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BIODIVERSITY CONSERVATION: STUDIES IN ITS ECONOMICS AND MANAGEMENT, MAINLY IN YUNNAN, CHINA

Working Paper No. 31

**Developing Community-Based Forestry in the
Uplands of Yunnan: Dictates of Environment
and Socio-Economics**

by

**Zhuge Ren
And
Clem Tisdell**

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Research for ACIAR project 40, *Economic impact and rural adjustments to nature conservation (biodiversity) programmes: A case study of Xishuangbanna Dai Autonomous Prefecture, Yunnan, China* is sponsored by the Australian Centre for International Agricultural Research (ACIAR), GPO Box 1571, Canberra, ACT, 2601, Australia. The following is a brief outline of the Project

Rural nature reserves can have negative as well as positive spillovers to the local region and policies need to be implemented to maximise the net economic benefits obtained locally. Thus an 'open' approach to the management and development of nature conservation (biodiversity) programmes is needed. The purpose of this study is to concentrate on these economic interconnections for Xishuangbanna National Nature Reserve and their implications for its management, and for rural economic development in the Xishuangbanna Dai Prefecture but with some comparative analysis for other parts of Yunnan

The Project will involve the following:

1. A relevant review relating to China and developing countries generally.
2. Cost-benefit evaluation of protection of the Reserve and/or assessment by other social evaluation techniques.
3. An examination of the growth and characteristics of tourism in and nearby the Reserve and economic opportunities generated by this will be examined.
4. The economics of pest control involving the Reserve will be considered. This involves the problem of pests straying from and into the Reserve, e.g., elephants.
5. The possibilities for limited commercial or subsistence use of the Reserve will be researched.
6. Financing the management of the Reserve will be examined. This will involve considering current sources of finance and patterns of outlays, by management of the Reserve, economic methods for increasing income from the Reserve and financial problems and issues such as degree of dependence on central funding.
7. Pressure to use the resources of the Reserve comes from nearby populations, and from villagers settled in the Reserve. Ways of coping with this problem will be considered.
8. The political economy of decision-making affecting the Reserve will be outlined.

Commissioned Organization: University of Queensland

Collaborator: Southwest Forestry College, Kunming, Yunnan, China

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Developing Community-based Forestry in the Uplands of Yunnan: Dictates of Environment and Socio-economics

1. Introduction

This paper stresses the importance of community-based forestry for the conservation of natural resources and alleviation of poverty in upland Yunnan. In contrast with state-managed forests, which account for the bulk of forested land in many countries, including China, community-based forestry is a decentralized form of forestry which empowers local people to manage and establish forests. Community forestry can take many forms. It can involve forestry, including agroforestry, on the private land of individual villagers, or it can entail communal or social forestry, for example, the communal establishment and management of forests on wasteland, or oil degraded land.

Communal forestry has been practiced in parts of India for more than 20 years and was first adopted in West Bengal. It has been observed that in villages where community forests have been established, biodiversity has increased and the extent of poverty appears to have been reduced. While China has less experience with community-based forestry than India, some minorities in China, such as the Dais, have engaged in silviculture for centuries. There is growing interest in community-based silviculture in China, particularly in Yunnan, the prime region of interest in this contribution.

This paper stresses two elements which are the focus of much contemporary research; (i) the state of the environment, and (ii) the significance of institutional structures for economic decision-making and the optimal use and conservation of resources. Decentralized governance structures linked with appropriate economic incentives to local communities can be a powerful force for improvements in decision-making about resource use and conservation. Nevertheless, they should not be regarded as a panacea for effective governance. The situation is more complicated than some advocates for the empowerment of local communities realize.

Yunnan, a mountainous province in South-west China, has a long history of upland cultivation. Today, the inhabitants of its upland areas are demanding improvements in their environment and in their living standards. The simultaneous achievement of these objectives

requires strategies to be found for environmentally sustainable development. There is worldwide interest in discovering strategies to achieve this and in particular China has adopted its Agenda 21 (State Council, 1994) with a view to achieving such development.

Over the past decades, human exploitation of forests has almost exhausted these in upland Yunnan and the area has fallen- into a vicious circle of poverty and environmental deterioration. Researchers in the province have been searching for a way to reverse this trend and have now concluded that the expansion of community forestry might be the most effective way to develop the area's rural economy and improve its environment. This can be seen as a new policy in China, where it is hoped that the establishment of community forestry will accelerate forest rehabilitation and foster environmental improvements.

In implementing this program, the benefits to the local area and its population are of prime concern, and local customs and beliefs will receive full consideration. Community forestry has been extremely successful in the developing countries of South and South-east Asia where these factors have been given priority. In view of this, it is felt that the advantages of community forestry far outweigh its disadvantages and that community forestry has great potential to help solve the development problems of upland Yunnan.

2. Background

Yunnan is a mountainous province. Of the province's total land area of 383,000 km², 94% is categorized as mountainous. Elevations in the province range from 6,740 m above sea level in the north-west down to 76.4 m above sea level in the south-east. Six famous rivers - the Lancangjiang (Mekong), Nujiang (Salween), Dayingjiang (Irrawaddy), Jinshajiang (Yangtze), Yuanjiang (Song Hong), and Nanpanjiang (Pearl)- and over one hundred of their tributaries, pass through Yunnan to the mainland of South-east Asia and the coastal provinces of China.

Yunnan has distinctive climatic conditions. Climate in its west is controlled by the plateau climate from Tibet and its east is subject to the wet monsoon from East Asia; its central region is influenced by the South Asia tropical monsoons. The pattern of mixing of the west winds with monsoonal air currents causes considerable oscillation of its climatic conditions. A dry season occurs in winter and spring and the wet season is in summer and autumn.

The diverse topography of high mountains, deep river valleys and steeply sloping land in Yunnan produces varied climatic patterns throughout the province and almost every type of climate in China can be found within Yunnan itself. Consequently the province contains a very wide range of vegetation types with over 17,000 higher plant species being found in its upland region.

Yunnan has a population of 40 million people but has only an area of 2.8 million ha. suitable for crop cultivation and 67% of this arable land lies on the mountain slopes. In addition, 70% of the forest resources are confined to the north-western highlands and southern remote areas of Yunnan (Xue, 1984). Consequently, Yunnan's shortage of arable land and its lack of accessible forest resources greatly intensifies conflicts between the demands of the human population on its natural resources and the conservation of those natural resources.

3. Traditional Practice of Community Forestry in Yunnan

During several thousand years of agricultural production in Yunnan, local people have developed many effective methods of cultivation. The following are the major types:

3.1 Trees for Commercial Non-Timber Products

Originally for self-consumption, the native people traditionally planted trees for fruits, spices, oils and fibres near their houses or on the corners of their fields. Through selective breeding of varieties which adapted most successfully, some areas gradually became known for particular local products. For example, Funing county is today one of the major anise-producing areas of China. Although the county's yield of anise ranks second in China, its quality is ranked first. However, it was not until 1675 that the first anise tree was introduced into Funing by a refugee from Guangxi province. It thrived in the county and the scattered plantings developed into mass production. The county is also renowned for its anise by-products. Similarly successful local products in Yunnan are Baozhu pear, Mixiang pear, Hongxie pear, Dapao walnut, early maturing chestnut, Fengdong orange, Zhongpai orange, seedless persimmon, Diao plum, sweet pomegranate, sour pomegranate, Yanshui pomegranate, Nuomi pomegranate, three-year mango, fingered citron, prickly ash, tung oil, lac, natural silk, palm fibre, lacquer, etc.

3.2 Home Gardening

Home gardening is a traditional activity in the villages of Yunnan. Fruit trees, bamboos, spice trees, vegetable trees (for example, the sprouts of Chinese mahogany *Toona sinensis* from which a delicious dish is made from a traditional recipe) and other trees are commonly cultivated in the gardens. Dai people are particularly successful in managing their own gardens. They often plant trees, shrubs, vegetables, vines and epiphytes together in one patch of ground, each plant positioned to make the most efficient use of the sunlight. It is possible for home gardens to meet all the needs of the local people for fruit, wood, vegetables, spices, flowers, medicinal herbs, etc. (Yu et al., 1985).

3.3 Fuelwood

Dai people have traditionally cultivated the senna tree *Cassia siamea* for the production of fuelwood. At five years old, a tree can be pollarded with a stump of 0.5-1.5 m remaining and it will sprout two to three new shoots the following year. Then shoots can be cut from the tree for fuelwood at three yearly intervals. One stump at between thirty and fifty years of age has over twenty shoots. Dai people usually divide a block of senna trees into three sectors so that they can rotate the collection of fuelwood each year. Some Dai people originally cultivate senna trees for timber and then switch to their use for fuelwood.

Many other minority groups are experienced in managing natural fuelwood resources. They identify the trees which provide good fuelwood and ensure that these remain dominant in their woodlands.

3.4 Village Woodlands

In rural areas of China, there are widely held beliefs that the forests guarantee favorable weather and bumper harvests, and that the trees ensure the prosperity of a village or community. Tree covered hills around a village are often called “dragon hills” or “holy hills”. In Chinese folklore, “dragon” is a monster that takes charge of rainfall. Another kind of protected woodland near villages is called “water source forest”. These woodlands help to maintain a continuous supply of water flowing into the villages and farmlands. Therefore, villagers always ensure that great care is taken of the local woodlands. The indigenous knowledge of trees and the traditional management of woodlands have ensured that woodlands have flourished near villages for thousands of years. Unfortunately, a lot of

protected woodlands were destroyed during the “Cultural Revolution” when beliefs associated with them were seen as a kind of feudal superstition.

3.5 Agroforestry

Agroforestry is an ancient practice which has existed for several thousand of years. In China, there are well-known examples of the intercropping of both *Paulownia* trees- and Chinese wood oil trees with crops. A less well-known example is that of the intercropping of alder trees *Alnus nepalensis* and upland rice which has been practised in the south-western part of Yunnan for several centuries. In this system, upland rice and alder trees are intercropped in the first year. After the rice harvest, the alder trees are left to grow for fuelwood and for supply of green manure. Usually the alder trees can provide green manure of 5-2.5 tons per ha. by the fifth year. After seven to ten years, the alder trees can be felled for timber and fuelwood and the next rotation of crops and trees can commence (Xue, 1984). Besides providing timber and fuelwood, the nitrogen-fixing capabilities of alder trees are beneficial for soil fertility. This system is very similar to the “Taungya System” first practised in Burma.

In central Yunnan, soybean, maize, wheat, buckwheat and radish are traditionally intercropped between rows of pine trees *Pinus armandi* for the first two or three years, after which the pine trees continue to be managed alone for timber. The edible seeds of the pine trees are also popular at the markets where they are sold. In addition, space and sunlight are used effectively in orchards, where various winter crops are planted under • deciduous fruit trees.

In Southern Yunnan, the local people cultivate tea bushes under natural forest. Ethnic minorities, such as Jino, Hani and Dai people have practised this kind of agroforestry for at least 400 years. In Menghal county, there are intercropped camphor-tea plantations (*Cinnamomum porrectum* + *Camellia sinensis* var. *assamica*). It is believed that the oldest tea bush in this area is over 800 years old. In the beginning, the Dai people occasionally planted tea seedlings under the natural camphor forests. Then they found that the most successful method was to create artificial mixed forests by intercropping camphor seedlings in the tea plantations. To date, more than 1,200 ha. of camphor-tea plantations have been established. Farmers can get 0.8-0.9 tons of tea and 0.2-0.3 tons of camphor from one ha. of camphor-tea plantation. In addition, the chemicals secreted by the .camphor trees protect the tea trees from

pests, resulting in higher quality leaves and shoots (Zou, 1995).

In South and South-east Yunnan, a shade-loving spice and medicinal plant, Tsao-ko, *Amomum tsao-ko* is widely cultivated in the forests near streams at an altitude of 1,000-1,500m. The Tsao-ko fruit is harvested in the third year and provides a good income. It is thought that this type of cultivation has been practised for over 300 years (Zou, 1991).

3.6 *Non-Timber Products of Forests*

A rich knowledge of the non-timber products of forests, such as edible mushrooms, wild fruits, wild vegetables, bamboo shoots, spice and medicinal herbs, is held by almost all nationalities living in the forest areas of Yunnan. Other non-timber forest products include raw materials such as tannin, lac, aromatic oil, resin, cork, gum, fibre, dyes, starch, forage and green manure. In the spring of 1995, a research team led by Zhuge Ren conducted an investigation at the local vegetable markets in Dehong Prefecture of South-west Yunnan and collected 56 kinds of wild vegetables in this single season, including trees, shrubs, vines and herbs. Some of these wild vegetables have been introduced into home gardens, for example, *Erynigium foetidum*, *Solanum indicum*, *Oenanthe javanica*, *Gynura crepidioides*, *Acacia intsia* var. *caesia*, *Houttuynia cordata*, *Solanum nigrum* var. *photeinocarpum*.

Another interesting aspect is indigenous knowledge of natural food additives and dyes. Dai people in South Yunnan mix the pollen of *Gmelina arborea* with glutinous rice to steam yellow-colored “Babe Cake” for their New Year Festival. The flowers of *Buddieja officinalis* are widely used by the minorities in Yunnan as a food colouring. One plant used for food colouring, *Peristrophe baphica*, changes its color from red to purple or black depending on the ash content of the plant. Yao people in South and South-east Yunnan use dye from this plant to colour rice for the celebration of their grand “Panwang Festival” (Tao et al, 1993).

3.7 *Handicrafts Based on Forest Products*

People from twenty-six different nationalities live in upland Yunnan and over thousands of years, the various cultures have developed a variety of arts and crafts based on the rich resources of the land. Handicrafts based on forest products are commonly found in the countryside. The best well-known of these are Jianchuang wood carvings, Tengchong rattan wares, Dali wood-marble furniture, Heqing white tissue paper and Dali knot-dyed cloth (APCYP, 1990).

As far back as the Ming Dynasty (A.D. 1368-1644), Jianchuang wood carving was renowned throughout the country. The artisans from Jianchuang county were selected to build the Beijing Imperial Palace. In the Qing Dynasty (A.D.-1644-1911), the famous Yunning Palace (destroyed by the Eight-Power Allied Expedition in 1900) was an outstanding example of the exquisite craftsmanship of Jianchuang artisans. Many ancient temples in Yunnan still preserve the consummate artistic handicraft in classical Chinese style of the Jianchuang carpenters who participated in their construction.

Tengchong county was renowned for its rattan wares during the Song Dynasty (A.D. 960-1279). “Teng” in Chinese means “rattan” and “chong” means “pass”. The hand-made rattan wares of Tengchong are both beautiful and durable. The high quality raw materials come from the native rattan plants, *Clamus spp.* and *Daemonorops margaritae*.

Dali wood-marble furniture is made by hand using local timber and marble. Tables, chairs and beds are decorated with wood carvings of flowers and birds and embellished with the natural patterns of the marble. Natural Chinese paint is used on the surface of the furniture.

The white tissue paper of Heqing county was in common use during the period of the Dali Kingdom (A.D. 937-1253). This white, soft and durable paper, made from the strong fibred bark of the daphne tree, was one of the earliest artificial papers.

Dali knot-dyed cloth uses dye from the cultivated “blue-dye plant”. White cloth is tied and sewn according to the pattern desired, then it is dyed in a vat and finally rinsed well to get the special print effect.

The abundance of natural resources of bamboo in most parts of Yunnan has led to the development of crafts utilising the bamboo for hand-made wares, for example, Eshan bamboo work. In addition, a market has been developed in processed bamboo shoots - dried, slivered, pickled and so on - and Zhaotong Qiongzhueta bamboo shoots and Xishuangbanna sweet bamboo shoots and pickled bamboo shoots are well known in the province. ,

4. Community Forestry, a Solution for the Present Problems of Yunnan

An area of about 346,000 km² of the province is mountainous and contains a population of some 25 million people. Over the past decade, the increasing pressures from harmful agricultural practices, such as shifting cultivation, cropping on steep slopes and so on, have

led to a significant worsening of the ecological environment in Yunnan's mountainous areas. Introduction of community forestry to such areas could well alleviate these problems. Furthermore, the development of community forests in Yunnan is seen as essential if the urgent problems of desertification of dry-hot river valleys, reduction of biodiversity, environment deterioration and rural poverty are to be solved.

4.1 Diversion of Shifting Cultivation

Shifting cultivation, or slash and bum agriculture, produces food by simple techniques and minimum use of labour. It has been practised effectively by the upland local people for over ten centuries under conditions involving low population density and rich forest resources. It is still practised in some remote areas of South Yunnan. However, with the current increase in population and decrease in forest areas, shifting cultivation has become a problem which is threatening the limited natural resources of Yunnan. Government attempts to control the practice by legislation have generally been unsuccessful. Since forests provide local people with items to meet their basic needs, an alternative means of providing support must be found before the inhabitants can be persuaded to change their way of life. Community forestry encourages local people to depend on permanent forest land for their livelihood and conserves forest resources. The most successful way is to replace the simple agricultural system with a mixed productive/economic system and to introduce trees of commercial value as a complement to food production. For example, the local people living in a mountainous Aini village have practised shifting cultivation for many generations. In 1976, they were given help to establish a tea garden and as a result, their tradition of shifting cultivation has, gradually changed. For nearly twenty years now they have lived on the same land in order to manage the tea garden and their living conditions have quickly improved (Long, 1985).

4.2 Restriction on Steep Slope Cropping

The cultivation of grain crops on steep slopes is a major problem in upland Yunnan. In Nujiang prefecture of West Yunnan, 42.2% of ploughed land is on slopes in excess of 25 degrees; the Yangtze River valley of North Yunnan also has about 40% of its ploughed land on slopes exceeding 25 degrees (He, 1991). In some places, people even cultivate grain crops on slopes of 50 degrees. Today, the pressure of the increasing population on the land is leading to slope cultivation in most areas of the province.. In addition, the lower productivity of steep slopes compared to flatter land requires the utilisation of a larger area of such land to

produce the required yield from grain crops. Soil erosion, mountain torrents, mud-rock flows, landslides and collapse of embankments frequently result from steep slope cultivation.

In the Yangtze River area of Yunnan, an ongoing project to establish protected forests is now addressing the reforestation of steep slopes. The main problem is to continue to satisfy the population's requirement for arable land when such plan is put into practice in a highly populated area. A successful technique for slope cultivation which could be considered is agroforestry. This technique involves the planting of multipurpose trees along the terrace ridges with crops being planted in the "alley". By this means, not only can people obtain food, fuelwood, fodder and other living materials, but the tree lines help prevent soil erosion. In addition, if nitrogen-fixing trees are cultivated, this will improve the fertility of the soil. Where such an alternative is offered, it will be much easier to reforest the steep slopes, than by merely forcing people to stop the cultivation of steep slopes.

4.3 Reforestation in the Dry-Hot River Valleys

Over 800,000 ha. of dry-hot river valleys are scattered along the Yangtze River, the Mekong River, the Salween River and the Song Hong River. The primary forest vegetation of these areas has been utterly destroyed and today it has been replaced by savanna-like woodland. The dry-hot climate of the dry season causes water shortages for living things and for farming, yet the heavy rain of the wet season frequently washes the soil from the bare land. From the 1950s through to the end of the 1970s, local governments adopted programs for the mass afforestation of these areas using both pine trees and broad leaved trees, but all failed (Du, 1994).

Actually, there are many plants, both native and domesticated, which adapt well to the unique ecological conditions of the area. . Coffee, mango, pear, orange, pomegranate and tamarind *Tamarindus indica* are commonly planted in the dry-hot habitat; *Phyllanthus emblica*, *Ziziphus mauritiana*, *Jatropha curcas*, *Calotropis gigantea* and *Dodonea viscosa* can be used as industrial raw materials; *Acacia farnesiana*, *Bombax malabarica*, *Bischofia javanica* and *Ficus lacor* grow quickly; *Toona cilicata*, *Schima wallichii* and *Pistacia chinensis* produce high quality timber. The exotic multipurpose trees, such as *Leucaena leucocephala* and *Eucalyptus spp.* are cultivated everywhere and are well received by the local people. In addition, the introduction of tropical crops into these areas has proved very beneficial and many spring or summer vegetables can be grown in winter due to the high winter

temperatures. It would also be advantageous to develop agroforestry systems by intercropping trees and crops or vegetables in the lower valley and to plant native cash trees or shrubs for reforestation of the slopes above the valley.

4.4 Conservation of Biodiversity

Yunnan is famous for the abundance of its species of animals and plants. It contains 1,638 species of vertebrates, 261 species of mammals, 779 species of birds and 13,000 species of insects. Of these, 164 species of wild animals are regarded as rare and endangered and are under protection. There are about 14,000 seed plants, of which 5,300 are trees. 145 rare and endangered plants have been listed in the first edition of the State Red Data Book. Since 1981, Yunnan has established 105 natural reserves covering over 2 million ha. However, shifting cultivation, the use of woodlands for crops and felling of trees for fuelwood have been threatening the conservation of biodiversity in the protected areas. Moreover, only about 70% of those botanical species has been included in reserves. The other 30% of those species are at present surviving outside reserves. According to an inventory of forest resources in the province, during 1985-1992, the area of woodland decreased at the rate of 50,000 ha. per year. Inevitably, if this rate of decrease continues, many living species will eventually disappear. The best method for conserving the biodiversity is to develop rural industries and handicrafts to release people from the land and, at the same time, increase production of forest resources in order to meet the demands of local people for them. The development of community forests fulfils these requirements.

4.5 Improving the Agricultural Environment

According to official statistics, during the period 1950-1990, there were 297 disasters involving mud-rock flows, landslides and other types of geological destruction in Yunnan. As a result, 14,000 ha. of farmland were destroyed resulting in a reduction of 14.51 million kg in grain supplies (Liu, 1993). This decade has seen an increased frequency of major droughts and floods. Serious soil erosion now extends over an area of 140,000 km² (Kang, 1991). Deforestation is the link between increased soil erosion, desertification, reduced water supplies, mud-rock flows, landslides, drought and flood. Forests are the basis of mountain agriculture. It is clear that any measures other than reforestation will only alleviate the symptoms of the "diseases". But reforestation can no longer be undertaken by the simple government initiative of mass plantings. The traditional method of reforestation is centred on

the establishment of large tracts of forest land, usually including few tree species. The essence of the modern community forestry is that it considers the needs of each individual and community in reforesting a region, which is where it differs from traditional forestry. The current project establishing the Yangtze River Shelter Forests in Yunnan has involved a massive labour force, considerable material resources and the expenditure of large sums of money. Little attention has been given to arousing the enthusiasm of the local people and to utilising their initiative. If the ideas of community forestry are to be incorporated into the project, the prime consideration in plans for reforestation and selection of trees must be the needs of the local people.

4.6 Poverty Alleviation

In Yunnan today, nearly 7 million people, or one-sixth of the total population, are classified as living in poverty. Serious poverty occurs in mountain regions in 72 counties containing over 3,500 communes (administrative villages). In poor areas, the traditional agricultural economy usually involves food production depending solely on cropping systems with simple techniques, and extended areas of cultivation giving poor yields. It is exactly as described by Dr Nancy Peluso (1988) in her famous PhD dissertation: "Rich Forests, Poor People...". Forestry policy also has a critical influence on the economy of rural areas. In China, all large forests belong to the state and local people are regarded as outsiders to be excluded. Even in the 1990s, many reports can still be found in official documents regarding the hostilities between government and local people concerning the use of forest resources.

Rural poverty has complicated roots some of which are linked with local conditions and customs and hence any solution requires integrated measures. Community forestry focuses on the coordination of forest resource management and use in conjunction with local people, thus diminishing conflict between the government and the local people. Furthermore, community forestry is designed to take account of the cultural and economic activities of local people and help them to select the best options for the development of mixed land-use systems.

5. Perspectives on Community Forestry in Upland Yunnan

Upland Yunnan has similar natural and social conditions to those of the countries of South and South-east Asia. Therefore, concepts and methods of community forestry being applied

in these countries can also be introduced and developed in upland Yunnan. In fact, initial results from the practice of community forestry have been very good.

5.1 Adjustment of Development Policies

The provincial government of Yunnan has recently adopted a development plan for the economy. The tobacco industry, which is currently the cornerstone of the province's economy will be gradually replaced by industries based on forestry, flowers and plants, tourism, sugar, tea, and processing industries. In China's ninth "Five Year Plan" starting in 1996, the alleviation of poverty and the exploitation of biological resources will be a prime focus. The Eighteen Exploitation Projects of Biological Resources mainly include the comprehensive utilization of forest products and economic plants as a basis for rural development.

Tourism is a new and expanding "smokeless industry" in Yunnan. At the end of 1992, the development of tourism became one of the most important items on the agenda of the provincial government and soon afterwards, special policies for promoting tourism were instigated. In October 1994, the provincial government convened a province-wide Tourism Program meeting in Lijiang, a city in North-west Yunnan. At the meeting, the governor of the province requested that the speed of construction should be increased for communication facilities, such as high-grade highways, new main line railways, new airports and other tourist infrastructures. Along with community forestry, tourism may provide a basis for conservation of natural resources. Tourism can contribute significantly to rural development and yet be environmentally friendly.

5.2 Education

Since the end of the 1980s, Yunnan has sent dozens of researchers abroad to study community forestry and other areas related to rural development. Most of them have now resumed work in these fields. In addition, several training courses for community forestry and agroforestry, sponsored respectively by the Ford Foundation (FF) and the Worldwide Fund for Nature (WWF), have also been conducted at various academic institutes in Yunnan. The Southwest Forestry College offers a course in community forestry. One of the aims of the FF supported project is to train government officials and foresters "on-the-job". As a result of the training of policy-makers and forestry technicians in community forestry, it will be much easier to introduce concepts and methods of community forestry- into traditional forestry

activities. The 1995 academic year saw the introduction of a three year course in community forestry at the Southwest Forestry College. All students accepted for enrolment have at least two years' experience in the forestry branch of the Ministry of Forestry and they will return there after completing their studies. Subjects from the community forestry course are also available to students completing other specialisations at Southwest Forestry College.

Plans for technical training for farmers are going ahead. The provincial government is sending scientists and technicians to poor areas to help educate local farmers in improved agriculture and forestry techniques. It is hoped that this will help to alleviate the poverty of seven million poor people.

5.3 *Potential of Natural Resources for New Uses*

To date, only a few hundred species of plants have been cultivated in upland Yunnan, but thousands of wild plants, from which fruits, oils, tannin, fibre, starch, gum, resin, lac, dyes and drugs can be obtained, remain to be exploited. For example, according to recent research, there are 28 genera and 215 species of bamboo widely distributed in Yunnan, but only a few have traditionally been utilized. The researchers at the Bamboo Research Institute at Southwest Forestry College, have developed processing techniques for local factories to enable them to produce plywood and plywood flooring from a variety of bamboos. They also developed a new technique for preserving bamboo shoot products. This has improved the economics of large scale production of bamboo shoot products and has brought profound changes to mountain regions. Another example is the production of soft drink from the wild plant, *Phyllanthus emblica*, which is found as a small tree in most parts of the province. During the 1980s, scientists discovered that the fruit of *Ph. emblica* is rich in vitamins and also contains a beneficial amount of selenium (Se), which can help to protect the human body against carcinogens. Since then, large investments have been made in rural areas in the production of *Ph. emblica* and soft drink products based on it. It has become a very important source of income for some rural communities.

The province of Yunnan has six state nature reserves, 99 local nature reserves, 17 national forest parks and over one hundred local forest parks. These reserves and parks represent diverse patterns of forests, ecological systems, climates and geographical conditions. Most of these are located in rural areas remote from cities and have been opened, or are to be opened, for forest recreation. Tourism in rural areas can bring many benefits: first of all, economic

prosperity from tourism can bring improvements to local communications and to the rural economy. Secondly, the varied commercial demands of tourists can propel minority groups into a commercial world and make them less dependent on subsistence activities. Tourism and rural development will be closely connected in the future of upland Yunnan.

5.4 Exploration of Indigenous Knowledge

It has been found that the traditional practices of community forestry which have been developed in local areas by local people are most successful. In addition to providing local people with supplementary incomes, cash tree planting and home gardening, community forestry provides a basis for cottage industries and handicrafts, leads to increased food production thereby assisting rural development. Traditional local products, especially handiworks of minorities, such as Dali knot-dyed cloth, Banna Tongpa (a small satchel made by the Dai people) and so on, are very popular purchases by tourists. It is an important undertaking to find and develop products with local characteristics.

Fuelwood from village woodland management will relieve the threat of insufficient energy for cooking and community forests can also help meet the demands of local people for wood for the building of houses and the production of furniture. The successful Taungya system in upland Yunnan is particularly practicable for the upland cultivation systems. Multi-purpose trees not only retard soil erosion and improve soil fertility, but also supply fodder, fuelwood, timber of short length and other forest by-products for local people. In developing community forestry and village silviculture it is of great importance to tap indigenous knowledge about traditional production practices involving trees.

5.5 Extensive International Cooperation

The natural advantages and special geographical position of Yunnan province have attracted much attention from international organizations in the past decade. The FF, WWF, World Bank, FTTP, UNFAO, UNESCO, IDRCC, RECOFTC, VSO, ICRAF, CARE, WINROCK and many universities in the developed countries, such as the United States, Canada, Australia, Germany, Britain and Holland, have all been involved directly or indirectly in projects concerning rural development of upland Yunnan. Government departments, research institutes and universities of Yunnan have worked with these international organizations towards the goal of poverty alleviation. As time goes by, we believe that many more international organisations or individuals will be willing to participate in the development

programs of upland Yunnan.

6. Concluding Comments

Community-based forestry has the potential to remedy unsustainable land-use practices in much of upland Yunnan and can help alleviate poverty in many areas. In fostering community forestry, it is important to take account of indigenous knowledge about land-use involving trees and create mixed (ecologically balanced) land-use systems drawing on the traditional practice of community forestry in parts of Yunnan. Unlike in the case of traditional state-based forestry where local communities have mostly been ignored, consultation with and responsiveness to the needs of the local community are paramount in community-based forestry. Because of their lack of attention to local communities, many state-sponsored reforestation schemes are in danger of failing and are creating much rural hostility.

Community-based forestry can have many favourable environmental and social effects: It can divert farmers from practicing shifting cultivation, reduce environmental problems arising from the cropping of steep slopes, help the afforestation of dry-hot river valleys, conserve biodiversity, and generally improve environmental conditions for the practice of agriculture, and, as well can alleviate much poverty. Community-based forestry together with rural oriented tourism can help provide a basis for sustainable development in upland Yunnan. Programs for educating the rural people in Yunnan about new sustainable land-use practices are increasing the likelihood of such developments. Furthermore, international co-operation and recent progress in community forestry and in ecotourism at Southwest Forestry College are bringing these goals closer to fruition.

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