MANAGEMENT RECOMMENDATIONS FOR CONSERVATION OF THE GUIZHOU GOLDEN MONKEY AND THE BIODIVERSITY OF FANJING MOUNTAIN RESERVE

William V. Bleisch
Wildlife Conservation Society
185th Street and Southern Blvd.
Bronx, New York 10460

Working Paper No. 1

September 1993

MANAGEMENT RECOMMENDATIONS FOR CONSERVATION OF THE GUIZHOU GOLDEN MONKEY AND THE BIODIVERSITY OF FANJING MOUNTAIN RESERVE

September 9, 1993
William V. Bleisch, Ph.D.
The Wildlife Conservation Society
The Bronx, New York

Note for Reviewers: This report is intended to be circulated internally within the Chinese Forestry Ministry and Guizhou Provincial Forestry Department. It is not for publication. Since this document is intended for internal distribution, please do not copy or quote without the author's express permission.

The opinions and recommendations expressed in this report are the author's own. They are the result of discussions with many people in Guizhou Province and elsewhere, but they do not necessarily reflect their views.

I. MANAGEMENT RECOMMENDATIONS

EXECUTIVE SUMMARY: Fanjing Mountain Reserve is an important part of China's network of natural protected areas. It protects a nearly pristine area of endangered subtropical forest, which is home to several threatened or endangered animals and plants. One of the most important reasons for establishment of the Fanjing Mountain Reserve is that **it is the only remaining habitat for the critically endangered Guizhou golden monkey (*Rhinopithecus brelichi*).**

The habitat for this animal is montane subtropical forest between 1,200 and 2,100 meters elevation. Individual monkeys range over more than ten square kilometers of habitat and apparently need a large area of intact forest to survive throughout the year. While hunting with guns is no longer a serious threat to these animals, snares set for other wildlife in the reserve may still kill monkeys. However, **the main threat to the survival of the Guizhou snub-nosed monkey is the continued destruction of their forest habitat within the reserve.**

Fanjing Mountain is located in an area of China with a very low per capita income. The park is home to over 1,000 families and it is surrounded by villages on all sides. Many local people obtain most of their cash by producing charcoal within the reserve's buffer zone, by collecting medicinal plants and, sometimes, by poaching protected timber or wildlife. With limited resources and training and spotty cooperation from local authorities, the management of the reserve has not been able to cope with these pressures. Hunting is increasing and is now endangering the continued existence of some animal species in the reserve. **Destruction of forest in Fanjing Mountain has now reached the level of a crisis.**

Fanjing Mountain Reserve has the potential to be an important part of the world's network of natural protected areas and to serve as a refuge for a viable population of wild Guizhou snub-nosed monkeys. However, this will be possible only if there are changes in the

management of the reserve. In particular, we recommend that the Reserve Management undertake to implement the following recommendations.

1) **The core area of the reserve should be protected from all anthropogenic disturbance.** Gradually, **all habitat for the Guizhou snub-nosed monkey should be added to the core area,** including areas of forest at lower elevations which are now in the buffer zone.

2) **More action should be taken by the reserve management to stop deforestation and poaching within the reserve,** with educational campaigns and with vigorous enforcement of existing regulations.

3) **Strengthen cooperation with local government and the courts.** Enforcement of the regulations cannot be effective without timely and certain punishment for violators.

4) To decrease the over-utilization of forest resources in and around the reserve, **local people should be assisted in moving out of the buffer zone,** with job training and help in overcoming restrictive residency permit requirements.

5) To discourage deforestation and poaching, **charcoal production within the Reserve should be phased-out and pilot programs that provide local people with alternative sources of income should be initiated.** These programs could include training for local people in service jobs supporting the growing tourist industry around the reserve, and training in techniques for cultivation of medicinal herbs and fruit crops. If successful, these programs should be disseminated within and around the reserve.

A. FANJING MOUNTAIN NATURE RESERVE: BACKGROUND:

Fanjing Mountain Reserve is situated in the Wu Ling Mountain Range at about 108°E, 29°N (Fig. 1). It lies 15 hours by road from Guiyang, the provincial capital of Guizhou Province. The reserve is a forested island in a sea of cultivated land in the poorest district in the province of Guizhou, which, on a per capita basis, is the poorest province in China. The reserve consists of 41,355 ha of mountainous terrain. It spans an elevational range from below 800 to 2,570 meters above sea level and includes at least four peaks over 2,000 meters. Vegetation includes evergreen-broadleaf, mixed-broadleaf and deciduous-broadleaf forest. Above 2000 meters there is coniferous forest in some areas. Details of the geology, climate, flora and fauna are contained in two collections of research papers on the reserve published in 1982 and 1987[1]. These detailed reports will not be reviewed here.

Fanjing Mountain Reserve is managed by the Chinese Ministry of Forestry through the Guizhou Provincial Department of Forestry. The reserve has a core area of less than 26,667 ha and a surrounding transition area or buffer zone of over 14,688 ha. The Reserve Management Staff includes over 80 managers and guards under the direction of Professor Yang Yeqing. Three Reserve Management Centers and over ten Reserve Management Stations have been constructed on the boundary of the reserve. At various times, there have also been up to eight full-time researchers working in the Reserve Management as special staff, all working on various aspects of wildlife research.

Fanjing Mountain Reserve is important habitat for many protected species, including the endemic Fanjing Mountain fir, (*Abies fanjingshanenesis*), found only in this reserve. Other species of special interest include Tragopan pheasant (*Tragopan temminckii*), leopard (*Panther pardus*), clouded leopard (*Neofelis nebulosa*), black bear (*Selenarctos thibetana*), giant salamander (*Megalobatrachus davidianus*) and dove tree (*Davidia involucrata*). Cathay tigers (*Panthera tigris cathayensis*) survived in the reserve until 1981, when the last one was shot. One of the main purposes for establishment of Fanjing Mountain Reserve was to ensure the survival of the endemic Guizhou snub-nosed monkey (*Rhinopithecus brelichi*). This unusual animal, discovered only in 1903 and almost unknown to science until as late as 1979, is found only in Fanjing Mountain Reserve.

The reserve was established in 1978, but it has already achieved international recognition because of its importance in conservation of biodiversity. In 1982, Fanjing Mountain Reserve was added to the system of Man and the Biosphere Reserves.

Beginning in 1990, as a partner in the Joint Chinese-American Guizhou Golden Monkey Project, I began a two-year, intensive field study of the ecology and conservation status of the critically endangered Guizhou snub-nosed monkey. During the course of this study, I also made observations of reserve management tactics and problems. The recommendations below are the result of these observations.

B. SPECIFIC RECOMMENDATIONS:

1) Continue monitoring of the population of Guizhou snub-nosed monkeys

The Guizhou snub-nosed monkey has several unique behavioral attributes (large bands, large home range, fission-fusion social system) which make accurate census of this species difficult and time-consuming, requiring large numbers of workers. However, continued monitoring of the population in the reserve is essential for good management. Censuses should be repeated at least every three years, or more often if funds allow, the next one scheduled for 1994-95[2]. Only in this way can reliable data on population sizes and changes be generated.

2) Protect resources critical for survival of the monkeys

Since magnolia flower buds may be a critical resource for the monkeys in winter, harvesting of buds by villagers should be stopped immediately. Guards should patrol the reserve at all times, but especially during the critical fall months when magnolia buds are harvested. A few highly publicized arrests and an educational campaign could solve this problem.

3) Improve capacities for site planning and impact assessment

Periodic reexamination of the zoning of the reserve and the status of biodiversity within it are a necessity for good management planning. This will require that management staff receive more training in wildlife survey techniques and conservation management.

4) Close mines in the core area

All mines within the reserve core area should be gradually closed, with closures beginning as soon as possible. Miners should be relocated outside of the core area.

5) Arrest outside poachers and initiate new education campaign

The wildlife poachers among the miners should be arrested, prosecuted and punished. This should then be widely publicized as part of an educational campaign to discourage poaching of wildlife and timber. Management must act rapidly to discourage other people from imitating the few law breakers.

6) Fine or relocate local poachers

Effective enforcement requires that the courts support the Reserve Management by punishing poachers swiftly and with reasonable certainty. Selective relocation of repeat-offender poachers could be a very effective way of decreasing pressure on the reserve's forests, while improving compliance with regulations.

7) Encourage villagers to resettle outside of the reserve

The Reserve Management should provide financial and logistical help to villagers who voluntarily choose to move out of the reserve buffer/transition zone. In particular, help in changing residency permits and in job training should be made available.

8) Improve schools around the reserve and encourage attendance

To increase the alternatives of local people and to decrease the rate of human population increase, primary and secondary education should be improved. Education should be made compulsory through grade school for all children, including girls. Education through middle school should be encouraged with grants to cover teachers fees, textbooks and lamp oil for night classes.

9) Expand anti-poaching patrols in core area

Special attention should be focused on enforcement of regulations prohibiting logging and wildlife poaching in the core area, since this is now the only place where most wildlife and ancient trees can be found. In order to stop the illegal felling of ancient trees before it is too late, patrols must be sent deep into the core of the reserve. These patrols can also harass and arrest wildlife poachers, protecting the reserve's beleaguered populations of bears, serow and deer.

10) Build guard huts on core area boundary

Guard huts should be built at strategic points on the boundary of the core area. These can be simple structures, costing no more than 5,000 yuan each (about $1,000. See Fig. 2). They should be manned by one or two men, with guards stationed in them on a rotating basis. Regular patrols along the boundary of the core area should also be instituted. Guards could travel from guard hut to guard hut along the trails which demarcate the core area.

11) Assess impact of tourism

A thorough assessment of the impact of tourist development on the reserve's natural resources, plants and wildlife should be undertaken as soon as possible. Further development for tourism should be delayed until this study is completed and

recommendations can be made. Particular attention should be given to an assessment of the impact of road building on the "wawa yu" giant salamander (*Megalobatrachus davidianus*) and the effect of tourists and religious pilgrims on the cloud forests around Jing Ding Peak.

12) Provide alternative fuel for tourists

Fuel must be provided for the cooking and heating needs of tourists, pilgrims, monks and hotel staff. At present, all visitors to the peak burn dead wood collected from the area around the peak. The increase in visitors means that the fuel needs will greatly exceed the amount that can be provided by this slow growing forest. Coal should be provided, at cost, to the hotels, and the use of wood fires should be prohibited.

13) Advertise reserve for international tourists

Once an assessment of the impact of tourism has been completed, an advertising campaign might be initiated to attract high-spending foreign tourists to the reserve. The editors of the Lonely Planet guide book and other guides to China should be notified that the reserve is open to foreign tourists and provided with information that can be included in guidebooks.

14) Institute admission fees and a fee schedule for transportation and guides

Foreign visitors (including scientists) should be charged to enter the reserve core area at a rate of about U.S. $10 per day. Chinese visitors should also be charged a modest entry fee of about five yuan per day. A schedule of fees for services should also be decided upon. Revenue from fees and concessions should stay in the reserve to be used for the protection of the reserve and the upkeep and improvement of visitor facilities.

15) Decrease litter on trails and at rest houses

Simple signs instructing people not to litter and a few well-placed litter bins should be installed on tourist trails. Litter bins should be emptied regularly and trails should be kept clean. Litterers should be fined.

16) Assist local people in finding jobs in service industries

Jobs as porters, guides and as service people for hotels and restaurants should be given to people living in the reserve whenever possible. Those who are caught poaching timber or wildlife should loose their privileges of working in the Reserve.

17) Build conservation education exhibits

Tourism to nature reserves provides an invaluable opportunity for conservation education. The new reserve visitor center and museum in Jiangkou should emphasize the conservation message, explaining with a few words and with many pictures and displays what the reserve protects and the importance of nature conservation[3]. Simple exhibits explaining what the visitor might see in an area should also be placed at strategic points along the route to Jing Ding. These exhibits will increase the visitors enjoyment of the reserve, while building appreciation of the need for protection of nature.

18) Protect all natural forest above 1200 m elevation

Special attention should be addressed to protection of natural forests at lower elevations (between 1200 and 1600 meters). All broadleaf forest above 1000 meters that is contiguous with the core area should come under the direct control of the reserve management. Regular patrols by forest department guards should be begun in these areas.

19) Phase out charcoal production in the reserve

Charcoal production for market in buffer zone areas should be gradually restricted and finally forbidden. To encourage people to use alternative fuels, the price of charcoal should be increased by taxation at the market, but not at the source. Tax revenue should be returned to the Forestry Department for reforestation programs. Alternative sources of fuel (such as coal) should be provided for surrounding villages and towns at reduced cost. At the same time, alternative sources of income should be found for those local people who now rely on charcoal production for cash.

20) Experiment with community control of buffer zone forest

Local control of community forests in the buffer zone may improve management of these areas since local people can be very effective in policing their forests once they are empowered to do so. However, if local communities are given control of forests in the buffer zones, this transfer of authority should be done only after village authorities are fully educated to the needs of conservation of watershed, timber and other resources. Constant monitoring by the reserve staff will be required to ensure that mismanagement does not occur.

21) Initiate reforestation campaign

The Forestry Department's Afforestation Bureau should target all three counties around the reserve for an intensive reforestation program. The goal should be to convert the extensive wastelands of hilly bamboo and bracken scrub in this area into productive forest. Local native species such as *Pinus massoniana*, *Cunninghamia lanceolata* and fuelwood should be planted. Agroforestry systems, with mixed plantings including fruit crops and medicinal

herbs, should be tried on an experimental basis. No existing forest should be replaced with plantations. Experimental projects with the contract responsibility system should be implemented. The entire program should be monitored to determine what succeeds and what does not.

22) Hold workshop on management of greater Fanjing Mountain management unit

A workshop (ganbu hui) should be held to consider the feasibility and desirability of expanding the buffer zone of the reserve. Representatives from the Forestry Department, from the local governments of Jiangkou, Yinjiang and Sungtao Counties and from the Provincial Government should be invited. The workshop should focus on the advantages and liabilities of expanding the buffer zone to include all forested land contiguous with the reserve and the entire upper watershed of the Da He River (Fig. 3). It should consider an integrated strategy for management of this greater Fanjing Mountain management unit. The meeting should discuss strategies for seeking funding for a program of integrated conservation and development projects for the management unit.

II. SUPPORTING INFORMATION

A. CONSERVATION OF THE GUIZHOU GOLDEN MONKEY:

At the time the Joint China-U.S. Cooperative Guizhou Golden Monkey Project was first planned, little information was available on the natural history of *R. brelichi*. Knowledge of the requirements of the species is essential to plan proper management of the species. We therefore concentrated our efforts on gathering basic information about this rare monkey in its natural habitat, studying how this species uses the forest, including what plant species are important food resources and how it ranges through the habitat. Our hope was that our research on the population biology, feeding ecology and reproductive biology of *R. brelichi* would help in efforts to conserve this critically endangered species.

General information about this species is contained in Bleisch et al., 1993[4] (attached). Information relevant to management recommendations is detailed below.

Population Biology: Although hunting and trapping of monkeys occurred widely in the past, these threats to the species decreased substantially after the reserve was established. This was probably the result of a vigorous effort to enforce regulations against hunting these animals, combined with an effective propaganda campaign. Based on their own field research, the Reserve Management reported in 1990 that the population of *R. brelichi* numbered about 800 individuals. Although we have not completed analysis of our field data, field work by our cooperative team suggests that the current population size is only slightly larger than this. The world population of *R. brelichi* is probably less than 1200 and may be less than 800, all in a single population.

Small isolated populations of animals may be endangered by processes of population biology even if there is no further disruption of their habitat or populations. Small population size can lead to demographic and genetic deterioration, starting the population down an "extinction vortex" of feedback effects between deteriorating genetic makeup, demographic parameters and fitness. Is *R. brelichi* in immediate danger from these problems?
Models of population processes can give some ideas about the magnitude of various threats to a population. I have modeled a population of long-lived, polygamous primates with a life history like what we expect to find for *R. brelichi*[5]. The result of this analysis indicates that, barring catastrophes, the wild population of *R. brelichi* should be able to maintain itself well into the future without intensive human management, provided that degradation of its habitat and hunting are controlled[6]. Thus, **captive breeding is not a high priority for the perpetuation of this species at this time, but protection of the wild population is essential, and should be given highest priority**[7]. The possibility of reintroduction of animals into the wild is often used to justify captive breeding schemes. However, there has never been a successful reintroduction of a viable population of higher primates from captivity to the wild, so protection of the wild population will always remain the single highest priority whenever it is possible.

Feeding Ecology: Partial lists of foods of *R. brelichi* have appeared in Chinese[8]. We are preparing a more complete list. To summarize, *R. brelichi* uses a large variety of resources, including young leaves of many species, leaf petioles (including *Fagus longipetiolata*, and *Acer* spp.), leaf buds, flower buds (*Cornus controversa* and *Magnolia* spp.), fruits and seeds (*Prunus* spp., *Dendrobenthamia* spp. and *Sorbus* spp.), bark and insect larvae. In general, the diet is not diverse in any one season, but the composition of the diet changes in a predictable way through the seasons of the year (Xie et al., in preparation.)

Although we have not yet finished analysis of our data on feeding, we have already found one disturbing finding. In fall and winter, snub-nosed monkeys appear to favor magnolia flower buds, although *Magnolia* spp. are not common in the forest. This suggests that magnolia flower buds are a critical component of the diet of the snub-nosed monkeys in winter, a season when monkeys may face a scarcity of nutritious food resources[9]. Unfortunately, these buds are also sought by local collectors, who collect the buds for their market value as a source of medicinal oils[10].

If magnolia flower buds are a critical resource for the monkeys, the new competition could have a detrimental effect on the monkeys' ability to meet their energy needs at a time of energy shortage. Lopping and felling of magnolias by bud collectors means that there may be a lasting shortfall of magnolia buds in years to come.

Critical habitat: *R. brelichi* live in flexible bands that at times include as many as 400 monkeys or more. These bands must range over a very large area to obtain enough food for all the animals. The home range of an individual monkey is over five square kilometers and may be as large as 35 square kilometers.

Monkeys do not use the full range of habitats available to them. Some areas of the reserve are used intensively in some seasons. Other large areas of forest are rarely used at all. We do not yet have an explanation for why the monkeys do not use some parts of the reserve. It may be that these areas do not contain as much food or other resources as those areas the monkeys do use. It may also be a historical effect, for example, if monkeys were extirpated from some areas by hunting in the past.

These monkeys use almost all the elevational zones of Fanjing Mountain Reserve except the very lowest valleys. We regularly find monkeys at elevations from 1200 meters above sea level to 2100 meters above sea level. Early reports that the monkeys did not use forest below 1500 meters were probably based on the fact that little forest remains below this elevation in many parts of the reserve.

Habitat destruction by local people is the most serious threat to the survival of this species. In most areas of the buffer zone, collection of firewood, timber and wood for charcoal production is occurring at unsustainable rates. As wood is removed from the forest faster than the remaining trees can regenerate, the forest is degraded. Eventually, only a scrub

dominated by dwarf bamboo, coarse grasses and bracken remains. Monkeys cannot survive in these degraded habitats.

Forest at the lower elevations of Fanjing Mountain is under the most severe threat from deforestation, since these forests are most accessible to villagers who live below (see below). Unfortunately, these lower forests may also be critically important for the survival of the Guizhou snub-nosed monkeys[11]. Although the monkeys do not use low elevation habitats often, it appears that the monkeys need to use low-elevation, sheltered habitats after severe winter storms. If these special refuges are destroyed by tree cutting, the population may be severely affected at some unpredictable time in the future.

Since establishment of the reserve, the rate of deforestation in the reserve buffer zone appears to have been increasing rather than decreasing. During the last four decades, deforestation and forest degradation caused by unsustainable harvesting in forests outside the reserve has caused an increasing demand for wood from inside the reserve, since few other sources of timber now remain.

B. MANAGEMENT OF HUMAN ACTIVITIES IN THE RESERVE

Protection of the habitat of the Guizhou snub-nosed monkey requires a consideration of the reserve in the context of the people who live in and around the reserve. These people constitute the main threat to the survival of this endangered species, and a long-term solution requires changes in their behavior. The Reserve Management and the Guizhou Forest Department should be actively involved in effecting these changes[12].

Decreasing over-utilization of resources: The more people who live within walking distance of the reserve, the higher the rates of utilization will be. Any decrease in the density of population in and around the reserve or in the rate of population growth, will benefit conservation in the reserve in the long run by decreasing the rate of utilization of the reserve's resources.

Methods to achieve this decrease include the direct methods of family planning already used throughout rural China (although, surprisingly, not in many areas in and around the reserve). Relocation of entire villages outside of the reserve has been used successfully at Fanjing Mountain Reserve and at other reserves in China, although this has been expensive.

Other means that have not yet been tried may be as effective as these direct methods. Relocation of entire villages is politically difficult and costly. Another means that may be as effective and would be much easier to implement would be to provide financial and logistical help to those who voluntarily choose to move out of the reserve buffer/transition zone. The system of fixed residency permits (*hukou*) prevents many people, especially young people, from moving out, even though they would if they had the choice.

Incentives to encourage education of all children, but especially girls, through high school could significantly increase the age at which girls begin to have children and decrease the population growth rate. At the same time, it would benefit the rural community. This has been a surprisingly effective means of population control in south India.

Mining: Recently several gold mines and crystal mines were opened or reopened in Fanjing Mountain Reserve. It is unfortunate that mining operations continue inside a nature reserve, since these activities are often incompatible with protection of biodiversity. Siltation and heavy metal pollution from current and previous mines have had a severe impact on most of the larger streams in the reserve.[13]

In one sense, the opening of these mines has also been an opportunity lost. The mines might have provided local people with an alternative means of earning cash, which could have discouraged them from cutting trees and making charcoal. Unfortunately, instead of providing opportunities for local people by helping them to get started in this lucrative business, the Reserve Management has allowed outsiders to come into the reserve to work the mines. These outsiders, from Guangxi, Hunnan and Guangdong, contribute little to the local economy and have significantly increased the destructive pressures on the reserve. Their needs for heating and cooking fuel come entirely from the reserve's forests, as do all the timbers for the mines. In addition, some of these men are reportedly dedicated wildlife poachers. They have introduced the non-selective and dangerous practice of using poisoned and explosive baits to kill bear and wild pigs.

Tourism: Development of tourism in the reserve is a special case of economic development that holds both perils and potential for conservation. If improperly managed, tourism can be very destructive to natural habitat, but if properly managed it can be an effective way of linking conservation and economic development. Because of its spectacular scenery, interesting history and abundant wildlife, Fanjing Mountain has great potential for attracting tourists. Visitors each year already number several hundreds, mainly from the local region, but occasionally from as far as Hong Kong, Japan and the United States. Once the airport in Tongren City is opened, Fanjing Mountain can be expected to attract even more tourists, many of whom could inject substantial money into the local economy.

Realizing the potential for the tourist industry to generate income for the local economy, the County of Jiangkou, working closely with the Forest Reserve Management, has embarked on an ambitious program of development of tourist facilities inside and outside the reserve. Much of the development has been done tastefully and with a minimum of destruction to the fragile forest and wetland environments of the reserve. However, other projects, such as road construction or expansion of hotel capacity within the core of the reserve, have required the destruction of substantial amounts of forest habitat and have had a heavy impact on fragile ecosystems. In the future, a detailed assessment of the environmental impacts of proposed projects should be done by the Forestry Department before a decision is made on approval, and less destructive alternatives should be considered[14].

From the point of view of the local economy, visitors from urban centers and from overseas are the most desirable portion of the tourist market, since they tend to spend more cash than local visitors. Attracting urban and foreign tourists will require advertisement and promotion of the reserve in publications, television and radio. Since Fanjing Mountain is still a relatively remote area, younger travelers may be the most appropriate market until transportation to the reserve improves.

Revenues from tourist entry fees can be an important supplement to the management budget for a park or scenic area. These revenues should be used to pay for the increased management expenses incurred by the added burden of policing tourists and protecting the reserve's scenic and natural attractions. Foreign tourists usually expect to pay fees of over $10 per day for entry to an outstanding national park or reserve, and higher fees for entry into fragile backcountry areas. If they know that these funds are used for protection of the reserve, most will be happy to pay this fee. Entry fees can also help convince visitors that the reserve is something valuable and worth protecting. However, entry fees for local visitors should be kept affordable, since these visits are an important way of increasing local understanding and support for the reserve's existence.
In order to attract high-paying foreign visitors, it is important to keep the standards of the reserve up to the level that these visitors are accustomed to and expect. This has already been considered in plans for new, more modern guest house facilities. However, garbage and litter on the trails and at the rest houses will give foreign visitors a bad impression of the reserve and of China.

Tourism will provide more benefit for protection of the reserve's forests and resources if the tourist industry provides jobs for people living in and adjacent to the reserve. Tourism can provide alternative sources of income that may enable local people to stop marketing charcoal, stolen timber and wildlife products. If employment is specifically linked

Enforcement: Enforcement within Fanjing Mountain reserve is poorly organized and ineffective. Patrols rarely if ever enter the reserve's core area. Despite widespread violation of the regulations, few arrests are made. When arrests are made, the courts are often lenient to those who are arrested. Violators often go free after paying only a small fee. Many local people actually complain about the lax enforcement, claiming that forest management of their communal forests in the buffer zones was better before the existence of the reserve[15].

Within the core area of the reserve, the situation is not much better. The reserve management stations are all outside the reserve's extensive transition zone. There are no reserve management stations actually inside the core of the reserve itself. Poachers can cut high value trees such as large *Cunninghamia lanceolata* and the protected species *Tsuga chinensis* without fear of arrest, then transport them across the reserve to towns in Yinjiang County, where the market for timber is great and enforcement is lax[16].

Perhaps a more immediate problem is the continuing poaching of wildlife within the core area. Snares, explosive baits and poison baits are all common sights in some areas. In one valley, we found five explosive baits, two poison baits and three nylon rope snares in an area of less then two square kilometers. Although signs of bear are still a common sight in this area, with this intensity of illegal hunting, the reserve's population of bears cannot be expected to last long. Snares also can injure or kill wildlife indiscriminately, including snub-nosed monkeys.

Buffer zone: Local people use forest products intensively. Houses are almost always made from planks and poles of *Cunninghamia*. All fuel for cooking is made up of wood, poles and twigs from the forests. Fuel for heat is usually from low-grade charcoal. The practice of *kaohuo* or toasting around an open charcoal fire uses large quantities of charcoal every day for more than six months of the year. Finally, high-grade charcoal, produced in charcoal ovens, is a major market commodity. Some villagers rely entirely on charcoal sales for their cash, and some entire villages, such as Liu Jia Wan in Yinjiang County, specialize in charcoal production.

Unfortunately, timber harvesting in the transition zone is not sustainable in any region of the reserve. Under current management practice, forest outside of the core area is being destroyed rapidly. I estimate that most of it will be gone within ten years, replaced by scrub of dwarf bamboo or bracken and grasses.

The Reserve Management has had difficulty monitoring and controlling the activities of local people in the buffer zone. In some areas, villagers cut firewood within the core area of the reserve so as to avoid the stricter controls in their own community forests, since village regulations are more strictly enforced than those of the reserve. It is often suggested that local people are better equipped to monitor and control use of the buffer zone forests and that these forests should be managed as communal forests. However, local control of buffer zone forest would still require dedicated oversight by the Reserve Management.

The Reserve Management has stated that it cannot be responsible for deforestation in the buffer zone, where local people can legally harvest some timber. In many areas there is little or no regulation of timber cutting, and the reserve forests is being rapidly degraded. If the Reserve Management really has no responsibility for control of deforestation in the transition zone, then that should be acknowledged publicly and the reserve's size should be recorded as 250 km^2, not 450 km^2 as it is now publicized. However, it should be recognized that this reduction in area would decrease the value of the reserve as a refuge for biodiversity.

A better alternative may be to design a comprehensive management plan for the entire buffer zone. The first step might be to enlarge the buffer zone of the reserve to include all relevant forest reserves outside of Fanjing Mountain Reserve. In this way, these areas also could be managed according to an integrated management plan[17]. Villages in this Greater Fanjing Mountain Management Area would also qualify for any special economic

development programs for the buffer zone under future integrated conservation and development plans. Not only could this lessen the pressure on the reserve's forests, but it could also protect the watershed of the Da He, which is still relatively undisturbed and a valuable refuge for biodiversity.

CONCLUSION:

Fanjing Mountain Reserve has an important role to play in China's efforts to protect the nation's natural heritage and world biodiversity. Every effort should be made to protect this priceless treasury of biodiversity. This will only be achieved by 1) prohibiting all activities that contribute to habitat degradation, such as tree cutting and animal trapping 2) effectively enforcing this prohibition with frequent and wide-ranging patrols and punishment of violators Other policies which should be pursued include efforts to increase the size of the core area and the buffer zone and efforts to link development of the local economy to conservation action. Above all, protection of Fanjing Mountain Reserve's biodiversity will require that reserve management be dedicated to conservation.

In the past, forest resources such as timber and wildlife have been seen as free for the taking, with no owner and no one harmed by the taking. But the natural resources protected in Fanjing Mountain Reserve have been purchased with the scarce resources, hard work and constant diligence of the Forestry Department and the world conservation community. The treasures of Fanjing Mountain belong to all of the people of China and the world.

There are those who believe that Fanjing Mountain Reserve is already a hopeless case; that there is too little forest and too many people to make it possible to save it. This is only true if those responsible for protecting Fanjing Mountain believe that it is impossible. The attention of all of China and the world has been turned to witness the fate of reserves like Fanjing Mountain. If we fail in their protection, we can only blame ourselves. If we succeed in preserving their biological treasures, we will all be the beneficiaries.

NOTES:

1. Fanjingshan Kexue Kaocha Ji (Scientific Survey of the Fanjingshan Mountain Preserve) (1982) Editorial Committee (eds). Environmental Conservation Bureau of Guizhou and Environmental Science Association of Guizhou; Guiyang, Guizhou and Fanjingshan Yanjiu (Research on the Fanjing Mountain). (1987) Zhou Z-X and Yang Y-Q (eds.) Guizhou Forest Department; Guiyang, Guizhou.

2. A census was performed by the reserve management in 1988, and by the Guizhou Golden Monkey Project in 1991-1992. Censuses need not provide exact estimates of population density numbers. Index counts which give relative density information, are sufficient to track changes in monkey numbers. For example, the number of monkeys seen per kilometer walked on randomly located transects would be a valuable index of monkey abundance.

3. The conservation education center at Bako National Park in Sarawak State, Malaysia is an excellent model for such a facility.

4. Bleisch, W.V.; Cheng, A.-S.; Ren, X.-D. and Xie, J.-H. (1993) Preliminary results from a field study of wild Guizhou snub-nosed monkeys (*Rhinopithecus brelichi*). Folia Primatol. 60:72-82.

5. The simulation was based on The Generalized Animal Population Process Simulation (GAPPS). This program takes into account the sexually-dichotomous, age-structured life history of primate species. With various simplifying assumptions (panmyxia, yearly turnover of male residency in breeding groups) and a reasonable estimate of the life-history parameters for the species (based mainly on life history data for wild macaques, details available on request), this analysis suggests that a population of 400 animals or more is not in great danger from demographic stochasticity or inbreeding depression. In addition, it indicates that a population of 400 animals can be expected to retain 90% of its genetic diversity for about 500 years.

6. This conclusion is supported by the fact that the population of R. brelichi at Fanjingshan occupies most of the existing habitat, and could not have been much larger in the past than it is today. It is likely that the population has already survived isolation on these mountain forest for several hundred years.

7. Captive breeding has many problems for this species. In addition to the cost in money and human resources, captive breeding programs remove breeders from the wild population. In general, captive breeding programs of large primates cause the death of as many animals as ultimately adapt to captivity. Of those animals which do adapt, many will not ultimately breed. For example, to obtain a founding population of 8 breeders for captive breeding, it may be necessary to remove 20 or more animals from the wild population. In this case, all of these animals must come from the single wild population in Fanjing Mountain Reserve. It is unclear that the wild population can sustain the loss of so many animals over a short time.

Captive breeding programs often distract managers from the difficult business of protection of wild populations. They may also give policy makers the mistaken impression that protection of the wild population is no longer necessary. Captive higher primates may suffer from the effects of inbreeding and domestication.

8. Xie, J.; Liu, Y.; Yang, Y. (1982) Preliminary survey of the ecological conditions of the Guizhou golden monkey In Scientific Survey of the Fanjingshan Mountain Preserve Editorial Committee; Environmental Conservation Bureau of Guizhou and Environmental Science Association of Guizhou; Gang, Guizhou. pp. 215-221 (In Chinese).

Sun, D.-Y. and Yang, C.-D. (1990) Qian Jingsihou. [The Guizhou golden monkey.] in Guizhou Yesheng

Lingchanglei Dongwu Ziyuan [Guizhou's Wild Primate Resources], Guizhou Provincial Forestry Department Office of Resource Policy; Gang, Guizhou. (In Chinese).

9. In November and December, the golden monkeys's diet contained a large amount of various parts of four species of Magnolia. Six of ten feeding observations in November were of magnolia flower buds, leaf buds or leaf petioles. This shift in the diet reflects a pronounced preference for this food, since magnolia trees are not abundant in the forest. In addition, during November and December of 1992, edible fruits and young leaves appeared to be much less abundant than at other times of the year. The ranging pattern of the animals also appeared to change, with longer day ranges and fewer daily rests, suggesting that the monkeys were having more difficulty finding food. This suggests that magnolia flower buds are a critical resource for the monkeys.

10. In 1991, the monkeys were faced with a new threat to their survival. A local business man advertised widely that he would buy magnolia flower buds, and this sent dozens of people into the forest in the quest for some quick cash. Since in this area there is little hardwood forest outside of the reserve, most of the harvesting occurred in the reserve core area itself. This is a violation of the reserve regulations. By mid-December, we met poachers in search of magnolia trees on a daily basis. Poachers collected the buds, which the monkeys could potentially have eaten. We also found several instances in which branches or even entire trees had been cut down, apparently in order to collect buds more easily.

11. During the winters of 1991 and 1992, after severe winter storms, our team observed the monkeys at very low elevations in areas where we had not observed them before. In one case, we observed monkeys foraging in an area outside the reserve core boundary. This was in Yinjiang County, above the village of Ping Suo on the northern slope of Dopeng Mountain. Local villagers reported that the monkeys often used this site during the winter in the past, but had not been observed there recently.

We suspect that the reason this habitat has not been visited much in recent years is that it has been severely damaged by tree cutting for charcoal production. Snub-nosed monkeys were observed foraging in a patch of trees directly below an active charcoal oven at an elevation of 1,700 meters a.s.l. This tree cutting in prime monkey habitat is legal. In this area, the reserve core area boundary is as high as 1,700 meters a.s.l., although in most areas it is 1,000 meters a.s.l. or below.

12. The following comments are based on a set of working principles concerning parks and people. These principles are detailed in an appendix included below.

13. I am not aware of any impact assessment to study the effect of these mines on wildlife. Some species, such as the giant salamander (*Megalobatrachus davidianus*, wawa yu) may have been all but extinguished in Guizhou Province because of habitat degradation in large, fast-flowing streams. Even after mining operations are completed, there may be long-lasting effects on rivers. For example, the upper Tao Jing He was the site of a large mining and processing complex in the 1960's. The complete absence of birds characteristic of clean mountain streams, such as forktails (*Enicurus* spp.), dippers (*Cinclus pallasii*) and plumbeous redstarts (*Rhyacornis fuliginsus*), suggests that Tiao Jing He's upper reaches may have little or no aquatic insect life. It is probable that this is the result of heavy metal pollution of the waters from mine tailings left by operations in the 1960's.

14. Development of infrastructure for tourism have included construction of more than ten kilometers of auto road along the Hei Wan River, extending from the Management Station at the boundary of the reserve to the base of the stair climb leading to Jing Ding Peak. Although the plan called for the road to be only a single lane, 10 meters wide, the steep terrain caused land slips that destroyed forest habitat extending substantially beyond the road itself (Photos available). In addition, the road was constructed directly adjacent to the Hei

Wan River, a pristine, rocky, mountain stream, which formerly was well-protected. Lack of safeguards against siltation and deposition of road construction debris in the river during construction probably had a serious impact on this pristine habitat and its biota. The stream formerly was known as an important habitat for the giant salamander (*Megalobatrachus davidianus*), a species that is under serious threat in China because of habitat destruction and collection for market. No surveys of this species have been conducted in the reserve.

The construction of the road obliterated a nature trail, which some considered to be one of the most beautiful trails in any Chinese reserve, and which had significant value as a cultural and scenic site in its own right. This trail could have been an important attraction for high-spending foreign tourists. No serious consideration seems to have been given to alternative routes through areas which are already deforested such as the route above Zhang Jia Ba to Fu Guo Shi.

Finally, guest house capacity within the reserve has been significantly expanded with construction of a 250 bed facility just below Jing Ding peak. I am not aware of any study to estimate the "carrying capacity" of the area for tourists. If this facility attracts as many visitors as hoped, the impact on the fragile subalpine forests near the top may be severe. In particular, collection of fuel wood, now restricted to dead wood near the peak, will have to be increased to unsustainable levels unless alternative sources of fuel are provided soon. The large quantities of garbage littering the area around the existing rest house has already seriously damaged the aesthetic experience of the peak climb.

15. For example, from my field notes:
"Some young students ... complain that the reserve Management has been mismanaging their communal forest in the buffer zone. They believe that the system worked better before establishment of the reserve, when people had to apply for permission to the brigade to cut trees, and the community forest was policed effectively by a protection team from the Brigade (*dadui*). Now, anyone who pays 15 ¥ to the *Baofu Zhan* [Protection Station] can cut as much as they like, and in fact they cut as much as they can to make it worth paying the fee. And if the protection team stops any outsider from stealing timber from the communal forest, there is no support from the Reserve Management. For example, the case still pending in Tongren, in which the Protection Team fought with a family Yang from Fuyongba who were stealing timber in the Community Forest. The court in Muhuang decided in favor of the thieves, charging the Protection Team with stealing the timber that they had confiscated [from the thieves]".

16. The cutting of a few large trees deep in the reserve may not seem like a serious problem. However, poaching of these large trees is jeopardizing the reserve's role as a genetic storehouse. These ancient trees are valuable reservoirs of genes that may be critical for China's efforts to improve its timber stock in the face of poorly managed cutting elsewhere. In the future, these giant ancient trees may be one of the few sources of seeds with the potential to produce fast-growing, straight trees. The degradation of *Pinus massoniana* as a timber species during the past century as a result of unselective felling and lack of seed sources is an important lesson. Once this species was a valuable source of timber, but now it is mainly represented by slow-growing, stunted strains. Since no gene bank was saved from unselective logging, it will be difficult to bring back the valuable strains of the past (S.D. Richardson, 1990, Forests and Forestry in China, pg. 226). It would be a economic tragedy if the valuable timber species *Tsuga chinensis* or *Cunninghamia lanceolata* experienced similar genetic degradation.

17. For example, in the watershed of the Da He from Hei Wan up to the village of Chang Gan Ling there are several large tracts of community forest which could be managed for sustainable forestry (see Fig. 3). Villagers living on the right bank of the Da He use the resources of the reserve as intensively as those living on the left, and their uses should be managed as well. If these areas were also included in the buffer zone, they could also be managed for sustainable timber and fuelwood production.

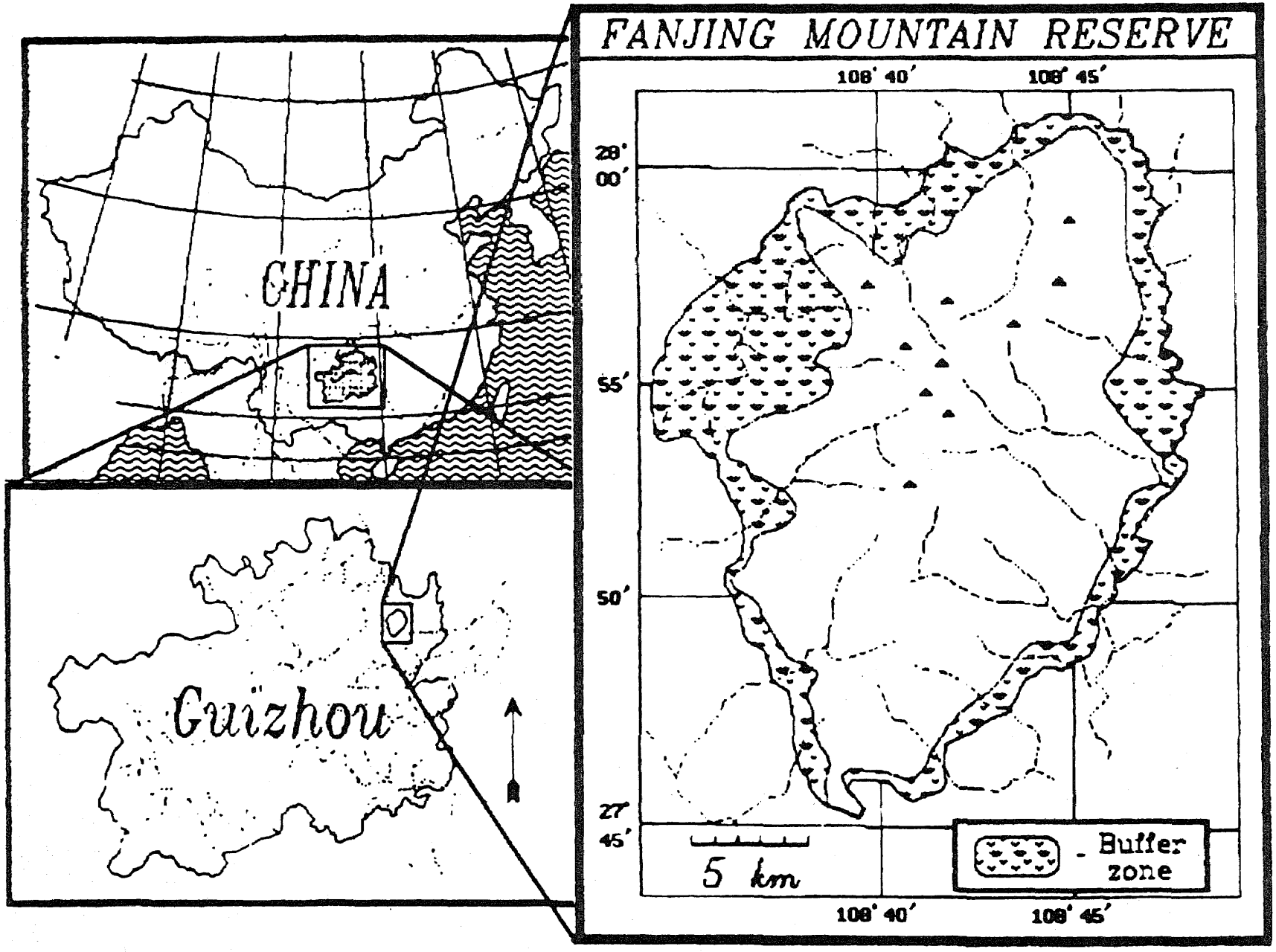
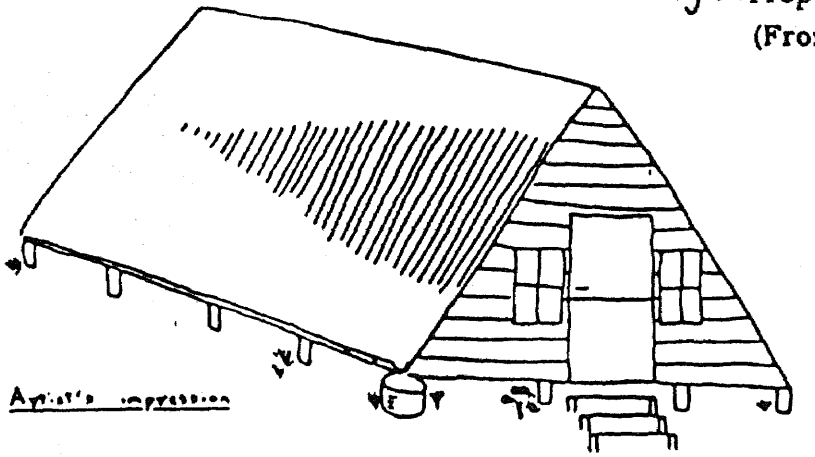
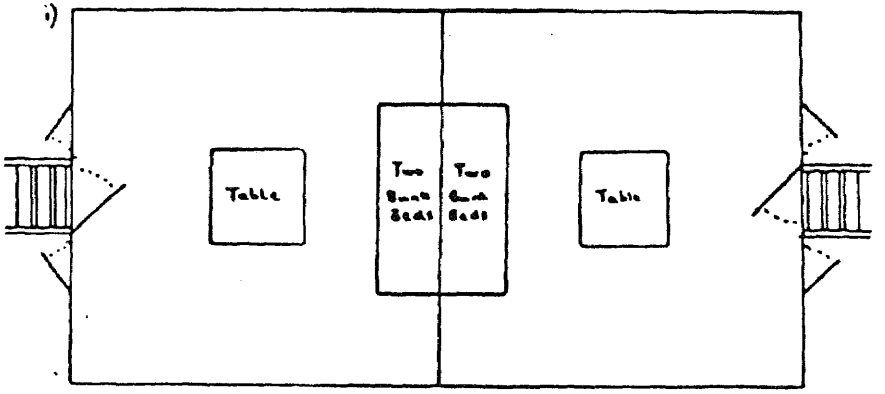


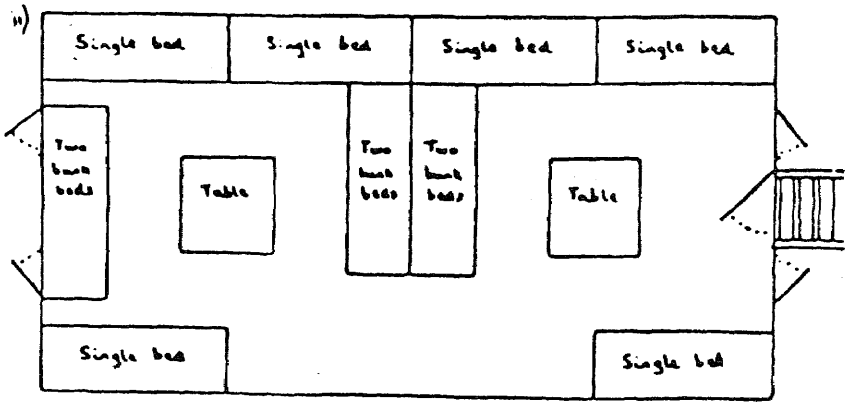
Fig. 1. Maps showing the location of Fanjing Mountain Natural Protected Area in Guizhou Province, China.

Fig. 2. Proposed backcountry gatehouse or monitoring station (From Hillman, 1986).



Internal layout – i) Game Scouts
ii) Tourists





Side wall/roof (covered in corrugated iron over planks)

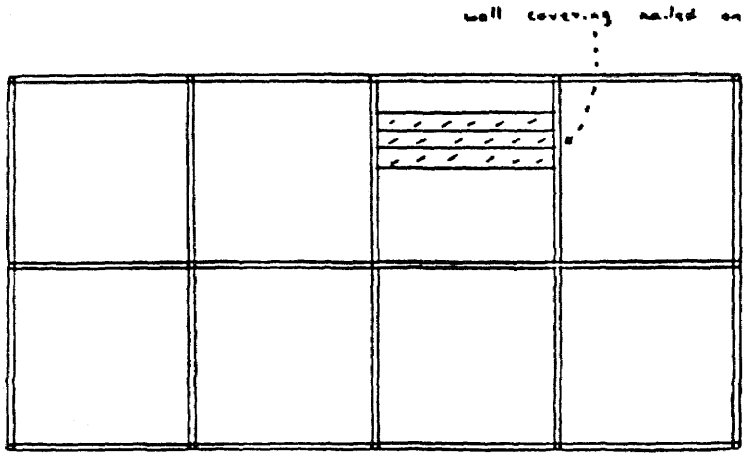
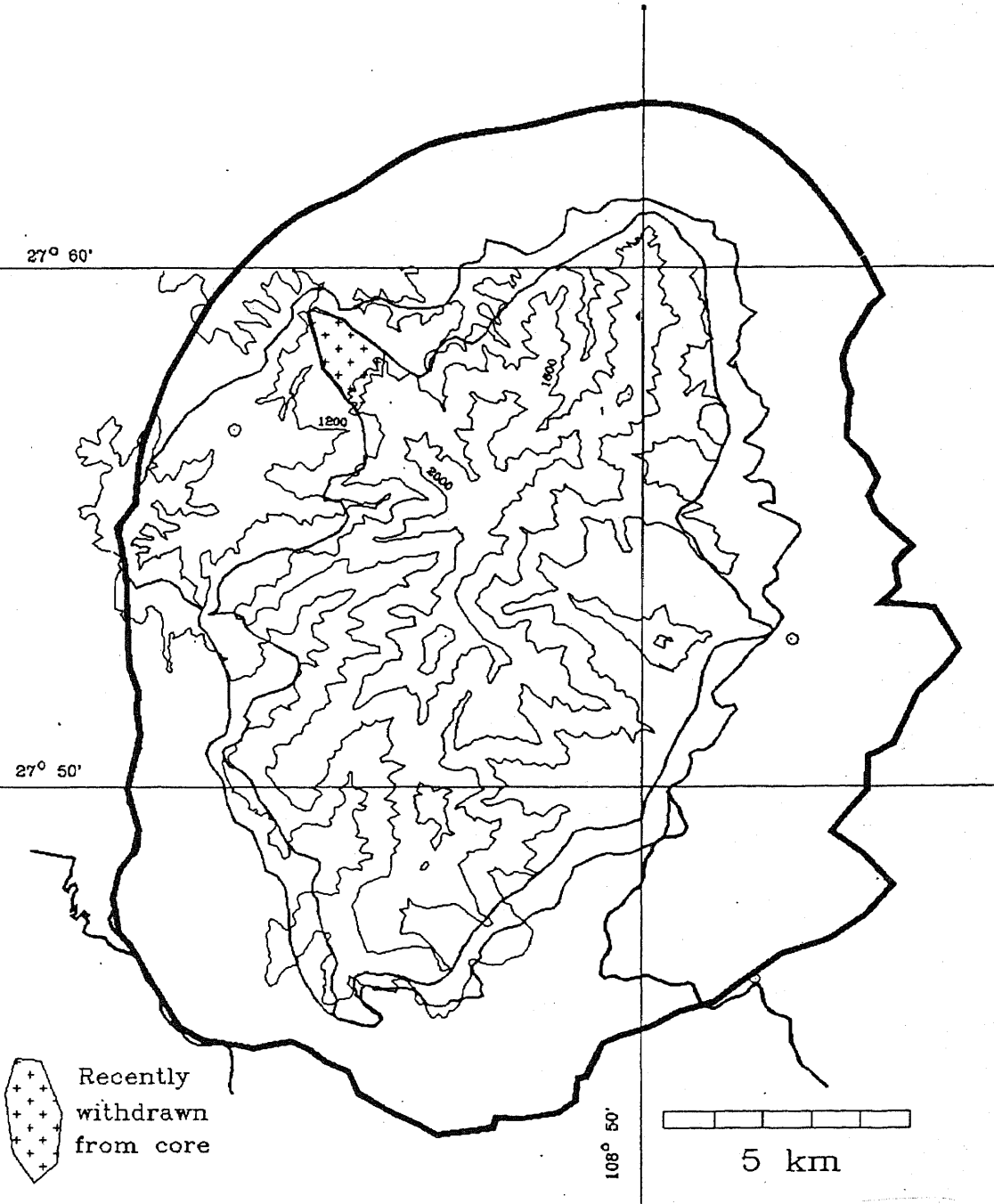


FIG. 3

FANJINGSHAN NATURE RESERVE

PROPOSED MANAGEMENT AREA



APPENDIX: WORKING PRINCIPLES CONCERNING PARKS AND PEOPLE:

When considering the relation between people and the reserve in detail, it may help to state certain working principles at the outset.

i) The main purpose of Fanjing Mountain Reserve is to protect valuable natural resources for the future.

ii) In particular, a major goal of the Reserve is to protect biodiversity; that is, to protect the hundreds of species which occur in the Reserve, and to protect the genetic diversity of these species. Biodiversity is a valuable resource in itself, even if we do not always have an immediate use for it or know what use it may be put to in the future. For example, the drug taxol has recently been found to have great potential as a treatment for some types of cancer. The Chinese yew, *Taxus chinensis*, is a rich source of this drug. Today, this tree is found in China mainly in natural protected areas such as Fanjing Mountain Reserve.

iii) Biodiversity is best protected in a living, functioning state, that is in the wild. Only in the wild can evolution continue to occur and can species fill their normal role in the ecosystems in which they naturally occur.

iv) Since one purpose of the Reserve is to protect biodiversity in a natural state, most of the Reserve should be managed to prohibit disruptive utilization of these resources. This is the core area of the Reserve. The core area must be large enough to insure protection of the Reserve's biodiversity into the future. Principles of conservation biology will dictate how large the core area needs to be to maintain viable populations of all components of a functioning ecosystem.

v) The goal of reserve management should be to insure that biodiversity within this core area is in fact protected.

Based on these principles, I make the following recommendations regarding management's relationship with local communities:

1) Management action that decreases the rate of utilization of forest resources in the Reserve's core is generally good management for conservation. Action that increases it is bad.

At present, the human population living in and around Fanjing Mountain Reserve is using the Reserve's resources at an unsustainable rate. This is seriously hampering the protection of biodiversity in the Reserve. Only by decreasing the rates of utilization of all resources within the Reserve can the goal of protection of biodiversity be achieved.

2) Actions that encourages people to find cash and products without destroying the resources in the Reserve's forests are generally good management.

For example, tax restructuring to encourage paddy rice farming and agroforestry and to discourage timber cutting and hill-slope crops could also decrease deforestation.

Management schemes that provide an attractive alternative for local people to make badly needed cash also could slow the rate of deforestation. However, not all programs that improves the living standards of local people will help protection of the Reserve.

For example, rural electrification is an important step for improving people's lives. However, by itself, it will not decrease people's desire for **further** improvement in their lives or decrease their capacity for hard work. Therefore, it will not necessarily decrease the rate of forest destruction. Some schemes to help the local economy, for example, increasing the value of wood products by creating local markets for timber, wood pulp, etc., will only increase the rate of destruction of remaining forest.

3) Enforcement of regulations is one means by which people can be encouraged to stop destruction of forest resources. Enforcement must be a component of any management plan for the Reserve.

Within the conservation community, it is now widely understood that enforcement of Reserve regulations in poorer areas can lead to a conflict between local people and the reserve management staff, which can escalate to ever-increasing violence. Because of this, many conservationists have begun to emphasize programs by which reserve management can help local people to improve their lives and find alternatives to utilization of resources from the reserve.

However, even if these integrated conservation and development programs (ICDPs) are successful, enforcement must be a component of protection of any natural protected area. Reserves such as Fanjing Mountain Reserve are a rich storehouse of valuable resources, which will only become more valuable as they become increasingly rare outside the reserve. Efforts to save the Reserve by improving the lives of local people alone without enforcement of regulations make as much sense as trying to protect a bank by removing the bank guards and giving away door prizes. To quote from a recent study of reserve management, (funded by the World Bank, the World Wide Fund For Nature (WWF) and the U.S. Agency for International Development):

[There is a] need to challenge the widespread but unsupported assumption that people who are made better off as a result of a development project will refrain from illegal exploitation of a nearby protected area even in the absence of the negative incentive provided by more effective penalties. Such expectations appear naive, and the needs to strengthen guard patrols and to impose penalties for illegal activities remains strong. Enforcement activities are not inconsistent with the ICDP concept when they are integrated with genuine local development efforts and serious attempts to improve local people-park communications through educational campaigns and other means.

M. Wells and K. Brandon (1992) People and Parks.

Note that enforcement works not by catching all the poachers all the time, but by decreasing the expected economic gain of those who violate the law. The greater the risk of capture and of prosecution after capture, the more effective will this disincentive be. Enforcement is used in reserves all over the world, from the United States to India, and it works.

4) Projects that help improve local people's lives may also help protection of the Reserve if benefits to local people are clearly tied to effective conservation action. Park management should experiment with integrated conservation and development projects (ICDPs), projects which seek to link conservation and development objectives.

ICDPs have become one of the main hopes for protection of parks and reserves, especially in developing nations. One of the main challenges of these projects has been to effectively link development programs with conservation so that all material benefits of the project to local people are clearly tied to its conservation actions. Local people must see development activities as incentives for protection of the Reserve's biodiversity, the ultimate goal of the project.

As one example of the difficulty in linking conservation and economic development, we can consider tourism. Development of tourism has great potential for bringing cash into the economy of communities near the Reserve. Tourism by people who want to view undisturbed natural beauty and wildlife, may also create an incentive for better protection within the Reserve. By increasing the value of the Reserve's resources in a natural and undisturbed state, tourism can be an important incentive to local government and local people to protect these resources[1]. At the same time, tourists can be a destructive force, increasing pollution, erosion and deforestation. The problem for management is to link the economic gains of tourism to effective protection of the Reserve's scenery, forests and wildlife.

---

[1] Fanjing Mountain Reserve may have provided an unplanned experiment that shows just how effective these linkages can be. In Jiangkou County, the county government, provincial Tourism Bureau and the Reserve Management have been working closely together to promote tourism. A major development plan has resulted. Although some of these activities were destructive to the Reserve, my point here is that the local government has made substantial investment in the Reserve in the expectation of substantial returns in the future from tourists. In addition, the local government has been very supportive of the Reserve Management's efforts to protect the Reserve and decrease forest degradation in Jiangkou County.

In sharp contrast, the northern half of the Reserve is in Yinjiang County. Since most visitors enter the Reserve from Jiangkou County, Yinjiang has received little direct benefit from tourists in the past and cannot expect major returns in the future. Perhaps because of this, the local government of Yinjiang County has been apathetic and even antagonistic to efforts by the Reserve Management to protect the Reserve's forests. In Yinjiang County, timber poachers have been released without prosecution on several occasions. In addition, the boundaries of the core area have been moved further up the mountain, decreasing the area effectively protected. Finally, according to the Reserve Director, the Management has been unable to regulate forest cutting within the buffer zone to prevent unsustainable use, because of opposition by the local government. This may be one reason that forest degradation and destruction is more severe in Yinjiang than in Jiangkou County.