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Strategies for agrobiodiversity conservation and promotion: a case from Yunnan, China

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Abstract. This paper deals with strategies for agrobiodiversity conservation and promotion based on studies on four plant groups (selected from 50 plant groups) occurring in the Yunnan Province of China. These plants are edible konjac (*Amorphophallus*), medicinal *Paris*, *Musella lasiocarpa* and wild tea (*Camellia sinensis* and its wild relatives), including their cultivars and wild populations. After analyzing the target plants, we conclude that the following strategies should be adopted to conserve and promote agrobiodiversity: (1) *in situ* conservation of agrobiodiversity, including habitat protection of wild populations, maintenance of native species and varieties in traditional agroecosystems, and relevant environmental education; (2) *ex situ* conservation and promotion of agrobiodiversity, including establishment of living collections and germplasm banks, and introduction of species and varieties into agroecosystems for agricultural practice; and (3) promotion and conservation of agrobiodiversity through sustainable uses, including technique development of propagation, cultivation, pest and disease control, on farm and off farm management, and other activities such as new variety breeding and scientific studies. Strategies developed here will be helpful to conserve and promote agrobiodiversity at agroecosystem, species, variety or landrace, and management system levels.

Introduction

As a scientific term, agrobiodiversity has been widely accepted by both scientists and the public only in recent years (Guo and Padoch 1995; Swaminathan 1996; Guo and Long 1998; Partap 1998; Partap and Sthapit 1998; Thrupp 1998; Jarvis 1999; Wood and Lenne 1999; CBD (Convention on Biological Diversity) 2000; Chen 2000; Long 2000; Hagmann and Muller 2001; Jarvis et al. 2001). It refers to the human-managed or modified biological diversity for general agricultural purposes. It is the synergy and interaction between living things, land, technology, and social systems. Agrobiodiversity is regarded as the sub-set of biodiversity that includes the diversity and variability of plants, animals, micro-organisms, and *in situ* and *ex situ* conservation of genetic resources linked with agriculture (Partap and Sthapit 1998).

Agrobiodiversity can also be defined as the diversity of agricultural systems and taxa of plants, animals and micro-organisms found in them, whether these taxa are deliberately introduced by the farmer or are in the agroecosystem without even the awareness of the farmer (Hagmann and Muller 2001). Agrobiodiversity can be divided into four levels: variety diversity or genetic diversity, agricultural species diversity, agroecosystem diversity, and management system diversity (Guo and Long 1998; Long 2000). Scientists believe that more biodiversity exists in human-managed ecosystems than in natural systems (Altieri 1987; Western and Pearl 1989; Pimentel et al. 1992; McNeely 1995).

Agrobiodiversity is regarded to be a basis for production and human survival (Wood and Lenne 1999), particularly for sustainable food security. It has been proven that agrobiodiversity can help to increase crop productivity while diseases can be controlled in the agroecosystems (Martin 2000; Zhu et al. 2000). Because of landuse system changes, deforestation, population pressure, urbanization, degradation of landraces, and over-harvesting of non-timber forest products, agrobiodiversity is now declining very quickly at ecosystem, species, variety and management system levels. For example, between 1949 and 1970, the number of wheat varieties cultivated in China dropped from 10 000 to only 1000 (Thrupp 1998). The upland rice varieties in the Jinuo community of southern Yunnan decreased from over 100 before 1980 to 65 in 1994. Recent statistics have shown that variety numbers of crops in swidden agroecosystems in the community have dropped since several improved varieties were introduced to the area within the past 10 years (Long et al. 1995). Agrobiodiversity, therefore, should be emphasized by academic, economic, social and political sectors.

Fortunately, the significance of agrobiodiversity has been understood by both scientists and different agencies worldwide, including the World Resources Institute, International Plant Genetic Resource Institute, Asian Development Bank, Deutsche Gesellschaft für Technische Zusammenarbeit (known as GTZ, the German Technical Cooperation Agency), Global Environment Facility (GEF hereafter) and many others. For instance, a document on agrobiodiversity was issued by GEF in 1998, entitled *A Framework for GEF Activities Concerning Conservation and Sustainable Use of Biological Diversity Important to Agriculture* (Global Environment Facility 1998).

Scientists have developed various methods to document, assess and evaluate agrobiodiversity (Guo and Long 1998; Partap and Sthapit 1998; Dao et al. 2000; Guo et al. 2000). Farming systems, species, varieties or landraces and management systems have been documented in some cases. For instance, 416 species of plants were reported to occur in homegardens of Xishuangbanna, a prefecture in southern Yunnan, southwest China (Long 1996). Numerous papers have revealed the significance of *in situ* conservation of agrobiodiversity (e.g. Altieri and Merrick 1988; Jarvis 1999; Sthapit et al. 2000; Zhou 2000; Zhu et al. 2000). However, people cannot preserve all agrobiodiversity through *in situ* conservation, including on-farm and farming systems (e.g. agroforestry systems and intercropping systems). For instance, introduction of many new varieties and farming systems changed (e.g.

monoculture) because of the uses of modern techniques or tools, resulting in the loss of agrobiodiversity in their traditional habitats. Other approaches such as *ex situ* conservation and sustainable uses may make necessary and important contributions to the conservation of agrobiodiversity. The overall strategies to conserve and promote agrobiodiversity, therefore, still need to be developed at different levels. This paper uses plants and plant-based systems as examples.

Materials and methods

In this study, we selected some plants occurring in Yunnan, southwest China, as representatives to develop the strategies to conserve and promote agrobiodiversity. The criteria for selecting the plants were as follows: (1) the plant(s) will positively affect the conservation and promotion of agrobiodiversity in future agricultural development; (2) they are economically significant; (3) they or their wild relatives are native to Yunnan; (4) they or their wild relatives are endemic to Yunnan; (5) at least some indigenous knowledge or modern technology regarding the target plants has been gathered or developed; (6) their wild populations are rare and endangered; (7) they are threatened by human activities; and (8) they have great development potential (Table 1). Fifty plant groups were initially identified for this study, of which 21 could meet most or all of the criteria. After re-screening these plants, we found four groups of plants that met all criteria. They are edible konjac (*Amorphophallus* spp., Araceae), medicinal *Paris* (*Paris* spp., Trilliaceae), *Musella lasiocarpa* (Musaceae) and wild tea (*Camellia sinensis* and its wild relatives, Theaceae). These plants are believed to be very important to economy and agriculture.

Literature studies were done before the field work was conducted. To collect information related to agrobiodiversity conservation and promotion, participatory approaches were used in the field studies. Twelve sites were visited and revisited. Key informants, including botanical experts, agronomists, biodiversity specialists, agro-enterprise technicians and managers, farmers and indigenous peoples, and local healers and herbal medicinal doctors, were interviewed based on questionnaires and participatory methods. Over 90 people were interviewed in terms of agrobiodiversity conservation and promotion. To develop conservation strategies, group discussions and consultations were organized both in the field and in meetings. Market surveys were also conducted at local and provincial levels to re-check the significance of the plants we selected.

This study was started in January 1998 and ended in May 2001. However, the first and second authors have studied *Amorphophallus, Paris* and *Musella* for over 15 years. Research on wild tea (*Camellia*) began in 1992 (Luo et al. 2001). Their studies on taxonomy, distribution, resources, cytology, phylogeny, geography, ethnobotany, agroforestry and development strategies have provided much knowledge for the present paper.

Table 1. Plant groups selected for studies and the selection criteria[a].

Plants re-screened	Selection criteria								Result
	1	2	3	4	5	6	7	8	
Aconitum spp.	+	+	+	+	−	+	−	±	±
Alnus nepalensis	+	+	+	+	+	−	−	±	±
Amorphophallus spp., edible	+	+	+	+	+	+	+	+	+
Camellia spp., wild tea, drinkable	+	+	+	+	+	+	+	+	+
Citrus lemon and wild relatives	+	+	+	−	+	±	±	+	±
Colocasia spp.	±	+	+	+	+	−	±	+	±
Dioscorea spp., medicinal	±	+	+	±	+	−	+	+	±
Eutrema spp.	−	+	+	+	+	+	+	+	±
Eucommia ulmoides	+	+	+	−	+	+	+	+	±
Fritillaria delavayi and wild relatives	−	+	+	±	+	+	+	+	±
Gingko biloba	+	+	+	−	+	+	+	+	±
Litsea cubeba and wild relatives	−	±	+	+	+	−	−	±	±
Musella lasiocarpa	+	+	+	+	+	+	+	+	+
Paris spp., with rhizome, medicinal	+	+	+	+	+	+	+	+	+
Passiflora, wild, edible	−	±	+	−	−	−	−	+	−
Phyllanthus emblica	−	±	+	−	+	−	−	±	−
Prinsepia utilis	±	±	+	−	+	−	−	±	−
Rhodiola spp., medicinal	−	+	+	+	+	+	+	+	±
Saussurea spp., medicinal	−	+	+	+	−	+	+	±	±
Taiwania flousiana	+	+	+	+	−	+	−	+	±
Taxus spp.	±	+	+	−	+	+	+	+	±

[a] Selection criteria and numbering in this table are the same as in the text. '+' means the plant(s) meet the criteria, '−' means not suitable, and '±' means intermediate.

Results

Status of biodiversity in Yunnan

The research area is Yunnan, a province located in the southwest corner of China. It shares borders with three Southeast Asian countries (Vietnam, Laos, and Myanmar) and five provinces of China (Chongqing, Guangxi, Guizhou, Sichuan and Tibet). Yunnan covers an area of 394000 km^2 (4.1% of China's total land area), located between 21°09′ and 29°16′ N, and 97°39′ and 106°12′ E. Yunnan is special for its complicated topography with altitude difference from 76.4 to 6740 m above sea level. There are seven climate and ecological zones in the province, from tropical rain forest to alpine cold desert (Guo and Long 1998).

With its rich biodiversity, Yunnan is known as the kingdom of plants and animals in China. Over 17000 species of seed plants have been recorded from Yunnan, about 56.7% of the total species number of the whole country (Wu 2000). In addition, plants in Yunnan have the highest endemism at species, genera and family levels. It is believed that there are three plant endemism centers in China, of which two are located in Yunnan and its neighboring areas, namely Northwest Yunnan Center and

Southeast Yunnan – western Guangxi Center (Li 1994). Northwest Yunnan, for example, is a significant biodiversity center of plants. Many taxa have their distribution and development centers here. It is also one of the richest regions in medicinal plant resources in China. Over 2000 plant species in northwest Yunnan have a long history of use as traditional Chinese, Tibetan and ethnopharmaceutical medicine. Such plants include *Aconitum*, *Angelica*, *Astragalus*, *Codonopsis*, *Dioscorea*, *Gentiana*, *Rhodiola*, *Rheum* and *Saussurea* (Lu 1999). Of China's total fauna, Yunnan has 64% of bird species, 59% of mammal species, 38% of reptile species and 46% of amphibian species (Guo and Long 1998). Besides, Yunnan crosses two biodiversity hotspots, namely Indo-Burma (Myanmar) and South-Central China, which harbor very rich flora and fauna with a high proportion of endemic species (Myers et al. 2000). These figures further support the global significance of Yunnan's biodiversity.

Yunnan also has the most abundant agrobiodiversity in China (Long 2000). As for the crop varieties only, Yunnan is regarded as the original and diversity center of many crops such as rice (*Oryza sativa*) and tea (*Camellia sinensis*). Starting from the 1950s, a series of germplasm surveys were carried out by the Kunming Institute of Botany, Yunnan Provincial Agricultural Department, Yunnan Academy of Agricultural Sciences and other organizations. The Yunnan Crop Germplasm Bank has preserved 23 450 accessions of crop germplasm resources, 2000 of which are wild relatives of crops.

Three wild rice species, *O. rufipogon* Griff., *O. officinalis* Wall. ex Watt and *O. meyeriana* Baill. have been found in Yunnan Province. Over 300 accessions of these three species from different sites have been collected and preserved in the germplasm bank. Yunnan is also very rich in domestic rice landraces. So far, 5128 accessions of domesticated rice have been gathered and stored in the germplasm bank, in which paddy rice, upland rice, glutinous and non-glutinous rice landraces are included. There are four species and one variety of wheat in Yunnan. About 400 accessions of wheat have been collected and preserved in the bank. Scientists in Yunnan have collected and stored 116 accessions of buckwheat in 11 species and varieties, nine of which are wild relatives of buckwheat.

Although the germplasm resources of the above mentioned species and a few other food crops have been collected, studied and stored in Yunnan, most of the plants important to agriculture and future rural development are not included in any germplasm conservation activities. Much of Yunnan's agrobiodiversity is very significant because many of its plant and animal species are endangered or do not occur elsewhere. It is, therefore, necessary to develop strategies to conserve and promote agrobiodiversity in Yunnan.

Agrobiodiversity issues of the target plants

In terms of agrobiodiversity conservation and promotion, four groups of plants selected for this study were summarized and analyzed based on the information we collected from interviews and field surveys.

Edible Amorphophallus

Amorphophallus or konjac is a genus in the family Araceae, distributed in the old tropics and southern subtropics. There are about 130 species in the genus (Hetterscheid 1996). China has recorded 22 species, 12 of them endemic to the country. Yunnan is the richest province in *Amorphophallus* species and 15 species have been recorded from the province, including nine endemic to the province (Li and Long 1989, 1998a, b; Long 1998; Long and Li 2000).

The tuber of some *Amorphophallus* species is used as food and such species are called edible konjac. The most common species cultivated for food in China are *Amorphophallus konjac* and *A. albus*. Because konjac likes shady, fertile and moist environments, it is usually grown in agroforestry systems or intercropping systems. In Yunnan Province, for example, konjac may be seen in orchards and maize fields. Crops intercropped with konjac are fruit trees, pulses, maize, sorghum, vegetables, and ground cover crops such as sweet potato and melon. The farming systems can be formulated as 'fruit trees/maize + konjac' (Long 1998).

The wild populations of these two species can be found only in northwest Yunnan and the upper Yangtze River watershed. They are strongly threatened by human activities such as land opening for agriculture, road building and tourism development in their natural habitats. Konjac has been cultivated in China for over 2000 years. In Yunnan only, the plantation area of konjac has reached 20000 ha since 1999. In the agricultural development of konjac, however, people still have problems to stabilize their germplasm or to control pests and diseases. New varieties need to be developed to meet the demands of world markets. Besides, the relationship between tree crops, annual crops and konjac has been insufficiently studied, so it is difficult for scientists to advise on the further development of konjac-based agroforestry systems.

Medicinal Paris

Paris is a genus in the family Trilliaceae. There are 24 species of *Paris* in the world, 19 of which occur in China. In Yunnan Province, 15 *Paris* species have been recorded, and eight species have been found in northwest Yunnan. Among them, at least three species, *P. daliensis*, *P. rugosa*, and *P. dulongensis*, are endemic to northwest Yunnan (Li 1998; Li et al. 2000). The species with rhizomes, or medicinal *Paris*, are traditional medicinal and ethnopharmaceutical herbs in Yunnan ethnic societies. Some pharmaceutical companies use them as the major raw material to make medicine. *Yunnan Baiyao*, for instance, is a product from the *Paris* rhizome, which is a very famous Yi ethno-medicine to deal with many diseases and injuries such as broken bones, back pain, bleeding, bites by poisonous snakes or insects, fungal diseases, tumors, some cancers and skin allergic problems. Almost every Chinese knows the name of this ethno-medicine. About 50% of the Chinese people (both in Mainland China and other countries/regions) have used *Yunnan Baiyao* in their lives. At least 20% of the Chinese families keep *Yunnan Baiyao* in their home as a common medicine (Landcare Research New Zealand 2001).

The *Paris*-based pharmaceutical companies used to purchase the *Paris* rhizomes, collected from forests and mountains by local people. Because the *Paris* rhizome grows slowly and its habitats have been destroyed, the natural resources have been decreasing very fast in recent years. Companies are now short of *Paris* rhizomes. Some species are very difficult to find in the forests.

The natural habitats of *Paris* species are montane evergreen forests, montane cloud forests, bamboo forests, broadleaf forests, shrubs, pine forests, and mixed forests of pine and broadleaf trees. Ethnic groups in Yunnan have a long tradition of agroforestry in the original places of *Paris*. Some people have already grown *Paris* in their traditional agroforestry systems. The Yi healers in Chuxiong of central Yunnan, for example, have traditionally grown one variety, *Paris polyphylla* var. *yunnanensis*, in their own agroforestry systems. Fruit trees and crops are the major components in the systems, while *Paris* is a by-product from the systems.

Because the natural propagation and growth of *Paris* are very slow, it is urgent to develop rapid propagation methods (e.g. tissue culture), mycorrhizal techniques, cultivation and management techniques, sustainable overall uses of whole *Paris* plants, and extension of cultivation techniques in the mountainous region of Yunnan. The species with high contents of effective components, like *Paris polyphylla*, will be a focus of these activities.

Musella lasiocarpa

Musella is a genus endemic to the border areas between Yunnan and Sichuan provinces in southwest China, belonging to the family Musaceae. The genus has only one species, *Musella lasiocarpa* C. Y. Wu ex H. W. Li. Its natural habitats have been destroyed by human activities. Scientists can find only one small wild population of *Musella lasiocarpa* now. The Yi people and a few indigenous groups in Yunnan and Sichuan have grown *Musella lasiocarpa* in their traditional farming systems for a few centuries. Thus this rare and endemic species has been prevented from extinction by using it.

Indigenous knowledge of *Musella lasiocarpa* has revealed that it has become an important component in local Yi people's farming systems and daily life. The *Musella*-based farming systems can be formulated as (1) *Musella* + food crops, and (2) fruit trees + *Musella* + food crops + bees. According to ethnobotanical studies, *Musella lasiocarpa* has many uses. It has been traditionally used for pig fodder, aesthetic purposes, soil and water erosion control, weaving material, as a vegetable, medicine, for wine-making, and as a honey resource plant (Long 1996).

With a large, bright yellow, spreading bud atop, good-shaped and long-lasting inflorescence, its ornamental value has endowed *Musella lasiocarpa* with great development potentials. Many actions related to conservation and uses of this species, therefore, should be proposed. The natural habitats and wild populations should be preserved through *in situ* conservation and environmental education in local communities. For the purposes of sustainable uses, the techniques of propagation, cultivation, pest and disease control, management, new variety breeding, and germplasm conservation will be developed.

Wild tea

Wild tea is a general name for the plants in section *Thea* of genus *Camellia*. They are the closest wild relatives of tea (*Camellia sinensis* O. Ktze), and can provide rich germplasm resources for tea plantations and future development. The young leaves of all these species can be used to make tea. Recent studies revealed that there are 12 species and seven varieties of wild tea in the world. All species and varieties distribute naturally in China, especially in Yunnan Province (Table 2) (Min 1992; Luo et al. 2001).

Only one species and one variety of wild tea are domesticated and used for commercial tea production. They are *Camellia sinensis* and its variety, *Camellia sinensis* var. *assamica* Kitamura. The latter is believed to be the ancestor of tea. Tea-based farming systems are very common in Yunnan, in addition to tea monoculture. An impressive combination is tea (*Camellia sinensis* var. *assamica*) and Yunnan camphor (*Cinnamomum pathenoxylum* Nees). Other plantations may be formulated as 'natural forests + tea' (southern Yunnan, for example, Long and Wang 1996; Long and Zhou 2001) and 'tea + crops' (central Yunnan and other provinces of China). With great development potential, wild tea species should be conserved and studied for sustainable uses. The natural habitats and populations of wild tea, however, are threatened by human activities. *Camellia taliensis* Melchior, for example, is becoming very rare and endangered due to habitat degradation.

Wild tea can be preserved through *in situ* approaches of either habitat conserva-

Table 2. Species and distribution of wild tea (Sect. *Thea*, *Camellia*).

Species/variety name	Distribution area	Altitude (m) and habitat
C. costata	China: SE Guizhou, NW Guangdong, N and E Guangxi	700–1100, evergreen broadleaf forest
C. crassicolumna		
var. *crassicolumna*	China: SE Yunnan	1300–2300, evergreen broadleaf forest
var. *multiplex*	China: SE Yunnan	1900–2210, evergreen broadleaf forest
var. *shangbaensis*	China: S Yunnan	2450, evergreen broadleaf forest
C. fangchengensis	China: S Guangxi	320, evergreen broadleaf forest
C. grandibracteata	China: W Yunnan	1750–1850, evergreen broadleaf forest
C. gymnogyma		
var. *gymnogyma*	China: SE Yunnan, SW Guangxi, S Guizhou	1000–1600, broadleaf forest or scrub
var. *remotiserrata*	China: NE Yunnan, N Guizhou, S Sichuan	920–1350, china fir forest or broadleaf forest
C. kwangsiensis		
var. *kwangnanensis*	China: SE Yunnan	1550–1850, broadleaf forest
var. *kwangsiensis*	China: SE Yunnan, W Guangxi	1500–1900, broadleaf forest
C. leptophylla	China: S Guangxi	220–850, scrub
C. petilophylla	China: Guangdong, S Hunan	270–480, sparse forest or scrub
C. purpurea	China: SE Yunnan	1500–2200, evergreen broadleaf forest
C. sinensis		
var. *assamica*	China: Yunnan, Guizhou, Gaungxi, Hainan; Vietnam; Laos; Thailand; Myanmar; NE India	100–1500, evergreen broadleaf forest
var. *dehungensis*	China: S Yunnan, SW Yunnan	1000–1600, under forest or scrub
var. *pubilimba*	China: SE Yunnan, Guangxi, W Guangdong, Hainan	240–1450, broadleaf forest
var. *sinensis*	China: S China, SE Tibet; S Japan; N Myanmar	130–200, sparse forest or scrub
C. tachangensis	China: E Yunnan, SW Guizhou, W Guangxi	1500–2250, evergreen broadleaf forest
C. taliensis	China: W Yunnan	1300–2700, sparse forest/scrub

tion or traditional farming practices (Long and Wang 1996; Long and Zhou 2001). *Ex situ* conservation such as living collection establishment and *in vitro* conservation of wild tea germplasm resources will also contribute to their conservation. The technique development of introduction and domestication, propagation, new cultivars breeding, cultivation management, farming system evaluation, and pest and disease control will be very helpful for sustainable uses of wild tea.

Conclusions and suggestions

Agrobiodiversity exists in traditional agroecosystems (e.g. agroforestry systems), natural ecosystems (e.g. wild populations of crops), and modern agricultural and rural production systems. Human food, medicine, fiber, fuelwood and other resources rely on agrobiodiversity. The conservation, management, promotion and sustainable use of agrobiodiversity require specific attention from academic, economic, ecological and political sectors.

In situ conservation

In situ conservation of agrobiodiversity includes two aspects, i.e. to maintain indigenous species or local landraces in traditional agroecosystems, and to protect wild populations or relatives in natural habitats. Policy strengthening, establishment of nature reserves and protected areas with rich wild populations, management promotion, environmental education and training (especially in local communities), adoption of indigenous knowledge, and local peoples' participation can strongly support *in situ* conservation of agrobiodiversity.

Many nature reserves in different ecological zones have been or will be established for various purposes. Most wild tea species (including the ancestor of tea and its wild relatives), for example, can be preserved in the nature reserves in southern and southeastern Yunnan. Most species and eco-types of wild tea can be found in these protected areas. Thus wild populations and natural habitats of wild tea will be conserved through reserve-based management, including conservation policy strengthening, capacity building, management promotion, environmental education and training, local community development, and local peoples' active participation.

On-farm management is the traditional and money-saving approach to conserve and promote agrobiodiversity in farming systems. *Musella lasiocarpa* and edible *Amorphophallus*, for instance, can be easily preserved in traditional agroecosystems. They are major components in traditional agroforestry or farming systems. It will be helpful for the conservation and promotion of agrobiodiversity to encourage such traditional agroforestry practices.

Ex situ conservation

Ex situ conservation, as a supplement of *in situ* conservation, is indispensable to the conservation and sustainable uses of agrobiodiversity. Since we cannot protect all

species and landraces important to agriculture in their natural environment or agroecosystems, *ex situ* conservation becomes essential in many cases.

Agrobiodiversity can be conserved in living collections, germplasm banks (in the forms of seeds, embryo, *in vitro* tissues, cells, tissue culture seedlings, or DNA clones), and modified agroecosystems. Medicinal *Paris* species, for example, are very difficult to conserve in their natural environment. It is necessary to protect them in the forms of *ex situ* conservation. They can be grown in living collections such as botanical gardens and germplasm nurseries. The seeds and rhizomes of *Paris* can be stored in germplasm banks. Some species of *Paris* may be introduced into agroforestry systems and become a component of the systems.

Sustainable uses

The ultimate purpose of agrobiodiversity conservation and promotion is to use agricultural bio-resources in the long term, while sustainable uses of agrobiodiversity will help the conservation and maintenance of agrobiodiversity. Therefore, techniques related to the sustainable uses of agrobiodiversity, such as sexual and asexual propagation (e.g. tissue culture), cultivation, pest and disease control, on-farm and off-farm management, new variety breeding, germplasm conservation, and technical extension, need to develop to meet the demands of modern development.

The uses of most agrobiodiversity resources are not sustainable. *Paris* and wild tea, for instance, are extensively collected from their wild populations without necessary controls. Their domestication and cultivars development from wild populations, and other relevant techniques, are still new to scientists, agronomists and the farmers.

It is easy to identify the problems, and to propose strategies for agrobiodiversity conservation and promotion. The implementation, however, will be very difficult. It needs financial support and various inputs, including academic, technical, political and ethical.

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