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A bamboo germplasm collection for community development in Central Yunnan, China

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Abstract—A community bamboo collection has been initiated in Hongqiang community, Chuxiong Prefecture of central Yunnan, Southwest China. The site for this bamboo collection is a mountainous area dominated by the Yi ethnic community. The people of central Yunnan have depended on native biodiversity (including bamboo) for many generations, and have a long tradition in cultivating or protecting certain species of bamboo. The Yi people worship *Phyllostachys nigra* and protect it [1]. The paper reports on an inventory of bamboos in central Yunnan and the selection of specific ones to form a community collection based on the importance to the local economy. Bamboo culture is an important traditional cultural phenomenon in central Yunnan. The Yi ethnic community worships bamboo with each clan worshipping only one species. The community bamboo collection contributes to community development by improving the economy as well as the traditional cultural practice of the people. However, it is important to promote awareness and training in conservation and use to ensure their commitment and contributions are sustained for the maintenance of the community bamboo collection.

Key words: Bamboo worship; Central Yunnan; community bamboo collection; Yi ethnic community; ornamental bamboos; indigenous knowledge.

INTRODUCTION

Ethnic groups manage and/or cultivate bamboos through using and conserving germplasm at a community level. This paper reports such efforts of the Yi ethnic community in central Yunnan province. The Yi people worship certain species [1] and use other species for particular purposes. Such cultural links need to be documented and strategies put in place to ensure sustainability.

Germplasm resources are the basis for sustainable development, and scientists and policy-makers have recognized the significance of such resources in agriculture,

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forestry, and related industries. Considerable investment has been made in the conservation and development of germplasm resources. Presently, more than 1300 gene banks have been set up around the world [2]. In the developing countries, particularly those rich in biodiversity and origins of domesticated species like China, Ethiopia, India and Peru, numerous gene banks have also been established, some with local and/or external support. In general, significant attention has been devoted to the conservation and use of genetic resources.

However, germplasm resources need to be conserved and studied at different levels, including the local community level and their role in rural development. Planning for any conservation measures, be it *ex situ* or *in situ* must go hand in hand with their use to increase productivity [3]. Some germplasm collections of bamboos have been established in China, India, Indonesia, Malaysia, and other countries, with the objective of conserving the bamboo genetic resources in those areas. Most of such collections have either been in the form of bamboo set or *ex situ* stand, with very little involvement of local people who depend on those resources for their livelihood and cultural values.

Central Yunnan, the area of this study, covers Kunming, Yuxi, Qujing, Chuxiong and Dali prefectures. The general landscape consists of the Yunnan Plateau with mountains on the plateau. The average altitude is 1800–2000 meters with Jiaozi Snow Mountain being the highest peak at 4223 meters above sea level. The climate is subtropical monsoon plateau type with an average annual temperature of 12–17°C. The annual rainfall is 700–1000 mm with distinct dry and rainy seasons. The dry season is from November to April, and the rainy season is from May to October [7, 8]. The forest cover is about 23% being dominated by pine forest and evergreen broadleaf forest. The dominant tree species are *Pinus yunnanensis*, *Pinus armandii*, and species of Fagaceae, and Theaceae. The main soil types are red soil, field soil and mountain yellow soil. Central Yunnan has a long history of development and bamboo cultivation. This paper describes the establishment of a bamboo collection for both conservation and community development.

MATERIALS AND METHODS

A literature survey was carried out for references to the bamboo resources of central Yunnan. These references included diverse facts relating to folk legends, site information, environmental conditions and other ecogeographic information. Major references include Refs [4, 7, 8].

Two field surveys were conducted over a total period of 3 weeks. Taxonomic and ethnobotanical methods were used for these investigations to gather data on the identity of the bamboo species, and indigenous knowledge related to these (Table 1). For instance, when we got close to the Chahe Village in Chuxiong, one bamboo species was easily identified as *Phyllostachys nigra* Munro according to our taxonomic knowledge. However, we did not understand why those wild bamboo plants were fenced with rocks. We interviewed an old man in the village about

Table 1.
Some examples of field investigation in Central Yunnan

Site investigated	Nationality	Informants	Species name	Indigenous use
Wumeng, Luquan, Kunming	Yi	Gao LQ, 46, female	*Fargesia yunnanensis* Hsueh et Yi	Cultivated for bamboo shoots
Houshidong, Guangdu Kunming	Miao	Lian KY, 37, male	*Bambusa textilis* McClure	Cultivated for weaving
Gaoqiao, Wuding, Chuxiong	Han	Wang DW, 28, male	*Bambusa intermedia* Hsueh and Yi	Cultivated for ornamental
Zhujia, Lufeng, Chuxiong	Yi	Huang JL, 30, female	*Fargesia* sp.	Cultivated for bamboo shoots
Chahe, Nanhua, Chuxiong	Yi	Luo ZQ, 65, male	*Phyllostachys nigra* Munro	Wild, for religious
Tuanshan, Dayao Chuxiong	Bai	Zhang JH, 41, male	*Bambusa lapidea* McClure	Wild, for construction

its ethnobotanical background and revealed the religious function of this bamboo species in local communities.

Samples of the most important species were gathered for the community collection, in the form of rhizomes with the culms that were removed by digging. The different culms collected were chosen at random so as to keep materials from different clumps as distinct samples [5, 6]. The samples collected from different sites were covered with grass ropes and transported within two days to Hongqiang, the site for the community collection. Two hectares of sloping land were prepared for the collection. Holes ($1.0 \times 0.5 \times 0.4$ m) for planting the collected bamboo materials were prepared in advance. The spacing adopted for planting was 3.0 m $\times$ 4.0 m [7].

Transplanting was carried out in July 2000, during the rainy season. Sixty-two culms of 12 species, varieties and cultivars of bamboo collected from different sites, including 2 species from outside central Yunnan, were planted. These two species were included as they appeared to have development potential. They are *Phyllostachys pubescens* and *Bambusa vulgaris* (Table 2). Local farmers actively participated in the planting activities.

The grass ropes on rhizomes used during transportation were loosened and some leaves and upper stems of bamboo culms were removed before planting. Rhizomes and roots were covered with soil mixed with organic manure, and surface soil. Rhizomes over 1 meter length were cut to fit the size of the holes. After planting, each hole was flooded with water drawn from the nearby stream.

RESULTS

During the field investigation it was found that 10 species of bamboo were widely cultivated or used by the local people in central Yunnan. Some of them were more widely used than others. For instance, *Dendrocalamus bambusoides* was cultivated

Table 2.
Bamboo species grown in the community bamboo collection in Hongqiang

No.	Species	Provenance
1	*Bambusa multiplex* (Lour.) Rausch ex Shult et Shult f.	Kunming
2	*Bambusa multiplex* cv. *alphonse* R. A. Young	Chuxiong
3	*Bambusa multiplex* cv. *fernleaf* R. A. Young	Chuxiong
4	*Bambusa textilis* McClure	Kunming
5	*Bambusa vulgaris* Schreber ex Wendland. cv. *wamin* McClure	Southeast Yunnan
6	*Dendrocalamus bambusoides* Hsueh et Yi	Kunming
7	*Fargesia fractiflexa* Yi	Eryuan, Dali
8	*Fargesia* sp.	Lufeng, Chuxiong
9	*Fargesia yuanjiangensis* Hsueh et Yi	Yuanjiang, Yuxi
10	*Fargesia yunnanensis* Hsueh et Yi	Chuxiong
11	*Phyllostachys nigra* Munro	Chuxiong
12	*Phyllostachys pubescens* Mazel	Northeast Yunnan

by many communities for its uses in construction and as weaving materials. The bamboo shoots of *Fargesia yunnanensis*, both wild and cultivated, were collected for both family consumption and selling. *Phyllostachys nigra* is protected and used for cultural and religious purposes by the Yi community. Thus all the species that were selected and introduced into the community bamboo collection were important from the point of their use in daily life, economy and or cultural significance (Table 2).

Sixteen months after planting it was found that 51 of the 62 samples had survived. Also during this period it was recorded that 12 individual households in Hongqiang had planted bamboo on their own land, using information from the collection. They selected 3 species, *Fargesia yunnanensis* for bamboo shoot production, *Bambusa texitilis* for production of weaving materials, and *Bambusa vulgaris* cv. *wamin* for ornamental purposes. Those who planted bamboo in their own fields during this project period are farming masters. They like to accept new techniques and varieties/crops introduced by agricultural technicians and scientists. An evaluation of the project activities revealed local farmers' great enthusiasm for the bamboo collection. Most families expected they could benefit from the collection, whether they grew bamboo or not.

Because of the interest, a training course on bamboo management was organized for about 60 farmers from the local community in association with the community bamboo collection. Management techniques were disseminated with an emphasis on propagation, cultivation and marketing. The training course proved to be very effective. For instance, a farmer with 0.08 hectares of *Fargesia yunnanensis* had a yield of less than 200 kg per year. At the training course the farmer learnt the management techniques of removing the very old and thin culms, implemented it on his own field, and the bamboo shoot yield was doubled in 2001. The local people are adopting the community bamboo collection and will receive some seedlings for planting in their own fields, thus benefiting from the community efforts.

DISCUSSION

The bamboo species that are native to and cultivated for a long time in central Yunnan include 24 species, 1 variety and 2 cultivars, belonging to 8 genera (Table 3). Data for 16 species, 1 variety and 2 cultivars were recorded for this study. These are marked in Table 3.

Bamboo plays an important role in the indigenous culture, although the number of bamboo species in central Yunnan is fewer than in the southern region of the province. Bamboos have become incorporated into the religion of the Yi community. They worship and conserve bamboo, and consider bamboo to represent their ancestors.

Some tribes of the Yi community celebrate a bamboo festival between 3 and 12 April, exact dates determined according to the lunar calendar. The festival is held for three and a half days to sacrifice *Phyllostachys nigra*. The sacrificing ceremony begins with the removal of weeds (shrubs and grass) for bamboo. Then the *Bimo*s (representatives of traditional Yi religion and culture) will tell many stories and legends about bamboo. One of the stories told that the ancestors of the Yi people could not survive without help from *Phyllostachys nigra* during the huge flood in ancient times. After the ceremony, young people in colourful traditional dress dance and sing close to the *Phyllostachys nigra* forest.

The Yi people in Chuxiong worship some bamboo species, including *Phyllostachys nigra*, and *Yushania polytricha* [1]. Different tribes worship other bamboo species. They protect the bamboos and use the rhizome or stem segments to make sculpture representing their ancestors.

The bamboo worship in the Yi communities is characterized by the following features, although over 70 tribes or branches are included in this group (Tang CC, pers. comm., 1996). 1) The Yi people believe that they have blood relationship with bamboo and that their ancestors were from bamboo. Hence, Yi believe their spirits would return to bamboo after their death. 2) The worshipping of bamboo is a result of the ancient ritual of totem worship, the ceremonies differing from one tribe to another. 3) The Yi people from different places or branches may worship different bamboo species. Their taboo to bamboo is limited to the species that they respect. 4) The symbolic boards (or effigies) of their ancestors are made with bamboo using only those species that are worshipped. The parts used for making the board are different in different tribes. Some tribes use the stem, but most of them use the rhizome. 5) The clans with blood relationships worship the same bamboo species. Through the bamboo species they worship, the people could identity their blood relationships amongst the Yi communities.

The people in central Yunnan, especially of the Yi community, are endowed with rich indigenous knowledge. A few examples are given here.

(1) *Construction*. People in central Yunnan believe that bamboo has great flexibility and bamboo culms are stronger and last longer than timber. They use bamboo to substitute for steel bars in building traditional houses. The species commonly used are *Ph. nigra* and *F. yunnanensis*. The frames of traditional houses are

Table 3.
Bamboos occurring in central Yunnan*

No.	Species	Distribution	Habitat, altitude	Uses
1	*Bambusa intermedia* Hsueh and Yi	Central and Southern Yunnan	Cultivated	Construction, weaving, ornamental
2	*Bambusa lapidea* McClure	Central, Southern and Southwestern Yunnan	1200–2300 m	Construction
3*	*Bambusa multiplex* (Lour.) Rausch ex Shult et Shult f.	Southern China	Cultivated	Ornamental
4*	*Bambusa multiplex* cv. *alphonse* R. A. Young	Southern China	Cultivated	Ornamental
5*	*Bambusa multiplex* cv. *fernleaf* R. A. Young	Southern China	Cultivated	Ornamental
6	*Bambusa ventricosa* McClure	Southwestern China	Cultivated	Ornamental, handicrafts, farming tools
7*	*Bambusa textilis* McClure	Southern China	Cultivated	Weaving, construction, furniture, ornamental
8	*Chimonobambusa yunnanensis* Hsueh et W. P. Zhang	Yunnan	Evergreen forests, 1600–2100 m	Edible shoots
9*	*Dendrocalamus bambusoides* Hsueh et Yi	Central Yunnan	250–1890 m	Furniture, construction, weaving
10*	*Fargesia fractiflexa* Yi	Central and Western Yunnan	Mountain slopes	Farming tools, weaving
11	*Fargesia frigidis* Yi	Central and Western Yunnan	Mountain slopes,	Farming tools
12	*Fargesia fungosa* Yi	Southwestern China	1800–2700 m	Weaving, edible shoots
13*	*Fargesia* sp.	Central Yunnan	1900–2400 m	Edible shoots
14	*Fargesia mairei* Yi	Central Yunnan	1700–2100 m (–3600 m)	Edible shoots
15	*Fargesia utilis* Yi	Northern Yunnan	2700–3650 m	Edible shoots, farming tools
16*	*Fargesia yuanjiangensis* Hsueh et Yi	Central Yunnan	680–1700 m	Ornamental
17*	*Fargesia yunnanensis* Hsueh et Yi	Central and Western Yunnan	Cultivated in evergreen forests	Edible shoots, farming tools
18	*Indocalamus longiauritus*	Southern and Southwestern China	Valleys	Chopsticks, packing, farming tools
19	*Neosinocalamus affinis* Keng f.	Southwestern China	Valleys under 1900 m	Construction

Table 3.
(Continued)

No.	Species	Distribution	Habitat, altitude	Uses
20	*Phyllostachys aurea* Carr	Southwestern China	Cultivated	Ornamental
21	*Phyllostachys bambusoides* Sieb. et Zucc.	Southern China	Cultivated	Ornamental
22	*Phyllostachys decora* McClure	Southwestern China	Cultivated	Ornamental
23	*Phyllostachys glauca* McClure	Southern China	Cultivated	Ornamental
24	*Phyllostachys meyeri* McClure	Central and Southeastern Yunnan	1300–1800 m	
25*	*Phyllostachys nigra* Munro	Southwestern China	Mountain slope	Ornamental
26*	*Phyllostachys nigra* var. *henonis* Stapt.	Southwestern China	Mountain slope	Weaving, fishing sticks, medicine
27	*Yushania polytricha* Hsueh et Yi	Central and Western Yunnan	Mountains	

* Transplanted into the community bamboo gene pool.
Underlined numbers: data of these species are recorded in this study.

made from bamboo or timber and the walls are made from mud and soil. In the mountainous Yi villages, many houses are still made with bamboo and mud.

(2) *Erosion control*. The people in central Yunnan are aware that bamboos are fast-growing and strong rhizome systems can be used for soil and water erosion control. On the banks of the Luochuan River, thousands of *Neosinocalamus affinis* clumps are grown to protect the paddy fields from flood damage.

(3) *Ornamental purposes*. The aesthetic values of bamboo are also widely recognized and utilized by the people in central Yunnan. The green bamboo ribbons at the Luochuan River banks have become a scenic view and fascinate many tourists.

(4) *Bamboo shoots*. The people in central Yunnan have developed many methods to prepare and cook bamboo shoots. *Fargesia yunnanensis* shoots, for example, are served in many restaurants all year around. The bamboo shoots can either be sent to local markets for sale or be put into jars for storage. Two methods are adopted to store bamboo shoots in jars. One is to cover the shoots with salt and the other is to let the shoots ferment. The bamboo shoots can be stored for over a year using either method.

The role of bamboo germplasm resources in community development

The significance of bamboo resources in the rural economy and ecology has been elucidated by many scientists [6, 8]. Field studies in central Yunnan revealed that bamboo resources contribute to the socio-economic and cultural development in

local communities. A household in Hongqiang can earn 15% of its total cash income from selling *Fargesia yunnanensis* shoots each year. Further development of bamboo resources could increase the income of the local people, thus contributing to poverty reduction.

The role of bamboo as an ornament is clearly shown in Table 3. This role should not be underestimated in relation to the aesthetic value of bamboo and the well-being of communities. The practice and development of traditional culture is another aspect of community development. The example of bamboo worship in the Yi communities indicates that bamboo germplasm resources have played and will continue to play an important role in the conservation of traditional cultural diversity. The concept of sacred groves could help in promoting community-based conservation of these important species.

Participation of local people in community-based bamboo conservation

Long term commitment and contributions from different sectors are essential for the establishment and maintenance of a collection. For the community collections, active participation and contributions from the local people are indispensable as external support will gradually decrease and the management and maintenance of the community collection will be the responsibility of the local people. The relevant education and training have to be provided to the people to ensure the long-term sustainability of the community collection.

Local people's response to the community bamboo collection

Although the local people in Hongqiang Community understood the significance of bamboo resources for many generations, they did not consciously conserve bamboo germplasm resources or make any effort to collect different bamboo species and grow them in one place. They grow only one or two bamboo species around their houses or fields for household uses. Bamboo shoots are collected from the mountains. There is no conservation strategy for these bamboo species. *Phyllostachys nigra*, is the only species protected by the Yi religion. The local people, however, welcome the setting up of the bamboo collection in their community. Many people attended the planting of bamboo and asked many questions such as what species they were, what were their uses, and how to propagate bamboo seedlings. They believed that in future the local people would be able to obtain different bamboo species from the collection for their own cultivation, learn agricultural techniques to manage bamboo, and obtain market information from the gene pool project. These are indeed to be main functions of the community collection.

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