (Table 3).

Bamboo shoots have the following advantages:

1. They possess high nutritional value. Some bamboo shoots have a high protein content (up to 15.23%). They also contain many amino acids, trace elements, and vitamins.
2. Most bamboo shoots grow naturally in mountainous areas, where neither chemical fertilizers nor pesticides are applied. Therefore, they provide a clean, pollution-free vegetable.
3. Bamboo shoots have a low fat content (less than 2.4%) and a high edible cellulose content (about 6–8%). Bamboo shoots thus help to reduce or prevent obesity (Yang and Hui 1998).
4. Several high-quality shoot-producing bamboo species can be exploited and utilized profitably on a large scale. However, this requires population surveys and genetic improvement of the natural populations of these species. Since most of the extensive natural bamboo forests in Yunnan are low yielding, proper care and management are important to increase production.
5. Bamboo shoots taste crisp and fresh.

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TABLE 4 Other traditional uses of bamboo in rural mountain life. (Sources: Li 1990; He and Liao 1994; Zhu et al 1994; Wang 1999; Wang 2000; Wang et al 2002; Yang 2002)

I. Bamboo used in everyday life			
Bamboo species	**Characteristics**	**Parts used**	**Products / uses**
Neosinocalamus affinis, Bambusa textiles, Cephalostachyum scandens, Schizostachyum funghomii	Long fiber and internodes, thin wall, soft skin, toughness, easy split	Skin and stratiform wall	Mats, baskets, fans, slippers, curtains, fences, hats, ribbons, woven bamboo products, ropes, straps
Bambusa blumeana*, *B. lapidea*, *B. sinospinosa*, *B. vulgaris	Thick wall, strong culm, solidity	Culm	Furniture, rafters, frames for lifting, scaffoldings, beanpoles, mine props
Dendrocalamus sinicus*, *D. giganteus*, *D. yunnanensis*, *D. barbatus*, *D. membranaceus	Large culm and thick wall, good bearing capacity	Culm and wall material	Houses, bridges, rafts, walls, floors, stools, construction materials, water channels, storage buckets
Phyllostachys decora*, *P. bambusoides*, *P. heteroclata	Medium diameter, good elasticity	Culm and branch	Fishing poles, bows, arrows, crossbows, brooms, carrying poles
Fargesia yunnanensis*, *F. papyrifera*, *F. utilis	Middle-diameter culm, thick wall, good resistance	Culm and rhizome	Walking sticks, bed rests, umbrella handles, vaulting poles, nails, hoops, smoking pipes, measuring implements
Phyllostachys bambusoides* f. *lacrimadeae	Long internode, beautiful skin	Culm	Flutes
Dendrocalamus sinica	Big culm and cavity	Culm	Drums
***Fargesia* spp. and *Yushania* spp.**	Small and smooth culm	Culm	Reed pipes (musical instruments)
II. Religious uses			
Phyllostachys nigra	Worship bamboo, planted around the houses of Yi people		
Bambusa ventricosa*, *B. multiplex	Cult bamboo, planted in Buddhist temples		
***Fargesia* spp.**	Sacred bamboo, kept in the houses of people in Tibet		
Dendrocalamus giganteus	Auspicious bamboo, planted around the village		
III. Medical uses			
Species	**Useable parts**	**Medical indication**	
Phyllostachys glauca	Leaves	Cough and lung inflammation	
P. heterocycla* cv. *subescens	Sap of young culms	Cough and throat inflammation	
Indosasa pingbianensis	Shoots	Common cold and headache	
***Fargesia* spp.**	Red bamboo fungus	Skin inflammation	
IV. Ornamental uses			
Species	**Ornamental characteristics**		
Phyllostachys aurea	Nodes of lower part of culm shortened and irregularly swollen		
P. heterocycla	Internode from base upward with continuous irregular contractions and swellings, in a criss-cross pattern, like the pattern of a turtle		
P. nigra	Black culm		
***Chimonobambusa* spp.**	Square culm		
Qiongzhuea tumidinoda	Big node, culm annulus strongly convex, like two closed trays		
Thyrsostachys siamensis	Straight culm and beautiful leaves		
Bambusa ventricosa	Internodes swollen		
B. vulgaris* cv. *Vittata	Internodes and branches golden yellow, interspersed with green longitudinal streaks		
B. vulgaris* cv. *Wamin	Internodes and branches short and swollen		
B. multiplex	Small and beautiful leaves		
Fargesia yuanjiangensis	Beautiful branches, level		
Yushania nana	Small culm and big leaves		

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Bamboo culms as a substitute for wood

Together, natural forests of *Dendrocalamus membranaceus* and *D. sinicus*, and bamboo plantations of *D. giganteus* and other species cover an area of 70,000 ha in Yunnan. Their total culm stocking reaches up to 7,000,000 t (see Table 2). These species are used for both timber and shoot production. Their culms are large in length and diameter, and consist of long fibers, thick culm walls, and tough timber. Sympodial bamboos yield good-quality timber for various traditional uses by ethnic peoples and provide good raw material to replace wood in manufacturing bamboo plywood and bamboo flooring, woven bamboo plywood, particleboard or fiberboard, the qualities of which are the same for wood (Hui and Yang 1998).

As the fiber shape and chemical composites of bamboo are similar to those of wood, most bamboo species in Yunnan are excellent raw material for producing pulp for paper. *Schizostachyum* spp. contain 7.5% cellulose, their fiber length reaches 3.6 mm, and the ratio between the fiber length and width may reach 296 (Xue et al 1995). In addition, bamboo culms can be used to produce floorboards pieced together in decorative patterns, to make ceilings, furniture, in architecture, and to produce charcoal or anything else made of wood.

Other traditional uses of bamboo in rural mountain life

Along with its uses as food and as a wood substitute, bamboo serves many other purposes in rural mountain life. These include construction, tools, and medical, cultural, and ornamental uses (Table 4).

Conclusion and recommendations

Bamboo resources in Yunnan show rich species diversity and diversity of vegetative types; they are therefore highly significant for the social, ecological, and economic development of the area: 250 bamboo species belonging to 29 genera are found in Yunnan, which accounts for half of all bamboo species and three quarters of all bamboo genera recorded in China. Yunnan's vast bamboo forests provide a source of important economically and ecologically desirable raw material.

Traditional bamboo uses are also very important for the cultural diversity of the ethnic minorities in Yunnan. Over centuries, various peoples have been using bamboo for a variety of purposes and have gained rich experience and knowledge. Their lives are closely related with bamboo, which has a strong influence on their history, art, handicrafts, music, religion, customs, architecture, and agricultural production. This understanding has helped to preserve traditional cultural knowledge systems in this mountainous province of China. The diversity of species and uses of bamboo resources in Yunnan are the basis of a stable and sustainable system.

Bamboo resources have a great development potential as an important non-timber forest resource. In order to develop and utilize the abundant bamboo resources of Yunnan, the following recommendations should be considered: (1) intensive high-yield, good-quality bamboo plantations should be established; (2) to strengthen transfer of bamboo research, the bamboo industry should be provided with scientific and technological resources; (3) to set up a bamboo development plan, macro-management in the bamboo industry should be strengthened; finally, (4) bamboo products for replacing wood should be developed, and the natural bamboo forests and their mountain ecosystems should be protected.

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ACKNOWLEDGMENTS

Amongst all those who generously provided information, special thanks to all the people from indigenous communities in Yunnan who shared their extremely important knowledge with us. This project was supported by the Yunnan Provincial Government (2000YP01, 2000YP17).

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