1998


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UMI
THE TIGER AND THE PANGOLIN:
CULTURAL ECOLOGY, LANDSCAPE ECOLOGY, AND NATURE
CONSERVATION IN CHINA'S SOUTHEAST UPLANDS

VOLUME I

A Dissertation
Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

in

The Department of Geography and Anthropology

by

Christopher R. Coggins
B.A., Wesleyan University, 1985
M.S., Louisiana State University, 1991
August 1998

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DEDICATION

This dissertation is dedicated to the people and wildlife of the Southeast China Uplands.
ACKNOWLEDGMENTS

This research project and dissertation have benefited from the support and inspiration of many individuals and organizations. First, I would like to thank my dissertation advisor, Stan Stevens, for his early advocacy of the project when it was still in the formative stages, and for his tireless involvement through the duration of my Ph.D. program. Stan has provided moral support, timely suggestions, and critical commentaries on the written work at every stage, from the earliest proposals to the grant applications, and through a number of drafts of the dissertation. Stan’s friendship and guidance have given me the confidence to pursue my dreams and to set high standards for field research, archival research, and writing. In his own life and work, Stan provides an example of scholarly excellence that I will always admire and strive to emulate.

I would also like to give special thanks to Zhu Hejian, my Chinese advisor (under the grant regulations of the Committee for Scholarly Communication With China). As the key player in my affiliation with Fujian Normal University, professor Zhu provided friendship, logistical and technical support, and advice throughout both research periods in Fujian. Kam-biu Liu was also helpful in the process of establishing contact with researchers in Fuzhou and Beijing. I thank him for his support in the early stages of research and in the final phases of the writing process. Qiu Honglie, his father Qiu Shuangjun, and their family were also instrumental in my first trip to the Southeast Uplands.

When it came time to enter the field study area, He Lian was an invaluable friend and resource. His expertise on the wildlife and hunting customs of the Southeast Uplands...
is, by the consensus of all who know him, unparalleled. I cannot thank him enough for being "in the right place at the right time," even if he prefers to attribute it all to "yuanfen" (destiny).

I thank Li Shuqing, of the Fujian Provincial Museum, for all of his support and for allowing He Lian to spend many weeks in Meihuashan. I thank Ruan Yunqiu, of the Fujian Forestry Bureau, for friendship, advice, and permission to conduct research in Fujian's nature reserves.

In the Meihuashan village of Gonghe, I was lucky to befriend Ma Shengxue and Ma Shulin, whose home I stayed in frequently. Their understanding of the village and the region was shared generously, over tea in their guestroom, in their dining room, and on countless mountain paths. Ma Shengxue's knowledge of wildlife and hunting in Meihuashan, in tandem with his boundless energy and enthusiasm, are invaluable resources for nature conservation. I thank Ma Shuwen for his friendship and wisdom, and for the generosity with which he shared his tremendous knowledge of local history and geomancy. This dissertation could only cover a portion of the culture history that Ma Shuwen discussed with me in interviews, but I hope that it provides others with some of the same pleasures of discovery that I found in the Ma household on many a cool mountain evening.

In the other study villages, Guan Yanzeng, Luo Zhiming, Luo Changxiu, and Luo Ruiqing were also great hosts, tireless guides, and special friends. I thank them and their families for the many hours they sacrificed in interviews and trips through the mountains. Though I cannot list the names of all the mountain villagers in Meihuashan who provided
tea, food, lodging, friendship, and information, I thank them all. Luo Zijian, Luo Bing, Luo Shunchang, Luo Shisun, Zhang Shisheng, and Luo Zhongkun will be remembered for their additional gifts of time and energy.

The Meihuashan Nature Reserve directors and staff deserve special thanks for the hospitality and friendships that enriched my family's life in the reserve. I would especially like to thank Luo Mingxi, Huang Chuguang, Fu Yongcheng, Wang Honggao, Huang Zhaofeng, Lan Meiyi, the Zhou family, Wu Jinping, Li Kaiming, and Chen Daqing. I thank the Wuyishan Nature Reserve staff, especially Wu Haohan, and the Longxishan Nature Reserve Staff, especially Xie Qiaosheng and Wang Guoliang for their hospitality and generosity. Lan Xiaodan, Minmin, and Huihui will always have a place in our hearts for befriending and regaling my son Aaron, when he was still a toddler.

Many people in the Southeast Uplands rendered aid and provided friendship, but special thanks go to Fu Qisheng, Fu Zhirong, Lai Chenghua, Liao Chunxiang, Lai Xiaobo, and Chen Xiangyi. Li Dengfa, Fang Pinguang, Lu Hongrong, and Han Liangfa were of great assistance in the libraries, archives, and special collections. Fang Pinguang provided a tremendous service in collecting gazetteer data for the study of human-wildlife encounters.

Institutions and groups in Fuzhou that were especially helpful include Fujian Normal University (especially the Office of Foreign Relations, the Institute of Geography, the Center for Research on Natural Resources, and the graduate students in the Department of Geography), the Fujian Forestry Bureau, and the Fujian Provincial Museum.
I would also like to thank the U.S. institutions, staff, and faculty members that have made this journey possible. The Department of Geography and Anthropology at Louisiana State University provided a grant through the Robert C. West Fund that allowed me to conduct preliminary research in Fujian and Beijing. The Committee for Scholarly Communication with China provided generous funding and institutional support for one year of research. CSCC officers Joan Carey and Keith Clemenger were especially helpful and supportive. Piper Gaubatz made valuable suggestions for my research proposal and grant applications, and arranged for my borrowing privileges at the W.E.B. Du Bois Library at the University of Massachusetts. My dissertation committee members, Joseph Chang, John Henderson, William Davidson, Kent Mathewson, Kam-biu Liu, and Stan Stevens provided important critiques of the research proposal and the dissertation. Dr. Davidson and Dr. Mathewson have eased the administrative burdens of the defense and filing procedures while I have been in far-off Massachusetts. They and their families also provided gracious accommodations during the defense. I also thank Dr. Mathewson for serving as my provisional Major Professor and for executing all of the required administrative tasks and much more with great energy and efficiency.

I thank the Caldwell family, especially Gail Harris and Muriel Caldwell Tillie, for inviting me into their home in Tennessee and sharing their fascinating family history.

My days at LSU will not be forgotten, and I thank all of my friends in the Department of Geography and Anthropology for the friendship and good cheer.

Here in the Berkshires, the Laurel Hill Association has provided funding, and Miss Hall’s School has provided a warm and caring community for us during the writing
period. I thank Pat Sharpe, the Dean of Academic Affairs, and Bernard Rodgers, Vice-president and Dean of Simon's Rock College, for providing me with fascinating work and plenty of bright students who make teaching a joyful challenge.

Finally I thank my parents, who have supported me materially and emotionally over the long haul, and my in-laws for all of their support. Above all, I thank my wife, Tanya Kalischer, and my son, Aaron Kalischer-Coggins, for sharing the hard times and the high points with love, affection, and patience.
The Tiger

"Before Liberation there were lots of tigers around the villages. They often roared at night and stole people's livestock. There were few hunters and everyone was afraid. They had to use drums and gongs to scare the tigers off. Why were there so few tigers by the 1950s? It has to do with national fate (guoyun); the tigers knew that the luck of the country (guojia de yunqi) was changing. When the country was in chaos (luan), stealing and killing were common in the mountains, so tigers went rampant. People say that after Liberation, the tigers went away because the government got better, the country settled down...I believe this too."


The Pangolin

<table>
<thead>
<tr>
<th>Ni lianli</th>
<th>You're a lianli (pangolin)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wo lilian</td>
<td>I'm a lilian (reciprocally inverted nonsense word)</td>
</tr>
<tr>
<td>Ni kai shan</td>
<td>You work the mountain</td>
</tr>
<tr>
<td>Wo zhong tian</td>
<td>I work the fields</td>
</tr>
<tr>
<td>Ni gei wo chile</td>
<td>When I've eaten you</td>
</tr>
<tr>
<td>Wo geng hui zhuan qian.</td>
<td>I'll be able to make even more money.</td>
</tr>
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Long Gui village (Meihuashan) pangolin hunter's incantation spoken before the kill to guard against bad luck.

<table>
<thead>
<tr>
<th>Ni lianli</th>
<th>You're a pangolin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wo lilian</td>
<td>I'm a lilian</td>
</tr>
<tr>
<td>Pao shang ye shi ni si</td>
<td>If you run up it is you who will die</td>
</tr>
<tr>
<td>Pao xia ye shi ni si.</td>
<td>If you run down it is also you who will die.</td>
</tr>
</tbody>
</table>

Gonghe village (Meihuashan) pangolin hunter's incantation.

<table>
<thead>
<tr>
<th>Ni lianli</th>
<th>You're a pangolin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wo lilian</td>
<td>I'm a lilian</td>
</tr>
<tr>
<td>Ni jiu yan qian</td>
<td>You're right here before my eyes</td>
</tr>
<tr>
<td>Wo jiu qian nian.</td>
<td>So I'm sure to live a thousand years.</td>
</tr>
</tbody>
</table>

Shipaichang village (Longxishan) pangolin hunter's incantation.
Ni lianli
You're a pangolin

Wo lilian
I'm a lilian

Ni jiu yan qian
You're right here before my eyes

Huan ni na huan you yan.
So I'll grab you and trade you for soy sauce and salt.

Shipaichang village (Longxishan) pangolin hunter's incantation.

The Tiger and the Pangolin

The South China tiger (*Panthera tigris amoyensis*) and the Chinese pangolin (*Manis pentadactyla*) - a scaly anteater, both occupy ancient and important niches in the biologically diverse ecosystem of Chinese folk cosmology. Both animals are believed to have mysterious magical power and high medicinal value, and both are now under state protection. The two species have also been anthropomorphized, to varying degrees, and represent two types of intelligent free agents, with very different roles on earth.

In traditional times, the tiger was seen as a representative of heaven that could bring justice to the aggrieved, aid the righteous in times of need, or impose a reign of terror upon wrong-doers. Tigrine action was believed to depend in large part upon how well the country was being governed - on the Mandate of Heaven (*tian ming*), and on the degree of harmony in the terrestrial realm. The tiger appeared to come and go of its own accord, or by the will of Heaven. Rampant tiger attacks during historical periods of massive deforestation reinforced this cosmological linkage; folktales and local histories portrayed the tiger as, among other things, a protector of the forest. Ironically, the virtual disappearance of the tiger in South China since the 1950s, a result of massive ideological changes, widespread habitat loss, and systematic persecution, is widely attributed by rural people to the good government and relative societal harmony (or greater degree of social control) associated with the rise of the Chinese Communist regime.
The magic of the pangolin, on the other hand, comes from its strange closeness to the earth. Its subterranean haunts have earned it the name "earth dragon" (dilong). Its peculiar fish-like scales have earned it the name "wears mountain armor" (chuan shan jia), or "carp" (linli or lianli). Like the villager, it depends on the mountains for a living. Like a shaman, it protects itself with black magic, so humans who hunt it for the medicine of its delectable meat and potent scales must first speak to the pangolin and coerce it to submit to its fait accompli.

Tigers also eat pangolins, and when tigers were more numerous, their dens were a good place to find pangolin scales.

While the tiger has often represented celestial or divine imperial power, and the pangolin chthonic, terrestrial, and local power, these two levels of agency exist in a state of continuous interaction. In the interior frontier of the Southeast Uplands, imperial administrators and mountain peoples have relied upon their own, often separate varieties of power, and both have helped shape the landscapes of southeast China in distinctive ways.

As nature conservation becomes increasingly important in the Southeast Uplands and in China as a whole, both tigers and pangolins are protected by national law. Wildlife conservation is, however, a new area of concern, and there are many obstacles to overcome. It remains to be seen how the needs and aspirations of local people and the goals of state-run conservation schemes like nature reserves will find lasting harmony.

---

1 Oddly enough, the name chuan shan jia could also be translated, "first class mountain climber" since chuan shan means to penetrate or climb the mountains, and jia means "first" or "first rate."
This dissertation examines land use traditions, landscape ecology, environmental history, and indigenous conceptions of the environment and natural resources in three nature reserves of the Southeast Uplands region. It explores the relationship between cultural landscapes and wildlife habitats, and between local resource management systems and government control over natural resources.

**The Research and the Study Area**

The project has involved several years of archival research in China and the United States combined with extended field research in southeast China. The fieldwork component was carried out in two phases. The first was a three week reconnaissance trip to Fujian province in 1992-1993, during which I visited the Daiyunshan and Meihuashan Nature Reserves, in the interior mountain ranges of Fujian. The second was a year-long period of intensive research in the Meihuashan Nature Reserve in 1994-1995, during which I also conducted rapid comparative surveys in the Longxishan and Wuyishan reserves, which lie further north.

The Meihuashan reserve covers 221 square kilometers at the boundaries of Liancheng and Shanghang counties and the Longyan Municipality, in Longyan Prefecture, southwest Fujian. While conducting preliminary research on tiger conservation efforts and protected area management, I found the Meihuashan area among the most promising for wildlife conservation and for conducting research on the relationship between humans, forests, and wildlife in the region. Preliminary research on tigers, conducted by the World Wildlife Fund in 1991-1992 (discussed below), showed that tigers still inhabited Meihuashan (though the population was undetermined) and that
the reserve and surrounding mountains were among the best remaining habitats for tigers
in southern China. During initial field trips in the mountains, I observed ground scratches
purportedly made by tigers and abundant signs of wild ungulates. A high percentage of
broadleaf, bamboo, and pine forest coverage, interspersed with extensive montane
grasslands and wetlands provided good habitat for many species in the reserve and
surrounding mountains. At the nature reserve headquarters, I saw a clouded leopard that
had died in captivity after being confiscated from local hunters.

The cultural landscapes of Meihuashan were no less remarkable. During visits to
several mountain villages, I learned that the small single-surname communities had a long
history of collective and household-based resource management centered on bamboo
cultivation, forestry, controlled burning, wet rice cultivation, and hunting. In each
village, I observed sacred fengshui forests, common property resources that had been
protected by local custom for many centuries.

The combination of good wildlife habitat and active, long-term human use and
stewardship of natural resources convinced me that the Meihuashan region was a good
field study area, an intriguing place worthy of extended field study in its own right, and a
sound benchmark from which to measure processes of environmental change across the
rugged terrain of the Southeast Uplands.

With a grant from the Committee for Scholarly Communication with China, I
moved to Meihuashan with my wife and young son, in the fall of 1994, and began
conducting field research. We lived in an apartment in the Meihuashan Nature Reserve
headquarters, in the valley town of Gutian, the seat of Gutian township. I made frequent
trips into the mountains by bus, car, or motorcycle. From the reserve boundaries I hiked from village to village along the extensive network of mountain trails. I lived in villages, tents, a reserve management station, and a mountain observation post. In some villages, residents stated that I was the first foreign visitor. If others had visited these villages before 1949, memories of them had long since vanished.²

After conducting wildlife habitat surveys with a friend and colleague from the Fujian Provincial Museum in Fuzhou, I was provided with a guide and assistant, an employee of the reserve who was to accompany me wherever I went in the reserve. This young man was very capable, but since he was a reserve employee and not a local resident (he was from Baisha, two townships to the east), villagers were not always comfortable discussing sensitive matters in his presence. Since my assistant did not speak the local Hakka subdialects, and since even many elderly villagers in Meihuashan can speak Mandarin, I decided to conduct all interviews and daily transactions on my own. My assistant was allowed to return to his regular duties, and I was permitted to travel wherever I needed to, inside or outside of the reserve. Freedom of mobility allowed me to spend more time in village households, developing friendships with local people, and relying upon their expertise and local knowledge. I continued to work with reserve staff on certain projects, most notably broadleaf forest surveys, wildlife observation efforts, and interviews on reserve management and planning. My relationship with administrators and staff remained cordial throughout the research period, although the

² In 1991-1992, Gary and Mona Koehler visited a number of Meihuashan villages during tiger surveys that Gary Koehler led in four provinces, with funding from the World Wildlife Fund China Program.
reserve directors were much more interested in learning more about the South China tiger than about land use patterns, environmental history, and other key features of my research. While they understood that I was not a wildlife biologist, they frequently urged me to "find the tiger" and photograph or video a living specimen. This is still one of the main missions of the reserve administrators, since the reserve was established to protect a species whose very survival becomes more questionable by the month.

While most of my ethnographic research was conducted within five study villages (described below), I made an effort to learn as much as possible about land use and environmental history in all 26 villages in the reserve and several outside of the reserve. To this end, I conducted interviews in about twelve additional villages within the reserve, and about six villages outside of the reserve. In some cases, there were local experts with whom I was advised to consult with. In others, research was initiated for comparative purposes.

The Structure of the Dissertation

In chapters one and two, I describe the geography of Meihuashan and the Southeast Uplands region in more detail and lay the theoretical groundwork for the geographic study of humans, land cover, and wildlife. I also discuss the history of conservation policy in China and the unique land tenure arrangements that are characteristic of China's nature reserves. Chapter three is an historical geography of humans and wildlife in southern China, including an analysis of human-tiger interactions recorded in gazetteers from four provinces. Chapters four through seven describe the history of settlement, land use, socioeconomic change, and landscape change in the
Meihuashan region. Chapter eight is an analysis of wildlife habitat conditions in Meihuashan based on comparative surveys of ungulate signs in ten habitat types. Chapter nine is an analysis of household bamboo forest management practices, which directly affect wildlife habitat in Meihuashan and other regions. Chapter ten describes the importance of fengshui, sacred forests, and other local religious customs that relate to land use, cultural landscapes, and sense of place. Chapter eleven is a survey of historical and modern hunting technologies and practices in Meihuashan and other parts of the region, including results of interviews with local hunters on their annual harvest patterns. Chapter twelve presents a broad spectrum of conservation strategies for the Southeast Uplands region, incorporating data from the Longxishan and Wuyishan reserves for comparative purposes. The final chapter is a synopsis of the main conclusions.

Significance

As a final prefatory remark, this dissertation explores one small part of a vast geographic and epistemological terrain, a territory that, despite ample exploratory efforts, remains largely uncharted. I have attempted to show how village settlement patterns, land use, and natural resource management in a specific region have shaped montane landscapes, ecosystems, and nature conservation efforts. This investigation encompasses a broad range of themes and features, including political ecology, environmental perception, indigenous knowledge, and community-based conservation. I argue that villagers in the uplands region have continually adapted not only to local environmental variables, but also to regional socioeconomic change, political and military campaigns, and a plethora of government directives. In the sequence of historical adaptation,
regulations on resource utilization imposed by nature reserve authorities are simply a new set of obstacles around which the stream of daily life must flow. Villagers recognize the power of reserve authority, but they will support the reserve as an institution only to the extent that it appears to serve their socioeconomic needs and support their cultural traditions.

On a positive note, land tenure conditions in the region (and in rural southern China in general) are relatively secure and stable. There are no large-scale migration streams of landless peasants entering the uplands in search of land, and forest clearing is no longer the main vector of environmental degradation. Unlike many areas in tropical and subtropical Southeast Asia and Latin America, where landless rural immigrants (or "shifted cultivators") clear millions of hectares of forest each year, China's subtropical highlands are an intricate weave of different vegetation types, in different phases of succession and under different tenurial and managerial regimes. This study focuses on cumulative changes in these complex microgeographic land cover patterns, for these form the components of the larger regional vegetation mosaic.

China's mountain regions are the final refugia for myriad species of plants and animals. Holistic interpretations of the environmental, cultural, and natural histories of these peripheral realms may give rise to more appropriate guidelines for conservation.

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Sponsel et al. (1996: 10) describe "shifted cultivators" (a play on traditional swiddenists, or "shifting cultivators") as poor, displaced, landless farmers, who colonize and clear tropical forests. These settlers, to whom the authors refer as both "victims and villains," are often part of government resettlement schemes (i.e. in Brazil and Indonesia) or arrive in the wake of initial land clearance or road building by state or private enterprises.
Integrative methods of geographic research can promote appreciation and respect for the tremendous biological and cultural diversity that remains.
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ABSTRACT

The Wuyi-Daiyun Mountains, which form the core of China's Southeast Uplands Region, support a mosaic of subtropical forest, grassland, and cropland habitats, with some 1,620 species of plants and 326 species of terrestrial vertebrates. Forty-two animal species are officially protected, including the highly endangered South China tiger (Panthera tigris amoyensis). This study, based on one year of field research, examines relationships between village land use, landscape change, and wildlife management in the Meihuashan Nature Reserve of Southwest Fujian. It includes comparative studies of reserves in Longxishan and Wuyishan, further north, and Daiyunshan, to the east.

Over 500 local gazetteer records of tiger attacks from 48-1953 A.D. provide baseline data on long-term anthropogenic environmental impacts in four provinces of the southeast. Habitat utilization surveys of five ungulate species in ten habitat types show how land use patterns affect prey densities. Intensive research in five Meihuashan villages examines historical settlement, demography, land use patterns, hunting practices, household economies, bamboo forest management, paper production, and village fengshui (geomantic) systems.

Until the 1980s, Meihuashan villages produced and traded bamboo paper. Local prosperity led to population expansion in the mid-to-late Qing (1644-1911), and some villages grew to five times their present sizes. Extensive wet rice agriculture and widespread burning, the latter of which enhanced the growth of bracken (Pteridium aquilinum) rhizomes (a starchy dietary staple), kept the upland region largely deforested for centuries. The chaos of the early twentieth century brought population decline, rice
terrace abandonment, and partial reforestation. Reforestation increased after burning was outlawed in the 1950s, but technological, commercial, and political changes intensified the extermination of regional fauna. Logging of *Cunninghamia lanceolata* in the 1980s also had a dramatic impact on montane ecosystems.

Nature conservation should include maintenance of sacred *fengshui* forests; increased protection and restoration of remote broadleaf forests, montane wetlands, and montane grasslands; containment and intensification of commercial bamboo production under more equitable tenurial systems; and promotion of sustainable agriculture and animal husbandry. These efforts will be greatly enhanced when local people have a greater role in reserve management, research, and commerce.
CHAPTER 1

HUMAN GEOGRAPHY AND NATURE CONSERVATION: LINKING CULTURAL ECOLOGY AND LANDSCAPE ECOLOGY

This is a geographic study of forest and wildlife management in the Southeast China Uplands. It investigates the effects of changes in human population, land use, settlement patterns, and hunting techniques on wildlife habitats and populations. It also describes the formation of biologically diverse and culturally meaningful landscapes in a region encompassing four major nature reserves in the Wuyi-Daiyun mountain range of western Fujian Province (Fig. 1.1). The study combines research techniques from cultural geography, wildlife biology, landscape ecology, political ecology, and cultural ecology in a theoretical and methodological framework that integrates the physical and social sciences. As a diachronic reconstruction of the environmental history of the Southeast China Uplands, the dissertation examines both the cultural-historical antecedents of wildlife and habitat management and the historical geography of anthropogenic biological extinctions. As a diachronic and synchronic study of cultural ecology and landscape ecology, this study examines the role of culture in maintaining biologically diverse landscapes, and the role of today's protected areas in the sustainable development and preservation of cultural landscapes and wildlife resources throughout southeast China.

1 Though the field research was conducted in the Wuyi-Daiyun Mountain Range of western Fujian - the core of the Southeast Uplands region, the dissertation includes historical data from the three other provinces in the region: Jiangxi, Hunan, and Guangdong.

2 There are ten smaller provincial, county, and municipal nature reserves in the Southeast Uplands (Fig. 12.4). These are discussed in chapter 12.
Figure 1.1. Nature Reserves of the Wuyi-Daiyun Range. The Meihuashan, Longxishan, Wuyishan, and Daiyunshan nature reserves lie in the heart of the Southeast Uplands region, in Fujian province. All four reserves belong to the 45-member Chinese Biosphere Reserve Network.
The Meihuashan Study Area: Key Questions

While China has been designated by the IUCN (International Union for the Conservation of Nature and Natural Resources) as one of the world's ten most biologically diverse countries, ranking fifth in species richness for mammals, within China, the Southeast Uplands is among the regions of highest species richness for mammals. This diversity is, in part, a function of the relatively sparse human population in the highlands, and the depletion of wild fauna in surrounding, densely-settled coastal plains and river basins. The Southeast Uplands region also encompasses tremendous ethnolinguistic diversity, with some 104 local Han dialects in Fujian Province alone, comprising the greatest cultural variation of Han subgroups of any province.

While over half of the roughly 750 nature reserves in China are in the biologically and culturally diverse subtropical and tropical regions of southern China, most of these reserves contain human settlements within their boundaries. In contrast to northern and western China, where most rural, non-agricultural land is under government jurisdiction, and land use decisions are made by the Ministry of Forestry, large tracts of wild and semi-wild mountain lands in southern China are managed by households and collectives (Ruan Yunqiu, pers. comm.). This distinction is the legacy of centuries of forest resource management and tenurial control by villages, clans, and individuals. An understanding of the historical formation of these heterogeneous landscapes will provide a critical perspective on the prospects for sustainable nature conservation in the region.

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3 John MacKinnon (1996), the foremost foreign authority on conservation and biological diversity in China, states that it is within the top three countries of highest biodiversity.
Field research for this project was conducted for one month in the winter of 1992-93, and for eleven months in 1994-95. During the first trip, the author conducted preliminary research in the Daiyunshan and Meihuashan nature reserves. During the second part of the study, the author conducted extensive field surveys in the Meihuashan nature reserve, and rapid comparative surveys in the Longxishan and Wuyishan nature reserves further north.

The Meihuashan Nature Reserve was established in 1985, with a mandate to protect the highly endangered South China tiger, a subspecies with perhaps fewer than 40 individuals surviving in the wild. The region also supports populations of leopards, clouded leopards, golden cats, Asiatic black bears, and Asiatic dholes (or red dogs). These animals require large areas of relatively undisturbed habitat and an adequate prey base of ungulates and smaller mammals. But human pressure on these species exists even inside of the nature reserves. The 221.75 square kilometer (85.6 square mile) Meihuashan reserve, for example, provides natural resources for more than 3,500 people, about 3,000 of whom live within 26 villages that fall entirely within reserve boundaries. The government has complete jurisdiction over roughly 23% of the reserve, mostly in the 59.6 square kilometer core area (Luo MX, pers. comm; FJMHSGJJZRBHQGLC, 1991) where economic activities are forbidden (Fig. 1.2). The buffer zone (known as the "experimental zone" - shiyian qu), which comprises 162 square kilometers, or 73.1% of the total area of the reserve, has been formally divided into land use zones that were not

---

*Including two small outlying sections of the reserve, the total land area is 225.679 square kilometers (ZHKCBGBWH, 1991).*
Figure 1.2. The Meihuashan Nature Reserve. The 26 natural villages in the reserve are clustered in the south and east, where elevations are lower and suitable agricultural land more abundant. Most of the mountains over 1,300 meters in elevation are in the central and western parts of the reserve, which has been designated as the core area.
<table>
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<td>10. Dagaoxie</td>
<td>Li</td>
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<td>11. Qingcaoyuan</td>
<td>Chi</td>
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yet demarcated in 1995. These include protected subareas (*baohu xiaoqu* - 86.5 square kilometers), scientific experimental subareas (*keyan qu* - 6.6 square kilometers), and (economic) land use areas (*liyong qu* - 68.9 square kilometers) (Fig. 12.1) (FJMHSGJJZRHBHQGLC, 1991).

The people of Meihuashan are Hakkas (in Mandarin *Kejia*), or "guest people," who began their southward diaspora from the North China Culture Hearth\(^5\) in the fourth century A.D. Between 400-600 years ago, they arrived in Meihuashan, settling in the flats and hollows of narrow valleys at elevations between 700 and 1300 meters. They built terraces for rice cultivation, and exploited the abundant forest resources. All of the extant reserve villages have maintained single surname, patrilocal lineages through the 20-30 generations since their establishment (though many villages have been settled by different lineages at different times). The insular settlements, tucked within the rugged Daimao mountains, have served to maintain local dialects and traditions, and the people of Meihuashan are culturally distinct from non-Hakkas in the Longyan municipality, to the east (Figs. 2.6 & 4.1).\(^6\) The economic mainstay of these villages has for centuries been the indigenous giant bamboo, known as maozhu (*Phyllostachys pubescens*), and until the 1980s, the region was renowned for the quality of its bamboo paper, which was exported through Guangdong Province to markets in Southeast Asia as early as the

---

\(^5\) An area centered on the Wei and Yellow River valleys, and encompassing the oldest Han settlements in China.

\(^6\) The Minxi (West of the Min River) region is synonymous with Fujian's Hakka culture region. Politically it consists of the Longyan Administrative Region, six counties and one municipality. Within this area, the five westernmost counties are predominated by speakers of Hakka and Hakka-related dialects.
mid-1700s. Since the 1980s, villages with access to mountain roads have sold unfinished poles for use as scaffolding in urban construction.

Today, a typical Meihuashan village is surrounded by a patchwork of family-managed dooryard vegetable gardens and rice paddies, a series of sacred forests in and around the village proper, family-managed bamboo forests, remote rice paddies, and collectively owned forestlands. Given these general land use patterns within a highly complex matrix of montane forests, scrub, and grasslands, this research addresses the following questions: 1. How have local people perceived of and shaped the structure and function of habitat configurations and patterns of biological diversity through time? 2. How have subsistence and mercantile resource use, in tandem with ideological forces, shaped local land use patterns within the larger political economic trajectory of late imperial, pre-revolutionary, and Socialist China? 3. How does the present configuration of vegetation patches function in maintaining mammalian biodiversity? 4. How should wildlife conservation in the Southeast Uplands proceed, given the present system of nature reserves and the contemporary suite of land use conditions and environmental values?

**Nature and Wildlife in China**

Most foreign explorers of Han Chinese culture have walked some stretches of the distinctly Chinese intellectual and aesthetic paths traversing the terrain of "nature." These forays provide ontological vistas quite different from those typically associated with "the Western tradition." We see human affairs diminished by mountains, streams, and sky. We experience for a time, humanity as part of nature, adrift in a seamless continuum...
(Murphey, 1967; Tuan, 1970). We inevitably ask ourselves if it is possible that this holism survives in Chinese culture, perhaps still sensible in China's landscapes and peoples. While Laozi, Chuangzi, Li Bo, and Guo Xi beckon us further down this sinuous track, we need only to examine the landscapes within a Chinese nature reserve at the close of the 20th century to find ourselves far from any envisioned destination, still at the beginning, where "among thousands of crags and ravines the road meanders" (Li Po in Liu and Lo, 1975).

Differences between Eastern and Western conceptions of nature loom large in the heated international discourse on contemporary wildlife conservation issues. Western environmentalists castigate China for its involvement in the international market for endangered species such as elephants, rhinoceros, tigers, leopards, and bears. Chinese consumer demands in Hong Kong, Taiwan, and the Mainland alone have had catastrophic impacts on wildlife populations throughout Asia and Africa, and notable effects on certain wildlife populations on other continents. In April 1994, the Clinton administration imposed trade sanctions on wildlife products from Taiwan after the Lee Teng-hui administration failed to curtail trade in rhinoceros and tiger parts despite warnings from the U.S. aimed at China and Taiwan. This was the first time in the history of the world that international trade sanctions have been used to protect wildlife (Friedman, 1994).

Surprisingly, China has not yet exhausted its own wildlife populations, with 500 species of mammals and 1,200 species of birds, both groups representing 13% of the their global totals (MacKinnon, 1996). Four subspecies of tigers, the Indian elephant, and two
species of bears are among a number of highly endangered taxa of large fauna in China that have extremely high (Chinese) medicinal value (Koehler, 1991; Li and Zhao, 1989; ZGYYDWZXZZ, 1982; Shou, 1962). The richness of China's natural fauna and the cultural values that have developed around wild animals through the millennia of Chinese history largely explain the demands that Chinese consumers now place upon wildlife populations throughout Asia and Africa. Increasing material prosperity in China is fueling the demand for domestic and foreign wildlife products. Families for whom meat was largely proscribed by economic limitations in decades past are now able to consume it on a daily basis. Added to this is a kind of culinary renaissance; wild game is in vogue for both the urban business elite and the rural farmer.

The Chinese government is keenly aware of the international condemnation evoked by these cultural patterns. As with all other "internal matters" that become subjects for dissection in the international press (e.g. human rights issues and family planning policy), wildlife conservation has become a political and diplomatic problem. Chinese policy-makers recognize it as an "image problem" that can affect foreign relations, jeopardize MFN (Most Favored Nation) trade status with the U.S., and hinder other opportunities for economic development that depend on international commerce (Bao, 1993, in Appendix A, section III, lines 55-83). The political friction resulting from such profound cultural conflicts has been a source of anti-foreign, and especially anti-U.S. sentiment in China. To many in China, the U.S. is known as a "qianda guojia," literally a "powerful country," but the term implies that we rely on economic and military threats to bully others into submission and compliance. In essence, Chinese cultural
practices that have reemerged or intensified as a result of economic development and increased trade with the West, have become a major source of conflict with the West.

An emerging international community, which strives for consistent legal and ethical rules, and even a global ethos, cannot tolerate rampant environmental degradation in a developing country that threatens to become a world power in a few short decades. While a global environmental ethic may be justifiable on scientific, moral, and aesthetic grounds, however, it cannot be developed according to historical and cultural conditions that are peculiar to the United States, Western Europe, or any other individual country or region. It would be a boon to the implementation of international environmental policy if we understood the very different cultural orientation toward nature conservation held by other peoples and nation states in the world (Blaikie, 1996), and recognized how destructive consumption and trade patterns in developing countries have accelerated the loss of biotic diversity worldwide.

Since the beginning of communist China's detente with the West, in the late 1970s and early 1980s, wildlife conservation has been an important, though sometimes troublesome, aspect of bilateral relations. The World Wildlife Fund (Worldwide Fund for Nature) panda conservation project, with field research directed by George Schaller, was begun in 1979 amid a series of misunderstandings and missteps on the part of Chinese and American participants (Schaller, 1993). In the mid-1980s, the UNESCO...
(United Nations Educational, Scientific, and Cultural Organization) Man and the Biosphere Program accepted 10 of China's nature reserves into the International Biosphere Reserve Network, including the Wuyishan Nature Reserve in the Southeast Uplands. Membership in the UNMAB brought China's incipient conservation movement more fully into the sphere of transnational development NGO's (non-governmental organizations) and funding agencies like the World Bank. There are many indications that foreign involvement in nature conservation and sustainable development schemes in China will continue to grow throughout the coming decades.

While Western involvement in nature conservation in China during the last decade has been substantial, it has come at a much later historical phase than did Western involvement in forestry and wildlife protection in Malaysia, India, and east Africa. The political geographic patterns of Western colonialism in China were very different from those of other regions, the former being based on coastal enclaves, commerce, and the policy of "extra-territoriality." Under this regime, the establishment of nature reserves by Westerners outside of the treaty ports may have been seen as an impossible undertaking of little benefit. Big game hunting by foreigners in China was not as prevalent as in India and Africa, and wildlife conservation was not essential for maintaining foreign economic dominance or sense of place (Gadgil and Guha, 1992; Kenny, 1995). Nevertheless, colonial contact with the West ushered in a new view of wild animals as demythologized commodities that could be exterminated without any threat of supernatural retribution, rankled the Chinese government, who have considered terminating his research projects (Schaller, 1993; Wang Wei pers. comm., 1993).
and this could be done in the name of God (Caldwell, 1924), science (Andrews, 1917), or sport (Smith, 1928).  

As political economic conditions in China have changed, so too have natural resource management and the policies and practices concerning forest and wildlife management. In broad terms there have been four historical periods in the development of wildlife resource exploitation and environmental perception since the late imperial era (1368-1911). They may be defined as: first, the period before Western influence, when local and national indigenous views of wildlife and resource management developed and prevailed; second, the period of contact and exchange with Western missionaries and naturalists; third, the period when communist China closed its doors to the outside world and the exploitation of nature in all forms became a heroic and patriotic quest; and finally, the current period of reopening to foreign contact and influence, corresponding to a deepening concern for nature conservation at the political level, and potentially, an emerging grassroots involvement in environmental issues at the local level.

Despite the fact that systematic nature conservation in China is in its infancy, many Westerners expect China to conform to our own cultural standards of wildlife conservation. This is not reasonable. Even if the same legal and institutional management apparatus existed in China as in the average Western country (which is not possible in the near term), a remarkably different set of cultural values concerning wild plants and animals would persist. Nature conservation in China, to be successful, will

---

While commercial trade in wildlife was by no means a new phenomenon in China, there were customs in many areas that tended to limit harvests and control access to hunting areas. These customs are discussed in detail in chapter three.
have to develop a set of structural and cultural features suited to prevailing conditions, that is "conservation Chinese style." In today's nature reserves, we see the emergence of this style, and it is important that we understand its roots, as its shoots and leaves continue to emerge.

While China's government has begun to follow the lead of Western powers in establishing nature reserves and promoting the required infrastructure of environmental beliefs and goals, many of these ideologies may be viewed as products of the world's industrialized societies, with little resonance in the belief systems indigenous to rural China. The practice of nature reserve establishment and management in China is largely based on Western archetypes, concepts, and values (He Lian, Pers. Comm.; Li and Zhao. 1989; Nash. 1982). There were no national nature reserves or comparable protected areas in China before 1949; imperial hunting reserves and indigenous protected areas differed from modern nature reserves in fundamental ways (Menzies, 1988; and see chapter three).

In most cases, especially in South China, reserves have been established in places occupied by peoples who have, over many generations, developed long-term natural resource management techniques and schemes. These include communal and familial cropland, forest, and pasture management; wildlife management; methods of gathering and processing medicinal and edible wild plants; and codes for protecting and maintaining commonly-held sacred forests. Living in environments with abundant wild flora and fauna, these peoples have developed a rich body of environmental knowledge and folklore. They have developed hunting and trapping techniques, as well as methods for keeping harmful species like wild boar, rats, and monkeys out of their crops. This
study describes enduring cultural patterns pertaining to wild animals in the many guises that they have assumed in Chinese culture: bestial terrors, destroyers of crops, bearers of magic, quarry, food, medicine, and most recently, protected natural resources. It reconstructs the history of wildlife depletion through habitat destruction, market hunting, government-sponsored "anti-pest campaigns," "sport," and "meat hunting."

While environmental perception may be changing rapidly among peoples throughout China, this research demonstrates that traditional values, beliefs, and practices still affect land and wildlife management at local, regional, and even national levels. These have both negative and positive effects on the operation of nature reserves and the viability of bureaucratically-administered wildlife management programs. In the Southeast Uplands, for example, many rural people have developed a rich knowledge of wildlife through generations of hunting and trapping, through the eating of wild game and the preparation of animal-based medicinal products, and through the frequent contact with wild animals that comes with living in a remote mountain region. Knowledge of animals does not always lead to a conservation ethic, however, and some continue to poach in order to earn money in the black market for wildlife products. Others have worked with conservation officials to study and protect wildlife. China's nature reserves are thus grounds of overlapping ideologies, patchworks of collective and familial lands inscribed with distinctive land use and resource conservation practices, many of which are rooted in the distant past, and now circumscribed by nature protection policies promulgated by distant regional and national authorities. Given enough time and
concordance, these intersecting schemes may evolve into workable conservation arrangements.

National parks, nature reserves, wildlife refuges, and other protected areas throughout the world are increasingly the subjects of geographic study, and human geographers are contributing to our understanding of how cultural and economic issues affect biodiversity in landscapes that have been "set aside" for the benefit of other species (Dilsaver and Tweed, 1990; Herlihy, 1997; Nietschmann, 1997; Stevens, 1997). Those who have been especially active in this field include several cultural ecologists (Herlihy, 1997; Nietschmann, 1997; Stevens, 1997). These researchers have focused on cultural ecological and political ecological issues of nature conservation and indigenous land tenure. Such cultural ecologies, along with cultural geographic approaches to landscape ecology, may provide new directions for geographic research and nature conservation efforts (Stevens, 1997).9 Utilizing perspectives from physical and human geography, geographers can contribute to an emerging conservation movement informed by the natural and social sciences. The conceptual framework of a landscape ecology informed by cultural and historical particularities, which can also be seen as a cultural ecology conceptually integrated with the "new ecology" (Zimmerer, 1994), is introduced below in the hope that both ancient and emerging visions of humanity within nature and nature

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9 Although Stevens (1997) does not use the term "landscape ecology," each of the case studies in Conservation Through Cultural Survival examines the spatial, and to varying degrees, the ecological relationships between indigenous land use and biological diversity.
permeating the human realm may live on in the "real world" and in the "geographical imagination" (Gregory, 1994; Katz, 1995).\textsuperscript{10}

The Human Geography of Protected Areas

The protected area movement began in the American West, with the establishment of Yosemite National Park in 1864 and Yellowstone National Park in 1872. By the time of Yellowstone's centennial in 1972, there were over 1,000 national parks worldwide (Lucas, 1992). The "Yellowstone Model," as it has come to be called, set a precedent for protected area management (Stevens, 1997: 28-32). The North American national park has traditionally been a place free of human occupants and land use activities, designed to prevent "the destruction of the fineness of wildness" (John Muir in Nash, 1982).

The final years of the twentieth century have seen the proliferation of national parks, nature reserves, wildlife refuges, and other nature protection areas in countries throughout the world. This trend has affected land use planning and development policy in nearly every nation, the diversity of governmental systems and political agendas notwithstanding, and shows no real signs of slowing in the near future (Stevens, 1997: 14). By 1989 there were 4,025 national parks and equivalent protected areas in 139 countries (IUCN in Shafer, 1990).\textsuperscript{11}

\textsuperscript{10} For more discussion on the conflicts, intricacies, and unconscious adaptations of "space" and "nature" in geographical thought see Gregory (1995: 183-185).

\textsuperscript{11} If we include other types of protected areas, the number is much greater. In 1994, the IUCN listed nearly 10,000 protected areas in more than 160 countries, encompassing over 5% of the earth's land surface, an area nearly the size of the United States (Stevens, 1997).
Whether the perceived goal of a particular protected area is the conservation and controlled use of natural resources or the preservation of wild species and ecosystems with little or no human disturbance, protected area managers are usually charged with the protection of all flora and fauna deemed valuable from a biological, aesthetic, or economic perspective. This is accomplished, in theory, by providing sufficient land, air, or sea space of adequate ecological quality to serve as habitat, with human disturbance kept within tolerable levels. While conservation biologists and government agencies are still grappling with suitable definitions of "sufficient space" and "ecological quality," protected areas of all types are generally seen as the best available tools for insuring the survival of natural landscapes and biota for the benefit of future generations (Shafer, 1990). There have, however, been few clear notions of how to define, design, and manage protected areas under diverse economic and social conditions around the world. The broad array of conservation goals, land use regulations, and morphologies of the world's protected areas has necessitated the creation of a protected area categorization scheme. To this end, the International Union for the Conservation of Nature (IUCN) has devised an international classification system (Appendix C) (IUCN, 1994).

While the U.S. national park system has been a vanguard in nature protection in this country and a worthy model for nature preservation efforts in certain contexts, it has proven inadequate, and even destructive, in places where people rely upon local natural resources for their livelihood. The problem is compounded when indigenous people have settlements within the area and no alternative locations for resource utilization or resettlement. The removal of indigenous people from their homeland in order to establish
a nature protection area is problematic, not only because it constitutes a violation of human rights, with potentially grave social and economic consequences (Anderson and Grove, 1987; Dasmann, 1984; Nietschmann, 1997; Stevens, 1993, 1997a, 1997b), but also because it fails to recognize the historical role of local resource utilization patterns and management systems in the formation and maintenance of ecosystems and natural landscapes (Anderson and Grove, 1987; Cronon, 1983; Dasmann, 1984; De Lacy and Lawson, 1997; Lucas, 1992; Nietschmann, 1997; Stevens, 1993, 1997a, 1997b).

The fundamental assumption of the national park paradigm has been that "wild" landscapes should have no trace of any human impacts, that they should be uninhabited and unaffected by human activity. There is, however, abundant evidence that humans have shaped and maintained many of the great wilderness zones in nearly every biome around the globe (Cronon, 1996:18-19; Denevan, 1992: 369-385). The "pristine myth" (Denevan, 1992; Stevens, 1997a) is being challenged, and the protean and often nebulous concepts of *wildness* and *wilderness* are being reexamined (Cronon, 1996; Gomez-Pompa and Kaus, 1992; Stevens, 1997a).12

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12 Stevens (1997: 299-300) points out that "wildness, wilderness, and biological diversity have come to be used in a variety of ways with subtle differences that have major policy, resource management, environmental protection, and human rights significance." He adds that "wildness" has a longstanding place in U.S. thought, exemplified by the writings of Henry David Thoreau, George Sessions, and Gary Snyder. In this sense, wild places are those in which "biological diversity and natural processes continue relatively undiminished - a state of nature not incompatible with some kinds and degrees of human settlement and resource use." This differs from common conceptions of "wilderness," a place which is "uninhabited and unaffected by people." In this view, wildness is found not only in wilderness, but in sparsely inhabited areas where natural conditions and biological processes are "essentially intact and dominant." (Sessions, 1995: 366, in Stevens, 1997: 299-300). This could include many areas in North America and other developed countries, and even larger proportions of the world's developing countries.
Cultural landscapes, or areas that have been modified by human activities and bear the cumulative imprint of human interaction with the environment (Sauer, 1925; Wagner and Mikesell, 1962), cover most of the terrestrial realm. Their historical value and cultural significance is dependent upon the perspective of the beholder. While many in the West, and in developed nations around the world, tend to view large, uninhabited "natural landscapes" as "wilderness," the latter term is frequently employed by those who live in urbanized environments to describe rural areas where the subsistence patterns of local peoples are undetected, unrecognized, or at best misunderstood (Lucas, 1992; Nash, 1982). The preservation of "wilderness" in protected areas may be seen as an act of creating sacred space (Graber, 1976) to meet the ontological and environmental aspirations of those who are empowered to delimit, demarcate, and control a landscape (Cronon, 1996: 15-18).

Conflicts are all the more likely when dominant core groups and local peoples are of different nationalities or ethnicities. This is exemplified by Anderson and Grove's (1987) study of the history of conservation in Africa, which demonstrates the "psychological function of the African environment in the European mind." The

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13 Wagner and Mikesell (1962) defined cultural landscape as, a "...concrete and characteristic product of the complicated interplay between a given human community, embodying certain cultural preferences and potentials, and a particular set of natural circumstances." Sauer (1925) pointed out that communities and cultures change through time, and that landscapes often bear the marks of successive occupants with different cultural beliefs and practices. Wagner and Mikesell (1962) emphasize the interplay between humans and nature through time in the formation of a given cultural landscape, stating that, "It is a heritage of many eras of natural evolution and of many generations of human effort."

14 Also see The Myth of Wild Africa (1992), by J.S. Adams and T. McShane.
seemingly unspoiled landscapes of Africa were viewed as a paradise, and Europeans set out to protect "Eden" from the ravages of their own technological civilization, oblivious to the primordial role and contemporary needs of local people in a complex and changing landscape. The authors argue, moreover, that conservation schemes in Africa have, from their beginning in the colonial era, been based upon environmental problems and perceptions of industrialized parts of Europe and North America, and that the resulting social and cultural dislocation has had a greater adverse impact on the environment than have top-down rural development schemes (Anderson and Grove, 1987).

It may be argued that the world conservation movement has roots in a core-periphery paradigm that is deeply imbedded in European and North American world views: the spoiled industrialized core verses the pure "wild" periphery. Empirical observation of the devastation wrought by industrialization has made this relationship appear axiomatic, and the acceleration of resource exploitation in colonial and post-colonial third world contexts has facilitated its reification, as former "peripheral" regions are linked to urban growth zones, and the present wild "periphery" becomes more and more remote. Environmentalists' fears of the diffusion of destructive resource use systems, be they connected to socialist or capitalist economies (Blaikie and Brookfield, 1987), largely explain their assumption that setting aside large tracts of land to protect wildlife is an action based on "universal" values and "apolitical" conservation ethics, regardless of the long-term consequences for local human inhabitants (Anderson and Grove, 1987; Stevens, 1997a).
In many developing countries, protected areas and their surroundings are marked by unplanned and unauthorized resource exploitation. Even in the United States, where national parks and wildlife refuges are fundamental to national identity (Nash, 1982), land use conflicts have been bitter and divisive. Even reserves that are faced with no immediate environmental hazards may be too small to protect plant and animal species. Island biogeography theory (MacArthur and Wilson, 1967) has sparked concerns about the size, shape, distribution, and the risks of insularization of nature protection areas. The science of reserve design first developed around a nucleus of spatial issues (discussed below) (Dasmann, 1984; Diamond, 1975; Harris, 1984; Shafer, 1990), but a complex variety of culture ecological factors bearing on land use and environmental degradation, and operating over a wide range of spatio-temporal scales, is still being integrated into conservation theory.

Cultural ecologists and ecological anthropologists (Moran, 1990: 3-40) have contributed more than any other definable group of researchers to our understanding of the social, cultural, and physical factors that bear on local and regional land use and environmental degradation, especially in rural, pre-industrial, and partially industrialized societies. To understand how cultural ecological and political ecological perspectives have contributed to nature conservation, it is useful to briefly examine the emergence and development of these disciplines over the course of the twentieth century.15

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15 Western scholarly concern with the connections between environment and culture began with the ancient Greek geographers, who analyzed the relationship between physical environmental conditions and human patterns of settlement and land use, and hypothesized certain linkages between physical environment and cultural development (Stevens, 1993: 4). For an extensive analysis of this scholarly tradition in the West, from ancient Greece and Rome to the Industrial Revolution, see Glacken
Cultural Ecology and Political Ecology

Cultural ecology can be described as "the study of peoples and their ways of life as parts of ecosystems" (Stevens, 1993: 4; also see Grossman, 1977). The complexity of human-ecosystem relationships has stimulated a process of continuing definition and redefinition of theoretical perspectives, thematic concerns, and methodological approaches in geography and anthropology over the course of the twentieth century. These paradigmatic actions and reactions have centered on questions relating to how the physical environment, or adaptation to it, has molded or shaped the nature and character of human culture, and on how human activity has changed the nature or configuration of the physical environment.

At the beginning of the twentieth century, American geographers like Ellsworth Huntington (1915) and Ellen Churchill Semple (1911) promoted the view that human societies were largely shaped by environmental factors like weather, climate, and landforms (James and Martin, 1981:301-307). This deductive, Darwinian viewpoint, known as "environmental determinism," is exemplified by Semple's (1911: 1) statement that "Man is a product of the earth's surface" (Grossman, 1977: 127). The contemporary view in anthropology was evolutionism, "the assumption that all cultures could be placed (1967)."

in a small number of stages and that cultures tended to move through these stages in a relatively fixed sequence” (Orlove, 1980: 236).

In anthropology, responses to the reductionist notions of environmental determinism and evolutionism came from the "culture history school" that is associated with possibilism, historical particularism, and functionalism. These approaches, which sought to minimize the role of the environment in cultural development and to find historical and diffusionist explanations for many cultural phenomena, are associated with the work of Franz Boas and his students Alfred Kroeber, Ruth Benedict, Margaret Mead, and Edward Sapir, and by the British Social Anthropologist, Daryll Forde (Grossman, 1977: 127; Orlove, 1980: 236).

In geography, alternatives to environmental determinism began to develop during the 1920s, with Harlan Barrows' (1923) assertion that geography should be defined as "human ecology," "the study of the mutual relationships between man and his environment" (Grossman, 1977:128) (italics are mine). But the diversity of interests and the growing range of subdisciplines already extant within geography precluded general acceptance of such a narrow definition (Grossman, 1977: 128), and the first geographer to provide a widely-accepted alternative view was Carl Sauer. In The Morphology of Landscape (1925), Sauer formulated the basic components of what Grossman (1977: 128) calls "the landscape perspective in American geography," underscoring that geography

17 Marx and Engels utilized the theory of cultural evolution proposed by Lewis Henry Morgan to augment their theory of historical materialism (Orlove, 1980: 236).
was the study of phenomena occurring within specific areas and of areal differentiation (chorology), and that the appropriate unit of study was the landscape. Most important were the concepts of the "natural" and "cultural" landscapes, the former being unmodified by anthropogenic factors, the latter being a modified landscape bearing the distinctive material features (including housetypes, settlement patterns, land-use patterns, agricultural systems, and alteration of the natural vegetation) of a particular culture or a series of cultures (Sauer, 1925: 320-321). Some of Sauer's other contributions to the study of human-environment interactions are discussed in more detail below.

Though geographers and anthropologists of this period had markedly different research strategies and theoretical inclinations, their efforts to supersede the environmental determinist perspective impelled them toward the common viewpoint that culture was self-generative, influenced by, but largely independent of environmental conditions. The tendency within both British and American anthropology to regard cultural and social phenomena as products of other cultural and social phenomena was later criticized as a type of cultural relativism (Grossman, 1977: 131).

The most significant response to the relativistic perspectives of environmental possibilism and historical particularism came in the 1950s, when Julian Steward formally set forth the principles of cultural ecology (Grossman, 1977: 131). Steward and Leslie White, though trained in the Boasian tradition, sought to construct new evolutionary perspectives on cultural development (Orlove, 1980: 237). Steward introduced the idea

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18 Steward was influenced by Sauer at Berkeley, and became interested in the relationship between cultural development and the physical environment (Orlove, 1980:237). He distanced himself from nineteenth-century evolutionists and from his contemporary, Leslie White, stating...
of "multilinear evolution" to show that "certain basic types of culture may develop in similar ways under similar conditions," and the method of cultural ecology described the ways in which "culture change is induced by adaptation to environment" (Steward, 1955: 4-5). In this view, the availability, distribution, quality, and quantity of natural resources were among the most important physical variables. Steward focused on how the utilization of natural resources shaped the technologies, economic systems, social organization, and demographic patterns of a particular culture (Orlove, 1980: 238). The aggregate elements of a culture group that were most closely connected to subsistence patterns and economic activities were called the culture core. Other aspects of culture were subject to historical and social variables, which Steward felt could be productively delineated through Boasian approaches. Steward argued that certain "regularities" could be found in cultures widely separated in time and space through the comparison of their culture cores. His approach engendered synchronic analyses of "static equilibria" and diachronic analyses of cultural changes occurring over a wide range of temporal and spatial scales (Orlove, 1980: 238; Steward, 1955: 37-63). Steward also proposed the concept of "levels of sociocultural integration," by which anthropologists could study large, complex, industrial societies as well as smaller, more isolated "tribal" groups (Orlove, 1980: 238; Steward, 1955: 37-63).

that, "Whereas these writers have sought to formulate cultural development in terms of universal stages, my objective is to seek causes of culture change. Since 'evolution' still strongly connotes the nineteenth-century view, I hesitate to use it but find no better term" (Steward, 1955: 5).
In the 1950s, Berkeley School cultural geographers continued to utilize the landscape approach, and those most interested in the linkages between culture and environment continued to focus on the human transformation of terrestrial biomes. This work reached its zenith in the 1953 symposium entitled "Man's Role in Changing the Face of the Earth," which is discussed below. This interest in environmental change as a subsidiary of landscape studies differed from Steward's focus on the interrelatedness of resource exploitation, institutional structures, and the environment (Grossman, 1977: 132). Grossman (1977: 132) characterized the anthropological and geographical approaches to cultural ecology during this period as "'adaptation to the environment' and 'adaptation of the environment,' respectively."

Divergent views of cultural ecology began to fade in the 1960s, as both geographers and anthropologists began to employ principles of General Systems Theory and ecology to the study of human populations. Cultural ecology became an important subdiscipline of geography, and field research by geographers like Brookfield, Clarke, Nietschmann, and Waddell attracted growing interest in subsistence and commercial land use practices, the dynamics of anthropogenic environmental change, energetics, and ecological modeling (Grossman, 1977: 132-139; Stevens, 1993: 4).

Since the 1960s, cultural ecology has gained an increasingly prominent position within geography and anthropology.19 The central concerns of this approach include:

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19 Within anthropology the subdiscipline and related approaches are often called ecological anthropology (Orlove, 1980). Within geography, as Butzer (1989) suggested, cultural ecology may be perceived more "as a research perspective than as a separate subfield." In any case, it has gone from "an explicit research perspective" in geography in the 1960s, to a Specialty Group in 1980 (with 196 members), to one of the Topical Proficiency categories in 1987. In 1993, there were 324 members in the
1. the interrelationships between subsistence and commercial land and resource
utilization patterns, cultural traditions, environmental constraints, environmental change
(including land degradation), and technological change; and 2. how these phenomena
relate to information flows, values and belief systems, political and economic institutional
structures and power (or political ecology, which is described below), local knowledge,
and gender relations (Blaikie and Brookfield, 1987; Butzer, 1989; Merchant, 1989;
Moran, 1990; Netting, 1981; Nietschmann, 1979; Rappaport, 1968; Stevens, 1993;

Some of the criticisms leveled at early cultural ecological studies focused on their
over-reliance on questionable ecological concepts like homeostasis, carrying capacity,
and energy budgets as limiting factors in population growth and social complexity (e.g.
also had to deal with issues relating to the definition and bounding of ecosystems, the role
of supralocal processes and internal differentiation, and time-scale problems due to
"disjuncture" between the synchronic equilibrium approach of neo-functionalists and the
long-term macroevolutionary approach of neo-evolutionists (Moran, 1990: 15-24; Orlove,
1980: 244).

Largely in response to these problems, processual ecological anthropology
emerged in the 1970s. It is oriented toward overcoming "the split...between excessively
short and long time scales" mentioned above, and to addressing the changes in

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specialty group, or 4.6% of AAG membership. In 1995, membership rose to
421, or 5.7% of AAG membership, making it the 11th largest specialty
group of 43.
perception, decision-making, and behavior of groups and individuals in response to, and as a cause of, anthropogenic and non-anthropogenic environmental change (Orlove, 1980: 245). The study of environmental perception has had an important influence in geography, strengthening the behavioral, phenomenological, and ethnoecological approaches, and confronting the notions that humans behave like rational economic maximizers (Grossman, 1977: 140) or that they can achieve "dynamic balance" or a "primordial harmony with nature" (Stevens, 1993: 5).

Stevens (1993: 5-6) writes that

"the study of environmental adaptation must look to local environmental knowledge as the cultural pivot of adaptation, the point where a society's shared set of perceptions and beliefs about resources, risks, and opportunities provides a basis for individual and collective decisions which adjust land-use practice to environmental conditions. Individual and group decisions provide a basis for adaptation in that they make adjustment and change possible. But, to the extent that these decisions are adaptive to environment, they must be grounded first in individual environmental perception and local knowledge and, when widely shared across generations and communities, ultimately also in socially transmitted and culturally shared assumptions, knowledge, belief, and customs."

Some recent cultural ecological studies by geographers (e.g. Stevens, 1993 and this study) have taken a processual approach in describing the variable nature of environmental constraints, risks, opportunities, perceptions, and responses at different temporal and spatial scales and among different individuals, families, villages, and larger institutional groups. The study of environmental knowledge, perception, land use, and decision making also provides an effective means for understanding political ecological conditions, or the relationship between local people as resource users and local and extralocal political and economic forces and structures (Blaikie and Brookfield, 1987: 35).
This methodology is advanced by the geographers Piers Blaikie and Harold Brookfield, whose "chains of explanation" begin with the relationship between land managers and their resource utilization patterns, and extend progressively "outward" to analyze relationships with other land users, other groups within society, the state, and the world economy (Blaikie and Brookfield, 1987: 27-37). Blaikie and Brookfield (1987) provide a comprehensive framework for the study of land degradation, focusing on the themes of marginality (economic, ecological, and political economic), core-periphery theory, decision-making processes, common property resources, problems of field mensuration and the scientific method, cost-benefit analysis, and the effects of colonialism, capitalism, and socialism.

Political ecology has been applied in numerous studies of land degradation, but within China the most notable recent work has been done by Muldavin (1997). Smil (1984, 1993) and Edmunds (1994) have also addressed political ecological issues in China, but their descriptions of environmental degradation processes take a broader spatial approach that are, with a few exceptions, less integrated with analyses of local conditions.

In this research, I have adopted a processual approach to the study of local and regional environmental change. I have attempted to provide synchronic and diachronic

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20 The authors call their approach "regional political ecology," emphasizing not only the social and political factors discussed above, but also the spatial heterogeneity of land variables under prolonged anthropogenic disturbance and the importance of environmental factors in regional economic growth and decline. Gadgil and Guha (1992) have used the term "socioecology" to denote the synchronic or diachronic study of interrelationships between social conditions, political power, ideology, local knowledge, land degradation, and poverty.
views of human-environment relations in the Southeast Uplands, with a primary focus on how land use practices and environmental perception relate to adaptation and environmental change. While I have focused on long-term subsistence, commercial, and religiously-based land use, my inquiry has been oriented more toward how human activity has affected vegetation and wildlife habitat than to a full elaboration of agricultural systems (which could include more extensive work on topics like agroecology and diffusion and innovation in agroecosystems). Nevertheless, a number of serendipitous discoveries impelled me to explore the relationship between agriculture, subsistence, population change, and human transformation of local and regional habitats. My theoretical and methodological approaches are explained in more detail below.

Cultural Ecology and Nature Conservation: Critical Links

The plethora of social and cultural issues surrounding nature conservation theory and practice have drawn a number of geographers, anthropologists, and others to the study of grassroots environmentalism and community-based natural resource management, and cultural ecologists are beginning to direct research and theory at protected area management issues around the world (Herlihy, 1997; Moran, 1990: 24-27; Nietschmann, 1997; Stevens, 1997; Western and Wright, 1994).

International development and conservation organizations and their structural reform have also contributed to resolving discrepancies between nature conservation and local or regional economic development. With this primary objective, the United Nations Educational, Scientific, and Cultural Organization (UNESCO), initiated the Man and the Biosphere Program (MAB) in 1971. Its goals were to identify and assess the changes in

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the biosphere resulting from human activities and to determine the effects of these changes on humans. The MAB program established an international association of protected areas called the Biosphere Reserve Network in 1974, and in 1997 there were over 300 biosphere reserves in 76 countries (CNCMAB, 1995; Dasmann, 1984; Stevens, 1997).

With a commitment to scientific research, the global network of integrated management areas is amassing a growing data base on the interrelationships between humans and ecosystems around the world (UNESCO, 1984). Each reserve contains at least one ecosystem characteristic of one of the world's biomes, in which human inhabitants represent an integral component. The main purpose of each is "to explore methods of both conservation and sustainable exploitation of the resources it contains, thus benefiting the indigenous human population, the wildlife, and...the plant species in all their diversity" (Collins, 1990: 181).

Biosphere reserves are designed to counteract the problem of habitat insularization by demarcating fully protected core areas of strict nature preservation surrounded by buffer zones where forestry, agriculture, tourism or other economic activities are carefully managed to minimalize damage to key habitats and species. The buffer zones may be surrounded by transition zones that gradually grade into more intensive land use zones.

Core areas may in some cases be designated as nature reserves, while buffer zones may be national parks and other scenic tourism areas, or forest, wildlife, and/or range management areas (Dasmann, 1984). Dasmann (1984) points out that among national
parks in the United States and Canada where nature conservation has been most successful, there exist buffer zones where resource utilization is managed by federal, state, provincial, or local conservation agencies. He adds that land management and attitudes toward nature conservation in these countries are relatively benign or favorable ("many towns and cities are de facto bird sanctuaries, supporting an unusual abundance and diversity of wild bird species as well as surprising variety of small mammals"). In the most successful conservation areas, cities, towns, and intensively used rural areas form islands of human settlement, connected by transportation corridors. These insular human habitats are surrounded by vast areas where natural vegetation and wildlife may thrive (Dasmann, 1984).

While the human-settlement-as-island phenomenon is a mirror image of the increasingly insularized reserve, resembling early phases of human settlement in frontier areas, it is the landscape envisioned by conservationists who argue that effective reserves cannot exist in a matrix of degraded land. In this view, land use and nature conservation regulations should apply everywhere, not just within protected areas. Protected areas alone will never suffice to preserve biodiversity if regulations on hunting, fishing, plant collecting, grazing, forestry, and mining go unenforced beyond protected area boundaries (Dasmann, 1984). The biosphere reserve model may be a first step for many developing countries in dealing with nature conservation issues in areas outside of strictly protected reserves. Regulation of resource use in buffer and transition zones may lead to the adoption of similar conservation policies at regional and national levels (CNCMAB, 1995; Dasmann, 1984).
The IUCN (1994) has taken steps to increase worldwide recognition of the critical role of local tradition in the formation of biologically diverse landscapes and to promote the preservation of cultural landscapes. Category V protected areas (Protected Landscapes/Seascapes, Appendix C) are designed to protect biological diversity, cultural landscapes, and local people, and Lucas (1992) provides a methodology for identifying and enlisting areas of critical concern. Under the IUCN's Guidelines for Protected Areas Management Categories (1994), it is recommended that protected areas of all kinds, including national parks and wilderness areas, should recognize the rights of indigenous peoples, as long as their activities are consistent with the conservation goals of a given category of protected area (Stevens, 1997).

Human geographers are in a unique position to bring interdisciplinary perspectives and methods to bear on sustainable development problems as they relate to the preservation of biodiversity. This is the first study conducted by a U.S. geographer to address these problems in a field study of Chinese nature reserves. It stands within a growing field of protected area studies and research on the role of indigenous resource management systems and environmental knowledge, or ethnobiology, in conservation efforts (Dasmann, 1984; DeLacy and Lawson, 1997; Herlihy, 1997; Lucas, 1992; MacKinnon, 1996; McNeeley and Wachtel, 1988; Nietschmann, 1992, 1997; Stevens, 1993, 1997a & b; West and Brechin, 1991; Zimmerer, 1994).

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21 Chinese research teams, which often include geographers, have conducted research in nature reserves all over the country. Many of these studies have been critically important for the design and management of biological diversity and other natural resources (ZHKCBGBWH, 1991). A growing number also present plans for sustainable development in local communities (CNCMAB, 1995).
This study attempts to elucidate the importance of cosmology in the formation of pre-industrial rural landscapes and the persistence of the meaning and character of these landscapes. The study also attempts to show the connection between biophilia\(^2\) (Wilson, 1984; Kellert and Wilson, 1993) and cultural landscape formation, arguing that biophilia is manifested in pre-industrial, industrial, and post-industrial cultural landscapes. Though the meaning of wildness varies across cultures, as does the demarcation of sacred space, there is a surprising degree of commonality in the valuation of certain types of biophysical assemblages in specified cultural contexts such as sacred forests, sacred ponds, and sacred mountains (Eliade, 1961; Gadgil and Chandran, 1992; Gadgil and Guha, 1992; Graber, 1976; Lebbie and Freudenberger, 1996; Nash, 1973; Stevens, 1993; Tuan, 1974; Kellert and Wilson, 1993). This congruity of values has important implications for biophilia theory and for conservation in a multitude of cultural contexts. In this sense, the interpretation of indigenous conceptions of nature is critical for conservation planning in any setting. When reserve managers and conservation officials understand the history of local values and customs regarding landscapes and biological assemblages, they may become more enthusiastic about co-management, entrusting local people with the management of natural resources.

**Human Geography and the Study of Biodiversity and Extinction**

Though geographers and others have long been interested in the impacts of human land use on the physical character of the earth's surface, they have been more concerned

\(^2\) Biophilia, according to E.O. Wilson (1984:1) is humanity's "innate tendency to focus on life and lifelike processes," or (1993: 31) "the emotional affiliation of human beings to other living organisms."
about soil, water, and forest conservation issues than about the problems of extinction and the preservation of biodiversity (though Nietschmann, 1973, 1979 has been an important and relatively early exception). This is not surprising since biological diversity is a relatively recent subject of scientific research. Though biology and later the biological subfield of ecology had strong influences on the dominant paradigms within both physical and human geography in the 19th and early 20th century, providing the "organismic" and "ecosystem" concepts, that have been used in a wide variety of geographic models at many scales (Stoddart, 1986), there has been little sustained concern for the theoretical or practical issues surrounding extinction and biodiversity. Reasons for this tradition of omission may be traceable to the increasing division, and even divisiveness, of academic disciplines during the late 19th century and throughout the 20th (discussed in relation to the meaning of the term "landscape" below). The disciplines of biology and geography have been increasingly estranged from one another, with biogeography becoming a kind of proxy common ground (Stoddart, 1986). Within geography as well, there remain rifts between physical and human geography that are difficult to cross, and still more difficult to close. This has been a setback for the discipline in an era of deepening awareness of human impacts on the survival of other species and of growing concern for the future of the biosphere.

This dissertation draws on the Berkeley School of cultural geography, which has maintained a sustained focused on the impacts of human activities on the earth's surface (Sauer, 1925; Thomas et al., 1955). The project falls within the goals for human geography advanced by Price and Lewis (1993), Turner (1989), and Zimmerer (1994,
1996). As such, it is geography at the interface of culture history and biological ecosystems, which sets it apart from past use of the "ecosystem concept" for heuristic purposes in ways that often neglected human interactions with the total assemblage of local plants and animals (Moran, 1990; Stoddart, 1986).

The earliest traces of an historical-geographic approach to extinction and biodiversity are visible from the birth of European natural history in the 18th century. The French naturalist Buffon (1707 -1788) is generally credited as the first scholar to focus attention on this subject, (though Plato and the Chinese scholar Mencius provided notable observations of it) (Glacken, 1967; James and Martin, 1981). In *Histoire Naturelle* he repeatedly asserted that wild nature could only be improved through human stewardship (though he criticized reckless exploitation), and yet he expressed empathy for wildlife, which he said was under constant threat from the destructive nature of humanity.

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23 Moran (1990: 25-27) notes that cultural ecologists may begin to play a critical role in protecting biological diversity and restoring ecosystems. He also stresses that in order for the ecosystem approach to cultural ecology to be viable, it should not be static and inflexible, but should remain attentive to the biotic and abiotic contexts within which human societies exist.

24 Following nearly three centuries of global exploration, a number of scholars attempted to systematize and understand an unprecedented influx of geographic, cultural, and biological information. For the first time in human history, the role of humans as agents of environmental change became a subject of significant inquiry (Glacken 1967).

25 As the director of the Botanical garden of Paris from 1739 to 1788, Buffon had access to biological specimens and travel accounts from recent explorations to parts of the world that were still largely unknown to his contemporaries.
He drew a clear connection between the increase in human populations and settlements and the diminution of wildlife distributions and populations (Glacken, 1967).26

While Buffon was the first Western scholar to concentrate on the subject of humanity as an agent of geographic change, and his inclusion of wildlife as a subject for study is noteworthy, his analysis did not match that of George Perkins Marsh [1801-1882] in spatial and temporal depth, nor did it approach the subject in as systematic and comprehensive a fashion.27 Marsh (1864) was deeply concerned about the plight of the world's wild flora and fauna, and he considered the study of organic life in all of its forms an essential part of geography.28

The greatest single work on anthropogenic environmental change to succeed Marsh's came from the collaborative efforts of 76 participants (including geographers and a greater number of other specialists) at the 1953 conference entitled Man's Role in

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26 Buffon was remarkably aware of the plight of large predators in the face of human encroachment, and he argued that a 10 to 50 fold decline in the lion population proved that the human population of the earth had sharply increased since Roman times (contrary to contemporary beliefs that there had been enormous declines in human population) (Glacken, 1967).

27 *Man and Nature or Physical Geography as Influenced by Human Action* (Marsh, 1864) was an historical account of the effects of resource exploitation, in its myriad forms, on the landscapes of North America, Europe, and the Middle East. Marsh's thorough approach to this subject earned him general recognition as one of the founders of the conservation movement in North America, if not the entire Western world.

28 Marsh (1885: 55-129) devoted many pages of *Man and Nature* to sections on the destruction of land mammals, aquatic mammals, fishes, and birds respectively. He was critical of a geography "which confined that science to delineation of terrestrial surface and outline, and to description of the relative position of land and water," and advocated a biocentric geography that embraced "not only the globe itself and the atmosphere which bathes it, but the living things which vegetate or move upon it, the varied influences they exert upon each other, the reciprocal action and reaction between them and the earth they inhabit (Marsh, 1885: 55)."
Changing the Face of the Earth, a conference that was dedicated to G.P. Marsh. In the volume of the same title that resulted from the conference (Thomas., 1956), there are insightful passages on anthropogenic declines in wildlife populations, the significance of habitat destruction, and the impacts of introduced exotics upon native vegetation and wildlife.29

Coverage in Man's Role of the subjects of biodiversity and extinction per se, was tangential, in fact the term biodiversity had not been coined. Anthropogenic extinction was mentioned only in the contexts of prehistoric megafauna overkill and the slaughter of North American bison and other large ungulates in historic times (Clark, 1956; Darby, 1956; Darling, 1956; Narr, 1956). Other anthropogenic effects on wildlife, however, are discussed in varying detail, especially as the topic relates to prehistoric and modern hunting and gathering (Clark, 1956; Curtis, 1956; Narr, 1956), predator control programs (Curtis, 1956), logging and the use of fire in vegetation clearance (Darby, 1956; Curtis), and the introduction of exotic species (Clark, 1956).

29 Carl Sauer, one of the main planners and the chief visionary of the conference, was deeply interested in the history of anthropogenic impacts on fauna and flora, having delved into the subject much earlier, in "Theme of Plant and Animal Destruction in Economic History" (Sauer, 1938). Sauer insisted that the conference not be a forum for social scientists and those "sons of Dedalus" who would focus on quantification and prognostication at the expense of thorough historical views of the multiplicity of cultural changes that had altered the ecology, landforms, and climate in specific places all over the globe (Sauer in Williams, 1987). This concern was echoed by E.A. Gutkind, whose aerial photos of cultural landscapes around the world provided a new type of "synoptic view" of human agency. This new perspective made visible the vast and ongoing human transformation of the earth's surface, and, in his opinion necessitated a synoptic approach to environmental history (Gutkind, 1956).
Despite frequent references to humans as agents of ecological destruction (Sauer, 1956), there is no mention of biological extinction as a critical problem. Sauer's "The Agency of Man on the Earth" (1956) sets the tone for the book, with a call for conservation and sustainable development (not a contemporary term or popular concept by any name in the 1950s), but a complete omission of any specific examples of how humans had destroyed wildlife habitat per se, or even diminished the populations of any wild animals. There was a sustained focus on vegetation change, for obvious reasons; vegetation patterns were more mappable, relatively fixed entities more readily accessible to observers of landscape change. The connection between vegetation and wildlife habitat, however, while implicit in some statements, was conspicuously lacking.

Remarkable exceptions to this problem can be found in Clark (1956) and Curtis (1956), and the latter provided a brief but prescient analysis of the effects of forest fragmentation and insularization on species richness that foreshadowed the theory of island biogeography, which surfaced 12 years later (McArthur and Wilson, 1967; Shafer, 1990).

When Man's Role was compiled, the two greatest barriers to geographic studies of landscape degradation and the diminution of animal species were institutional and conceptual in nature. Graham (1956) points out that 5 separate professions had arisen within 50 years to deal with environmental destruction, and he listed forestry and wildlife management among them. From a professional standpoint, the rise of specialties geared

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30 Lest the reader think that these were not important issues, the major works of Aldo Leopold (1933, 1949), which focused on wildlife conservation and the development of a "land ethic," were internationally famous. Similarly, Rachel Carson's (1941, 1951) descriptions of marine biota and their conservation were widely read. In fact, The Sea Around Us (1951) won the national book award.
toward the management of other species may have been a disincentive for geographers to involve themselves in these issues, which seemed peripheral to the central concerns of the discipline.

Concern for the history of wildlife became the province of naturalists, and Peter Matthiessen produced the first comprehensive historical account of Euro-American impacts on the fauna of North America in 1959 (Matthiessen, 1959). For the first time, wildlife was the focus of history. Human settlement, land use patterns, and especially hunting and fishing practices were blamed for the destruction of North American ecosystems and fauna. Matthiessen's work, had it come earlier, would have made a fine contribution to *Man's Role*, and his concerns could have set an important precedent for geographers. As it was, histories of ecosystem change that included a focus on fauna did not gain ground until the emergence of the field of environmental history in the 1980s (Cronon, 1983).

*Man's Role in Changing the Face of the Earth* was the last great, concerted effort within geography to grasp the cumulative impacts of human agency on the earth's ecosystems before historical environmental geography was temporarily eclipsed by the quantitative revolution in the 1960s, and this monumental treatise neglected to focus on nonhuman animal species, the threat of extinction, or the importance of biodiversity. These topics have only been examined within geography since the 1970s by geographers cognizant of ecological issues brought to light by the growing environmental movement (Doughty, 1975; Hammond et al., 1978; Walter 1978). Traditional strength in the study of environmental historical geography has also been revived (Dilsaver and Colten, 1992;
Goudie, 1981; Roberts, 1989; Stevens, 1993; Simmons, 1989) and spurred on by the rise of this subfield within history (Cronon, 1983; Worster, 1989).

Recently published environmental histories of China include works by Chinese scientists (He and Wen, 1980; Ma, 1987), Western historians (Averill, 1983; Marks, 1996; Menzies, 1985, 1988; Schoppa, 1989), and a fine collaborative, multidisciplinary effort (Keightley, 1983). The North American geographers, Smil (1984, 1993) and Edmonds (1994) have written comprehensive books on current environmental problems in China, and the western biologists MacKinnon (1996) and Schaller (1993) have written the most extensive reports on wildlife conservation.

In China, works on environmental historical geography can be found within geography and forestry journals and treatises on historical geography. They often highlight human impacts on forest and wildlife in particular regions through centuries of local history (Chai, 1991; He and Wen, 1982; Huang, 1985; Li, 1987; Ma, 1987). Most of the historical vignettes rely on local historical records to reconstruct environmental change. Their purpose is both scholarly and didactic. They are lessons on the cumulative environmental degradation that follows chronic deforestation; hydrologic imbalances, soil loss, declines in wildlife populations, local climate change, and concomitant economic losses. In these respects, the Chinese works resemble sections of *Man's Role*.

From a theoretical standpoint, while many contributors to *Man's Role* provided valuable synoptic views of long-term forest fragmentation and the destruction of wild grasslands (Clark, 1956; Curtis, 1956; Darby, 1956; Graham, 1956), there were no contemporary spatial theories that linked vegetation patterns with areal patterns of species
richness. As stated, Curtis (1956) is recognized as the first to hypothesize a connection between habitat patch size, isolation, and biotic variation (Shafer, 1990). This link was further developed by Preston (1962) and through the theory of island biogeography (MacArthur and Wilson, 1967).

The theory of island biogeography has been the bedrock for a plethora of ecological research on the spatial characteristics of habitat as a determinant of biodiversity. The theory has been applied to nature reserve design in explicit ways (discussed below) despite the indefinite nature of many of its precepts when applied to real world situations. In short, it is the theoretical bulwark behind the axiom that the preservation of biodiversity depends upon the maintenance of suitable habitat of sufficient areal dimensions. The theory invites response from human geography at the end of the 20th century. Human geographers are faced, knowingly or not, with the centrality of the issues of biodiversity and space, and the scientific, intellectual, and ontological implications of a geography that continues to draw the Juggernaut\(^{31}\) of monospecieism. For in this case, it is not the devotees alone who may be sacrificed. While it would be wrong-headed, unrealistic, and even destructive to suggest that human geographers should disengage from their current areas of research, it may not be unwise to suggest that geography could contribute much more to the theoretical, philosophical,

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\(^{31}\)The commonly used juggernaut is defined as "Anything that draws blind and destructive devotion, or to which people are ruthlessly sacrificed, such as a belief or institution." I have capitalized the word to suggest the original meaning of Juggernaut, which is "A title of the Hindu deity Krishna, whose idol is drawn in an annual procession on a huge car or wagon under the wheels of which worshipers are said to have thrown themselves to be crushed." [Hindi Jagannath, from Sanskrit Jaganatha, "Lord of the world"] (American Heritage Dictionary: Morris, 1980).
and practical dimensions of keeping human existence in balance with the existence of other species. The discipline is uniquely endowed with a wide range of traditional and emerging analytical skills to deal with one of the greatest and most intriguing spatial, cultural, and philosophical problems of the coming millennium.

**Plains of Isotropia: Island Biogeography and Conservation Theory**

Geographic studies of human impacts on wildlife populations and habitats may be most fruitful when informed by relevant spatial theories, which to date, have been the province of ecologists rather than geographers (Zimmerer, 1994). Human geographers can augment the analytical capabilities of existing conservation theories by providing additional insights into such phenomena as local land use history and resource utilization patterns (Stevens, 1993, 1997).

Before discussing points of affinity between these disciplines it is important to examine a few of the basic principles of spatial theory within conservation. This is not a review of theories that are by now well known within conservation biology and related disciplines, rather it is a summary of key concepts that have been considered most applicable to conservation problems such as the design of nature reserves. It is remarkable how the nomothetic spatial approach to conservation problems has been, in its

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The spirit of this argument is beautifully expressed in Stephen Birdsall’s (1996) presidential address entitled, "Regard, Respect, and Responsibility: Sketches for a Moral Geography of the Everyday." Birdsall deals with some of the "underlying assumptions" of Western culture, the "disenchantment of the world," "rationalization as method and efficiency as goal," and the segmentation of time and space. While his critique takes aim at the severe and destructive constraints that Western ideology and material life place on the experience of everyday life, he contends that "intellectual countercurrents" like sociobiology, the Gaia hypothesis, and the biophilia hypothesis could be beacons leading toward an "indivisible whole."
formative period, marked by the same problems as were found in geography during the spatial analytical period of about the same time. Theories have been constructed on the basis of isotropic planes with little real world applicability. This does not negate the importance of theory building, but it makes Stoddart's (1986) call for "putting the geography back in the bio" ring as true for ecological biogeographic problems as for the historical biogeographic issues that he addressed.

Island biogeography theory posits that an island or isolated patch of habitat exhibits the following properties: 1) the rate of species extinctions decreases continuously with area; 2) the rate of immigration decreases with isolation. The theory predicts that: 1) the number of species will increase directly with area; 2) species richness will decrease with distance from a source of replenishment; 3) the number of species will remain near equilibrium; 4) there will be species turnover, with extinction balanced by newly arriving (colonizing) species; and 5) successful colonization will be non-random, determined by dispersal abilities and demographic characteristics of source populations (Shafer, 1990).

Shafer's (1990) analysis of the theory's applicability to reserve planning and management is based on an extensive review of all available research. He makes the following points: 1) only the first prediction is indisputable and has been demonstrated in a number of studies: the larger the reserve, the more species will survive (though the species-area equation is too poorly understood for precise application to nature reserves); 2) there has been no convincing evidence of an equilibrium between the number of species extinctions and colonizations, and thus there is no reason for confidence that a reserve will have an equilibrium number of species with non-random species turnover;
and 3) the theory has provided new ways of thinking about complex and interrelated spatial variables affecting biodiversity, but it does not provide a ready-made guide to nature reserve design and management, which many scientists and conservationists fail to realize (Shafer, 1990). Following Simberloff (1988) and Zimmerman and Bierregaard (1986), Shafer states that there is an urgent need for studies of the habitat requirements of individual species, or autecology, as a complement to theoretical and applied island biogeography.

The concept of minimum viable population size is also difficult to apply and has not been confidently calculated because of the complexity of interacting demographic, genetic, environmental, and social (in the zoological sense) variables (Shafer, 1990). Likewise, in studies of the effect of habitat (or reserve) size on species loss, it may be impossible, "even with multivariate techniques," to separate the effects of area from those of isolation, habitat heterogeneity, internal impacts, external influences, and myriad anthropogenic factors (Shafer, 1990). Shafer (1990) and others (Wilcox, 1980) recommend that reserves be as large as possible, but given the many restrictions on this agenda, biogeographic theory should be set aside in favor of autecological estimates of the needs of individual species of large carnivores and/or herbivores. They argue that if reserves are designed to meet the space requirements of large vertebrates, there will be an "area-umbrella" for smaller species across the taxonomic spectrum (Shafer, 1990). Reserve planning can proceed as follows: select a terrestrial vertebrate with a large home range, determine its minimum viable population, determine the habitat needs for a population, determine the amount of space needed to preserve the required habitats for a
population. In this process conservationists confront numerous theoretical and practical questions that cannot be satisfactorily answered, but the protection of large land areas for the protection of large vertebrates usually insures that more organisms will be safe from disturbance.

Reserve shape and reserve system spatial configuration have also been topics of great interest in conservation theory. Though there was initial consensus that round reserves are superior because they reduce potential for negative impacts at boundaries, known as "the edge effect" (Diamond, 1975), there is now evidence that this may not be true for all species in all natural conditions (Harris, 1984; Shafer, 1990; Schelhas and Greenberg, 1996). The importance of area to perimeter ratio as a determinant of external effects is, however, an important consideration in the design of reserves (Shafer, 1990). Theories on the optimum spatial configurations of nature reserve systems have also devolved from the nomothetic simplicity of the isotropic plane to address variation in geomorphology, vegetation, and natural history (Schelhas and Greenberg, 1996). Harris (1987) provides two examples of how differences between terrestrial habitat islands and oceanic islands make island biogeographic theory inapplicable.  

Another distinction between real patches of habitat and the model's oceanic islands is that in the former there may be no "continental" source area for new immigrant

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33 The first example shows how old growth forest "islands" are commonly surrounded by similar forest types in different phases of succession. Unlike water around an island, the forests outside the patch of old growth may not impede colonization, on the contrary, they serve as habitat for many species, which favor various stages in the successional sequence (Harris, 1987). Harris (1987), in a study of Pacific Northwest montane forests, derived an ordination system showing the habitat preferences of amphibian, reptile, mammal, and bird species in 6 forest successional phases that resulted from logging.
species. In the model, there is an endless supply of species on the "continent" with the potential to colonize and keep the island's biodiversity in equilibrium; even if extinction is rapid, there is rapid "turnover" (of species). There is no comparable situation in many types of ecosystems, and even islands near continents cannot be colonized endlessly.

Conditions in many nature conservation areas are the exact opposite in the practical sense that they may contain endangered species, like grizzly bears, in an area encompassing the best available habitat in an entire biogeographic province (biotic region). There may be species out-migration, but there are no dependable source areas for new arrivals of the species targeted for protection. Harris (1987) likens this pattern to islands in a sea with no continent.

Western et al. (1989) consider wildlife conservation through reserves a "Noah's Ark solution," that will fail if there is no way to preserve biodiversity outside of reserves. There is growing consensus that reserves must be used, in combination with regional land use management and game laws, to protect wildlife and habitats outside of reserves and to insure gene flow between reserves (Forman, 1995; Harris, 1987; Naveh, 1994; Shafer, 1990; Schelhas and Greenberg, 1996). Where human activities dominate the landscape in ways that exclude wildlife, corridors of habitat may be preserved or created to connect isolated habitats. There is growing realization among conservationists that landscapes must be seen in terms of the dynamics of connectivity and interaction. Land use decisions concerning a particular site should not be made in isolation, but in reference to the functional role of the site within a larger matrix of ecological processes. This approach to conservation, first developed in Central Europe, is increasingly being applied
in conservation schemes in many parts of the world (Forman, 1995; Naveh, 1994; Schelhas and Greenberg, 1996).

Landscape Ecology and Beyond

Westmann (1985: 467), in his introduction to the relatively new science of landscape ecology, reminds his readers that geographers have long been concerned with human impacts on the landscape and with the constraints "imposed by nature" on its development. Alexander von Humboldt, the early 19th century German pioneer of physical and human geographical field research and theory-building, was the first to use the word "landscape" as a scientific-geographic term. Humboldt called geography "Erdbeschreibung" (earth description), the aim of which was to describe "interrelated phenomena that exist together in areas or segments of earth space" (Hartshorne, 1958, in James and Martin, 1981). Humboldt defined landscape as "the total character of an earth region," including both the organic features, like wild and domesticated plants and animals, and inorganic features, namely landforms and human artifacts (Naveh and Lieberman, 1984). The fission of academic endeavor into institutional and paradigmatic specialties in the late 19th century had the effect of stripping wild animals from the geographic landscape and relegating them to the biological laboratory and museum. Gone were the synoptic viewpoints of Marsh and Humboldt, and the "total character" of the landscape has yet to be fully restored.

Naveh and Lieberman (1984) credit Russian geographers with maintaining an integrated science called "landscape geography," but along with Forman and Godron
(1984), they honor the German biogeographer, Karl Troll (1899-1975), as both the founder and christener of the discipline of "landscape ecology."34

Landscape ecology is an emerging discipline that combines geographic and ecological perspectives on the landscape to provide practical solutions to biological conservation problems (Forman, 1995; Naveh, 1994). It focuses on geomorphology, vegetation mosaics, land use patterns, and all other natural and anthropogenic landscape features that affect local and regional ecology. Shafer (1990) considers the science of landscape ecology critically important for the preservation of biodiversity, though he believes that its general perspectives are much more important than its nomenclature (Forman and Godron, 1984). Though there may not be a general consensus on the best definition of the term landscape, Forman and Godron (1984: 11) provide a useful definition:

"We now can define landscape as a heterogeneous land area composed of a cluster of interacting ecosystems that is repeated in similar form throughout. Landscapes vary in size down to a few kilometers in diameter. Aerial photography is often useful in portraying the ecosystems

34 Naveh and Lieberman state that Troll defined landscape as "'the total spatial and visual entity' of human living space, integrating the geosphere with the biosphere and its noospheric man-made artifacts. He regarded landscape as a fully integrated holistic entity, meaning a "whole" that is more than the sum of its parts and that should be studied in its totality. As early as 1939, while studying problems of land use in East Africa, he coined the term 'landscape ecology,' realizing its great potential in the aerial photographic interpretation of landscapes. He hoped for a closer collaboration between geographers and ecologists, from which a unified earth and life research might develop - a new 'ecoscience,' as distinguished from a 'geoscience' - dealing only with the inanimate lithosphere and not the biosphere. In practice, landscape ecology combined the 'horizontal' approach of the geographer in examining the spatial interplay of natural phenomena with the 'vertical approach' of the ecologist in studying the functional interplay in a given site, or 'ecotope.' "Geo-ecology" is another subfield derived from Troll's integrative approach to mountain geography.
composing a landscape as well as its boundary, which is usually relatively distinct, especially in vegetation structure."

The degree of human disturbance in a particular landscape is a function of physical and cultural-historical variables. Landscape complexity is a factor of natural geological and ecological variation combined with the degrees and kinds of human intervention that have occurred through time.\textsuperscript{35} Ecological patterns in the landscape are typically a result of differences in the ages or successional stages of contiguous patch types, and by differences in the adaptability of individual plant and animal species to certain patches or mosaics at various scales (Forman, 1995; Naveh, 1994; Schelhas and Greenberg, 1996; Turner, 1987).

Scientists and planners may continue to benefit not only from the use of new conceptual tools from landscape ecology to analyze landscape structure, function, and change, but also from an understanding of the particular social, cultural, and historical forces that are inextricably intertwined therein. Shafer (1990) argues that there has been an overemphasis on design and a lack of emphasis on management in conservation theory. While a well designed reserve may help prevent ecosystem damage, even the best designs will have no value if reserve management is unsound. Schelhas and Greenberg (1996) provide numerous case studies on forest patches in the tropics that lie outside of protected areas. These studies show that such patches are often critical refugia for flora

\textsuperscript{35} In this sense, a more complete definition of landscape is:"the geological structure of the land, its soils, animals and its vegetation; the pattern of human activity - fields, forests, settlements and local industries - both past and present. It is a matter not only of beauty, of aesthetic appreciation of nature and architecture, but of the whole ecology of an area and the history of its occupation and use by people" (Poore and Poore in Lucas, 1992).
and fauna, and that in many cases they can only be protected through sustainable land use schemes based on the participation of local people (Schelhas and Greenberg, 1996).

Unfortunately, there is no simple formula for land management that meets the needs of local human populations and insures the survival of local fauna and flora. Though conservationists in the United States and other developed nations are designing increasingly sophisticated legal and administrative tools for wildlife management and the establishment and management of protected areas, many of these may be applicable only in countries that have gone through what has been called the "risk transition" (Suttmeier, 1995). This term is derived from the familiar "demographic transition," and refers to societies that have reduced the risks found in developing countries (plagues, famines, uncontrollable natural hazards, and other sources of early mortality) through the adoption of "modern" scientific and technological management strategies. Suttmeier (1995: 120) argues that China is undergoing a "risk transition," in which the relationship between "scientific" understandings of environmental degradation (and risk) and other forces of social construction" are still unclear.

China and other developing countries may do well to emulate the legal and managerial techniques for nature conservation currently used in the developed world, but such measures may seem unnecessary, against the will of the people, and downright draconian. Their effectiveness depends ultimately upon cultural, historical, and political economic factors. These include the sustainability of land and resource utilization patterns; the degree of economic development and regional disparity; the degree of cultural heterogeneity, assimilation, and political alienation; the degree of state
legitimation and the viability of legislative and law enforcement systems; and the persistence or degeneration of traditional beliefs and practices regarding the exploitation of wildlife and natural habitats (which is largely a function of the other factors).

It should be kept in mind that economic needs, land use practices, land tenure systems, and belief systems may exhibit striking spatial and temporal variation even within small culture regions. Nature conservation that meets international and intercultural demands will require great flexibility and a diverse array of management strategies. Studies of the human dimension of wildlife conservation in East Africa provide numerous lessons on the importance of regional planning, landscape ecology, and cultural ecology in protecting wildlife (Homewood and Rogers, 1991; Grove and Anderson, 1987). In many parts of the world, the most biologically diverse regions coincide with the ancient homelands of ethnic minorities, whose preindustrial economies have had less extensive impacts on the environment than those of industrial societies. Recent studies from North America, Central America, Australia, and Asia demonstrate the rise of an integrated approach to nature conservation that is sensitive to the subsistence, economic, social, territorial, and spiritual needs of diverse traditional cultures (Stevens, 1997).

A final, but certainly not least essential concern in the human geography of nature conservation, is the social construction of place, nature, and wildlife. Gadgil and Guha view such ideological concerns as the "software" of environmental change, the ever-changing frameworks from which decisions are made and systems continuously defined and redefined. The intersection of mind, culture, and landscape, and the formation of a
"sense of place" (Relph, 1976, 1981; Tuan, 1974), or a world view in which cosmology and perceptions of the physical environment of the home community are intertwined, is a rich area for research, with profound implications for the study of anthropogenic environmental change and protected area management. Human geographers such as Pred (1984), Tuan (1974), and Graber (1976) have elaborated upon the formation of socially meaningful landscapes and the perpetuation or transformation of value systems through the continuous transformation of ecosystems (or of "nature," as in Pred 1984). Graber (1976) and Nash (1982) have explored the Euro-American sacralization of wilderness, and the role of religious feeling in the protection of "vast, chaotic scenery" because it is "sublime and beautiful" (Nash, 1982: 45-6). But to what extent do these sentiments have currency among cultures that have not been influenced by Euro-American notions of the sanctity of wilderness? Strong arguments have been made for the sanctity of wild landscapes in East Asian cultures, but these have frequently been met with the response that such sentiments are relics of a high culture, maintained by an urban elite, with little value to rural people in daily contact with wild nature (Murphey, 1967). Aesthetic valuation of the landscape among indigenous cultures, including rural Chinese of Han and minority nationality, is a subject in need of much greater attention. How, for instance, are landscapes structured, segmented, and maintained by local institutions and according to local cosmology? How does this relate to patterns of food and energy production,

The contributions of Lovelace (1985), Fan (1992), and Hase and Lee (1992) deserve mention, for they shed light on the relationship between the aesthetic, cosmological, and conservation functions of Han village fengshui. Pei (1985) has also contributed a fine description of Dai village sacred forests.
development and maintenance of the built environment, demarcation of territory, and other activities that transform the (natural) landscape? Finally, how do cosmological and religious beliefs and practices tie in with resource conservation functions?

**Research Parameters: A Cultural-Historical Landscape Ecology**

In their environmental history of India, Gadgil and Guha (1992) state that "Human history is...a patchwork of prudence and profligacy, of sustainable and exhaustive resource use." This patchwork is highly mutable in both temporal and geographical dimensions. To apprehend the ecological implications of this mutability, this dissertation employs a theoretical and methodological framework that combines cultural geography, cultural ecology and landscape ecology. In this approach, landscape transformation is analyzed from the viewpoint of a unified cultural, historical, and biological perspective. Thus, the creation and development of cultural landscapes are investigated not only from the perspective of cultural geography, but also in the context of biological conservation, as pioneered by landscape ecology. The cultural landscape and coexistent ecological assemblages are shaped by resource utilization patterns that are central to the study of cultural ecology.

The research objectives of cultural-historical landscape ecology are: 1) to reconstruct the spatial configurations and ecological characteristics of anthropogenic landscapes through time; and 2) to delineate key cultural, social, historical, and economic variables that relate to land use and biodiversity in regional landscapes throughout the biosphere. This requires both "emic" and "etic" landscape analysis, for how local people view the landscape is fundamental to how they inhabit and transform it.
In the United States, a nature conservation technique known as "extended gap analysis" combines GIS and regional planning techniques to analyze socioeconomic conditions and land use practices between existing protected areas (Machlis and Forester, 1991). The goals of extended gap analysis are: to identify land use patterns that threaten biodiversity, to monitor the threats, to mitigate the threats, and to create additions to existing protected areas with the goal of removing threats. Cultural-historical landscape ecology can be viewed as an elaboration of this technique to include the cultural, economic, and ideological concerns of resident peoples in regard to their historical transformation of the landscape. This is a critical amendment, because preservation of global biodiversity is ultimately a matter of managing local and regional land use across the vast panoply of the earth's cultural landscapes. The interaction of cultural and biological features across a landscape can be analyzed effectively only when spatial and temporal frames of reference are clearly defined. Shafer (1990) and Stoddart (1986) discuss the importance of time frames and geographical scales in understanding and preserving biotic distributions. Stoddart (1986) proposes a scheme devised by Udvardy (in Eldredge, 1981) to analyze vicariance and dispersal processes. The scheme includes three spatio-temporal orders of magnitude:

1. The "secular scale," which has spatial dimensions of roughly 100 kilometers and time spans of roughly 100 years (also called "ecological time").

2. The "millennial scale,"
which has spatial dimensions of up to 1,000 kilometers and spans the past 10-12,000 years, or the Holocene Epoch (though Udvardy also indicated that it could be extended by an order of magnitude to include the Pleistocene). The "phylogenetic scale," which has spatial dimensions of 40,000 kilometers and "evolutionary time" spans up to 500 million years.

Anthropogenic ecological changes are readily discernible (and ubiquitous in recent centuries) at the secular scale, and cultural landscape ecologists may investigate the entire spectrum of human land use activities, including, but not limited to: hunting-fishing-gathering, shifting and settled cultivation, nomadic and settled pastoralism, settlement processes, forestry, the use of fire in landscape modification, mining.

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This scale is appropriate for studying biological processes affected by climate and sea level changes (Stoddart, 1984). Historical biogeographic research often employs this scale, as exemplified by palynological studies of the post-glacial migration of eastern North American and western European tree taxa (Davis, 1965; Huntley and Birks, 1983). Anthropogenic landscape features are important at this scale, and research may focus on the ecological effects of hunting-fishing-gathering during the paleolithic (roughly 40,000 - 10,000 BP); forestry (especially the use of fire in forest and grassland management) (Sauer, 1956; Simmons, 1989), early agriculture, and permanent settlement in the neolithic (roughly 10,000 to 1,500 BP); all of these activities plus widespread settled cultivation and mining between 1,500-200 BP; and all of these activities plus industrialization for the past 200 years. The disciplines of paleoecology, bio-archaeology, and geoarchaeology examine the cultural landscapes and ecology of prehistoric periods (Roberts, 1989; Piperno, Bush, and Colinvaux, 1991). Historical sources, including cartographic records are extremely useful for analyzing relatively recent anthropogenic impacts near the end of the millennial time scale (Delcourt, 1975).

This scale is appropriate for studying biological processes affected by continental drift and other aspects of plate tectonics. While the phylogenetic scale of evolutionary time spans millions of years and continent-sized areas, Shafer (1990) points out that the long term future of "evolutionary options" on earth depends largely upon human actions over the course of the coming decades. Cumulative anthropogenic environmental impacts associated with industrial modes of resource use qualifies this human epoch as the only one that matches the evolutionary changes and mass extinctions that have occurred over evolutionary time.
transportation networks, the myriad land use features of industrialization, and the establishment of protected areas. Geographical studies of environmental history have already proven the efficacy of this approach (Dilsaver, 1992; Simmons, 1989; Stevens, 1993). Environmental historians have also developed socio-ecological schemes for reconstructing the social history of environmental change. Gadgil and Guha (1993) have made a notable contribution in this realm.  

This study focuses primarily upon secular scale changes in the patchwork of montane landscapes inhabited by settled agriculturalists in an era of expanding industry. Most of the analysis focuses on landscape change within the last century in three study areas within a region that spans 350 kilometers from north to south and 100 kilometers east to west. Greater temporal depth - spanning the past 2,000 years - is given to the analysis of human-wildlife interactions recorded in local gazetteers over a four province region that spans approximately 1,150 kilometers from east to west at the widest point and 850 kilometers from north to south. This expands the scope of the research to include anthropogenic ecological change over the millennial time scale.

Research in cultural-historical landscape ecology assesses the degree of landscape change within specified temporal and spatial frames. The vegetation assemblages of a

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The authors propose that ecological historical analysis follow a modified Marxist framework, subsuming human societies within four "modes of resource use" (as opposed to modes of production): gathering (including shifting cultivation), nomadic pastoralism, settled agriculture, and industry. Any particular society or mode may then be analyzed along five "axes": technology, economy, social organization, ideology (i.e. religion, tradition, or science), and ecological impact (Gadgil and Guha, 1992). While this study avoids such a regimented and limited categorization of resource utilization, it does analyze the effects of technology, economy, social organization, and ideology on ecological dynamics at the level of individual villages, regions, and larger geographic areas.
study area comprise a framework of interaction between humans and other plant and animal species through time. Research procedures may include the following operational phases:

1) Design a map of the (hypothetical) historical landscape ecology of the study region before significant human disturbance or under low impact indigenous management schemes.

2) Design a map of the current landscape ecology of the study region, including habitat mosaics and their physical and cultural components. In conjunction with this map, the researcher designs an index of wildlife habitat preference as a modern analogue for past and future wildlife habitat patterns.41

3) The researcher obtains data on the effects of current land use (including hunting practices if applicable) on wildlife habitat and populations. These data may be obtained through field measurements, cartographic analysis, and remote sensing data on vegetation change.

4) Through formal and informal, and structured and unstructured interviews of individuals and (if possible) groups, the researcher reconstructs the history of land use (including hunting practices), with as much temporal depth as possible. In the course of extensive ethnographic surveys on the regional history of forestry, agriculture, and wildlife management, the researcher gathers additional data on environmental perception, local knowledge, land use ideology, and the cultural significance of wildlife and hunting.

41 The data may be readily obtainable if relevant studies have been conducted in the region (but this was not the case in Fujian). If no data are available, the researcher may conduct the necessary surveys, preferably with the aid of field biologists and/or local hunters.
5) The researcher compares past and present land use patterns and their impacts on wildlife and vegetation, predicts future problems on a site-specific level, and makes recommendations for conservation planning that will meet current and future needs.

The research may address: 1) how technology, economy, social organization, and ideology have created, sustained, and altered the mosaic of habitats and land use zones in the study area; 2) the present conditions of animal and/or plant habitats in terms of biodiversity (to be defined by the researcher) or suitability for certain species; 3) how human geographic factors are likely to affect the study area in the future; 4) the prospects for sustainable development and nature conservation; and 5) ways to implement or improve regional sustainable development and nature conservation practices.

Research Topics, Goals, and Methodologies

This research addresses a wide range of issues, but the central objective is to describe the relationship between people, montane ecosystems, and wildlife in the Southeast Uplands region. Centuries of anthropogenic environmental change in the Chinese subtropics have left a legacy of distinctive landscapes and ecological conditions. This study focuses on land use, development, and habitat conditions in the Meihuashan Nature Reserve, and attempts to place conservation efforts in this and other reserves within the environmental historical and cultural ecological context of the Southeast Uplands as a whole.

The researcher has pursued as many sources of information on the subject as possible, delving into historical records; conducting wildlife habitat research; and holding in-depth, often outdoor interviews in the forests and fields, with villagers and managers in
three nature reserves. In the course of research it was often necessary to take stock of what had been learned, what was missing from the puzzle, and what steps were necessary to fill in the gaps. For example, results from a survey of wildlife habitats in Meihuashan yielded important information about the negative effects of local land use practices. Surveys on village and household land use then focused on distal causes of environmental degradation, originating in the socioeconomic and socio-ecological conditions at the level of the household and village. These conditions were then related to larger-scale economic factors at the level of the township, county, and region. This research process, known by one proponent as "progressive contextualization" (Vayda, A., 1983), applies a flexible perspective on ecosystem scales and boundaries to account for the multiple exogenous and endogenous factors involved in environmental change.\(^4\)

In proceeding through each chapter, the reader will see how the research progressed, what methods were used to collect the data, what kinds of data were collected, and what conclusions were drawn.

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\(^4\) As Vayda (1983: 267-268) explains, "...we need to make no assumption that the people-environment interactions that interest us are necessarily the components or expressions of some previously defined system. Instead we are free to gain understanding by proceeding empirically to put the interactions in question into context - sometimes by going far beyond the boundaries of a nation-state or island (e.g., in looking at the movement of forest products from the interior of Kalimantan to buyers in Hong Kong, Japan, North America, and Western Europe), sometimes by being satisfied without going beyond even the boundaries of a single Dayak village and its land (e.g., in looking at the villagers' collection of forest products for local use in building, cooking, and medicine)."
CHAPTER 2
A MOUNTAIN PATCHWORK: BIODIVERSITY, CULTURAL DIVERSITY, AND CONSERVATION IN CONTEXT

Montane landscapes in southeast China today are a heterogeneous mix of successional forest and scrub interspersed with bamboo, tea, fruit orchards, and rice paddies. The assemblage of wild and domesticated fauna and flora found in this embroidery, and the landscape structure resulting from human modification of the mountain environment are what make the region unique. This chapter provides an overview of the physical geography, zoogeography, and cultural geography of the Southeast Uplands. The chapter closes with an analysis of the political-ecological history and regional attributes of nature reserve management in China. This includes translations of key legislation on wildlife conservation and the establishment and management of nature reserves in China.

The Southeast Uplands in China's Geographic Mosaic: Physical and Human Features

The "Southeast Uplands Region," traditionally known as "the Southeast Mountain Kingdom" (Dongnan Shanguo), denotes first and foremost the five ranges of the Wuyi-Daiyun Mountains of Fujian province (Fig. 2.1) (Pannell and Ma, 1983; Zhao, 1986). The 150-200 kilometer (95-125 mile wide mountain region runs parallel to the coastline

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1 Zhao (1986), the Chinese geographer who helped design the most comprehensive physical regionalization scheme of China, designates the Wuyi-Daiyun Mountains as the most mountainous of four subregions within the Southeast Coast - Evergreen Broadleaf Forest Region.
Figure 2.1. Fujian Province - Physiography. The Southeast Uplands Regions is bounded by the Wuyishan Range in the west and the narrow coastal plains and foothills in the east. The Minjiang is the largest river in the region. Its largest tributaries are the Jianxi, the Futun, the Shaxi, and the Youxi. Meihuashan lies in the Daimaoshan Range in the southwest.
(SSW-NNE) from 24-28° N, a distance of some 450 kilometers (280 miles). In Fujian, the mountainous zone is extremely rugged; 95% of the land area is mountainous or hilly land and only 5% consists of alluvial plains. Though the ranges of the uplands region continue southward some distance into NW Guangdong province, to the north they taper off just over the Zhejiang border, and form a distinctive barrier along the eastern boundary of Jiangxi province. In the east, the region is bounded by the hills and the narrow coastal plain, where the mainland meets the Taiwan Straits and the South China Sea.

The SSW-NNE trending mountain ranges that compose the region begin on the western border of Fujian province with the Wuyishan ("Military Safety Mountains"). This long, linear range includes the highest mountains in the region, the highest of which, Huanggangshan, at 2,158 m (7,078 feet asl (above sea level), lies on the Jiangxi border in NW Fujian. The Wuyishan range continues southward, forming the natural barrier (mentioned above) along the border between Fujian and Jiangxi.

Further east, forming the central axis of Fujian province, are the Daimaoshan ("Hawksbill Turtle Mountains") in the south, and Jiufengshan ("Vulture Peak Mountains") extending to the northeast. These ranges contain numerous mountains above 1,500 m (4,920 ft) with highest peaks over 1,800 m (5,900 ft). Along the southeastern edge of the upland region are the Bopingling ("Beaten-Flat Mountains") and Daiyunshan ("Wearing Clouds Mountains"), of comparable elevation with the two central ranges. East of these, and outside of the SE Upland region, lie the foothills, which
gradually descend to the narrow coastal plain and the bays, headlands, and rocky islands of the rugged ria coastline.

The mountains of the Southeast Uplands were formed during episodes of volcanism and faulting. The present orientation of mountain ranges and valleys is due to three fault systems. One series of faults controls the orientation of the SSW-NNE-trending ridgelines and valleys of the Wuyi-Daiyun mountain system. The other two series of faults intersect the mountain system. the first perpendicular to its ridges (ESE-WNW), and the second at a more oblique angle (E-W) (Qiu. 1993). The intersecting faults form gaps and river valleys, which have facilitated immigration and settlement. The network of rivers is dense (.1 Km/Km squared) and forms a trellis drainage pattern in alignment with the geological structure of mountain ridges and valley faults. The longest river is the Min(jiang) River (539 Km.), which is only about one-tenth as long as the Yellow River but produces an annual discharge that is 16% greater (Zhao. 1986), a result of both higher rainfall and steeper stream gradients within its drainage basin. Other major rivers include the Tingjiang, Jiulongjiang, Pujiang, Mulanxi, and tributaries of the Minjiang - Jianxi, Futun, and Shaxi.

Most of the 9.9 million (1993) inhabitants\(^2\) of the Southeast Uplands are concentrated along arable alluvial plains within these intermontane valleys and their tributaries. Large riverside settlements in or near present-day Longyan, Sanming, and

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\(^2\) This figure is derived from population data for the administrative regions that correspond most closely to the Southeast Uplands region: Longyan, Sanping, and Nanping Prefectures, and Dehua, Yongchun, and Anxi counties, in the Quanzhou Municipality (Fig. 2.1) (FSTJJ, 1994). This is an area of 76,058 square kilometers (29,366 square miles), roughly the size of the state of Maine (30,865 square miles) with a population eight times greater.
Figure 2.2. Administrative Regions of the Southeast Uplands. The administrative regions of the Wuyi-Daiyun core area of the Southeast Uplands are Nanping Prefecture in northern Fujian, Sanming Prefecture in central Fujian, and Longyan Prefecture in southwest Fujian. Because of their mountainous terrain and other geographic features, the author also includes the counties of Dehua, Yongchun, and Anxi, in the Quanzhou municipality, in the uplands region.
Nanping had become administrative and trade centers between the 2nd and 8th centuries, and today these cities are the capitals of prefectures that bear the same names. The Southeast Uplands region roughly corresponds to these three prefectures and the counties of Dehua, Yongchun, and Anxi (in the Quanzhou Municipality) (Fig. 2.2). Rice, tea, bamboo, indigo, and timber (especially Chinese fir -Cunninghamia lanceolata), cultivated in the hinterlands, have long been the economic mainstays of the region.

Following the short, swift rivers eastward to where they flow out upon the alluvial and marine terraces of protected bays and estuaries, one finds a narrow coastal plain. Two-thirds of Fujian's 30.9 million residents (FSTJJ, 1994) inhabit these bounded plains, where arable land, marine resources, and good harbors gave rise to the ancient urban trade centers of Quanzhou, Zhangzhou, Fuzhou, and Xiamen, a rapidly developing Special Economic Zone. Economic disparities, socio-cultural, and environmental contrasts have

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3 Longyan was established as a county (originally called Xinluo) in 736 A.D., Nanping was established in 196 A.D., and though ancient historical settlement data for Sanming were not available (the county seat was established in 1956), the adjacent county of Sha, to the north, was established in 425 A.D. Many of the earliest settlers of the interior migrated through passes where the Jianxi river and its tributaries penetrate the mountains along the Jiangxi and Zhejiang borders. Following the Jianxi (and then the Futun, Shaxi, and Min), they established most of the counties in Nanping Prefecture by the end of the third century A.D.

4 The major economic products of ancient and medieval Fujian were diverse and their provenance varied. In addition to the agricultural and silvicultural products previously mentioned, the interior uplands region produced silver, copper, and kudzu (Fueraria lobata aka P. thunbergiana and P. montana). Kudzu was used as food, medicine, and fiber, and is still common in the Southeast Uplands, though it is no longer an important part of the economy. The coastal region produced salt, fish, and other products of the sea, which were traded for mountain products of the interior (Schafer, 1954; Vermeer, 1990).

5 With a land area of 47,362 square miles (122,668 square Km), Fujian is about the size of New York state (47,224 square miles), and the latter has a population of 18,044,505 (1990 census).
long differentiated the coastal region and the mountainous interior (Vermeer. 1990). The average population density in the Southeast Uplands in 1993 was 131 people per square kilometer (FSTJJ, 1994), while that of the coastal region was 452 people per square kilometer. Income disparities are marked as well; even in the agricultural sector, coastal families in Xiamen average twice the income per capita of farm families in Longyan prefecture.6

The climate of southeast China is unusually humid in comparison with other land areas at similar latitudes. Whereas the vast majority of the earth's terrestrial surface between 10 and 20° latitude is desert or semiarid steppe, and all of the world's great tropical and subtropical deserts lie at this latitude (in Australia, much of the Middle East, the Sahara, and South Africa), Southeast China is one of the largest humid subtropical (Cfa in the Koppen scheme) zones on earth (FSZRZYYJH, 1991). This is due to the influence of maritime tropical and subtropical air masses, which cause an abundance of precipitation with no season of soil-water deficit. Given such climatic conditions, double (and to a lesser extent triple) cropping of rice is widely practiced on the red alluvial (ultisol) soils of the valley lowlands throughout the region. Even on the poor, granitic yellow (ultisol) soils of the mountain slopes, abundant precipitation and intensive husbandry have allowed for the production of silvicultural and agricultural products (mentioned above) over the course of many centuries (FSZRZYYJH, 1991).

6 While the average (pure) income for farm families in Xiamen was estimated at 2,225 yuan per capita in 1993, in Longyan prefecture the average was an estimated 1,074 yuan (FSTJJ, 1994). Average income for non-farm families in the urban coastal zone is much higher.
Local relief plays a major role in climatic variation in the Southeast Uplands region. The NE-SW trending Wuyi-Daiyun Mountain system impedes the flow of air from both the summer and winter monsoons. As a result, the southeastern slopes of the Daiyun Mountains, which mark the southeastern boundary of the Southeast Uplands region, are exposed to warm maritime air masses associated with the summer monsoon, and sheltered from continental polar air masses associated with the winter monsoon. As a result, there is a marked N-S temperature gradient in Fujian, and mean annual temperatures vary from 14° centigrade (57° Fahrenheit) in northern Fujian to 21° centigrade (70° Fahrenheit) in the south (FRBZS, 1980). Temperatures in the coastal hills and plains to the south and east of the Daiyun mountain barrier, are milder in all seasons (Lin, 1990).

Within the province there is also a distinct zonal precipitation pattern caused by the orographic effect, with western mountain areas receiving up to 1,200 mm (46 inches) more than coastal plains at the same latitude. The average annual precipitation in Fujian varies from 1,000 mm (40 inches) along the coast, to 2,200 mm (86 inches) in the Wuyi Mountains. The highest mountain in Fujian, Huanggang Shan (2,158 meters asl), in the Wuyi Shan region, receives an average of 2,871 mm (113 inches) of precipitation in the form of rain and snow (Lin, 1990; Qiu, 1993).

Throughout the Southeast Uplands region, the rainy season lasts from March to June (January to June in Meihuashan), with 50-60% of the annual precipitation, so that there is seldom a problem with the spring drought that affects other regions in China before the arrival of the summer monsoon. Typhoons in late summer and early fall bring...
some rain to the interior mountain regions, but September marks the return of cool, dry
air from the Mongolian High, and the beginning of a nearly rainless period that lasts from
October to February, with about 15-20% of the annual precipitation (Zhu, 1994).

Because of the distinctive climate and vegetation patterns on opposite sides of the
Daiyun mountain barrier, physical geographers in China have subdivided Fujian Province
into two climate zones, divided by a line that runs along the major peaks of the Daiyun
mountain range. Boundaries between these zones correspond to the boundary between
the Southeast Uplands and the coastal hills and plains (Fig. 2.2), with the Central
Subtropical climate zone to the north and west, and the Southern Subtropical climate
zone in the south and east. The latter zone comprises about one-third of the province and
(Lin. 1990; Qiu. 1993; Zhu, 1994). This boundary is actually a transitional zone or
ecotone between the two biophysical regions, and areas lying within this ecotone have
traits characteristic of both.

The predominant potential natural vegetation of the Southeast Uplands, though
now highly disturbed and surviving only in remnants, is subtropical broadleaved
evergreen forest. This can be further subdivided into southern subtropical monsoon
rainforest and central subtropical broadleaved evergreen forest (Lin, 1990; Qiu, 1993).
The subtropical broadleaved evergreen forest was probably the most widespread forest
type in southern China before extensive deforestation occurred. These forests are
composed chiefly of members of the oak-beech family (Fagaceae), especially chinkapins
(Castanopsis). Cyclobalanopsis, tanoaks (Lithocarpus); members of the laurel family
(Lauraceae); magnolias (Magnoliaceae); camellias (Theaceae, especially Schima);
Altingia (a member of the witch hazel family, Hamamelidaceae), and members of the Rosaceae (Hou, 1983; Qiu, 1993; Wang, 1961).

Many of these taxa have similar leaf types, characterized as cupuliferous (cup-shaped), ovate to lanceolate, coriaceous (leathery), and entire margined or slightly serrate. The crown shape and branching of these trees is also similar (Wang, 1961). These forests are characterized by a relatively small number of genera, but each genus has many species and varieties.7

Coniferous genera are also well represented as the following list indicates: yews (Taxaceae: Amentotaxus, Taxus, Torreya); plum yews (Cephalotaxaceae: Cephalotaxus); members of the Cupressaceae (which now includes the Taxodiaceae): Chinese cedar (Cryptomeria), Chinese fir (Cunninghamia), cypress (Cupressus), Fujian cypress and (Fokienia); members of the Pinaceae: Keteleeria, Pines (Pinus), golden larch (Pseudolarix), Douglas fir (Pseudotsuga), and hemlock (Tsuga); and Podocarps (Podocarpaceae: Podocarpus) (Lin, 1990; Wang, 1961; ZHKCBGWYH, 1991).

Because of the rugged terrain of the uplands region, there is marked zonation of vegetation types along an altitudinal gradient. Near the summits and upon the ridges of the higher mountains (above about 1,400 m), subtropical mountain meadow is the predominant vegetation type. Down slope there is a transitional zone of mountain bush and shrub or needleleaf forests predominated by pine, which may extend down to as low

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7 Wang (1961) points out that many of the components of this forest type are also found in the Southeastern United States, e.g. Quercus, Picea, Beilschmiedia, Magnolia, Ilicium, Liquidambar, and Ternstroemia. This regional similarity represents a small part of the complex of East Asia - Eastern North American phytogeographic affinities that have resulted from vicariant events beginning with the break up of Laurasia in the early Tertiary Period, some 65 million years ago.
as 1,200 m asl. At lower elevations lie the subtropical broadleaved evergreen forests, mixed needleleaf-broadleaf forests, and mixed deciduous-evergreen broadleaf forests. Another distinctive vegetation type in the region is associated with montane wetlands, or dambos. These assemblages of grasses and forbs grow in and around bogs and ponds in alpine headwater zones and alluvial terraces⁷ (Lin, 1990; Qiu, 1993; ZHKCBGWYH, 1991).

The Meihuashan ecosystem, which lies in the central Daimao mountains, is in a transitional area between the Central Subtropical and Southern Subtropical climate zones. The southern subtropical zone resembles South China's narrow east-west-running belt of tropical monsoonal rainforest, which stretches from southeast Tibet, through southern Yunnan.⁹ Broadleaf forests in Meihuashan contain lianas and epiphytes, a characteristic of tropical rainforests, but the canopy is less complex, and such dendrologic features as plank buttressing and cauliflory are rare.

Cultural and Biological Diversity in the Southeast Uplands

China, as mentioned earlier, is one of twelve national states that the I.U.C.N. has called "megadiversity countries," which together account for an estimated 60-70% of the

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⁷ In Meihuashan, the numerous montane wetlands, which lie at elevations over 1,200 m, are called "yang," a word that means ocean but connotes, in this case, an open marshy area. A traditional verse about Meihuashan states that, "In Meihuashan there are eighteen yang...") (see epigram at the beginning of chapter 6), meaning that there are many montane wetlands among the high peaks. These diverse ecosystems are described in more detail in chapter 8.

⁹ This includes southernmost Guangdong, Guangxi, and Hainan, as well as border areas of Yunnan, including Xishuangbanna in southern Yunnan, the region of highest biodiversity in China. This evergreen broadleaved forest is composed of four or five layers: the canopy layer, with tree crowns at a height of 40 to 50 m; a secondary tree layer, with crowns just beneath the canopy layer; a layer of small trees and shrubs; and a sparse layer of ground cover. (Hou, 1983; Wang, 1961).
world's terrestrial species. Most of these countries are within the earth's humid tropical centers of high biodiversity, but biodiversity in China, which is the third largest country in the world, stems from three primary factors: 1. the multitude of biomes encompassed within the country's borders; 2. the heterogeneity of geomorphology and habitats within those biomes; and 3. China's paleo-historical role as an important center of mammalian evolution and dispersal (Zhao, 1986; Sheng, 1991).

Preliminary surveys show that there are over 2,000 species of terrestrial vertebrates in China, or nearly 10% of all species of terrestrial vertebrates on earth (Zhao, 1986). The mammalian flora of China is especially diverse, with 500 species (MacKinnon, 1996), and China ranks fifth in the world in diversity of mammals (WRI, 1992). Large mammals are especially diverse, for example, there are 20 living species of deer, or 41.7% the world's deer species (Sheng, 1991). The foremost Western authority on mammals in China, George Schaller, has written that China "supports a diversity of wildlife unequaled by any country."

High species richness for terrestrial vertebrates is, in part, due to China's position as a transition zone between the tropical and subtropical fauna of the Indomalayan realm and the temperate fauna of the Palearctic realm. China is a mixing ground for fauna of the biologically rich, low-latitude Southeast Asian humid tropical rainforests and the less rich, high-latitude temperate forests and grasslands of Eurasia. Most maps of the earth's major zoogeographic realms place South and Southeast Asia and southern China within the Indomalayan (Oriental) realm, with the rest of China, along with most of the Eurasian landmass assigned to the Palearctic (Paleo-arctic) realm (e.g. Whitfield et al., 1989).
While Western zoogeographers have traditionally placed the boundary between these two realms deep in southern China. Chinese zoogeographers are well aware of the fact that such species as the rhinoceros, the wild elephant, the peacock, and the gibbon ranged far to the north until historical times, when their ranges contracted southward with the expansion of Chinese civilization (discussed below) (Zhu et al., 1979). Chinese zoogeographers, therefore, place the boundary between the zoogeographic realms at the northern edge of the potential ranges of the Indomalayan species - the Qinling-Huai He ecotone (Zhu et al., 1979).

This zoogeographic pattern has an equivalent in the phytogeography of China as well. The continuum of tropical and subtropical forests grading with temperate and boreal forests in the north, creates a mixing zone with the most diverse mid-latitude temperate forests in the world (Coggins 1991; Liu, 1988). China is the only country in the world that encompasses an unbroken series of climate zones, with an extraordinary variety of biomes and ecosystems, from the desert basins of Xinjiang to tropical rainforests in southern Yunnan, and from montane tundra in the Himalayas to coral islands in the Nansha archipelago.

Added to this regional diversity is the extremely rugged terrain in most of China. Mountains and hills over 500 m asl in elevation cover 74.8 % of the country (Zhao, 1986). This topographic variety has given rise to altitudinal zonation of ecosystems, enhancing species richness at microregional scales. It has also played a role in preventing biotic extinctions by muting the destructive capacity of humans within natural ecosystems that is characteristic of China's lowland plains and basins. The inherent difficulty of
placing mountain lands under widespread, permanent cultivation, though not
insurmountable, has prolonged the viability of wildlife populations in many regions that
would otherwise have perished centuries ago. This is especially true in eastern China and
Sichuan province, where population pressure has been greatest. While most species of
terrestrial vertebrates, especially mammals and birds have been wiped out by human
inhabitants in the coastal plains and arable river basins of northern and central China,
mountain refugia continue to provide vital habitat, as patchy as it usually
is.10

Within the national context, the biodiversity of the Southeast China Uplands is
remarkable, especially given the high population densities of southern and eastern China.
Fujian province alone, which accounts for only 1.26% of the land area of China (122,668
square kilometers, or 47,362 square miles), has an estimated 110 species of mammals,
accounting for 25% of the national total; over 540 species of birds. 45% of the

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10 The remains of rhinoceros, elephant, a type of buffalo (Bibos
geron), Malayan tapir, and subtropical species of snakes, deer, boar,
and other animals have been found in archaeological sites dating from as
late as the mid-Holocene, in Zhejiang (Pearson, 1983), and from the
late-Pleistocene as far north as Beijing (Zhoudadian) (Whyte, 1983). A
number of historical documents indicate that in the tenth century A.D.,
wild elephants were still living in Fujian and the Yangzi valley, and
peacocks (Pavo muticus), now limited to southern Yunnan, ranged over
much of South China, south of the Xijiang (Schafer, 1954; Zhu et al.,
1979). Ma (1987) and Zhu et al. (1979) provide chronological maps of
the vastly diminished distributions of parakeets, peacocks, the wild
Indian elephant, the Sumatran rhinoceros, Pere David's deer, gibbons,
the Malaysian crocodile, and the Yangzi alligator, all but the last two
of which have been pushed south and southwest by expanding human
populations. Climate change may have have also caused zoogeographic
distribution changes, though on a smaller scale. Pearson (1983)
indicates that there has been a one to three degree southward shift in
the northern distribution of the bamboo rat (Rhizomis spp.), which, in
addition to other paleoclimatic data, may demonstrate a three to five
degree centigrade temperature decrease in the last three to five
thousand years.

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Table 2.1. Terrestrial Mammals of the Southeast Uplands

(Not including bats or small rodents)

**Artiodactyla**

<table>
<thead>
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<th>Species</th>
<th>Scientific Name</th>
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<tr>
<td>wild boar</td>
<td><em>Sus scrofa</em></td>
</tr>
<tr>
<td>Chinese water deer</td>
<td><em>Hydropotes inermis</em></td>
</tr>
<tr>
<td>common muntjac</td>
<td><em>Muntiacus muntjak</em></td>
</tr>
<tr>
<td>Reeves muntjac</td>
<td><em>Muntiacus reevesi</em></td>
</tr>
<tr>
<td>black muntjac</td>
<td><em>Muntiacus crinifrons</em></td>
</tr>
<tr>
<td>crested deer</td>
<td><em>Elaphodus cephalophus</em></td>
</tr>
<tr>
<td>serow</td>
<td><em>Capricornis sumatraensis</em></td>
</tr>
<tr>
<td>wild boar</td>
<td><em>Sus scrofa</em></td>
</tr>
<tr>
<td>sambar deer</td>
<td><em>Cervus unicolor</em></td>
</tr>
<tr>
<td>goral</td>
<td><em>Naehemordus goral</em></td>
</tr>
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**Carnivora**

<table>
<thead>
<tr>
<th>Species</th>
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</thead>
<tbody>
<tr>
<td>South China tiger</td>
<td><em>Panthera tigris amoyensis</em></td>
</tr>
<tr>
<td>leopard</td>
<td><em>Panthera pardus</em></td>
</tr>
<tr>
<td>clouded leopard</td>
<td><em>Neofelis nebulosa</em></td>
</tr>
<tr>
<td>golden cat</td>
<td><em>Felis temmincki</em></td>
</tr>
<tr>
<td>leopard cat</td>
<td><em>Felis bengalensis</em></td>
</tr>
<tr>
<td>Asiatic black bear</td>
<td><em>Selenarctos thibetanus</em></td>
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<tr>
<td>red dog</td>
<td><em>Cuon alpinus</em></td>
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(table con’d.)
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<tr>
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<tr>
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<td><em>Vulpes vulpes</em></td>
</tr>
<tr>
<td>large Indian civet</td>
<td><em>Viverra zibetha</em></td>
</tr>
<tr>
<td>small Indian civet</td>
<td><em>Viverricula indica</em></td>
</tr>
<tr>
<td>masked palm civet</td>
<td><em>Paguma larvata</em></td>
</tr>
<tr>
<td>crab-eating mongoose</td>
<td><em>Herpestes urva</em></td>
</tr>
<tr>
<td>racoon dog</td>
<td><em>Nyctereutes procyonoides</em></td>
</tr>
<tr>
<td>martin</td>
<td><em>Martes flavigula</em></td>
</tr>
<tr>
<td>yellow-bellied weasel</td>
<td><em>Mustela kathia</em></td>
</tr>
<tr>
<td>Siberian weasel</td>
<td><em>Mustela sibirica</em></td>
</tr>
<tr>
<td>badger</td>
<td><em>Meles meles</em></td>
</tr>
<tr>
<td>hog badger</td>
<td><em>Arctonyx collaris</em></td>
</tr>
<tr>
<td>Chinese ferret-badger</td>
<td><em>Melogale moschata</em></td>
</tr>
<tr>
<td>common otter</td>
<td><em>Lutra lutra</em></td>
</tr>
<tr>
<td>oriental small-clawed otter</td>
<td><em>Aonyx cinerea</em></td>
</tr>
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**Primates**

<table>
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</thead>
<tbody>
<tr>
<td>rhesus macaque</td>
<td><em>Macaca mulatta</em></td>
</tr>
<tr>
<td>stump-tailed macaque</td>
<td><em>Macaca speciosa</em></td>
</tr>
</tbody>
</table>

**Pholidota**

<table>
<thead>
<tr>
<th>Animal Type</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>pangolin</td>
<td><em>Manis pentadactyla</em></td>
</tr>
</tbody>
</table>

*(table con’d)*
**Lagomorpha**

South China rabbit  
* (Lepus sinensis latouchei)

**Rodentia**

bamboo rat  
* (Rhyzomis pruinosus)

porcupine  
* (Hystrix hodgsoni)

national total; 115 species of reptiles, or 35% of the national total; and over 5,000 species of insects, 20% of the national total (Zhuang, 1991).

Regional patterns of biodiversity in the Southeast Uplands, as in China as a whole, exhibit an intriguing relationship to a complex of climatic, geomorphic, demographic, and cultural factors, with important implications for nature conservation. As one might predict, indices of biodiversity rise with temperature and humidity, for tropical and subtropical broadleaf evergreen forests produce the most biomass and are the most ecologically complex terrestrial biomes on earth. A map of China’s actual (as opposed to potential) density of terrestrial mammal species reveals, however, that human population density is an important intervening variable, with profound impacts on biodiversity (Fig. 2.3 and 2.4). Mammalian species density values in China are highest not only in the tropical and subtropical humid climates of southern China, but also in mountain regions of relatively low population density, which are found in nearly every physical region of the country (Fig. 2.3). The warm temperate humid to subhumid climates of North China, and the subtropical humid climates of Central China (including parts of the Yangzi basin) no longer hold the vast deciduous, mixed, and evergreen broadleaf forests of historic and prehistoric times. The loss of forests and wildlife resulting from centuries of intensive land use in these regions, in conjunction with industrialization and serious pollution problems, have reduced mammalian diversity to levels lower than those of the colder but less densely populated and less environmentally degraded mountain regions of the Northeast and the Northwest.
Figure 2.3. Mammal Species Density in China

Source: Zhang Y.Z.
Figure 2.4. Density of Population in Mainland China. With an average population density of 10-50 people per square kilometer, the rugged Southeast Uplands region forms an island within a surrounding sea of more densely settled lowlands. Mountains extending through the interior to the west are also less densely populated than lowlands to the north and south.
In China as a whole, mammal species density values are highest in traditional Han border and frontier regions of the southeast (the Southeast Uplands), southwest (Yunnan and SE Tibet), northwest (the Tianshan and Altaishan), and northeast (the Daxinganling and Changbaishan).

These regions also encompass the greatest cultural diversity in China. One form of cultural diversity can be gauged by the number of Han ethnolinguistic subgroups in an area, which is by far the greatest in montane regions of high biodiversity in the South and Southeast (there are 104 local dialects in Fujian province alone - Fig. 2.5). Non-Han peoples. China's 55 non-Han nationalities. also represent great cultural diversity, comprising only 8% of the population but occupying approximately 60% of the land area. The tropical rainforest region of southern and western Yunnan exhibits the highest land mammal species density (100) and the greatest cultural diversity in China. 11

Geographers have commented on the correlation, or overlap, between high cultural diversity and high biological diversity in regions throughout the world (Nietschmann, 1992; Stevens, 1997). It may be argued that this pattern is merely a result of the territorial marginalization of minority peoples within remote mountainous or lowland rainforest regions, areas in which obstacles to transportation and settlement have precluded cultural homogenization by dominant national groups until modern times. However, conservation may also be a factor (Nietschmann, 1992; Stevens, 1997). In Xishuangbanna and the Southeast Uplands there is evidence that indigenous land use and

11 This tropical region bordering on Laos and Burma is home to many of the 46 national minorities of Yunnan Province, or 82% of the 56 nationalities of China.
Figure 2.5. Han Dialects in China. The greatest diversity of Han ethnolinguistic subgroups is found in the mountains of southeastern China (Source: Pannell and Ma, 1983).
resource stewardship have allowed for the perpetuation of biodiversity through the conservation of forest and crop resources. It will be argued that the diversity of mammals in these areas is, in part, a legacy of this tradition of stewardship.

**Ethnolinguistic Diversity and Hakka Identity in the Southeast Uplands**

In southeast China as a whole, language is the most important single variable in the establishment and differentiation of local and regional ethnic identity (Cohen, 1996). The Southeast Uplands is no exception, and no place in China has such a diversity of Han subgroups. This fact is most easily grasped when one attempts to delineate the region's ethnolinguistic distribution patterns, for linguistic affinities (and concomitantly, historical relationships) between groups are complex, and in many cases, obscure.

In the mid-nineteenth century, Westerners with a knowledge of Chinese began to recognize the intricacy of this cultural weave. After a trip from Fuzhou to Shaowu county in 1878, J.E. Walker wrote,

"What a babel of brogues, (sic) and dialects there is among those wild mountains! A native can hardly pass the limits of his own village but his speech will betray him" J.E. Walker (1878) in (Moser, 1985: 165).

Of this ethnolinguistic richness, Sowerby (1929) declared that, "A traveller up the Min [River] will soon realize there are many types of people in this area, types as distinct as, let us say, the different races in Europe."

Later observers and researchers realized that ethnolinguistic diversity in Fujian (and Guangdong) was evident at micro and macro scales, and that within each of Fujian's major dialects (Fig. 2.6) there were numerous subdialects. The Fuzhou dialect, for
example, though grouped with the Minbei (North of the Min River) dialects, "is said not to be understood more than forty miles from Fuchow [Fuzhou] itself" (Forrest, 1951: 675-676, in Cohen, 1996). In many areas, people in adjacent valleys spoke mutually unintelligible languages, and in some cases, this was true of neighboring villages. As Cohen (1996: 38) points out, "many of the inhabitants of [Fujian and Guangdong] may have found themselves frequently dealing with people speaking dialects other than their own."

This is certainly the case today, as diverse peoples in China are brought into ever-increasing contact with one another. While *putonghua* ("the common language" - Mandarin), also known as *guanhua* ("the official language"), is supposed to be the *lingua franca* of China, dialects are essential for individual and group identity. For this reason, one could argue that in general, people in the Southeast Uplands (and throughout Southeast China) speak Mandarin primarily out of necessity, and prefer to use their native dialects as much as possible.

Moser (1985: 165) posits that the formation of Fujian's ethnographic complexity stems largely from "the fact that there was no single, easy route of access for Han culture and people to enter the province." Sinitic culture and language entered the region slowly, from different source areas, and from different directions; it followed overland routes

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12 This has been observed especially in areas where groups of agnates migrate into an area lying outside of their dialect region and establish an enclave settlement (Cohen, 1968, 1996). Cohen (1996: 66-67) describes such a village that was established by Minnan (South of the Min) speakers in the central Min valley, where local people spoke only the Gutian (sub)dialect of Mindong (Eastern Min). Wives who married into the village could not understand their husbands initially, and the men had to conduct external business in Mindong. This pattern was continued over many generations, and Cohen argues that "lineage solidarity and dialect differentiation" were mutually reinforced.
traversing mountain passes to the north and west, and it came by maritime trade routes to the coastal trade centers and up the larger rivers that drained their hinterlands (Fig. 2.6).

Minnan (Southern Min, or Southern Fujian) peoples, first settled the coastal areas around Quanzhou, Xiamen, and Zhangzhou, establishing counties by the end of the third century A.D. From the coast, the Minnan people gradually spread inland along trade routes, establishing the rest of the counties in the Minnan region by the 13th century. The Minnan dialects bear little linguistic affinity with those of the Fuzhou-Eastern Min, Xianyou-Futian, or Northern Min (Moser, 1985). Though many of the counties in northern Fujian were established during the same period as those of Minnan, their occupants were of different cultural backgrounds, having entered the province from Zhejiang and Jiangxi, following the Jianyang river valley into northern Fujian. The first Hakka settled in Changting and Ninghua counties between 880-1126 (Moser, 1985), having entered the Southeast Uplands from Jiangxi (their cultural origins and migration history are discussed in detail below).

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13 There has also been a longstanding rivalry between people of the Fuzhou-Northern Min region and those of the Southern Min region. This tension has roots in the differing roles that these regions played through the course of Fujian’s history. The coastal cities of Minnan (especially Quanzhou and Zhangzhou), having little arable hinterland and requiring large imports of food grain, owed their survival to overseas trade, which the central government repeatedly sought to control. As Vermeer (1990: 6) explains, “Often in history, the central government found support in Fu-chou [Fuzhou], the provincial capital, for policies detrimental to the interests of Minnan. Fukien’s [Fujian’s] small size, weak provincial government, state of constant civil unrest, and the variety of difficult dialects spoken probably had a negative influence on its position with the central government.”
Figure 2.6. Dialects of the Southeast Uplands and Coastal Fujian By County.
Of the thirty-two counties and municipalities in the Southeast Uplands region, seven are predominated by speakers of Western Min Hakka (described below), seven by speakers of Hakka-related (mostly Gan-Hakka) dialects, one by speakers of Eastern Min, two by speakers of Central Min, seven by speakers of Northern Min, and seven by speakers of Southern Min (specifically "Interior Southern Min") (Moser, 1985; Li and Wang, 1990).

Instead of mixing within a cultural and linguistic melting pot, many local cultural traditions and dialects persisted through the centuries. Indeed, in certain areas there are notable examples of local adaptation to intra-ethnic strife that bespeak an acceptance of such conflict. The apparent stability of ethnolinguistic diversity is, therefore, not merely the result of physical isolation among constituent culture groups, but also a product of the formation and alignment of social groups that encouraged the maintenance of lineage and ethnic differentiation.

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14 Historical examples from Hakka culture appear to be most abundant (Cohen, 1996). The building of yuan lou (round buildings, also known as tu lou - earthen buildings), the circular fortresses that housed extended families or entire villages (of up to a few hundred people) are monuments to Hakka perseverance in a hostile land. These distinctive rammed earth buildings, which dot the landscape in Western Min (Minxi) region of SW Fujian were built to withstand sieges by other Han peoples, bandits, or soldiers. They are still inhabited in many parts of Yongding and Nanjing counties, though none have been built since the 1950's (Laude, 1992).

15 Cohen's (1996) analysis of the history of conflict between speakers of Hakka and speakers of Cantonese (in Guangdong and Guangxi provinces) illustrates how "the linguistic diversity of Southeast China was a variable influencing the social organization of the region." Intra-ethnic conflict, which even developed into small-scale warfare from time to time, reinforced the need for individuals, families, and villages to identify and unite with larger groups of the same or similar ethnolinguistic heritage.
The social organizations that exemplify social insularity most vividly are what Pasternak calls "the large, localized, highly corporate, lineages" that persist throughout large parts of the Southeast Uplands today. Freedman (1966) argued that these lineages developed in response to a number of demands: first, the need for large, cooperative labor pools for rice cultivation and large scale irrigation, and second (though no less important) to face the exigencies of frontier life, including the need to defend life and property from non-Han aboriginal people, like the She (and their ancestors, discussed below), who inhabited most of Fujian.

Pasternak (1969), on the other hand, used examples from Hakka settlement in Taiwan, to argue that large local patrilineages developed only after the frontier was settled and population pressure began to exceed the resource base. According to this view, lineage villages developed in response to severe intravillage (as opposed to intra-ethnic) conflict and competition for land and natural resources.

Cohen (1996) has provided convincing evidence that linguistic diversity and land tenure conflicts led to inter-ethnic strife between Han subgroups, like the Hakka and Yue-speakers of Guangdong. In many cases, these opposing ethnic groups formed alliances with members of their own subculture. Even in rural areas, these extended well beyond the village level, to groups of villages, secret societies, and powerful trade organizations.

It appears that all of these arguments are valid and can be supported with historical examples. Perhaps the most important point is that despite a half century of government efforts to establish greater cultural uniformity, Han subethnic diversity in the Southeast Uplands remains strong. Perhaps the most defining cultural characteristic of
the rural peoples of the region today is their belief in the importance of belonging to a lineage and to a language or dialect group. In many rugged mountain areas, especially those occupied by Hakka, single surname patrilineage villages are still common, ancestral records provide a sense of ethnic and familial heritage, and many important social and economic interactions are made on the basis of kinship and ethnicity. Cultural identity is further augmented through the sense of place developed in village landscapes through time. The houses, temples, fields, sacred forests, and hinterlands bear the distinctive, collective imprimatur of people who have long claimed the land by shaping it to meet their social, economic, and spiritual needs.

Before discussing specific examples of the relationship between cultural identity and cultural landscapes, it is necessary to examine how historical settlement patterns led to the present distribution of ethnolinguistic groups in the Southeast Uplands. As stated, the earliest Han settlers of Fujian did not enter an empty land and simply transfer their modes of living into a new environment. Starting at the Pacific littoral and extending throughout the interior of southeastern China, there were aboriginal people known by names such as Yue, Man, Wuling Man, and Nan Man who had, by early in the first millennium A.D., occupied certain parts of the region for centuries, if not for millennia. In prehistoric times, the Yue are believed to have inhabited the coastal zone, from Zhejiang (and possibly further north) through Fujian, Guangdong, Guangxi, and into
Vietnam (Moser. 1985; Pulleyblank, 1983). An Austro-Asiatic people, they are believed to have been linguistically related to the modern Vietnamese (also Austro-Asiatic).  

In the interior mountains, starting from the Southeast Uplands and extending throughout the interior of southern China south of the Changjiang, there were other non-Han tribal groups (including the so-called Man, or "Barbarians," Wuling Man. and Nan Man) who were probably the ancestors of today's minority nationalities known as Miao, Yao, and She (Lebar et al., 1964; Pulleyblank, 1983; Shi. 1985). These minority nationalities share a complex of ethnolinguistic and other cultural traits. They have traditionally been classified as Tibeto-Burmans (Lan. 1985; Lebar et al., 1964; Moser. 1985), although recent research indicates that this designation is questionable, and Pulleyblank (1983) provides evidence that they are of Austro-Asiatic origin. Shi (1985) and Pulleyblank (1983) concur that the She. Miao. and Yao are descendants of the Changsha Wuling Man. who once occupied the Wuling Mountains of Hunan during the Han and Jin Dynasties (202 B.C.- 316 A.D.) (Shi, 1985). The three groups migrated to different regions of southern China. probably in the wake of Han persecution, and developed separate cultural identities despite their cultural and linguistic similarities.

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16 Pulleyblank (1983) enumerates the abundant historical and linguistic evidence for these relationships, adding that there are colloquial words in the Min dialects of Fujian that are derived from Austro-Asiatic.

17 She and Yao share a long and well documented history of dog worship. These groups believe in the myth of pangu (or pangu), a dog-ancestor (a belief once shared by some groups of Miao according to Lebar et al., 1964), worship pangu totems, and have proscriptions against eating dog meat.
The ancestors of the Miao migrated eventually to the Guizhou plateau and surrounding areas of Yunnan, Sichuan, Hunan, and Guangxi. The Ancestors of the Yao migrated to Guangxi, Guangdong, and Yunnan. The ancestors of the She were probably more closely aligned with the Yao than with the Miao (as indicated by the dog-ancestor myth and other cultural traits that they share with the former group). They migrated to the mountains at the borders of Jiangxi, Fujian, and Guangdong (the southwestern portion of the Southeast Uplands) by the Sui dynasty (581-618) or shortly thereafter (Shi, 1985). In the Southeast Uplands, they came into contact with Hakka settlers, who referred to them as She, meaning "swidden (slash-and-burn) cultivation," or She Man ("the Man who practice swidden") (the history of swidden among She and Hakka is discussed in Chapter 6).

Relations between the She and the Hakka were extremely close: She and Hakka communities were interspersed (Lan, 1985), there may have been mixed communities, and intermarriage was probably not uncommon. Gradually, the She language became, by general consensus, a dialect of Hakka. Nearly all of the 330,000 She (Lan, 1985) who inhabit Fujian, Guangdong, and Zhejiang (mostly along the coastline) speak Hakka dialects even though many now live far from the linguistic source areas of these dialects (Fig. 2.6). In the Western Min region (Longyan Prefecture), there are two She dialects even though many now live far from the linguistic source areas of these dialects.18

18 1974 census data showed that over 99% of the 250,000 She, most of whom lived in Fujian and Zhejiang provinces, spoke Hakka dialects, even in areas where there are no Hakka today. The She dialects of Hakka most resemble those of the Western Min region, and differ from other Hakka dialects in other areas that She now inhabit; grammatically, phonetically, and in terms of vocabulary. This and other evidence indicate a long period of intermingling with Western Min Hakka immigrants, and a later She diaspora. In 1974, there were still about 1,000 speakers of She, a language related to Miao and Yao, in Chaozhou, a prefecture in N.E. Guangdong province (Luo, 1987).
townships (Guanzhuang and Lufeng), both in Shanghang county (Fig. 4.1). Other Fujian She communities in Fujian are found along the hilly northeast coastal counties of Fu'an, Xiapu, Fuding, and Ningde (Li and Wang, 1990).

In general terms, the She and their settlements are said to be indistinguishable from the Han, for the minority nationality has been thoroughly assimilated into Han culture. As a young She man explained, ethnic discrimination against the She by the Han has lasted since the Yuan dynasty (1264-1368) and most She have preferred not to display their ethnic identity (Zhong Boqing, pers. comm.). This changed in the 1980s when it was announced that national minorities would receive favored treatment in terms of family planning policy, and each family would be allowed to have more than one child (He Lian, pers. comm.). One of the only distinguishing characteristics of the She today is that all, or nearly all, possess one of three surnames: Lan, Lei, or Zhong. Another common trait is that many She still follow the dietary proscription against eating dog meat (which puts them in marked contrast with most Hakka, who regard it as a delicacy). Superficial appearances notwithstanding, She culture and ethnic identity are without doubt more substantial and more nuanced than they may seem, and these patterns deserve

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19 Though there are no She villages in close proximity to the Meihuashan Nature Reserve (and even fewer farther north in vicinities of the Longxishan and Wuyishan reserves), the author briefly visited one She village and one She township in Shanghang county. Though there were few apparent differences between these settlements and their inhabitants and those of the Han, further research is needed.

20 During this period the large influx of Hakkas and their subsequent struggle to become established on a limited land base was undoubtedly a source of friction with She natives.
thorough research. This dissertation makes a preliminary effort to define the She people's role in the environmental history of the Southeast Uplands (see chapters 5 and 9).

Though the Hakka arrived in Fujian somewhat later than did the She, they entered the province by a similar route. Scholars of the Hakka diaspora from the North China Plain divide the southward migration into a series of 3-5 stages or "waves." Though the estimated dates of each stage often vary considerably since they are based on family genealogies and other historical records, there is general agreement on the arrival of large numbers of Hakka in southeast Jiangxi and southwest Fujian some time between the late ninth and late thirteenth centuries (Huang et al., 1993; Kiang, 1991; Leong, 1997; Pulleyblank, 1983; Shi, 1985; Moser, 1985).²¹ It is possible that there was a continuous flow of immigrants to the frontier over extended periods, and for that reason dates may remain inclusive.

While the origins and migrations of the Hakkas is a subject of some scholarly debate (Leong, 1985; Shi, 1985), the assumption of ancient connections to the North China Culture Hearth is a fundamental part of Hakka cultural pride and an essential component of what could be called the "Hakka mystique." Reviewing the historiography of the Hakkas, Leong (1997: 28-36) states that the "...first and last scholarly investigation of the Hakkas..." was Luo Xianglin’s (1933) study, entitled Kejia Yanjiu Daolun (Introduction to the Study of the Hakkas). According to Leong (1997: 28), the work

²¹ Huang et al. (1993) point out that by the beginning of the Tang dynasty (618–907) there were already some settlers in the Tingzhou region of southwest Fujian. They state that these early settlers had mixed with the She and Yue aborigines, an idea supported by many other Hakka scholars.
became a "Bible for the Hakkas," containing a comprehensive and definitive statement of their most cherished beliefs about their own cultural identity. Among these was a treatise on the Hakkas' northern origins and a series of five successive southward migrations. Leong (1997: 28) states that Luo's work is "part scholarship and part ethnic rhetoric," and that it is based on a small sample from Hakka geneologies, which "pose serious problems of elite bias and reliability." He adds that numerous variations on the theme of the southward diaspora have been developed from Luo's work, but that these provide few new insights on early Hakka origins and migrations.

More or less traditional views of Hakka origins and migrations are exemplified by Kiang (1991). Kiang argues that the Hakka are descendants of Central Asian Tungusic peoples called the Xiongnu, also known as the Huns. After early invasions of the Han heartland (Zhongyuan), they were partially assimilated into Han culture and established the Kingdom of Qi, one of the nations of the Warring States Period (403-221 B.C.). The first Hakka migration occurred from 249 to 209 B.C., with the rise of the Qin dynasty (221-206 B.C.) and its violent persecution and removal of the people of Qi. Refugees fled south to Henan, Anhui, and Jiangxi. The Han overthrow of Qin put many Hakkas who remained in the North in positions of power within the Han dynasty (Kiang, 1991). The second Hakka migration (307-419) began during the Western Jin Dynasty, a period marred by famine, when non-Sinicized Xiongnu revolted in the North, causing the so-called "Yongjia Panic." This spurred the largest of the three migrations, and many refugees settled in southeast Jiangxi at the borders of the Minxi region of southwest
Huang et al. (1993) state that in the early Tang, some 100,000 Hakka entered southwest Fujian.

The third migration (907-1280) was triggered by harsh foreign rule by yet another wave of northern tribes (the Jurchen) at the fall of the Tang dynasty, and by severe flooding in the lower reaches of the Yellow River, and it continued with the turmoil of the Southern Song (960-1127). Many Hakka migrated into the Southeast Uplands, and the Minxi Hakka dialect groups were formed during this period (LYDQDFZBZWH. 1991). A fourth Hakka migration (1281-1644) resulted from the Mongol establishment of the Yuan dynasty. Many Hakka loyal to the Song migrated to Guangdong and Guangxi (Kiang. 1991). Some refer to this as the "third migration." and do not count the "first" that is mentioned above (LYDQDFZBZWH. 1991; Moser, 1985). After the 17th century, there were many Hakka migrations out of Fujian, especially to the highlands of the Yangzi river valley, Taiwan, and Southeast Asia. These movements also involved large numbers of Hakka (Averill. 1983; Kiang, 1991).

The Hakka of the Southeast Uplands are distinctive because most belong to the third migration wave (having never made the fourth stage journey into Guangdong). This group can be divided into three geographical subgroups (Moser, 1985). These are the Western Min Hakka (Southwest Fujian Hakka), the Hakka-related people of Jiangle, and the Hakka-related people of Shaowu (Fig. 2.5). By the beginning of the fourth migration (to Guangdong and Guangxi), these people had lived in SW Fujian for some four

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Of a total of five related Hakka subgroups in the Western Fujian - Southern Jiangxi region, three are in Fujian, and two are in southern and southwestern Jiangxi respectively (Moser, 1985).
centuries (Moser, 1985), mostly in and around the ancient city of Tingzhou (now Changting) and in Ninghua county. The term "Hakka" had not yet come into existence, and there was some degree of assimilation with the Gan to the west and with the Minzhong (Central Min) peoples to the northeast. This led to the formation of transitional dialects among Hakkas and their neighbors in the Western Min region (Moser, 1985). The process was similar for those Hakka who migrated to the northern regions of the Southeast Uplands, neighboring the Northern Min peoples.

As the Yuan dynasty Mongols overtook the Song, the period of Hakka stability came to an end, and Ninghua county lost some 80% of its population to outmigration (Moser, 1985). Arriving in northern and eastern Guangdong by the thousands, the Hakka were first labeled "guest people" by the native Han (the Cantonese-speaking Yue subethnic group). It was at that juncture that the very different history of the Guangdong Hakkas began to take shape.

From all accounts, the Hakkas of Guangdong were never assimilated into "punti" (in Mandarin, bendi - local person), or Yue culture (Cohen, 1996; Moser, 1985). Hakka survival in the face of Yue hostility depended upon degrees of subethnic unity that have made the Hakka famous around the world. Moser (1985:242) points out that, in contrast,

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21 According to Huang et al. (1993), most contemporary Hakkas trace their ancestral migration through the village of Shibi (formerly Shibi Zhai, or Shibi Fortress) in Ninghua county.

24 The ethno-geography of the Minxi (Western Min) - Minnan (Southern Min) border region, which runs just east of the Meihuashan Nature Reserve, is discussed in chapter 4, in conjunction with local Hakka subdialect distribution patterns.

25 Interestingly, many Guangdong Hakka, if not most, trace their ancestry to a single village (Shibi) in Ninghua county Fujian.
the Hakka who never left the Southeast Uplands "...share most of the cultural traits of the third-wave people. [But] Having remained in the land where their ancestors were long established, and not having suffered from treatment as outsiders, they understandably lack the sense of group identity that characterizes the people of the third wave."

A number of the traits commonly associated with Hakka culture and character derive from the difficulties of the diaspora. Most Hakka immigrants found that the best land had already been settled, and were thus forced to settle in the highlands and in mountain valleys. The longterm historical struggle to eke out a living on often marginal lands has given the Hakka a reputation for being hardworking, persevering, exemplars of pioneer virtues. Moser (1985: 240) notes that,

"The Hakka remained adept at the agricultural skills needed to glean a living from land that was considered insufficiently productive by other Sinitic peoples. Generally this meant hillside land and the Hakka were alert to new crops such as sweet potatoes and peanuts that could be grown on land previously unworked."

A hardscrabble life did not detract from the value that Hakkas put on education and a love of the great traditions of Chinese culture and learning. Even in remote mountain villages where only footpaths linked villagers to the outside world, the author has observed sacred "scholar peaks" (wenfeng), the summits of which were once made sharper with rocks and dirt in order to insure that the village produced scholars.

Concern with scholarship stemmed from a belief that the Hakka were true Chinese, superior to the Yue and Min southerners around them. Moser (1985) calls this "the northern mystique," an important part of the Hakka self image that has served to downgrade ties with other local cultures and to connect the individual with the high
culture of the nation. As the wenfeng example illustrates, however, veneration of national culture has not made the Hakkas any less attuned to the village environment and the substantial canon of local tradition. On the contrary, the "little traditions" have proven essential for maintaining the superstructure of clan organization and village cosmology. Here one might include the preservation of family genealogies, the worship of ancestors and local gods, and the maintenance of good fengshui. As will be seen, these traditions are extremely important in Hakka villages of the Southeast Uplands in the 1990s (Huang et al. 1993; Levesque, 1969).

Another facet of Hakka culture that is unique among Han subgroups relates to the status of women and the definition of sex roles. Hakka women have been characterized as more self-reliant and even "more liberated" (Moser. 1985: 248) than women of other Sinitic subgroups. While these statements are debatable, certain historical examples distinguish Hakka women from their other Han counterparts. For example, Hakka women were not subjected to the cruel tradition of footbinding.

The apparent freedom that Hakka women had, however, was probably due in large part to poverty (Moser. 1985); no laborers could be sacrificed. Women have often had to do the labor typically reserved for men. Indeed, the household division of labor in Meihuashan in the mid-1990s is such that women work in the vegetable garden, the rice paddy, the collective forest, the bamboo forest, and in the home. In the bamboo and collective forests, women cut and haul heavy poles and logs for hours up and down steep slopes. Upon reaching home, their work does not come to an end, but shifts to a new phase.
Other indications of traditional Hakka poverty and atypical gender and intra-ethnic relations are exemplified first by the fact that Hakkas seldom took concubines or more than one wife, and second in that marriage to non-Hakkas was rare and seen as a betrayal of one's ancestors. Those who grew rich and cosmopolitan (or daring) enough to break these traditional rules were seen as having been corrupted by the Yue, the Minnan, or other "Southerners" (Moser, 1985).

The Hakka emphasis on hard work, social insularity, genealogy, ancestor worship, and the importance of fengshui have led to the formation of distinctive village landscapes. In the long struggle to establish a sense of place, Hakka in the Southeast Uplands have developed patterns of landscape signification and environmental perception that have important implications for nature conservation. Villages within the three nature reserves in this study, for example, exhibit strikingly different land use and village structural patterns. While some of these may be viewed as largely a function of subsistence opportunities and adaptation to particular environmental conditions, many are more closely linked to cultural identity and environmental perception.

The Meihuashan Nature Reserve lies at the edge of the Southwest Fujian Hakka region, where the Hakka-speaking counties of Shanghang and Liancheng meet the Longyan municipality, home to people who speak the Interior Southern Min dialect (Fig. 2.6). The Longxishan nature reserve is in Jiangle, a county lying in the second ethnolinguistic area (Hakka-related people of Jiangle). The Wuyishan Nature Reserve lies outside of the Hakka culture area (though it overlaps with Shaowu county) in the zone of Northern Min speakers.
In addition to linguistic similarities, the Hakka villages of Meihuashan and Longxishan share certain cultural traits that are manifested in local landscape ecology. These traits are largely absent from the Northern Min villages of Wuyishan. The first of these is long-established local patrilinages. Villages in Meihuashan are single-surname, patrilineal communities with a settlement history of between 20-30 generations of *in situ* habitation. The villages surveyed in Longxishan contained 6-9 family surnames each with lineages of between 3-8 generations. In Wuyishan, lineage histories were less clearly defined, but most villages had comparable numbers of surnames and generations with those of Longxishan.26 There were striking differences between the cultural landscapes of Hakka villages in the first two reserves, and those of the Northern Min villages of Wuyishan. First, there were no rice paddies in the five Wuyishan villages, since all valley land had been allocated to tea cultivation, and slopes were devoted to tea and bamboo groves. Second, the houses in Wuyishan are composed of Cunninghamia timbers with bamboo shingle roofs, materials which have not been used in the other regions for decades. Third, and most significantly, the Wuyishan villages lacked ancestral temples, active earthgod shrines, and substantial sacred forests (see chapter 9).

Within these three reserves, which are the most important in the Southeast Uplands, the largest and most biologically diverse sacred *fengshui* forests are found in the

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26 The people of Wuyishan, as with many settlers of the Northern Min region, migrated from Jiangxi province in the late 18th and early 19th centuries to rent land (under permanent tenancy contracts) in order to produce the world famous *Bohea* (Northern Min for Wuyi) tea. These fermented black teas (along with the Oolong and Pekoe added later) were the region's staple export to the West (by way of Guangdong middlemen and the East India Tea Company). There was considerable unrest in the region, which Gardella (in Vermeer, 1990) attributes to the fact that much of the workforce consisted of single male migrant laborers.
villages of Meihuashan, where long-term landscape management by single lineages has insured the preservation of some of the only patches of primeval broadleaf evergreen forest in the region. In Longxishan, despite the relatively recent arrival and higher degree of transience of family lineages, there were ancestral temples, local earthgod shrines, and fengshui forests of substantial age and areal dimension (though few could compare with those of Meihuashan). In Wuyishan, where there has been a high degree of transience and little lineage stability, there were no ancestral temples in five villages surveyed, earthgod shrines had been abandoned, and fengshui forests survived only in vestigial remnants, if at all. As a reserve manager in Wuyishan explained. „There are no ancestral temples (citang) here because there are no Hakkas; the Hakkas preserve records and traditions."

While ethnicity may account for some of the cultural distinctiveness of Wuyishan landscapes, there is another factor involved. In the 19th and the first half of the 20th centuries there was a very active Catholic and Protestant missionary effort in the region, and an old stone church built by American Dominicans still stands in the village of Tongmu. Western missionary influence provides an additional or alternative explanation for the lack of continuity in traditional cultural features among the villages. Since several villages in Wuyishan retained their Christian identity after 1949, holding secret masses and prayer meetings even during the Cultural Revolution, some residents consider

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27 Some villages still had several large trees at places in the landscape where one would expect to find sacred broadleaf forests or groves of Cryptomeria. Some of these sites even had old remnants of earthgod shrines, almost completely engulfed by vegetation. Elderly villagers acknowledged that these had been fengshui forests at some time in the past.
themselves Christian. In some homes, crucifixes and other Catholic icons can be seen within ancestral shrines, having replaced Daoist and Buddhist deities. As one resident in the famous but remote and seldom visited village of Guadun explained, "We have no village ancestral temple, no earthgod shrines, and no fengshui forests because we are Catholics." Indeed, in a shady bamboo grove opposite the few scattered houses, lay not the usual isolated stone or cement tumuli, each taking advantage of a favorable location in the landscape, but rather a cluster of wooden crosses that formed a rustic cemetery.

While there is a correlation between Hakka ancestor worship, the building of ancestral and earthgod shrines, and the cultivation and maintenance of fengshui forests (see chapter 9), the connection between fengshui forest management and subethnic identity is less clear. Fengshui forests can be found in many areas throughout the Southeast Uplands (He Lian, pers. comm.) and their distribution in relation to particular subethnic culture areas is a question that remains unexplored. What is clear, is that longterm settlement and lineage traditions among the Hakka correspond with intensive village landscape management based on fengshui. In upland Hakka villages fengshui forests are a persistent feature. This is true not only in the Western Fujian, but also among Hakka villages in the New Territories of Hong Kong (Hase and Lee, 1992; Lovelace, 1985). These settlements lie in rugged mountains, where fengshui forests are

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28 The village of Guadun was where the famous Jesuit missionary, Pere David Armand (known for his rescue of the Pere David's deer), lived and worked in the 19th century. During his tenure in the village and in nearby Dazhulan village, he discovered a number of bird species that were new to science, including the short-tailed parrot bill (Paradoxornis davidianus), silver pheasant (Lophura nycthemera), white-necklaced hill partridge (Arborophila torquata), and the red-tailed laughingthrush (Garrulax milnei) (MacKinnon, 1996).
functional components of the soil and water conservation systems critical for sustainable wet rice agriculture. These relationships, and the importance of sacred forests in protecting biodiversity are discussed in chapter 9.

Patterns of Land Degradation in the Southeast Uplands

It has been estimated that in the early Holocene, 70 percent of the land in China was covered with forests, in contrast to 8 percent today (Simmons, 1989). The accuracy of these estimates is debatable, but it is evident that deforestation has occurred on a massive scale (Smil, 1984; Richardson, 1990). When, where, and how fast it has occurred are important research topics for detailed regional analysis. Today, significant stands of old growth forest are found only in the Da Xingan, Xiao Xingan, and Changbai Mountain ranges of the Northeast, remote areas of Guangdong, Fujian, Yunnan, and Sichuan, and in river valleys of southern Tibet (Richardson, 1990; Hou, 1983). The most severely deforested regions are found in North China, especially the North China Plain and the eastern part of the Loess Plateau; areas which were once covered by deciduous forests. Seven thousand years of agriculture have left this area nearly devoid of natural vegetation. Another region that has been almost completely deforested is the Sichuan

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29 Another possible explanation for why Wuyishan lacks fengshui forests relates to agriculture. Only five of the seventeen natural villages of Wuyishan produce rice, and combined paddy amounts to only a few hectares. These paddies were established only in the 1960's, in the wake of government campaigns to increase grain production. Since tea cultivation, the traditional basis of the economy, does not require the intensive water control that rice paddies do, it is possible that fengshui forests were less important in the agro-ecosystem, and gradually lost their place in the landscape for functional (though perhaps subliminal) reasons, in addition to the cultural reasons discussed above. It has been noted, however, that tea farming produced serious erosion in parts of Minbei during this period (Gardella, 1990 - in Vermeer).
Basin. Once covered by subtropical evergreen broadleaved forest, this rich agricultural land has been under cultivation for at least 2,000 years (Zhao, 1986; Hou, 1983).

The Southeast Uplands Region is noted for its relatively high percentage of forest coverage. Fujian is purported to be the province with the highest percentage of forest coverage in China, estimated at 50,034 square kilometers, or 41.18% \(^{30}\) (Gao, 1991). This figure may be attributed in large part to the constraints of rugged terrain on traditional land use patterns. Mountains and hills make up 87.5% of the land area of the province (Zhu, 1994), and in traditional times, approximately 85% of the rural labor force was concentrated on only 10% of the land, specifically the arable land in narrow valleys, basins, and plains, where wet rice was cultivated (Zhu, 1994).

John Caldwell, the son of the renowned missionary-tiger hunter Harry Caldwell, described this relationship in the first half of the 20th century,

"Americans think of China as a crowded land, with people packed like sardines. The human population is large, but it is concentrated in villages and cities. In Fukien, wilderness is always close at hand." (Caldwell, J., 1953: 35)

The persistence of primeval and secondary forest cover in the most mountainous parts of the province, even into the 20th century, prompted the renowned naturalist, Arthur Sowerby, to comment that

\(^{30}\) Only Taiwan has a higher percentage of coverage (55.08%). This figure is not based on canopy closure, but on the percentage of land where forest, at any stage of growth, is present. "Forests" include those that are designated for timber harvest, soil conservation, firewood and charcoal production, and "special uses," as well as fruit orchards, bamboo forests, sparse woodlands and shrublands. Reforestation accounts for an impressive 58.44% of the forest area in Fujian. There is much room for improvement, however, since the total amount of land designated as suitable for forestry in Fujian is much greater than the present forest coverage (73.0%, or 89,790 square kilometers) (Gao, 1991).
"In spite of its comparatively dense population, Fukien [Fujian] is wild, inexpressibly wild, and over the greater part of the province the people live very close to the jungle" (Sowerby, 1925 in Moser, 1985: 163).

Sowerby's depiction of vegetation conditions is highly misleading, however, and there is evidence that widespread deforestation has been common throughout Fujian, even in parts of the more mountainous areas, for over a thousand years (Qiu, 1993). The severely deforested coastal hills of Xiamen's hinterlands prompted the tiger hunter William Lord Smith to observe that,

"In southeastern China the forests passed ages ago, and there remains today a bare, low-lying country studded with boulder-covered (sic) hills. Often these scattered rocks reach enormous size - twenty feet or more in height - and in the caves formed among these huge and tumbled blocks, the tigers live" (Smith, 1928: 430).

The degradation of mountain land in South China is aptly described by Parham (1995: 16):

"For a thousand years, soil erosion, landslides, unreliable water supplies, waterlogged soils, and sandstorms have led to the loss of wildlife habitat and extinction of certain animal and plant species. Loss of vegetation sets in motion a variety of interrelated changes that drive the degradation process: increased soil temperatures, reduction of soil organic matter, soil compaction, and erosion."

Parham (1995: 16) adds that, "...increased soil temperatures accelerate decomposition of existing soil organic matter. Soil organic matter holds nutrients in a form available to plants, without which revegetation is nearly impossible. With the loss of vegetative cover, intense tropical rains compact the surface soil. Clay-sized particles plug small soil pores, inhibit water infiltration, and increase runoff and erosion, causing pronounced drying on uplands. Sparse vegetation that is characteristic of drier environments replaces the original vegetation, while downstream, erosion leads to sedimentation of aquatic ecosystems, burial of agricultural lands, and flooding...Land degradation stemming from vegetation loss is common in tropical areas; however, in South China, the prevalence of granitic bedrock accentuates many of the problems. Fresh granite in its unweathered state is a poor source of plant nutrients; when deeply weathered, the nutrient suite becomes even more restricted. Degraded tropical lands composed of broad expanses of deeply weathered granitic rocks extend across some 30-40% of..."
These problems are compounded by the prevalence of granite bedrock and associated nutrient-poor soils throughout much of the Southeast Uplands. In the most severely degraded areas, a grassland shrub vegetation complex characteristic of more arid regions becomes dominant and persistent.

Caldwell (1953) provides a more geographically specific description of vegetation conditions in the province in the early 1900s:

"...among the barren seacoast hills there are valleys and pockets of tall sword grass. As one advances inland the cover thickens until there are vast tracks of virgin hardwood-and-bamboo forests."

The uneven distribution of forests in Fujian is still evident, and 60% of the total forest area lies in the three prefectures of the mountainous interior, Longyan, Sanming, and Nanping (Lin, 1990) (Fig. 12.4). These are the prefectures that comprise the Southeast Uplands Region.

High forest cover in the interior mountains and parts of the coastal hills is due in part to a history of locally managed sustainable forestry. It is clear that indigenous forestry systems based on Chinese fir (Cunninghamia lanceolata - known in the region as "shanmu") and pine (especially Pinus massoniana) account for substantial forest coverage in the Southeast Uplands (Chandler, 1994, Menzies, 1988), comprising approximately 22,876 square Km, or 18.65% of Fujian's land area and roughly 45.7% of the total forest area in 1988 (Gao, 1991).
What simple statistics on forest coverage do not reveal, however, is the severity of forest degradation and loss of floristic biodiversity in the decades since 1949. Official records show rapid rates of deforestation in past decades. Forest destruction accelerated during a series of disastrous government movements and policies (discussed at length in chapter 5), beginning with the "backyard iron smelting movement" (da lian gang tie) of the Great Leap Forward (1958-59), which resulted in the famine of 1960-61. During the turbulent years of the Cultural Revolution (1966-76), when Mao initiated the "grain first" policy, forest clearance for agriculture reached an all time high (Smil. 1984, 1993). In the 1980s, market values for Chinese fir increased exponentially, and remote primeval forests in the Southeast Uplands that had been too inaccessible to harvest, were devastated. From the later years of the Cultural Revolution to the beginning of the free market period, deforestation in Fujian reached disastrous levels, and total forest coverage declined from 49.3% in 1973 to 39.5% in 1978 (Lin, 1990).

In many areas of the Southeast Uplands, government-directed reforestation campaigns, starting in the 1950s, helped stabilize deforestation rates through the aerial broadcast of pine seeds in tandem with the abolishment of an ancient tradition of clearing mountain lands with fire. Despite these measures, however, the quality of forest stands throughout the province has steadily degenerated since 1949. Broadleaf forest coverage, which amounted to 10,930 square kilometers (21.8% of the total forest area in 1988), has continuously decreased, and reforestation schemes throughout the province have been limited to coniferous forest monocultures of pine and Cunninghamia. The extensive fire-controlled montane scrub and grassland ecosystem, which covered vast areas of the
upland region before 1949, has been succeeded in many areas by Masson and Huangshan pine forests, mixed needle leaf - broadleaf forests, and to a much lesser extent, by stands of broadleaf evergreen forest (Lin, 1990). This problem is widespread throughout eastern China, and there has been concern about the ecological consequences, including podzolization of soils, loss of water storage capacity (Zhou, 1986), and the loss of plant and animal biodiversity.

The villages of Meihuashan have a distinctive history of forest management. Having long relied upon bamboo for their economic survival, Meihuashan people have developed their own approaches to forest conservation. These differ significantly from the indigenous forest management systems associated with Cunninghamia cultivation, which was predominant at lower elevations in the Southeast Uplands and other parts of Southeast China (Chandler, 1994; Menzies, 1988b). Forest management in Meihuashan is discussed in chapters 5-8.

An Historical Perspective on the Development of Wildlife Conservation Laws in China

While the central government gained control over forest resources in China after 1949, and attempted to curb deforestation (obviously with very mixed results), there was little effort to protect wildlife and develop a practical system of wildlife conservation. The first national wildlife protection law for the People's Republic of China was passed by the National People's Congress on November 8, 1988, and went into effect in March of 1989 (see translation of portions of "The P.R.C. Wildlife Protection Law" in Appendix A). The law established that all wildlife was the property of the nation, and that it must
be carefully protected, actively propagated, researched, and exploited in a rational manner. The Ministry of Forestry and the Ministry of Fisheries were charged with directing the national management of terrestrial and aquatic species. The governments of each province, autonomous region, and national city (zhixia shi) were ordered to coordinate wildlife management within their jurisdictions and at the lower administrative levels of the county and municipality. All unauthorized hunting and disruption of nationally protected wildlife was banned, and a system of punishments was imposed to deal with offenders. A rating system was initiated, in which each species was given Category 1 or Category 2 national protection, based upon rarity, economic value, and/or scientific value. Permits to hunt or otherwise utilize species designated category 1 were to be issued by the national authorities, while provincial and autonomous region governments would be in charge of permits for hunting category 2 species. (For other regulations, please see Appendix A).

The apparent tardiness of this type of legislation should not lead one to the conclusion that game laws have been non-existent or that hunting has not been an important part of life in traditional China. Literary records and archaeological data indicate that the royalty of ancient China not only practiced hunting, viewing it as a means of demonstrating bravery and nobility (Waley, 1978), but also established protected hunting enclosures and wildlife parks.

Imperial rulers preferred to set aside large tracts of wild land, where wildlife and habitat were protected by remoteness from human activity, as well as by walls and guards, rather than relying on unenforceable edicts restricting hunting throughout a particular
administrative region (Menzies, 1988a). The *Book of Songs* describes a wildlife reserve established by King Wen, the legendary model ruler of the Zhou dynasty, in about 1150 B.C. (Karlgren in Menzies, 1988a). One such enclosure during the reign of Emperor Han Wudi measured 50 kilometers from east to west, and 25 kilometers from north to south (Schafer, 1968, in Menzies, 1988b). In the Qing Dynasty (1644-1911), during which the Manchu royal family established a management agency called the "Bureau of Imperial Gardens and Hunting Parks." there were 105 such reserves in three categories. They were: "Imperial Hunting Enclosures" (*Yu Wei*), "Enclosures Designed to Provide for the Needs of the Imperial Household" (*Wangduoluosu Wei*), and "Enclosures for Military Training" (*Xian Wei*). As these categories imply, the reserves were designed to meet the cultural and political needs of the Manchu ruling minority (Menzies, 1988a).

Though there were a number of imperial nature reserves, some exceptional administrative regions, and even historical periods when certain types of hunting or the killing of certain species was restricted, wildlife management in many (if not most) regions in China appears to have varied according to local custom (Caldwell, 1924).

In the Southeast Uplands, local wildlife management systems were diverse and geared toward local conditions and preferences (LYDQDFZBZWHY, 1992). A Longyan prefectural gazetteer account of local hunting customs (LYDQDFZBZWHY, 1992: 1425) states that,

"Folk customs relating to [wildlife] resource allocation were fairly complex and regulations and restrictions, which varied in each locale, were diverse. Common regulations included the rotating hunts from one village to the next and [a series of rules for dividing the quarry]."
Hunting was often conducted by groups of men from different villages who assembled for game drives in specific places. Game was divided according to who was hosting the hunt, who bagged the game, who saw the quarry first, by the drawing of lots, according to social stature, and according to other specific conditions. Those who heard the dogs and joined the hunt, and even those who heard the guns and rushed to the kill site, were often privy to a share of the meat, bones, hide, organs, or blood (Caldwell, 1924; Lord, 1928; LYDQDFZBZYH, 1992). Wildlife was a common property resource that was often harvested by groups of villagers from different villages. Whether these men were of common ethnicity or kinship probably depended upon local settlement patterns and interethnic relations.

There were also magico-religious traditions prohibiting the hunting and/or consumption of certain animal species in certain areas, in certain seasons, or under certain conditions. In the Eastern Min region of Fuqing county (south of Fuzhou), for example, local hunters were forbidden by the god Hieng Tieng Siong-da from hunting on particular hills that were believed to be inhabited by "fox spirits." These spirits communicated through a female medium and "enjoy[ed] an immunity due to a superstition stronger than law" (Caldwell, 1924: 28-29, and see chapters 3 and 9).

After the transition to a socialist government, China's official view of wildlife was utilitarian at best, hostile and aggressive at worst. Government leaders at all levels organized extermination campaigns against animals that attacked livestock, ate grain crops, spread disease, or were generally perceived as a nuisance. Large livestock predators like tigers (which also have a colorful history of dining on people in South
China) and wolves were attacked systematically (Mao Piao, pers. comm.). Animals that posed a threat to grain crops were trapped, shot, and poisoned by the thousands. During the "Great Leap Forward," the entire nation was mobilized to destroy the "four pests:" mosquitoes, flies, rats, and sparrows. In Beijing, for days at a time, in city streets and rural fields, the people banged pots and lit firecrackers in an attempt to wear out sparrows by giving them no place to land (Murphey, 1967).

Nature was viewed as an obstacle to progress. Traditional cosmologies that prohibited the destruction of certain components of the landscape (i.e. sacred forests and perhaps animals, as we will see), were officially banned as "feudal superstition" (fengjian mixin), and complex land use traditions of rural people all over China were changed perhaps irrevocably. A favorite Chinese Communist Party parable was about an old man who moved a mountain that was blocking the way to his house (with some shovels and a lot of help from his friends and family). In Communist China, wild animals were part of that mountain, and they would be removed with no remorse, whenever and wherever it was necessary, but not without first serving the people (Murphey, 1967).  

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Murphey (1967: 314-319) has provided perhaps the most succinct but thorough analysis of the post-1949 "revolution in the conception of man's relation to his physical environment." He characterizes the traditional Chinese view of nature as one in which humanity was seen as "an integral part of a cosmos dominated by nature. Contentment as well as material success could come only through acceptance of the rightness of man's adjusting himself to the greater natural world to which he belonged...To question or attack nature was to contradict a broader natural order, sometimes labelled 'heaven' (t'ien) [tian], and hence was potentially disturbing to the profoundly hierarchical social order of traditional China." It is true that traditional land management and the manipulation of nature in China were vast, and perhaps unparalleled in terms of "irrigation, terracing, highly intensive cultivation, deforestation, and the progressive occupation of an originally difficult or resistant southern landscape." However, "such activities were not in doctrinal terms seen as pitting man against nature, nor as destroying a basic official or orthodox attitude of respectful stewardship, of co-operation with a
In the first three decades of communist rule, the utilitarian approach to wildlife that allowed for its destruction without the fear of supernatural reprisal (MacKinnon, 1996), together with undying traditional Chinese beliefs in the medicinal value of wildlife and an international demand for fur, supported the construction of one of the largest wildlife processing systems in Asia, if not the entire world. It is ironic that in its effort to "ban the old and embrace the new" (chu jiu bu xin), the Chinese government never attempted to alter the age-old popular perception that wildlife was endowed with healing properties greater than the biochemical sum of its parts. The harvest and consumption of wildlife was not completely exempt from centralized control, but since wild animals are mobile rather than rooted in the landscape, there were no clearly defined access rights and tenure arrangements of the sort that were central to the revolutionary redistribution of inanimate resources like arable soil, forestland, and water. Government control was achieved by coopting the retail function of local wildlife markets. Communes had "Foreign Export Departments" (Waimaozhan) that bought forest products, including wild plants (or those for which no production quotas existed) and animals (especially skins - it appears that in many cases peasants used the meat, organs, and bones for themselves or sold them to others). Many of these products were stockpiled in coastal cities and then exported to international buyers (LYDQDFZBZYH, 1992; Ma Shengxue; Zhou

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natural order which could, like society, benefit man only if he accepted the limits it was seen to impose and of which he was himself a part." In the "new China" nature was "no longer to be accepted but must be 'defied' and 'conquered'...an enemy, against which man must fight an unending war..."
Zhongsheng, pers. comm.). Chapter four provides an in-depth look at the impacts of this trade system on wildlife in the Southeast Uplands.

From a historical perspective, the comprehensive legal protection for wildlife decreed in 1989 represents a significant step toward national standardization of wildlife conservation. The real difficulty of enforcing game laws, however, has yet to be resolved, and in many areas, including nature reserves, hunting continues unopposed. With the development of free enterprise in China, the increased availability of guns, and ever-increasing access to markets abroad, it appears that poaching for personal use and commercial markets has intensified (MacKinnon, 1996).

The Development of a National Nature Reserve System in China

In China, political and economic problems have rendered the "Yellowstone Model" of protected area development impractical in general, and undesirable in all but the most remote and sparsely populated areas. Since the inception of the nature reserve system forty years ago, there have been constant administrative setbacks and even a period of complete disintegration (CNCMAB, 1995; Li and Zhao, 1989). The country's first nature reserve, Dinghu Shan in Guangdong province, was established in 1956. Ten years later, there were 19 reserves in the country. But during the tumultuous decade of the Cultural Revolution, many of these were destroyed, and no new reserves were created (Li and Zhao, 1989). During this ten year hiatus, nature conservation was not a political priority, and even if it had been, local and regional political conflicts would have made protected area management difficult at best.
The late 1970s and 1980s marked the beginning of a renaissance period for reserves in China. With the opening to the West, China's environmental crisis became the focus of international attention. In order to stave off criticism and attract international funding, a tremendous effort was made to designate sensitive areas as nature reserves (ziran baohu qu - "nature protection areas"). The 19 original reserves were restored and by 1990, there were 289 Chinese reserves listed in the United Nations List of National Parks and Protected Areas, with 285 type IV (partially protected) reserves and four type I-III (fully protected) reserves (IUCN, 1990). The movement accelerated in the 1990s and by 1995, some 477 new reserves were established at county, provincial, and national levels. In 1996, there were over 766 nature reserves in China, including 90 state (national) level reserves, covering a total of 6-7% of the national territory (CNCMAB, 1995; Li and Zhao, 1989; Fu pers. comm. 1995).

Though the establishment of hundreds of reserves within a twenty year period represents a "great leap forward" for nature conservation in China, a survey of 159 nature reserves in 1993 showed that 44% had either no administrative bodies or no management staff. The same survey showed that there are nearly 10,000 people in each reserve, on average, and many more people living outside reserve boundaries who depend on resources within reserves. With an estimated 7.6 million rural people in some 769 reserves in 1995, it is imperative for county, provincial, and national administrative bodies to integrate nature protection with local economic development. Since there are only ninety state level reserves, accounting for less than 12% of the total number of
reserves nationwide. Coordinated management on a national level is a daunting challenge (CNCMAB, 1995).

The 1994 *Nature Reserve Law* addresses the difficulties facing China's nature reserve system by enacting laws for the solution of a series of complex and interrelated issues. These include: local economic development (Section I. Articles 4, 5, 6; Section II. Articles 14, 23); land use conflicts and reserve zonation (Section II. Article 18; Section III. Article 32); reserve establishment, administrative/bureaucratic ambiguity, and reserve oversight. (Section I. Article 8; Section II. Articles 11-17; Section III. Articles 19-25, 30): the development of tourism (Section II. Article 18; III. Articles 22, 28, 29): environmental damage and mitigation procedures (Section III. Articles 30, 33), and penalties for wrongdoers (Section IV. Articles 34-40).

The reserve system envisioned by China's national assembly differs markedly from the U.S. national park system and resembles, in a number of ways, the biosphere reserve model. Because of the allowance for controlled extraction of natural resources, the vast majority of China's reserves are classified as IUCN category IV protected areas (Managed Nature Reserves and Wildlife Sanctuaries). From a structural standpoint however, the reserve zonation scheme outlined in the 1994 legislation places China's reserves in the biosphere reserve mold (Appendix B: Section II. Article 18; Section III. Article 27).

The *Nature Reserve Law* has extremely important implications for the future of protected areas in China, calling as it does for the consolidation of nature reserve management schemes and local, regional, and national development planning (Section I.
Articles 4.5; Section II. Article 17; Section 3. Article 23). The success or failure of this undertaking will both shape and be shaped by the integration of nature conservation into the national identity (or identities of) of a country of many peoples.

In recognition of the difficulties that lie ahead, the Chinese Ministry of Forestry is adopting the biosphere reserve model as the most appropriate approach to nature conservation in a country where high population densities require close cooperation between protected area managers and local people. China has joined the International Biosphere Reserve Network, with 10 of its own international biosphere reserves. The country also established a national system in 1993, the China Biosphere Reserve Network (CBRN), which includes a total of 45 member reserves; ten international biosphere reserves and 35 at the national level (CNCMAB, 1995).

The main difference between current conservation legislation and the IUCN-based model is in the degree of integration of local people into protected area management and decision making. While "local participation" is the foremost of three strategies in the Chinese Biosphere Reserve Network Action Plan (CNCMAB, 1995), the kind of local empowerment implied is subject to varying interpretation. Such provisions may be perceived by the government as a threat to state authority, especially in sensitive areas where minority nationalities reside. The problem of political autonomy among local, especially non-Han peoples, may preclude such amendments from national legislation.33

33 The Action Plan for the CBRN contains 3 major strategies:

1. Participation by and benefit to the local population...

2. Use of the MAB Programme as an international channel to mobilize effective support through practical scientific activities such as training, workshops, exchange visits, and joint research...focusing on the multiple functions of reserves and on improving management of reserves, [and]

3. ...[to]
On the Ground: the Political Ecology of Land Tenure in China's Nature Reserves

The web of land tenure and settlement issues facing nature reserve managers, reserve inhabitants, and those living adjacent to reserves, complex in any particular case, is further complicated by regional variation in land tenure conditions, traditional land use patterns, and environmental perception. This is evident in the mostly Han dominated areas of eastern China, and will probably prove to be a chronic problem in non-Han areas of the west.3 4

In southern China, conservation and development issues are complicated by land tenure regulations that limit the power of authorities to control land use within reserves. These regulations reflect differences in ancient land tenure patterns and communist era administrative objectives for North and South China (Fig. 2.7). In North and Northeast
China, approximately 80% of the forested land is nationally owned in "forest areas" (*lin qu*) and with the exception of former government-sponsored forest laborers and their descendants, most nature reserves are devoid of long-term human settlements. In South China, however, ancient settlements comprising larger collectives (*jiti*) hold land use rights over roughly 80% of the land, and nature reserve managers are responsible for the economic development of the villages within their domain (Lin, 1990; Ruan Yunqiu, pers. comm.).

In Meihuashan Nature Reserve, the government has full jurisdiction over only 23.5% of the reserve. The rest of the land is under the control of the collectives, even though it is owned by the government. The collectives have rights to use the agricultural land (*tu quan*) and rights to use the forest land (*lin quan*). Although forest use must conform to reserve guidelines, any family, collective, or government agency that practices reforestation on wasteland can gain usufruct rights (*shiyong quan*) to the forests (while paying taxes to the government in the form of harvested timber) (Coggins, 1995; Fu Yongnian and Luo Mingxi, pers. comm).

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35 Approximately 80% of China's nature reserves contain human settlements within their boundaries. In northern China, these communities are composed of former employees of what had been state-run forestry reserves before their conversion to nature reserves, usually within the last 10-15 years. Since these workers were, in most cases, brought in by the government within the last 30-40 years to work on national land, they have very little, if any, collective land. The Chinese government has, in the 1990's, refrained from removing local people from their homelands, since the World Bank will provide no money to nature reserves or other conservation projects that include forced emigration (Ruan YQ, pers. comm.). While there is a distinctive dichotomy between land tenure patterns in nature reserves of the North and South, where Han people are in the majority, the situation is less clear in Western China, especially the Southwest, regions where national minorities comprise the majority of the rural population.
Figure 2.7. Nature Reserves in China. The boundary line is an approximate division between the reserves of southern China and those of northern and western China, macroregions where very different land tenure systems affect nature reserve management. This map does not show all of the nature reserves in China.
The unique land tenure rights and historical land use conditions affecting nature reserves in the Southeast Uplands merit close study. Not only do these factors largely determine the scope of sustainable nature conservation in the region, but they also provide a useful model for the study and implementation of community-based conservation in a variety of third world contexts. Before land and resource tenure conditions specific to the Meihuashan Nature Reserve are addressed in chapters 4 and 5, chapter 3 provides a longterm view of the relationships between humans and wildlife in the Southeast Uplands and adjacent regions of Southeast China.
CHAPTER 3
PEOPLE AND WILDLIFE IN SOUTHEAST CHINA: A CULTURAL HISTORICAL GEOGRAPHY

"Chinese literature from the earliest times is full of tiger stories - man-eating tigers, weretigers, symbolic tigers, anti-tiger spells, tiger hunts - tigers in China are like mice in a cheese factory." Edward Schafer (1967) The Vermilion Bird: T'ang Images of the South

Han Chinese settlement of the mountains, hills, and basins south of the Yangzi River occurred in a series of wave-like migrations, first from North China and then from the southeast coast. Escaping drought, famine, poverty, invasions by nomadic tribal peoples, or political persecution, individuals and groups left the North China culture hearth, seeking refuge along the coastal plains and interior valleys of the southern subtropics (Wiens, 1967). The plethora of strange vertebrate species and indigenous peoples encountered by early civilian and military settlers as they opened the wild frontier contributed to the Chinese literary record on wild animals and "wild barbarians." Literary research on wild animals and non-Han peoples in classical literature (Hammond, 1991; Schafer 1967; Schiffeler, 1977), show that there was a fine line between the observed and the imaginary, between wildlife, wild people, and wild chimeras.¹

¹ Geographic compendia, such as the Classic on Mountains and Oceans (Shanhaijing) and the Ancient and Modern Literary Compendium (Qinding Gujin Tushu Jicheng), abound with fanciful beasts and semi-humans from both within and beyond the Chinese empire. There is some resemblance, in this respect, to medieval European views of wild creatures as found in bestiaries. Early navigators in the western Age of Exploration saw mermaids in manatees, after all, and mythical beasts lurked among the pages and danced upon the maps of many fifteenth and sixteenth century travelogues (Pollard, 1964). Medieval European views of animals are discussed at length in Salisbury (1994) and Cohen (1994). One of the main differences in Chinese tradition is the extent to which wild animals have been incorporated into cosmology through systems of
Gradually the South became the richest grain producing region in the empire, and urban centers of political and economic power developed on the coast and along the larger rivers of the interior. Some of the more remote interior highlands, however, remained unsettled until the 16th to 18th centuries (Averill, 1983; Vermeer, 1990). The pacification of wild nature and the removal of threats associated with fierce and deadly animals like tigers was not complete until the 1950s. Even in the 1990s, villagers residing in the relatively wild mountain areas like Meihuashan view species such as wild boar, monkeys, and rats as a serious menace to their agricultural crops and silvicultural products like bamboo shoots and fruit.

Through long contact with wild animals, upland peoples have developed a unique set of cultural values and management tools in response to them. These values, beliefs, and practices reflect both Han and non-Han aboriginal traditions. While the human impact on wildlife throughout China has been severe, the influence of animals on Chinese culture has also been vast. The purpose of this portion of the research is to shed light on: 1. the types of conflicts that have arisen between humans and wildlife in the Southeast (especially those encounters involving tigers) and the spatial and temporal relationships of such conflicts to patterns of human migration, settlement, and resource exploitation; 2. methods of management and mitigation of attacks by tigers, bears, leopards, red dogs, and
correlative thinking (Henderson, 1984), and have thus permeated and informed such diverse fields as fine art, medicine, geomancy, and philosophy.
wolves, and how these changed as a result of western influences in the early 20th century; 3. the depiction of tigers in Chinese myth and folklore, and how this relates to perceptions of wildlife and management strategies past and present; and 4. the historical and current significance of wild animals of the Southeast Uplands in Chinese medicine.

In Western classical thinking, animals were part of a designed universe, of which humans were a natural, albeit superior, part. The teleological view of nature first espoused by Aristotle, was later taken up within Christian theology, which modified it to assert that animals were placed on the earth to serve humanity. In this latter view, the taming of wild lands and animals, along with the conversion of pagans, were acts of godliness, services that returned Christians to a state of dominion over nature, to a paradise that had been lost in the Fall (Glacken, 1967). We will see how this world view was resurrected by missionaries in the mountain landscapes of Fujian later in this chapter. First, however, it is important to understand how wild animals have long been part of Chinese systems of correlative thinking. As will be seen in the following review

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1 In the Middle Ages, the domestication of feral animals, the taming of wild animals, the clearing of wild land, and the conversion of local pagans, were central to the establishment of monastic orders. Glacken (1967: 310) describes how

"...monks entered the forests...'sometimes axe in hand, at the head of a troop of believers scarcely converted, or of pagans surprised and indignant, to cut down the sacred trees, and thus root out the popular superstition (Montalembert, 1896).'. St. Benedict...cut down the sacred grove at Monte Cassino, a survival of pagan worship in a Christian land. St. Sturm 'seized every opportunity,...to impress upon them (the pagans)...that they should forsake idols and images, accept the Christian faith, destroy the temples of the gods, cut down the groves and build sacred churches in their stead (Eigil, no date)."
of gazetteer records, people of the Southeast Uplands have, from the period of earliest Han frontier settlement, used these systems, along with more physical and practical approaches, to deal with their fiercest and most colorful non-human neighbor, the South China tiger. With this historical background in place, we may begin to view post-1949 developments in environmental perception and nature conservation in a new light. Current efforts to establish nature reserves and protect key species will then be placed within the distinctive cultural context of the Southeast Uplands region.

The author has utilized a number of resources and methodologies to analyze the history of human-wildlife interactions in the southeast. These include: local and regional gazetteer records, compendia of Chinese folklore on animals; guides to the medicinal value of wildlife; Western missionaries' and naturalists' accounts of wildlife, hunting, and local cultures in the Wuyi-Daiyun range at the beginning of the 20th century; and ethnographic field surveys conducted among villagers in the four Fujian nature reserves discussed in this study.

A History of Human - Tiger Encounters in the Southeast

Before the 1950s, the South China tiger (huanan hu) (Panthera tigris amoyensis), inhabited a vast area south of the Changjiang (Yangzi River) with outlying populations further north (Fig. 3.1). The geographic center of the distribution lay in the provinces of Jiangxi and Hunan, and the greatest population concentrations were probably found in mountain regions where wild ungulate
Figure 3.1. Historic Range of the South China Tiger. Before the 1950's, the population of the South China tiger was widespread in South and Central China. The geographic center of the population was in the provinces of Hunan and Jiangxi.
prey was most abundant.\(^3\) There is little information on where this range may have met or overlapped with those of the Siberian tiger in the Northeast, the Southeast Asian tiger in the Southwest, and the Bengal tiger in southeast Tibet (Tan, 1984, 1987; Xiang, 1983; Xiang et al., 1987). Prior to human disruption of the ecosystems adjoining their ranges, there were no major physical barriers between these subspecies (with the possible exception of the Hengduan Mountains between southeast Tibet and China proper). It is important to note, however, that the distribution boundaries proposed by Lu and Hou (1986) and Xiang et al. (1987) (Fig. 3.1) suggest that \(P. T. \text{ amoyensis}\) was limited to subtropical humid Central and South China, which extends from the Qinling - Huai River ecotone in the north to the humid tropical fringe of southernmost Guangdong, Hainan and southern Yunnan.\(^4\) In the Southwest, the South China tiger was displaced through competitive exclusion by the Indochina tiger (\(P. T. \text{ Corbetti}\)), which still survives in

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\(^3\) The main prey species of the South China tiger are the wild boar (\(Sus scrofa\)), the sambar deer (\(Cervus unicolor\), now fairly rare in the SE Uplands), and the serow (\(Capricornis sumatraensis\)) (Caldwell, 1924; Koehler, 1951). These are large ungulates that supply enough meat to warrant the energy expenditure required in their capture (He, Pers. Comm.). Potential prey include smaller ungulates common in the tigers' range such as: muntjacs (\(Muntiacus \text{ crinifrons}, Muntiacus \text{ muntjak}, Muntiacus \text{ reevesii}\)), tufted deer (\(Elaphodus \text{ cephalophus}\)), pangolins (\(Manis \text{ pentadactyla}\)), porcupines (\(Hystrix \text{ hodgsoni} \text{ subcristata}\)), frogs, reptiles, rodents, and lagomorphs (Allen, 1940; Caldwell, 1924; Koehler, 1951).

\(^4\) Herrington (1987: 57) provides convincing evidence that the historic distribution of the South China tiger represents the center of origin for the eight subspecies of tigers known to have existed until modern times. Her comparative study of cranial morphology and dentition in six of the eight subspecies of \(P. \text{ tigris}\), showed \(P. \text{ amoyensis}\) to be the most unique. She concluded that "The characters distinguishing this population reflect a primitive morphology, and [it appears that] the center of origin is occupied by the most primitive member of the clade...Therefore, \text{amoyensis} may be regarded as a relict population of 'stem' tigers."
southern Yunnan, and by the Bengal tiger \textit{(P. T. tigris)}, which occurs in southeastern Tibet (MacKinnon, 1996).

Linguistic evidence and historical mythology show that the so-called \textit{Man} ("Barbarian") aborigines, ancestors of the Miao-Yao-She peoples (discussed in chapter 2), felt a deep cosmological affinity with tigers. According to the \textit{Hou Han Shu (Book of the Later Han Dynasty)}, the Man of eastern Sichuan (the former Ba region) believed that their primary ancestor turned into a white tiger after his death, and human sacrifices were subsequently offered to this tiger-ancestor (Pulleyblank, 1983).\footnote{In addition to mythical relationships with tigers and a history of tiger hunting with crossbows that has continued down to the present, the Miao, Yao, and She share a belief in the ancestral dog-god \textit{Panhu} (described in chapters 2 and 9) (Lebar et al., 1964). During Zhou and Han times, the Changsha and Wuling Man of Hunan believed in \textit{Panhu}, while the Man of the Ba and Nan commanderies further north and west (eastern Sichuan and northwestern Hubei) believed in a tiger ancestor. Both groups of Man are believed to have been speakers of Miao-Yao-related languages (Pulleyblank, 1983; Shi, 1985) and to have had profound influences on subsequent cultural development in southern and central China.} Archaeological finds from the Ba region show a preponderance of tiger motifs, believed to be associated with a tiger cult (Chang, 1977; Pulleyblank, 1983). Miao and Yao folklore of the present day contains stories of the transmigration of human souls into the bodies of blood-sucking were-tigers, and of the transformation of living people into tigers (Pulleyblank, 1983), a theme common in later Han folklore, discussed below. Pulleyblank (1983), citing Mei and Norman (1976), suggests that the Mandarin word for tiger - \textit{hu} (ㄏ), may have been derived from Austro-Asiatic and/or Miao-Yao-She roots (the latter language(s) may be related to Austro-Asiatic languages like Mon and Khmer).
The most important technological innovation for managing tigers was also an aboriginal invention that appears to have diffused from the Miao and Yao (who are related to the She of Fujian), during the Warring States Period (403-221 B.C.), when they (the Man) began to be assimilated into the Chinese empire in the Kingdom of Chu (Pulleyblank, 1983; Temple, 1986; Wiens, 1967). The word crossbow, in Mandarin nu (弩), is the same or similar in Austro-Asiatic and Tai, and probably diffused northward, along with the crossbow itself, into the Han Chinese sphere. Temple (1986) attributes the invention of the crossbow as a military weapon to the Chinese in the kingdom of Chu, adding that it was first invented by aborigines in China as a bow trap to kill game. She (and possibly some Han) tiger hunters in the Meihuashan region and other parts of the Southeast Uplands relied on crossbow traps until the 1980s, as modern technologies became ineffective due to the rarity and reclusiveness of surviving tigers. The hunting techniques and history of one such crossbow hunter is discussed in more detail in chapter 9.

As Han settlers gradually filled the southern frontier, aboriginal peoples in many areas were assimilated into Han culture, and settlements sprang up across mountain regions that had previously been wild and remote from lowland towns and cities. With this increased settlement came greater exploitation of mountain resources, and a plethora

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4 The Chu State was probably, as Wiens (1967) suggests, comprised mostly of Miao and other aboriginal inhabitants of the Changjiang Basin. In fact, the leaders of Chu considered themselves "Man." By the time the people of Chu were incorporated into Qin Dynasty China (221-206 B.C.), there had probably been a great deal of diffusion of tiger lore and hunting technology. Han texts give credit for the "invention" of the crossbow, for example, to a person named Qin, from the state of Chu, in about the seventh century B.C., and there is additional evidence that the military crossbow was developed in the state of Chu (Temple, 1986).
of environmental disturbances that put humans in greater conflict with tigers. This can be documented through historical records such as local gazetteers (difangzhi), especially county gazetteers (xianzhi), to analyze changes in the distribution of the South China tiger and the nature of human-tiger encounters through time.

The compilation of gazetteer records first became systematized on a national level at the beginning of the Ming Dynasty in 1368, when local governments were required by imperial law to maintain records of important historical events, as well as economic, political, and demographic data. Since then, records of wildlife in the Southeast China Uplands have been fairly numerous. Though gazetteer records have been used for the study of Chinese environmental history and historical geography (He and Wen, 1980; Huang, 1985; Li, 1987; Perdue, 1987; Schoppa, 1989; Chai, 1991), this is one of the first attempts to analyze spatio-temporal patterns of human-wildlife encounters in relation to anthropogenic environmental disturbance.7

Gazetteer records of tiger problems in four southeastern provinces (Fujian, Jiangxi, Hunan, and Guangdong) provide what may be the longest written chronological account of human-wildlife interactions of any region of comparable size in the world.

In 1993, I collected and analyzed all of the gazetteer records on tigers that I could find in the Fujian Gazetteer Bureau in Fuzhou. I then decided that a larger sample was needed, and in the summer of 1995, I sought the assistance of the librarian in charge of

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7 After this chapter was written, the author discovered an interesting article by Robert B. Marks (1996) that relates economic development and land degradation to changes in the distribution of tiger attacks in the Lingnan region (the provinces of Guangdong and Guangxi). His results are discussed below.
the ancient books collection at Fujian Normal University. The librarian compiled all of
the available gazetteer records on wildlife (see the species mentioned below) from Fujian,
Jiangxi, Guangdong, and Hunan provinces. This material was transcribed with dates in
the common era, and gazetteer citations. I translated this material and analyzed the data,
and therefore must take responsibility for all mistakes of translation and interpretation.

This study focuses on the tiger in part because it appears more frequently than any
other species of wild animal in gazetteer records on the Southeast China Uplands. There
are also records on Asiatic black bears (*Selenarctos thibetanus*), wolves (*Canis lupus*),
red dogs (*Cuon alpinus*), macaques (*Macaca mulatta* and *Macaca arctoides*), wild boar
(*Sus scrofa*), and rats (among eight species of *Rattus*), as well as one mention of wild
elephants (*Elephas maximus*). These species are mentioned only sporadically, and with
the exception of perennial crop damage caused by wild boar and rats, they do not appear
to have constituted a serious hazard to human welfare. Most of the records of wildlife in
the gazetteers tell of the appearance of tigers in human settlements, or of the casualties to
humans and wildlife caused by tigers. Casualties caused by bears, wolves, and red dogs,
and crop damage caused by rats, boar, and monkeys are mentioned as well, but with much
less frequency.

Tiger attacks were sporadic, and often involved many human and livestock deaths
and injuries. They were recorded in sections of the gazetteers called "*shouzai.*" or bestial
disasters, which rarely lasted more than a few months to a year. This may indicate that a
few problem tigers could cause a lot of damage, and as is well documented, certain
individuals could become prone to preying on humans and livestock.
Before considering the results of this research, it is important to keep in mind that all gazetteer-based quantitative data is constrained in terms of the availability and reliability of certain types of information. We must assume that recorded events represent only a tiny fraction of actual tiger encounters, and that records that have survived to the present represent a small fraction of those originally kept at the local level. There is no guarantee that local records of tiger incidents were transcribed when gazetteers were rewritten, or that they were transferred to prefectural or provincial gazetteers. We must assume that uneven patterns of reporting, recording, and transcribing incidents involving wildlife provide only a very general impression of the actual number of events, casualties, and animals involved.

The gazetteers (difangzhi) used in this study included provincial gazetteers (shengzhi or tongzhi), prefectural gazetteers (fuzhi, zhouzhi, or diquzhi), county gazetteers (xianzhi), and city gazetteers (shizhi). Of 362 extant counties, administrative cities, and municipalities in the four provinces, over 80% are represented by local (county or city) level gazetteers in the library collection. This figure is inexact since many county and city names and boundaries have changed over time. It is also important to keep in mind that some tiger incidents that occurred in counties and cities not directly represented by local gazetteers in the collection were recorded in prefectural or provincial gazetteers. Finally, there is significant provincial bias in the number of gazetteers in the Fujian Normal University library. The library contains the most complete coverage of Fujian
(143 volumes), followed by Guangdong (78 volumes), Jiangxi (66 volumes), and Hunan
(64 volumes).8

There were 511 records (591 before repeat entries were removed) of encounters
with tigers.9 Encounters (which include all sightings and other events) occurred in 146 of
362 present-day counties and administrative cities (a total of 40%), and span from 48-
1953 A.D. (Table 3.1, Figs. 3.2 & 3.3).

During the roughly 1,900 year period under examination, the data show that over
10,000 people were killed or injured by tigers in the four provinces in question. This
figure would be much higher, but 395 records did not specify the numbers of casualties
(Table 3.1).10 It is also important to consider the fact that these records represent only
what could be gleaned from archival research in a library in Fujian province. Further
investigations in gazetteer collections from libraries in Guangdong, Jiangxi, and Hunan,
as well as in foreign countries, would probably produce even more data from those
provinces.

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8 Of the 143 volumes on Fujian, ten are provincial gazetteers, 22
are regional gazetteers, and 111 are county or city gazetteers. Of 78
volumes on Guangdong, three are provincial gazetteers, fourteen are
regional gazetteers, and 61 are county or city gazetteers. Of 66
volumes on Jiangxi,
one is a provincial gazetteer, 16 are regional gazetteers, and 47 are
county or city gazetteers. Of 64 volumes on Hunan, four are provincial
gazetteers, nine are regional gazetteers, and 51 are county or city
gazetteers.

9 This includes eight cases that included tigers and/or other
"strange, fierce beasts" that may or may not have been associated with
tiger attacks. These included flying tigers (feihu), flying foxes
(felii), and the mythical luoma (described below).

10 This is hardly surprising if we consider Richard Perry's (1965)
estimate that at least 1 million Asians had been killed in the last 400
years, an average of 2,500 per year.
Table 3.1. Gazetteer Data Tabulation

<table>
<thead>
<tr>
<th>Category</th>
<th>4 Provinces</th>
<th>Fujian Province</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of cases involving tigers:</td>
<td>511</td>
<td>220</td>
</tr>
<tr>
<td>Number of cases in which number of casualties specified:</td>
<td>116</td>
<td>46</td>
</tr>
<tr>
<td>Total (specified) number of deaths:</td>
<td>&gt;9,354</td>
<td>&gt;3,591</td>
</tr>
<tr>
<td>Total (specified) number of injuries:</td>
<td>&gt;135</td>
<td>&gt;104</td>
</tr>
<tr>
<td>Total (specified) number of deaths, injuries, and undifferentiated casualties</td>
<td>&gt;9,914</td>
<td>&gt;4,615</td>
</tr>
<tr>
<td>Highest number of casualties in one incident:</td>
<td>&gt;1,000</td>
<td>&gt;1,000</td>
</tr>
<tr>
<td>Percentage of cases that occurred between 1550-1850:</td>
<td>71</td>
<td>74</td>
</tr>
<tr>
<td>Cases in which outdoor work or travel impeded:</td>
<td>17 (3.3%)</td>
<td>13 (5.9%)</td>
</tr>
<tr>
<td>Cases in which fields left for fallow:</td>
<td>7 (1.4%)</td>
<td>1.5%</td>
</tr>
<tr>
<td>Cases in which homes closed at dusk:</td>
<td>7 (1.4%)</td>
<td>3 (1.4%)</td>
</tr>
<tr>
<td>Cases associated with famine:</td>
<td>7 (1.4%)</td>
<td>7 (3.2%)</td>
</tr>
<tr>
<td>Cases associated with drought:</td>
<td>6 (1.2%)</td>
<td>5 (2.3%)</td>
</tr>
<tr>
<td>Cases associated with epidemics:</td>
<td>6 (1.2%)</td>
<td>5 (2.3%)</td>
</tr>
<tr>
<td>White tiger sightings:</td>
<td>8 (1.5%)</td>
<td>2 (.9%)</td>
</tr>
<tr>
<td>Melanic (&quot;blue&quot; or &quot;black&quot;) tiger sightings:</td>
<td>3 (.6%)</td>
<td>3 (1.4%)</td>
</tr>
<tr>
<td>Encounters with strange beasts (flying tigers, <em>luoma</em>, 7-tailed foxes, etc.):</td>
<td>8 (1.5%)</td>
<td>4 (1.8%)</td>
</tr>
</tbody>
</table>

(table con’d)
<table>
<thead>
<tr>
<th>Description</th>
<th>Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases in which tigers enter a town or city:</td>
<td>117(22.5%)</td>
<td>55(25%)</td>
</tr>
<tr>
<td>Cases in which tigers enter homes, temples, schools, or other buildings:</td>
<td>25(4.9%)</td>
<td>13(5.9%)</td>
</tr>
<tr>
<td>Cases in which local officials tried to deal with the problem:</td>
<td>47(9.2%)</td>
<td>24(11%)</td>
</tr>
<tr>
<td>Cases in which local officials pray for divine assistance:</td>
<td>33(6.4%)</td>
<td>14(6.4%)</td>
</tr>
<tr>
<td>Cases in which prayers said to be effective in ending a disaster:</td>
<td>24(72.7%)</td>
<td>11(78.6%)</td>
</tr>
<tr>
<td>Cases in which military attempts to catch/kill problem tigers:</td>
<td>24(4.7%)</td>
<td>7(3.2%)</td>
</tr>
<tr>
<td>Cases in which specialist-hunters attempt to catch/kill problem tigers:</td>
<td>15(2.9%)</td>
<td>10(4.5%)</td>
</tr>
<tr>
<td>Cases in which non-specialist locals attempt to catch, kill, drive away problem tigers:</td>
<td>38(7.4%)</td>
<td>15(6.8%)</td>
</tr>
<tr>
<td>Cases in which tigers killed:</td>
<td>58(11.3%)</td>
<td>31(14%)</td>
</tr>
<tr>
<td>Number of tigers killed:</td>
<td>155</td>
<td>107</td>
</tr>
<tr>
<td>Cases in which a forceful response by military, hunters, or others (38 cases) stated to have solved the problem (ended the peril):</td>
<td>25(32%)</td>
<td>17(7.7%)</td>
</tr>
<tr>
<td>Cases in which tigers said to throw themselves into traps or otherwise allow themselves to be captured/killed (&quot;zi bi&quot;):</td>
<td>5(.9%)</td>
<td>3(1.4%)</td>
</tr>
</tbody>
</table>
Existing records indicate that incidents involving tigers were taken very seriously by the government, and even the sighting of a tiger in or near a county seat (xiancheng) was sufficient to warrant recording. Tiger attacks on humans and livestock were dutifully recorded, albeit with varying degrees of specificity and detail as to the number of tigers involved, the number of people involved, and the nature of the incident. All of the records include the year(s) and location(s) in which incidents occurred.

For example, the very earliest record discovered, penned in Jiujiang county, Jiangxi province, in the 24th year of the Han emperor Guangdi (48 A.D.), says simply, "(a) tiger(s) injured (a) person (people)" ("hu shang ren"). The ambiguity of singular and plural noun status in Chinese leaves the reader in the dark about the number of people or tigers involved. Table 3.1 shows that 77.3% of the records did not specify the number of casualties except, in many cases, through the use of quantifying adjectives like "many, countless, without number, etc." With these caveats in mind, we can still extract meaningful geographic data from the records.

There are only eight records on tigers from the four provinces prior to 1000 A.D. (Fig. 3.3a), and seven of these describe sightings of white tigers. White tigers have always been extremely rare (after 1000 A.D. there were only two recorded sightings of white tigers), and their physical beauty secured them a central place in Chinese cosmology from early times. Records of white tiger sightings may well have had political or cosmological significance, representing a contemporary or imminent state of
Figure 3.2. Human - Tiger Conflicts in Southeast China (Map). Historical gazetteer records of tiger attacks on humans and livestock show a widespread pattern of conflict across the greater Southeast Uplands region. Records from the Wuyi-Daicyun core area are especially numerous. The large number of events in Fujian province is, to some degree, a reflection of the location of the archives where data were collected.
Human-Tiger Conflicts in S.E. China
S.E. Uplands Region - 48 to 1953 A.D.

1000 to 1953 A.D.

Figure 3.3a. Human - Tiger Conflicts in Southeast China (Graph 1).

Figure 3.3b. Human - Tiger Conflicts in Southeast China (Graph 2). The frequency of recorded incidents involving tigers increased dramatically in all four provinces in the mid-1500s and reached a peak in the last quarter of the 1600s. There is a smaller peak in all four provinces in the late 1800s. The first two climaxes correspond to a period of increased anthropogenic disturbance throughout the greater Southeast Uplands. Records of tiger depredation may have also held political significance, peaking in periods of dynastic instability in the late-Ming, the early Qing, and, once again, in the late-Qing.
humane government and social tranquility. In any case, the lack of evidence of tiger attacks or problems with tigers in general during the first millennium suggests that 1. attacks on humans were much less frequent than in the following millennium; or 2. that tiger attacks were not recorded as frequently. It is possible that tiger attacks were not deemed worthy of inclusion in gazetteers because they were so common. It is likely that the gazetteer record is simply too sparse before about the 14th century to be reliable.

Despite these and other limitations of the gazetteer record, cultural and environmental variables should not be ruled out as factors in the increase in recorded tiger attacks in the second millennium. Indeed, such attacks were almost certainly due to demographic and social factors that resulted in unprecedented degradation of wildlife habitat and that put people in closer proximity to tigers on a routine basis. While analyzing some of these broad historical patterns of environmental change, however, it

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11 The white tiger (bai hu) is described in the Hu Hui (Tiger Anthology), a late Ming compilation of tiger lore from Tang, Song, and Ming sources (Hammond, 1991). Ordinary tigers living to the age of 500 years were said to turn white. Unlike its orange and black (melanic) relatives, the white tiger has long been a symbol of kindness, "appearing when the ruler was humane and caused no harm" (HH). It is also an important symbol in fengshui, corresponding to Venus ("the Great White"), and to the west in general (Williams, 1974).

12 This possibility seems less tenable when we consider the fact that the earliest record (48 A.D., cited above) recounts what appears to be a rather ordinary tiger attack, in which only one or a few people were injured. This was certainly not a "tigrine disaster" ("hu huan" or "hu bao") with numerous casualties, like the many yet to come. If tiger attacks had been commonplace, this record might not have been made in the first place, nor would it have survived the numerous transcriptions down through the centuries.

13 Man-eating is believed to become a problem only when natural prey is not available in sufficient numbers, or when a particular tiger resorts to killing a person due to inability to catch wild prey. Once a tiger learns that people are a possible source of food, they may lose fear of humans altogether, and enter villages or larger settlements in broad daylight to hunt (Caldwell, H., 1925; Caldwell, J. 1953; Corbett, 1944).
should be kept in mind that individual records are themselves historical artifacts. As such, they are signs that can reveal as much about culturally-constructed conceptions of nature as they do about the natural phenomena being described. This theme is pursued more vigorously below.

Starting in the mid-1500s, Han migrations to areas south of the Yangzi, along with natural population growth, caused an overflow of people from the original walled-cities and other valley settlements and into unsettled or sparsely settled uplands (Averill, 1983; Wiens, 1967). Under conditions of burgeoning human population and the disruption of upland ecosystems, conflicts with tigers were inevitable. In fact, as stated above, the highest incidence of human - tiger conflicts in all four provinces coincides precisely with a period of unprecedented environmental disturbance from the mid-1500s to the 1800s, when montane forests were being cleared and settled by a massive wave of migrants and settlers. Of 511 incidents involving tigers, 363 (71%) occurred during the period between 1550-1850 (Figs. 3.2, 3.3b).

The late Ming - early Qing immigrants were known as "guest people" (ke min), or "shed people" (peng min),¹⁴ because they constructed simple huts in the forests and scrublands, and settled into the difficult job of transforming the rugged wildlands into economic bases for the production of subsistence and commercial crops and forest products (Averill, 1983; Leong, 1997). Many of these migrants had been compelled to

¹⁴ Leong (1997) uses the term "shack people." The author follows Menzies (1988) and Averill (1983) in using the term "shed people," which (as in Averill) is not capitalized here since it seems to have denoted a category of people more than a particular ethnicity. This was probably not true in all places in all times, but for the present purposes, the term is not treated as a proper noun.
leave their homes in the heavily overpopulated Fujian and Guangdong coastal plains because of shortages of arable land. Overpopulated areas in the interior basins and mountain regions provided another source area for impoverished migrants. The shed people were drawn to the abundant lands in sparsely populated highlands of the same or neighboring provinces (Averill, 1983). An entry in a Nanping county (Fujian) gazetteer (date not given, Morita in Averill 1983: 90) describes this population of wanderers:

"(Those who) depend on the mountains and ravines, cut grass, bind it into dwellings and live [in the grass huts] are called shed people... They are mostly from Ting, Zhang, and Yong [the Hakka core areas of Southwest Fujian, that is, present-day Changting, Zhangzhou, and Yongding]. After three or four years the land's fertility declines and they often move elsewhere."

While the macro-historical conditions that led to this wave of internal migration are still under investigation, the most important factors were the commercialization of agriculture along the coasts of Guangdong and Fujian in the sixteenth and seventeenth centuries. Commercial crops replaced food crops, and changing land tenure relations led to a concentration of land ownership, with the result that many previously land owning peasants became tenants (Averill, 1983; Marks, 1996).

In addition to commercialization and the divestment of peasants from their lands, Averill (1983: 87) lists other "push factors" for migrants from the larger population centers: "large population pressing on limited food supplies, unsettled political and social conditions, and government resettlement policies..." The political and social unrest that swept the southeast coast during the Ming-Qing transitional period, was largely due to the
activities of anti-Manchu rebels like Zheng Chenggong and Wu Sangui,\textsuperscript{15} who fought off Manchu domination until the 1680s. Political chaos and social dislocation were intensified by rampant piracy and a reactionary government policy of forcing people out of the most fertile and populated coastal areas that might invite the depredation of pirates and rebels (Averill, 1983; Menzies, 1988a; Vermeer, 1990).

Displaced peoples had little recourse but to cross the South China sea to Taiwan or SE Asia, or to journey to the interior, where wild, unsettled mountain land was abundant. Many remote areas of the interior highlands south of the Changjiang were designated "crown lands" (\textit{guantian}), and this was true of most of the Southeast Uplands region of Fujian (Menzies, 1988b). These areas were largely ungovernable and ungoverned, and as Menzies (1988a: 89) notes:

"Neither the Ming nor the Qing governments seem to have had an explicit policy with regard to [southern] wildlands. Agriculture, the economic foundation of the Chinese state, was seen as the highest and best use for land. Wildlands were of interest in so far as they posed a threat to orderly government as a refuge for unruly elements such as the Shed People or rebels, or when flooding and siltation, presumed to be the result of upland forest clearance, threatened the irrigated agriculture of the lowlands."

Ironically, some coastal emigrants found free land in areas that had been designated "closed mountains" (\textit{jin shan}) during the Ming, where cultivation and settlement were forbidden because of the prevalence of bands of outlaws (Averill, 1983). Many highland areas were as politically and economically unstable as the coast, and some were overpopulated as well, contributing to the a continuing stream of vagrants in need of

\textsuperscript{15} Although Wu Sangui had aided the Manchus in their invasion of China in 1644, he later became a co-leader (with Zheng Chenggong and other military commanders loyal to the Ming) in the anti-Manchu Revolt of the Three Feudatories, which lasted until 1681.
land. Consequently, the shed people were not defined by a single ethnicity or dialect group, but were comprised of Han peoples (including the Hakkas, Minbei, and Minnan peoples) and non-Han peoples (including the She, Yao, and Miao) (Averill, 1983; Leong, 1997; Menzies, 1988b; Vermeer, 1990).

Many shed people practiced short-cycle pioneer swidden, cutting and burning the montane vegetation, planting crops, and moving on after the soil was exhausted. As the migrant population increased, large tracts of montane forests, scrublands, and meadows were destroyed. Erosion and siltation of streams that fed irrigation systems in the long-established valley settlements often led to violent conflicts with local inhabitants, who considered the shed peoples intruders (Averill, 1983; Cohen, 1996).

In other cases, mountain lands were rented to the shed people under long-term lease agreements that gave the tenant usufruct rights to the surface, or "skin" (pi) of the land, while the owner kept the "bones." This was common in Fujian, where it was known as "One field, two landlords" (yi tian liang zhu) system. Typically a "mountain lord" (shan zhu) controlled the land, while shed people had usufruct rights to all of the resources that grew upon the land. Gradually the shed people were integrated into the various societies and economies of the mountain regions in which they had first settled, and they came to be seen by many locals as important agents of landscape reclamation (Averill, 1983; Menzies, 1988b).

A passage from a Funing prefectural gazetteer of the eighteenth century (in Menzies, 1988a: 89) shows that local officials had discerned an important connection between land tenure conditions and the degree of destructiveness of land use practices:

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"Most of the land in Fujian is crown land, with no prohibition on cutting timber. Any branches or twigs that grow are burned or taken away, and they even dig up the roots to use as cooking fuel so that nothing can grow again and the mountains become barren. However, where the mountain is owned, industrious owners plant pine, Cunninghamia, tung oil, and tea oil, earning themselves considerable profits."

As shed people began to settle into more permanent forms of sedentary agriculture, pioneer swidden became less common. The following passage from a Nanping County (Fujian) gazetteer shows that both subsistence and commercial crops of both New and Old World origin were important components of the new economy:

"They bring the seeds of maize, sweet potatoes, tong trees, tea, cedar, lacquer, indigo, yams and potatoes; cut the thorns and brambles; drive out the foxes, and plant. They are mostly from Ting, Zhang, and Yong [former Fujian prefectures centered in present-day Changting, Zhangzhou, and Yongding]. After three or four years the land's fertility declines and they often move elsewhere" (Morita in Averill, 1983: 90).

Averill (1983: 93) points out that the diversity of these crops shows that there was "much more to the settlement of the Yangzi highlands than peasant realization of, as Ho (Ping-ti, 1959) phrases it, 'the economic advantages of maize and sweet potatoes'." In fact, as Averill shows, the earliest shed people, arriving in the mid-1500s, served as a catalyst for region-wide, (and I would add national and international) interest in mountain resources of all types.

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16 Menzies (1988) contrasts the destructive pioneer swidden practices of the early immigrants to the southern interior with a sustainable, long-cycle agroforestry system known that resembled Burmese taungya (Burmese for "hill cultivation"), which was first practiced by non-Han tribal peoples. In the earliest of these systems, which were developed by the Miao and Yao (and possibly the She), mountain land was cleared and burned, and food crops were planted together with trees (especially Cunninghamia and Masson pine). Menzies (1988b) argues, with good reason, that the shed people did not have the security of land tenure to engage in such long-cycle agroforestry practices.
Examples from the relatively remote areas where the nature reserves in this study are found today provide a case in point. In Meihuashan and Longxishan, this was the period when bamboo paper production reached its zenith; in Wuyishan tea production for foreign markets expanded rapidly; and in Daiyunshan (Dehua) porcelain "China" made from local kaolinite was produced at unprecedented volume (largely for European buyers). These products were important in domestic trade and in world markets from Southeast Asia to Europe and the Americas.17

Dehua county, in Fujian province, may have suffered some of the earliest effects of widespread destruction of montane wildlife habitat, and as a consequence, some of the earliest disastrous tiger problems occurred there. The following account, written in the early Ming Dynasty, provides a glimpse of what was later to occur in many other counties:

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17 It is important to differentiate between the settlement histories of interior areas that were settled during this period of dislocation and resettlement, and those that had been established generations earlier during different migration streams. Meihuashan fits in the latter category, and its present-day 22-30 generation, single-lineage mountain villages had been established before the wave of coastal settlers and other shed people in the 16th and 17th centuries. The villages of Wuyishan and Longxishan, however, often have people of many surnames, representing multiple migration paths with, in most cases, 3-7 generations of settled history. It is clear from this evidence and other data collected in field interviews (discussed in chapter 5) that these villages were established in an era of internal migration and socioeconomic flux, characteristic of the shed people migrations. Dehua County, site of the Daiyunshan Nature Reserve, probably has the longest history of forest disturbance of any of these areas, both because it is lowest in elevation and was settled by the earliest wave of Han migrants, and because it was a major center of porcelain production by the Song (960-1279). The industry required huge supplies of firewood for kiln firing. As Qiu (1993) demonstrated through pollen analysis, before Dehua county was established, in 933 A.D., large areas had already been clear cut, and the primeval broadleaf forest had been replaced by pine forests.
"In the 20th year of Hongwu (1387), in Dehua county there were tiger problems. There were black (melanic) tigers (hei hu) all over the place. In broad daylight, they ate people in their own homes. At night, they pushed open doors and entered houses. When people were killed in one house, they fled to other peoples' homes. Crops were abandoned and returned to the wild" (Dehua Xianzhi, 1940: 16).

By the fifteenth century, "tiger problems" (hu zai, hu huan, or hu bao) were becoming increasingly common in all four provinces of the southeast. In Fujian, especially in the Southeast Uplands, tiger problems were widespread. This is evident from the map in Figure 3.2, which shows a high incidence of tiger problems from the hills of coastal Fujian, through the middle-elevation Daiyun mountains, to the Wuyi mountains of the west. The northeast coast appears to have been particularly prone to tiger problems, and Ningde (formerly Funing) county had the highest number of incidents of any county in this survey (21). This may have been due, in part, to unusually rugged terrain - a mountain corridor extending out upon a broad coastal plain, where extensive agriculture surrounded a finger of montane habitat. Fuzhou and Putian county, mountain-bound coastal population centers further south, also had fairly high rates of conflict (6-10). Counties in the Daiyun mountain range (Shaxian, Nanping, Dehua, and Changtai) had high frequencies of tiger problems as well (11-15). A high rate of incidents along the length of the Wuyi-Daiyun range is evident from Guangze and Shaowu counties (site of

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18 The melanic tiger was a phenomenon that reappeared through the centuries in South China. There are three records of melanic tigers from the four-province gazetteer survey, and Harry Caldwell's book, Blue Tiger (1924), documents his attempts to collect a specimen of such a tiger, which he spotted on a number of occasions.

19 As stated, incidents include all sightings, attacks on livestock, and attacks on humans. Casualties ranged from zero to an estimated one thousand.
today's Wuyishan nature reserve), through Jianning and Jiangle counties (site of the Longxishan nature reserve), and south to Ninghua, Changting, and Liancheng counties (the latter includes part of the Meihuashan nature reserve) (Fig. 3.2).

In Jiangxi province, human - tiger encounters were distributed fairly evenly, with higher frequencies in the relatively densely populated urban centers along the alluvial plain of Lake Poyang and the Gan River. Nanchang (the capital) and De An counties had between 11-15 and 6-10 tiger incidents respectively (Fig. 3.2). The more isolated montane basins of Fenyi and Yongxin counties also had between six and ten incidents each.

Similar patterns are evident in both Hunan and Guangdong provinces. In Hunan, tiger encounters were widespread throughout the province, with a high number of incidents (11-15) in the densely populated settlements of the Lake Dongting - Xiang river basin (Changsha, Liuyang, and Hengyang), a fairly high number (6-10) in neighboring Ningxiang and the more mountainous Shaoyang county (Fig. 3.2). Tiger incidents in northwest Hunan, a rugged and sparsely populated region dominated by Miao and Tujia nationalities, may have been under-reported and/or remained beyond the wave of massive Han frontier settlement.20

20 Indeed, Menzies (1988b) indicates that many of the Miao and Yao settlements had already reached a high degree of ecological stability by the time of the shed peoples' migrations. This was due to the predominance of indigenous agroforestry systems (resembling Burmese taungya) previously mentioned. The intercropping of Cunninghamia and pine with subsistence and commercial crops, in long-cycle systems of continuous sustained yield, were probably emulated by others. Varieties of this system are still practiced today. In many of the villages of Meihuashan, for instance, Cunninghamia has been cultivated in bamboo stands. Cunninghamia shades the soil, promoting the development of new bamboo shoots. It will be harvested after 20-30 years, by which time the bamboo will
In Guangdong province, a high number of incidents occurred in the densely populated settlements along the estuaries of the Pearl River's deltaic plain - Guangzhou (11-15) and Shunde (6-10) (Fig. 3.2). Chaoyang county, on the coast near Fujian, and Dabu county, on the mountainous border with Fujian, both had 6-10 incidents. As with Hunan, a dearth of data from the western and northwestern border areas of the province, where Yao and Zhuang minorities predominate, may reflect a gap in record keeping, less intensive Han settlement, less environmental disturbance, or some combination of these factors.

It is clear that the disruptive human onslaught into upland habitats, in addition to increased disturbance in interior river and lake basins, led to an increase in tiger attacks not only on rural village peoples and their livestock, but also on walled towns and cities (Table 3.1). We can surmise that beyond the most densely populated and intensively cultivated plains, human interference had not yet caused a decrease in regional tiger populations. Instead, there was an increase in man-eating behavior and attacks on livestock, and tiger populations in rural areas did not diminish as long as there were nearby hill or mountain refugia. The following passages illustrate the magnitude of the crises that faced settlements throughout the region:

"In the third year of Ming Tianshun (1459), tigers attacked the villages near Beiyi mountain in Xinghua county (Fujian). Human and livestock casualties numbered in the hundreds. In the daytime, some people ventured abroad in groups, and even some of these were attacked. In the mountains, all travel ceased" (Ba Min Tongzhi, Juan 81: 24b).

have reached a density at which its canopy creates sufficient shade.
"In the fourteenth year of Qing Shunzhi (1657), in winter, there were many tigers in Tiaohua township in northwestern Ningxiang county (Fujian). Over 100 people were eaten. The fields were abandoned and returned to the wild" (Ningxiang Xianzhi: 14a).

In many areas throughout southeastern China, tiger attacks continued through the mid-twentieth century, though they were probably under-reported during the tumultuous first half of this century. Westerners' accounts of the Southeast Uplands region during this period show that tigers were still a serious threat throughout Fujian province. John Caldwell, the son of the Methodist missionary and tiger hunter, Harry Caldwell, describes the county seat of Fuqing (on the coast south of Fuzhou) in the early 1900s with a stark explanation of the need for security against the wilds:

"The walls were high and the gates were closed for another reason. Fuqing lies in the heart of the south China tiger country. Every home outside the city was locked at night. the cattle, pigs, and precious water buffalo brought into the inner court for safety. Even so there were years when the annual toll from tigers ran to over five hundred people in Father's four districts" (Caldwell, J., 1953: 28).21

Even with high walls and in some cases moats around towns and cities, tigers often found a way inside. In 22.5% of the gazetteer records, tigers entered larger human settlements, many if not most of which were walled. Foreigners in Fujian at the turn of the century do not mention this phenomenon, but they do state that tigers entered villagers' homes with some frequency. Another phenomenon that is frequently mentioned in the historical records that contradicts "normal" tigrine behavior is the presence of

21 The Fuqing County Gazetteer (1898) had no records of tiger attacks. Twentieth century gazetteers from Fuzhou and Putian also lacked records of these particular attacks. It is obvious that many very serious incidents, in which numerous casualties were incurred, never became part of the historical record. This may have been especially true during the chaotic years between 1911-1949.
"groups" (qun) of tigers. The Caldwells observed the same phenomenon, however, and on one occasion they saw five tigers together in Fuqing county, Fujian. The majority of human casualties, however, were probably attributable to one or a few man-eaters hunting individually. A particularly ferocious man-eater was said to have killed 250 people in Gutian county (presumably within a period of a few years), and Caldwell's description of the carnage, as well as the fear that spread among the people is reminiscent of many gazetteer records of earlier centuries:

"Men tending their herds or walking along the trails disappeared, or were found mangled and half eaten. Crops were going untended; paralysis began to settle on the hills...people were afraid to stir from their houses" (Caldwell, 1953: 38).

**Strategies for Tiger Management as Seen in the Gazetteer Record**

Through time, tiger management strategies were developed in response to the many crises that disrupted the peaceful existence of villages, towns, and cities. Methods of mitigating disasters or preempting them at an early stage were often decided upon by local government officials. Management tools included: spontaneous efforts by groups of local people to drive away a marauding tiger; organized reconnaissance and counter attacks by local military forces or conscripted militias; the enlistment of hunter-specialists (or sorcerers) to trap or kill tigers; and the offering of prayers, usually by local officials, to local gods of the city, town, or mountains. As with other forms of natural disaster, local officials were held responsible for mediating with heaven to bring an end to tiger

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22 Traditional tiger traps and ground set crossbow traps and guns are discussed in chapter 9. She tribal people appear to have been among the most proficient tiger hunters, and they have continued to use crossbow traps to hunt tigers in the Meihuashan region in recent decades.
attacks. As a nexus between heaven and earth in the Chinese state religion and a representative of the emperor, the county or prefectural magistrate was expected to uphold the mandate of heaven. Good government meant a harmonious and prosperous peace between people and nature. A Confucian proverb stated that, "an oppressive government is worse than a tiger." Hammond (1991) notes that "many Chinese, influenced by practices and beliefs that linked rulers and other authority figures to religious forces, supposed the statement to mean that a ruler's subjects would be free of the depredations of tigers if the ruler were truly benevolent." That the burden of responsibility rested at least partially upon the shoulders of government officials is attested to by their involvement in about one of every ten recorded cases (Table 3.1). The very act of keeping official records of tiger encounters was part of an effort to monitor and manage a natural (or supernatural) hazard.24

If we consider the increased frequency of tiger depredation shown in figure 3.3 from the perspective of the record keepers, some interesting patterns emerge. The climax in tiger depredation in the late 1600s coincided not only with increased internal migrations (and environmental disruption) but also with the disintegration of state control under the Ming and a transition to foreign rule under the Qing. Problems of state

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23 In the classic Li Ji, it is said that Confucius met a woman living with her family in a remote area infested with man-eating tigers. Asked why she lived in such a remote and dangerous place, she responded that it was the only way to avoid oppressive government rule.

24 The connection between poor government, societal disorder (luan), and tiger depredation has lasted to the present, and some villagers in Meihuashan today say that the rise of the Chinese Communist Party brought order, and as a result tigers "went away" (zou le). Where they went is unclear and unimportant in this view.
legitimation may have impelled the local literati who made and transcribed the record to include more natural disasters, for these were signs of cosmological disharmony that had serious implications for the maintenance of political power.25

The number of cases in which officials offered prayers in response to serious tiger problems (6.4% of all records), and the high rate of assumed efficacy (about 73%) (Table 3.1), reveal the extent to which tigers were viewed as part of an active and purposive cosmos, a cosmos that often responded, for better or worse, to the prayers and actions of human beings. Some records even state that tigers submitted to the entreaties of local authorities by "leaping" into bamboo or granite tiger traps (Figs. 11.1), or by walking into ground set bow (Fig. 11.2) or gun traps to be killed in a kind of suicide (zi bi). The following cases from Fujian show how official prayers, forceful action, and divine intervention were often combined to restore order:

"In spring of the seventh year of Ming Chongzhen (1634), in Pinghe county, there were tigers on the rampage in the mountain forests...There were countless attacks on people and livestock...The county magistrate pleaded with the city god and the mountain spirits for mercy. As a result, one tiger was killed, two tigers sacrificed themselves (zi bi), and two tigers fled. The disaster was then quelled. The local person, Zhu Longxiang,

25Gazetteer research on the frequency of typhoons in Guangdong province reveals a peak in the late 1600s, resembling the pattern of tiger attacks described above (Kam-biu Liu, pers. comm.). Records that hint at a connection between seemingly causally unconnected physical events, in this case typhoons and tiger attacks, may indicate an effort by local officials to promote the notion that the Mandate of Heaven did not favor the new Manchu rulers of China.
had a tiger-destroying sign (mie hu ji)\textsuperscript{28} (Kangxi Pinghe Xianzhi, Juan 10: 12a).

"In the 39th year of Ming Wanli (1611), in Luoyuan county, a bunch of tigers attacked people. The county magistrate, Chen Liangke, prayed to the gods and enlisted a She [nationality] person to use poison arrows [a crossbow trap with poison arrows]. [The hunter] killed four tigers. The terror came to an end" (Daoguang Luoyuan Xianzhi, Juan 29: 1b).

These accounts demonstrate that there was a perceived connection between the moral rectitude of officials, as shown in their pious petitions to heaven, and their ability to halt the depredation of nature's fiercest beast. If the tiger answered to heaven (tian), according to this belief system, one might reasonably ask why heaven was determined to destroy so many people from time to time. Was the tiger an agent of righteousness, carrying out the will of the gods; a henchman for "mountain devils (shan xiao)"; or an animal that acted on its own volition, but could be swayed by greater powers? Hammond's (1991) analysis of Chinese folklore on tigers shows that tigers played all of these roles and more.\textsuperscript{27}

\textsuperscript{28} This may well have been a written "fu" or charm that had magical properties. These were observed in Meihuashan in 1994-95, where they were used to keep wild boar out of the crops. When steeped in tea, the paper talisman had the power to cure certain illnesses. Only one villager in a particular part of the reserve had the power to make the charm, a skill he learned from a "master" from Jiangxi who once lived in the area.

\textsuperscript{27} Hammond (1991: 87) writes in the introduction to "An Excursion in Tiger Lore" that tigers play "a variety of roles in omenology and religion, affecting the way ruling officials, the gods, and the larger society perceive and negotiate fate, as well as specific actions...Its terrifying aspect led people to interpret its appearance often as an evil omen, or as a signal of bad government. Some would interpret a tiger's behavior towards humans as heaven's just punishment, making the animal itself a symbol of justice, or righteousness. Occasionally, officials perceived attacks against tigers as interference with a smoothly functioning universe, and some, engaging in grand wish fulfillment, saw the tiger as benevolent or as an agent of their own destiny."
The Tiger in Chinese Cosmology

The tiger has left a deep and lasting impression on Chinese culture for a number of reasons, not least of which are its size, beauty, and the relative frequency of its predation upon humans and livestock under conditions of environmental stress. The tiger, comparable to the lion in the west, was known as "the king of 100 beasts" (bai shou zhi wang). Dominion over other animals, however, was not the only thing, or even the primary thing, that gave the tiger such preeminence in traditional cosmology and lore.

In Medieval Europe and post-Columbian North America, large predators have, until the late twentieth century, been commonly viewed as a scourge to be wiped out without hesitation, apology, or reflection (Cohen, 1994; Lopez, 1978; Salisbury, 1994). As we have seen, in southeast China, depredation by tigers (as well as leopards, wolves, and red dogs) was a serious problem. These animals however were not seen simply as large, nuisance predators, as was the case with grizzly bears and wolves in European and Euro-American culture. Though near-extinction has been the final outcome in the last phases of the ancient and ongoing human-tiger relationship in China, the cultural significance, especially the high aesthetic, totemic, spiritual, and medicinal value of the tiger in China, has had no parallel in the belief systems of Europeans or Euro-American culture.

According to the Hu Hui or "Tiger Compendium," a 16th century collection of centuries of tiger lore, tigers were both feared and revered. Tigers, like people, could think rationally, and were sometimes held responsible for their crimes. Tiger calamities were seen either as a natural manifestation of poor government, an idea related to the
mandate of heaven concept, or as the just dessert of the victims, who had, in many cases, offended local, regional, or universal deities. According to legends in the Hu Hui, tigers were sometimes brought to court and tried for their crimes against humanity, and some stories hold that they were required by heaven to pray for divine permission to kill humans. One management strategy for problem tigers, an approach that shows Daoist sensibilities, was to leave them alone, in which case they would supposedly go away of their own accord.

The supposed ferocity of tigers has made them a popular talisman throughout China (and in many Asian cultures). Hats with tiger face motifs were and still are, though less frequently today, worn by babies in China to ward off illness. A doting parent would bundle an infant or toddler up layer upon layer to keep its body warm, and seal its head with a tiger cap to ward off evil spirits. On the front of the cap was the intricately stylized

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28 In the Guang Yi Ji, there is an account dating from the Kaiyuan period (713–741) about a group of 100 woodcutters from Sichuan who traveled to Shanxi to cut wood. They began cutting huge pine trees from a sacred forest in front of a "Venus Temple." An old man wearing a cap and leaning on a staff told them to stop cutting the holy trees. When they refused, the man said that he was the god of the planet Venus, and warned that they would die a useless death if they continued. They did not stop, so the man called, "Stripe!" Whereupon a few tigers sprang from the forest and ate all but a few of the more virtuous, whom the "god" had spared (Hammond, 1993).

29 Hammond (1991: 89-90) cites an example from the Xin Tang Shu: "For some officials, the solution to the problem of marauding tigers was to resist the impulse to interfere with them...Before (the arrival of a certain official at Huoshan in Anhui in the ninth century A.D.)...the tea-pickers...had been so afflicted by tiger attacks that they laid traps to catch them and dispatched hunters to shoot them, to no avail. After he was posted to the area as prefect (the official) stopped the trapping and hunting of tigers, and the threat disappeared." Hammond states that there are other examples of this approach in a number of standard-history biographies of officials. There are also cases of tiger problems coming to a cease when new, more virtuous, officials take office in a particular place. This type of incident is recorded in gazetteer record from the Song Zhaoning middle period (1068-1077), in Wan An county, Jiangxi province (Guangxu Ji An: Fuzhi, Juan 53: 4).
face of the beast, with fangs bared and eyes burning. On the tiger's forehead was the character for "lord/king" (wang), for as the Taipingyulan states, "the tiger is the king of a hundred beasts" (bai shou zhi wang) (Hammond, 1991). On some caps there is another, lilliputian tiger, sitting on the forehead above the character for lord, and if one looks carefully at the forehead of this tiny tiger, there is another character for "lord/king." This stylistic reiteration amplifies the power of the tiger icon. The three horizontal bars and one intersecting vertical line of the "wang" character represent one who not only rules, but more precisely one who mediates between, and ultimately unites, heaven and earth by holding an axial position between heaven above and earth below. The importance and persistence of the tiger-as-king myth is exemplified by Harry Caldwell's account of the evaluation by local literati, who were often on hand with other villagers to inspect tigers he killed in Fujian in the early 20th century:

"The Chinese character meaning "lord" or "emperor" must also be found in the markings of the face of a tiger if it is to be a real tiger of whom devils and demons are afraid. I had shot one handsome male tiger with two horizontal and one vertical white lines in the forehead not exactly to the liking of the scholars, and this animal too was discredited. Such a one is said never to have been born of tiger parents, but to have emerged through some strange metamorphosis from some animal or fish living in the sea" (Caldwell, 1924: 47).10

10 Caldwell (1924: 46) also discusses an interesting myth about a grass blade in every tigers' stomach, which holds a lesson about the tiger's magnanimity and local peoples' assessments of authenticity: "(The sages) claimed that because of the benevolent spirit of the tiger, which prompts it to leave the head and parts of a kill for some less fortunate of its kind which on account of old age or otherwise is unable to kill enough to maintain it, the gods have placed in the stomach of this king cat this blade of grass, which oozes out nutrition so the kindly animal is thus protected from ever suffering from hunger... The gentry standing around when the animals were being skinned were bidding high for the blades of grass, but upon finding there were none announced with disgust that the animals were not true tigers."
In the Meihuashan Nature Reserve, the author observed a tiger talisman sculpted out of clay onto the wall of an adobe house in the village of Zhongping. Villagers said that it was there to scare away evil spirits (Fig. 3.4).

Two final locations where the tiger symbol appears in Chinese cosmology are in geomancy (fengshui or dili) and in toponyms. In fengshui, the white tiger is associated with a hill or mountain to the west of an ideal site (with the green dragon to the east). It is still common for rural villagers to refer to this symbol in locating good sites for graves, houses, and temples. Finally, toponyms that include the word "tiger" in them can be found in perhaps every county across southern China, especially in reference to mountains and other geomorphic features. In Dehua county, Fujian, there is even a village named "Fierce Tiger" (Menghu).

The tiger's presence in every level of cosmology, from fengshui to talismanic iconography, in religious symbolism, literature, and fine art, give it a very different position in relation to Chinese culture from that of the grey wolf, grizzly bear, or any other wild animal in relation to traditional European and Euro-American cultures. As a case in point, after the rise of Christianity, no mere animal could serve the will of God by enforcing celestial laws, as did the tiger in numerous examples from Chinese folklore.31

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31 Cohen (1994: 61) describes the medieval European use of animals as religious "exempla" in sermons, bestiaries, and encyclopedias: "The animal was...not only inferior to the human in a hierarchy of government. It was also farther removed from divinity. The Aristotelian teaching, attributing a rational soul to man alone, fitted in well with the Christian tradition...The use of animal symbolism here had nothing theological about it. It was merely an effort to bridge the distance between two perceptual schemes by using familiar examples...the preachers yielded nothing when it came to the confusing of categories."
Figure 3.4. A Tiger Talisman in Zongping Village, Meihuashan. This clay tiger face grimaces at passersby from the wall of a house in Zhongping village, north of Majiaping. Such icons are still placed on roofs and walls to ward off evil spirits.
Another aspect of the traditional relationship between humans and wildlife in China, and one that has persisted to the present, is the importance of wild animals in Chinese medicine. Though medieval Europeans also believed that there was medicinal value in particular parts of certain wild plants and animals (Cohen, 1994), this belief did not develop into the complex, systematic ethnoscience that Chinese medicine has become. This system of knowledge was collected in classics like the *Herbal (Bencao)*, and in recent times, has been propagated and institutionalized through government-sponsored research and writing in such books as *The Guide to Economically Important Animals of China* (Zhongguo Jingji Dongwu Zhi, Shou Z.H., 1962) and *The Guide to Medicinal Animals of China* (Zhongguo Yao Yong Dongwu Zhi, ZYYDZXZ, 1983). The supposed tonic, curative, or empowering effects believed to come from ingesting the meat, bones, fur, or organs of wild animals represent natural power in its purest form. To absorb this power is felt to be a way to reconnect with the cosmos. Within the correlative thinking schemes and empirical processes through which Chinese medicine developed, this paradigm has become highly elaborate, and the human body is viewed as a microcosm of the universe. Each organ is associated with one of the five elements (*wu xing*), a certain color, certain sounds (Williams, 1974) and in the wild pharmacopeia, with particular parts of certain animal species. It is a cosmologized medicine, reinforced through trial and error, so that cures are found through the restoration of harmony. It is a holistic approach to health (with great appeal to many Westerners), but its commercialization and expansion into world trade networks has had grave consequences for wildlife conservation in China and worldwide. Given these problems, it is important
to note that the Southeast Uplands is a veritable pharmacopoeia of Chinese medicines derived from wild plants and animals.

The Bible, the Gun, and the Butterfly Net

Given the kind of reverence for (or ambivalent obsession with) the tiger that is evident in Chinese art, literature, folklore, and medicine, one might ask, what caused the Chinese people to exterminate the "lord of 100 beasts" throughout most of its range? It is clear that tiger parts were highly valued as medicine, and that man eating tigers were often killed, but would total destruction of the species have been a human prerogative, or even a conceivable event, according to the traditional Chinese view of nature? The settlement of large numbers of Westerners in China, especially in the late 19th and early 20th centuries, had a profound influence on how the Chinese viewed nature and natural resources, and as a result, on how they treated wildlife.

Perhaps the first written Western account of the Southeast Uplands and the South China tiger was that of Marco Polo. In the late 13th or early 14th century, Polo allegedly journeyed overland from what is today Zhejiang province, into the mountains of what is today northern Fujian. He followed the pass that leads to the Jianxi river, and boated to the Min River at Nanping (Fig. 2.1), which was the main trade route to Fuzhou. Of the Min valley hinterlands of Fuzhou, he wrote:

"Over hills and along valleys, you continually pass towns and villages, where the necessities of life are in abundance, and there is much field sport, particularly of birds...In these parts there are tigers of great size and strength" (Marsden, 1961: 300-301, in Moser).
Missionaries and specimen collectors in Fujian during the early 20th century have left accounts of the natural environment that far exceed customary descriptions of exotic landscapes. Harry Caldwell, a Methodist missionary from Tennessee who was also a hunter and naturalist, left a detailed narrative of his experiences with the people and wildlife of western and central Fujian from around the turn of the century to the 1920s (Fig. 3.5). His book *Blue Tiger* provides useful information on the South China tiger and many other species of mammals and birds. It also describes local perceptions of wildlife, including the superstitions that Caldwell avowedly sought to destroy through hunting and preaching. The book chronicles the encounter between Western and traditional rural Fujianese concepts and practices of wildlife management. It reveals how advances in weapons technology and the desacralization, or at least demystification, of wildlife precipitated a major shift in ecological dynamics, resulting in the virtual annihilation of large carnivores like the tiger.

Until the 1950s, tigers were common from the Yangzi River south to Guangdong Province, and hunting took place mostly in mountainous areas devoid of forest cover. Man-eating was common in many areas and provided a convenient excuse for Westerners to impress locals with their superior weaponry. Caldwell tied live goats to stakes, usually near densely vegetated ravines in an otherwise treeless landscape, to lure tigers within rifle range. Caldwell saw tiger hunting as "a means for advancing the knowledge of the Christian God in the heart of Asia."
Figure 3.5. The Methodist Minister, Harry Caldwell, With a Tiger He Killed in Fujian. Caldwell killed many tigers in Fujian in the early decades of the 20th century. Of this specimen he wrote, "I shot the animal with a 22-caliber high power Savage rifle at close range, after the animal had charged me from a long distance. This is a bit of real missionary work I have greatly enjoyed, and incidentally have found most helpful in the preaching of the gospel." (Caldwell. 1924: 7)
In the Fuzhou - Eastern Min region, he sought to refute local beliefs about so-called "spirit cats" that were protected by local deities. As mentioned in chapter 2, these animals were thought to be imbued with spiritual powers that made them impervious to bullets or dangerous for humans to harass, and were part of a shamanistic religious cult. Caldwell noted that the magico-religious prohibitions against killing the animals were stronger than game laws would have been, had they been part of the legal code. Blind to any possible conservation functions in these customs (despite being an ardent and gifted naturalist himself), the minister sought to portray local mores as aberrant superstitions:

"...these so-called 'cats' include the civets, wild dogs, and foxes, all of which have worked great havoc among the small pigs and poultry of the peasant people. Porcupine, pangolin, and small deer are also here in abundance, all with marked medicinal values, so it is safe to say that at one time hunters frequented this region with bow and gun. But things suddenly changed one day; the gods changed them, and finally established the fact that these animals were not flesh and blood at all, but evil spirits incarnate in the denizens of the wilds!...Since that day in the long ago the superstition about spirit cats has grown as mold grows, until the very life of the ignorant people of this part of China has become blighted. The woman into whom has entered one of these spirit cats is as popular as the priest and must be consulted on every imaginable occasion. She is a diviner of spirits and interpreter of omens and dreams. Unto her is committed the fate of the living, and in her is the voice of the dead. As Saul consulted the witch in the days of his trouble, so do the people of China commit their all into the hands of her into whom has entered the spirit of a devil cat. This female conjurer and spirit medium decides the destinies of millions of people, while foxes and wild cats enjoy an immunity due to a superstition stronger than law." (Caldwell, 1924: 26)

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32 Caldwell uses this term because the Chinese word for civet - "lingmao," can be translated "spirit cat." The name lingmao is also commonly used in the Southeast Uplands to denote a number of small and medium-sized mammals like foxes, civets, leopard cats, and mongooses.

33 Shamanistic cults involving mediums, who were often female, were common among people of all ethnicities in southeast China before 1949, and have enjoyed a renaissance in Meihuashan (and probably in other regions of the Southeast Uplands) in recent years.
Caldwell ridiculed the local belief system that gave these animals "immunity," and he set out to prove that his gun and his god provided immunity from superstition about devils, shamans, and the magic powers of animals. Accompanied by the famous naturalist, A. de C. Sowerby, he agreed to observe the "spirit cats" on a certain sacred mountain only under the condition that if he could successfully kill one (which local hunters said was impossible) the people would have to abandon their belief in the "fox devils." and "were never again to consult the temples and shrines in order to ascertain the will of the gods regarding the hunt" (Caldwell, 1924: 33).

Another Westerner, William Lord Smith, in an article in *Natural History* magazine in 1928, tells of a tiger drive near Xiamen in which locals armed only with tridents, encircled a tiger at its den in the boulder-strewn montane grasslands, where the author finished it off with a gunshot (Figure 3.6).

A number of other foreign naturalists were active in the Southeast Uplands at this time, including the director of the Asiatic Expeditions for the American Museum of Natural History, Roy Chapman Andrews, and one of its most famous employees, Arthur Sowerby. As mentioned, many new species of birds had been discovered in Wuyishan by the French naturalist, Pere Armand Davids, and European naturalists of less renown continued to work with and employ local people, collecting specimens there through the first half of the twentieth century (Zheng Fengchun, pers. comm.).

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34 In the village of Aotou, in the Wuyishan Nature Reserve, the author interviewed a 71 year old former hunter who had worked for decades as a specimen collector and taxidermist. In the 1940's, the man and his brothers had worked with a German naturalist. After 1949, he and his six children continued to hunt commercially, selling parts and specimens to specimen collectors from China and abroad. The man still has an attic full of bird and animal specimens, mostly from before the
In fact, all of the naturalists mention that local people were employed as hunter-guides and specimen collectors. From about 1900 on, there was a transfer of values and technology, as well as the formation of a new market for wildlife parts and specimens. This period marked the beginning of a transformation in local perceptions of wild animals from supernatural beings to natural objects for scientific investigation, and from sacred medicine that was sold in local and regional markets, to commercial commodities to be sold in a growing international market. Before the period of contact, wild animals possessed magical powers and were sometimes accorded divine status as terrestrial representatives of celestial agencies.

The vast environmental changes to come as the Chinese Communist Party attained power were driven by new definitions of "natural resources" and a revolution in the speed and thoroughness with which natural resources were exploited. Wildlife and other forest resources became commodities, the sole purpose of which was to serve the economic needs of "the people." Before assessing the damage of the post-1949 period, however, it is necessary to evaluate habitat conditions in the region in the early part of this century.

One might easily conclude that most of the forested land in the Southeast Uplands was destroyed during the early decades of CCP rule, and that tigers were pushed to the brink of extinction as a result of habitat loss starting in the 1950s. While habitat destruction was, by all indications, a critical factor in the extinction process, one must

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1980's. Wildlife populations in Wuyishan are said to have been severely and perhaps permanently (in the case of some species) decimated by the well-known specimen trade there (He, pers. comm.).
Figure 3.6. Trident-Bearing Minnan Natives with Quarry Taken in Nanping (Fujian) in December 1921. The photo was taken near the tiger's lair. in a typical mountain landscape of granite boulders and caves. William Lord Smith, who organized the hunt and took this photograph for an article in Natural History in 1928, finished the tiger off with a rifle shot.
consider how adaptable tigers were to the extremely degraded habitats that prevailed over much of the region for centuries. Virtually all of the western naturalists' accounts from the early part of this century comment on the fact that tigers were still abundant in the barren and anciently deforested hills and mountains. Even today, in western Fujian - where there is a relative abundance of forest cover - it is still commonly believed that tigers prefer grasslands and avoid the forest because once under the trees they might have their coats soiled by bird droppings (Luo Mingxi, pers. comm.).

Tigers survived in degraded grasslands and scrublands for hundreds of years, making dens in the dense foliage of ravines and preying on muntjacs, wild boar, serow, and crested deer. Most of the time there was little conflict with humans, even though the landscape had long since been shaped by fire, agriculture, small scale hydro-engineering, and commerce. In areas where the vegetation was a mosaic of forests, agricultural crops, and montane meadows, ungulates were probably at maximum density, and the same was probably true of tigers, as has been observed in India.

35 This contrasts with Marks' (1996) basic premise that a decrease in the number of tiger attacks in Guangdong and Guangxi corresponds to a growing area of deforested lands, habitats where tigers could not survive. While the author tends to agree with Marks' conclusions, abundant historical evidence presented here indicates that tigers survived in barren regions of Fujian as long as there was enough vegetation cover in ravines or enough boulders in the grasslands to establish den sites. Declines in the number of tiger attacks recorded in the gazetteers may indicate severe decreases in local and regional tiger populations, but they do not necessarily mean local or regional extinction.

36 Panwar (1987) notes that traditional village land use practices in India have been beneficial to both ungulates and the tigers that prey upon them:

"Paradoxical as it may appear, the interspersion of human habitation through these forested tracts enhanced the habitat productivity for the deer and the antelope, and hence, also for the tiger. This was because, traditionally, the people maintained..."
Problems arose when wild ungulate populations were inadequate, or when tigers suffered from diseases or other conditions that altered normal predatory behavior patterns. Under these circumstances, tigers entered towns or villages and ate dogs, pigs, or people. An impoverished prey base could result from over hunting or the destruction of ungulate habitat due to intensified land use at all elevations. Judging from current patterns of ungulate habitat preference (chapter 7), however, the most prolific ungulates, especially wild boar and Reeve's muntjacs, can maintain viable (if not dense) populations in extremely degraded habitats, even in the hills and mountains outside of large cities, where hunting pressure and habitat loss are severe.

Large areas around villages as pastures and open forests in order to meet their fuelwood and pasture needs. Rotating fallow marginal lands with the long cycle 'slash and burn' cultivation practices further enriched these habitats. In a low people:forest ratio that held well at that time, the rural ecosystems complemented the quality and extent of tiger habitat.

Tigers could develop a taste for human flesh in other ways as well, some quite macabre. A gazetteer record from Ningde county, Fujian, dating from the twenty-fifth year of Qianlong (1760) relates how a lapse in traditional burial practices caused an upsurge in tiger problems in forested mountainous areas. Normally, the dead were (and are still in the Minxi region) buried in a wooden coffin made of Cunninghamia planks (which are rot-resistant) for three years, after which the remains are removed, burned, and put in a ceramic urn. The urn is then placed in a hillside niche, either temporarily, or permanently if the place is known to have good fengshui (beneficial cosmic forces). Sticks are placed in front of the urn to protect it, or in the in some cases, more elaborate tombs of stones (and today cement) are constructed. For reasons that are unstated (perhaps relating to a scarcity of Cunninghamia and/or an influx of shed people who could not afford coffins or did not follow the custom), people in Ningde were not using coffins for the first stage burials, and tigers were attracted to the corpses. After eating human flesh, the record implies, the tigers became a threat to the living. A local official instructed the people to bury the dead using conventional methods and the tiger problems came to an end. A similar phenomenon involving man eating leopards was observed by Jim Corbett in northern India following a cholera outbreak early in the twentieth century.
In remote mountainous areas like Meihuashan, which had relatively sparse human populations and relatively high percentages of forest coverage, it appears that tigers were less prone to predation upon humans and livestock. Few villagers in the reserve remember having had tiger problems, and tigers have not attacked livestock since the 1930s-40s. In the lower valleys near Gutian, however, there were tiger attacks on humans in the 1940s, and less frequently, in the 1950s.

In the 1950s there were still an estimated 4,000 South China tigers. So how and when did the population crash? If you ask a villager in Meihuashan, you may well receive the answer I did from one man, "After liberation, the whole country was in order again. there was peace and stability, and the tigers went away. I don't know where, they just left." Once again, the mandate of heaven is alive and well.

The People's War on Wildlife: Wiping out the Four Pests

During the 1950s, predator control was carried out with revolutionary and patriotic zeal. Teams of peasants and soldiers encircled tigers in their mountain lairs, but now the weapons of choice were grenades and machine guns. The extermination of tigers through systematic hunting was part of a national movement to bend nature to the will of the people. Anti-predator campaigns, like the "Kill the Tiger Movement" (Da Hu Yundong) were part of the national policy of "bending nature to the will of the people," a refrain that played almost daily in the national press (Mao Piao, pers. comm.; Murphey, 1967).

A former army officer in Dehua county, Fujian became a local hero in 1956, when he led a group of soldiers and peasants in pursuit of one of the last tigers in the county.
The tiger was killed with grenades and machine gun fire, and the national news agency was on hand to make a movie about the heroic peasants' struggles to overcome hostile nature (Mao Piao, pers. comm.; see chapter 10).

To make the best use of wildlife, which was being killed off at unprecedented rates due, in part, to a massive increase in military weaponry among the peasantry, the government set up a system of Foreign Trade Stations (Waimao Zhan). By the 1970s and 1980s these trade stations were scattered across the Southeast Uplands in virtually every commune (today's townships), even in the remote mountain highlands. Every county had a foreign trade bureau (waimaoju) to collect products from stations in the hinterlands.

There were no prohibitions against the sale of any kind of animal. No plants were sold, only animals. The trade in furs and skins (as well as wild and cultivated plant products) was fueled by international demand. From the Meihuashan Foreign Trade Station, in Buyun, and hundreds of other stations across the Southeast Uplands, furs were transported to Xiamen, and shipped to other nations (Ma Shengxue; Zhou Zhongsheng, pers. comm.). The state-run fur trade is discussed in more detail in chapter 10.

Of the many "feudal superstitions" that the Chinese Communist Party sought to eliminate, the belief in animal medicines was not targeted, in fact the national drive to

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Some skins were also used for the domestic leather market. Around 1985, the Buyun Township Waimaozhan was closed, and forest products could only be sold to the government via the Longyan and Shanghang Waimaozhan offices, which remain open today (Ma, pers. comm.). Despite increased international control of trade in wildlife and wildlife products, a report for CITES (Convention on Trade in Endangered Species) on trade in wildlife and wildlife products through the year 1989, showed that China had exported 89,656 cat skins, about 66% of the world total (reported) of 136,825 (WRI, 1992). Though this report does not indicate species, it is clear that a serious threat to wild cats must still exist in China, and it appears that it is not recognized by the government agencies that permit this trade to continue.
capitalize on all available natural resources, starting in the 1950s, led to government endorsement and subsidization of research and development of wildlife exploitation. While great effort has been made to modernize Chinese medicine, there has been more effort to find some medicinal value, however small, in traditional animal and plant ingredients than to systematically identify those that could be discontinued. Before the rise of a nature conservation ethic, in the 1980s, the government did not interfere with the perpetuation of folk remedies as long as they did not harm people. Efficacious folk medicine filled an important gap, and still does, at a time when millions of people have only limited access to what Westerners consider modern medical care.

In the 1990s, the enforcement of wildlife laws is still spotty, and even in Beijing, Tibetan street vendors can be seen hawking musk deer glands,39 artificial forelegs of "tigers" (constructed from ox bones, claws carved from hooves, and fur of unknown origin), and a number of other animal parts. Pharmacies and restaurants throughout the country have continued to sell illegal wildlife parts in the 1990s, and a backwoods game trade prevails in mountain regions throughout the country, where the absence of fixed business venues makes it extremely difficult to control.

Saving the "Lord of a Hundred Beasts"

In the mid-1980s, biologists in China began to call on the government and the people to take rapid action to protect the South China tiger (Lu, 1987; Tan, 1984, 1987a

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39 Sheng Helin, author of The Deer of China (1991) states that there were an estimated 2-3 million musk deer (Moschus moschifera) in China in the 1950s. The medicinal value of musk oil has led to intensive hunting since the 1960s, and today the musk deer is designated as "endangered" on the 1994 IUCN Red List of Threatened Animals for China.
& b: Xiang, 1983, 1987; Xu, 1988). These specialists declared that the subspecies was on the verge of extinction, with some 30-50 tigers inhabiting widely-disjunct pockets of wild mountain habitat across the Chinese subtropics from Fujian to Guizhou and Guangxi. It seemed clear that the remaining tigers would not survive without immediate intervention by the government, lasting cooperation from local people, and technical aid and expertise from abroad (Lu, 1987; Tan, 1984, 1987a & b; Xiang, 1983, 1987; Xu, 1988).

By 1990, the Chinese Ministry of Forestry and the World Wide Fund for Nature (WWF-International) were working together to ascertain the status of the South China tiger in the wild. In 1990-1991, the WWF and the Wildlife Protection Associations of the Forestry Departments of Guangdong, Fujian, Jiangxi, and Hunan, conducted a series of field surveys in mountainous areas of those provinces, to locate tiger tracks and ground...
scrapes (characteristic territorial markers made by large felids), and to tabulate these and recent sightings. The primary goals were to determine the overall distribution of tigers, and the approximate population and age composition in each survey area, and to see if reproduction was still occurring. The researchers also assessed the status of prey species and of other large felids, especially the leopard and the clouded leopard (Koehler, 1991).

Gary Koehler, the American wildlife biologist in charge of the surveys, relied heavily upon the knowledge of local people who had hunted tigers until the 1970s:

"Hunters not only possess the skills for identifying tracks and marking scrapes but they knew areas that tigers had frequented and areas where tigers had scrape marked in past years. sites which were often still used by tigers. Tiger sign was frequently observed during the survey at sites where hunters had killed tigers 30 years ago. A technique employed by some hunters...was to construct tilled dirt pads about 30 cm in diameter in the center of a wild animal trail. This method was used successfully by the survey team in Fujian to collect impressions of tiger tracks..." (Koehler, 1991: 5-6)

The survey team discovered the most tiger signs in nature reserves and wildlands in two regions: 1. the Southeast Uplands (especially Meihuashan and Longxishan); 2. at the borders of southwest Jiangxi, northern Guangdong, and southeast Hunan, in a region where the Nanling and Luoxiaoshan mountain ranges converge (Fig. 3.7). The data were insufficient for accurate population estimates, but recent sightings of cubs in certain areas (including Meihuashan) indicated that reproduction was still occurring (Koehler, 1991).

Koehler (1991) proposed a number of measures to protect the South China tiger, including: 1. increased protection for tigers and other felids by enforcing bans on trapping ungulates in areas where clouded leopards and tigers occurred;
Fig. 3.7. Tiger signs recorded in Koehler's surveys (1990-1991). Most of the tracks, scrapes, and sightings were documented along the mountainous border zones between the provinces of the greater Southeast Uplands. Note the abundance of tracks and scrapes found in the Wuyi-Daiyun Range.
2. protection of prey species, including possible bans on guns and traps and initiating ungulate habitat protection; 3. protection of tiger habitat; 4. establishment of adequate-sized nature reserves; 5. development of public education and information programs; 6. continuing research on tigers and their prey; 7. developing, if necessary, programs for reintroduction of captive bred tigers to the wild; 8. an international commitment of funding and expertise.

There have been no studies on how much habitat is sufficient for the survival of a viable population of the South China tiger, nor are there adequate data on the home range size of a single individual.\textsuperscript{41} Koehler (1991) stated that few reserves in the four provinces were greater than 400 square kilometers, and that only Wuyishan (560 square kilometers) and Hupingshan (Hunan) (400 square kilometers) were possibly adequate for tiger conservation. For this reason, he recommended that existing reserves should be enlarged, combined, or connected by corridors where human disturbance is minimal.

Koehler also noted that local people could contribute to conservation practices and to wildlife research.\textsuperscript{42} He felt that future studies should include assessments of the habitat needs of prey and of the influence of human management practices on habitat; the effects of seasonal vegetation changes on ungulate habitat use; the use of fire in grassland

\textsuperscript{41} Xiang et al. (1987) estimate that one South China tiger needs roughly 30 square km of habitat, which can supply approximately 75,000 kg of herbivore meat. This area, obviously varies with local conditions of vegetation, prey density, and the intensity of human activity. A study of tigers in Chitwan National Park, in Nepal, showed that in good habitat, individual home ranges averaged roughly 40 square kilometers in area (Sunquist, 1987).

\textsuperscript{42} Although, in a more classical conservationist stance, he suggests that, “People living in areas important for tigers should be relocated” (Koehler, 1991: 15).
maintenance: and the importance of grasslands for ungulate populations. These issues are addressed in chapters 4-10.
CHAPTER 4

THE WEALTH OF THE MOUNTAINS:
SETTLEMENT, SUBSISTENCE, AND POPULATION CHANGE
IN MEIHUASHAN BEFORE 1949

"The Ting, the Nine Dragons, and the Min River,
The headwaters of the three rivers are here.
Tingzhou, Zhangzhou, and Fuzhou Prefecture,
The wealth of the three prefectures arises here."
Qing dynasty verse describing Meihuashan (Records of Min Cities,
in "Meihuashan," MHSLGC, 1993)

The relationship between population density, natural resource consumption, and
infrastructural development is critically important in a nature reserve where local people
depend on agriculture and forestry for a living. The populations of the 26 natural villages
in Meihuashan have fluctuated dramatically through the centuries in response to
prevailing subsistence, socioeconomic, and political conditions. Both internal (village
and intervillage) social and ecological forces, and external (national, regional, and
microregional) political and economic forces have shaped each village. Though this may
seem axiomatic, it is important, especially since there have, at times, been complex
internal factors behind migration, such as the relations between agnates within and
between villages. "Push and pull" factors revolving around lineage issues such as
fengshui, especially as it pertains to tomb placement and lineage security, appear to be
endogenous forces, more idiosyncratic and difficult to predict than phenomena more
tangibly linked to larger historical patterns. In short, villages have their own histories.¹

¹ This is abundantly evident in Meihuashan from the intriguing
cases in which villages have been abandoned, destroyed, or both,
eventually disappearing beneath the dense foliage. Though these events
may be directly related to exogenous forces, there may no longer be
evidence of the connection. For example, the village of Zhongmenqi and
a village between Jiaotan and Mawu were abandoned between the 17th and

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With this caveat in mind, it is safe to say that there has also been a high degree of correspondence between periods of immigration, economic prosperity, and peace, on the one hand, and emigration, economic decline, and political and social turmoil on the other. Attacks by marauding bandits and soldiers, starvation, economic decline, and combinations of these factors have led to decreases in village populations at least twice in the past century.

Large population swings have led to dramatic variation in the amount of pressure on natural resources. By linking episodes of population fluctuation to specific historical events and processes, we can gain an understanding of some of the primary forces behind anthropogenic ecological changes in the nature reserve and throughout the Southeast Uplands (Lees and Bates, 1990). We can also gain insight into the relationship between "outside" political forces and agencies (represented, with irony, by the "tiger") and...
internal adaptations made by local people (who are represented, also in an ironic sense, by the "pangolin").²

**Ethnolinguistic Diversity in the Meihuashan Region**

Comprising as it does, the southern end of the Southeast Uplands, close to the borders of Jiangxi and Guangdong, the Meihuashan region of the Daimao Mountains contains distinctive natural and cultural features. The Qing dynasty verse above (see the epigram at the beginning of this chapter) alludes to the fact that this mountain region encompasses the headwaters of the Nine Dragons river (*Jiulong Jiang*), and major tributaries of the Ting river (*Ting Jiang*) and Min River (*Min Jiang*) (Fig. 2.1). The high peaks of Meihuashan (Gouzinao - 1,811 m, Jiangjunshan - 1,664 m, and Youpoji -1,777 m) form a triple divide, with streams flowing north to the Shaxi ("Sand river") thence into the Min river, east into the Nine Dragons river, and southwest into the Ting river drainage system (Figs. 2.1, 4.1).

The mountains of the Daimaoshan range also form an ethnolinguistic barrier within the Western Min Region. There are two major dialects (*fangyan*) in this region: the Southern Min dialect (or Interior Southern Min *vide* Moser, 1985), spoken in the Longyan Municipality and Zhangping county, and the Western Min Hakka dialect, spoken throughout the other five counties in Longyan prefecture.³ Between these two

² The title of the dissertation is explained in the preface. The pangolin, by its very name - "the best at piercing (or traversing) the mountains" (*chuan shan jia*), is emblematic of the Hakka settlers of the Meihuashan frontier.

³ There is abundant historical evidence that She people inhabited the Western Min region before Hakkas arrived in the Tang and Song (Shi, 1985). Today the She in Longyan prefecture speak subdialects of Western Min Hakka. They are highly-assimilated into Han culture, though they
dialects, there are 24 mutually incomprehensible subdialects (hua), divisible into 52 regional accent sections (fangyin pian) (LYDQDFZBZWH, 1992: 1461). Speakers of the two dialects and one of the Hakka subdialects are divided among the three drainage basins described above. From the Daimaoshan range heading east into the Nine Dragons river drainage, live speakers of the Southern Min (Minnan) dialect of Southeastern Fujian. Within the Min drainage basin in northeastern Liancheng county live speakers of the Liancheng subdialect of Western Min Hakka, which has close linguistic affinities with Hakka-related dialects further north. Within the Ting river drainage, which includes four counties (over two-thirds of the region), live other speakers of the Western Min Hakka dialect, which has similarities to the Hakka dialects of Northeast Guangdong (Fig. 2.6) (LYDQDFZBZWH, 1992).

Due to diverse migration streams, long-term settlement, and the difficulties of travel within the Western Min Hakka region, there are twenty subdialects (hua) of Western Min Hakka, and these are divided into a total of forty-three regional accent sections within a particular subdialect are generally mutually comprehensible, though accents and some vocabulary differ.

5 For centuries, Zhangping county and the Longyan municipality were part of Zhangzhou Prefecture, which was governed from the coastal city of Zhangzhou. Starting in the Tang dynasty, the other five counties of what is now Longyan prefecture were part of Tingzhou Prefecture, a Hakka culture area. In 1913, the two administrative regions were merged as Tingzhang Dao (Tingzhou-Zhangping Route). In 1949, these became the Longyan Region.
sections (*fangyin pian*), with 1,792,000 local speakers as of 1985 (LYDQDFZBZWYH, 1992). All of the Western Min Hakka trace their ancestry through Ninghua county prior to later settlement in Tingzhou Prefecture (which included what are now the five counties of Changting, Liancheng, Yongding, Shanghang, and Wuping). The Changting subdialect is held as the standard representative of the Western Min Hakka dialect as a whole (LYDQDFZBZWYH, 1992).6

The Meihuashan nature reserve lies within the Hakka-speaking culture region, and all of the surrounding townships speak the Western Min Hakka dialect (even those in the neighboring Longyan municipality). The Meihuashan high mountain region (encompassing the nature reserve and surrounding townships) is a fracture zone between the *Gujiao* subdialect (Gutian accent) to the south, the *Wenxiang* subdialect (Luxi accent) to the northwest, the *Wanan* subdialect to the northeast, and the *Shuangche* subdialect to the southeast (Fig. 4.1).

Which villages within Meihuashan speak which of these subdialects and accents is unclear. While the subdialects are, in many cases, mutually unintelligible, the subdialects of all of the reserve villages are mutually intelligible. They are in many cases, however, easily distinguished from one another (by natives) by accent and less often by grammar, vocabulary, or both (Ma Shulin, pers. comm.). Linguistic relationships in Meihuashan are complicated by the fact that villages sharing common surnames and migration histories are spread across the reserve and interspersed with other villages

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6 Just as the *Meixian* (Mei County) dialect is seen as the representative dialect of the Hakkas of northern Guangdong, and, by many people, as the standard Hakka dialect in general.
Figure 4.1. Longyan Prefecture, Showing the Location of Meihuashan Nature Reserve and Other Places Mentioned in Text. The prefecture is also known as the Western Min (Minxi) Region. The Meihuashan Nature Reserve lies at the boundaries of the Longyan Municipality, Shanghang County, and Liancheng County. Villages outside of the reserve where sacred (fengshui) forest surveys were conducted are represented by numbered circles. Townships mentioned in the text are represented by squares.
of quite different origins. In the absence of formal linguistic data, it would be impossible to define or map any ethnolinguistic groups by village. The task could probably be accomplished with further research (it is possible that new regional accent groups would be discovered), for according to a Gonghe man who was in his 50s and had interacted with villagers throughout the region for many years, the villages of the Meihuashan region can be grouped according to similarities in accent and other speech patterns.7

Village Administrative Status, Structural Features, and Settlement Patterns

Within the regional administration system of China, there are two types of "villages" (cun): "natural villages" (ziran cun) and "administrative villages" (xingzheng cun). The five study villages in this research (Gonghe, Guizhuping, Majiaping, Taipingliao, and Long Gui) are natural villages, which means that they are more or less discrete settlement units. For administrative purposes, they have been grouped with other villages within four administrative villages (Table 4.1).

An administrative village consists of two or more natural villages, for instance, the natural villages of Guizhuping and Gonghe together comprise one administrative village known as Guihe (a name derived from characters in the names of the two natural villages). A number of administrative villages comprise a township (xiang or zhen).

In a list of 45 natural villages in the greater Meihuashan region, this man delineated 15 groups based on distinctive accents and (to a lesser extent) grammar and vocabulary. In many cases, he put neighboring villages of significantly different geographical origins into the same groups. This and other evidence indicate that similarities in accent between villages in each group are due more to longterm interaction in Meihuashan than to historical origin.
<table>
<thead>
<tr>
<th>County/Municipality</th>
<th>Township</th>
<th>Village</th>
<th>Natural Villages</th>
<th>Settlement Land in Reserve</th>
<th>Outside Reserve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longyan</td>
<td>Wan An</td>
<td>Zhangchen</td>
<td>Huakeng Beikeng*</td>
<td>Dagaoxie</td>
<td>Yangjiashan Daban</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Huameng Xiaogaoxie*</td>
<td></td>
<td>Guangtoufu</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Guanfuban Yingkeng*</td>
<td></td>
<td>Shitoukeng</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Guizhuping Gonghe*</td>
<td></td>
<td>Nanping</td>
</tr>
<tr>
<td></td>
<td>Beiyang</td>
<td>Fukeng</td>
<td>Guanfuban Yingkeng*</td>
<td>Daluoban</td>
<td>Beiyang*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Xiache</td>
<td></td>
<td>Jiazikeng</td>
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<tr>
<td></td>
<td>Shuangche</td>
<td></td>
<td></td>
<td></td>
<td>Shangche*</td>
</tr>
<tr>
<td>Shanghang County:</td>
<td>Buyun</td>
<td>Guihe</td>
<td>Guizhuping Gonghe*</td>
<td>Xiaowudi*</td>
<td></td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Shelongtou</td>
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<td></td>
<td>Daxie</td>
<td>Wudi</td>
<td>Dawudi</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Shisun</td>
<td></td>
<td>Liziping</td>
<td>Xialping</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Xiaokengmeng Shangshisun*</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Zhongshisun</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Xiaoshisun</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Yanxiao</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Gaojikeng</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Yuandingyan</td>
<td></td>
</tr>
</tbody>
</table>

(table con’d)
<table>
<thead>
<tr>
<th>Country/Municip.</th>
<th>Township</th>
<th>Admin. Village</th>
<th>Natural Villages</th>
<th>Settlement Land In Reserve</th>
<th>Land in Reserve</th>
<th>Outside Reserve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liancheng County:</td>
<td>Miaoqian</td>
<td>Yanbei</td>
<td>Majiaping</td>
<td>Zhongping</td>
<td>Shangyan Xiyan*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Luxi</td>
<td>Luodi</td>
<td>Chendi</td>
<td>Luodi* Chendi*</td>
<td>Leikou Pingkeng</td>
<td>Zhaiyi Yang</td>
</tr>
<tr>
<td></td>
<td>Pingkeng</td>
<td>Baishuizhai</td>
<td>Chijiashan Xiebei</td>
<td>Taipinglia*</td>
<td>Daguan Bajinshan</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Taipingliao</td>
<td>Taipinglia*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Baishi</td>
<td>Baishi*</td>
<td></td>
<td></td>
<td>Dudley Mao</td>
<td></td>
</tr>
</tbody>
</table>

| Total: | 7 | 19 | 26 | 15 | 21 |

<table>
<thead>
<tr>
<th>Population Villages</th>
<th>Natural Villages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1986: 8,396</td>
<td>2,718</td>
</tr>
<tr>
<td>1994 (estimated): 9,640**</td>
<td>3,120***</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Households</th>
<th>Data Incomplete</th>
<th>Data Unavailable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1986:</td>
<td>1,928</td>
<td></td>
</tr>
<tr>
<td>1994:</td>
<td>22,3 people/Sq. Km</td>
<td>12.2 people/Sq. Km</td>
</tr>
</tbody>
</table>

| Area | 377 square Km | 222 square Km |

<table>
<thead>
<tr>
<th>Population Density</th>
<th>25.6 people/Sq. Km</th>
<th>14.1 people/Sq. Km</th>
</tr>
</thead>
<tbody>
<tr>
<td>1986:</td>
<td>22.3 people/Sq. Km</td>
<td>12.2 people/Sq. Km</td>
</tr>
<tr>
<td>1994:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Indicates location of administrative village headquarters
**Based on number of households multiplied by five (there was an average of 5 people per household according to the 1994 data set).
***Approximately 3,120 if 14.8% growth rate of 19 administrative villages is applied.
Note: Study villages are shown in boldface.
(Sources: ZHKCBGBWH, 1991: 2-3, 2-8; Meihuashan Nature Reserve unpublished data, 1994)
The administrative system in Meihuashan is complicated by the fact that the reserve straddles two counties (Shanghang and Liancheng) and one municipality (Longyan). Furthermore, the 26 natural villages of the reserve are grouped within 19 administrative villages, in seven townships (Table 4.1). Before 1936, Meihuashan was an administrative area (qu) called Tiechang Qu (Fig. 4.2), which lay within Changting county (formerly Tingzhou prefecture). The area was later divided into smaller administrative areas, and these became communes in 1957. In 1981, the communes were dissolved, largely replaced by townships, which, in Meihuashan, continued to manage the same areas.

Given the complexities of the administrative system, it is more instructive for cultural historical research to focus on the natural village as a settlement unit than on the administrative village. This is because the natural villages have a much higher degree of historical homogeneity and structural integrity than do the administrative villages (especially since the latter are often groups of natural villages with different lineages, settlement histories, and traditions).

Natural villages are typically comprised of discrete clusters of houses and other buildings nestled in narrow valleys (like Gonghe, Guizhuping, and Majiaping), clumped on high promontories (like Long Gui), or arrayed along sloping mountainsides following small streams (like Taipingliao) (Figs. 4.3-4.5). Their structure could best be described as compact (tuanzhuang), though a few riverside settlements in the reserve are elongated or "linear villages" (daizhuang). Dispersed villages (sancun) were observed only in
Tongxian and Guanzhuang townships in Shanghang county and in the Wuyishan Nature Reserve.8

All of the natural villages in the Meihuashan Nature Reserve and most of those in surrounding highland areas are composed of single surname lineages, which are further subdivided into descent groups with residences that, in Gonghe and probably other villages, exhibit some degree of within-village residential clustering (Fig. 1.2). The structural features of the study villages: single lineage (with multiple descent groups), natural (as opposed to administrative), nucleated, compact, interspersed with vegetable and rice crops, and surrounded by rice paddies and managed forests, made them useful settlement units for analysis and comparison.9 The compactness of the Meihuashan villages also facilitated the drafting of sketch maps, which were used as part of the interview process to discuss the development of the built environment of each village, its fengshui, and the relationships between socioeconomic development, land use, and structural changes (Figs. 4.3, 4.4, 4.6).

The reserve area can be divided into four traditional hinterland tributaries to four or five different market towns, with which there has long been a reciprocal relationship of mountain-valley trade (Fig. 4.2). These tribute areas are in the southern, northwestern, northern, and northeastern portions of the reserve. Villages in Buyun township

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8 These village structural types are drawn from Knapp (1992), who has provided a useful description of various morphological characteristics of Chinese villages.

9 Most natural villages in Wuyishan and Longxishan are much less homogeneous and insular in terms of land use, settlement patterns, and culture history. These features revealed a lot about their settlement history and land use patterns, however, so in these reserves it was also important to focus on the natural villages as basic settlement units.
Figure 4.2. Sketch Map of Tiechang Qu (The Historic Tiechang Administrative Area). The area, which was part of Changting County until the 1930s, corresponds fairly closely to today’s reserve boundaries. This map, which was among the loose papers in the Ma family genealogy in Gonghe, includes the five study villages. Tiechang Qu was divided between Liancheng and Shanghang counties in 1939, and included what are now the townships of Luxi (in Liancheng) and Buyun (in Shanghang).
(Shanghang county), in the southern part of the reserve, trade in the Gutian market, which occurs on every day in the lunar calendar with a date containing the numbers 4 or 9 (4, 9, 14, 19, etc.). Villagers in Gonghe recall making the trip on foot to Gutian (a distance of about 16-18 kilometers by trail) loaded with trade goods in 4-5 hours, and returning late at night. In the northwest, the villages of Zhongping and Majiaping have traditionally traded in the town of Miaqian (in Liancheng county), though Majiaping people also buy and sell products in the coal mining center of Jiangxie village, which is 7.5 kilometers distant, and on the way to Miaqian. Longyan villages like Chenyi Keng, Da Gaoxie, Qingcaoyan, Xiao Gaoxie, Beikeng, and Dutou, along with villages of Liancheng county like Chijiashan and Xiebei, trade in Wan An township (in Longyan municipality) or in Meicun village, in the northeast. Villages in the northern part of the reserve, such as Taipingliao, Baijinshan, Da Guan, and Wuku use the market in Luxi (in Liancheng county).

Village Profiles: The Interview Process

In the five study villages, preliminary land use surveys and interviews focused on the history and present conditions of resource management and economic change (Appendix D). The study villages were chosen because they are fairly widely scattered across the reserve and yet none is far from the core area (Fig. 1.2). Formal, structured interviews (interviews based on questionnaires) were followed by a series of less structured, semi-formal interviews with selected informants, who were especially

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10 The preliminary questionnaire was composed in Chinese, so that interviewees could read the questions in the event of ambiguity or confusion. This turned out not to be a problem.
knowledgeable. Questions for the latter were generated while analyzing the results of former interviews, and many questions were composed spontaneously during the interview process. In many cases, the researcher discovered contradictions in the data, needed further information on a topic, or sought to initiate a new topic of inquiry. Follow up interviews were conducted with helpful informants and corroboration was sought from others. This research process is part of an analytic strategy known as progressive contextualization, an integrative approach to the study of human-environmental relationships at a wide range of temporal and spatial scales (Vayda, 1983). The project benefited greatly from this approach because of the many overlapping topics and sources of information under investigation.

The researcher administered all of the interviews in this research project, and no questionnaires were completed by informants outside of the interview process. Informants generally welcomed the author's note-taking during interviews. Since most villagers value literacy and the written word, and village history is seen as an important part of cultural identity, many local people enjoy not only explaining and interpreting local history, but also contributing to a written record of it. The most knowledgeable sources on history were, in most villages, the elderly. Elderly women were generally less comfortable with Mandarin, and may have been less comfortable socializing with a foreigner, or even with non-affinal males in general.11 Most of the interviews on land use

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11 Women also appeared to stay busy with food preparation and countless other jobs in the household, fields, and forests. The researcher rarely saw women participating in the frequent rounds of drinking and socializing that men seem to engage in on a regular basis.
history were therefore conducted with men, while women sometimes added additional information, corrections, and the like.

The first formal survey focused on two themes: 1. population change, settlement history (including ancestral origins), and labor and income structure; and 2. village structural changes and changes in the areal patterns of agricultural and forest land utilization since 1949 (discussed in chapter five). The initial interviews were conducted with people of various ranks and positions within their villages, though in most cases the researcher was referred to those who were generally considered most knowledgeable about particular subjects. Thus, one village survey often involved many local experts including: present and former natural village chiefs (ziran cunzhang) and administrative village leaders (xingzheng cunzhang or zhuren - administrative village chiefs; and shuji - secretaries, who are the highest ranking village leaders) who resided in the natural village under study; elderly cadres and non-cadres (including some who had been associated with pre-revolutionary militias - yowcidui - and were particularly knowledgeable about the political-administrative components of local land use and land tenure changes), and a number of other people who were seen as knowledgeable and reliable.

On several occasions, young men (age 18-25) asked to speak with me about injustices allegedly committed by reserve officials. These complaints varied from stories of unfair prosecution for poaching or tree cutting, to the unfair termination of employment meted out to a village forestry worker (described below). In general, men of all ages were remarkably forthright about their feelings concerning the reserve and its administrators, and local attitudes were commonly hostile, sometimes even bellicose.
Less structured interviews, conducted during the late winter and spring rainy season, when outdoor work was exceedingly difficult, enabled the researcher to amass a body of data on Long Gui and Gonghe villages. Similar data were then sought in a more formal survey of the other three study villages.

The second formal survey was designed to collect data on the lineage, settlement, and land use histories of each village. In regard to land use history, the villagers explained the role of fire as a tool for vegetation clearance, changing timber utilization patterns, the process of rice terrace abandonment, and the rise and decline of the bamboo paper industry.

These subjects were discussed in relation to regional historical changes in land tenure regulation, political-administrative structures, and resource management regulations - structural changes often imposed from above, but with different outcomes in each village. For example, each village responded differently to the responsibility systems introduced in the early 1980s, dividing former collective lands according to their own systems of equity. Of greatest import for nature conservation was to gain an understanding of present distribution, ownership, and management patterns of household bamboo forests. At a later phase in the field research, these topics were investigated in more detail through household surveys based on interviews with the heads of five randomly selected households in each village (described in chapter nine).

Though most of the land use history research was conducted in the five study villages, the researcher also conducted structured interviews in other selected villages to
determine ranges of variation for historical and contemporary land use variables relating to settlement history, herding, and bamboo forest management and tenure patterns.

The first sections of this chapter describe the five study villages and provide a profile of settlement history, general land use practices, demographic changes, and socioeconomic factors that shaped the villages before 1949. Chapter five focuses on the political ecology of socioeconomic changes after 1949. Chapters 6 and 7 describe the cumulative anthropogenic effects on ecosystems in Meihuashan as a whole.

**Village Settlement History and Geographic Conditions**

All five of the villages are between 500 and 700 years old, with an average age of 610 years (Table 5.1). Like most villages in the area they were settled by Hakkas during the Southern Song, Yuan, and early Ming dynasties (ZHKCBGBWH, 1991), and most of the people of Meihuashan trace their lineages back to Ninghua county, an important stepping stone in the Hakka diaspora. Ma, Luo, and Guan are all common surnames in the area (Table 1.1), and many villages whose members share surnames also share ancestral origins, as shown in ancestral records.

Some villages were settled first by families or groups other than those present today, so the number of generations of a lineage that have resided in a particular village today does not always reflect the age of the village. Fortunately, some ancestral records (zupu) were preserved through the cultural revolution (as was the case in Gonghe), so

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12 Though She aborigines may have been the first to establish villages at many of the same sites in early historical or pre-historic times.

13 In Gonghe village, a man whose family was designated as "poor farmers" (pin nong) was able to hide a copy of the village ancestral record in his home. This man was not under the scrutiny that "rich
the dates of arrival, names, and numbers of settlers are documented. Even in villages where ancestral records were destroyed, certain middle-aged or elderly people know their village history well, having become familiar with the genealogies and village oral histories before the subject was forbidden in the 1960s.

Like nearly all of the villages in Meihuashan, and many of the villages in the Southeast Uplands as a whole, these settlements have developed at or near the heads of valleys where streams converge in valley bottoms to provide a steady supply of water to irrigate the rice paddies. Valley slopes above the villages are richly endowed with sacred broadleaf forests. and wherever streams enter or exit the village core there are groves of ancient *Cryptomeria* purported to have been planted by the first ancestors. This prototype of village settlement exemplifies a regional pattern of ecological adaptation that follows the dictates of *fengshui* and the hydrological demands of wet-rice agriculture (see chapter 10 and Fig. 10.1).

The settlement history and present conditions within each of the five study villages are described below, starting with Gonghe, where the author had access to ancestral records. This written record provides a brief but fairly detailed glimpse of the historical migration patterns that lie behind Hakka village settlement in Meihuashan.

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peasants" (*fu nong*) and "landlords" (*di zhu*) were subjected to. Anxious to preserve the record, a close relative who was designated a "landlord" slipped the book to the poor man. Years later, the book was given to the son of the "landlord," whose father had been executed. The author spent many hours interviewing the murdered man's son, who was in his 50's and had a keen interest in village history and *fengshui*. 

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Gonghe (Guihe Administrative Village, Buyun Township, Shanghang County)

Gonghe, or "Common Peace" (or "republic") village, is an enclave of the Ma family (Fig. 4.3). The village has developed upon a narrow alluvial terrace in the bottom of a high, narrow valley that runs NNW-SSE. The plain is less than 500 meters in width and lies at an elevation of about 1,200 meters. Buildings, gardens, and some of the rice paddies are clustered together along both sides of a small stream, which is a tributary of the Malin Xi river (itself a tributary of the Nine Dragon River - Jiulongjiang). On a low hill in the eastern part of the village there is a forest that is crescent-shaped when viewed from above. This forest is the fengshuilin that protects the main ancestral temple. A high ridge to the southwest runs parallel with the valley, its steep flanks are covered with bamboo forests and its saddles hold groves of towering Cryptomeria trees. These are also fengshui forests. Up the valley, about one kilometer away, is the village of Guizhuping. Down the valley a couple of kilometers is the village of Liling, which is outside of the nature reserve.

Although the Ma family ancestral record (zu pu) traces the forbearers back to a number of prestigious military leaders in Xi'an, Shaanxi province, during the Later Han dynasty and Three Kingdoms era (25-280 A.D.), the record of their southward journey is unclear until some four centuries later. Like many other Hakka, the Mas were in Fujian by the Tang Dynasty (618-907 A.D.), when the brothers Ma Falong and Ma Fawang settled in Zhuangyuanfeng village, in Ninghua county. Ma Falong sired nine sons, some

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14 This implies that these segments of the Ma family arrived in Fujian between the second and third great episodes of the Hakka's southward migration began. They arrived in Meihuashan during the third migration wave. This appears to be the case with many Hakka lineages in
(or all) of whom moved to Majiawei village, in Liancheng county before the end of the Tang. In the Song Dynasty, some (or perhaps all) of Falong's descendants moved to Sibao Mawu (now known as Sibao), also in Liancheng county, where there is today an ancestral temple that descendants return to each year to offer prayers. One of Falong's grandsons also produced nine sons, one of whom, Ma Zhiyuan, moved from Sibao to Lingfang village, during the last years of the Yuan dynasty (ca. 1368). Zhiyuan's descendants occupied a number of villages in the Meihuashan area before settling in Gonghe. These were, in order: Luxi, Mawu, Tieshan Luodi, Majiaping, Zhongmenqi (no longer extant), and Guizhuping (Fig. 1.2). In the course of field research, the author visited all of these villages. Only Mawu is today inhabited by Mas, and from what is known of the history of other villages in Meihuashan, it appears that the Ma family may have coexisted with other families in at least some of these villages before moving on en Meihuashan. The fact that the Mas (as well as the ancestors of other local families) first arrived in Ninghua county is also consistent with the assertion that all of the lineages of Meihuashan migrated to the region via the Yanfu river (flowing northeast of Ruijin) to Shicheng, Jiangxi province (ZHKCBGBWH, 1991). From Shicheng, they entered Fujian by way of a pass leading to the Jikou river, which flows westward to Ninghua. From Ninghua and neighboring Qingliu, one stream of Hakka settlers headed south along the Ting river and settled first in what is now Liancheng county. This particular migration path is one of three main routes the Hakka followed into the Minxi region (ZHKCBGBWH, 1991). Evidence from ancestral records, and the fact that villagers in Gonghe and other villages in Buyun speak a Hakka dialect that more closely resembles those of Liancheng than those of Shanghang county, leave little doubt that this was the course by which the early settlers found their way to Meihuashan.

15 On Qingming, the festival known to westerners as "grave-sweeping day," descendants of the Mas of Sibao, return to worship and celebrate at the Sibao ancestral temple. These include representatives communities as far away as Guangdong, Zhejiang, and Jiangxi provinces, as well as those from throughout the Minxi region.
Figure 4.3. Topographic Sketch Map of Gonghe Village. Gonghe lies nestled in a narrow valley surrounded by steep slopes. A crescent-shaped fengshuilin, representing the moon, covers a low hill behind the main ancestral temple. Sacred Cryptomeria groves extend downward toward the valley from gaps in the ridges to the south, east, and west (see also Fig. 10.5). A dirt road has replaced the former footpath running north to Guizhuping.
Table 4.2. Legend for Village Topographic Maps (Figures 4.3, 4.4, 4.5)

<table>
<thead>
<tr>
<th>Cultural Feature</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fengshui forest</td>
<td>🌲</td>
</tr>
<tr>
<td>Earthgod shrine</td>
<td>🌟</td>
</tr>
<tr>
<td>Main ancestral temple</td>
<td>🕉️</td>
</tr>
<tr>
<td>House</td>
<td>🏡</td>
</tr>
<tr>
<td>Shed, outhouse, or other small building</td>
<td>🏖️</td>
</tr>
<tr>
<td>Stream</td>
<td>🌸</td>
</tr>
<tr>
<td>Bridges</td>
<td>🚢</td>
</tr>
<tr>
<td>Footpath</td>
<td>🚶️</td>
</tr>
<tr>
<td>Dirt road</td>
<td>🚶️</td>
</tr>
</tbody>
</table>

**Basic Information:**

Scale: 1:4,000

10 meter contour intervals.

Note: Positions, shapes, and locations of cultural features are approximations based on field sketch maps.
The first ancestor to settle in Gonghe was Ma Wangfu, who arrived during the Ming Dynasty, in about 1444.

Upon arriving in Gonghe from neighboring Guizhuping, the Ma's built an earth-walled house (tu lou), or fortress (baoweizhai) on a hill called Longjian Zhai (1,247 m) (Fig. 4.3), just southeast of the village. Like the tu lou in Yongding, Nanjing, and other areas of Minxi that remain today, this was a defensive structure. Soon, however, they found that the wind was too strong up on the hill top. This was not good fengshui, so the villagers moved down to Fufeng Tang, where the main ancestral temple is today. The fengshui of that location was good and soon there were a number of male offspring. As

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16 If this was the case, it would support Pasternak’s (1973) argument in *The Role of the Frontier in Chinese Lineage Development* that cooperation between different lineages may have been important in the initial stages of environmental transformation (especially in the construction of rice terraces and irrigation systems). However, the fact that the first building constructed by the Mas in Gonghe was a hilltop fortress to house the entire village supports Freedman’s (1958, 1966) contention that the exigencies of frontier life encouraged the insularity of lineages. In this vein, it is possible that on man of their "steps" from village to village along migration route to Gonghe there was conflict with established or newly-arriving settlers from other lineages. A thorough analysis of a number of ancestral records in the area could shed light on the problem.

17 The main ancestral temple is dedicated to the ancestor who settled the village, Ma Wangfu. In the third generation, there was a family with five sons, the eldest of whom was named Ma Zhengtong. Ma Zhengtong's tomb was well-placed and had good fengshui, but two of his younger brother's tombs were not, and the other two had no children. The descendants of the two brothers with bad tombs had to emigrate, thus all those remaining in Gonghe were descendants of Ma Zhengtong. In the 13th generation, probably in the early to mid-Qing, there were four brothers to whom all of today's villagers trace their ancestry. Thus there are four secondary ancestral temples in the village, some of which are today inside of peoples' homes. People of the same sublineage (co-descendants of one of the four brothers) are more likely to conduct business together than they are with descendants from one of the other three sublineages. Brothers, cousins, uncles, and other closely-related people are afforded the most favorable treatment of all. The problem of lineage-based factionalism (zongpai) is not seen as a severe problem in Gonghe (yet). The phenomenon is returning to many other parts of China, however, as revived lineage organizations gain power (Ma SW, pers. comm.).
the main informant on village settlement history stated while interpreting the ancestral record, "Fengshui is serious, you can't live long as a village if it's bad. There are only certain places (in the landscape) where you can live" (for comparison, see notes on Majiaaping below) (Ma Shuwen, pers. comm.).

The danger of attack by bandits or even marauding soldiers also proved as problematic for villagers in Gonghe as it was throughout Meihuashan and in other remote mountainous areas of the Southeast Uplands (Averill, 1983). At times, the villagers had to take dramatic precautionary measures to survive such depredation. According to the ancestral record, in the late Ming dynasty, during the Hongxiu reign, troops under general Hai Kou made attacks in the area (for unspecified reasons). Once again, the villagers retreated to fortified earth-walled houses built on hilltops around the village.

After 22 generations, some 550 years since its founding, the population of Gonghe is about 232. Unlike other villages in Meihuashan (and for reasons that are unknown), ancestral records do not indicate that the population increased dramatically during the Qing Dynasty. Ancestral records and village oral history from the neighboring villages of Jiaotan and Mawu, however, indicate that those villages had population levels 3-5 times higher than those of the present (Ma Shuwen, pers. comm.).

**Guizhuping (Guihe Administrative Village, Buyun Township, Shanghang County)**

Guizhuping, or "Cassia Bamboo Flats," has been occupied by the Guan family for some 22 generations. Though the village ancestral record has been destroyed, elders say that their ancestors came from Qingliu county, just east of Ninghua and north of Liancheng county. They then moved to Changting county (first Hetian, then to
Guanfang). Upon arriving in Meihuashan, they first settled in Guanfuban, later moving to Gangxi (the upper village of Liling), and finally to Guizhuping (Guan Yanzeng, pers. comm.).

Though the village is at the head of the same valley as its neighbor, Gonghe, it is only 10 meters higher in elevation (1,210 meters), and it lies along a different tributary of the Malinxi. As a result of stream capture, both villages now lie at the headwaters of southeast-flowing streams, and today only an irrigation ditch shunts water from the upper village to the lower.

Guizhuping is similar to Gonghe in many respects, and given the close proximity and strong similarities between the two natural villages, locals are as likely to refer to "Guihe" (the administrative village encompassing both villages) as they are to "Gonghe" or "Guizhuping." Guizhuping is nearly identical to Gonghe in areal size, occupying the highest alluvial plain in the valley large enough for a settlement. Its roughly 43 families

18 Like the Guans of Qiushan, Dapingshan, and Qiushan, to whom they are related, this lineage is atypical of Meihuashan in that its ancestral migration to Meihuashan was by way of Changting rather than Liancheng county.

19 It would appear that the first settlers arrived in Guizhuping at about the same time as the Ma family left Guizhuping to settle in Gonghe. If Guizhuping is actually 700 years old, there were probably people there before the Ma's of Gonghe. The Guans of Dapingshan, Daxie, and Qiushan are said to have come from Guizhuping. Perhaps these sections of the Guan lineage were already in Guizhuping when the Ma's arrived.

20 This does not appear to be the case with natural villages that are farther apart and share fewer similarities, but are grouped together as an administrative village. These groupings are an artifact of administrative designations. They do not reflect affinity that is found, for instance between villages whose inhabitants share surnames and common descent. There are marked historical and religious dissimilarities between Gonghe and Guizhuping. There have been fengshui conflicts, and in recent years there was a dispute over rights to worship at a particular earthgod shrine. These issues will be discussed in chapter 6.
comprise a total population of about 230. As in Gonghe, the 25 houses of the settlement are tucked into the narrow valley bottom and backed by steep mountains that are covered in a green carpet of bamboo and sacred forests. Though vegetable gardens and rice paddies surround the buildings in Guizhuping, the majority of Guihe's rice paddies are on gentler slopes east of the valley, toward the villages of Mawu, Jiaotan, and Wulang (the first two villages comprise the administrative village of Hongqi - "red flag.").

Majiaping (Yanbei Administrative Village, Miaojian Township, Liancheng County)

A couple of kilometers by cobblestone trail northwest of the village of Guizhuping, one passes through a pine-covered saddle at an elevation of roughly 1,600 meters. The spot marks a gap in the major drainage divide of Meihuashan, a place known locally as "fenshui ao" - "divide water gap." Another kilometer through the dry, mountain pine forest, brings one into Liancheng county (from Shanghang county), and after another couple of kilometers the trail descends along a rushing stream through dense broadleaf forests. Some 10-12 kilometers from the divide along the old stone trail, lies the isolated village of Majiaping ("Ma Family Flats").

The village lies at an elevation of 770 meters, in a small alluvial basin, where four swift streams converge before plunging through a steep gorge to the north, where they eventually enter a tributary of the Tingjiang river. Mountains embrace the village on the south, east, and west, and only the north is open to a lower valley. These remote and rugged slopes contain the greatest expanse of broadleaf evergreen forest in the reserve,
Majiaping Village

by, C. Coggins, 1997

Figure 4.4. Topographic Sketch Map of Majiaping Village. Majiaping lies within a horseshoe-shaped alluvial basin that is open to the north. Four tributary streams provide water to irrigate rice paddies in the flat area north of the village. Where the streams converge and flow out of the village there is a sacred forest. Fengshui forests also protect the village where the two largest streams enter the village.
Table 4.3. History, Population, and Modern Infrastructure: Basic Data On Five Study Villages In Meihuashan

(GH =Gonghe, GZP = Guizhuping, MJP = Majiaping, TPL = Taipingliao, LG = Longgui)

<table>
<thead>
<tr>
<th>Surname</th>
<th>GH Ma</th>
<th>GZP Guan</th>
<th>MJP Luo</th>
<th>TPL Luo</th>
<th>LG Luo</th>
<th>Avg.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age of Village (Yrs)</td>
<td>550</td>
<td>700</td>
<td>&gt;600</td>
<td>&gt;700</td>
<td>500</td>
<td>&gt;610</td>
</tr>
<tr>
<td>Generations in Situ</td>
<td>22</td>
<td>22</td>
<td>11</td>
<td>20</td>
<td>18</td>
<td>18.6</td>
</tr>
<tr>
<td>Elevation (m)</td>
<td>1,200</td>
<td>1,210</td>
<td>740</td>
<td>800</td>
<td>780</td>
<td>927</td>
</tr>
<tr>
<td>Population Ca. 1950</td>
<td>91</td>
<td>119</td>
<td>50</td>
<td>80</td>
<td>68</td>
<td>81.6</td>
</tr>
<tr>
<td>Ca. 1965</td>
<td>120</td>
<td>105</td>
<td>93</td>
<td>-</td>
<td>52</td>
<td>92.5</td>
</tr>
<tr>
<td>Ca. 1980</td>
<td>200</td>
<td>165</td>
<td>116</td>
<td>165</td>
<td>78</td>
<td>144.8</td>
</tr>
<tr>
<td>1990</td>
<td>210</td>
<td>200</td>
<td>154</td>
<td>200</td>
<td>92</td>
<td>171.2</td>
</tr>
<tr>
<td>1994</td>
<td>232</td>
<td>230</td>
<td>175</td>
<td>220</td>
<td>100</td>
<td>191.4</td>
</tr>
<tr>
<td>1950-94 % Growth</td>
<td>155</td>
<td>93</td>
<td>250</td>
<td>175</td>
<td>47</td>
<td>144.0</td>
</tr>
<tr>
<td>1994 Male/Female</td>
<td>1.38</td>
<td>.77</td>
<td>1.09</td>
<td>.83</td>
<td>1.5</td>
<td>1.11</td>
</tr>
<tr>
<td>Families</td>
<td>42</td>
<td>43</td>
<td>25</td>
<td>40</td>
<td>19</td>
<td>33.8</td>
</tr>
<tr>
<td>Pop./Family</td>
<td>5.4</td>
<td>5.3</td>
<td>6.9</td>
<td>5.5</td>
<td>5.3</td>
<td>5.7</td>
</tr>
<tr>
<td>Infrastructure Houses</td>
<td>29</td>
<td>25</td>
<td>18</td>
<td>30</td>
<td>21</td>
<td>24.6</td>
</tr>
<tr>
<td>Wooden/Earthen/Brick-Concrete</td>
<td>2/26/1</td>
<td>7/13/5</td>
<td>5/13/0</td>
<td>?/?/8</td>
<td>1/17/3</td>
<td></td>
</tr>
<tr>
<td>Families/House</td>
<td>1.4</td>
<td>1.7</td>
<td>1.4</td>
<td>1.3</td>
<td>.9</td>
<td>1.3</td>
</tr>
<tr>
<td>Road, Tractor Trail, or Footpath</td>
<td>R</td>
<td>R</td>
<td>F</td>
<td>T</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>Own Hydro-electric Generator or Grid</td>
<td>G</td>
<td>G</td>
<td>O</td>
<td>G</td>
<td>G</td>
<td></td>
</tr>
</tbody>
</table>
and when viewed from the high pass to the west, the village is a small clearing in a U-shaped valley, surrounded by billowing green mountains.

Though the village received its name from the Ma lineage, who settled there for a time, probably some 6-700 years ago, it is now occupied by the Luo family. The Luo's trace their lineage back to Kanzibao (in Wenxiang township) and Luodi village, the latter of which overlaps with the nature reserve in the northwest. They were the fourth descent group known to have settled in Majiapang, arriving some eleven generations (and they say roughly 260 years) ago (Luo Shunchang; Bing, pers. comm.). The first people known to have lived in the village were She tribal people named Zhong. They lived by the stream in the western part of what is today's settlement. After the Zhong family came Han families named Zai and Lou. The Ma family, ancestors of the Ma's of Gonghe, came next, settling in the house in the southeasternmost corner of the village (Luo Shunchang, pers. comm.).

Majiaping is one of 5 natural villages with lands in the reserve that have no access roads for transporting bamboo products to the outside. Two of the other three villages, Yanbei and Zhongping, with Majiapang, form the administrative village of Yanbei. Due to the remoteness of the three natural villages and the lack of even a "tractor road" (tuolaji lu), the Yanbei administrative village is the poorest of the 20 administrative villages in the reserve, with an official average annual income of 486 yuan ($58 U.S.) in 1994.
Taipingliao (Taipingliao Administrative Village, Luxi Township, Liancheng County)

The meaning of the name Taipingliao was not clarified by the few villagers queried about it. Taiping can be translated as "peaceful," and "liao" (僚) means "companion, associate, or subordinate" (Liang, 1973). Liao is also part of the compound "Man Liao" (蛮僚), a term from Sui and Tang times, referring to the aboriginal ancestors of the She (Jiang, 1987). The Man Liao inhabited the Fujian-Jiangxi-Guangdong border region, of which Meihuashan is a part. It is possible that the name Taipingliao refers to pacified or peaceful Man Liao natives that may have inhabited the area.

Today Taipingliao is divided into an upper and a lower village, both of which are inhabited by the Luo family. The village extends nearly one kilometer along the north bank of a mountain stream that descends from east to west down a steep mountain slope from its source at about 1200 meters. Houses face down valley to the east. The highest houses of the upper village, in the west, lie at an elevation of about 970 meters, the lowest houses in the lower village, in the east, at about 770 meters. The village is striking due to its conformity to the precipitous terrain, and to the large, primeval fengshui forest that separates the upper and lower residential areas. The main trail is composed of a stone staircase that winds its way up the steep slope, weaving in between the houses and drying platforms.

The youngest of the roughly 220 inhabitants of Taipingliao represent the 20th generation of Luo's in situ. Though the village is over 700 years old, having been
Figure 4.5a. (Top) The Village of Majiapin. This view is from a hill just west of the village.

Figure 4.5b. (Bottom) The Village of Taipingliao. Note the sacred fengshui forest, a remnant of broadleaved forest between the upper and lower villages.
established as Heyuan Lower Village, during the Song Dynasty, which ended in 1279 (Luxi Township, 1994), the Luo family settled there about 450 years ago (Luo Zhongkun, pers. comm.). Who inhabited the village for the first 250 or more years of its existence is apparently unknown. The Luos of Taipingliaio trace their ancestral migration path from Wenheng and (like the Luos of Majiaping) from Kanzibao, in Liancheng county. Though there is said to be an ancestral record for the village, the author did not have access to it.

Long Gui (Yunhui Administrative Village, Buyun Township, Shanghang County)

Long Gui, or "Dragon Turtle" village, is also known in local dialect by its older name of "Broken Caldron Hollow" ("Poding Keng" in Mandarin). The latter name is attributed to an accident of long ago, in which a person selling the three legged cauldrons or sacrificial vessels known as ding, slipped down a ravine in the village and broke some of his merchandise.

The village is situated on a north-facing slope, with the highest row of houses on a platform at an elevation of 740 meters. The lowest houses further down slope are at an elevation of roughly 710 meters. A lower village with a few houses lies at across a ravine, at an elevation of about 700 meters.

Like the Luo’s of Majiaping and Taipingliaio, the Luo’s of Long Gui trace their ancestry back to Kanzibao, in Liancheng. Taipingliaio and Long Gui have long had close
Figure 4.6. Topographic Sketch Map of Long Gui Village. The small village of Long Gui ("Dragon Turtle") lies on the back of a "dragon," the descending arm of a ridge. From this promontory, villagers enjoy commanding views of the mountains and valleys to the north. Sacred forests protect the dragon upon which the village rests (see chapter 10).
relations based on mutual descent, and today intervillage marriage is permitted. Some 500 years ago, the first Luo's to settle the village consisted of one couple with five children (Luo Ruiqing, pers. comm.). Today there are roughly 100 people in Long Gui, making it one of the smallest natural villages in Meihuashan.

Long Gui is also the richest village as measured by per capita income, with an average of 1,761 yuan ($210 U.S.) for the two natural villages of the Yunhui administrative village (Long Gui and Qiushan). This is 82.6% higher than the average income of all 20 administrative villages in Meihuashan (970 yuan or $115 U.S.), and 382% higher than that of the poorest villages of Majiaping, Zhongping, and Yanbei (Yanbei administrative village). Long Gui's relative wealth is due mostly to a combination of its low population and the large area of village lands devoted to legal timber harvesting, which is especially lucrative because it is supported by large quotas and logistical support from the nature reserve management.

The Qing Dynasty Socioeconomic Climax: Capitalism or Commercialization?

From an historical perspective, the current population within the area of the reserve is not high (2,718 in 1991). In 1994, the average population of the five study villages was 191, and in addition to figures from seven other natural villages where this information was sought, the average population per village was 180 (official population

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*In traditional times no two people with the same surname were permitted to marry. In Meihuashan and other areas with single lineage villages that meant that one could never marry someone from the same village, nor even someone from another village of the same surname. Today there are not only some couples with the same surname but from different villages, but some couples from the same village and the same surname. The one couple the author met who were of the same village lineage, lived in Xiache. By law or by present village rules, people who share no direct bloodline for three generations are permitted to marry.*
data were available only on the level of the administrative village, and only for 1986). In contrast, informants in ten of twelve villages stated that at some point in the Qing dynasty (1644-1911) village populations were 50-1000% greater than today (Figs. 4.7 & 4.8).

By the late Ming, bamboo paper production and related industries (described in the next chapter) were the economic mainstay of most of the villages in Meihuashan. When the paper trade reached its zenith in the mid-Qing, the population of Meihuashan was probably at or near its all time high. It is likely that local economic growth attracted clan members and non-affinal migrant laborers (such as the shed people) from other areas, and villages grew by in-migration as well as by natural increase. Tremendous

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\[22\] Based on interviews in the following natural villages, Qing populations are believed to have been higher than present populations (in parentheses) by the following percentages: Qingcaoyuan (130) - 200-300%; Chijia Shan (205) 150-200%; Xiao Gaoxie (180) - >66%; Du Tou (140) - 50%; and Beikeng (330) - 51%. Based on ancestral records and oral histories, Gonghe and Guizhuping do not appear to have had substantially greater populations during the Qing. This may have been related to the limited amount of arable land within the steep-sided valley around each village. Guihe villagers later took over paddy lands belonging to Mawu and Jiaotan after those villages experienced radical depopulation in the late 19th and early 20th centuries. These paddies, to the east and northeast of Guihe, now comprise the majority of Guine's rice fields.

\[23\] This would be a more tenable argument if supported by documentary evidence from ancestral records throughout the bamboo-growing regions in Minxi (a project the author could not attempt at this point). It is clear, even without this evidence, that groups of non-affinal "shed people," if they were present, did not establish themselves long enough to form lineage villages or even lasting membership within pre-existing villages. Migrant bamboo laborers in Meihuashan today live within village homes on a temporary basis. Such arrangements, along with the construction of housing for workers within the villages, allowed for rapid village population growth and subsequent decline. In contrast, groups of in-migrants in Wuyishan and Longxishan were able to establish themselves within pre-existing villages, and there are today many different lineages (different surnames) within each community. These villages appear to support Pasternak's (1969) argument, that cooperation between different lineages was essential for settlement of the frontier. The age of the lineages, moreover, supports the argument that they settled during the early Qing, during the wave of migrations undertaken by "shed people."
Qing Dynasty Vs. Present Population
Estimates from Selected Villages

Figure 4.7. Population in Four Meihuashan Villages Qing Dynasty and Present.
Figure 4.8. Population Change in Three Study Villages Since the Qing Dynasty.
population growth during this period has been documented by Chinese researchers as well (ZHKCBGBZWYH, 1991).

Popular examples of this phenomenon are still cited by village elders. For example, in Taipingliao it is said that there were over 1,000 inhabitants during the Kangxi, Yongzheng, and Qianlong periods (1661-1722) (Luo Yizhang, pers. comm.), and local legend holds that the village of Jiaotan, which had an official population of 111 in 1991, reached a peak of 999 people in the late 19th century. Not wanting to let the opportunity for demographic greatness slip away, the villagers of Jiaotan bought a person, who was kept in the village as the thousandth resident.

A critical feature of the economic boom was that it did not signify the end of the subsistence economy; there is no indication that food demands were matched by import, and subsistence was still a major concern (Luo, Yizhang, pers. comm.; Ma Shuwen, pers. comm.). Such conditions exemplify what Marks (1996) has called, "commercialization without capitalism," and this characterization would hold true for communities in many parts of the Southeast Uplands in the same period.

Assuming that the population in the 26 villages of today's reserve area were five times greater during the mid-to-late Qing, overall population would have been roughly 13,600, and population density (12.2 people/Sq. Km. in 1991) would have been 61 people

24 Marks (1996: 77) describes the economy of Lingnan (Guangdong and Guangxi) in the 16-19th centuries as having undergone "commercialization without capitalism." In this vein, he takes issue with environmental historians like Worster (1993), who "categorize agroecosystems as either capitalist or 'traditional'" (Marks, 1996), and view the "transition from subsistence- to market-oriented agriculture as the process of capitalist transformation" of the global environment. Marks (1996: 77) makes this distinction to argue that commercialization, rather than capitalism, has been "a driving force of modern global environmental change."
per square kilometer. This would have caused much greater pressure on local subsistence systems, and ultimately on the natural environment. The lower yield per unit area of traditional breeds of rice could not sustain villagers through the year, even at population levels of the mid-twentieth century. Therefore, even without a precise figure for the population during the mid-to-late Qing, it is known that forestry-based commerce flourished and the demand for laborers drew a much larger population to Meihuashan than the local grain supply could sustain. The supply of rice was certainly inadequate to feed such a large number of people even though the area of rice paddy was much greater than it is today, and the roots of wild plants served to fill the gap in carbohydrate-rich staple foods. These subsistence challenges had dramatic and lasting impacts on the landscape ecology of Meihuashan, which are discussed in detail in chapter 7.

Political, Military, and Economic Factors in the Population Decline of the Early 20th Century

Since it is known that village populations in Meihuashan, as "low" as they are today, have been increasing (with one setback due to nationwide famine in the early 1960s) since 1949, some intriguing historical questions come to mind. These include: How could a flourishing society of mountain communities collapse in the late Qing or early Republican period and fail to fully recover within a century? When did demographic and socioeconomic conditions reach their nadir and at what level of population? What were the effects of such depopulation on the landscape? And, projecting into the future, is such a level of population density likely to recur?
In regard to the first two questions (the latter two are addressed below), it is clear that in Meihuashan, throughout the 20th century, there has been a direct relationship between political, military, and economic disruption at national and regional scales, and demographic and socioeconomic conditions at the village level. Village histories of Taipingliao and Long Gui provide abundant evidence of this relationship and illustrate the catastrophic local impacts of the political and social chaos that swept China in the first half of this century.

In Taipingliao, population growth was spurred by the development of the village's bamboo paper industry during the reign of the Kangxi emperor (1661-1722). Like a number of other villages in the region, Taipingliao was able to capitalize on the growth of an extensive foreign trade network, which included the transport of paper from the Minxi region to other parts of China, especially Guangdong, and from that province to overseas markets in Southeast Asia. The village developed its own "paper factories" (zhi chang). Porters carried the merchandise out to local market towns like Luxi and Meicun, and the local economy grew. With the development of a more vibrant cash economy came an increase in the division of labor and a diversification of commercial industries. Like the large villages and small towns in the lower valleys outside of the reserve today, Taipingliao was large enough to support a number of producers and vendors of locally-consumed goods like toufu, rice wine, and peanuts (Luo Yanzeng, pers. comm.).

The population is said to have crashed at the very end of the Qing dynasty and the beginning of the Republican period, that is from 1910-1915 (the exact population just prior to the decline was not determined). By 1920 the population was down to about 100
people, and by 1949 there were just over 70. Whether the decline began earlier and was actually less rapid is unknown, but villagers say that the causes were manifold, and included emigration, a higher death rate, and an increase in the selling of women and children to other villages, all problems that were connected to a rise in opium addiction, a protracted civil war, and long-term social upheaval. In Taipingliao, as in Gonghe, Majiaping (see below), and other villages where the subject was discussed, opium was widely used in the villages until about the 1920s, when it became unavailable due to government control. In Taipingliao, opium is said to have caused serious social problems associated with addiction, including the early death of addicts, the selling of wives and children to support the habit, and, it may be inferred, an increase in violence associated with the activities of opium dealers and other outlaws (tu fei), the latter of which were numerous in Meihuashan during this period (discussed below).\(^{25}\)

Though social dislocation may have already hindered economic sustainability in the villages of Meihuashan by the late Qing, the most serious threats to survival came when China's civil war spread into the Minxi region. All of the villages of Meihuashan

\(^{25}\) The tu fei (bandits or outlaws) were often lineage groups or other bands of villagers that sought to gain economic and local political power, often through illegal means (Averill, 1983; Caldwell, 1924). In Meihuashan, certain lineage villages became infamous as centers of such organized crime, and the Luo's of Tieshan Luodi village were and are infamous for acts of violence. Residents of Long Gui recall public beatings and killings that were carried out by outlaw bands from Luodi and Pingshui (no longer extant). Villagers routinely fled when these gangs arrived. Majiaping had lineage and business connections with Luodi, and one of the author's older guides from Gonghe, remembering attacks on travelers in the area by Majiaping people, was very leery of the villagers' motives even today. He feared that they might attack and rob or kill us. As mentioned, a family planning worker was killed in Luodi in 1994, and reserve workers do not like having to go there because of the enmity toward the reserve that is common there. These feelings may pertain to Majiaping to a lesser extent as well.
were forced to align with either Chinese Communist Party insurgents or Nationalist Party
(Guomindang) forces, and neither side was able to guarantee safety or security from
attacks by the other, or from the depredations of local bandit gangs. During the Period of
Warlordism, the village of Pingshui (between Long Gui and Chijiashan) was a bandits'
lair. Bandits (tu fei) made frequent attacks on surrounding villages. In the 1920s, the
village was wiped out by Nationalist forces and has never recovered. Today only the
columns of a former official's house remain.

Taipingliao was under the control of the Guomindang, but supported the
communist guerilla brigades (you ji dui) led by Luo Buyun and others (Luo Yizhang,
pers. comm.), and there was intense fighting there until 1948, when the village was
"liberated" by communist forces. With the establishment of the P.R.C., stability returned.
the population began to increase naturally, and Taipingliao was named a "Key
Revolutionary Village" (geming ji dian cun).

The civil war had dramatic effects on Long Gui village as well, causing its virtual
annihilation for a time. As a center for CCP guerilla activity by the early 1930s, Long
Gui provided foot soldiers and spies for the communist cause (Luo Hewen, pers. comm.).
With the execution of Luo Buyun in the mid-1930s, the guerilla brigade disbanded until
1939, when a new leader was sent to Long Gui. By then there were ten Long Gui
residents (of a population of roughly 60 people) serving as guerilla soldiers and others
who served as spies, communication specialists (jiaotongyuan), and propagandists
(xuanchuanyuan). They served under two different leaders, until 1944, when turncoats
reported their activities to the Guomindang. About a hundred Nationalist troops, who
were stationed in the village of Shang Che, attacked the village and all of the villagers fled. Faced with constant pursuit by the soldiers, the villagers were forced to set up temporary encampments above village paddy fields in the mountains between Long Gui and Taipingliao. These "zhai" served as home (reminiscent of Gonghe during military attacks in the Ming), and villagers secretly tended their crops in order to survive. After the turncoats revealed the encampment to the Guomindang, soldiers attacked it, killing two people and capturing four (who were later tortured and killed). With no means of subsistence and under constant terror, the villagers dispersed to many separate villages in the region, and only one old couple remained, surviving as beggars. The guerilla brigade was routed and the village was virtually empty for three years, until 1947-48. when the Red Army regained control of the region, and villagers were able to return safely. By 1949, the population rebounded to its previous level of over sixty people (Luo Hewen, pers. comm.).

After the Communist victory in 1949, the villages of Meihuashan enjoyed a respite from war. The peace was gained, in part, through an unprecedented degree of government intervention in every aspect of daily life. It soon became clear that an absence of warfare did not signify peace at all. For two decades, Meihuashan, and indeed all of China, were to endure a new variety and a new scale of authoritarian rule. The following chapter describes how villages both adopted and adapted to the tools and techniques of "permanent revolution" (yongyuan geming).
"In the Meihuashan Nature Reserve, the conditions of agricultural production are characterized by a lack of diversification. Aside from the commercial value of timber and bamboo exchanged each year in outside markets, production not only fails to meet commercial demands, but only partially meet the needs of daily life. Production is underdeveloped, production forces weak; to a large degree these are the characteristics of a self-sufficient, natural economy (ziji zizu de ziran jingji)" (ZHKCBGBWH, 1991: 2-19).

If pre-1949 resource utilization patterns in Meihuashan exemplify what Marks (1996) calls "commercialization without capitalism," a corollary concern is whether this still holds true today. The current era of capitalist development in China has taken place on socialist foundations, and the villages of Meihuashan exhibit resource utilization and land tenure patterns that are unique to this period of Chinese history. This chapter examines how socioeconomic conditions, cultural landscapes, and patterns of natural resource management have developed over the past half-century of Chinese Communist Party rule, and how the legacies of Mao and Deng have affected the landscape ecology and nature conservation practices in Meihuashan today.

**Demographic and Socioeconomic Change Since 1949: the Effects of Communist Land Tenure and Resource Management Systems**

Since 1949, the reserve villages have undergone alternating periods of socioeconomic development (population growth and economic development) and socioeconomic decline (depopulation and economic degeneration). These cycles of change have closely paralleled the course of nationwide socioeconomic development and
the political movements and programs that gave rise to them. Still, there have been
important local exceptions within the Minxi region as a whole and within the villages of
Meihuashan collectively and individually.

The oscillating pattern of changes in living conditions in the reserve (and
presumably those of China as a whole) have been described as "three rises, two falls"
("san qi er luo") (ZHKCBGBWH. 1991).¹

The first period of "rise" or resurgence after the long period of wartime poverty
occurred from 1949-1958. This period was far from a peaceful transition to
"normalization." however, even in the exceptional case of the Minxi region.

In the PRC of the early 1950s, land reform and the creation of a classless society
were fundamental rural and urban development policies. In rural areas these goals were
expressed in the well-known slogan, "Overthrow local despots and redistribute the land"
(Da dao tuhao fen tudi). In parts of the Minxi region like Meihuashan, however, land
reform (tudi gaige or simply tugai) was carried out without violent class-leveling
(pingjieji) actions (Chen et al., 1995; Ma Shuwen. pers. comm.). This was because of the
relative success of the reform movement in Minxi before 1949, and to the powerful
influence of the mastermind behind it, a man from Jiaoyang township (Shanghang
county) named Fu Baicui.² Fu was a lawyer and social reformer who initiated local and

¹ A more objective analysis of village living conditions would not necessarily include some of the "rises" as improvements since they were sometimes based on coercion and brutality (see below).

² The son of a wealthy and powerful landlord in Jiaoyang township (just west of Gutian township), Fu Baicui was a self-described Utopian Socialist (Kongxiang Shehui Zhuyizhe). According to legend, Fu was born in 1896, during a sudden thunderstorm, emerging in the form of a leopard cub (much to his mother's horror). An unruffled midwife wrapped him in

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regional land reform in Jiaoyang and Gutian townships, in Shanghang county, during the 1920-30s. In September of 1950, when the "land revolution movement" (tudi geming yundong) began in Shanghang county, Jiaoyang and Gutian (and part of Baisha) townships did not have to participate (having already achieved some degree of land reform under the leadership of Fu Baicui), still other townships in the Minxi region were allowed to divide the land without undergoing "class-leveling" - the redistribution of other forms of wealth, such as houses and personal possessions.

red cloth, and when the cloth was opened, a male infant was inside. Fu attended law school in Tokyo, Japan, where he was influenced by Japanese social reform ideology and by Sun Yatsen, who was then active in that country. Returning to Shanghang to practice law, he dreams of establishing utopian "New Villages" in Meihuashan, but realized that local support might be limited. Instead, he organized a local people's militia to protect Jiaoyang township from warlords. In 1926-27, he led a left-leaning, revolutionary faction of the Guomindang in Shanghang county. Through a series of political demonstrations, he promoted land reform (dividing his own lands among peasants) and the empowerment of peasants and workers, as well as alignment with the CCP and Russia.

In 1927, the mainstream GMD crushed revolutionary GMD and CCP factions in Shanghang, and Fu joined the CCP. He forged strong ties with Mao Zedong in 1929, when Mao held the historic Gutian meeting. By 1932, Fu was the leader of an independent social democratic self-governing region in Jiaoyang and Gutian (called the "Gu Jiao" region). In this area of 450 square km. and a population of over 30,000 people in 41 villages, there was universal suffrage, land reform, access to healthcare and education, and other policies designed to empower the peasants.

By 1934, Fu had left the CCP, disapproving of its armed insurrections, and maintaining that peasants preferred peaceful reform. The CCP was driven out of Minxi and their central base in Ruijin, Jiangxi (initiating the Long March). Fu Baicui stayed in Shanghang county, maintaining the Gu Jiao region, which was administered by peasant associations and avoided party affiliations and formal political designations in order to stay out of trouble (while simultaneously aiding covert actions by the CCP's militia (youjiding)).

After 1949, Fu Baicui became a powerful leader in Fujian, starting in 1950 as the head of the Fujian Province People's Court. His ideal of peaceful reform made it possible (for a time) for Minxi people to circumvent violent class struggle, though by the mid-1950's, it could no longer be averted (Fu QS, pers. comm.; Chen et al., 1995; Ma SW, pers. Comm.).

The story of Fu Baicui (Chen et al., 1995) shows that the relationship between socioeconomic conditions, the CCP, the rural peasantry, and powerful elites was much more complex than generally believed, and as Huang (1994) has stated, conventional "...explanations for revolutionary success need reevaluation and modification."

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Land reform was not enacted in Meihuashan until 1952 (perhaps because of the geographical remoteness of the region). A resident of Gonghe recalls that in that year, county officials entered the village and determined that there were 2 families that qualified as landlords (dizhu) and 3 that qualified as rich peasants (fu nong). In the villages of Meihuashan (and probably in many other small, high mountain settlements of the Southeast Uplands) class distinctions were not always evident from the amount of land owned. Most privately owned land, land with some degree of economic value, consisted of rice paddies and bamboo forests. These were held by families on the basis of land deeds (tudi zheng). Other forest and grassland areas were communally held by the villagers, with open access for fuelwood gathering, cattle grazing, the taking of wildlife, and the gathering of wild herbaceous plants and other resources (fengshui forests were communal and protected, and resource use within them was restricted to varying degrees). In some villages, like Gonghe, rice paddy and bamboo forest lands, while not evenly distributed, were not predominantly in the hands of the wealthier villagers. These villagers owned more land than many others, but only slightly more (Ma Shuwen. pers. comm.).

Before 1949, each natural village had a committee of elders, which was composed of representatives of each household or extended family. These representatives were known as fangzhang ("household elder or chief"). Some families had more than one fangzhang, depending on the relationships between and land tenure status of different segments of the family. In Gonghe there were about eight fangzhang who participated in land use conflict resolution (jiufen tiaojie) and other important decisions. The
representatives generally came from middle income and rich families, which in Gonghe constituted most of the population, since there were nine paper factories (many similarly-sized villages had just one or two factories) (Ma Shulin, pers. comm.).

In 1952, rich peasants and landlords were distinguished from middle peasants (zhong nong) and poor peasants (pin nong) mostly by their material wealth and control of the workforce. Landlords were defined as those who did not have to work. They hired year round laborers to work in their fields and their households. The landlords were money lenders who probably owned or controlled a large portion of the village paper making industry. Rich peasants, on the other hand, were defined as those who worked, but who also hired laborers and lent money to other villagers on a regular basis. Middle peasants owned land and were self-sufficient. They did not hire other laborers. Poor peasants had no land and worked for others and/or on rented land.

In Meihuashan, class differentiation and land tenure conditions varied markedly between villages. In Gonghe, it was determined that the 2 families classed as landlords and 3 families classed as rich peasants (in a village of 27 families) earned about 40% of the income. In Guizhuping, there were no landlords, but there were three families of rich peasants, whose landholdings were comparable to those of other villagers. In Long Gui, there was one landlord, who owned some 40-60% of the productive land. In Majiaping, one landlord owned all of the productive village land and six of nine local "paper factories" (zhi chang). In Taipingliao, there was one landlord (the same person as in

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3 Long Gui and especially Majiaping resemble the more classical CCP stereotypes of exploitation of the many by the few. In Long Gui, before 1949, the richest villager was named Luo Bifeng. His family had earned money by selling bamboo to a businessman in Meicun. He rented his
Long Gui), but he did not own much land. In that village, many people rented and owned land, and there was a village rule that large amounts of land could not be amassed by one person or one family (Luo Yizhang, pers. comm.).

During the land reform campaign, lands belonging to landlords and rich peasants were divided among the middle and landless peasants. Middle peasants were allowed to keep their deeds to land. The goal was to provide each family in the village with equal amounts of bamboo forest and paddy land, or equal amounts in terms of productivity. This was deemed more or less successful. Rich peasants and landlords still hired some extra labor, but not as much as before, exploitation was significantly reduced, and the village environment was safer and more stable (Ma Shuwen, pers. comm.).

The relatively peaceful nature of post-1949 reforms in Meihuashan changed dramatically in 1955, however, when Minxi officials implemented the "Democratic Revolutionary Reeducation (or Remediation)" (Minzhu Geming Buke) movement. CCP officials decided that certain areas in Minxi (especially those that had been under the command of Fu Baicui) had not been thoroughly revolutionized according to class distinctions and political affiliations. The geming buke movement was intended to
complete the work of identifying and reforming enemies of the people. In addition to isolating landlords and rich peasants, officials also targeted "counter-revolutionaries, traders, and bad elements" (Chen et al., 1995). By 1953, the heads of the two families in Gonghe labeled "landlords" had been executed (one for his alleged association with bandits in Luodi, the other for reasons undetermined). The buke movement in the village, therefore, focused mainly on the confiscation of the houses, gold, cattle, and other possessions of rich peasant and landlord families, and the redistribution of such items to other villagers or to the government. One landlord's son recalls that the landlord's houses were little different from most of the others. After his father's execution, however, the family was forced to move into a particularly dilapidated house (Ma Shuwen, pers. comm.). The geming buke is seen by villagers, in retrospect, as having been unnecessarily harsh, especially since it involved the persecution of agnates.

Along with the end of war and tumult, land reform, and firmer government control over the economy, came a growth in productivity and relative stability in village population numbers. Improvements in public health and education improved living conditions. Rice production and traditional commercial industries and subsidiary economic activities like paper making were resumed. Through the 1950s, the economy showed signs of improvement and the population was beginning to rise (ZHKCBGBWH, 1991). In 1957-58, the collectivization (jitihua) movement swept through China, and all of the recently divided private paddy and bamboo forest lands in Meihuashan reverted to joint ownership by administrative villages, which were called production brigades.
(shengchan dui). Villagers, as parts of these collectives, ceased to produce rice for their own families, working instead as laborers of the collective.

The first post-liberation disaster in the villages of Meihuashan resulted from the reckless policies of the "Great Leap Forward" (Da Yue Jin) in 1958. The nation was swept up in a political movement that aimed to make a rapid transition to industrialization and to a kind of communism in which the proletariat consisted of industrial workers. This has subsequently been labeled "communist wind" (gongchan feng) - attempting to make a transition to communism too rapidly or prematurely. In Meihuashan, villagers were ordered to hand in their woks and other iron implements to local procurement officials for smelting in small blast furnaces in the valley towns. Luxi township (Liancheng county) had over 20 such smelters (Luo Daoqian, pers. comm.). Agriculture was poorly managed and some villagers were put to work in the smelters, in lumber yards, on road building teams, and on other large projects designed to spur rapid economic development through industrialization. This occurred throughout China, and in 1960 and 1961. 2-3 years of collective agricultural and poor management resulted in a famine that has been deemed the worst in human history, with some thirty million deaths and untold suffering (Becker, 1997).

Each village responded in its own fashion to the crisis, adapting according to local ecological conditions and economic opportunities. Many resorted to older subsistence practices, gathering wild plants, trapping, and hunting, others lacked access to forest resources, and suffered more casualties. As a result, there was considerable variation between villages in the number of casualties during and just after the famine. Villagers in
Long Gui, Gonghe, and Majiaping were affected by the famine in different ways and faced it with different strategies. The meager rations of watered down rice gruel and rice bran or chaff (mi kang) were supplemented with wild herbs and nuts, and wild game. People in Long Gui ate chinkapin (Castanopsis) nuts gathered from the surrounding broadleaf evergreen forests, and herbaceous plants like "revolution spinach" (gemingcai). In Gonghe and many other villages, people gathered herbs and returned to the ancient practice of digging up the roots of bracken fern (jue cai) (Pteridium aquilinum), which they pounded into a powder called shan fen (mountain starch). This powder was made into balls and steamed or boiled like glutinous rice.

Villages outside of the reserve in deforested areas, which lacked natural resources and wild foods, suffered the heaviest losses. In Beiyang administrative village, for example, which lies in a dry, deforested, piney area southeast of the reserve, and had a population in the early 1960s of a few thousand, people were forced to eat tree bark. In villages like Beiyang, lacking natural resources and economic opportunities, there were periods when a few people would starve to death during the course of a day (Luo Qizhang, pers. comm.).

In bold contrast, Majiaping village was not adversely affected by the famine, in fact the villagers prospered and even benefited from the plight of others. During the Great Leap Forward, while other villages responded to official orders to grow rice collectively and provide laborers for industrial projects, the people of Majiaping were left alone or were unresponsive. Their geographic remoteness from central authority and their tradition of independence are both cited as factors in their choice to continue producing
rice for their own families, thereby maintaining normal grain production levels. While other villages lost people to death and emigration, Majiaping thrived. As a result, children from other villages were sold to families in Majiaping, and young women were given in marriage to available men in the village in a last resort effort to help them survive (or because they were seen as a burden) (Ma Shuwen, Luo Changxiu, pers. comm.).

The famine of 1960-61 decreased the population and slowed further population growth in Meihuashan. In 1962 villages began to reinvigorate traditional agricultural and forest production, along with paper making and other local industries (ZHKCBGBWH, 1991). The population began to increase slowly, though a number of people died of malnutrition-related diseases contracted during the famine (Luo Zhiming pers. comm.).

The second socioeconomic "decline" came in 1966, with the beginning of the Cultural Revolution. The national movement to "take grain as the key link" (yi liang wei gang) impelled county and regional officials to demand that peasants produce as much rice as possible. In tandem with national movements to "cut off the tail (or last vestiges) of capitalism" (pou ziben zhuyi weiba) and to cleanse China of all elements of the old society, there was widespread social chaos. Red Guards and party leaders led a campaign of destruction focused on temples and religious icons. In the Southeast Uplands (and in most regions of rural China), centrally-inspired attempts to reform Chinese society in toto spelled the end of all but the most basic economic activities.

In the villages of Meihuashan, which traditionally produced one crop of red rice per year, the movement forced a transition to two crops per year. Due to the colder water
of the high elevation streams feeding the rice paddies, the increased expenditures of capital, and the relatively sparse labor force, it was soon discovered that at elevations above about 750 meters, two crops per year was an unfeasible regime that produced less grain than one well-managed crop (ZHKCBGBWH, 1991; Luo, Zhiming pers. comm). It was only in the mid-1970s that the villages were allowed to return to the more productive practice of growing one crop per year, and in early 1981, rice paddy and bamboo forest lands were once again distributed to families with incentives for better management. This was implemented under the national program known as the "household mutual production contract responsibility system" (jiating lianchan chengbao zeren zhi). Since then, the third "rise" has been marked by continuous economic and population growth.

In summary, population growth in Meihuashan after 1949 was slow in the beginning, accelerating only after the Cultural Revolution. It was only in the early 1970s that the population rose to the same levels as in the early 1950s. The relatively slow growth could not reverse an inexorable expansion, however. From 1951 to 1994 (disaggregated data on natural villages populations in the 1960s-70s are not available), the population of each of the five study villages had grown from between 47% (in the cases of Long Gui) and 250% (in the case of Majiaping), with an average growth of 144%.

4 An important exception is the village of Daxie (mentioned above), north of Dapingshan village, which was abandoned between 1987-1993, when a tractor road to the latter village made it easier to settle there. Today there are about 20 abandoned houses in Daxie, most of which are wooden. At an elevation of 1,271 meters, the highest elevation of any village in the reserve, rice harvests were a mere 300 jin per mu. Daxie is now an eerie "ghost village" that makes one wonder if a similar fate awaits Majiaping and other villages that may not be able to establish road access to outside markets.
According to researchers from Fujian Normal University (ZHKCBGBWH, 1991: 2-7), the population of the 26 natural villages of the reserve increased from about 1,400 in 1949, to 2,718 in 1986, an increase of 94%. This is in contrast to a 126% increase in population for the Longyan region as a whole (LYDQDFZBZWHY, 1991).

Though the author did not have access to more recent population data for each of the natural villages, population figures for the administrative villages (which include natural villages inside and outside of the reserve) were derived from the number of households in each village in 1994 (multiplied by an average of five people per household - the reserve's official estimate in unpublished data collected from surveys) (Table 5.2). The estimated populations of 9,640 for the 18 administrative villages and 3,120 for the 26 natural villages within the reserve should be viewed as rough approximations only (explained in Table 5.2). From these estimates were derived the 1994 population densities of 25.6 people per square kilometer in the eighteen administrative villages, and 14.1 people per square kilometer in the reserve. The actual populations and population densities may be greater. Official population figures for 1994 may not be accurate since there are probably a number of unregistered children in each village, and the author found substantial discrepancies between the population figures provided by village officials, police departments, and the nature reserve.

5 There is a much greater population density (50-100 people per square kilometer) in the Southeast Uplands region as a whole. In the surrounding interior basins and coastal plains, which are among the most densely populated regions in China, the population density reaches 400-600 people per square kilometer (Zhao, 1986: 131).

6 The latter organization would only provide the author with administrative village populations from 1986.
Since violations of the two child policy are the norm and not the exception, close scrutiny of village population figures by outsiders appears to be a source of uneasiness and an occasion for practiced dissemblance or genuine uncertainty. Many (if not most) married couples in Meihuashan appeared to have more children than the law permits, and they were willing to pay fines for the extra sons they gave birth to. It is not uncommon to encounter families with three boys or a total of four or five children.

The author learned that unwanted newborn baby girls are left at the front gates of wealthier peasants' houses or at the township government headquarters in the dark of night, so that the unwanted children will at least have a chance to survive in another family or in an orphanage. While the ancient concept of "zhong nan qing nu" (to look highly upon males and lightly upon females) persists in the rural agrarian sector of society, girls may also be seen as good laborers (since women do all types of physical labor in the forests and in the home), and bride prices may be an increasing incentive for raising girls (in addition to less pecuniary motives, one hopes). In small patrilineal and patrilocal village societies as found in Meihuashan, however, the "zhongnan" syndrome is severe and will probably persist longer than in other parts of rural China.

In the six counties and one municipality of Longyan Prefecture, the government has realized that family planning has been a failure and so has stepped up its efforts to control the population. Violations of the family planning policy have led to stricter punishment, including the destruction of family property, usually houses or furniture,

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1 Farmers can have one child, but if it is a girl, a second child is permissible after the first has reached age four.
which is carried out by the township or county family planning committees. These punitive actions have led to increasing animosity among villagers toward government authorities. During the period of field research in Meihuashan, a family planning worker was murdered in retribution for his participation in smashing the roof of a violator's house in Luodi village (a place which, as mentioned, has a history of outlaw violence).

The severity of punitive measures and the bitterness of the conflicts between reproductive traditions and state authority do not presage an easy transition to a state of population stability in Meihuashan. Probably the only hope for stabilizing or decreasing population growth without resorting to draconian measures lies in economic development, education, and the possibility of an approaching "demographic transition."8 Economic and educational development planning are discussed in chapter 12.

More critical than the absolute population density, however, is the distribution of the population across the land area of the reserve, and how residents use village lands to make a living. In fact, it could be argued that with a transition to a less land-dependent economy, the villages of Meihuashan will have a less severe impact on the landscape than today, even with moderate population increase (depending on the impacts of future developments in transportation and energy use). Population monitoring is however, no

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8 It appears likely that couples will choose to have fewer children as the cost of raising children outweighs the benefit of having more family laborers. Although this may not be true for some families, or it may not be perceived as true, based on observations of the reproductive behavior of many young couples in Meihuashan (who are concerned about raising their annual incomes and conscientious about providing for the needs of their children), the author cautiously predicts that the area may be approaching a late expanding stage (stage 3) of the demographic transition (Haggett, 1975). Unfortunately, there is a dearth of available data on village population structure.
less critical for an understanding of the relationship between demography, land use, and environmental degradation.

Equally important for the future of nature conservation in the reserve is the development of relations between its inhabitants and the outsiders who try to control their land use decisions and direct their political and economic conditions. Meihuashan villages have a long tradition of enlisting outside help when it is strategically important, while avoiding involvement with the outside when possible. This bimodal approach is part of a larger and more uniform strategy to maintain the *de facto* autonomy that mountain villages have long held. Land use patterns in Meihuashan have long reflected the fact that villagers must simultaneously produce subsistence crops in an environment where constraints on agriculture are marked and to extract forest products for commercial exchange. These ancient imperatives and their effects are still manifest and still developing in the Meihuashan landscape.

**Infrastructural Development and Changes in Income Since 1949**

It is clear from the historical events thus far described that since the 1950s, the villages of Meihuashan have been engaged in a process of active adjustment to the political and economic developments that have transformed China. Alterations in traditional political and trade relations within and among the mountain communities and between the villages and the "outside world" have led to manifold changes in resource management practices, land use patterns, and local human impacts on the environment. Beginning in the 1970s, a series of infrastructural modifications ushered in a new phase of development and brought a new visage to the mountain enclaves: the construction of
winding dirt roads and narrow tractor paths; the advent of electricity via hydropower; innovation in architecture and access to new building materials; the use of motorized vehicles like motorcycles and tractor-carts; and, in recent years, the arrival of television. These developments are occurring in an uneven fashion, but today four of the five villages are in the incipient phases of integration with outside markets and information systems.

**House Construction and Building Materials**

The most immediate visual impression of village transformation during the past half century comes from the *melange* of house types. Village architecture exhibits the local characteristics of an economic and cultural transformation that is occurring throughout rural China. Though the newcomer may perceive the buildings of the village core as ancient and apparently unchanged for centuries, there are three types of building materials in use that represent three phases of house building ideals. For the people of Meihuashan, the three house types that one finds in the villages today represent three stages of economic progress and a rational response to the decreasing availability of a once plentiful natural resource (Table 4.3).

The oldest houses, built of broad, dark planks hand-hewn from the huge Cunninghamia trees that were once common in the mixed forests, represent the ancient past of the old society (*jiu shehui*). In Meihuashan, these simple, elegant structures are one-story, with rooms surrounding an open, sunken patio paved with granite stones at a

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9 For more information on the cultural geography of Chinese folk house types, see Knapp (1986, 1989).
depth of roughly 30 centimeters below the plane of the floor. The open courtyard, known as the "heavenly well" (tianjing), permits the entrance of natural light and fresh air into what would otherwise be a gloomy interior. In the floor of the courtyard are holes that drain water to the outside of the house. In many houses there is also a cement basin for collecting rain water, washing food and cooking utensils, and performing morning ablutions. The bedrooms, kitchen, and storage rooms face the patio, and on the side opposite the front door is a large alcove used for both an ancestral shrine and a dining area. Many houses may adjoin one another, which creates a structural honeycomb with multiple families separated only by wooden walls, and connected by hallways and patios.

From the 1950s to the 1970s, a new type of house became popular - the earth-walled house. Rammed-earth houses in other parts of the Minxi region have become world famous, especially in Yongding and Nanjing counties, where many are round, multi-family fortresses (tu lou), in some cases housing over 150 occupants (Laude, 1992). In Meihuashan, the earth-walled houses are typically two-storied, rectangular, and house just one extended family. The walls are built by pounding a mixture of water, red clay, and sand into wooden wall frames, each about 40 centimeters wide. The thick earthen walls keep out winter cold and hold in cool air during the summer. For these reasons, and because of the extreme scarcity of large Cunninghamia trees, villagers favor these houses

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10 The cement basins are divided into two sections, one serving as a cistern for water storage, the other as a sink for washing work. The cistern is also supplied by a continuous flow of water from tubes that run down the mountain from larger, often communal, springs or cisterns. Baths are taken in the early evening in a closet in the back of the house or in a shed attached to the house. One bathes in the "water closet" with a bucket of hot water that has been heated in one of the large kitchen woks.
to the older wooden ones, and have rapidly adopted them as replacements or additions to
their original homes. Often the interior walls are plastered and painted white, which
makes the interior of the house brighter. Though earth-walled houses are similar in plan
to individual wooden houses (though the former are usually two stories), they are not
connected to each other. Since there is no longer a need for defensive residential
clustering, this is not considered a drawback.

In the mid-1980s, following the nation-wide economic reforms, a third kind of
house became popular: the brick house, or its further modified brick, cement, iron, and
tile flat-roofed house. Over the last decade, this house type has become more common,
but only the relatively-affluent can afford to build in the new style. Though many aspire
to own such houses, earth-walled houses are still far more numerous. This may change in
the coming decade, as more families find the means to purchase materials and pay for
construction costs.

As a rough indicator of economic conditions and transportation constraints, one
can examine the percentage of the various house types in Meihuashan villages (Table
5.1). In Majiaping, there are no cement or brick houses, about three quarters of the
houses are earth-walled (or earth-walled and wood hybrids), and about one quarter are
wooden. At the other end of the income spectrum is Long Gui, where there is only one
remaining wooden house, three are mixed brick and earth-walled, and the rest (17) are
earth-walled. In Taipingliao, Gonghe, and Guizhuping are similar to Long Gui in that the
majority of houses are earth-walled, though there are a growing number of brick and
cement houses, especially in Taipingliao and Guizhuping.
In front of all houses, be they wooden, earth-walled, or cement, there is usually a drying platform built of bamboo that provides an extension of the flat ground surface out over the slopes upon which virtually all houses are built. Rice, vegetables bamboo shoots, and clothing are dried there, and people sometimes sit there to chat and gaze at the valleys and mountains beyond.

Other Buildings and Shrines

Other buildings in the villages include storage buildings; ancestral temples (citang); earth god or Taoist-Buddhist temples (including temples built on bridges - qiao miao); small shops that sell basic necessities (sometimes these are located in a spare room inside a house); and schools (which sometimes double as assembly halls) (Fig. 5.2). From a distance, stores, schools, and some temples may be difficult to distinguish from houses. Many are made of the same materials as surrounding houses. Ancestral temples and bridge temples, however, are striking components of the built environment, often distinguishable by elaborate stone masonry, woodwork, and stylistic features that have, in many cases, survived the ban on religious activity spanning the last 30-40 years. Some temples have been rebuilt, though it appears that few were destroyed during the Cultural Revolution, when they were used for storage or for domiciles instead. Small man-made ponds in front of the ancestral temples serve a fengshui purpose (discussed in chapter 8), while also being used to cultivate duckweed and other aquatic plants for fodder, and sometimes fish as well. Large, wooden covered-bridges invariably house Buddhist and local Daoist icons, and are thus "bridge-temples." They are the loci of
Figure 5.1. Cantilevered Covered Bridge Near Jiaotan Village. Such bridges also serves as temples, known as "bridge temples" (qiao miao). They are valuable vestiges of vernacular architecture, having survived through decades of political chaos due to their critical role in transportation. Restoration of religious relics inside the bridge temples has occurred in the last decade.
Figure 5.2a. (Top) Rustic Bridge Temple in Gonghe Village.

Figure 5.2b. (Bottom) Earthgod Shrine (*Tudigong*) in Guizhuping Village. Each village in Meihushan has several earthgod shrines. Most are located in or near *fengshui* forests.
powerful fengshui, religious worship, transportation nodes, and shelter during severe weather (Figs. 5.1 & 5.2).

Earth god shrines (tudigong) are another important feature of the built environment. These small stone dolmens or simplified replicas of temples are rarely more than half a meter in height, but they are commonly nested within a raised, circular or semi-circular stone base of up to 5-6 meters in diameter (5.2b). The shrines are placed by trails at the entrances to the village, especially where there is also a stream entering or leaving the village. They may also be found in the saddles of mountains above villages. The religious architecture and landscape design that surrounds it are an attractive and intriguing aspect of the Meihuashan village environment that deserves study and careful conservation.

Hydropower

Because of the abundance of rainfall and rugged terrain in Fujian province, it has been deemed one of the most promising areas in China for hydropower development (Cai, J.M., 1991; Yang, J.T., 1991). In Meihuashan and other parts of the Minxi region, the power of mountain streams has long been harnessed to propel water wheels attached to streamside mills. These pulverize bamboo for paper production; powderize the wood, leaves, and roots of other plants for making incense and other products; and polish rice. Meihuashan, with its "abundant rainfall, wide distribution of granite bedrock, well-developed joints and cracks, thick regolith, rich forests, and dense vegetation" (Lin Q.D., 1991), has great potential for hydropower development. There is an estimated 320,000 kilowatts of hydropower potential in the reserve, which could be used to bolster village...
sideline industries like bamboo processing, and to decrease reliance on fuelwood, thereby decreasing deforestation (Lin, Q.D., 1991). These possibilities must be carefully weighed against the potential ecological damage caused by small reservoirs, aqueducts, penstocks (cement channels and pipes that carry water down steep slopes to turbines), and the power stations themselves.

There has been rapid development of energy resources in Meihuashan, an area where villages only began to construct their own streamside hydropower generators in the late 1970s and early 1980s. By 1991, there were 19 such units, most of which produced only 5.5-10 Kw, and the largest of which produced 40 Kw. Of the five study villages, Majiaping produced 5.5 Kw, Long Gui 5.5 Kw, and Gonghe and Guizhuping 10 Kw each (there is no 1991 data for Taipingliao, though today it receives power from outside stations) (ZHKCBGBWH, 1991). Of these five, the three natural villages of Buyun township (Gonghe, Guizhuping, and Long Gui) soon went on line with the newly constructed 1.200 Kw hydropower plant in Qiushan (Long Gui's partner village in the Yunhui Administrative village) (ZHKCBGBWH, 1991). In the early 1990s, seven other small industrial hydropower stations were built in and around the Meihuashan reserve, with funding from county and township governments and private sources.

Today, Majiaping is the only village that the author knows of where electricity is still generated by the villagers with the use of small generators run by nearby streams (some of the other reserve villages in Liancheng county may do the same). In 1994, there were three generators in the village, each producing about 2 Kw, but only about two-thirds of the villagers in Majiaping had electricity in their homes. The generators cost
about 2,000 yuan (U.S. $250) and are shared by a few families. Electricity is used almost exclusively for light bulbs, and there are only 3 televisions in the village, with little or no reception (Luo Changxiu, pers. comm.).

At present, there are plans to build at least three more small hydropower stations in Jiaotan (with 1,200 Kw), Fukeng (with 1,200 Kw), and Daguan (with 10,000 Kw) villages, using village and nature reserve funds (Huang Zhaofeng, pers. comm.). Since the generation of electricity from water requires the water to be pooled or channeled and made to flow by a turbine, there are two main types of large-scale hydroelectric production systems in Fujian: reservoirs with dams and large penstocks. As mentioned, the latter are composed of cement channels that divert water to large pipes constructed on steep mountain slopes. The water rushes down the slope to turbines in a power station below. So far, there are four hydropower reservoirs near the Meihuashan reserve, one of which was generating electricity in 1994, and the other three of which were in different stages of construction. There are at least two industrial penstock generating systems in the vicinity of the nature reserve, one in Shangfu (Buyun) and one in Qiushan.

Though there appears to be little concern about the potential ecological damage caused by hydrogeneration, there are critical issues that should be addressed, namely: how the water is used to produce energy, how the energy is used in the villages, and the implications of such usage for the protection of natural resources. The creation and maintenance of dams and reservoirs is definitely the more destructive of the two methods of power generation.
The construction of a reservoir at Da Yang, within the southwest border of the reserve, is especially unfortunate from an ecological standpoint, since it has been sited along the middle reach of a mountain stream that descends from the heart of the core area of the reserve. The best montane wetland habitat is found in a large riparian headwater area a few kilometers upstream, at a place called Xiaoyang. The Xiaoyang dambo lies in a basin between the highest peaks (Gouzino, Youpoji, and Miaojinshan) (Fig. 1.2). The dam, which will provide power for Gutian township, will be 45 meters high when complete (Zhang Mou, pers. comm.).

The construction site lies amid pine and broadleaf forests in the extreme southwestern part of the reserve's core area (where the reserve boundary and the core area boundary coincide). Construction workers and managers at the dam site said that boar, muntjac, and other wildlife had been abundant in the area until 1992, when the project began. Forest clearance, dynamiting the land, and dam construction had scared the animals away (Zhang Mou, pers. comm.).

As recently as the mid-1980s, tigers were seen in the area (Zhang Mou, pers. comm.) and in nearby Dayuan village, some of the last tigers to be shot in Meihuashan were bagged in the early 1980s (Guan Yiteng, pers. comm.). In 1991, tree scratches made by a tiger were discovered near Dayuan as well, and Gary Koehler believed that the best tiger habitat in Meihuashan was in the southwest part of the reserve. For all of these reasons, it is clear that conservation goals for the area in question are incompatible with such a destructive dam project. Reserve administrators and regional planners should
explore ways to mitigate the damage, restoring and protecting watershed forests as the project nears completion.

Penstock systems for channeling water to fall pipes can be destructive too. In Qiushan the author observed a waterfall that had been created by overflow from a channel leading water to a power plant. The fall had caused serious slope erosion, and the reduced flow in the river below caused stagnation and eutrophication. The massive pipes that descend the mountain slopes are a couple of meters in diameter and hundreds of meters long. Their visual impact, at least by current western standards for "wilderness" areas, detracts from the beauty of the landscape. They are also a barrier to the movement of wildlife.

The other end of the hydropower issue is how energy is used in the villages today, and what benefits it is likely to bring in the future. Currently, the majority of the energy used in the villages of Meihuashan goes to electric light bulbs (which have replaced kerosene lamps), with minor amounts used for the few televisions, tape players, fans, rice steamers, and other electric devices that are used in some village homes.

Industrial activities that add value to forest products, thereby increasing village income, are limited to a wood carving factory in Gonghe, which has had little benefit for the majority of the villagers. Machine processing of bamboo, a prominent and prosperous activity in Wuyishan, has not been established in the Meihuashan reserve.11

11 Although for a two-week period in 1995, in Long Gui, a rented mobile bamboo processor was set up in the village to produce zhupian - small, thin blocks of bamboo used in the manufacture of a number of different products (described in chapter 10).
Virtually all of the energy needed for cooking, which is the most energy intensive household activity, is derived from fuelwood collected from surrounding forests. Most people use electric rice steamers only secondarily to the traditional bucket-shaped wooden steamers that are placed over a wok on the woodfired stove. The large wooden steamers are especially favored by large families, since much more rice can be cooked all at once in the traditional fashion.

In summary, the advantages accruing from hydroelectric generation in the reserve have not reached their economic potential, have not solved the fuelwood problem (which will be addressed later), and have caused considerable ecological damage.

**Roads**

Paths and roads are a component of the cultural landscape in the Southeast Uplands that reflect ongoing culture-historical change. Regardless of size, whether narrow mountain footpaths or paved highways, they are all called roads (lu), which indicates the importance of the network of small trails that have served as transport routes throughout the South since ancient times. In general terms, there are four types of "roads" (lu) in the Southeast Uplands: 1. mountain footpaths (shan lu), which can be subdivided into trails paved with stones ("stone roads" - shi lu) and unpaved "mud" paths (ni lu); 2. narrow dirt "tractor roads" (tuolaji lu), which support small 4-wheeled tractors, the most important vehicles for agricultural transport in China; 3. dirt roads wide enough for car or truck transport ("simple roads" - jianyi gonglu); and 4. paved or well-graded roads (gonglu). Since 1949, the road network in China has expanded at an unprecedented rate, and road construction has been so squarely equated with economic development that it
may be difficult for officials and still more difficult for villagers to justify foregoing road building in order to protect natural habitat. This may prove to be one of the most destructive aspects of human habitation of the reserve, and may become a more contentious issue in the future.

Throughout South China, stone roads were for centuries the major routes for land transportation. The roads were painstakingly paved with stones over miles of remote terrain, to prevent the muddy mires and erosion common in areas with heavy precipitation and subtropical soils. Human beings were the draft animal of choice. The use of horses and donkeys was impractical under these conditions, and they were (and still are) virtually unknown in the South. Many of the trails were "official roads" (guan lu), connecting important centers of trade and political power.

In Meihuashan, stone paths can be found in every part of the reserve, and at least one of these, which goes from Gonghe to Majiaping, was an "official road" during the late imperial era, a section of the key transport route between the regional administrative centers of Longyan and Changting (formerly Tingzhou) (Ma Shuwen; Fu Yongcheng, pers. comm.). The labor resources and organization required for the construction and maintenance of these roads through what are today wild, seldom-traveled mountainous areas demonstrates their past importance for commerce, communication, and the extension of centralized political authority into the hinterlands.

A network of mountain trails is still the most important transport system between many villages inside of the nature reserve, but links to market towns outside of the reserve have developed rapidly in the late 1980s and early 1990s. In the past decade there
has been an increasing orientation toward radial connections to the lower elevation market towns surrounding Meihuashan, and a decrease in travel and transport along certain interior pathways between mountain villages. Road building has changed the lives of many villagers, making it possible for some to reach market towns by tractor, truck, motorcycle, or bus, to conduct business, and to return to the village, all within one day. New roads have also made it possible to transport larger quantities of goods, and much heavier items from the highlands to the lowland market towns and vice versa, with less expenditure of labor. This has made possible a virtual revolution in the quantity and type of consumer goods and building materials entering some villages and in the quantity and variety of natural products that are being exported. Road transport has thus been the first step in a new phase of economic growth and regional interconnection, and access to roads has become an important determinant of economic development in the natural villages.

Until 1978 there was not a single dirt road reaching any of the reserve villages, and all transport depended upon strong backs and legs (ZHKCBGBWH, 1991). On market days in village townships, which have long been held every five days, villagers or hired porters set off hours before dawn with shoulder poles bearing reams of bamboo paper to sell in the market. At the end of the day, it was commonplace for people to return to their villages. The return load often consisted of daily necessities and powdered limestone, the latter of which was the primary ingredient in soaking pits where bamboo strips were softened before being pulverized and made into paper.
Today, all of the villages except Majiaping, Chijiashan, and Xiebei have access to tractor roads or dirt roads that reach the villages or those nearby, but well graded roads that qualify as "gonglu" are limited to about 12.2 kilometers in the southeastern part of the reserve. The road from Gutian and Buyun meets the reserve boundary in the extreme southeastern corner at the village of Xiache. From Xiache a road traverses a steep slope high above a deep gorge northwest for 5.7 kilometers to Qiushan, and an extension to Zhongcun and Dapingshan villages is being improved. From Xiache, another fork runs northwest to Long Gui village, a distance of 6.5 kilometers. This road has made it possible to reach the market, the nearest hospital, and the nature reserve headquarters, all of which are 30 kilometers away in Gutian, in just over one hour. These so-called "(Class IV) forestry roads" are the best in the reserve. Other roads in the reserve are steeper, rougher, and more prone to erosion, with stretches that become virtual streams during rainstorms. This type of "simple road" is found from Buyun to Gonghe (connected as a tractor road in 1979 and improved in the early 1980s) and Guizhuping (extended and improved from a tractor road to a dirt road in 1993). As a result, the trip from Gonghe to Gutian can be made in about one hour and ten minutes. In 1992, an unimproved dirt road was also extended to Taipingliao from a network extending to Luxi township, and to Beikeng from the Wan An township network. These roads have given rise to tractor roads leading to a number of other isolated villages.

The economic and ecological ramifications of new roads and motorized vehicles are vast. Long Gui village is the richest natural village in the reserve largely as a result of the road access it gained in 1978, and its establishment of a timber area before the reserve
was established in 1985. In addition, its low population and the reserve’s slowness to curtail the village’s timber quotas have helped some of Long Gui’s villagers to become quite prosperous by local standards. Similarly, in Gonghe village, certain villagers were quick to take advantage of their new transport link, the construction of which coincided with national market reforms and exponential inflation in timber values. Many new houses were built with money from *Cunninghamia* sales. A few villagers even purchased trucks and transported local timber to coastal cities in Fujian and Guangdong. By the mid-to-late 1980s, virtually all of the large *Cunninghamia* trees in the reserve had been cut.

In stark contrast to the relatively wealthy villages with road access are villages like Majiapings, which have no access to roads. Because of the steep terrain surrounding the basin in which the village lies, the 7.5 kilometer trail to the nearest road, in Jiangxie, takes villagers nearly three hours to traverse on foot without heavy loads. Bamboo poles cannot be carried out economically, even by paid porters, and bamboo is converted to chopsticks for transport (income disparities between Majiapings and other villages are discussed in the following section).

The advent of truck and tractor transport led to even more profound land use and economic changes when the export of bamboo poles replaced paper production as the primary source of income for mountain villages. Until the early 1980s, the local economy was based on the export of paper made locally from bamboo culms. Motorized transport made it possible to export unprocessed poles for use as scaffolding in urban construction, a more lucrative and efficient use of the resource. The dwindling village paper industry
came to an end by the late 1980s and early 1990s, as the nature reserve prohibited the
activity because of the water pollution associated with the flushing of lime and other
substances from soaking pits. By the mid-1990s, there were no paper "factories"
(*zhichang* - the small rammed-earth buildings where paper was made) operating in the
reserve, though their ruins can still be found even in remote sections of the core area.

**Telecommunications**

In 1994, none of the villages in the reserve had telephones. Ironically, up until the
initiation of economic reforms in the early 1980s, there was one-way phone and/or
loudspeaker communication in each village.\(^{12}\) One way systems were used by central
authorities to issue commands and maintain contact with cadres. Phones were used in
medical emergencies and (at least in some villages) by private individuals for personal
calls. With the decline in government-funded infrastructure in the 1980s, the phone lines
were not maintained. In 1994, there was talk of restoring the phone system, with
financial support from the reserve, but real action did not appear to be forthcoming.

**Present Day Labor & Income Structure**

Bamboo pole processing and/or export comprises the most important source of
income for nearly every family in every natural village in the Meihuashan Nature
Reserve. No families earn enough money running shops or other local enterprises to
cease bamboo production, and still fewer have established businesses outside of the
reserve that free them from primary sector activities in the home village. In each of the

\(^{12}\) Taipingli and Majiaping had one-way loudspeakers. Long Gui and the two villages of Guihe had one public phone per village.
five study villages informants responded that virtually 100% of the workforce was engaged in both rice cultivation and bamboo management, with the few exceptional individuals (1-2 in some villages) having moved outside of the reserve to engage in business or to work in another work unit (danwei) (Table 5.1).

When viewed within the larger economic realm of the Southeast Uplands, the villages of Meihuashan appear to be on middle ground, geographically situated between the widespread poverty in Jiangxi province to the west, and the rising wealth of Fujian’s coastal metropoli to the east. Despite the economic constraints associated with primary sector economic activities, a steady stream of immigrants, mostly from Jiangxi, enter certain villages each year to work as hired hands. These "outsiders" (waidiren) are men who work for local families, cutting bamboo on family-managed lands, and hauling poles to road heads where they are loaded onto trucks or tractors for transport to the lowlands. The laborers may work for a particular family for a few days, weeks, or months, before helping another family in the same or another village. On holidays the men return to their families, bringing cash.\(^\text{13}\)

To the east of the Wuyi-Daiyun range, however, in the coastal cities of Xiamen, Quanzhou, and Zhangzhou, economic growth rates rival those of southern Guangdong.

\(^\text{13}\) Some itinerant workers even settle along streams far from the villages to extract and process forest resources. Inside the reserve this is limited to small groups that process pine pitch (described in chapter 5). Outside of the reserve boundaries, encampments of small groups of laborers (including some with families) were observed on several occasions. These people were mostly from other counties in Fujian, and specialized in bamboo cutting and hauling (as laborers for local villagers), and in the manual production of bamboo paper. Their peripatetic lifestyles resemble those of the shed people of centuries past. Although they were not observed engaging in land clearance or cultivation, similar groups are said to specialize in the cultivation of Cunninghamia (Ma pers. comm.).
As a result of more rapid growth along the coast and in certain montane hinterland areas (like the Minxi Administrative Region), the Longyan Administrative Region (Longyan diqu) is the poorest of the nine administrative regions and cities in Fujian province. Government surveys of sample populations showed that the average per capita rural income in Fujian in 1993 was 1,210.51 yuan (Table 5.3). Official reports noted that this was the first year that average income in Fujian had "broken through the 1,000 yuan (barrier)" (increasing 226.41 yuan from an average of 984.1 yuan in 1992, an increase of 23%) (FJSTJJ, 1994) (FJSTJJ, 1994). For comparative purposes, the author calculated average rural incomes for all of the counties and municipalities of Fujian, based on total rural income (chun shouru) divided by total rural population (these data are found in the 1994 Fujian Rural Economic Yearbook, FJSTJ, 1994). According to these figures, the average rural income in Fujian was 1,530 yuan and the Longyan Administrative Region had the lowest per capita income in Fujian, averaging 1,087 yuan. Rural income in the hinterlands of the Xiamen Special Economic Zone (Jingji Tequ), a day’s drive from Meihuashan by car, was more than twice that of the Longyan region. Uplands (and in most regions of rural China), centrally-inspired attempts to reform Chinese society in toto spelled the end of all but the most basic economic activities.

Due in part to its location at the boundaries between the Longyan municipality and the counties of Shanghang and Liancheng, Meihuashan lies somewhere toward the middle of the economic spectrum of the Longyan Administrative Region. Of the seven

14 Though there is some discrepancy between the two estimates of rural income, due to sampling problems and reasons discussed below, the latter method allows for comparison between different administrative regions and counties in Fujian.
Table 5.1. Labor and Income Structure in the Five Study Villages

<table>
<thead>
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<th></th>
<th>CH</th>
<th>GZP</th>
<th>MJP</th>
<th>TPL</th>
<th>LG</th>
<th>Avg.</th>
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<td>Labor Force</td>
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<td>100</td>
<td>66</td>
<td>73</td>
<td>32</td>
<td>75.4</td>
</tr>
<tr>
<td>% of Population</td>
<td>47</td>
<td>44</td>
<td>38</td>
<td>33</td>
<td>32</td>
<td>38.8</td>
</tr>
<tr>
<td>Stated Per Cap. Income (Yuan)</td>
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<td>1,000</td>
<td>255</td>
<td>1,000</td>
<td>1,000</td>
<td>731</td>
</tr>
<tr>
<td>Stated Per Capita Income (U.S. $)</td>
<td>48</td>
<td>119</td>
<td>30</td>
<td>119</td>
<td>119</td>
<td>87</td>
</tr>
<tr>
<td>Stated Per Cap. Income Per Laborer (U.S. Dollars)</td>
<td>102</td>
<td>273</td>
<td>80</td>
<td>358</td>
<td>390</td>
<td>221</td>
</tr>
<tr>
<td>Official Per Capita Income of Administrative Village (Yuan)</td>
<td>1,345</td>
<td>1,345</td>
<td>486</td>
<td>603</td>
<td>1.761</td>
<td>1,108</td>
</tr>
<tr>
<td>% of Labor Force Engaged in Both Forestry and Agriculture</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Estimated % Labor Force Engaged In Other Activities</td>
<td>10</td>
<td>5-10</td>
<td>5-10</td>
<td>12-15</td>
<td>20</td>
<td>9-14</td>
</tr>
</tbody>
</table>

Note: In 1994 $1.00 U.S. was worth approximately 8 Yuan.

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These are official figures on per capita income for the administrative village to which each natural village belongs. In this case, Guihe (Gonghe and Guizhuping); Yanbei (Majiaping, Zhongping, and Yanbei); Taipingliao (Taipingliao, Baijinshan, and Daguan); and Yunhui (Dapingshan and Long Gui).
Table 5.2 Labor and Income Structure in the 20 Administrative Villages of Meihuashan

<table>
<thead>
<tr>
<th></th>
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<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Zhangchen</td>
<td>265</td>
<td>1986</td>
<td>495</td>
<td>200</td>
<td>573</td>
<td>1990</td>
<td>1,486</td>
</tr>
<tr>
<td>Huakeng</td>
<td>540</td>
<td>1986</td>
<td>645</td>
<td>245</td>
<td>440</td>
<td>1990</td>
<td>1,260</td>
</tr>
<tr>
<td>Xiyuan</td>
<td>395</td>
<td>1986</td>
<td>495</td>
<td>265</td>
<td>455</td>
<td>1990</td>
<td>1,080</td>
</tr>
<tr>
<td>Beiyang</td>
<td>--</td>
<td>1986</td>
<td>415</td>
<td>729</td>
<td>391</td>
<td>1990</td>
<td>683</td>
</tr>
<tr>
<td>Fukeng</td>
<td>216</td>
<td>1986</td>
<td>325</td>
<td>454</td>
<td>437</td>
<td>1990</td>
<td>634</td>
</tr>
<tr>
<td>Shuangche</td>
<td>--</td>
<td>1986</td>
<td>525</td>
<td>274</td>
<td>450</td>
<td>1990</td>
<td>665</td>
</tr>
<tr>
<td>Guihe</td>
<td>396</td>
<td>1986</td>
<td>435</td>
<td>174</td>
<td>782</td>
<td>1990</td>
<td>1,345</td>
</tr>
<tr>
<td>Jiaotan</td>
<td>203</td>
<td>1986</td>
<td>190</td>
<td>189</td>
<td>590</td>
<td>1990</td>
<td>1,387</td>
</tr>
<tr>
<td>Daxie</td>
<td>270</td>
<td>1986</td>
<td>290</td>
<td>124</td>
<td>591</td>
<td>1990</td>
<td>1,341</td>
</tr>
<tr>
<td>Yunhui</td>
<td>139</td>
<td>1986</td>
<td>145</td>
<td>859</td>
<td>1,115</td>
<td>1990</td>
<td>1,761</td>
</tr>
<tr>
<td>Wudi</td>
<td>737</td>
<td>1986</td>
<td>1,080</td>
<td>229</td>
<td>1,070</td>
<td>1990</td>
<td>1,317</td>
</tr>
<tr>
<td>Shisun</td>
<td>914</td>
<td>1986</td>
<td>1,175</td>
<td>187</td>
<td>688</td>
<td>1990</td>
<td>933</td>
</tr>
<tr>
<td>Yanbei</td>
<td>447</td>
<td>1986</td>
<td>--</td>
<td>241</td>
<td>812</td>
<td>1990</td>
<td>486</td>
</tr>
<tr>
<td>Luodi</td>
<td>655</td>
<td>1986</td>
<td>865</td>
<td>243</td>
<td>537</td>
<td>1990</td>
<td>611</td>
</tr>
<tr>
<td>Chendi</td>
<td>311</td>
<td>1986</td>
<td>330</td>
<td>390</td>
<td>614</td>
<td>1990</td>
<td>650</td>
</tr>
<tr>
<td>Pingkeng</td>
<td>906</td>
<td>1986</td>
<td>370</td>
<td>433</td>
<td>644</td>
<td>1990</td>
<td>624</td>
</tr>
<tr>
<td>Chijiashan</td>
<td>--</td>
<td>1986</td>
<td>310</td>
<td>--</td>
<td>426</td>
<td>1990</td>
<td>623</td>
</tr>
<tr>
<td>Taipingliao</td>
<td>--</td>
<td>1986</td>
<td>330</td>
<td>--</td>
<td>521</td>
<td>1990</td>
<td>603</td>
</tr>
<tr>
<td>Luosheng</td>
<td>599</td>
<td>1986</td>
<td>865</td>
<td>641</td>
<td>799</td>
<td>1990</td>
<td>1,218</td>
</tr>
<tr>
<td>Baishi</td>
<td>193</td>
<td>1986</td>
<td>220</td>
<td>329</td>
<td>926</td>
<td>1990</td>
<td>1,310</td>
</tr>
</tbody>
</table>

(Source: Meihuashan Nature Reserve, unpublished)

*1994 population determined by multiplying the number of households by the average household population (5.0). These figures were made available to the researcher, whereas 1994 population figures were not.

**Between 1986 and 1994 Pingkeng administrative village was divided into three administrative villages, Pingkeng, Chijiashan, and Taipingliao. Zhangchen and Wudi may have had natural villages added to their jurisdiction during this period, which would explain abnormally high population increases.
Table 5.3. Average Rural Income in Administrative Regions and Administrative Cities in Fujian Province

<table>
<thead>
<tr>
<th>Region</th>
<th>Average Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fujian Province (Government Sample)</td>
<td>1,210</td>
</tr>
<tr>
<td>Fujian Province (Income/Population)</td>
<td>1,530</td>
</tr>
<tr>
<td>Xiamen City</td>
<td>2,225</td>
</tr>
<tr>
<td>Quanzhou City</td>
<td>1,914</td>
</tr>
<tr>
<td>Fuzhou City</td>
<td>1,720</td>
</tr>
<tr>
<td>Sanming Administrative Region</td>
<td>1,593</td>
</tr>
<tr>
<td>Putian City</td>
<td>1,411</td>
</tr>
<tr>
<td>Nanping Administrative Region</td>
<td>1,349</td>
</tr>
<tr>
<td>Zhangzhou City</td>
<td>1,339</td>
</tr>
<tr>
<td>Ningde Administrative Region</td>
<td>1,117</td>
</tr>
<tr>
<td>Longyan Administrative Region</td>
<td>1,074</td>
</tr>
<tr>
<td>Longyan Municipality</td>
<td>1,389</td>
</tr>
<tr>
<td>Yongding County</td>
<td>1,385</td>
</tr>
<tr>
<td>Zhangping Municipality</td>
<td>1,097</td>
</tr>
<tr>
<td>Liancheng County</td>
<td>1,080</td>
</tr>
<tr>
<td>Shanghang County</td>
<td>969</td>
</tr>
<tr>
<td>Wuping County</td>
<td>850</td>
</tr>
<tr>
<td>Changting County</td>
<td>833</td>
</tr>
</tbody>
</table>

(Source: FSTJJ. 1994)
administrative regions and municipalities in the region, the Longyan municipality is ranked first, with an average of 1,389 yuan, Liancheng county is ranked fourth, with an average of 1,080 yuan, and Shanghang county is ranked fifth, with an average of 969 yuan (Table 5.3).

Per capita incomes in the villages of Meihuashan are beginning to surpass the 1,000 yuan mark, though there is substantial unevenness in economic development between administrative villages, and even between natural villages in the same administrative village. There is also a substantial disparity between rich and poor households in each village, a subject addressed in chapter 7. Income differences among the five study villages are substantial, especially since these include natural villages from the wealthiest and poorest administrative villages. Long Gui, with a stated per capita income of 1,000 yuan, is in the Yunhui Administrative village (along with Dapingshan), which has an official per capita income of 1,761 yuan (Tables 5.1 & 5.2). Majiaping, on the other hand, had a stated per capita income of 255 yuan in 1994, and the administrative village of Yanbei (which also includes upper and lower Yanbei and Zhongping) had an official per capita income of 486 yuan. The stark contrast in income between these

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16 Official incomes on record in the nature reserve headquarters and estimates of average village incomes made by village chiefs and other leaders during interviews, appear inconsistent at times. Some inconsistencies are due to inaccuracy, since records for the natural village are inadequate. Since the economic liberalization of the 1980's, household income is highly variable between families. Even individuals do not necessarily have good records of money earned, since the government demands only flat per capita taxes, and centralized record keeping is underdeveloped. Also, money lending is common, income is earned from multiple tasks and there are various sources of income, and labor and material goods are bartered and borrowed. So estimates of per capita income are only good for comparative purposes.
villages is due in large part to one key geographical factor that affects the economies of all of the natural villages in Meihuashan: access to roads. Road development (discussed above) is a catalyst for both habitat destruction and economic growth. In the Southeast Uplands, it is viewed as an absolute necessity to economic development, and even nature reserve administrators often allow villages to develop roads where footpaths have sufficed for centuries, if the roads serve to connect a village to the larger road network.

The economic primacy of Yunhui administrative village (Long Gui and Qiushan) is a constant reminder to the people of Meihuashan that mechanized transportation can lead to wealth. Road access beginning in 1978 in Long Gui and in the mid-1980s in Qiushan gave the Yunhui administrative village an early advantage as nationwide economic reforms opened new trade opportunities. Abundant natural resources, low population, and the opening of a timber area on village lands allowed for rapid economic development, and by 1986, per capita income in Yunhui (859 yuan) far exceeded that of all other villages in the reserve (Table 5.2). By the late 1980s one villager had became well known in the region for his wealth, having made large profits from investment in cement plants in Gutian and other areas, as well as starting his own plywood factory near Fukeng. He subsequently moved down to Shangfu village (outside of the nature reserve), the administrative center of Buyun township, where he built a two-story cement and tile house complete with a courtyard and fountain. He may be the only native of the reserve area who owns his own car. While his case is exceptional, there are other villagers in Yunhui and other villages who have enjoyed considerable windfalls by trading *Cunninghamia* (during the 1980s price hikes, before the trees were completely removed...
from the reserve), producing *Cryptomeria* carvings (one entrepreneur in Gonghe), and through simultaneous pursuit of a number of sideline activities (discussed in chapter 6).

It should be noted that another village that lacks direct road access is not as seriously impoverished as Majiaping. Chijiashan village, with an average per capita income of 623 yuan in 1994 (Fig. 5.2), has a low ratio of population to bamboo forest area. In the natural village of Chijiashan, the most extensive areas of well-managed bamboo forest in the reserve belong to about 220 people. Labor requirements exceed the capacity of the workforce, and Jiangxi migrants workers are a critical supplement. Poles are cut into chopsticks or flat, thin pieces (*zhu pian*) used in the manufacture of car seat covers, couch covers, and other portable partially-finished products. Just as Yunhui provides an example of the benefits of modern transport, Chijiashan stands out as a model of the benefits of effective bamboo management. An early advantage in Chijiashan has to do with its long history of bamboo management. Bamboo was cultivated for the dried shoot trade, for which the village had comparative advantage, since goods could be transported to the Malinxion river and by boat to Wanan.17

At present, the economic development of villages within the nature reserve is constrained by land use regulations, especially those that limit timber harvests and prohibit the disturbance of broadleaf forests (discussed in chapter 7). This is perceived by

17 According to a reserve manager, during the collectivization period, Chijiashan village leaders secretly allowed families to continue managing their own bamboo forest areas, while leading central authorities to believe that all land was collectively managed according to national policy (Huang ZF, pers. comm.). This assertion was denied by a Chijiashan native. It is also said that *Cunninghamia* was cultivated with bamboo in mixed forests (a pattern observed in Gonghe), and timber was exported as well (Huang ZF, pers. comm.).
villagers in the reserve as a handicap, inhibiting their economic competitiveness, and it is a source of serious conflict between the reserve administration and reserve residents. The future economic well-being of the villages of Meihuashan is largely contingent upon at least four conditions: 1. that bamboo management be improved so that villagers can increase the density of plants per unit area, thus increasing overall bamboo culm production without significantly increasing the area under cultivation (the environmental consequences of bamboo forests expansion are discussed in chapter 7); 2. that villages or townships develop the capacity to process bamboo, thus adding value by creating marketable finished products (as is done in Wuyishan); 3. that bamboo lands be redistributed equitably among families at periodic village meetings, as household populations change (some villages do this and others do not, a problem discussed in chapter 5); and 4. that villagers become the operators of an emerging service and technical economy associated with reserve management, research, and tourism in and around the nature reserve. The two-edged sword of tourism and commercialism will require conscientious management if environmental destruction, landscape degradation, and economic inequity are to be avoided.

With the development of a capitalist economy, there is also the danger of an ever-weakening centralized welfare system. Villagers complain that health care, education, and telecommunication services for rural villagers have declined. Since the reserve is divvied up among seven townships in two counties and one municipality, there is a serious lack of coordination between government bureaus in the provision of social services, law enforcement, and general planning. This is a source of acrimonious
controversy, as villagers accuse the reserve of backing out on pledges to provide funding for poverty relief and capital investments for the production, processing, and marketing of bamboo, livestock, and other primary sector commodities. Enforcement of game and forestry laws has thus become extremely contentious (an issue discussed at length in chapter 9).

Summary

Chapters four and five have described how the villages of Meihuashan were established, by whom, and with what general impacts on the natural landscape. The dual imperatives of subsistence and economic survival in a mountain society with trade connections extending beyond the borders of China have caused fluctuations in the population and in the intensity of pressure on local natural resources. Social and environmental instability due to banditry, military invasions, national political movements, and famine often culminated in periods of depopulation through death and outmigration. Still, the villages in the nature reserve today are inhabited by direct descendants of the early Hakka settlers. The history of their land and resource use is critical to their identity and to the ecological conditions in which indigenous wild plants and animals exist today.

As China begins its first experiments with democracy by allowing villagers to elect their own leaders, it is clear that the long-term human inhabitants of places like Meihuashan should be considered stewards of the land. Striking a balance between the national (and international) values, goals, and regulations of nature conservation, on the one hand, and local traditions and economic interests, on the other, is the main challenge
confronting both the inhabitants and the management of Meihuashan and other nature reserves in the Southeast Uplands. To understand the impacts of current land use practices on landscapes and ecosystems, it is important to reconstruct the cumulative impacts of village land use through time. This subject is addressed in chapter 6.
CHAPTER 6

BURNING THE MOUNTAINS: AN HISTORICAL LANDSCAPE
ECOLOGY OF THE MEIHUASHAN ECOSYSTEM

"In Meihuashan lie eighteen basins (dong), in each basin lie eighteen marshes (yang), in each marsh lie eighteen coves (li), in each cove lie eighteen crannies (ku), in each cranny lie eighteen golden armchairs (jin jiaoyi)." - An ancient ode to Meihuashan (Lai, 1990: 54).

Vegetation patterns in Meihuashan today are the result of centuries of landscape modification by Hakka settlers and probably by earlier aboriginal inhabitants as well. As the Hakka came to dominate the region, they continued to transform the once ubiquitous subtropical broadleaf forests into a patchwork of cultivated, semi-cultivated, and wild habitats. Over some 550 years of Han settlement, rice terraces crept up valley sides, fire scoured montane meadows to the highest peaks, bamboo forests covered the slopes, and sacred broadleaf forests or cultivated groves of Cryptomeria trees towered over villages blocking fierce winds in the water gaps and covering low knolls among the houses and temples.

China's transition to socialism initiated a series of changes in local resource management patterns and accelerated the rate of landscape transformation (Murphey, 1967). As a result, environmental change in Meihuashan since 1949 has been complex.

1 The "eighteen basins" ("shiba dong") for which Meihuashan is famous are actually montane wetlands, or dambos (described in chapters 2 and 8) (Lai, 1990). There are many such wetlands in the nature reserve at elevations above 1,300 meters, and they are an important source of water and forage for wildlife during the dry season. The "golden armchairs" (jiao yi) may be metaphors for good fengshui locations. Although Lai (1990) prosaically states that the term "golden armchairs" symbolizes abundant natural resources, it more likely connotes the most favorable fengshui sites, where mountains surround and protect a tomb or dwelling on three sides, with the fourth side ideally open to the south (Lovelace, 1985).
In the last 50 years, a Western-influenced, scientific-utilitarian view of "nature" and "natural resources" has been propagated, and new conservation techniques introduced, along with the beginnings of industrialized agriculture and forestry. With the establishment of the nature reserve, in the late 1980s, still other goals and values were instituted, most notably those related to wildlife conservation. Through all of the changes of the last half century, however, some of the oldest land use traditions continue, and certain ideologies and social structures developed in conjunction with the basic goals of settlement and subsistence have persisted, and even found renewed vigor in recent years.

The simplistic notion that deforestation and land degradation have been the predominant trend in rural China since the 1950s is challenged by the evidence gathered from this field investigation. While there have been negative impacts on wildlife and habitat, there have also been changes in land use patterns that have led to greater forest coverage on the higher mountains.

The Meihuashan landscape is a mosaic of vegetation types, in different phases of succession, each associated with a certain elevation zone and a particular set of land use practices and indigenous perceptions. Traditional local knowledge, or emic views, of these vegetation and land use zones are reflected in the history of their anthropogenic formation. As perceptions have changed, the landscape has changed, and vice versa. To understand the causes and impacts of this panoply of human activities on the ecosystem through time, we must investigate both the etic (in this case the objective, "scientific," and ecological) and the emic (in this case local, experiential, and ethnohistorical) dimensions of the local landscape.
Contemporary Land Use Patterns In and Around Village Nuclei

Since the population of Meihuashan is clustered in 26 natural villages, the land use patterns surrounding these settlements is the critical link between human impacts and habitat conservation. Current land use patterns concentrate most human disturbance on the valleys and slopes closest to the villages. The human living space of the village nucleus is surrounded by lands devoted to the production of crops with subsistence and commercial value, as well as sacred forests and the commercially important bamboo forests. The composite map of land use patterns in and immediately surrounding an idealized Meihuashan village was adapted from original sketch maps of the five study villages (Fig. 6.1). Houses, temples, and other buildings are woven into a living green fabric of vegetable gardens and rice paddies. Fengshui forests are preserved on the slopes above ancestral temples, around earth god shrines, where streams enter and flow out of the village proper, and in the gaps or saddles of surrounding ridges, where "pernicious qi" (sha qi) may enter the villages.²

Beyond the village nucleus and its rice paddies, vegetable gardens, and sacred forests, there are extensive stands of bamboo, as well as broadleaf, pine, and mixed forests. There are also less extensive grasslands, which can be divided into two types: 1. lower elevation grasslands (so-called montane wastelands - huangshan), where rice terraces have been abandoned or where grazing pressure has prevented reforestation; and

² For a detailed description of the significance of sha qi, also known as sha, see Feuchtwang (1974:115-119).
Figure 6.1. Village Land Use in Meihuashan - Ideal Village. The following land use and land cover patterns are common in the villages of Meihuashan, starting from the village center: a dense cluster of houses, temples, and other buildings; rice paddies and vegetable gardens (the latter not shown); old growth broadleaf and Chinese cedar fengshui forests; household-managed bamboo forests; and collectively-managed forest, scrub, and grassland.
2. high elevation grasslands on the ridges and summits above 1,700 meters, where conditions are unsuitable for pine forest succession.

On these more peripheral village lands, residents extract forest resources for subsistence and commercial purposes. Bamboo forests are divided into plots, with usufruct rights granted to individual families under the "household responsibility system." in a fashion similar to the allotment of rice paddy lands (more details of bamboo production under this system are discussed in chapter 7). Most of the pine, broadleaf, and mixed forests are jointly owned by the collective (jiti), which in Meihuashan consists of all members of a particular administrative village. Substantial areas of forest have reverted to complete government jurisdiction (totalling 23% of the reserve area), typically as the result of unresolved inter-village land tenure conflicts.

Though there are similarities among forest land use patterns around each of the five natural villages, each village has distinctive land use characteristics and land tenure management systems. For example, some natural villages hold meetings every five years (or at comparable intervals) to redistribute bamboo forest and rice paddy among families according to changes in the population of each household. Other villages have no meetings to redistribute land, and face the inevitable problem of land tenure inequity (an issue addressed in more detail in chapter 9).

**Traditional Foodways and Subsistence Patterns in Meihuashan**

Since the early 1950s, dietary regimes in the villages of Meihuashan have changed dramatically. The transformation in local foodways has occurred in tandem with developments in agriculture, animal husbandry, and transportation, all of which have
increased local food production. The Chinese "Green Revolution" has increased the availability and affordability of new varieties of grain, vegetables, and livestock. This has had profound impacts on land use patterns and led to an apparently irrevocable dependence on chemical pesticides and fertilizers. Local people (especially hunters) have noticed the devastation to wildlife populations caused by chemical contaminants, but the problem remains largely unexamined by the scientific community. On the other hand, the advent of hybrid rice has led to much higher productivity per unit area, therefore much less land is today devoted to agriculture, and forest succession is occurring in many relict rice paddies throughout the reserve. It could also be argued that higher grain production per unit area has further obviated the traditional need to burn large land areas to produce starch-rich ferns. Thus a major source of vegetation disturbance has been removed (discussed below). From these trends we can see that the development of more "modern" subsistence practices, which correspond to a change in diet and consumption patterns, has had both positive and negative impacts on wildlife and habitat.

Before 1949, Meihuashan villagers subsisted primarily on rice, vegetables, starch from the roots of bracken ferns, and other wild edible plants and animals.³ There was no cooking oil, so these foods were steamed or boiled. Though villagers raised pigs, pork was eaten only about twice a month, when a pig was slaughtered, and then only in small quantities since one family's pig was divided and sold to the rest of the village (Ma Shulin, pers. comm.). Most people ate more fat than lean meat, which often appears to be

³ Some villages in Meihuashan, including Long Gui, also grew small amounts of wheat during the winter. Long Gui started growing wheat some time before 1949 and continued until the 1970's. There was no mention of this practice in any of the other study villages.
the case today as well. Chickens and ducks were raised by individual households, providing eggs, but their meat was eaten only during celebrations and holidays. Bean curd (doufu) was another source of protein. It was produced in the market towns and in some cases within the villages themselves.

The meat of wild animals provided an important supplement to the local dietary regime. Many families trapped bamboo rats (zhu shu) (*Rhizomys pruinosus*), forest rodents that resemble large guinea pigs (with long tails) and feed on bamboo. Dried bamboo rat meat is a famous local specialty, and the trapping and consumption of the rats is still commonplace. Frogs (*shidong* or *shiren*) captured in mountain streams are another traditional delicacy, and the same applies, though to a lesser extent, to certain species of turtles that inhabit riparian habitats.4

The hunting of large mammals was typically practiced by only a few males in each village (though there are more hunters in most villages today) (Ma Shulin, Ma Shengxue, pers. comm). Hunters provided the meat of muntjacs, wild boar, and other animals, but this was probably not a reliable source of protein for entire villages. Other animals and birds that have long been captured for food and medicine include pangolins, porcupines, badgers, civets, mustellids, wild cats, bears, red dogs, pheasants, and other

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4 Before the late 1980's, when the use of chemical pesticides and fertilizers began to affect agroecosystems throughout South China, people gathered "tiger stripe frogs" (*Rana tigrina*) from the rice paddies at elevations below about 900 meters (ZHKCBGBWH, 1991). Today the people of Meihuashan often hike deep into the reserve to take an illegal harvest of "Shiren" (or "Shidong"), a species under state protection. The most popular kind of turtle appears to be *Platysternon megacephalum*, known for its fragrant meat and for the medicinal value of its shell. In the Longxi Shan area, over 1,000 Kilograms of the shell were gathered in 1963 alone (ZHKCBGBWH, 1991).
gallinaceous birds. Even now, when people in Meihuashan are not under dietary stress, they will eat virtually any animal, even those killed serendipitously, including owls and other non-game birds. Hunting, trapping, wildlife consumption, and their impacts are discussed in more detail in chapter 8.

Though wild plants and animals were frequently consumed for medicinal and food purposes, village dietary regimes were based on agricultural products, especially rice and vegetables. Three types of rice have figured prominently in the diets and cultivation systems of Meihuashan: glutinous rice (luomi), white rice (baimi), and red rice (hongmi, also known as heimi - "black rice").

Glutinous rice traditionally comprises between one-quarter and one-third of each family's total annual rice crop. As the primary ingredient in rice wine and ceremonial foods, it has great cultural significance. Most families use their glutinous rice stocks to make rice wine (mi jiu), which is ritually consumed at meals. Though the frequency and volume of consumption varies between families, males typically drink one or more servings from their rice bowls before rice is served at a meal. This was observed mostly at lunch and dinner, but sometimes at breakfast as well. Some people prefer to drink rice wine instead of eating rice, even in times of grain scarcity, such as the early 1960s (Ma Shengxue, pers. comm.).

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5 This is still the case, and often there is little distinction between food and medicine, for dishes which include wild plants and animal parts are considered to have great medicinal value (Ma, SX pers. comm.).

6 It should be noted that while alcohol consumption is part of daily life, chronic, pathological alcoholism is rare. Drinking, and sometimes heavy drinking, are seen as a highly social aspect of ritualized host-guest protocol, an activity that promotes social
Within the last 15-20 years, the average person's daily rice consumption is reported to have decreased by nearly one-half (Ma Shengxue, Ma Shulin, pers. comm.). Though this statement is difficult to verify and still more difficult to prove in a quantitative fashion, there are compelling reasons for a decline in starch consumption (Grigg, 1996). Villagers attribute the change to three factors, first of which is a decrease in the metabolic energy requirements of laborers since the advent of roads and vehicular transport of goods to and from the montane villages. Second, there has been a shift toward more sedentary work modes: more business dealing, less hard labor, and the hiring of waidiren (outsiders) as laborers. The third factor is the availability of a much greater variety of locally and regionally produced food items, which have partially replaced rice and other starches in the diet. The transition from a diet predominated by starchy staples, cereals and root crops, which are the cheapest available plant foods, to a diet more balanced with other, more expensive, animal and plant foods, has been observed in developing countries around the globe (Grigg, 1996).7

89 bonding, and is often part of competitive games among males. The author never heard of a single incident of solitary drinking or the chronic alcoholism so familiar in the West. Still, drinking patterns are changing. Beer and baijiu (a strong, clear liquor made from sorghum) are replacing rice wine, and many younger people avoid the latter, saying that it is acidic or sour ("suan") and causes stomach pains in the many who suffer from a type of peptic ulcer disease ("wei bing"). Social drinking may also cause serious health problems, and according to one source, there has been an increase in cirrhosis of the liver among urban businessmen, many of whom must drink frequently and heavily (He Lian, pers. comm.).

7 Grigg (1996) demonstrates that there is a correlation between increases in gross national product (GNP) per capita and decreases in the ratio of starchy staples to other foods in the diet. It is important to note that there was no correlation between GNP per capita and absolute starch consumption, since people in the poorest countries eat less food altogether, and their consumption of starchy staples is therefore less than that of wealthier nations.
Because of a shorter growing season, more extreme cold events, and cooler year-round temperatures, as well as soil and agricultural limitations, Meihuashan does not produce the array or quantity of vegetables common in lowland and southeastern hill areas of Fujian. Most of the vegetables consumed by Meihuashan villagers are grown in household gardens interspersed with houses and other buildings throughout the village. Before the 1950s, these consisted mostly of taro (many varieties of wet and dryland types) \( (Colocasia esculenta) \), five to six varieties of peas and beans (including \( Phaseolus vulgaris \), \( Pisum sativum \), and \( Vigna sinensis \)), four types of squash (including \( Cucurbita moschata \), \( Cucumis sativus \), \( Momordica charantia \), and \( Benincasa hispida \)). Chinese-cabbage (\( qingcai \) and \( xiaobai cai \) (\( Brassica spp. \)), \( jiaoyu \) (\( Canna edulis \)), and sweet potatoes (\( Ipomea batatas \)) (Ma Shulin, pers. comm.).

Taro has been grown in small plots within the villages of Meihuashan for many centuries (Ma Shulin, pers. comm.). Along with rice and bracken root, it was an important source of starch in the local diet. The most favored varieties are those that produce drier root. These types include both dry and aquatic types (Ma Shulin, pers. comm.). While there was no mention of upland taro cultivation in historical times, and no evidence of this practice today, it is possible that taro was cultivated in mountain plots during periods when higher populations created a greater demand for starch.8

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8 Though villagers in Meihuashan did not indicate that larger-scale taro cultivation had been practiced in historical times, several records in the Longyan Prefectural Gazetteer indicated that people had been arrested in the region in the 1960s for burning the mountainsides in preparation for taro cultivation.
Sweet potatoes, which were introduced in Fujian by Portuguese traders in the 16th century, do not appear to have revolutionized subsistence practices in Meihuashan as they did in many other montane areas of southeast China. In Meihuashan, villagers had no success with germination from tubers. The traditional variety of sweet potatoes cultivated in Meihuashan had a long, thin tuber that rotted when hung up to dry. For this reason, the crop had to be sown each year with seedlings purchased in the market towns, and these were not abundant in Gutian (they had to be imported from Longyan). Villagers state that in the pre-Communist era people lacked the time and labor supply to maintain the troublesome sweet potato crops. They had to expend too much time and energy on rice crops, paper production, and other activities. There may have also been local cultural factors that kept these tubers from becoming more important. Today people avoid eating sweet potatoes. There may have also been a preference for other sources of starch (Ma Shulin, pers. comm.).

Bamboo shoots are also a traditional food of great nutritional value, and these are gathered between March and May in the managed forests of maozhu bamboo (Phyllostachys pubescens) as well as in stands of wild bamboo, especially nude sheath bamboo (shi zhu - "stone bamboo") (Phyllostachys nuda) and "water bamboo" (shui zhu) (P. heteroclada) (Ma Shulin, pers. comm.). Bamboo shoots have long been considered both a delicacy and an important local staple during food shortages.

By the 1970s, a number of cultivars were introduced to the vegetable plots of Meihuashan. These included hot peppers, bell peppers, potatoes, new types of squash and cabbage, and fruit crops like peaches and pears. There were also improvements in hybrid
varieties of sweet potatoes, which led to the introduction of a variety with a shorter, fatter tuber, that was hardier at higher elevations and could be germinated successfully. For the first time, villagers could produce their own seedlings for new sweet potato crops each year. Today there are over 30 types of vegetables in Meihuashan. Within three broad categories they are as follows: Cruciferae (cabbages and other green, leafy vegetables) - roughly 10 kinds (species and varieties), beans - roughly 10 kinds, and tubers - about 8 kinds (Luo Zhiming, pers. comm.).

The general pattern of household vegetable cultivation is today very similar to how it was before 1949 (Ma Shulin, pers. comm.). In the second lunar month (in March-April), the villagers begin to plow the ground with hoes, repair the bamboo fences that keep out animals, and fertilize the soil. Around the time of the festival of "Pure Brightness" (Qingming - April 5 or 6th), the villagers sow seeds, adding more fertilizer to the ground around each seed. The fertilizer consists of cow and pig manure (and to a lesser extent human nightsoil) composted with the ashes of grass and ferns, the origins of which are discussed below. When the plants are in the seedling stage, a mixture of water and human urine (at a ratio of 2:1) is applied weekly, and as the plants grow, a higher concentration of urine is applied. Vegetables are harvested through the summer, fall, and in the case of squash and cabbages, into the winter months (Ma Shulin, pers. comm.).

Traditional Rice Cultivation and Its Impacts

The villages of Meihuashan are distinctive in that they have relied upon rice cultivation for subsistence through most of their history. This is not the case in all high elevation areas of the Southeast Uplands. In Wuyishan, for instance, few villages grow
any rice, because the scarce alluvial valley cropland has been devoted to the production of tea and bamboo products, and cash from these exports has been used for the purchase of grain (and many other necessities) from surrounding settlements in lower valleys. Though yearly grain production in Meihuashan consistently failed to meet annual needs until the 1980s, rice cultivation has long been the most fundamental part of local subsistence strategies. Terraced rice paddies, some of which may be as old as the villages themselves, are a defining element of the cultural landscape, with dramatic longterm impacts on montane hydrology and ecosystems. Even after terraces are abandoned, the restoration of geomorphologic and vegetation patterns can require many decades. At least two historical episodes of extensive terrace abandonment, one around the turn of the century and one over the past fifteen years, have led to oldfield succession to broadleaf (and mixed) forest and low elevation grassland respectively.

Present-day agricultural conditions in Meihuashan provide a reference point from which to view the past. In 1986, the total area of cultivated land (including vegetable plots and rice paddies) in the reserve was 11,100 mu, or about 7.4 square kilometers, comprising about 3.3% of the total land area (ZHKCBGBWH, 1991). Over 95% of the cultivated land in the reserve consists of rice paddy. Most rice paddies are on montane terraces, and most terraces are narrow (some hold only two rows of plants). Paddy lands are small in area and scattered through the rugged terrain at elevations up to 1,200 meters.

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9 This figure includes all cropland that falls within reserve boundaries, which belongs to 41 natural villages. Fifteen of these villages are settlements outside of the reserve boundaries. Cropland belonging to the 26 natural villages with settlements inside the reserve boundaries equals 5,985 mu, or about four square kilometers, comprising about 1.8% of the land area of the reserve (ZHKCBGBWH, 1991).
Most are found around 800 meters, though in the Guihe-Jiaotan area paddies average about 1,000 meters in elevation, and Mawu village has paddies at 1,200 meters. Even large terraced areas are rarely more than about 100-150 mu (roughly 7-10 hectares) in area (with exceptions, especially between Guihe, Jiaotan, and Mawu). Many are isolated patches surrounded by mature broadleaf, pine, bamboo, or mixed forests. Some are up to 10-12 kilometers from the nearest village. Isolated paddies a long distance from villages are especially susceptible to depredation by wild boar, monkeys, and rats.

Natural conditions in Meihuashan are not ideal for rice production, and most paddy land is considered low in productive capacity. There is an abundance of precipitation, with 200 centimeters (78.7 inches) of rain per year on average, and up to 220 cm (86.6 inches) in wet years. Since most of the paddies are fed by the natural flow of groundwater and runoff, or by small bamboo pipe aqueducts, large-scale irrigation ditch systems are unnecessary. Despite the favorable conditions of precipitation, there is a relatively long frost season, extending from mid-to late November to March or early April, a period of 140-150 days (ZHKCBGBWH, 1991). Early frosts are a threat to late-season rice crops, and given the short frost-free season, double cropping of rice is not feasible. Double cropping was only practiced in Meihuashan during the "high production" (gao shengchan) campaigns of the Cultural Revolution, and in some years annual production fell below single crop levels. Other impediments to rice cultivation include thin soils (due to the steep slopes) and water temperatures that are lower than optimal. Cool paddy water temperatures result from cool air temperatures, short daily insolation periods, steep slopes, and poor circulation (ZHKCBGBWH, 1991).
The current scale of agriculture in Meihuashan precludes its mechanization. Rice paddies are small and remote, many are far from roads, and economic returns are so small that mechanization would not be cost-effective. Even water buffaloes, which are common in the region at elevations below about 750 meters, are not found in the reserve. Their absence is due to a number of possible factors, first, the mountain rice terraces are too steep and narrow to support their weight. The animals are also too large to negotiate the mountain trails or to turn around within the small terraced paddies. One local man stated that the lack of standing water and slow moving rivers (their favored habitats) in the higher villages is another important limiting factor.\(^{10}\) For these reasons, locals have long relied upon the much smaller yellow cattle for draft animals, and each natural village has between five and 30 head.

A distinguishing characteristic of ancient agricultural tradition in the Meihuashan region is the burning of straw, ferns (chiefly *Dicranopteris dichotoma*), and other herbage for fertilizer. This is done in the fields or in concavities on mountain slopes from which ashes are collected and spread over the paddies. A field fertilized in this manner was known as a "she (or xie) tian" (畬田), meaning burned field. Because of this cultivation method, many mountain villages in the region contain this character as an element of their names, including the reserve villages of Daxie (Big Field), Da Gaoxie (Big High Field), and Xiao Gaoxie (Little High Field). There is thought to be an historical and etymological connection between this practice and early swidden cultivation by the She.

\(^{10}\) Water buffaloes are found at much higher elevations in other regions (e.g. Nepal - >2,000 m and Kashmir - 3,500 m, Stevens, pers. comm.), and the 750 m limit in Meihuashan applies only to local conditions and traditions.
people, whose name is represented by the same character (Jiang, 1985; Pulleyblank, 1983). In fact, the practice of burning field stubble or wild vegetation and using the ash as fertilizer probably developed from long-cycle swidden practices of the She people. The influx of Hakka settlers to southwest Fujian no doubt altered indigenous mountain land tenure patterns, and swidden systems eventually gave way to sedentary rice cultivation.

Before the introduction of hybrid rice (zajiao shuidao), a product of the "Chinese Green Revolution," Meihuashan villagers (and millions of other peasants throughout southern China) cultivated varieties of rice that were much taller than those used today (this was true of white, red, and glutinous varieties). Hybrid varieties of high-yielding rice developed by the International Rice Research Institute and designated "IR-8 dwarf indica". were propagated throughout southern China by the mid-1970s (Pannell and Ma, 1983). Today. "Keng dao" (Oryza sativa var. Keng) is grown in the most mountainous

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As Pulleyblank (1983: 428) states, "The word She, also read yu, means 'slash-and-burn cultivation,' and it may be that the people became known as She min or She man because of their use of this agricultural method." Jiang (1985: 113) states that the word "she" (or yu) appeared early in Chinese literature: "The Er Ya...states that 'In the first year (a plot of land) is called a clearing (zai), in the second year it is called a new field (xin tian), in the third year it is called a she (or yu)." She and yu are defined as: "To cultivate land by first setting fire to it, or land that has been cultivated for some time" (Liang et al., 1973). Jiang adds that the She probably earned their name from the practice of swidden cultivation (dao geng huo zhong - "to till or plow with a knife and plant or sow with fire") and that this is reflected in their ancestral records. Shi (1985: 45) notes that there are over 100 She (pronounced "xie" in toponyms) place names in Fujian, and most are within the Western and Northern Min regions.
areas of Fujian. While "Xian dao" (*Oryza sativa* var. *Hsien*) predominates in the plains (Lin, 1990).12

Hybrid rice first reached Meihuashan in 1976 (Ma Shengxue, pers. comm.) but was not adopted by all of the villages until the early 1990s. Certain villages, like Majiaping, resisted the adoption of hybrid rice for over a decade. Among the reasons cited for this decision were the prohibitive expenses of purchasing and transporting seeds, chemical fertilizers, and pesticides to the village (which in the case of Majiaping has no access roads), and unwillingness to make a potentially risky transition into an unknown system of agriculture (Luo Changxiu, pers. comm.).

Traditional varieties of red rice, white rice, and glutinous rice yielded much less grain per unit area than the modern hybrids. Traditional rice yields in Guihe are believed to have reached yields of 200 kilograms per *mu* (3,000 Kg. per Ha.) (before drying) at maximum, whereas hybrid rice production in the village can reach a maximum of up to 350 kilograms per *mu* (5,250 Kg. per Ha.) on the best paddies today (Ma Shengxue, pers. comm.).13

Today's higher yields per unit area are attributed to the closer spacing of the seedlings in each row, and to the closer spacing of rows. Although dwarf hybrid rice

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12 There are many other varieties of dryland, wet, and deepwater rice, which are further divided according to their use in early, mid, and late-season crops (Lin et al., 1990).

13 These figures should be taken as approximations; they are not based on formal surveys. In comparison, average rice production in Longyan prefecture in 1993 was 307 Kg./*mu* (4,605 Kg./Ha) and 321 Kg./*mu* (4,817 Kg./Ha) for Fujian as a whole (FJSTJJ, 1994). Crop yield increases in the past 20 years are discussed in more detail in chapter 7.
plants are only about half the height of traditional varieties (which were approximately one meter tall), they have the same number of grains per plant (about 180-200) (Ma Shengxue, pers. comm.). Smaller plants of equal productivity are planted closer together, producing more grain per mu. Whereas traditional varieties were planted in rows spaced about one chi (33 centimeters apart), with 1.2 chi (40 centimeters) between plants, new hybrids are planted with about .7 chi (23 centimeters) between rows and .6 chi (20 centimeters) between seedlings in each row (Ma Shengxue, pers. comm.). This means that under the same physical conditions, new hybrid varieties are potentially 2-3 times more productive than traditional varieties.

There are, however, serious drawbacks involved in using the hybrid varieties of rice: 1) they require heavy inputs of chemical fertilizers and pesticides, which have negative impacts on local ecosystems; 2) they make farmers dependent upon outside sources of fertilizer, pesticide, and seeds, expenses that are making grain agriculture uneconomical; and 3) they are causing the disappearance of traditional varieties of rice that were better adapted to local soil, climatic, and ecological conditions (including the depredation of insects and other pathogens) (Smil, 1993).

Traditional agriculture in Meihuashan was completely organic and sustainable as long as it was limited to a relatively small areal scale. It is axiomatic that deforestation was a prerequisite of agriculture in tropical and subtropical forest ecosystems, and that the cultivation cycle, including the construction and maintenance of terraces, perpetuated agricultural disturbance patches indefinitely. Under traditional cultivation schemes, however, disruptions to the hydrological, pedological, and ecological systems of the area...
were limited mostly to the agricultural plots themselves. Anthropogenic soils were
developed through careful stewardship, and seasonal inputs of human and livestock
wastes, ashes, composted plant materials, and other organic fertilizers were required to
maintain fertile paddy lands. Since water is abundant, hydrological alterations were
comparatively minor, except in areas of extensive terracing, where large populations from
3-4 villages shared abutting terrace lands (as in the Guihe-Jiaotan area). Ecological
conditions may have actually been enhanced (depending on which trophic levels one
wishes to focus on). Mature rice crops have extremely high forage value for ungulates,
especially wild boar and Reeve's muntjacs, and for rats. During other seasons, small.
remote paddies provide prime open and edge habitat for ungulates and other large and
small herbivores, omnivores, and carnivores (see chapter 6).

A History of Rice Terrace Abandonment

Since traditional rice cultivation in Meihuashan did not require chemical
fertilizers or pesticides, or major alterations of surface hydrology,\textsuperscript{14} direct ecological
disturbance was probably limited to the sites where paddies were made and maintained.
Ecological disruption was thus a function of the scale of agriculture. From a landscape
ecological perspective, if valley paddies or terraced slopes were extensive enough to
adversely alter ecological conditions (the movement of animals, the transport of nutrients,
and other flows of matter and energy) within surrounding or adjacent landscape patches
or elements (Forman and Godron, 1986), then rice cultivation had a more severe impact.

\textsuperscript{14} Certainly there was a difference in runoff regimes in and around
the paddies, but there were few or no large water diversion systems.
The combined impacts of rice cultivation and other land use activities are discussed below, but before exploring these effects, it is important to try to ascertain the historical areal maximum of terrace land and to have some sense of its configuration.

There are no reliable estimates of the rate of rice terrace abandonment since the Qing, but abundant visible evidence of abandoned terraces, now in many different stages of succession, concords with oral histories indicating that the phenomenon has a long history and many causes.

The population of Meihuashan was much greater (according to some estimates, as much as five times greater) during the mid-to-late Qing, while grain production per unit area was much lower - perhaps half of the present level at best. Therefore, the paddy area required to feed the local populace (assuming contemporary levels of demand) would have to have been roughly ten times greater than at present. Though it is known that traditional rice production was insufficient to feed the population through the course of a whole year, the presence of relict rice terraces in many broadleaf, mixed, and bamboo forests all over the reserve (and outside the reserve) reveals that there were significant attempts to match the demand. Observations in the study villages and in other parts of the reserve reveal that while paddy lands probably never reached ten times their present extent, they probably spread over an area several times greater than the present.

According to villagers, terraces were abandoned for one or more of the following reasons: 1) a decrease in the population of one or more of the adjacent villages led to a

15 This is assuming that yields from traditional varieties were roughly the same as they were in the decades before hybrid rice was introduced. Since chemical fertilizer was introduced before hybrid rice, yields were considerably higher than in the Qing.
decrease in subsistence demands; 2) population decreases diminished the agricultural workforce necessary for maintaining paddies, aqueducts, and other components of the irrigation system; 3) terrace expansion into less suitable lands (those at higher elevations, farther from villages, with thinner soils, colder water, and an insufficient water supply) reached a point of diminishing returns, with repeated years of low productivity; and 4) depredation by wild boar, monkeys, and rats made remote paddies much less productive.

Today there are relict terraces on forested slopes around all of the study villages and in all other natural villages where such features were investigated or inquired about. There are also abandoned terraces in some areas far from any existing villages. Similarities in the chronology of terrace development and abandonment in all five study villages suggests a regional rise and decline in population and socioeconomic conditions during the Qing dynasty (discussed in chapter 4). Qing population estimates, when compared with the present area of relict terraces, provide a rough idea of the extent of agricultural development during a period of maximum population and paddy land expansion. The following is a reconstruction of Qing population and terrace land conditions in light of present land use patterns in the five study villages.

The two villages of Guihe provide an example of how population change and cropping patterns in neighboring villages could affect land use conditions in one's own village. The villages of Gonghe and Guizhuping are exceptional in that they are not believed to have experienced substantial population increases during the Qing (as mentioned in chapter 4). This may have been due, in part, to the lack of available arable land until more recent times. Most of the agricultural terraces maintained by Gonghe and
Guizhuping today are outside of the valley in which the two village settlements lie; some terraces are outside of village land boundaries (on lands long held by the villages of Jiaotan and Mawu), and some paddies are outside of the nature reserve. The steep slopes immediately surrounding the villages have only small areas of relict paddies (observed only to the west and northwest of Guizhuping, and just northeast of Gonghe). These slopes have long been covered by bamboo forests, mixed forests, and in the past, by seasonally burned grass and shrublands. East and northeast of the two villages of Guihe, along the trails to Jiaotan and Mawu, lie a large number of terraces, some of which form the largest unbroken expanses of cropland in the reserve. These terraces were not constructed by Guihe villagers, but by farmers in the two neighboring villages.

During the Qing dynasty, Jiaotan and Mawu experienced a major population increase (see chapter 4), and there was a third village just south of Mawu (inhabited by Wu's who later moved to Wulang). The huge labor force from these villages developed the massive terrace system, probably in the mid-Qing, only to abandon many parts of it in the late 19th or early 20th centuries. The paddies were taken over by villagers from Guihe, and most have remained productive. About three-fourths of Gonghe's (roughly) 380 mu of paddies lie in this zone, and most of Guizhuping's 350 mu are found there as well (Guan Yanzeng; Ma Shulin, pers. comm.). At least 100 mu (seven hectares) of paddy has been abandoned in this area, but some 80% of it was given up in the late 1970s and early 1980s, at the end of the high grain production (gao shengchan) era (it is not known when the other 20 mu were abandoned). Because of the scale of these terraces, a five kilometer bamboo aqueduct from Jiaotan was required for supplementary irrigation.
The difficulty of maintaining the aqueduct was not compensated by the production level of the paddies, and the devolution of agricultural production to the household level in 1981 removed collective incentives to maintain such a system. Another reason given for the decision was that deforestation during the peak Cunninghamia-cutting years destroyed a substantial part of the water supply above some of the paddies (Ma Shengxue, pers. comm.).

Majiaping village provides a striking contrast to Guihe. Its isolation from other villages is exceptional, and has had important effects on subsistence rice production. Because of its location in a deep, steeply-sided basin. Majiaping's 180 mu of paddy land is today concentrated in the basin floor just north of the settlement. This was not always the case, however. According to village elders (who had seen the village ancestral record before its destruction in the Cultural Revolution), there were at least 300 people inhabiting the village during its period of maximum development in the Qing. Therefore, the population was at least 70% greater than that of the present. The areal extent of rice paddy is estimated to have been at least twice that of the present (Luo Changxiu; Luo Shunchang, pers. comm.), and the distribution of croplands was morphologically different. Most cropland was concentrated on terraced slopes just west of the village, and other paddies extended outward like fingers from the village nucleus, following the streams that formed the village's distinctive morphology. Today there are relict terraces in the young pine forests just west of the village, and in broadleaf and bamboo forests along four or five tributaries of the village's two main streams. The population fell below 200 some time in the Nationalist Era, and an estimated one-third of total crop area was
abandoned before the 1940s. Streamside paddies were abandoned first since those most distant from the village suffered heavy depredation by wild boar, rats, and monkeys (Luo Changxiu; Luo Shunchang, pers. comm.). The most extensive terrace area just west of the village, appears to have been abandoned more recently, probably in progressive stages over the last 40 years. Today it is covered in young pine and to a lesser extent by mixed forests.

In Taipingliao, there are abandoned terraces to the north, south, east, and west of the village (Luo Zhongkun; Luo Peizhong, pers. comm.). Starting in the early Qing, during the Kangxi era (1661-1722), Taipingliao began producing paper, and the population reached 1,000 by the reign of Qianlong (1735-1796). By the Nationalist era of the early 1900s the population reached its nadir of around 70 (see chapter 4). During the Qing, there was a major effort to meet grain demands, as evidenced by the current area of abandoned terraces, which is at least equal to the area of active paddy lands (Luo Peizhong, pers. comm.). The majority of this land was abandoned before 1949, and now consists of pine, broadleaf, and mixed forests. The roughly 5% that has been abandoned in the last 10 years, was given up because of insufficient water (and deteriorating aqueducts), excessive boar depredation, and distance from the village. Today the village has about 450 mu of active rice paddy (Luo Zhongkun, pers. comm.), mostly around the settlement area and in scattered paddies to the north and the southeast.

In Long Gui, rice cropping covers an area of about 178 mu. This is less than half the amount of paddy land that was cultivated in the 1970s, when there was still an estimated 365 mu of terraced land. There was widespread terrace abandonment between
1975-80, as economic reforms began to take effect and as communes dismantled (Luo Zhiming, pers. comm.). In the early 1900s, there was even more paddy land, and virtually all of the land surrounding the village was in paddies (Luo, Ruiqing). Four big fields and numerous smaller plots have been abandoned. These are now pines, "wasteland," or mixed forest. A large ravine northwest of the village was abandoned in about the 1930s (Luo Zhiming, pers. comm.), such relict terraces in the forest attest to the vastness of the village's former paddy lands. Today the terraces are covered by a mixed forest with an increasing proportion of broadleaf trees.

In summary, abandoned agricultural terraces are landscape evidence of bygone eras when village subsistence needs required more extensive cropland. This was most significant in the Qing dynasty, when a population surge created greater food demands. and in the mid-twentieth century, when government grain policies fostered greater grain production through collective agricultural development. Today, terrace abandonment continues even as the population grows. This is due to the following factors: 1) inputs of chemical fertilizers (and pesticides) and the cultivation of modern hybrid rice varieties allows for more grain production within less paddy space; 2) rice is used for family subsistence only (in most cases), and it is no longer economically sound to produce it for the market or to meet government quotas (taxes are paid in cash, in lieu of grain tax); 3) the depredation of rats, boar, and monkeys make rice cultivation in remote paddies especially problematic (see below).

When cropland reached its maximum area, presumably in the Qing, paddy land probably exceeded its present area by a factor of at least two or three. This would
account for between 6-10% of the present reserve area. This much agricultural clearance might not significantly affect wildlife habitat in areas where paddies were mostly small and dispersed, as long as non-agricultural lands on higher mountain slopes and summits, and remote valleys and wetlands retained sufficient forest cover. Rice cultivation came far short of meeting human subsistence demands, however, and the production of other starchy staples affected (to varying degrees) a much larger proportion of the Meihuashan than did rice cultivation. Just as the "she (xie) tian" rice cultivation system made use of fire to create ash for fertilizer, which was then spread over the rice paddy, another starch production practice involved the widespread firing of slopes, ridges, and summits to enrich otherwise uncultivated mountain soils. While agricultural clearance for rice production, at its maximum in the Qing, may have accounted for a maximum of 10% of the land area of today's reserve, the burning of the mountains for the production of starch-bearing wild plants (among other motives) effectively kept most of Meihuashan cleared of forests, and this clearance was maintained over the course of centuries.

A Supplementary Source of Starch: The Bracken Root - Fire Complex

The use of fire as a tool for landscape management in South China is well-documented in local gazetteers and by environmental historians and ecologists (Averill, 1983; Chandler, 1994; Fenzel, 1929; He and Wen, 1980; Ma et al, 1992; Marks, 1996; Menzies, 1988b; Pendleton, 1933; Qiu, 1993). While Averill (1983), Chandler (1994), and Menzies (1988) have focused on the use of fire as part of indigenous agricultural and forestry systems, especially the cultivation of Cunninghamia lanceolata and associated intercrops, Marks (1996), writing about the Lingnan region (Guangdong and Guangxi),
comments on the historical Han and Yao custom of burning non-cultivated upland areas on an annual or biennial basis. There has been little satisfactory investigation into the history and *raison d'etre* of cyclical shrub and grassland burning. Along with the dearth of historical analysis of this problem there is a lack of recent ethnographic fieldwork on the local oral history of the use of fire in grass and shrubland management in South China.

Marks (1996) implies that the origins of mountain burning in the Lingnan region lie in swidden cultivation patterns developed by Yao tribesmen and altered by the Han into a non-agricultural land use practice. By the twentieth century, and possibly much earlier, this practice was ubiquitous:

"In Lingnan, at least in the twentieth century, peasants habitually burned off the hills every year or two, not only rendering the hills unfit for replanting, but also preventing trees from growing. In Guangxi, Albert B. Steward observed that the peasant farmers 'habitually fire most of the burnable slopes in the vicinity of the homes during the dry season each year. The continuation of this practice tends to destroy the majority of the species of woody plants and change the aspect of a once richly forested country to that of a hilly or mountainous grassland.' In Guangdong, according to Fenzel, Chinese farmers 'annually burn down the grass covering the mountains.' (Marks, 1996: 71)

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16 Marks (1996: 71) states that "The vast, treeless grasslands observed in the early-twentieth century emerged as a result of a historical process of burning off the forest, planting a crop for two or three years, and moving on to another location without replanting trees. By the twentieth century, the Yao tribesman Fenzel observed had taken to replanting trees after they moved on; but the Chinese did not do so, and probably had not in earlier times. After abandoning a cleared hillside, 'the land is often invaded so seriously by weeds that further cropping is impossible,' according to Robert Pendleton, a botanist who studied similar processes in the Philippines. After five or ten years, scrub brush might grow, and the soil regain some fertility, making it possible to burn it off again. 'If, however, the weeds and the brush growing up in the abandoned clearings are removed by annual burning, tree growth has little chance to develop.'"
In the course of field investigations, Fenzel (1929) and Pendleton (1933) asked farmers why they burned off the hills on a regular basis. Pendleton was told that ashes from the burned slopes washed down and fertilized agricultural land in the valleys, a phenomenon in some ways comparable to the she tian system in Meihuashan, but one that Pendleton found unlikely since there were contour ditches along the slopes to carry water and erosional materials away from the paddies and prevent flooding of the rice crop. Fenzel (1929) got another response to the question of why montane grasslands were burned: "to deprive the robbers, tigers, and snakes of their dens (Marks, 1996)." The annual burning of the mountains in the Southeast Uplands before the 1950s is partially explained in this way by farmers there today as well, but animal control is only one of four common explanations given.

In interviews conducted in 13 study villages, in three nature reserves, spanning roughly 300 kilometers along the axis of the Wuyi-Daiyun mountains, the author found that all of the villages had a history of burning extensive tracts of surrounding uplands on an annual basis. In Meihuashan, Longxishan, Wuyishan, and areas between the reserves, the researcher sought information on the reasons for grassland burning. In all but three of the 13 study villages, one of the primary reasons for burning was to enhance the growth of bracken fern (*Pteridium aquilinum* var. *latiusculum*), or *jue cai* (蕨菜), the rhizomes (or roots, in layperson's terms) of which were used to produce edible starch powder,

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17 This may have been true in certain areas of southern China, as it is today in Madagascar, where Malayo-Indonesian tribal groups cite this as an important reason for burning hillslopes in mountains of the interior (J. Dickinson, pers. comm.).
called *shan fen* (山粉) - "mountain flour," or less commonly * juefen* (蕨粉) - "fern powder" (Table 6.1).

In these high mountain areas, which lie mostly between 650-1,800 meters in elevation, rice production was low or non-existent, and sweet potatoes were less common than in lower mountains and hill areas further east.¹ Village in Meihuashan and Longxishan did not produce enough rice each year to meet subsistence needs, and in Wuyishan there was no rice cultivation, since villages used cash earned from the commercial production of tea and bamboo shoots to purchase rice from valley market towns. In all three areas, the production of starchy staples was insufficient to sustain the population, and bracken fern roots provided a much-needed supplementary source of starch. In Fujian, bracken fern grows mostly in barren hills and mountains or along the edges of forest or shrublands (FJZWZBXH, 1991). Only by burning the mountains during the dry season (in late fall or winter), did bracken fern grow in sufficient abundance, and with roots large and starchy enough to warrant the arduous efforts of root collecting and processing (Ma Shuwen, pers. comm.). Fire kept the dense grasses (*maocao*) cleared to promote the growth of the heliophytic ferns, and laid down a yearly layer of ash for fertilizer. As one Jiangdun (Wuyishan) villager stated, "Without burning there was no *shan fen.*"

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¹ During preliminary field surveys in Dehua county, in the Daiyun Shan range, sweet potato storage caves were observed in many villages. These were never observed in the Wuyi-Daiyun range, and villagers from all three nature reserves report that sweet potatoes have not been a major source of starch.
Table 6.1. Reasons Given For Annual Burning of Montane Grasslands

Sample: 13 study villages in three nature reserves
1 = important reason
2 = secondary reason
0 = not important
NM = not mentioned

<table>
<thead>
<tr>
<th>Nature Reserve</th>
<th>Village</th>
<th>Reasons for Burning Grasslands:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Production</td>
</tr>
<tr>
<td>Meihuashan</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gonghe</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Guizhuping</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Majiaping</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Taipingliao</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Long Gui</td>
<td>1</td>
</tr>
<tr>
<td>Longxishan</td>
<td></td>
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<tr>
<td></td>
<td>Shipaichang</td>
<td>*</td>
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<tr>
<td></td>
<td>Yujiaping</td>
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<tr>
<td></td>
<td>Shangdi</td>
<td>1</td>
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<tr>
<td>Wuyishan</td>
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<td></td>
<td>Guadun</td>
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<tr>
<td></td>
<td>Sangang</td>
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<tr>
<td></td>
<td>Aotou</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Jiangdun</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Huangxizhou</td>
<td>1***</td>
</tr>
</tbody>
</table>

*Though all of the mountains in the area were burned frequently, and shanfen collection was important in many areas near these Longxishan villages, Shipaichang and Yujiaping villagers did not collect it. Shanfen was an important part of the diet, however, and was purchased in Bailian, the nearest market town.

**Burning made off-trail traverses easier.

***Ferns were also gathered in tea fields.
The effects of fire on fern growth were observed on steep slopes outside of the Meihuashan reserve near Gutian, where a *Cunninghamia* plantation had been clear cut and burned in preparation for replanting tree seedlings. Bracken ferns were among the first pioneers on the slopes in spring, with the shorter and more leathery *Dicranopteris* fern (*Dicranopteris dichotoma*), or "mangqi," becoming ubiquitous only in later stages of succession, when it formed dense green mats in the pine forest understory.

In Meihuashan, burning was extremely common and, apparently, not managed with much rigor. No groups or individuals were designated fire managers, and burning was apparently restricted by very few regulations. Timing was important however, and it was customary to burn the shrub-grasslands after the "first day of winter" ("lidong yihou," after the first day of the first winter period, one of 24 seasonal periods in a year) which normally falls on November 7th or 8th. By then the vegetation was still dry enough to burn but not dry enough to allow the fire to spread into bamboo forests, sacred forests, or village settlements, areas that were off limits to burning.

Due to their growth form and autecology, the density of ferns was probably not great, even in favorable conditions, and huge tracts of land had to be burned to meet subsistence needs. Within the vast area of montane shrub and grasslands, one villager said, "Anyone could burn anywhere. As long as you did not burn a village's bamboo forest nothing mattered, no one cared" (Ma Shuwen, pers. comm.). Fires spread easily across the montane meadows. Since burning was frequent, there was not enough fuel to give rise to a catastrophic fire that could threaten bamboo groves or sacred forests. Remnants of broadleaf forests were fairly fire resistant in this regime, since they held
moisture much more effectively than did other types of vegetation. Though such forests could be cleared and burned with some effort, as under a swidden cultivation system, fires set in the grasslands did not easily invade broadleaf forests or riparian broadleaf shrub thickets within the grasslands.

A burned area would provide plenty of bracken fern for about two years (Ma Shuwen, pers. comm.). The ferns, which grow up to over a meter in height, could be harvested in the fall and winter, between August and December. In Meihuashan, people from many villages could harvest in the highest mountains (like Gouzinao, Youpoji, and Miaojinshan) without triggering land use conflicts. Blatantly harvesting within another village's lands, however, was generally prohibited (Luo Peizhong, pers. comm.). In Wuyishan, there were also no known land use conflicts related to shanfen collection, since the population density was relatively low, especially in high grasslands where the ferns were gathered (Zhan Mou, pers. comm.).

One person could gather about 25 kilograms of fern roots in a day. The roots were then washed and beaten with a wooden mallet on a stone slab, until they were soft. This stage was often completed in the mountains, on granite boulders near where the ferns were picked. In the village, the roots were washed in a bucket and beaten again repeatedly until the water in the bucket turned white. The water was then dumped into a bamboo basket, which was suspended over a wooden tub. The watery paste drained into the tub and water was added to the basket until all the paste had sifted through. The dregs from the basket were disposed of. After sitting in the tub for a day and a night, excess water was dumped out and the paste at the bottom of the tub was placed in the sun to dry.
into the powder known as *shanfen* or *juelanfen*. The starch could be stored for a long time. To cook it, one needed only put it in a wok with water and stir it, or knead it into a hoecake and fry it. A day's collection of 25 kilograms of roots could be made into about 2 kilograms of starch powder, a ratio of about 12 to one. If we assume that each adult consumed 1 kilogram of starch every two days, as was the case with rice, then 2 kilograms (a day's harvest) was probably enough to last one adult about four days without any rice to eat (Ma Shengxue, pers. comm.).

Bracken fern is distributed in temperate and tropical regions worldwide. It was one of the most (if not the most) important subsistence food items among the Maori in New Zealand until well into the 19th century, even in areas where sweet potatoes and taro were cultivated. Like the peoples of the Southeast Uplands, the Maori burned large areas in the hills every 1-3 years to insure that starchy rhizomes were produced. These were pounded into a flour, shaped into bread, and cooked (Best, 1942).

In China, *Pteridium aquilinum* is said to occur all over the country, but most abundantly south of the Changjiang (FJZWZBXH, 1991). Although bracken root consumption in the Southeast Uplands is well known (LYDQDFZBZWyH, 1992; 15 This is a rough estimate; there are no figures available on how much *shanfen* was customarily eaten in a day. For comparative purposes, it is said that one jin (one-half kilogram) of rice was often eaten in a day before the 1960's, since there was not much to eat aside from rice. 20 Best (1942) devotes 21 pages of *Forest Lore of the Maori* to a discourse on the centrality of bracken root production and consumption in traditional Maori culture. In addition to its importance in Maori subsistence, Aruhe, as the fern root was known, had deep religious and mythical significance and high medicinal value. Best's work draws on his long immersion in Maori culture and on numerous accounts of bracken cultivation, processing, and consumption dating from the 18th and 19th centuries. These include descriptions by James Cook, George Forster, and others.

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ZHKBGBWH. 1991), there appears to be little information on the geographical
distribution of this practice in China in historical times. The fact that it was common
throughout the Southeast Uplands has important implications for understanding the use of
fire throughout China, especially south of the Changjiang (Yangzi river).

Based on interviews in the three nature reserves, there was remarkable similarity
between mountain communities in different subregions in the use of *shanfen* as a
supplementary source of starch. Probably all of the villages in both Wuyishan and
Meihuashan were self-sufficient in the production of *shanfen*. In Ao Tou village (in
Wuyishan), before the 1950s, villagers ate more *shanfen* than rice, since the latter was not
cultivated there (Zheng Fengchun, pers. comm.). Some villages in Wuyishan and
Meihuashan produced enough of the starch to sell it or trade it for rice to outsiders in
nearby market towns.

In Meihuashan, some villages were more involved in *shanfen* collecting and
processing than others. Informants in Gonghe and Mawu stated that the most active users
of bracken root (for subsistence and commercial purposes) were villages in the southern
part of the reserve, especially the two villages of Guihe, and the villages of Mawu,
Jiaotan, Wulang, Dapingshan, Daxie, Zhongcun, and Qiushan. They said that Taipingliao
was not as reliant on the starch, since the village produced enough bamboo paper to be
considered prosperous by local standards (Ma Shuwen; Lin Fucong, pers. Comm.). An
82 year old man from Taipingliao also implied that his village had not been as active in

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21 Since Wuyishan produced no rice, villagers needed no draft
cattle, and their habit of burning the mountains certainly had nothing
to do with clearing land for grazing.
collecting bracken roots as had villages further north (Baijinshan, Wuku, and Daguan). These poorer villages, he said, had depended on *shanfen* for survival (Luo Yizhang, pers. comm.).

Gonghe informants stated that there were times when one *jin* of *shanfen* could be traded for three *jin* of rice in the Gutian market. People went to the Gutian market from as far away as Longyan to purchase the starch (Ma Shuwen, pers. comm.), which appears to have also had value as a specialty item for festive occasions. Some villagers in Mawu and Jiaotan took starch as far away as Longyan to sell it themselves (Lin Fucong, pers. comm.).

Though the Longxishan villages that the author visited were not able to produce the fern starch themselves, it was collected by others in the area, and the villagers depended upon it as a staple. People in the three villages surveyed bought it in the valley market town of Bailian. Though the Longxishan villages practiced annual burning, bracken fern did not grow well. According to one informant, the soil was too "stony." Others indicated that the villagers had enough money from paper production that they did not need to collect *shanfen*, preferring to buy it, especially in times when rice was scarce or during holidays, as a special treat (Wu Xingqiu, pers. comm.).

Though this subsistence complex was widespread before 1949, central authorities of the communist regime moved rapidly to prohibit the burning of the mountains. One Wuyishan resident stated that even the local representatives of the Nationalist government had attempted to ban mountain burning by the late 1940s. The relationship between forest coverage and water conservation was well understood by central authorities, and
the first significant forest conservation efforts in Longyan Prefecture revolved around fire prevention and reforestation (LYDQDFZBZWH, 1992). By the early 1950s prefectural forestry authorities were drawing up yearly reforestation plans, establishing reforestation zones, "mobilizing the masses" in reforestation efforts, administering an aerial broadcast program to grow pines in rugged mountain zones, and prosecuting those who continued the ancient practice of firing the uplands (LYDQDFZBZWH, 1992).

The use of fire was deeply ingrained, however, and there were many conflagrations, as villagers continued burning the mountains for various reasons. Gazetteer records show that seven of the nine largest forest fires in Longyan Prefecture since 1949 occurred before 1965, and were set intentionally for subsistence purposes, including: clearing land for growing taro, burning fields to clear weeds, burning to promote the growth of bracken ferns, and burning to make fertilizer (LYDQDFZBZWH, 1992). The largest forest fire on record, which occurred over a two day period on December 31, 1960 and January 1, 1961 burned 84,000 mu (56 square kilometers) of mountain land at the border of Shanghang and Liancheng counties (near the present reserve boundaries). The fire was set by a man named Fu Guiyang, who was burning to promote the growth of bracken ferns, so that he could "dig for fern flour (wa juefen)" (LYDQDFZBZWH, 1992). The event says more about local and national history than first meets the eye. Though mountain burning for this purpose had subsided in the late 1950s throughout the province, 1960-61 saw a resurgence in bracken starch consumption, as villagers struggled to survive the famine. Many villagers recount the events of this period when they discuss the bracken subsistence system, for it was then
that many younger people gained experience collecting roots and processing the flour. During the famine, bracken was considered the key to survival in many villages.

Though large forest fires were much less common in the region after the mid-1960s, smaller forest fires were frequent. Many were set in or near rice paddies to clear weeds or make fertilizer, and later got out of control. Some, however, were illegally set in the mountain grasslands and pine forests. Of 2,409 forest fires recorded between 1977-1984, the purported reasons for starting the fires were as follows: 16.2% were set for making fertilizer (in mountain concavities); 16% were set to clear weeds from rice paddies (and went out of control); 11% were set to clear mountain land (kai huang); and 5.7% were set to "burn the mountain" (lian shan). Other alleged reasons for setting the fires included: burning rice stubble, burning debris, burning pasture land, making charcoal, making saltpeter (shao jian), worshipping (burning sacrificial paper money and incense), and burning to drive off wildlife (LYDQDFZBZWYH, 1992).

In Meihuashan, these traditional uses of fire have shaped the landscape and daily life in innumerable ways. Even daily worship in many villages still requires that three rockets, or other pyrotechnic devices, and wads of fake money be ignited early each morning.22 It should be recognized that the annual or biennial burning of large tracts of mountain land before the 1950s served a number of physical functions beyond the bracken root subsistence scheme described above. The most important related to: wildlife management; the clearance of high-elevation cattle grazing areas; and the

22 There are also ceremonial "firepit crossings" (guo huo keng), which take place irregularly, upon the recommendation of local gods, who speak through shamans during village seances. The author participated in one such ceremony in Long Gui, in April 1994.
facilitation of off-trail overland travel (mostly for collecting *juecai*, hunting, and herding cattle) (Table 6.1).

From the perspective of wildlife management, the rationale for burning the grasslands each year was to keep the vegetation as sparse as possible, thereby destroying habitat and removing cover for many species of mammals. Wild boar, monkeys, rats, and other animals often caused serious crop depredation, as is the case today. In some villages, fire was used as a retaliatory measure immediately following boar or monkey depredation. Villages also faced the threat of attacks on humans and livestock by tigers, leopards, and red dogs, which provided another reason to use fire liberally. Even the frequency of snake bites and bandit attacks was thought to decrease after foliage was removed and not allowed to regenerate.

With all of the reasons given for yearly or biennial burning, one must consider the possibility that the practice served multiple psychological, cultural, and physical functions in perpetuating a desired montane grassland landscape. The smooth, grassy aspect of the hills may have had a certain aesthetic appeal for local people, or at least signified that theirs was a domesticated landscape; well-managed, accessible, productive of food, and relatively free of marauding tigers, bandits, and other dangerous enemies. Given the ancient ritual importance of fire as an agent of symbolic purification (an important pyric ritual is described in chapter 11), the burning of the mountains may have had great significance on deeper perceptual, psychological, and cultural levels as well (Gadgil and Guha, 1992: 77-82). This is discussed in more detail in chapter 11.
Whatever the motives held by people of different regions, ethnicities, clans, or villages, the annual burning of the grasslands was encouraged as a multi-purpose management strategy. In bamboo paper or shoot producing areas, which included most of the Wuyi-Daiyun range, mountain fires had only to be kept out of bamboo forests, sacred forests, and buildings in the village settlements. In Meihuashan, annually burned grasslands once extended over the entire area that is today covered in high grassland, shrub, and pine. It also included parts of what are today bamboo, mixed, and broadleaf forests. At present, pine forests cover an estimated 65% of the reserve area (ZHKCBGBWH. 1991), and judging from oral historical accounts, the vast majority of this area was put to the torch. In the aggregate, informants from the five study villages stated that annual or biennial burning was carried out in virtually all areas (excluding bamboo forests, cropland, broadleaf forest, and settled areas) in three main areas. The largest expanse (Fig. 6.2) extended from the southwest corner of the reserve (on lands belonging to Hongxing and Wudi administrative villages today) north to Majiaping (much of which was and is surrounded by broadleaf forest) and Luodi, east from Luodi to Wuku and Daguan, south from those villages to Taipingliao, Dapingshan, and Wulang, and west to the southwest corner of the reserve. This area accounts for roughly half of the coterminous area of the nature reserve. A second, less extensive and more varied area was regularly burned from West of Long Gui, in what is today a pine forest, to the grasslands west of Da Gaoxie, east to the village of Chen Erkeng, and south to Long Gui. This area has some large tracts of broadleaf forest that were not burned, and the vegetation mosaic is much more complex. This is due, in part, to the lower elevation and
Figure 6.2. Forest Fragmentation in Meihuashan. U.S. Army topographic maps show that only fragmented patches of the once extensive broadleaf forests remained in Meihuashan in 1949. Villagers in Meihuashan and throughout southern China traditionally burned vast tracts of mountain land on an annual or biennial basis. Grasslands, the dominant vegetation under this regime, were not replaced by forests until the 1950s, when the government banned mountain burning.
corresponding thicker soils and microclimatic conditions that are more favorable for forest regeneration. The pine forests east of Da Guan and north of Baijin Shan were probably burned regularly also. Third, a fairly extensive patch of pine forest lying east of Da Gaoxie and north of Chen Erkeng was also fired on a regular basis by those villages.

Today in Meihuashan, most of the former montane grasslands have become dense, nearly impenetrable forests of short Huangshan pines above 1,250 meters, and Masson pines and mixed forests at lower elevations. This is largely the result of aerial pine seed broadcasting in 1957, a program implemented by central authorities to reforest the denuded uplands. The natural regeneration of broadleaf taxa in the montane grasslands is occurring only along streamside ravines, where broadleaf shrubs and trees form dense, linear thickets in the pine-grass-shrublands above about 1,400 meters. In the high mountains, the soil layer is thin, the wind strong, and winter frosts frequent, so the reestablishment of mixed coniferous-broadleaf forest (the representative natural vegetation of the region) may take many, many decades.

Cartographic data provide further evidence of the areal extent of vegetation clearance from annual burning in the Meihuashan and Longxishan landscapes before 1949. In 1942, the Fujian Provincial Land Survey Bureau prepared 1:50,000 topographic maps of the province. In 1955, the U.S. Army Map Service revised these maps using aerial photographs of certain sections. The maps, which are available in the

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23 Period maps of the area of Wuyishan Nature Reserve were not found, though there were maps for the area just to the east and south.
U.S. Library of Congress, provide the possible synoptic view of land use, village sizes, and vegetation cover in the 1940s and 1950s. They are also a useful guide to place names, many of which have changed in subsequent decades. While the maps may not accurately delineate small agricultural plots, they do show larger patterns of montane land use and vegetation coverage, especially the ratio of montane forest to shrub and grassland.

The maps were used during interviews with local people, especially those old enough to discuss land use and vegetation changes since liberation, and the historical, political, social, and economic implications of those changes. The maps provide dramatic evidence of the degree of forest fragmentation that annual burning in the Meihuashan landscape caused through time.

Forest patches shown on the map correspond closely to the distribution pattern of broadleaf forests of the present. This is probably due to the fact that the remaining broadleaf forests were the only forests left. Other forests, if they existed, were probably sparse or small in area, and so were not mapped. Since broadleaf forests did not burn as easily, it makes sense that they withstood the traditional firing regime. The largest patches shown on the forest fragmentation map are those surrounding Majiapang, those

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24 In addition to natural features that are standard in USGS contour maps, the map legend includes a comprehensive key to 10 land use/vegetation types: rice paddies, cultivated fields, plantation or orchard, tea, sugarcane, salt evaporating areas, woods or brushwood, scrub, marsh or swamp, and land subject to (periodic) inundation. The legend also contains over 20 types of linear and point cultural features of the built environment such as: roads and paths (eight types), railroads (4 types), Confucian temples, other temples, houses (not in legends but on maps), urban areas, and cemeteries, and tombs. These features are only represented in the maps where surveyors were able to detect their presence or map makers were intent on including them. Therefore, many temples, graves, footpaths, and even paddies or significant parts of them were not included in the 1:50,000 maps, whereas they may have been represented in larger scale maps based on ground surveys alone.
south and east of Taipingliao, scattered patches from north of Guizhuping to southwest of Long Gui, and patches along the north central border of the reserve. According to Long Gui natives, there was more broadleaf forest near that village than is shown on the map (Luo Ruiqing, pers. comm.). From this evidence, it is likely that the map does not show all of the forest stands that existed at the time. There was little evidence, however, that the forest area was much more extensive than the map indicates.

The Provincial Forestry Bureau has determined the approximate ages of all of the vegetation stands in the reserve, based on average ages of selected trees and shrub. Based on this system, most of the broadleaf forest stands corresponding to the forested areas shown in the 1955 maps are today between about 45 and 65 years old (Fig. 5.6) (MGJJZRHBHQGLC. 1991). These are the oldest vegetation stands in the reserve (though there are many trees within these stands that are much older).

Traditional Commercial Forestry: Bamboo Cultivation, the Paper Industry, and Sideline Cottage Industries

Bamboo has played a critical role in the culture history of China. It has also been widely utilized, over the millennia, by diverse peoples throughout East and Southeast Asia. Its rapid growth, high productivity, and physical properties, like strength, lightness, and flexibility, make it one of the most useful plants on earth for the construction of

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25 In the map legend, the ground survey accuracy is rated "fair," and there were probably many errors in the final maps.

26 It should also be noted that the U.S. Army maps do not appear to be flawed by a general tendency toward under-representing the forest coverage in the areas surveyed. Some maps of other areas in the Wuyi-Daiyun range show extensive forest coverage. Longxishan, for example, appears to have had considerably greater forest cover than Meihuashan.
buildings, boats, fences, and a wide variety of weapons, tools, utensils, and other products (see chapter 9) (EFCANTU, 1980; Huang, 1992). Its edible shoots have long been utilized as both a subsistence food source and a much sought-after delicacy.

The long-term interdependence between people and bamboo has contributed to the spread of certain bamboo species. Of some 1,000 species worldwide, over 300 are found in China. Roughly 80% of the total area of bamboo forest in China is, however, dominated by one species, "furry" or "hairy bamboo" (maozhu) (Phyllostachys pubescens var. pubescens) (Huang, 1992). In Meihuashan and throughout the Wuyishan range, maozhu bamboo has been the most important forest product for centuries. From an economic standpoint, it is also the most important species of bamboo in China. Maozhu bamboo is cultivated most widely in subtropical China, south of the Changjiang (EFCANTU, 1980). Stands of this species comprise 80% of the country's total bamboo forest (Huang, 1992). Maozhu grows at elevations between 100-1,500 meters, but is most productive when grown in hollows or on lower slopes, between 300-800 meters. These sites are protected from wind and have relatively thick, soft soils, with more humus and higher water content (Huang, 1992).

In Fujian, which has more land area in maozhu bamboo forests than any other province, the most extensive forests are found in the central and western mountains, from Daiyunshan west to the Wuyi range, along the entire NE-SW axis of the province (Lin, 1990). Since natural conditions in the Wuyi-Daiyun range are superior to those in other parts of the province (and because the terrain allows for few economic alternatives), the mountain prefectures of Longyan, Sanming, and Nanping produce most of the province's
bamboo. In 1994, these three (of nine) prefectures produced 63.3% of Fujian's bamboo (FJSTJJ, 1994).

Maozhu bamboo can spread from roots without sexually reproducing. In fact, in favorable soil, water, and climatic conditions, this species can go without flowering for up to 100 years. As long as the culms do not flower, new shoots break through the soil surface each year or two, rising from a complex, rapidly-growing underground root system. To encourage the spread of bamboo, one needs only to insure that existing culms are surrounded by enough space to spread roots and enough good soil for sprouting shoots. When these requirements are met, maozhu bamboo spreads rapidly.

Due to a number of climatic, soil, and anthropogenic factors that affect the nutrient storage and physiology of maozhu bamboo, shoot growth is often most prolific in alternating years. In spring, a particular stand or forest of bamboo will produce many shoots. only to be followed the next spring by little or no shoot growth. The productive year is called a "big year" (da nian), the unproductive year a "little year" (xiao nian). Usually a fairly extensive area is affected by the same conditions, and the cycle is synchronized over large areas.

Since maozhu bamboo is a heliophyte, it grows best in areas where there is little or no underbrush over the shoots, and no canopy cover above the mature culms. Through the centuries, humans have fostered the spread of bamboo by clearing adjacent trees and understory plants that could inhibit the growth of new shoots, and eventually overtake the bamboo forest itself. Under these conditions, it has formed pure stands, which in some places cover many square kilometers of mountain land. Over the last decade, the practice
of manual defoliation (or "cutting" - *pi*) has intensified, as families strive to increase the
density and area of their newly acquired bamboo stands.

It not known just how many centuries ago people began to promote the spread of
bamboo forests in Meihuashan. It is likely that aborigines and early Han settlers favored
bamboo as a source for building material, tools, and shoots. It is certain that by 1000
A.D., bamboo was an important part of the local and regional economy. By the Song
Dynasty (960-1279), bamboo paper production was the most important industry in
southwest Fujian. By the Ming (1368-1644), locally produced "Minxi Paper (*Minxi
tuzhi*)" was exported to countries throughout Southeast Asia. During the reign of the
first Qing emperor, Shunzhi (1644-1661), paper from Liancheng county was presented as
tribute (*zou*) to the emperor in Beijing. By the end of the Qing, so-called "Jade Button
(*yukou*)" paper, produced in Changting (which included Meihuashan), was exported to
India, Japan, and other countries (LYDQDFZBZWH, 1992).

Before 1949, each village relied upon bamboo to different degrees; some
specialized in the production of certain types of paper, others in the production of pulp,
which they traded with villages more skilled in paper production; still others may have
had no processing capability, choosing instead to sell bamboo shoots, poles, and other
forest products. Even in villages where paper was manufactured, some villagers
supplemented household or clan incomes with other types of forest resource extraction
and trade.

There were a number of stages preparatory to paper making, activities in which
those who were unskilled or otherwise unable to undertake the manufacturing process

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were productively and profitably engaged. First, young bamboo culms had to be cut. These had to be new culms, harvested just weeks after growing out of the ground, but "before six pairs of stems had developed from the culm" (Ma Shengxue, pers. comm.). The cutting had to be done in a shoot-producing year (da nian), and enough culms were harvested at this time to be used for two years, until the next da nian.

All stems and roots were removed, and the poles were split lengthwise into roughly meter-long strips, bundled up, tied with cord, and placed in a soaking pit (hu tang) (Figs. 6.3, 6.4). When the bundles were in place, in two rows across the bottom of the pit, and the cords were removed. Lime (from crushed limestone) was sprinkled on the bamboo strips, and water was added until even with the top of the stack. Finally, the bamboo was tamped, so that the lime spread evenly. This was repeated, layer after layer, until the 1-2 meter deep pit was full. Rocks were placed on top of the stacks, to hold the pile in place. The bamboo strips were soaked for 50 days and removed. The water was then drained through a bamboo pipe running from the base of the pit. The stacking and preparation process was repeated, and the strips were soaked again, this time for 60 days. The strips were then removed, and the fine skin was removed from the inner pith. The first would become sacrificial money, the latter was converted into high-quality paper, used for writing and painting. Though manual paper production is becoming rare in Fujian, and is illegal in the Meihuashan nature reserve (for reasons discussed below), stone-lined soaking pits are a common sight in bamboo groves throughout the region.

Some villages did not produce paper, but were engaged in preparing the pulp. This involved the process described above, plus the following: placing the wet pulp in a
Figure 6.3a. (Top) Bamboo Strips Stacked in Soaking Pit. Bundles of bamboo strips have been stacked and weighted down with rocks in preparation for the first soaking period.

Figure 6.3b. (Bottom) Soaking Pit With Submerged Bamboo Strips.

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huge lever-operated press to remove excess water (these presses are still used to
dehydrate edible bamboo shoots), and pounding these materials in a huge pounding mill
(so-called shui che dui, which are still used for rice polishing and other processes) that
was driven by a water-wheel. The pasty pulp, known as bamboo silk (zhu si), was then
ready for conversion to paper in one of the small workshops known as "paper factories"
(zhi chang).

Paper factories were roughly the size of a house, though some were larger. Ruins
of some of these workshops, as well as an active one observed outside of the reserve,
indicate that they were earth-walled, at least in recent times. Inside, at one end of the
building, there was a rectangular vat, which was filled with bamboo pulp and water. A
mesh screen mold was dipped into the vat, and a wet sheet of pulp sediment formed on
the mold. These wet sheets of aggregated sediment were peeled off and placed in a neat
stack. Running lengthwise down the center of the room was a tent-shaped earthen drying
wall, within which a fire was maintained. The fire was fed from outside, since the end of
the "tent" opened at one of the outside walls of the building. Wet sheets were placed
carefully upon the warm wall, brushed flat, and allowed to dry for a few minutes, before
being removed as the final product. In this way, about 1,200 sheets of paper could be
produced by a couple of workers each day (Ma Shengxue, pers. comm.). Each factory
typically employed three or four workers on a regular basis (Luo Peizhong, pers. comm.).

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27 Early factories were probably wooden, though the interior drying walls were probably made of clay.
The importance of paper production in the economy of a particular village can be inferred from the number of active "paper factories" (zhì chang) extant at a given time. Oral histories of the five study villages reveal a surprising degree of economic diversity and changing patterns of paper production through time. Gonghe village provides a case in point. For most of its history, the village did not produce paper, probably because none of the villagers had been trained in the art of paper making. Still, villagers depended on the paper trade, since their most important economic activity was the production of finished pulp ("bamboo silk"). This was transported across the mountains to Majiaping, where paper production flourished early on. The stone road between Majiaping and Gonghe was kept in good repair, since it was a critical transport route through most of the Qing. By the late-Qing, however, Gonghe village began to produce paper. The new enterprise was successful, and there were up to nine factories there through much of the twentieth century (Ma Shuwen, pers. comm.). These operated until 1987 (Fig. 6.4).

In Guizhuping, there were seven paper factories that operated from some time in the Qing up until the 1980s. The village was also well known throughout the region for producing items made from a species of marsh grass (described below), the sale of which provided them with a substantial portion of their annual income.

In Majiaping, paper making reached an early apex in terms of quality and volume of production. This was due to the village's relative proximity to traditional paper centers in other parts of Liancheng county, such as Luodi and Luxi. In the Qing dynasty, the village had nine factories that produced a famous, high quality paper called "golden village paper" (jinzhhuang zhì). This paper was sold to merchants in Miaoqian and Luxi,
Figure 6.4. Bamboo Paper Produced in Gonghe Village. This villager is holding mao bian (zhi) paper. Paper was produced in the village until 1987, when the reserve banned the practice to prevent stream siltation. This type of paper is still produced in remote mountain villages in the region. Much of it is burned as "money" offered to the ancestors, thus the common name today, "superstition paper" (mixin zhi).

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some of whom sold it in Guangdong and overseas. The production process was more time consuming, and it was not known by other villages in Meihuashan. From the end of the Qing (1911) to 1949, however, there were only three factories in the village, due to socioeconomic problems (see chapter 4). After 1949, Majiaping had four factories, but they only produced regular paper (mao bian zhi), since people lacked the time and resources to make jinzhuzhuangzhi. The village ceased paper all paper production by the late 1980s.

In Taipingliao, informants know of only three village paper factories before 1949, and there were two from then until the 1980s. Some families engaged in selling forest products, such as dried bamboo shoots and saltpeter (jianshui) (described below).

In Long Gui, paper production began in the late Qing, but it ceased completely some time around the late 1930s, when war and banditry nearly wiped out the village (see chapter 4). One informant stated that paper production had never been great in Long Gui, since sources of lime were too distant (Luo Ruiqing, pers. comm.). Even in Gonghe, this was a problem, but one that villagers chose to surmount by hauling lime in from Gutian on the return trip from selling paper in the market there. In later decades, Long Gui's paper industry was revived, but as in other villages, it was only to last until road access was created, which, in Long Gui, was 1981.

In Long Gui, as in some other villages, there were additional cottage industries that sometimes surpassed paper production in importance or replaced it altogether. From the 1930s onward (and possibly before that time), saltpeter (xiao or jianxiao) and mushrooms were the most important products that the village could produce and trade
Saltpeter (Potassium Nitrate or Sodium Nitrate) was produced from the ashes of green bamboo mixed with water. One bamboo pole could produce 2-3 Kg of saltpeter, which was poured into bamboo tubes and carried to Gutian. From Gutian, it was taken to Longyan for processing into products like gunpowder, insecticide, soap, and fertilizer. Informants in Long Gui say that many of the villages in the region produced saltpeter, since it was much easier to make than paper (Luo, Ruiqing, pers. comm.).

Guizhuping villagers also earned money by making products from another local plant, "mat grass" (*xi cao*) (*Lepironia mucronata*). While burning the montane grasslands each winter, the villagers made sure to burn the wetlands as well, for these were where the mat grass grew, and it grew in greatest abundance after fires. The villagers then harvested the grass to weave certain products, especially bed mats, but also sandals, bags, and other household items. They sold these in Gutian and Wanan, often earning almost as much money in one year as they did from bamboo. In recent years, a grass mat could still fetch up to 300 yuan (Guan Yanzeng, pers. comm.).

**Summary**

From the earliest period of Hakka settlement, late in the Southern Song dynasty (1127-1279), to the end of the Chinese Civil War in 1949, the landscape of Meihuashan was transformed to meet the subsistence and commercial needs of village communities. The production of rice, vegetables, bracken flour, and paper in each village led to the conversion of once vast subtropical forests into a mosaic of rice terraces, montane grasslands, bamboo forests, and forest patches. Extreme population growth in the
mid-to-late Qing placed an unprecedented demand on the land to produce food for basic subsistence. The burning of the mountains on a regular basis promoted the growth of ferns and opened land for cattle grazing. Burning was probably also intended to keep wildlife populations within manageable levels, to drive out tigers, leopards, dholes, monkeys, rats, and wild boar, and to remove the high grass and shrub vegetation where these species could find cover.

While each village community altered the surrounding natural vegetation to suit their needs and preferences, they also insured the survival of patches of old growth broadleaf forest and planted or protected existing stands of Cryptomeria or, in rare cases, Cunninghamia. The custom of village sacred forest preservation is discussed in chapter 7 and in more detail in chapter 10.

The following chapter describes the ecological impacts of village land use after 1949, and especially the most dramatic changes, which have occurred in the past two decades.
THE TIGER AND THE PANGOLIN:
CULTURAL ECOLOGY, LANDSCAPE ECOLOGY, AND NATURE CONSERVATION IN
CHINA'S SOUTHEAST UPLANDS

VOLUME II

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
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requirements for the degree of
Doctor of Philosophy

in

The Department of Geography and Anthropology

by

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During the first 30 years of communist rule, an unprecedented degree of
government intervention in village land tenure relationships, subsistence patterns, and
cottage industries, brought massive change to the traditional social and economic order of
village life (see chapters 4-5). As Chinese Communist Party leaders carried out land
reform, collectivization, and communization, family-based commercial paper production
was transformed to a communal enterprise geared toward meeting quotas set by local and
regional cadres, the engineers of the command economy. In the 1950s, the practice of
fern root consumption was essentially abolished because of a strict prohibition on
burning the mountains. In the early 1960s, following the Great Leap Forward, starvation
forced local people to continue this and other traditional foraging practices. Following
the famine, government coercion made grain production the most important economic
activity, and during the Cultural Revolution, villagers were expected to increase yields by
growing two crops of rice per year. Village families, having lost all means of making
substantial economic profits, concentrated most upon staying alive and following
collective and communal initiatives¹ (although the most remote villages, like Majiaping,
as mentioned, were able to evade government control to a greater extent). It was not until
the late 1970s that villagers regained some degree of control over local land use practices.

¹ This is not to suggest that there were not improvements in the
standard of living. As most villagers agree, standardized universal
education, better healthcare, and the modification of house materials
and construction were substantial socioeconomic gains.
and by then, socioeconomic and resource tenure conditions had been changed fundamentally and perhaps irrevocably.

Central control over rice and bamboo production transformed villagers into laborers on their own (traditional) lands. Except for the period of the Great Leap Forward, most of the local labor force was intensively concentrated upon the relatively small area of pre-existing rice paddies and bamboo groves. There was no need to expand these cultivable areas, but merely to reclaim parts of a formerly more extensive rice terrace system. Pre-existing bamboo groves, which surrounded each village, were sufficiently large to meet the needs of the command economy, and villagers had no incentive to expand bamboo forest through clearing adjacent forests (Ma Shuwen; Ma Shulin; Luo Changxiu; Luo Zhongkun; Guan Yanzeng, pers. comm.).

Patterns of ecological change in Meihuashan during this period were strikingly different from those of the surrounding mountains and valleys of lower elevation. While rampant deforestation during the Great Leap Forward and the Cultural Revolution left devastation across vast tracts of the Southeast Uplands Region, Meihuashan lacked the requisite network of serviceable roads (and most villages lacked the large streams) to support such enterprises until the late 1970s and early 1980s.² For these reasons, the most dramatic change in the vegetation patterns of Meihuashan at the meso-and macro-scales was the disappearance of widespread montane grasslands under a virtual sea of

\textit{Huangshan} and Masson pines (Fig. 7.2). Since pine seeds were aerially broadcast in

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² Taipingliao and Majiaping were exceptional in this case (see below).
anthropogenic grassland zones throughout the Southeast Uplands, this human-influenced succession occurred throughout the region. Meihuashan is exceptional in that the logging of more mature forest stands was not as severe or systematic during this period as it was elsewhere (Guan Yanzeng; Luo Changxiu; Luo Ruoqing; Luo Zhongkun; Luo Zhiming; Ma Shengxue; Ma Shuwen, pers. comm.).

While the government prohibited the use of fire to clear the grasslands, village customs prohibiting the cutting of trees in the fengshui forests were, with some relatively minor exceptions, strictly upheld. The existence of these forests is testimony to the power of village forestry traditions, especially since there were periodic efforts to cut them down (Luo, Zhiming; Luo Ruiqing; Ma Shengxue; Ma Shuwen, pers. comm.).

After the Cultural Revolution, and especially after the economic reforms of the early 1980s, land use changes were largely in response to new opportunities, market forces, and technological change. The Individual Responsibility System brought a series of economic and political freedoms that had mutually amplifying effects on land use and resource extraction. For the first time since the early 1950s, families had virtual ownership of their own rice and bamboo plots, and could make their own decisions regarding production and marketing. Newly adopted hybrid rice varieties led to self-sufficiency in rice production for the first time in history. New roads put an end to paper production, as the demand for poles for scaffolding in urban coastal construction projects increased. Collectives gained rights to sell timber under a quota system, and the value of Cunninghamia (also for construction) rose exponentially in the early 1980s. As a whole,
these developments have led to new ways for the people of Meihuashan and others to define and use local natural resources.

The advent of more powerful and destructive technologies has put tremendous pressure on wildlife habitat throughout the Southeast Uplands. The speed with which humans can transform the environment has increased, and only proactive conservation has the potential to hold environmental degradation in check. Since the end of the Cultural Revolution, some of the most devastating local and regional examples of degradation include: rapid expansion of the road network, increased cutting of primeval stands of Cunninghamia, Cryptomeria, and other tree species (even within sacred forests), increased use of agricultural chemicals and rat poisons, which have spread through the food chain, increased use of firearms and headlamps in hunting, and increased use of electric shock devices for fishing.

The growth of a capitalist economy has both increased market demands for a wide variety of natural resources, and created an expanding web of economic pressure on rural people, who must convert available natural resources into cash income. New patterns of resource extraction have given rise to new patterns of landscape delineation and to land tenure conflicts between neighboring families and neighboring villages.

At the village level, new household land tenure patterns provide fertile ground for bitter disputes and inequity, on the one hand, or for equitable resource tenure and periodic redistribution of land resources, on the other. The following examples of land tenure relations, subsistence, and economic land use in the 1980s and 1990s present a new set of
problems and prospects for protected area management and wildlife conservation, both within and beyond the boundaries of Fujian’s nature reserves.

Village Rice Paddy and Bamboo Forest Land Tenure Distribution: Issues of Equity

As part of the nationwide economic reforms, in 1981, all of the natural villages in the Southeast Uplands (and other parts of China) held meetings to divide up certain parts of what had been collectively owned lands. In Meihuashan, the chief (duizhang) of each natural village led the meeting, and the collective’s rice paddies, vegetable plots, and bamboo groves were distributed among households according to the number of people in each family. All other lands (forest and grasslands) remained the property of the collective. In redistributing rice plots, some villages subjectively took into account the variation in productivity between different plots (which is largely a function of elevation), and the distances of individual paddies from the village. Some villages carried out redistribution on the basis of land deeds (tudizheng) that had been issued to poor and middle peasants during the land reform campaigns of the early 1950s. In this system, families were given rice and/or bamboo plots that had belonged to them for the brief period after land reform (1952) and before collectivization (1957), (and in some cases before liberation). Others received the same lands they had owned, but with adjustments based on their present household population. Still other villages chose to distribute the collective land solely on the basis of present household populations, regardless of former land deeds.³

³ Of eight villages in the eastern part of the reserve where this information was sought, one had undergone land redistribution on the basis of household population, three on the basis of old land deeds with adjustment for household population changes, and four on the basis of
As these decisions were being made in village meetings, some villages decided to continue holding regular meetings, at fixed intervals of between five and 20 years. The purpose of such meetings would be to redistribute land on a regular basis, as household populations changed due to births and deaths. Other villages did not plan to meet again, effectively deciding then and there that lands allotted to each household would never have to be redistributed, regardless of changes in household size. The ramifications of these decisions could be very great, and the potential future of land tenure and power relations in the villages spans the political economic spectrum (Fig. 7.1).

In the worst possible future scenarios, there could be a return to a landlord-landless laborer system, in which those with more bamboo land and wealth gradually buy up longterm rights to use the lands of other villagers. In the best, a system of flexible land redistribution could be sustained. The fact that the villages in Meihuashan are composed of agnates may reduce conflicts to some extent, and it is possible that non-agnatic communities, as found in Longxishan and Wuyishan, will not fare well without regular meetings and a land redistribution system (some have planned to hold regular redistribution meetings, others have not). In either case, there is economic pressure to expand family bamboo forests into other forest stands, which usually belong to the collective, eventually replacing more diverse stand types with bamboo monocultures.4

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4 Some villages have mixed bamboo-cunninghamia stands, which are more diverse from an economic perspective, but only marginally so from an ecological perspective.
Villages like Long Gui and Gonghe are committed to a flexible system, with periodic redistribution of rice and bamboo plots. In Long Gui, meetings are held every five years to redistribute both rice and bamboo lands. One informant stated that land was not distributed fairly in 1981, because land area and land quality were not carefully determined. This problem was mitigated, however, when land was redistributed in 1986 and 1991.

In Gonghe, meetings are held every 10 years and the current land use divisions are generally seen as fair, so conflicts are rare. In Guizhuping, on the other hand, there are no meetings planned. When asked about this issue, two village informants were in disagreement about the ramifications. One man felt that the present allotments were unfair and would definitely lead to greater inequity. Another man, the elected Party Secretary of Guihe, countered that under the present system, the more one works (to expand ones present bamboo groves) the more one gets ("duo lao duo de").

This point lies at the heart of the bamboo problem, for villagers are expanding their bamboo forests. it is at the expense of other, more biologically valuable vegetation communities, especially broadleaf forests (see chapter 9). It is also an incursion onto collective forest land, where no cutting of timber is permitted without a permit from the reserve. With each family striving to enrich themselves through the sale of bamboo

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5 As one of the reserve directors stated, propaganda and education campaigns to prevent the cutting of broadleaf forests have largely failed. For this reason, the reserve issued a notice to all of the villages on February 22, 1995, entitled, "On Strengthening Management Measures for the Protection of Broadleaf Trees Within Bamboo Forests." These regulations include prohibitions on felling and ringing broadleaf trees. Other provisions of this legal notice are discussed in chapter 9.
Individual Responsibility System (1981); Bamboo Allotted to Families:

According to Land Deeds of Early 1950s, Typically No Plans For Redistribution

According to Land Deeds and Family Size, Often No Plans For Redistribution

According to Family Size Only, Sometimes Plan For Redistribution

Possible Scenarios in the Nearterm:

According to Land Deeds and Family Size:

- Area of family plots determined by deeds; inequities likely.
- No redistribution; ratio of family size to plot area likely to be increasingly imbalanced.

Possible Scenarios in the Longterm:

- Domination of bamboo forest tenure by one or a few families. Increasing population density. Tenure inequity. Total bamboo forest area expansion possible.
- Village bamboo forest area expands, population grows, forest tenure equitable.
- Village bamboo forest area limited to original area, population controlled. Forest tenure equitable. Bamboo production and income increase as culm density increases.

Legend:

- Small Bamboo Forest Allotment
- Large Bamboo Forest Allotment
- Indicates Many Family Members Per Plot (High Family Population/Area Ratio)
- Indicates Few Family Members Per Plot (Low Family Population/Area Ratio)

Fig. 7.1 Possible Trajectories of Household Bamboo Forest Tenure.

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poles, pressure to expand stand area increases. In Meihuashan, villagers and reserve managers state that the area of bamboo forests has expanded since the 1980s, and individual stands have begun to spread even more rapidly in the last few years under more intensive management. Since raw poles need only have their thin branches removed with a field knife, little processing is required and there are few barriers to rapid resource consumption. Though the reserve headquarters issues annual harvest quota permits to each village, these can be increased any time the quota has been met, and this has become common practice.

The inequity of land tenure has also affected Majiaping, where bamboo allotments have not changed since 1981, and there are no plans to hold redistribution meetings. The land tenure situation was seen by at least one informant as already unfair and "getting worse and worse" in the future. He said that those with lots of land were earning the most money from bamboo (2-3,000 yuan per year), while those with little land were earning very little (3-400 yuan). Though there has been talk of having a meeting, it has never happened (Luo Shunchang, pers. comm.).

In Taipingliao, there is a meeting every five years to redistribute rice paddies and one every 20 years to redistribute bamboo. Informants did not comment on the fairness of the system or the frequency of conflicts. In eight other villages surveyed (in the eastern part of the reserve), seven reported that there were no meetings to redistribute land, and none planned. It is conceivable that meetings could be held some time in the future. It is likely, however, that as a village's land tenure patterns remain unchanged over time,
resistance to change grows stronger; those who have positioned themselves well will probably predominate in most conflicts.

One of the most serious problems relating to economic disparity and land tenure is that wealthier families may be gaining a monopoly on land and labor resources. The wealthy are already at an advantage in a number of ways. First, they can afford to cut bamboo once a year or less, which allows their stands to increase in density year by year, providing the potential for greater harvests each year. In contrast, poor families must harvest bamboo whenever they need money for basic subsistence purposes, a number of times each year, and their stands may never reach high densities. In Gonghe, for example, only about 10% of the households are able to reduce their bamboo harvest to a rate of once per year. Second, richer families can afford to hire more outside laborers, migrant workers from other counties in Fujian, from Jiangxi province, and even as far away as Sichuan province. The heads of wealthier families are becoming the equivalent of straw bosses, operating as brokers in the growing competition for jobs, land, and money. At the very least, the hiring of outside laborers to work in the bamboo forests is changing the system of labor relations and inter-familial economic cooperation. At its worst, the disparities may be driving land degradation by forcing poorer families to sell or lease part or all of their land to wealthier villagers, expand their remaining bamboo stands into adjacent collective forests at an ever increasing rate, or become laborers on others lands as they lose their own. The relationships between income, bamboo forest tenure patterns, and bamboo management practices is analyzed in chapter 9.
The dynamics of rice paddy distribution and household tenure are considerably different from those of bamboo, and local grain production is still primarily a subsistence activity rather than a commercial one. Meihuashan, like most of the Wuyi-Daiyun region, has long been deficient in rice production. The central government recognizes this problem, and while implementing the Responsibility System, it made villages in the region exempt from "state purchase responsibility" (zhenggou zeren). In other words, each family was free to use or sell rice however it saw fit, paying an annual flat tax to the government in lieu of the required quota of grain that most peasants must sell to the government at a set price. Even after great gains in rice production following the reforms, by 1986, Meihuashan villages had not reached the national standard of grain self-sufficiency. In 17 natural villages surveyed, average per capita rice production was 347 kilograms, while the national standard for self-sufficiency was set at 400 kilograms (ZHKCBGBWH. 1991). It should be kept in mind, however, that with the substantial decrease in daily rice consumption the definition of self-sufficiency may need to be modified. Villagers state that one adult eats about one-half a jin (one quarter of a kilogram) of rice per day, half as much as they did in the 1960s (Luo Zhiming, pers. comm.).

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6 One Long Gui villager, his wife, child, and two parents, have about 1 mu of paddy on which they can grow 1,000-1,100 jin/year. This is high quality land at about 700 meters in elevation, so the production level is unusually high. Other couples have more or less land, depending on how much they have abandoned. The family eats about 80% of the harvest, and the remainder is saved until the next year. This consumption comes out to about 176-210 jin per person (depending on how the child's consumption is estimated). Before liberation and until about the late 1960's each person had to eat a jin (one-half kilogram) of rice per day because there was little else. Today the family averages between .48-.58 jin per day.
While villagers require less rice for their own consumption, there is rarely enough surplus for commercial purposes. Rice production for commercial purposes is generally seen as a losing proposition (*kueiben*), due to the costs of fertilizer, pesticides, seeds, tools, and labor, and the low government subsidies. As a result, there has been a continuous decrease in the ratio of crop area per capita. While no new paddies have been developed in recent decades (and many have been abandoned), there has been a steady natural increase in population. In 1980, there was an average of 2.43 *mu* of paddy per person in the 26 natural villages of the reserve. This figure dropped to 2.20 in 1986 and 2.0 for all 18 administrative villages (*ZHKCBGWYH*, 1991). Paddy area per person for the 10 administrative villages of Buyun township were 2.3 *mu* (or .153 Ha) in 1985 (*Buyun Township People's Government*, 1985). Though official data were not available in 1994, the five study villages averaged only 1.6 *mu,* (.107 Ha). These figures suggest a dramatic decrease in paddy land per person in the last decade. This trend seems to coincide with the advent of higher-yielding rice crops, a decrease in grain consumption, and an increase in the consumption of meat, vegetables, and other foods purchased in the market towns.

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*Gonghe could not, or chose not to provide data on the area of village paddy. There are obvious problems with this comparison of the unofficial 1994 figure on the average area of paddy per person in four study villages with the official 1985 figure for the 10 administrative villages. One must take into account the fact that paddy per person in these four villages may have been substantially below average in 1984. Since the government is not monitoring terrace abandonment in Meihuashan, even though such activity is illegal, there are no other figures available. This is one example (among many), of how the reserve's division among three counties and seven different townships make record keeping, administration, law enforcement, and economic development highly problematic.*
In the mid-1990s, there is considerable variation in the amount of paddy land that each family cultivates. Some families have chosen to reduce their rice cropping area to the minimum sufficient for yearly household consumption. Many families have chosen to abandon less productive paddies or those that are frequently plagued by rats, wild boar, or other animals (Luo Zhiming; Ma Shengxue, pers. comm.).

Most abandoned croplands are higher elevation paddies or those that lie farthest from the village settlement, and rice production per mu is directly related to elevation. "Class I" land can produce 500-550 kg/mu (wet weight) (7,500-8,250 kg/ha). Class III land may only produce 200-250 kg/mu (3,000-3,750 kg/ha) (Luo Zhiming, pers. comm.). Long Gui village, with some of the most fertile land in the reserve (due to its low elevation), has approximately this range of productivity. In contrast, Gutian produces about 1,000 kg/mu (15,000 kg/ha) (Luo Zhiming; Fu Yongcheng, pers. comm.).

In most Meihuashan villages, which use ravine terraces, there is a maximum of 100-200 kg/mu (1,500-3,000 kg/ha), or as low as one-tenth the productivity of Gutian. Around 1949, using only nightsoil and ash fertilizers they could grow only 50-75 kg/mu (750-1,125 kg/ha). In the 1950s, villagers began to buy chemical fertilizer, which they lugged over the mountain trails from the market towns. At that time they used about 3-5 jin of the chemical fertilizer per mu and increased production to about 150 kg/mu (2,250 kg/ha) (Luo Zhiming; Guan Liteng, pers. comm.).

Today most villagers use about 40-50 jin of fertilizer per mu and can produce 500 kg/mu (7,500 kg/ha) in the very best paddies. Many mix chemical fertilizer with the manure of hogs and cows, human night soil, and the ashes of burnt ferns (Dicranopteris)
and other herbaceous and woody plants (Luo Zhiming, pers. comm.). Others now use organic fertilizers only on vegetable crops and not on grains (Ma Shengxue, pers. comm.). It is estimated that chemically enhanced fertilizer is ten times more effective by weight than the same amount of nightsoil and ash (Guan Liteng, pers. comm.). The intensification of chemical inputs and the advent of hybrids, has thus significantly decreased the spatial requirements of agriculture.

While rice production in Meihuashan has reached a low level of self-sufficiency, albeit one heavily dependent on chemical additives, there is very little commercial grain production, and no apparent commercial vegetable production. Vegetable production is important in the household economy, as is livestock production, but many families purchase some of their vegetables and meat from market towns and other families. In general, Meihuashan households are in transition to a more heavily cash-oriented household economy, with stable incomes from bamboo sales and other forms of private enterprise (Ma Shengxue, pers. comm.).

Factors in Contemporary Terrace Abandonment and the Ecology of Old Ricefield Succession

The most widespread abandonment of rice paddy in Meihuashan since 1949 occurred from the mid-1970s to the early 1980s, when hybrid rice was adopted by most of the villages. Before this, when traditional varieties of rice were cultivated, there was an average of about four mu per person of rice paddy. After the economic reforms gave control of agriculture and forestry back to the family unit, there was continued
abandonment, and today there is an average of about two mu per person (Ma Shengxue, pers. comm.).

Today, rice paddies are still being abandoned for a number of reasons. First, there has been a shift in the investment of labor toward the more lucrative work of bamboo management. Villagers no longer work in production teams, and there are not enough family members to maintain four mu of rice per person, especially given the low returns of grain or money (Ma Shengxue, pers. comm.). Villagers also state that depredation by wild boar, monkeys, and rats is a ceaseless problem, especially in more remote paddies. Since more distant paddies are often at higher elevations, they are also less productive, due to the colder water in their catchments. They also present more hydro-engineering challenges.

In terms of crop depredation by wildlife, rat damage is generally a greater problem than boar damage because it occurs more frequently. Rats cut the stalks at the base and carry the entire rice plant to their dens. Serious rat damage may destroy 20% of the harvest in the flat lands and 30% in mountain areas (Luo Zhiming; Guan Liteng, pers. comm.). Boar damage is less common but more severe. Though boar enter the fields less frequently, they usually come in groups. The worst boar damage is caused when boar wallow in the rice. Villagers say that boar will do this to cool off in the water or to relieve an itch. They also root for bugs and crustaceans, when not feeding on the rice itself. Bad boar damage can claim 90% of the crop.

Before 1990 it was legal to abandon paddies, but since Fujian has the lowest amount of arable land per capita of any province, the government now campaigns actively
to prevent the loss of agricultural land. In some rural areas of Fujian, local officials have established "small agricultural protected areas" (nongye baohu xiaqu), with signs demarcating paddy lands where other development is prohibited. The grain bureaus (liangshi bumen) in each township are supposed to regulate cropland maintenance, but in Meihuashan, they rarely inspect village land use, and abandonment goes unpunished. No one has ever been fined for abandoning paddy though the practice is commonplace. Even if household paddy land is abandoned, there is a flat per capita tax each year. Taxes are levied on the basis of the number of mu per person, at a rate of 10 yuan per mu in 1994. There is an average of 2 mu per person throughout Meihuashan, so villagers were expected to pay 20 yuan for each family member. Since all will pay the same rate, regardless of the amount of paddy land they own, there is no incentive for the grain bureau to interfere with terrace abandonment.

According to villagers, abandoned paddy can legally be used for agriculture purposes, including rice, fruit orchards, or fish ponds. Permission can be obtained from the collective to do this on land abandoned by other villagers. No permission is needed to do this on ones own land. One particularly wealthy Long Gui native grew pears and peaches on his own abandoned cropland, but the trees died of neglect. He gave his other paddy land away (Luo Zhiming, pers. comm.). A fruit orchard established between Guihe and Jiaotan also failed, suffering intense depredation by muntjac and other animals (Ma Shengxue, pers. comm.).

Abandoned paddies that are not reclaimed are soon overtaken by dense grasses, ferns, and other herbaceous plants. After a few years, these are overshadowed by shrubs

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and small trees. Within 60 years a maturing mixed forest develops; a stand of trees that resembles older forests, save for the higher proportion of pines, and the lack of very large, old trees that can be found in fully mature broadleaf forests. Since terrace abandonment is a function of both elevation and distance from the village, active rice paddy areas are gradually receding toward the village settlements which depend on them, and natural succession is occurring on the many remote terraces that have been abandoned.

Effects of Chemical Fertilizers and Pesticides on Wildlife and Ecosystems in Meihuashan

The arrival of modern agricultural technology in the Southeast Uplands has had both positive and negative consequences. As higher levels of rice production are concentrated on smaller areas of land, new types of wildlife habitat are created in and around abandoned paddies. The problem is that some of the very technologies that have made intensive hybrid rice cultivation possible, like chemical fertilizer and pesticides, have also introduced toxins into the environment.

When chemical agents were first introduced, their potential impacts were poorly understood, even by the state agencies responsible for their distribution. Today in Meihuashan, there are still dangerous pesticides in use, and local people are not fully aware of their harmful effects. To complicate these matters, at the same time that new agricultural technologies have been introduced, traditional beliefs about agriculture have been expressed more freely. These paradoxical trends follow the removal, during the reform period, of state-sanctioned oppression of local belief (or superstition - mixin) and the end of centralized control of production. Families are free to make their own
decisions about fertilizers, pesticides, and rat poisons, and even certain substances that were made illegal over a decade ago may persist in local crop management schemes, having been stockpiled in the villages before they were banned (Ma Shengxue, pers. comm.). These chemicals affect wildlife in a number of ways, but given the lack of formal ecological research on this subject in China, the following descriptions are qualitative, and based mostly upon anecdotal evidence.

Some of the most serious effects occur when poisons are directly introduced into the food chain. Rat poisons (*laoshu yao*), for example, have become common throughout China, and they are causing severe damage to wildlife populations. Rat poisons are purchased from government stocks at the agricultural supply bureaus (*nongzimeng shibu*) or from travelling peddlers at local markets. There are some nine different types of chemical compounds used as rat poison in Fujian today, about half of which are hydrocarbons (like Warfarin and strychnine, which are common in the West) (Zhu Hejian, pers. comm.). The liquid substances are poured on pig organs or cookies, which are placed around the rice paddy. The most popular kind locally is called "red medicine water" (*hong yaoshui*); it is an odorless liquid that is said to kill instantly. Villagers say that it affects only mammals, not ducks or chickens, which also forage in the paddies (Ma Shengxue, pers. comm.).

In Meihuashan, populations of carnivores that feed on rats and other animals that have ingested the poison, or scavengers that eat the poisoned bait itself, have been decimated. Many hunters have noticed a radical decrease in the number of red dogs (dholes, or in Mandarin, *chai*), crab-eating mongooses (*shixiemeng*), and members of the
weasel family that once frequented the paddies. According to interviews conducted in all three nature reserves, rat poison has caused the virtual elimination of red dogs in western Fujian. Domestic cats and dogs have also suffered heavy casualties from rat poisons, and today cats are rare and dogs are not allowed to leave the houses of their owners except when taken out to hunt. Similar effects on domestic animals have been reported all over China, and the cumulative toll on wildlife has been devastating.

Ironically, insect pests do not appear to have been a major problem in Meihuashan before the introduction of hybrid rice. Since villagers produced their own seeds from each year's crop, local varieties of rice underwent a longterm selection process that made them more resistant to pests. When less resistant varieties came into use in the mountains (as well as in surrounding lowlands), previously unknown pests followed, and the survival of the rice crop came to depend on chemical pesticides. As insects and plant pathogens developed resistance to one pesticide, others were adopted. One villager portrayed this ecological vicious-cycle with irony; "It's like with people, the more medicine we use, the more diseases there are." Even the invasion of a type of wooly caterpillar on ancient trees in the low elevation groves of sacred Chinese cedar (Cryptomeria fortunei, or liushan) are said to have occurred only in the last few years. It is believed that a natural predator of the caterpillars has been eliminated (Guan Yanzeng, Ma Shengxue, pers. comm.). To protect the trees, villagers in Meihuashan and Longxishan weave thick, coarse ropes from grasses or plant stalks, dip them in pesticide, and tie them around the tree trunks so that the caterpillers will not be able to climb to the branches and leaves on which they feed.
Among villagers, there persists a strong belief in unseen forces that affect one's luck (yunqi), and even the Chinese word for weather, tianqi (heavenly qi) has some supernatural connotations for many. Many villagers consult almanacs (lishu) to determine the best times for planting, harvesting, and even business activities or new undertakings of any kind. Local perceptions of time, seasonal change, agricultural cycles, and ritual cycles (see chapter 8) reflect the persistence of an ancient belief system. In this context, pestilence and other agricultural disasters are seen (to varying degrees) as cosmological in origin, related to both yunqi and tianqi, and possibly mitigated by local earth gods or other deities (Ma Shengxue, pers. comm.). This does not mean that new pest control methods are viewed as threats to the system. On the contrary, when faced with crisis, many people will use whatever means they perceive as possibly effective as a solution, even when the outcome is largely unknown. In this context, chemical remedies to crop depredation are seen as "magic bullets" aimed at a maleficent part of nature (da ziran), which is itself an all-encompassing, cosmological term. They are not seen (at least not universally) as complex molecular agents that have specific physiological effects on specific pathogens, and which may persist in the environment to the detriment of humans or other species.

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1 In fact, the lunar calendar (nongli, agricultural calendar) is more important in local reckonings of the time of the month and year than is the officially recognized Western calendar (xin li, or new calendar). While Western calendar dates are used for government business or relations with the "outside," the lunar calendar is the usual framework for arranging social events, festivals, or other activities that fall within a local context.

2 A parallel example of this way of thinking comes from the long-known connection between drinking unboiled water and developing gastro-intestinal problems. Even comparatively well-educated villagers have taken this to mean that the water temperature is what matters, not the
In the late 1970s and early 1980s, when insect pests first became a problem, villagers experimented with a variety of pest control methods. One year in the early 1980s, there was a particularly serious pest problem in Gonghe. Having no success with other methods, locals devised the "solution" of pouring kerosene into the paddy water, then gently hitting the rice stalks with sticks to knock the bugs onto the sticky surface. Afterwards, the water was flushed out of the paddies, carrying the bugs with it. One elderly man did not want to use the method. After praying to the gods for help, he told his neighbors that he had received assurance that his crop would be okay. As a result, many weeks before harvest time his whole crop had already been devoured, while others were able to reap a substantial harvest (Ma Shengxue, pers. comm.).

The lack of information or understanding of pesticides has led to other mishaps, including poisoning by residue on vegetables grown in household gardens. One such incident occurred while the author was in Meihuashan. A family in Taipingliao, including both parents and two children (the father of which was one of the informants in this study), was hospitalized for over a week after eating their own vegetables without having washed them thoroughly enough. Apparently they had used a pesticide they were unfamiliar with, and had been unaware of the possible hazards.

The most common biocides in Meihuashan, are the pesticide DDVP (dimethyl-dichlorovinyl phosphate), known locally as *didiwei*, and Kitazin, a fungicide known as *fact that boiling the water effectively kills bacteria and other microbes. Even though bottled spring water has become available and some villagers drink it or drink boiled water after it has cooled, there is still a preference for tea or hot water. This is true all over China, though it is changing rapidly as refrigeration makes cold drinks available, and young people develop new consumption habits. This transition occurred in Taiwan at least 20 years earlier.
Although the production of DDT (dichloro-diphenyl-trichloroethane), BHC (benzene hexachloride), and other organochlorine pesticides, was banned by the government in 1983 (Edmonds, 1994), BHC (liuliu fen) is still stockpiled in many villages. Fortunately, it is not popular because it is in a powder form that is less convenient to use than liquids (Ma Shengxue, pers. comm.).

For killing insect pests, people prefer to mix DDVP with jia anlin (a substance containing ammonia and phosphorous, judging from its name), a most effective combination, which is also commonly used by those who wish to commit suicide (Ma Shengxue, pers. comm.). This combination is also said to wipe out frogs, snails, and other aquatic animals that were once common in the rice paddies (Ma Shengxue, pers. comm.). While permanent pesticides (arsenic, lead, and mercury) and highly persistent pesticides (those that stay in the environment for up to 20 years, including DDT, aldrin, dieldrin, endrin, heptachlor, and toxaphene) are the most harmful, those that degrade rapidly, like organophosphates such as DDVP, are extremely toxic and non-selective. They therefore encourage the rapid development of resistant insects and kill their natural enemies.

According to local observation, there is a high correlation between weather conditions and insect depredation. From planting time, in April, to the beginning of fall on the lunar calendar (li qiu) which falls in August, insect pests are most numerous. Periods of heavy rainfall alternating with intensely hot, sunny days seem to bring on the worst bug problems. If there are bugs present after 10 days of seedling growth, the farmer sprays the crop with the DDVP (using a backpack spray container). After this point, the
crop is checked frequently for bugs, both before and after the transplanting of seedlings. Whenever bugs appear, the whole paddy is sprayed. Usually this happens 2-3 times per year. By August, the bugs usually become much less numerous, but a fungal disease known as Daowenbing (warm rice disease), which causes the deformation of rice grains, is a frequent scourge. It is between then and the September harvest that Kitazin (daowenjing), an organic fungicidal spray, is applied to the maturing plants.

In the longterm, there may be perpetual problems with insect pests, the development of pest resistance to many pesticides, and further chemical contamination if integrated pest management is not adopted. Edmonds (1994) points out that integrated pest management was used effectively in many parts of China in the late 1970s, but diminished with the return of croplands to individual families in the reform period.

The effects of chemical fertilizers on wildlife are more subtle than those of pesticides and rat poisons, but they may be equally problematic in the long run. Some of the most direct threats arise from the build up of excess nitrogen and phosphorous in the paddies and the transport of these pollutants in runoff to streams. The most commonly applied fertilizers are called "tan an" (which contains carbon and ammonia) and "guo gai" which contains calcium. About 25 kilograms of fertilizer are used on each mu of

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10 In other parts of eastern China during the 1960's, pesticides wiped out the natural enemy of the plant hopper (Nilaparvata lugens, or la chan), and a crisis in rice production occurred between 1970 and 1972 (Edmonds, 1994).

11 Before 1960, there were very few chemical fertilizers used in China. During the mid-1960's and 1970's, however there was a dramatic upsurge in the availability and use of chemical fertilizers throughout the country. By 1989, China's average annual fertilizer usage was estimated at 208 kilograms per hectare, twice the world average, 80% of which was nitrogen (Edmonds, 1994).
paddy (375 kg/ha). Most of the fertilizer is added just before the plants produce grains. In some villages, little or no organic fertilizer (human and livestock wastes and ashes) are applied to the rice crop today, although most families still use these traditional nutrient sources on vegetable plots (Luo Zhiming; Ma Shengxue, pers. comm.).

Studies of water quality conducted at nine sampling sites in 1988-89, showed that streams were then uncontaminated in their upper reaches, above village settlements. They were also cleaner within the boundaries of the reserve than outside of the reserve. Though a single streamside village increases the level of contaminants in the dissolved and suspended loads, water at all of the sites was well within the highest class of cleanliness, as defined by national standards (see ZHKCBGWYH, 1991).

Livestock Raising and Its Environmental Impacts

Yellow cattle (*huang niu*) are the most important large livestock in Meihuashan. They are used individually as draft animals because they are small and nimble enough to maneuver on narrow terraces and steep slopes, and light enough that they don't destroy the bunds. These animals are only used for food when they have become useless due to injury or age (there is no consumption of dairy products). Cow manure (along with pig manure) is an important source of fertilizer, especially for vegetable gardens. At present, cattle are not raised for commercial purposes. Each village has between 5-30 head, with

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\[ This figure is comparable to the highest provincial averages of nitrogen application in China, which, in 1988, occurred in Fujian, Guangdong, Hunan, Zhejiang, and Jiangsu (Smil, 1993). All of these provinces averaged more than 250 Kg. N/Ha. The highest rates were in Guangdong (350 Kg. N/Ha) and Zhejiang (400 Kg./Ha). Smil (1993: 171) states that these "areas of better soil with high and relatively stable yields used for growing the two staple grains and cotton and tobacco, the leading cash crops, get disproportionately high shares of fertilizer nitrogen...[resulting] in frequent overfertilization of several leading crops in highly productive coastal regions." \]
most villages owning 10-20. Not all families own cattle, but the ratio of cattle to households in many villages is almost 1:1. In eight villages surveyed, the average ratio of cattle to humans was 1:7.5.

Cattle are not numerous enough in most parts of the reserve to constitute a grave threat to the vegetation, water quality, or other aspects of the environment. Since burning to clear pastures is no longer legal, cattle management has less impact than in the past. This could change, however, if herd sizes increase. At present, cattle are allowed to range freely in the mountains for most of the year, being brought down to the villages at plowing time in the spring. When herds congregate in wetlands, they may cause soil compaction, overgraze fragile plants, and displace other ungulates.

Some villages have planned to seek permission to increase their herd sizes and raise cattle commercially. This should not be allowed without a careful environmental impact analysis. Similar plans have been made to raise goats, and one family in Long Gui has begun to raise a herd of about 65 head. Before this practice is allowed to spread, there should be a careful analysis of the impacts of caprine grazing on grasslands, wetlands, and the forest understory.

Pigs are the other large livestock of importance in village subsistence. The ratio of pigs to households is probably close to 1:1, though statistics have not been collected. Chickens are also raised by nearly every household, and ducks are almost as common. Eggs are eaten frequently, and poultry is consumed at special occasions.

Although pigs, chickens, and ducks are used primarily by the families who raise them, some households sell pork and eggs at village stores. In some villages,
freshly-butchered household-raised pigs are sold in the stores about once a week. Pigs are useful as consumers of rice chaff and other detritus from the field and the household; they effectively convert waste products to fertilizer and food at very low cost to their owners. Small scale pig husbandry does not pose a significant threat to natural vegetation, so from an environmental standpoint it may be considered preferable to cattle and goat husbandry.

**Forestry and Extractive Activities on Collective Land**

Before 1949, mountain lands that were not devoted to the production of rice or bamboo, were either open access areas (namely the grassland shrub zone that was regularly burned, along with wetlands and some remnant broadleaf and mixed forests that escaped devastation through their remoteness), or community-protected common lands, specifically the village *fengshui* forests.

Strict land use controls imposed by the government in the 1950s brought great changes to the longstanding land use practices and vegetation coverage on these peripheral lands. From the 1950s to the 1970s, only grazing, hunting, and the collection of assorted plant resources like grasses, mushrooms, and medicinal plants were permitted on these lands. Though forest clearance was legal, forests were generally viewed as too inaccessible to make logging cost effective (with the few exceptions described below).

During the economic reforms of the late 1970s and early 1980s the situation changed dramatically. In 1983, when commodity prices began to reflect demand, the value of *Cunninghamia* (*Shanmu*, Chinese fir) wood increased rapidly. Within one year, the value of a cubic meter of wood rose from 3-5 yuan to 45-50 yuan. Suddenly, there
was a rush to cut and sell *Cunninghamia* as fast as possible. In Meihuashan, there were no plantations, but very large *Cunninghamia* trees grew in family-managed bamboo forests, in remote parts of collectively owned old growth broadleaf and mixed forests, and in a few planted *fengshui* groves that were planted long ago.\(^{13}\) With the exception of those few growing in *fengshui* forests, virtually all of these large, ancient trees were removed and trucked out to Guangzhou and other coastal trade ports by the end of the decade.\(^{14}\)

Although there was some collective logging in Meihuashan (which continues under heavily restrictive quotas today), with profits accruing to entire villages, individual entrepreneurialism reached a level unparalleled in almost half a century. A number of families grew relatively wealthy from the timber boom. A few in Gonghe and Long Gui (among the only villages with roads) even bought trucks to haul bamboo to the coast, cutting out the middlemen altogether. New houses were built, and a new phase of capitalism was underway. Today, there are very few large *Cunninghamia* trees remaining in Meihuashan, aside from those in the sacred forest in Lingbeixie village, where giants of the species have thrived under village protection for centuries.

\(^{13}\) The most notable example of this is found in the northern outlying section of the reserve, where the village of Lingbeixie, has a roughly 170 hectare *fengshui* forest comprised mostly of ancient, cultivated *Cunninghamia* trees.

\(^{14}\) In some villages, like Majiaping and Taipingliào, *Cunninghamia* had been heavily harvested in earlier decades. In Majiaping, this was done in the 1960’s by a government timber trading organization in Pengkou, which cut and floated the logs to Xinquan, from which they were taken to Zhangzhou. From Taipingliào, *Cunninghamia* logs were floated to Wanan before 1949 and in the 1950’s. Both of these villages had access to rivers large enough to carry the logs to market towns.
While Cunninghamia trees were being scavenged from the forests, their cousins the *Cryptomeria* (both are in the Taxodiaceae, or redwood family) were still prudently protected. While the *Cryptomeria* (*liushan*, or Chinese fir) is not a traditional timber tree, it was highly valued as a *fengshui* tree. According to village laws, before the reserve was established, *Cunninghamia* trees could be cut by families on their own bamboo forests, or on collective lands by whomever contracted with the regional forestry committee to do the work. *Cryptomeria*, on the other hand, could not be cut anywhere (Guan Yanzeng, pers. comm.). Unfortunately, the market value of *Cryptomeria* products has increased dramatically in the 1990s, endangering sacred forests throughout Meihuashan (discussed below and in chapter 10).

In the late 1970s and early 1980s, some villagers and even a few outsiders began to tap the larger Masson pines (*Pinus massoniana*) for rosin (pine resin). Other itinerant outsiders specialized in digging up pine tree roots and burning them in outdoor furnaces to produce the distilled industrial product known as *wuyou* (pitch or tar). Both of these activities are still common in the reserve today. Rosin collection is mostly done by villagers, who can earn up to 3,000 yuan ($375) per year where large pines are abundant and available. Pitch distillers are non-local tradesmen who live in sheds beside their furnaces, in some cases far from the nearest road or village. After they have exploited the wood resources at hand, they move on to other areas.
Figure 7.2. Historical Change in Altitudinal Zonation of Land Use and Vegetation in Meihuashan.
Long-term Anthropogenic Vegetation Change in Meihuashan

Before discussing the impacts of nature reserve management policies on local land and resource utilization patterns, it is important to summarize the history of land use and vegetation cover in Meihuashan (Figure 5.10). Changes in the land have been dramatic, and the trajectory of such changes has been directly related to traditional land use practices in specific elevation and vegetation zones.

Before the establishment of numerous permanent Han or She settlements, there was probably a period when the vegetation was less disturbed by human activity. The date of the earliest anthropogenic vegetation change is unknown, but palynological data from Daiyunshan, shows that the first massive forest clearance occurred about 1,000 years ago (Qiu, 1993). The onset of intensive disturbance was perhaps similar for the Meihuashan region, for it is likely that before Han settlers established villages in the mountains, there were aboriginal inhabitants who were driven into mountain refuges like Meihuashan in sufficient numbers to affect the forest cover through repeated firing. Before burning was carried out on a sustained and widespread basis, there were extensive stands of primeval broadleaf evergreen, deciduous evergreen, and mixed broadleaf-needleleaf forests.

Over the centuries following the earliest Han immigration, the primeval forests of pre-historic times were transformed by Hakka settlers into agricultural, forestry, and grassland extraction zones. Lands in the 400-1,250 meter elevation range were converted to rice paddies, bamboo forests, and needleleaf forests of pine and Cunninghamia, while certain patches of broadleaf forests in this zone were preserved as village *fengshui* forests.
Above about 1,200 meters (and much lower in remote western parts of the reserve), ridges, slopes, and wetlands were burned annually or biennially, and a montane grassland-shrub meadow was maintained. In these meadows, fern roots were gathered for subsistence purposes, and small herds of yellow cattle shared grazing land with wild ungulates.

In the 1950s, afforestation schemes, including the prohibition of burning, led to the growth of *Huangshan* pine forests in the former highland meadow zone, and the regeneration of mixed forests in many areas. Masson pine spread into many lower elevation grasslands. From 1949 to the 1990s, there was extensive rice paddy abandonment. Following the economic reforms of the early 1980s, there was a rapid clearance of mature Cunninghamia trees from different stand types throughout the region and an areal expansion of family-managed bamboo forests. Most of Meihuashan's ancient sacred forests remained intact.

**The Establishment of the Reserve: New Land Use and Conservation Policies**

Land use patterns in the villages of the Meihuashan Nature Reserve resemble those of many settlements outside of the reserve, at least superficially. The greatest difference is that outside of the reserve, there are fewer restrictions on the harvesting of timber on collective lands. This simple difference has had vast consequences. When the reserve was in the earliest phases of establishment and planning, in the early 1980s, this problem was anticipated, but some 15 years later it remains unsolved.

The people who first worked to establish the nature reserve included researchers and bureaucrats from the Fujian Provincial Forestry Bureau, Xiamen University, Fujian
Normal University, Academia Sinica, and the Longyan Regional Forestry Committee.
When they began to delineate the boundaries of the reserve, in the early 1980s, they proposed that it cover an area over five times that of the present, totaling over 1,000 square kilometers (Huang Zhaofeng, pers. comm.). When representatives from Shanghang and Liancheng counties, the Longyan Municipality, and Laiyuan Township (in Liancheng) convened to review the plan, it was decided that only the least populated central area would be included in the reserve. These officials feared that if timber cutting were restricted in the areas of higher population density, like Gutian, Laiyuan, Wan An, and other townships, there would be too many people with no means of economic survival (Huang Zhaofeng, pers. comm.).

The paradox of this decision is evident. The dilemma lay between limiting the size of the reserve to give more land use freedom to denser populations, or expanding the size to insure that more people practiced good resource stewardship over a larger area. Huang Zhaofeng, a reserve forester/administrator described the situation quite aptly:

"It's hard to know whether it would have been better to include them (people in the greater area) within the reserve. Nature protection is all of society's business. On the other hand, people have to have an income. People understand the protection concept as a whole, but as individuals they have to protect themselves. It's easy to do the 'concept work' with the peasants (laobaixing) - the hard part is the policies - how do people survive?" (Huang Zhaofeng, pers. comm.).

To make up for the low incomes and lack of timber revenue anticipated in the interior of reserves, the provincial forestry bureau planned to offer a 120 yuan subsidy for each cubic meter of standing timber volume (Ruan Yunqiu, pers. comm.). The payment was never made, and inhabitants of the reserve have not forgotten it.
Timber Management: The Forest Resource Quota System

Timber and bamboo cutting on village lands is now controlled by quotas set by the nature reserve, and all sales of timber and bamboo must be made through the Meihuashan Forestry Development Office (*Meihuashan Linye Kaifa Gongci*), in the reserve headquarters. Outside of the reserve, timber quotas are managed by the Longyan regional forestry committee (*diqu linwei*). Of the useful timber tree species, reserve villagers can only sell, pine and *Cunninghamia*, and quotas for these grow smaller each year as logging within the reserve boundaries is gradually phased out altogether.

There is no legal cutting of broadleaf trees over 30 cm dbh (diameter at breast height) inside or outside of the reserve, and the forestry bureau stopped issuing sales permits for hardwoods of any size in about 1990. Aside from camphor (*zhang*, *Cinnamomum camphora*) (which is used to carve Buddhist and Daoist icons), *Schima* (*Schima superba* or *mu he*), and a few other species, broadleaf trees are not seen as having a great deal of economic value. Low demand for broadleaf has no doubt saved the remaining patches of montane forests in the Southeast Uplands from rapid conversion.

In 1994-95, only Long Gui, Dapingshan, and five or six other reserve villages in Liancheng county were issued permits to cut pine. Except for Long Gui, which has a special forest road (aside from the village access road) for cutting and hauling timber, the forest road was built north of the village as part of a forestry area (*lin chang*), which was established after the village access road was built (1983) but before the reserve was opened (1985). During the next few years, while there is still some pine to harvest there, the reserve will continue to issue permits to the village, but these are smaller each year, and will soon be phased out. The forest area and the low population of Long Gui have helped make it the wealthiest village in the reserve.

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15 The forest road was built north of the village as part of a forestry area (*lin chang*), which was established after the village access road was built (1983) but before the reserve was opened (1985). During the next few years, while there is still some pine to harvest there, the reserve will continue to issue permits to the village, but these are smaller each year, and will soon be phased out. The forest area and the low population of Long Gui have helped make it the wealthiest village in the reserve.
only villages that had newly established roads were given cutting permits. Villages without roads cannot get permits since there is no truck access, and villagers that have had road access for a number of years have already exhausted the legal timber supply. Outside of the reserve, most villages still receive yearly permits to cut pine and Cunninghamia, which they then replant from seedlings. This disparity has caused resentment among reserve villagers; it has also made bamboo management a high priority. Through superior bamboo management, reserve leaders hope to close the slight income gap that exists between the interior and surrounding mountain villages.

In Long Gui, pine was sold for 250 yuan ($31 U.S.) per cubic meter. In coastal markets logs over 40 cm dbh (diameter at breast height) could be sold for over 900 yuan ($112 U.S.). When pines are removed from mixed forests, it must be done without cutting down other trees. A recently logged broadleaf forest in Long Gui appeared to be recovering quickly, and removal of pine may have accelerated its succession to a more mature broadleaf community. In 1994, logging was prohibited on slopes that were visible from roads or streams, a restriction designed to protect both scenic integrity and watershed quality (Huang Zhaofeng, pers. comm.).

Since Cunninghamia is the most important source of lumber in China, its market value is much greater than that of pine. At the village level, sales value was between 400-500 yuan per cubic meter (coastal sales values were not determined). There were no legal sales of Cunninghamia in 1994-95, however, and there may not be for many years. Since almost all of the naturally occurring Cunninghamia has been removed, and most of the
planted stands are less than twelve years old, there will be few permits for *Cunninghamia* for another decade or so, if cutting is not phased out entirely.

Though there were no legal sales of *Cunninghamia* in the mid-1990s, some villagers capitalized on the market rates by operating illegal logging and transport networks. Remote valleys like Qikouping, in the core area of the reserve, had a number of large *Cunninghamia* trees scattered through the broadleaf and mixed forests. Villagers from Tieshan Luodi, a settlement just northwest of the reserve with lands in the reserve, set up a camp in Qikouping and built trails through extremely dense forests and difficult terrain, to haul logs out of the reserve on foot. All of the roadside forestry checkpoints were easily bypassed. On several occasions, the author encountered log porters while hiking with a forest manager in the northwestern part of the reserve. On one such occasion, on a trail above Luodi, the sight of us caused a group of about 20 porters, male and female, to disperse into the woods. In the early 1990s, a number of villagers, many from Luodi, were arrested for such activity, which has caused tremendous resentment toward the reserve. As this example illustrates, illegal timber cutting in Meihuashan is a serious problem, and relations between reserve managers and local people, while outwardly stable, are strained to the degree that local cooperation is based mostly on passive acceptance of legal authority and the varying degrees of regulation and enforcement that it imposes.

Among the most flagrant forestry violations in the 1990s, however, involved the complicity of certain reserve and forestry officials. This was the cutting of ancient and towering *Cryptomeria* trees in village *fengshui* forests. Japanese businessmen have
provided international market access to a local entrepreneur, namely the village chief (cunzhang) of the Guihe administrative village. In the early 1990s, the village chief started a factory in Gonghe, hiring outside artisans to convert logs into panoramic carvings of magical landscapes, which end up on the walls of Japanese homes and offices, or in glass-topped tables, for a price of roughly U.S. $3,000. Villagers in Gonghe and Guizhuping do not appreciate the new industry, since it employs few villagers and robs the sacred forests of trees that they and their ancestors have protected for hundreds of years.

In the fall of 1994, the author found 36 fresh stumps near Guizhuping. That particular harvest had allegedly been carried out with payoffs to local officials and provincial forestry directors (sources anonymous). While the Guihe village secretary (the highest village leader) was not at home, the trees were officially declared dead and purchased for a meager price of 3,300 yuan ($412 U.S.), although the local market value is about 1,500 yuan per cubic meter (Guan Yanzeng, pers. comm.).

**Bamboo Management: Village Quotas, Family Plots, and Resource Conservation on Collective Lands**

The most critical forestry management problem facing Meihuashan today is the conversion of broadleaf and mixed forests into bamboo forests. Though reserve workers state that large parts of the reserve could gradually be converted into a "bamboo desert"
(Wu Jinping, pers. comm.), state officials were just beginning to address the problem in a systematic fashion in 1995 (Huang Zhaofeng, pers. comm.).

To grasp the economic and land tenure issues surrounding the conversion process, we must understand what happens when a particular family's bamboo forest expands onto lands belonging to the entire village collective (designated jiti de tudi, collective land), or onto lands belonging to the entire country (designated guoyou de tudi). Since families have the forest (usufruct) rights (lin quan) to rice paddies and present stands of bamboo, and collectives hold the rights to all other mountain lands, the areal expansion of present bamboo stands is (potentially) a conversion of collective land to family-managed land.

When bamboo spreads to collective land, the village has the choice of either allowing the land use rights to revert to the family from whose stand of bamboo it spread, or to claim the bamboo as collective property to be distributed to a family in need (within the ongoing system of redistribution that some villages have adopted). If bamboo spreads onto national lands, and reserve managers happen to notice, then all trimming of foliage and other activities that allow it to survive could be curtailed, and other vegetation would soon become dominant. The most likely response, however, would be for the village and/or the reserve to ignore the situation, and for the family from whose plot the bamboo spread to assume rights to it. In most cases that particular household would have cleared the underbrush around shoots in a growth year (da nian), allowing the bamboo forest to

---

16 In February 1995, the reserve headquarters issued stricter regulations on cutting broadleaf trees and expanding bamboo forest areas on collective lands (see chapter 9). When the author left the reserve in August 1995, it was not yet clear whether these regulations had been effective. Effective enforcement of the laws had not yet begun.
enlarge, and to question the land use rights to new tracts would be highly confrontational. In summary, although the reserve presently controls timber harvests on collective lands as strictly as possible, it is unwittingly allowing villages to decide how to allocate these lands to families as they are converted to bamboo forest.

Current regulations in Meihuashan forbid the cutting of broadleaf trees, but trees under about 30 cm in diameter at breast height are cut down without serious consequences. Since larger trees cannot be cut down (and fines for cutting large trees have been levied in the past), they are often killed by bark-ringing, which was not officially illegal until February of 1995 (Huang Zhaofeng; Wang Honggao, pers. comm.) (see chapter 9). Under lax management from the reserve, many families take an aggressive, entrepreneurial approach, promoting rapid lateral incursion of bamboo into adjoining forests by clearing the underbrush down to ground level.

In quadrat studies, we (the author and village assistants) found that bamboo forests can invade adjacent forest stands at an average rate of 4 m per year when underbrush is removed before the shoots emerge. The threat of "bamboo desertification" is very real, and has occurred in many areas outside of the reserve (see chapter 9).

Reserve managers have moved to protect remaining patches of broadleaf forest not already protected by village custom, by designating miniature protected areas (baohu xiaoqu) within the reserve, where all woodcutting is prohibited. When the author left the reserve in August 1995, signs had been placed around some of these protected sub-areas. It remains to be seen whether the villagers will support the effort. These issues are discussed in more detail in chapters 9 and 12.
Comprehensive Village Land Use and Vegetation Cover Patterns Today

Present village land use and vegetation patterns are the equivalent of a single frame in a continuous film. What we see today has developed from what came before, and forms the basis for what will develop in the future. We can examine the composition of this frame, knowing the forms and influences that preceded it, attempting to anticipate the contents of the frames still to come. Each village has unique land use and vegetation patterns resulting from different geographical and historical conditions. Each has different amounts of broadleaf forest, bamboo forest, rice paddy, pine and mixed forest, and sacred forest. This overview poses the following questions of each of the study villages: to what degree and where are bamboo forests invading broadleaf forests? Are "economic forests," like fruit orchards present? Where is terrace abandonment occurring in relation to the village settlement and other vegetation communities? Where are the sacred forests, and how do they relate to other vegetation components? Where are the pine and mixed forests, and are they in the process of succession to broadleaf forests?

This evaluation of land use and vegetation patterns precedes an analysis of the habitat values of each vegetation type in chapter 8.

Guihe Administrative Village (Gonghe and Guizhuping Natural Villages)

Of the five study villages, Gonghe and Guizhuping are at the highest elevations (1,200-1,210 meters). They are also near the high peaks of the reserve's core area. One of the most fragmented landscapes in the reserve lies to the east and northeast of these two village settlements, with virtually every vegetation type represented in small patches. This pattern is a testament to centuries of intensive rice cultivation and more recent paddy
abandonment by many of the surrounding villages, like Mawu, Jiaotan, and Liling.

Today, Guihe's rice paddy extends from the slopes northwest of Guizhuping, along the valley bottom southeast to Gonghe, and (most extensively) on lands belonging to Jiaotan and Mawu villages, to the east and northeast.

Most of the bamboo forests in Guihe grow along the slopes of the valley in which the settlements lie (Figs. 4.3 & 7.3). Gonghe's bamboo forests lie to the south, southeast, southwest, and west of the settlement, with distant stands expanding in a valley southwest of the one in which the settlement lies. In Guizhuping, the most extensive bamboo forest lies to the northwest, and it has crossed into a valley to the north. One large stand is also developing to the northeast, and one to the northwest, near Youpoji Mountain. All of the bamboo stands in Guihe are adjacent to broadleaf or mixed forests along at least part of their boundaries, and all of these forests are threatened by the bamboo encroachment.

Southwest of Gonghe, there are extensive, young broadleaf forests, with estimated ages of 40 years. These forests have regenerated from fragments after the ban on burning in the 1950s. Today, most of these stands do not appear to be as threatened, due to their remoteness from the village settlement and bamboo encroachment. The pine and mixed forests that intergrade with these patches of broadleaf forest should eventually become broadleaf forests in the next century, if free of human disturbance and natural wildfire.

Surrounding Guihe, there are vast tracts of young pine forests that form a horseshoe shape with the open end to the southeast. In the northeast, these forests grow in a valley that belongs to the Jiaotan administrative village. In the west and northwest,
Figure 7.3. Gonghe and Guizhuping Village Vegetation Patterns. Rice paddies cover the valley floor. Sacred broadleaf forests grow near the villages, reaching impressive dimensions in Guizhuping. Cryptomeria groves are not shown. Pine and bamboo forests cover the slopes; the latter forms the dominant vegetation at increasing distance from the village.
the pines cover high elevations from about 1,350 to 1,800 meters, and are predominant from about 1,400 to 1,750 meters. These forests are dominated by Huangshan pines, which have spread across the former montane grasslands from aerially broadcast seeds, starting in the late 1950s. The pine forests of western Guihe border with extensive tracts of unused land in the reserve’s core area. Since the cutting and burning of these pine forests is today prohibited by law, commercial forest activities in Guihe are restricted mostly to bamboo and mixed forests closer to the village center. On the valley floor, between the two natural villages, there is a planted stand of five year old Shancangzi shrubs (Litsea cubeba), the fruit and roots of which can be used for medicinal purposes.

Guizhuping has one of the largest village fengshui forests in Meihuashan. With tree ages averaging 65 years (and numerous ancient trees still standing), it is located on a slope to the east of the village, intergrading with more a more extensive broadleaf forest across the ridge in Jiaotan, further north. The sacred forests of Gonghe include a small, crescent-shaped forest in the eastern part of the built settlement, and numerous groves of huge Cryptomeria trees in the many gaps within the high ridge that runs SE-NW on the western side of the village.

Majiaping Village

Because of its isolation, low population density, and low elevation, Majiaping has the most extensive stands of relatively undisturbed mature broadleaf forests in the nature reserve. Large parts of these forests were never burned, and composed large stands even in the first half of this century (Fig. 7.4), and probably much earlier. Average tree ages in these stands fall between 40 and 60 years. The broadleaf forests form a ring around the
core of bamboo forests covering the steep slopes closer to the village settlement. All of
the present paddy lands lie just north, west, and southwest of the settlement itself. A
relatively small area of pine forests lies to the northwest, where grasslands and paddies
were once maintained.

In 1994, the villagers actively began to expand their bamboo forests into the
broadleaf forests by clearing forest underbrush and small trees, and by ringing larger
trees. Over time, the core of bamboo forests may expand outward, replacing broadleaf
stands. The villagers have no qualms about converting broadleaf to bamboo (a subject
addressed in more detail in the next chapter), and their distance from central authorities
and nature reserve management stations makes it possible for them to make many land
use decisions on their own (as was discussed in chapter 5). A large area of broadleaf
forest in the southernmost tracts of village land belong to the government, so enforcement
of forest regulations may be more effective there.

The sacred forests in Majiaping are composed almost entirely of large broadleaf
taxa. There is one fengshui forest, the "shuitou" (headwaters) forest, just south-southeast
of the village center. The other is the "shuiwei" (literally "water tail" - where streams exit
the settlement space) forest just north of the village.

Taipingliao Village

Taipingliao village lands are more extensive than those of most other natural
village in the reserve. Vegetation patterns are fragmented and complex. West of the
village are found the most extensive high mountain forests of Huangshan pines. The
largest areas of rice paddy lie within the village cluster, with smaller paddies to the
Figure 7.4. Majiaping Village Vegetation Patterns.
southeast, toward Chijiashan village. Surrounding the village in all directions are intermediate to large stands of broadleaf forests. Those lying south and east of the village are remnants that were never burned in this century (Fig. 7.5). Bamboo forests are widely dispersed in all directions from the village, with the largest continuous stands lying south-southeast of the village center. The expansion of bamboo into broadleaf forests is occurring in many areas where the two vegetation types are contiguous.

**Long Gui Village**

Because of its low population density throughout the twentieth century, Long Gui village is surrounded by broadleaf forests. These forests continue onto land belonging to Xiache and Qiushan villages, and comprise the second largest continuous expanses of broadleaf forest in the reserve (Fig. 7.6). Very large tracts of broadleaf forest lie west-northwest and due south of the village center (continuing on Xiache village lands). Much of this forest is said to have been here before 1949 (Luo Ruiqing, pers. comm.), though it was not recorded on the U.S. Army map of the area (Fig. 6.2). Mountain burning occurred further north, northeast, and due west of the village, so broadleaf forests closer to the settlement survived. Due to the low population of the village, the bamboo forest is not very extensive. This has been offset by favorable geographic conditions, including low elevation and thick soils. These factors, plus careful stewardship, have allowed Long Gui to develop some of the densest stands of bamboo, with the largest culms in Meihuashan. The largest rice paddy lies just west of the village, where most families have some active plots. Other rice terraces lie isolated in the broadleaf forests farther
Figure 7.5. Taipingliao Village Vegetation Patterns.
Figure 7.6. Long Gui Village Vegetation Patterns.
### Table 7.1. Village Land Use Patterns

<table>
<thead>
<tr>
<th></th>
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<th>LG</th>
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</tr>
<tr>
<td>Ca. 1950</td>
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<td>ca.400</td>
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<td>&gt;450</td>
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<td>351</td>
</tr>
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<td>&lt;450</td>
<td>365</td>
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<td>450</td>
<td>178</td>
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</tr>
<tr>
<td>% of Village Land</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Mu/Person</td>
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</tr>
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<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>(Cubic Meters)</td>
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**1994 Pine Harvest:**

|                  |    |     |     |     |    |      |
| **Official:**    |    |     |     |     |    |      |
| Harvest (Quota)  | 0  | 0   | 0   | 150 | 200 | 70   |
| (Cubic Meters)   |    |     |     |     |    |      |

(Table con'd)
**Bamboo:**

Area (mu):

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<tr>
<td></td>
<td>-</td>
<td>&gt;2,500</td>
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<td>(Poles)</td>
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<td>4,000</td>
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Note: 1 mu is equal to .0667 hectare

**Sacred Forests:**

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<tr>
<td>(Poles)</td>
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<td>30,000</td>
<td>20,000</td>
<td>27,500</td>
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Source: Village surveys (1994-95)
west (toward Qiushan) and south of the village center. A number of the smaller plots are being abandoned.

**Summary**

Since the densest concentrations of villages are in the south-central and east-central parts of the reserve, these areas are where the population has the most visible impact on surrounding montane vegetation. Between the southern villages of Mawu, Jiaotan, and Wulang there is a continuous expanse of bamboo forests and rice paddies some 3-4 square kilometers in area. Starting about two kilometers west of the villages of Xiebei and Chijiashan and extending east to Qingcaoyuan and Xiaogaoxie, and north to Dutou, and Beikeng, there is a roughly 20 square kilometer swath of bamboo forest flecked with rice paddies. In this area, there are only minor interspersions of abandoned terraces and low elevation grasslands, and a few patches of pine, broadleaf, and mixed forest.

Village land use patterns have created a mosaic of vegetation stands within the reserve. The next chapter analyzes the significance of these stands for wildlife conservation. It is a preliminary attempt to determine which types of land use are most harmful to or least suitable for habitat conservation, which types of land use are not detrimental, and which actually improve wildlife habitat. This information can provide a better foundation for conservation planning in the future.
CHAPTER 8
WILDLIFE HABITAT EVALUATION
IN THE MEIHUASHAN NATURE RESERVE

Human modification of the landscape in the Southeast Uplands began in prehistoric times and greatly accelerated with the arrival of Hakka immigrants in the first and second millennium A.D. Despite widespread forest fragmentation, some species of wildlife, including tigers and other large carnivores, apparently adapted to changing conditions, and remained in abundance until the mid-20th century, when the intensification of hunting led to the near-extinction of some, and the increasing decline of many others. The recent establishment of nature reserves within a patchwork of anthropogenic landscapes, marks a turning point in the relationship between humans and wildlife in the region. The main problem facing conservationists in the Southeast Uplands today is how to protect wildlife and habitat in a landscape dominated by human activity.

The main objective of this research was to determine the frequency with which certain species of animals use different components of the landscape. This was done by measuring the amount of bird and mammal activity evident across each of ten vegetation types and assessing the value of each type as wildlife habitat. This basic delineation of the landscape ecology of the Meihuashan reserve provides information on how wildlife has responded to anthropogenic ecological change through the centuries, and on the ecological implications of current economic development and village land use patterns.
Wildlife Habitat Analysis - Procedure

Analysis of wildlife habitat preference was based on track and sign surveys in ten representative vegetation types (Table 8.2). The objectives of this research were: 1) to measure habitat use by five species of ungulates (hoofed animals); 2) to measure habitat use by other mammal species for which data could be collected; and 3) to measure habitat use by birds. From these data, the researcher devised a preliminary model of habitat use by mammals and birds across the ten major vegetation types in the reserve, and autecological habitat utilization profiles for individual species of ungulates.

With the help of a zoogeographer from the Fujian Provincial Museum, as well as the assistance of local villagers, the researcher conducted 37 stratified random trail sample surveys of wildlife signs in ten vegetation types during fall and spring, to determine the relative density of wildlife signs in each. We collected data on the tracks, scats, and feeding-and-nesting signs of five species of ungulates, as indices of the density and frequency of each species across the vegetation mosaic. Our survey method enabled us to collect data on other herbivorous and carnivorous mammals, as well as birds (especially six native species of pheasants). Measurements of bird activity, based on calls, sightings, and other signs, were conducted simultaneously with track and sign surveys.

The researchers walked along small mountain trails recording mammal and bird signs and listening for bird calls. The surveys covered a total of 35 km (or about 21 miles) of trail. The five species of ungulates were selected from among eight species.
Figure 8.1. Meihushan Nature Reserve Vegetation and Habitat Survey Locations. Forest coverage in the reserve is estimated at 88% (ZHKCBGWYH, 1991). Pine forests cover much of the most mountainous central and western portions of the reserve. Before the 1950s, these areas were mostly anthropogenic grasslands that were burned every year or two. Trail survey locations are represented by black dots (labeled “transects”).

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believed to inhabit the region (Table 2.1). Selection was based on three assumptions: first, that these five species are more abundant than the other three species of ungulates (the survival of the latter in the SE Uplands region is in doubt); second that the tracks, scats, and signs (including browsed twigs and nests) of these species are fairly abundant and discernible for research purposes; and third, that these species comprise the prey base for important large carnivores.

The sample species were: wild boar (Sus scrofa), Reeves' muntjac (Muntiacus reevesii), common muntjac (Muntiacus muntjak), serow (Capricornis sumatraensis), and crested deer (Elaphodus cephalophus). These animals are shown in figures 8.3 and 8.4. Life histories of each species are presented below.

The tracks and signs of large and small carnivores, omnivores, and herbivores were also recorded, but these were observed with less frequency than those of the ungulates (Table 8.1). Important large carnivores sampled in the survey were the South China tiger (Panthera tigris amoyensis), the leopard (Panthera pardus fusca), the clouded leopard (Felis nebulosa), the golden cat (Felis temmincki), and the Asiatic Red Dog, or Dhole (Cuon alpinus).

Small carnivores included the leopard cat (Felis bengalensis chinenses); members of the Mustelidae, or weasel family - the crab-eating mongoose (Herpestes urva), the Siberian weasel (Mustela sibirica), the hog badger (Melogale moschata), and the badger (Meles meles); and members of the Viverridae, or civet family - the small Indian civet (Viverricula indica), the large Indian civet (Viverra zibetha), and the masked palm civet (Paguma larvata).
Omnivores (large and small) included the Asiatic black bear (*Selenarctos thibetanus*), the pangolin (*Manis pentadactyla*), and rats *Rattus spp.* Other herbivores included the Rhesus macaque (*Macaca mulatta*), the stump-tailed macaque (*Macaca speciosa*), the South China rabbit (*Lepus sinensis*), the porcupine (*Hystrix hodgson*), and the bamboo rat (*Rhyzomis pruinosus latouchei*).

In order to insure significant trail sample lengths for each of the ten vegetation types, the researchers used a 1:25,000 Meihuashan Nature Reserve vegetation map to determine the relative areal proportions of the ten vegetation types (Table 8.2, Fig. 8.1). The vegetation map is a color coded version of the Meihuashan Basic Forestry Map, which is divided into 63 forest stand units (*lin ban*) according to village land boundaries. Each forest unit is further divided into between 15 and 75 subunits (*xiao ban*) according to vegetation patch types (stands). These maps are based on a survey conducted by the Fujian Ministry of Forestry (Longyan Regional Committee) in 1991, and modified every four years. Forestry and land tenure data for each subunit are compiled in the Meihuashan Forest Subunit Data Book (*Xiaoban Lanbiao*), which was also produced by the reserve in 1991. For this research, the 10 vegetation types were categorized as follows: 1) pine forest, 2) *Cunninghamia* forest, 3) broadleaf forest over 1,000 m in elevation, 4) broadleaf forest under 1,000 m in elevation, 5) mixed broadleaf and coniferous forest, 6) bamboo forest, 7) remote rice paddy (dry season), 8) economic.

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1 The word "remote" is used to denote distance from the nearest village. The three areas where rice paddy surveys were conducted were 0.8, 2, and 11 kilometers from the nearest villages, with an average distance of 4.6 kilometers.
Table 8.1. Mammal Species Recorded in Track, Scat, and Sign Surveys of the Meihuashan Nature Reserve

(Compare with Table 2.1)

<table>
<thead>
<tr>
<th>Group</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ungulates</td>
<td></td>
</tr>
<tr>
<td>common muntjac</td>
<td><em>Muntiacus muntjak</em></td>
</tr>
<tr>
<td>Reeves muntjac</td>
<td><em>Muntiacus reevesi</em></td>
</tr>
<tr>
<td>crested deer</td>
<td><em>Elaphodus cephalophus</em></td>
</tr>
<tr>
<td>serow</td>
<td><em>Capricornis sumatraensis</em></td>
</tr>
<tr>
<td>wild boar</td>
<td><em>Sus scrofa</em></td>
</tr>
<tr>
<td>Large Carnivores/Omnivores</td>
<td></td>
</tr>
<tr>
<td>South China tiger</td>
<td><em>Panthera tigris amoyensis</em></td>
</tr>
<tr>
<td>leopard</td>
<td><em>Panthera pardus</em></td>
</tr>
<tr>
<td>clouded leopard</td>
<td><em>Neofelis nebulosa</em></td>
</tr>
<tr>
<td>Asiatic black bear</td>
<td><em>Selenarctos thibetanus</em></td>
</tr>
<tr>
<td>red dog (dhole)</td>
<td><em>Cuon alpinus</em></td>
</tr>
<tr>
<td>Other Mammals</td>
<td></td>
</tr>
<tr>
<td>large Indian civet</td>
<td><em>(Viverra zibetha)</em></td>
</tr>
<tr>
<td>small Indian civet</td>
<td><em>(Viverricula indica)</em></td>
</tr>
<tr>
<td>masked palm civet</td>
<td><em>(Paguma larvata)</em></td>
</tr>
<tr>
<td>golden cat</td>
<td><em>(Felis temmincki)</em></td>
</tr>
<tr>
<td>leopard cat</td>
<td><em>(Felis bengalensis)</em></td>
</tr>
<tr>
<td>Siberian weasel</td>
<td><em>(Mustela spp.)</em></td>
</tr>
<tr>
<td>badger</td>
<td><em>(Meles meles)</em></td>
</tr>
<tr>
<td>Chinese ferret-badger</td>
<td><em>(Melogale moschata)</em></td>
</tr>
<tr>
<td>hog badger</td>
<td><em>(Arctonyx collaris)</em></td>
</tr>
<tr>
<td>crab-eating mongoose</td>
<td><em>(Herpestes urva)</em></td>
</tr>
<tr>
<td>bamboo rat</td>
<td><em>(Rhyzomis pruinosus)</em></td>
</tr>
<tr>
<td>pangolin</td>
<td><em>(Manis pentadactyla)</em></td>
</tr>
<tr>
<td>porcupine</td>
<td><em>(Hystrix hodgsoni)</em></td>
</tr>
<tr>
<td>Chinese hare</td>
<td><em>(Lepus sinensis)</em></td>
</tr>
</tbody>
</table>

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Table 8.2. Vegetation Types: Estimated Total Area and Trail Survey Distance*

1. Montane Wetland  
Area: Unknown (Probably 1% or less of reserve area).  
Trail Survey Length: 1.45 Km.

2. Cunninghamia Plantation  
Area: 4.5 Sq. Km. (2% of reserve area).  
Trail Survey Length: 1 Km.

3. Fruit Orchard  
Area: Unknown (Probably <1% of reserve area).  
Trail Survey Length: 1 Km.

4. Remote Rice Paddy  
Area: 10.4 Sq. Km. (4.7% of reserve area).  
Trail Survey Length: 2.1 Km.

5. Broadleaf Forest >1,000 m*  
Area: Unknown. total broadleaf forest area: 43 Sq. Km. (19.5% of reserve area).  
Trail Survey Length: 3.4 Km.

6. Broadleaf Forest <1,000 m*  
Area: Area: Unknown. total broadleaf forest area: 43 Sq. Km. (19.5% of reserve area).  
Trail Survey Length: 3.4 Km.

7. Montane Grassland  
Area: Unknown, probably 4% or less (Only 7.4% of designated forest land, which includes montane grasslands. still lacked forest cover in 1991).  
Trail Survey Length: 5 Km.

8. Pine Forest  
Area: 144 Sq. Km. (65.6% of reserve area)*.  
Trail Survey Length: 10.3 Km.

9. Mixed Forest  
Area: Unknown.  
Trail Survey Length: 2.95 Km.

10. Bamboo Forest  
Area: 45 Sq. Km. (20.4% of reserve area)*  
Trail Survey Length: 4.7 Km.  
*These estimates probably include components of mixed forests, so total is >100%.  
(Sources: FMGJZBHQLGC, 1991; ZHKCBGBWH, 1991)
forest (mostly fruit orchards), 9) montane shrub-grassland, and 10) montane wetland or "dambo."

The total length of surveyed trail in each vegetation type approximated the relative ratios of vegetation cover over the whole reserve (Table 8.2). The researchers calculated an index value of wildlife habitat for each vegetation type according to the average number of tracks, signs, and sightings recorded per kilometer.

Field surveys were conducted in teams of two; the author and one co-researcher. There was a total of three co-researchers in the Meihuashan region, and one co-researcher in each of the Longxishan and Wuyishan surveys. Field surveys were first conducted in Meihuashan in the fall of 1994, from late October to early November, and subsequently at the end of the spring rainy season, in May and June of 1995. Thirty of thirty-seven surveys (81%) were conducted in the fall. Surveys in Longxishan and Wuyishan were conducted in August 1995.

Trail surveys followed pathways used by both humans and animals, but were restricted, where possible, to smaller trails with softer soil (hardpacked soils on large main trails do not provide a good medium for track impressions). Trail distances were calculated by counting paces. Data were collected on a specially designed survey form (Appendix E).

Wildlife researchers describe the technique of counting scats, tracks, feeding signs, scratches, nests, and other evidence along a transect, road, or trail as an "indirect method" for evaluating habitat use by terrestrial vertebrates. This is contrasted with
"direct methods," such as observation, capture, and radiotelemetry (Bookhout, 1994). The advantages and disadvantages of indirect methods vary according to which "index" is used (i.e. tracks, scats, or other signs). Bookhout (1994) recommends the use of more than one index (i.e. counting tracks and signs), and this study made use of a total of eight indices: tracks, scats, feeding signs, scratches, sightings, dens and nests, feathers or fur, and songs or calls (for birds) (Appendix E).

This method assumes that the more time an animal spends at a site, the higher a particular index will be, and that population density increases as the index increases. The problem with these assumptions is that index accumulation rates may vary according to which activities an animal is engaged in (feeding, sleeping, etc.), independent of the amount of time spent in a particular habitat, and indices can give a biased impression of habitat use (Bookhout, 1994). This may be especially true of scat accumulation. Bookhout notes that this problem can be mitigated by the use of many indices, and that approach was adopted for this study. Furthermore, the use of five relatively common species of ungulates (rather than one or two), each with distinctive habitat use patterns, provided a broad spectrum of habitat preference, and decreased the significance of errors in species identification (since the most important objective was to determine general ungulate habitat preference, and defining the autecological habitat preferences of each species was a secondary objective).

Bookhout (1994) lists the advantages of using track counts as: 1) all segments of a population can be sampled (whereas only small samples of a population can be studied in radio telemetry studies); 2) it is inexpensive (which makes it a promising method for
many parts of the developing world); and 3) a large area can be sampled in a short time.
To this list may be added: 4) tracks may be counted in habitats where dense foliage or
rough terrain may make observation and/or radio telemetry impractical; and 5) tracks are
records of diurnal and nocturnal activity, whereas observation (and in some cases
telemetry) may be limited, in many habitats, to the daylight hours.

Bookhout (1994) lists the disadvantages of track counts as: 1) the distance an
animal travels within a habitat may not be correlated with time spent within that habitat;
and 2) seasonal and regional limitations if relying on snow. To this list the author adds:
3) limitations on track formation or visibility in certain soil substrates (i.e. extremely dry
and non-moldable soil) or vegetation types (i.e. extremely thick, dense grass without
well-formed animal trails). In this study, the first problem was largely offset by the
selection of a large number of different sample species. Tracks that appeared to be made
by the same animal walking along a trail were recorded only once for every ten meters
along the transect. In most habitats, we found that animal trails formed a network, rather
than a "single highway," so the probability of the trail survey route coinciding with an
individual animal's travel route decreased with distance. By limiting the track count to
1/10 m/individual animal, we reduced the possibility of individual route bias in
determining frequency of habitat use. The rate of track accumulation may still be only a
partial reflection of time spent within a particular habitat, but high accumulation rates of a
number of species, as in this study, are a clear indication of habitat importance. Elapsed
time within a particular habitat is an important indicator of habitat value, but so is
frequency of use. In other words, an animal or group of animals may traverse a particular
patch of habitat rapidly to get to a feeding or sleeping area, but the value of that patch as a travel corridor should not be underestimated, especially since its vegetation features may determine its role as cover as much as or more than does its position between other functional units in the landscape. The particular advantages and disadvantages of scat and sign counts as independent indices of wildlife activity and habitat preference (Bookhout discusses scat counts, browsed twig counts, and squirrel nest counts) need not be discussed here since this research used a number of indices to offset site and activity bias.

Problems of seasonality with snow tracking were not applicable, since the surveys did not take place in snowy conditions. The problem of seasonal variation of precipitation, however, was a factor in track studies. The dry season in western Fujian lasts from September through December, and this was the best time for outdoor field work. Laterization, or the formation of hardpan, was a problem on exposed surfaces that lacked any type of vegetation cover, such as roads and certain broad paths through fields. This was not a problem in any of the sample habitats however, for only the rice paddies were exposed (during the dry season fallow period), and the soil water moisture and soil type allowed for track formation in paddies even near the end of the dry season.

Finally, the problem of observer bias is important in tracking and animal sign observation (Bookhout, 1994) because different people's tracking abilities, survey habits, and enthusiasm vary significantly. The author resolved this problem by conducting all track surveys in the same fashion, with a small group of avid and reliable trackers as assistants. In Meihuashan there were two expert assistants who helped the author with
over 90% of the surveys. In Wuyishan there was one expert assistant and in Longxishan there was one semi-experienced assistant.

Another important advantage of measuring visible wildlife signs without relying upon complex and expensive technologies is that this activity is central to the primordial relationship between humans and other species of animals. Tracking is an ethno-bioscience that was developed early in human evolution and has been an essential part of cultural development. How tracking figures in local environmental knowledge and subsistence patterns is an important measure of a peoples' connection to the environment. It is often part of the repertoire of nature observation skills of local hunters, and even those whose formal educational background is limited are often invaluable assistants in biological field studies. One might even argue that as formal education increases in a given area, subsistence patterns change, and the environmental knowledge and skills related to tracking become increasingly rare.

By enlisting local trackers in these studies, the researcher achieved a number of research goals simultaneously, for example: 1) survey results were improved due to the experience and knowledge base of local hunters; 2) local wildlife history and folklore was collected as survey conditions brought to light many questions and comments relating to hunting and the life histories of certain species; and 3) rapport was built with informants and their level of interest and confidence in the possibility of participating in local wildlife management schemes was increased.

In Wuyishan and Longxishan, the researcher selected broadleaf forests over 1,000 meters in elevation for wildlife habitat preference surveys. Since the field research period
was extremely limited, only one type of vegetation was surveyed. The same survey format was used in these reserves as was used in Meihuashan. Local hunters (or, as they called themselves, former hunters) were hired as guides. As in surveys conducted with local people in Meihuashan, these field excursions proved to be extremely valuable for collecting data on hunting techniques, local environmental knowledge, and environmental change.

Ungulate Autecology

Life cycles of the five ungulates are described below, along with findings on the autecology of their habitat preferences in the Meihuashan Nature Reserve. They are discussed in order of the abundance of signs recorded for each species in the habitat surveys.

Wild Boar (Sus scrofa) - Ye Zhu (野猪) "wild pig"; Local: Shan Zhu (山猪) "mountain pig"

The wild boar is found throughout temperate, subtropical, and tropical Eurasia and North Africa. In China, it is common from the Northeast south to Hainan Island, and west to Xinjiang. In the Southeast Uplands it is very common, especially in mountainous areas, and has a reputation for being both a ferocious attacker and a rapacious devourer of crops. The first trait was evident in three Meihuashan villages, where two hunting dogs and one hunter suffered serious injuries in three separate boar attacks, all within a period.

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2 The word "signs" will be used to denote all of the indices used in the survey (scats, tracks, feeding and nesting signs, etc.)
of a few months. There is no special state protection for the animal, and hunting is not managed in a scientific fashion.

Though domestic pigs are descendants of the wild boar, and can still interbreed with it, there are considerable differences in behavior and appearance between the two. The wild boar has a coarse, brownish, bristly coat that commonly turns grey with age. Its head is long and narrow. In males, the upper canines form tusks, which grow outward and upward. The lower tusks grow upward and are sharp from rubbing on the upper tusks. Boars can grow up to 1.5 meters (5 feet) long, 79 cm (31 inches) high at the shoulder, and 91 kilograms (200 pounds) in weight. They commonly travel in packs, with anywhere between 2-40 individuals. Older males tend to be solitary (Walker et al., 1975; Shou, 1962). Often feeding in groups, boar are omnivorous and will eat all parts of many kinds of herbaceous plants; the roots, bark, nuts, and fruits of certain woody plants; and a variety of other things, including insects and the carcasses of dead animals. They tend to uproot great swathes of earth as they forage, digging holes when they smell edible roots.

The yearly life cycle is described by hunters in Meihuashan as follows (Ma Shengxue, pers. comm.): in winter, when food is scarcest, boar go to the higher elevations (above 1200 m) to bask on sunny slopes in grass-scrublands during the day. They feed on the bark of pine roots, on fern roots, and on the acorns of chinkapin (Castanopsis) trees in the broadleaf forests. The author found holes nearly a meter deep and equally wide, where boars had excavated the roots of bracken fern (Pteridium aquilinum var.
Figure 8.2a. (Top) Wild Boar Specimen.

Figure 8.2b. (Bottom) Reeve’s Muntjac.
Figure 8.3a. (Top) Serow Specimen.

Figure 8.3b. (Bottom) Crested (Tufted) Deer Specimen.
latiusculum), the starch of which has also sustained villagers in years past (see chapter 6). One also finds holes at the bases of pine trees, where boars have eaten the bark of exposed roots.

In spring, the shoots of giant bamboo (Pylocestachys pubescens) erupt from underground roots in the groves managed by village families. The boars sleep on low ridges or summits in forests above the bamboo groves during the day, making forays into the groves at night to feed on tender shoots. It is at these times that villagers seek methods to keep boar and monkeys out of their bamboo plots, through a variety of means that will be discussed in chapter 11.

As spring passes to summer, a number of wild, uncultivated bamboo species sprout shoots, and the boar feed on at least three species in the higher elevation forests: shi zhu - "stone bamboo" (Phyllostachys nuda), gen zhu - "root bamboo," and bian zhu - "whip bamboo" (Phyllostachys nigra). In summer, boar also eat yangmei (bayberries), the tart, juicy fruits of Myrica rubra, which grow in the broadleaf forests and are also favored by villagers (Ma Shengxue, pers. comm.).

In the fall, boar frequent the paddies, trampling the rice plants and sometimes rolling over them, as they feast on the golden grains. In Meihuashan, as in other areas of the Southeast Uplands, damage to rice paddies is sometimes extensive, occasionally wiping out entire crops. In Gonghe village, it is roughly estimated that over 10 mu (over seven-tenths of a hectare) of rice paddy, approximately 10% of the total crop area, is

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3 As opposed to the wild giant bamboo (Phyllostachys pubescens), which is cultivated in so far as its growth is managed from year to year.
Frequency of Ungulate Indices

Signs/Kilometer (in 10 Habitat Types)

$n = 988$ (Unidentified Ungulate Signs Not Included)

Figure 8.4. Frequency of Ungulate Indices.
destroyed during the growing season every year (Ma Shengxue, pers. comm.). Along with depredation by rats, boar foraging in rice paddies has been a major catalyst in the abandonment of terraces that are farthest from the villages. Caldwell (1924) observed cases in which villages were completely abandoned after suffering devastating crop damage by wild boar.

Fall is also the mating season, preceded by fierce fighting among males. After a gestation period of about 5 months, an average of 5-8 piglets are born (Shou, 1962), and survivorship may number half that (Ma Shengxue, pers. comm.). Sows with piglets build a nest that may be more accurately described as a "house;" a hollow dome constructed of grasses, tree branches, and ferns up to a meter in height and a few meters in diameter, with a front "door." and sometimes a less obvious rear exit as well. These are often on mountain slopes in pine or scrub thickets, though one was observed in a remote valley wetland area as well. Males and females build less meticulous nests when in need of shelter during inclement weather. Males prefer to build on the peaks of hills or small mountains.

Wild boar signs were more numerous than the signs of any of the other five ungulates. This was due in part to the high visibility of their feeding and nesting activities, but also to their relatively high population, which is sustained by a high rate of reproduction (Fig. 8.4). Boars are well-adapted to a wide range of environments, and in Meihuashan their signs were found in all of the major habitats at all elevations (Figs. 8.4, 8.5, 8.6). Montane wetlands had the highest density of boar signs - an average of 50 per kilometer (as well as the highest density of signs for most of the other species), due to the
abundance of water and herbaceous plant forage (Figs. 8.6, 8.7). Rice paddies also attract a lot of boar (over 30/km), but this is mainly during the early fall harvest and the fall dry season. After the harvest, when no rice crops are grown, boar feed on tender grasses and other herbaceous plants in the paddies. The high elevation broadleaf forest is the most important forest type for boars, providing dense cover, as well as mast and fruit (mentioned above). Other vegetation types are more or less equally used by boars (Fig. 8.5), though cultivated groves of maozhu bamboo appear to be less frequented. It should be remembered that boar depend on the bamboo shoots in spring, but their nocturnal or crepuscular forays into the bamboo groves are brief and leave few signs.

Reeve's Muntjac (Muntiacus reevesi) - Huang Ji (黄几); Local: Shan Zhang (山猪)

The species with the second highest number of signs/Km. (with about half the frequency of boar signs) was the Reeve's muntjac (Figs. 8.2, 8.4). The Reeve's muntjac is one of four members of the genus Muntiacus found in China.4 M. reevesi, endemic to southern China, is found throughout the subtropical regions of the country, from about the Qinling-Huaihe ecotone south to the coastline, on Taiwan, and west to Sichuan, Yunnan, and Gansu. The limiting factor controlling its northernmost range is snow. It may not survive accumulated snowfall of greater than 10 cm. for more than about ten days (Sheng, 1991). Its population appears to be stable despite huge annual harvests. Sheng (1991) states that the total population is estimated at between 2,000,000-2,500,000. The

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4 A total of eight species of small deer comprise the subfamily Muntiacinae, all of which are indigenous to east and southeast Asia. There are five species of this subfamily in China, the four muntjacs and the crested (or tufted) deer (Elaphodus cephalophus). In England, Reeve's muntjac escaped into the wild after introduction into Woburn Park in 1900, and now has a population there that numbers in the thousands (Sheng, 1991).
Figure 8.5. Autecology of the Five Ungulates.
estimated annual harvest, estimated at 650,000, is not managed scientifically, and there is
no special state protection for the animal, but populations will be very resilient if
protective measures increase (Sheng, 1991). Reeve's muntjac is the most popular
mountain game species in southern China (Sheng, 1991). Like other deer, its meat and
organs are seen as medicinal foods, and its antlers and bones are ground up and sold as
medicine (ZGYYDWZXZZ, 1981).

Reeve's muntjac is the smallest of the muntjacs. It has adapted to the dense,
thorny foliage associated with lower elevation subtropical montane forests, where its
small body allows it to make quick escapes into the underbrush. Its fur color varies from
orange-brown to tan or light brown. Two vertical brown-black stripes run along the
length of the forehead. It averages about 79 cm in length, 42 cm in height at the shoulder,
and a mere 10-15 kg in weight. Like other muntjacs, males have not only antlers (short
with long pedicles) but also long upper canine teeth, which are used in combat during the
rut (all year long). Muntjacs also share the ability to emit a warning or location call that
sounds similar to a dog's bark, thus its other English name - barking deer.

These small deer have the highest breeding rate of the Cervidae family. Despite
an estimated harvest of 650,000 per year, the species is not believed to be threatened.
They have no fixed reproductive season and are extremely prolific. Females become
fertile at 5-7 months of age, and typically breed five times in three years, producing one
fawn per parturition. Males and females have separate ranges, the male's larger range (16
hectares in Britain) usually overlapping with those of two females (11 hectares). Sheng
(1991) attributes the species' ubiquitousness in China to: 1) reproductive vigor; 2) the
acceleration of forest clearance, which creates brush and successional forest habitat; and 3) a decrease in the leopard population, the leopard being the main predator of muntjacs (muntjac accounted for >30% of the gut contents of 23 leopards examined) (Sheng, 1991).

In Meihuashan, Reeve's muntjacs are very common in all habitats between about 700-1400 meters. They feed primarily on the tender leaves, buds, shoots, flowers, seeds, and fruits of herbs and shrubs. Sign frequencies for this species reflect the fact that it favors the damp, wooded areas, and clearings, and does not make use of the relatively dry montane grasslands (above 1400 meters) (Fig. 8.5). It is an opportunist, taking advantage of anthropogenic disturbance patches (fruit orchards, Cunninghamia stands, and rice paddies), as well as montane wetlands under about 1,400 meters, to sample fruits, shoots, and young leaves.

**Tufted (or Crested) Deer (Elaphodus cephalophus) - Mao Guan Lu (毛冠鹿); Local: Shan Zhang (above) or Hei Ji (黑 鹿)**

The crested deer is found only in China. Restricted to the subtropics, its range is similar to that of Reeve's muntjac, except that it does not occur in southernmost China or Taiwan, and it is found further west in Yunnan and Sichuan, and not as far north in easternmost China. In contrast to Reeve's muntjac, the crested deer population may be in some danger of decline due to hunting. Sheng (1991) estimates that in the 1980s, 100,000 were taken annually, and that there was a total population of about 4-500,000. The total population and the reproductive capacity of this species is much lower than that of Reeve's muntjac.
Like muntjacs, male crested deer have long canine teeth and pedicles at the bases of their antlers. Their common name comes from the black tuft of hair on the forehead (Fig. 8.3b). The fur is black or bluish-grey, the underside, flanks, and underside of the tail are white. The white ventral surface of the tail provides a startling contrast to the dark body when the deer bounds swiftly through the dense, high elevation (>1,300 m) scrub thickets that it favors. It averages about 95 cm in length (15-20 cm longer than Reeve's muntjac), 55 cm high at the shoulder (slightly taller than Reeve's muntjac), and weighs about 20-25 kg (almost twice the weight of the muntjac).

The crested deer's lower reproductive rate is a function of its seasonal breeding and late sexual maturity. It cannot reproduce until 1.5 years of age. It mates in winter and spring and gives birth to one fawn in late spring or early summer.

In Meihuashan, crested deer signs were almost as common as those of the Reeve's muntjac, but the former were found at higher elevations (roughly 1300-1800 meters)\(^5\) (Figs. 8.4, 8.5). In the Meihuashan landscape, crested deer are common in high elevation grasslands, montane wetlands, and high mountain broadleaf, pine, and mixed forests. They are less common with decreasing elevation and, unlike reeve's muntjacs, do not capitalize on the lower elevation anthropogenic disturbance patches that are typically in relatively close proximity to human settlements (Fig. 8.5).

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\(^5\) Sheng (1991) notes that it can range from 300-800 meters elevations in southern China, but in the Qinling Range, it can be found between 1,000-3,000 meters, with one population observed at 4,750 meters. In Meihuashan, crested deer seem to inhabit the higher elevations. There may be competition for resources with the Reeve's muntjac at middle elevations, and the Indian muntjac at low elevations (<700 meters).
Serow (*Capricornis sumatraensis*) - *Su Men Ling* (蘇門羚); Local: *Shan Yang* (山羊)

The serow is a type of mountain goat, classed in the Bovidae, which include cattle, antelope, sheep, and goats. It is found from northern India to southern China, and throughout the Indo-Chinese peninsula and Sumatra (Anderson, 1982). In China its distribution is similar to those of Reeve's muntjac and the crested deer. It is found in mountainous areas throughout the subtropics, from Gansu and the Qinling Mountains in the north to the southern coastal hills in the south, and from Taiwan in the southeast to Yunnan in the southwest, from which its range extends into Southeast Asia. The serow is listed in the China section of the 1994 IUCN Red List of Threatened Animals, a database of species that are "globally threatened as of late 1993," maintained by the World Conservation Monitoring Center.

Compared to the small cervids, with which it shares the Southeast Uplands, it is a very large animal (Fig. 8.3). It grows to a length of 1.8 meters, 1 meter high at the shoulder, and up to 140 kg (315 pounds) in weight. Its brown-black, coarse coat contrasts with a stunning whitish mane which, when seen among the cliffs and boulders in the high mountain grasslands where it resides, makes it resemble a small horse grazing in a secluded patch of meadow. Its horns are short (15 cm, or 6 inches).

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4 Two large ungulates, the sambar deer (up to 180 Kg.) and the Sika (or Meihua deer) (up to 155 Kg.) may have been more common as recently as the 1970's. Along with the much smaller goral (a wild goat), they appear to be locally extinct in Meihuashan, or very nearly so, apparently due to hunting and habitat loss.

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Serow tend to live alone or in small groups, with a distinct territory of a few square kilometers in area. They mate in winter or early spring and give birth to one calf eight months later. They feed on grass, shoots, and leaves. In Meihuashan, serow are found exclusively among cliffs and boulders in the high montane grasslands and broadleaf covered headwater ravines, from about 1,500 meters to the summit of Gouzinao, at 1,811 meters. They spend hours basking in the sunlight in patches of grass or on rocks near mountain summits. On hot days in spring and summer, they retreat to nearby broadleaf forests to drink and graze along streams below the summits. In Meihuashan, they are known to graze on grasses in the montane wetlands and basins, eat a fragrant grass called xiangpu along streams, and cull the leaves from the lashuye (Vaccinium sinicum), a hardy montane shrub that withstands the frequent winter frosts of the high grasslands. Research in Taiwan has shown that serow also eat the needles of fir and spruce trees, as well as the leaves of shrubs in the genera Berberis and Urtica.

Sign surveys in Meihuashan show that serow activity is restricted to higher elevations, between about 1,400 and 1,800 meters. It is notable, however, that in one survey of a Cunninghamia plantation, serow signs were abundant at an elevation of about 700 meters (Fig. 8.5). This relatively new (1-3 year old) disturbance patch was high up on a rocky ridge, far from the nearest village, and replete with tender grasses. Other important habitats for serow, as the surveys indicate, are the montane wetlands, montane grasslands, and broadleaf forest >1,000 meters. At lower elevations, serow are less apt to be found. No signs were found in rice paddies, mixed forests, or bamboo forests (Fig. 8.5).
Indian (or Common) Muntjac (*Muntiacus muntjak*) - *Chi Ji*; Local: Same as *M. reevesi*

The Indian muntjac is the largest species in the genus. The 20 subspecies are found throughout India, east to Southeast Asia as far south as Java, and in southern China (Anderson, 1982). In China the distribution extends from a core area in Yunnan province (in the southwest) eastward to Fujian, southward to Hainan, and westward to southeast Tibet. It is better adapted to tropical conditions than are the crested deer or Reeve's muntjac, and its distribution does not extend as far northward. In the Southeast Uplands its northernmost limits are in central Fujian, southern Jiangxi, and northern Guangdong. It is not found in Hunan (Sheng, 1991).

The Indian muntjac is similar in appearance to the Reeve's muntjac, but it is larger and has longer antlers than the latter (males only in both species). It grows up to about 95 cm long, 55 cm at shoulder height, and can weigh up to 25 kg (55 pounds).

Like Reeve's muntjac, it has no fixed breeding season and is highly prolific. It goes into estrus shortly after giving birth and can produce a fawn every seven months. Its population in China is estimated at over 600,000, and the annual harvest is between 100,000-150,000. There is no special state protection for the animal, and hunting is not managed in a scientific fashion (Sheng, 1991).

The Indian muntjac is usually solitary and is most active at dawn and dusk. It feeds primarily on tender leaves and fallen fruits. It also eats tender grasses, buds, and flowers.
This muntjac, appears to be the least common of the five selected ungulates in the reserve but appears to be more common at lower elevations (<800 meters) (Figs. 8.4 and 8.5). It is probably common on the periphery and outside of the reserve. Its apparent avoidance of higher elevations in the area may reflect an aversion to colder winter temperatures and competitive exclusion by other ungulates. It signs were abundant in a low elevation, 1-3 year old stand of Cunninghamia with average tree heights of about 1 meter (Fig. 8.5). Under these conditions, grazing is good and there are open views of predators. A few signs were found in low elevation rice paddies, as well as broadleaf, pine, and bamboo forests, but no signs were detected in the montane wetlands or grasslands, which are among the best ungulate habitat associated with higher elevations (Fig. 8.5).

**Survey Results - Ungulate Habitat Preference**

With a basic understanding of the autecology and habitat preferences of the five ungulates, we now focus on these individual patterns in aggregate form, to gain a composite view of ungulate habitat utilization patterns (Figs. 8.6, 8.7). The vegetation type with the highest density of ungulate signs/km. was the montane wetland, with an average score of over 109 (Fig. 8.6). This was followed, in order of average sign density by *Cunninghamia* plantation (64), fruit orchard (51), remote rice paddy (44.8), broadleaf forest >1,000 meters in elevation (41.2), montane grassland (26.4), pine forest (19.4), mixed forest (18.6), broadleaf forest <1,000 meters (17.9), and bamboo forest. The flora of these vegetation types was discussed in chapter 2. The following is a brief description...
of the most important characteristics of each habitat type and some of the anthropogenic influences that presently affect them.

**Montane Wetlands (Dambos)**

The montane wetlands are grassy bogs at high elevations, that is, between about 1,300 and 1,800 meters, far from the highest villages, which stand at around 1,200 meters. The wetlands are elongated peat-filled depressions in subalpine headwater zones, and often contain shallow pools, along with plenty of tender grasses and forbs for foraging. At dawn, dusk, and dark, muntjacs and other ungulates graze along the edges, where adjacent pine or broadleaf forests provide protective cover. In Meihuashan, the montane wetlands have not been carefully mapped. The larger Xiaoyang (sometimes referred to as Dayang) wetlands in the southwestern portion of the reserve are a notable exception (Figs. 1.2, 8.1).

Given the unique geomorphology of these small montane basins, and their importance for wildlife, the wetlands should be targeted for special protection. Since the wetlands of Meihuashan are far from the nearest villages and are not presently used for agriculture, forestry, or intensive gathering (this has not been the case in the past), protection measures may prove effective. The main threat to the ecology of the Dambos today is cattle grazing. If herds of yellow cattle become too large, they will cause impaction of the peaty soils and some degree of disruption to the flora. Pastoralism and its effects will be discussed in more detail in chapter 5.

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7 The author observed Reeve's muntjac, crested deer, and civet in many dambos in the core area of the reserve.
Wildlife Habitat Analysis

Index of Ungulate Activity

Figure 8.6. Wildlife Habitat Analysis: Index of Ungulate Activity.
Ungulate Activity in 10 Habitat Types
Average No. of Signs/Kilometer

*n = 988 (Unidentified Ungulate Signs Not Included)*

![Graph showing ungulate activity in 10 habitat types stratified by species.](image)

Figure 8.7. Ungulate Activity in 10 Habitat Types Stratified By Species.

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Cunninghamia (Chinese Fir) Stands

Cunninghamia is a member of the redwood family (Taxodiaceae) that has long been the primary source of timber in South and Central China, where it is commonly grown in large-scale plantations. About half (53%) of the Cunninghamia forests in the Meihuashan reserve have been planted for timber, and the remainder are sacred forests on Lingbei Xie village lands, in the outlying part of the reserve in the north. The 41 cultivated stands in the reserve are generally less than 10 years old, and relatively small in area (average area = 87 mu, 5.8 hectares, 14.3 acres) compared to stands outside of the reserve. With a total of 6731 mu (4.5 square kilometers), this vegetation type accounts for only 2% of the forested land in the nature reserve.

Since Cunninghamia is not common in the reserve, we found only one suitable patch for research, and surveyed a total of one kilometer of trail. This particular patch was between 1-3 years old, less than 1 meter high, and filled with herbaceous plants that had attracted numerous muntjacs and serow. If the trees had been any older, it is very unlikely that ungulates would have signs would have been as abundant (He Lian, pers. comm.).

The small size of most Cunninghamia forests in Meihuashan is another important factor in their possible value (while young) for ungulates. Ungulates are attracted to the young stands at night, where they can graze on tender grasses, with open views of predators and an easy retreat to better cover at the periphery (He Lian, pers. comm.). If these disturbance patches were larger, or if the trees were taller, it is unlikely that deer and serow would venture into their interiors, even at night. Where Cunninghamia and
pines form vast needleleaf forests in the hills and low to mid-sized mountains, ungulate species are not as richly represented, and overall plant and animal species diversity is greatly diminished. Therefore, the creation of large, pure stands of Cunninghamia should be discouraged, and the number of stands should be monitored.

**Fruit Orchards and Other "Economic Forests"

Like the cultivated stands of Cunninghamia in Meihuashan, fruit orchards are small, discrete, anthropogenic disturbance patches of high value for ungulates. The term "economic forest" denotes areas used for the cultivation of orchards to produce fruit, medicinal, and/or industrial products. It has been recommended that in Meihuashan these may include plantations of tea (Camellia sinensis), tung (Aleurites fordii), duzhong (Eucommia ulmoides), houpu (Magnolia officinalis), cinnamon (Cinnamomum cassia), pears (relative) (Pyrus pyrifolia), peaches (Prunus persica), li (Prunus salicina), plums (Prunus spp.), loquats (Eriobotrya japonica), and shan cangzi (Litsea cubeba) (ZHKCBGBWH, 1991). There appears to be little precedent for cultivating these species on a large scale in Meihuashan, though in recent years it has been attempted in a few small plots. There is no accurate estimate of the area of economic forests in Meihuashan today, the 1991 estimate of 32 mu (ZHKCBGBWH, 1991) being much too small. Orchards surveyed in this study included a 13 mu (.87 ha) patch of six year old shan cangzi, and a 2-3 year old orchard about 70 mu (4.7 ha) in area, which included li, peaches, and plums (Prunus mume) that were rapidly being overtaken by grasses and forbs.
Though it has been recommended that villagers cultivate economic forests to enhance and diversify their income, such activity has, to date, been slow to develop. Aside from one small field of tea (most households grow a couple of bushes for their own use), shan cangzi, and a few young orchards (some of which have been abandoned), there are few "economic forests" in the reserve. There total area is certainly less than 1%. One of the only villagers the author met who had an orchard (the latter one mentioned above) complained that Reeve's muntjacs, rabbits, and other animals had damaged many of his trees (note the predominance of Reeve's muntjac signs in the fruit orchard - Fig. 8.7). For orchards to succeed, they must be managed vigilantly, and this could lead to an increase in conflicts with wildlife.

**Remote Rice Paddies**

Rice paddies are available only on a seasonal basis, in fall, winter, and spring, providing first a feast of grain at harvest time, when wild boar can wipe out entire paddies if no one stands guard through the night, and then a supply of tender grasses and forbs, which are available from after the harvest until spring plowing time. Rice paddies (including remote paddies and those close to villages) cover 15,629 mu (10.4 square km), or 4.7% of the total area of the reserve. The paddies surveyed were all relatively small in area, more than three-quarters of a kilometer from the nearest villages, and surrounded by forests, so they were optimum for grazing. Of the ungulates, wild boar and Reeve's muntjacs appear to be the most common denizens of the fallow season paddies (Fig. 8.7). The area of rice paddy has decreased over the last century, and following a period of government-enforced grain production from the 1950s to the 1980s, a further decline
in area is occurring, especially in paddies farthest from villages. Villagers complain that it is too difficult to keep out rats and wild boars during the harvest, and since these high elevation paddies are not very productive (see chapter 7), it is not economical to invest time and labor in producing more rice than is required for family subsistence needs. Boar and rats have long been a threat to the rice harvest, and muntjacs are common in paddies after the harvest, but since there is no legal protection for these species, villagers will continue to exterminate them using a variety of methods (see chapter 11).

**Broadleaf Forests > 1,000 Meters in Elevation**

Of the more extensive vegetation types, broadleaf forests over 1,000 m have the highest density of ungulate signs. The equitability of this habitat (i.e. its importance for a relatively large number of species) is shown in figure 8.7. Like the montane wetlands, the high altitude broadleaf forests are used relatively equally by all four of the ungulate species that are common at elevations above 1,000 meters (all but the common muntjac).

These are successional remnants of the vast subtropical broadleaf evergreen forests that once covered the region. They are dominated by members of the Fagaceae, or oak-beech family, (especially the genus *Castanopsis*, and secondarily by *Cyclobalanopsis*), and the Lauraceae, or laurel family, such as the camphor tree. Most common on steep slopes far from villages, they are a source area for ungulates, providing cover, water, and forage, especially in the form of leaves, fruit, and mast, especially the acorns of *Castanopsis* and *Cyclobalanopsis* trees.
Broadleaf forests cover 43 square kilometers, or 19.4% of the reserve, and 28.6% of its forested area. The most severe threat to these forests is deforestation due to the expansion of managed bamboo forests (discussed at length in chapter 7).

**High Mountain Grasslands**

High mountain grasslands are among the best habitats for the high-altitude dwellers - serow and crested deer (Fig. 8.6). Wild boar also make use of these remote meadows. The high mountain grasslands differ from those of lower elevations in terms of taxonomic assemblage, and in their greater persistence after fire (due to drier soils and colder temperatures). These grasslands are found at elevations between 1,500 and 1,800 meters, around the summits of the highest mountains in the Meihuashan region. They are dominated by a species of grass called *mang* (*Midcanthus sinensis*). Other important grasses include *xi bing cao* (*Capillipedium parviflorum*), *ye gu cao* (*Arundinella hirta*), *qian li guang* (*Senecio scandens*), and *di er cao* (*Hypericum japonicum*). Scattered shrubs include mostly *du juan* (*Rhododendron simisii*), *la shu ye* (*Guangxiyueju* (*Vaccinium sinicum*), *bai zhu shu* (*Gaultheria leucocarpa*), *ye mu dan* (*Melastoma spp.*), and *jia ye nan du* (*Lyonia ovalifolia* var. *lanceolata*). There are also a few species of vines, and the seedlings of Huangshan pines, which disperse from the surrounding dense stands below. The high grasslands were traditionally viewed as prime territory for the South China tiger, but for the last 30 years these meadows have been rapidly engulfed by impenetrable forests of stunted Huangshan pines and shrubs. The gradual succession to pine forest and shrub is occurring because of the strict prohibition against burning the mountains. This
ecological transformation is being carried out with the best intentions, but it amounts to
the loss of highland meadows that are, at the very least, many centuries old.

Pine Forests

The pine forests of Meihuashan consist of two types, one dominated by Masson
pine, known as "ma wei song" (*Pinus massonianaa*), and those dominated by Huangshan
pine (*Pinus taiwanensis*). Together these two types of pine forest cover an estimated
65.6% of the reserve (ZHKCBGWYH, 1991) (note that this rough estimate probably
includes substantial areas of mixed forest). Forests of Masson pines are common
throughout the Southeast Uplands. In Meihuashan, they occur from about 400 meters in
elevation to 1,300 meters. Huangshan pine forests grow on the high-elevation slopes
from 1,300 to 1,800 meters in elevation, covering about 19% of the reserve. These pines
thrive in the dry soils, high winds, and cold winter temperatures of high mountains. At
elevations over about 1,500 meters they have not grown taller than about 2-3 meters
(though their average age is 15-20 years), which makes the forest dense and virtually
impenetrable for humans. Most ungulate species do not favor this type of community, for
it provides little forage, open area grazing, or water.

Despite their remoteness from the frequent human disturbance around low
elevation villages, pine forests do not constitute particularly good ungulate habitat. In
winter, wild boar root for pine root bark. They also sometimes make nests in the pine
forests (Fig. 8.7). Crested deer and serow appear to use the Huangshan pine forests
adjacent to high grasslands for cover, but it is not as important in that sense as are
broadleaf forest and riparian scrub thickets.
Mixed Pine - Broadleaf Forests

Mixed pine-broadleaf forests are comprised of a mixture of pine, broadleaf, and bamboo taxa. This forest type comprises a large part of the reserve, though there are no accurate estimates of the total forest area. A large percentage of the pine forest is gradually being succeeded by broadleaf forests, so we can infer that the area of transitional mixed forest is steadily increasing. The four forest areas sampled in these surveys ranged from about 900 to 1200 meters in elevation. They may not represent the full range of geographic and ecological conditions of this important forest type. The ecological value of these forests can be better understood by including indices of other mammals and birds (Figs. 8.7-8.10).

Broadleaf Forests < 1,000 Meters in Elevation

Broadleaf forests under 1,000m contain less than half of the density of signs of the same vegetation type at higher elevations, which suggests that proximity to human disturbance in the form of day-to-day activity and the alteration of adjacent vegetation patches is a critical factor in ungulate density. All ungulates were represented in surveys of this habitat, but Reeve's muntjacs and wild boars clearly dominate, given their adaptability to anthropogenic environmental disturbance. In density of bird activity, however, these forests were second only to the higher elevation broadleaf forests (Fig. 8.10), and like the mixed forests, the ecological value of these forests can be better understood by including indices of other mammals and birds (Figs. 8.7-10).
Figure 8.8. Wildlife Habitat Analysis: Index of Carnivore Activity.
Bamboo Forests

The habitat type with the lowest density of ungulate activity consists of managed bamboo forests. This habitat also scores lowest in sign density for carnivores, all mammals, and mammals and birds combined. There is little doubt that large stands of carefully groomed bamboo forests do not comprise good wildlife habitat. Bamboo forests are frequented by villagers, who keep the underbrush cleared to promote the growth of new shoots, and who set up traps, dummies, and explosives devices to repel boars. Though ungulates browse there at night, especially along forest edges, there is little cover. Bamboo forests with dense understories - that is those that are managed in a very lax fashion - are said to be good wildlife habitat, but virtually all of the understory has been neatly trimmed in Meihuashan during the last three or four years, for reasons that will be discussed below. As a result, wildlife feeding activity is intense only during the spring period of bamboo shoot development, when wild boar and monkeys can cause serious depredation. At other times of year, Reeve's muntjacs browse the underbrush at night, eating the tender herbaceous plants that sprout after villagers clear the underbrush (Fig. 8.7).

Forests dominated by bamboo currently cover about 20.3\% of the reserve, and the area of pure bamboo stands is increasing each year, as villagers clear out the undergrowth.

\footnote{As noted in chapters 9 and 12, only 4,522 \textit{mu} (301 Ha) or less than 1\% of the reserve area was estimated to contain completely pure stands of \textit{maozhu} bamboo (in which all or most of the other canopy species had been clear) (Wu, 1991). This can hardly be accurate however, since the average bamboo forest area of the natural villages surveyed was 4,280 in 1994, and each village was in the process of clearing these forests rapidly (see household bamboo management in chapter 9).}
and remove canopy trees. It is critically important that this essential economic activity be as limited in areal extent as possible. Otherwise the reserve could become what has been called a "bamboo desert" (see chapters 7 and 9).

**Habitat Preferences Among Other Mammals and Birds**

Though tracks, scats, feeding signs, nesting signs, and sightings of carnivores and small herbivores were much less frequent than those of ungulates, they provided an important source of information on wildlife habitat preferences in Meihuashan. These indices (in addition to feathers and calls) were also used to analyze the habitat preferences of birds.

As with ungulates, evidence of carnivores was far more abundant in the montane wetlands than in any other habitat type (24.8/km) (Fig. 8.8). This included the scats and tracks of the golden cat (*Catopuma temmincki*), Asiatic red dog (*Cuon alpinus*), leopard cat (*Felis bengalensis*), large Indian civet (*Viverra zibetha*), small Indian civet (*Viverricula indica*), and crab-eating mongoose (*Herpestes urva*). Other species detected in other habitats included the tiger (*Panthera tigris amoyensis*) or leopard (*Panthera..."

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9 The golden cat is known locally as the "you xi hu," or "stream following tiger" because of its mostly nocturnal predation on birds, small mammals, and muntjacs by following the banks of small streams. Tracks of the golden cat were seen on small sand banks along streams in the larger wetlands and higher elevation broadleaf forests on a number of occasions. Golden cats are generally red-brown, about 1 meter in body length, and weigh 10-15 kilograms. They are found from Indian and Nepal to Burma and parts of Southeast Asia. In China, they are rare throughout their distribution, which extends from about the Qinling mountains south to the coastline (Gao et al., 1987). This species is listed on the 1994 IUCN Redlist of Threatened Animals as "Indeterminate," that is "known to be 'endangered,' 'vulnerable,' or 'rare,' but...there is not enough information to say which of the three categories is appropriate."
Figure 8.9. Wildlife Habitat Analysis: Index of Mammal Activity.
pardus), cloded leopard (*Neofelis nebulosa*) (two sets of tracks found in two rice paddies), masked palm civet (omnivorous) (*Paguma larvata*), Eurasian badger (*Meles meles*), weasels (*Mustela spp.* and *Melogale moschata*), and pangolin (insectivorous) (*Manis pentadactyla*). The order of habitat preference is different from that of ungulates, most significantly in terms of the greater importance of broadleaf forests. As with ungulate habitat preference, bamboo is the least valuable habitat. Other evidence of large carnivores and omnivores is discussed below.

Aggregated data for all mammals (ungulates n = 999; carnivores n = 99; and small herbivores n = 136) shows a pattern that is similar to that of ungulates (Fig. 8.9). Figure 8.9 is a composite of figures 8.6 and 8.8, with the addition of the habitat preferences of small herbivores. The habitats that are important feeding areas for ungulates, such as fruit orchards, wetlands, grasslands, and rice paddies, are also important for small herbivores like rabbits (*Lepus sinensis*), rats (*Rattus spp.*), bamboo rats (*Rhyzomis*...)

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10 On October 31, 1994, one ground scratch was discovered in a pine forest at an elevation of 1,330 meters, 6 kilometers from the nearest villages (Gonghe and Guizhuping). The scratch was 60 cm in length (including the litter pile at the end of the scratch), 10 cm wide, and 10 cm deep. It was attributed to a tiger when it was discovered by He Lian, a zoogeographer with the Fujian Provincial Museum, the author being outside of the reserve waiting for permission to enter. He Lian has seen 5-6 such scratches in the reserve, mostly while in the company of Gary Koehler, a cat specialist who conducted research on tigers for the Worldwide Fund for Nature in 1990-91 (see chapter 3). There is, however, some degree of doubt about whether such scratches are made by tigers or leopards (He pers, comm.). On June 21, 1995, the author discovered two tree scratches on the same tree, in a broadleaf forest at an elevation of 1,200 meters, about 3 kilometers west of Gonghe village. The unidentified broadleaf tree was near a stream in a place called Bai Zhu Wo. One scratch was 14 cm long, at a height of 170-156 cm above the ground, the other scratch was 20 cm long, from 160-140 cm above the ground. They resembled tree scratches believed made by a tiger above the village of Da Yuan northwest of the reserve, which were verified as tiger signs by both Huang Zaiqiu (a tiger hunter) and Gary Koehler).
pruinosus) and mice (Mus spp., Apodemus spp., Micromys spp). Mammal activity as a whole is similar to that of ungulate activity in the sense that montane wetlands are critically important and that managed bamboo forests are the least favored habitat. It is recognized that this similarity is due in no small part to the fact that sample sizes for carnivores and small herbivores were relatively small. It is also notable that low elevation broadleaf forests appear to play a more important role for other mammals, and their important value for wildlife should not be underestimated. Similarly, pine forests appear to be relatively depauperate, which has very important implications for vegetation history and wildlife management.

Of 776 observations of bird signs, 41.6% were those of pheasants and other gallinaceous birds, and 58.4% were those of other birds, mostly passerines (for taxonomic information, see Table 8.1). Of the pheasants, 98.4% were identified as predominantly forest-dwelling. Of the other birds, 95.6% were identified as predominantly forest-dwelling. This estimation was based more upon the habitats in which the birds were observed than upon correct taxonomic identification, since the main objective of the field survey was to record the relative number of birds in each of the ten habitat types, rather than to identify the birds.12 With that caveat in mind, passerines and other birds observed

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11 The bamboo rat is probably exceptional in its preference for pine, broadleaf, and mixed forests. Its burrows are found in or near forested areas, where it eats three or four species of bamboo. Villagers excavate these burrows as soon as they discover them in order to remove the three to four pound rats inside. They are a favorite food throughout the Southeast Uplands.

12 The relative abundance of bird signs in fruit orchards and montane wetlands does not mean that these were predominantly field-dwelling birds. We assumed that was not the case, and that the birds were simply feeding on the edges of these open habitats.
Wildlife Habitat Analysis
Index of Bird Activity

Figure 8.10. Wildlife Habitat Analysis: Index of Bird Activity.
in open meadows or other areas without trees were seen in the following habitats (in order of abundance): rice paddies, montane grasslands, orchards, and montane wetlands.

The vast majority of signs (of pheasants and other birds) were found in forest habitats (Fig. 8.10). The broadleaf forests (above and below 1,000 meters in elevation) accounted for 363 signs, or 46.8% of the raw total for all 10 habitat types (and 42.2% of the average signs per kilometer). Feeding signs (ground scratches) of pheasants, especially the silver pheasant (*Lophura nycthemera*) are ubiquitous in the broadleaf forests at all elevations. Mixed forests are also important for both passerines and gallinaceous birds. Forests of pure pine are less important, providing fewer opportunities for feeding and nesting. Fruit orchards are important feeding areas for passerines and pheasants, and montane wetlands are important feeding and watering areas for passerines.

Bamboo is more important for birds than for any other kinds of wildlife. This may be due in part to the interspersion of large broadleaf trees that are left standing in many bamboo forests. These trees may serve as nesting and feeding areas. Cunninghamia stands are not good habitat for birds. A walk through even the more mature pure stands in plantations over ten years of age is strangely silent, for there are very few birds. Finally, montane grasslands, especially those around the summits of the highest peaks, are often blasted by high winds. There is little shelter and perching sites for passerines are few.

Figures 8.8-8.10 reflect the relative importance of montane wetland habitat at one extreme, and the lack of habitat value of managed bamboo forests at the other. Of the

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13 This may also be true of some species of mammals whose signs were not amenable to the survey, like flying squirrels and masked palm civets. These species are known to live and feed in broadleaf trees, but we could not detect many signs of arboreal animals.
more obvious anthropogenic disturbance patches, fruit orchards may be the most valuable, followed by rice paddies (during the fallow season), and 1-3 year old *Cunninghamia* stands. Broadleaf forests score much higher when bird signs are taken into consideration, and even the lower elevation stands are important, because birds are less affected by proximity to village noises and other disturbances than are mammals (especially ungulates and carnivores). Mixed forests (which tend to be dominated by pine) and pine forests are less important than the broadleaf forests, due to their relative structural homogeneity and lack of feeding and nesting opportunities. Montane grasslands surveyed in this study were limited to the highest peaks, above the encroaching pine forests, so they comprise a harsh environment that is not favored by any birds, although it is critical habitat for serow and crested deer. Finally, the bamboo forest is a homogeneous environment that is especially lacking in feeding and nesting opportunities at ground level and in the understory (due to intensive yearly clearance). It attracts boars, and to a lesser extent monkeys, during the spring shoot-growing season, and individual broadleaf trees among the bamboo may serve as habitat islands, but this vegetation type is relatively depauperate and should not be allowed to spread.

In summary, land use management decisions in the reserves should be made on the basis of specific wildlife management goals. For instance, if Meihuashan were to be managed to maximize the population of serow, it would be best to focus on vegetation management in the high elevation meadows. Serows need open grasslands around the boulders and cliffs that occur above 1,500 meters. These meadows are best when bordered by riparian broadleaf forests below. Huangshan pine forests should be cleared
(at least in certain areas) at these elevations. To protect the serow population, which is not apt to rebound quickly, hunting (especially with the use of dogs) would have to be eliminated in high mountain areas.

Conservation strategies for Meihuashan, and for the Southeast Uplands as a whole are discussed in more detail in chapter 12.

Evidence of Large Carnivores and Omnivores in Meihuashan

Much of the information collected on wildlife was not part of the wildlife surveys per se. This was especially true of signs and other information concerning large carnivores and omnivores. The following observations provide evidence of the persistence of certain large carnivores and omnivores in the SE Uplands. This information is important because very little systematic wildlife research has been conducted in Fujian since 1949 (for one exception see Koehler, 1991; see chapter 3). Thus, there is little reliable data on wildlife - most information on mammals is anecdotal or based on fur collection records.

Figure 8.11 shows a clouded leopard that was caught in 1993 in leghold traps, and was confiscated while still alive by the Meihuashan reserve staff, it had just died in captivity when this photo was taken. As mentioned, in track and sign surveys we found clouded leopard tracks at two sites within rice paddies. Clouded leopards are probably the most common of the large cats in SE China, but the species is under first level state protection in China and listed as "vulnerable" on the IUCN Red List (meaning they are likely to become endangered in the near future if causal factors that have led to their population decline continue).
Figure 8.11. Clouded leopard That Was Caught in Leghold Traps. The animal was confiscated live in a local market by reserve officials in 1992, after having been caught in steel leghold traps by poachers. The animal had just died in captivity before this photo was taken.
Figure 8.12 shows an Asiatic black bear feeding spot in a yangmei tree (*Myrica rubra* - a type of bayberry or waxmyrtle that produces lots of luscious, tangy-tasting red fruit). This photo was taken in a very remote broadleaf forest of Meihuashan, where a pine resin collector led the author to a series of trees with fresh scratches in the bark, where bears had climbed up to get the fruit. Once in the tree they break branches and pull them into a kind of nest where they can sit and dine on their harvest. The author found the same feeding signs of bears in high elevation broadleaf forests in Wuyishan Nature Reserve as well.

Evidence of large carnivores activities included two Reeves muntjacs believed to have been killed by Asiatic red dogs. The two kill sites were located in two montane wetlands, and what was believed to be red dog scats were found near one of them. It is possible that the kills were made by a big cat, since the prey were not dismembered.

In May of 1995, two sets of large cat tracks in two sets were discovered in a peanut field near a village some miles south of the Meihuashan Reserve. Separate investigations by the author and a former tiger hunter who was accompanied by reserve staff, showed that the tracks were probably made by two leopards that had wandered into the cultivated valley from a densely forested ridge nearby, and it appeared that they soon returned to the forested slope.

Finally, in 1991, a villager led Koehler to some tree scratches that were made by a large cat, believed to be a tiger that had been caught in a leghold trap attached to the tree trunk. The tree was in a very remote area just west of the Meihuashan reserve. Koehler discovered what was thought to be a tiger's tooth stuck in the tree (Koehler, 1991).
Figure 8.12. Asiatic Black Bear “Nest” of Yangmei Branches. This vegetative mass in a *Myrica rubra* (yangmei) tree near Majiaping village, was made by a bear pulling together a “nest” of fruit-laden branches. The platform then becomes both a perch and a plate.
Summary

Results from this survey of ten habitat types in the Meihuashan Nature Reserve show that ungulate activity was greatest in montane wetlands, a young (<3 years old) *Cunninghamia* stand, fruit orchards, remote rice paddies during the fallow season, broadleaf forests >1,000 meters in elevation, and montane grasslands (>1,300 meters in elevation).

Since most of the surveys (30 of 37) were conducted in the fall, these data may reflect habitat preferences during the dry season more than in other seasons. This may account in part for the high number of signs/km found in the montane wetlands. Montane wetlands may be critical dry season watering areas, as is true in other regions with distinctive wet and dry seasons.

A high number of signs in other non-forest patches (i.e. young *Cunninghamia* stands, fruit orchards, and rice paddies) does not indicate that forests are unimportant habitats for ungulates and other species. On the contrary, as Bookhout (1994: 693-694) explains, many forest animals feed in clearcuts but seek shelter and cover in adjacent forest patches. Proximity to mature forests or other dense cover is a critical factor, determining which species will make use of a given clearing. In mountainous areas, the altitudinal zonation of vegetation is another important factor, influencing the composition and structure of the vegetation, and creating a high degree of variation in opportunities for feeding, breeding, and other activities.

The survey showed that less-favored habitats were the pine forests, broadleaf forests <1,000 meters (especially those near village settlements), and bamboo forests.
Pine forests actually have the same value for wildlife as *Cunninghamia* forests. If our sample had been limited to pine forests at the same stage of development and in the same geographic conditions as the *Cunninghamia* patch, the results would have been similar. Similarly observations in more mature *Cunninghamia* forests revealed that these were not suitable habitat for ungulates or other animals or birds. Commercial conifer plantations, which are common outside of the reserve, and high elevation conifer forests propagated through aerial broadcast (as is ubiquitous in the core area of the reserve) are poor wildlife habitat (Koehler, 1991).

Broadleaf forests <1,000 meters in elevation are more subject to human encroachment, hunting, and disturbance in the form of noise from villages and roads. Survey results showing rather low levels of ungulate use should be weighed against the high levels of bird and signs. These forests may be critical for migratory and resident bird species.

Bamboo forests contained the fewest signs of wildlife of any vegetation type. The total clearance of understory vegetation and a sparsity of canopy area make for few cover or feeding opportunities for birds or mammals. The relatively frequent and intense activity of humans in these habitats is another drawback. The recent emphasis on keeping the understory cleared to permit shoot development has decreased the frequency with which mammals enter the bamboo forests to forage (He Lian; Ma Shengxue, pers. comm.). As long as bamboo is intensively cultivated in Meihuashan, its distribution, like that of coniferous plantations, should be kept within strictly specified boundaries.
Maozhu bamboo is a renewable natural resource that has for centuries brought tremendous economic benefits to the people of the Southeast Uplands. Preliminary results of the wildlife habitat surveys, however, showed that bamboo was the least favored wildlife habitat of the ten types surveyed (see chapter 8). The threat of bamboo forest proliferation and the concomitant loss of broadleaf forests and other superior habitat is perhaps the most critical land use issue in the Meihuashan reserve. In 1991, forests in which bamboo was a dominant element covered some 20.3% (4,510 Ha) (ZHKCBGWYH, 1991) of the total land area of the reserve and these were becoming pure stands (through the clearing of adjacent trees) at a rapid rate (see chapter 8). Bamboo forest management practices in Meihuashan and other areas of the Southeast Uplands have serious potential impacts on faunal and floral biodiversity. During the 15 years since managerial control returned to households, village bamboo forests have spread rapidly. In Guizhuping, for example, bamboo forest area has increased from about 4,000 mu in 1977 to about 7,000 mu in 1994, an increase of 75% in less than two decades (Guan Yanzeng, pers. comm.). With the recent emphasis on intensive stand management in Meihuashan, the threat of rapid conversion of other vegetation types into bamboo

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1 As noted in chapters 8 and 12, only 4,522 mu (301 Ha) or less than 1% of the reserve area was estimated to contain completely pure stands of maozhu bamboo (in which all or most of the other canopy species had been cleared) (Wu, 1991). This can hardly be accurate however, since the average bamboo forest area of the natural villages surveyed was 4,280 in 1994, and each village was in the process of clearing these forests rapidly (see household bamboo management below).
forest has increased still more. Given good soil and intensive management, it is estimated that one *mu* of bamboo can double in area within three years (in thinner soils, 7-8 years) (Ma Shulin pers. comm.). As individual families seek to better their lot, the spread of bamboo accelerates.

This chapter first examines some of the factors that influence household bamboo management decisions. Such factors include family size, income, supplementary sources of income, and secondary processing and marketing activities. This is followed by an analysis of the rate of bamboo incursion into adjacent forest stands. The final part of the chapter examines current forest protection policies, assesses several underlying land tenure problems that affect biological diversity, and suggests how the reserve management can work cooperatively with villages and households to develop bamboo resources in a fashion that is more ecologically sustainable. The underlying hope inherent in these arguments is that bamboo will continue to provide a cheap, abundant, and environmentally sound source of income for the people of the Southeast Uplands.

**Bamboo Earnings, Family Size, and Household Economies**

In each of the five study villages, families were randomly selected for a survey on bamboo management practices. Household managers, including males and females, were interviewed using the short questionnaire shown in Appendix F. The questionnaire was designed to determine the categories; the areal dimensions of individual stands and household bamboo forests in the aggregate; the number of outside workers employed; the amount of household income generated from bamboo sales; and the extent of understory...
clearance and tree area and number of bamboo stands managed by families of different sizes and income cutting. Results of the survey are shown in Tables 9.1 and 9.2.

There does not appear to be a linear relationship between these variables in the small sample population analyzed.\(^2\) From such a small population it may not be possible to accurately predict earnings from bamboo by variables such as family size, bamboo forest land per household, or bamboo forest land per capita. Also, a number of estimates of bamboo stand area are probably inaccurate due to a lack of formal measurements. Estimates of household incomes may also be inaccurate because they are difficult for families to calculate (due to changes in employment patterns)\(^3\) or simply held as private information, not to be shared with outsiders. These relationships may even more complex due to different levels of productivity between individual bamboo stands (due to

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\(^2\) Regression analyses were conducted on the relationships between:
1. family size and earnings from bamboo (total and per capita earnings),
2. area of bamboo forest land per family member and bamboo earnings per family member, and
3. total area of bamboo forest managed by the family and total family earnings from bamboo. In all of these analyses, there was no linear correlation between the independent and dependent variables. In the first test, there was an R squared value of .125713, in the second, .064574, and in the third, .059751.

\(^3\) The informal economy is fairly complex and family incomes appear to vary from month to month and from year to year. Some villagers work for other families on a part time or seasonal basis and a few find work outside of the home village on a part time or seasonal basis. Also, prices for commodities like bamboo poles, bamboo handicrafts, and livestock fluctuate in the course of a year, affecting the local economy and household income. To complicate this pattern, in many families there are more than two workers; a married couple, their offspring, parents, and unmarried siblings may all contribute to the family’s total income.
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<th>Total Total Inc./ Inc.</th>
<th>Bamboo % of Tot. Inc./ Person</th>
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</table>

Income in Yuan (eight yuan = one U.S. dollar in 1994)

**Wealthiest households of those surveyed in village.

*Poorest households of those surveyed in village.
differences in soil quality, distance from village, or other factors) and a plethora of different household economic management strategies.

Despite these problems, some observations and inferences can be made from the data. Most of the household income in the five study villages comes from bamboo, and bamboo-related income ranges from an average of 47% of total household income in Long Gui to 98% of total household income in Taipingliao. Bamboo-related income comprises an average of 68% of total household income in all five villages. Variation in the percentage of bamboo-derived income reflects differences between villages in the importance of additional sources of income, which is determined by factors such as the feasibility of processing and marketing bamboo products, access to transportation, and governmental regulation of timber and other natural resources.

Even villages with similar percentages of bamboo-derived income are under very different sets of geographic and economic constraints. For instance, the villages with the lowest levels of bamboo-derived income, Long Gui (48%) and Majiaping (50%), have more diversified household economies for very different reasons and with very different consequences. By some indicators, the former village is the most prosperous in the reserve, while the latter is the poorest (see chapter 5).

In Majiaping, the lack of access to roads and motorized transport precludes the export of unfinished bamboo poles and pine logs (as discussed above, no timber quotas are given to villages unless they have road access). Under these constraints,
Majiaping households must process a wide variety of forest and agricultural resources and, in some cases work as laborers in distant villages, towns, and cities. Household export products include bamboo-derived durable goods and perishables, pine resin, and livestock (pigs, chickens, and ducks). To process bamboo into durable products that can be hauled out of the basin in which the village lies, bamboo workbenches are set up in the home or in the forest, and poles are sliced into strips and converted into chopsticks (partially finished and finished) or longer sections called "zhupian" (flat, thin strips or pieces of bamboo). The latter are bought by middlemen, transported to larger industrial centers, and used in the manufacture of seat covers, bed covers, and other consumer goods. At the village level, zhupian and chopsticks are only manufactured on a consignment basis, when outside traders make orders. Therefore, prices and demand fluctuate through the year. In general, villages with road access can sell one unfinished bamboo pole for between 10-15 yuan, whereas Majiaping households can only sell chopsticks and zhupian for the equivalent of about 7 yuan per pole (Luo Changxiu, pers. comm.). Ironically, if Majiaping had road access, the production of finished and half-finished products could be more lucrative than the export of unfinished poles, as households in Taipingliao have proven (see below).

As mentioned above, many Majiaping households supplement their incomes by producing dried bamboo shoots and pine resin (songxiang) for export, and livestock for local sale. Pine resin extraction is an effective way to convert otherwise untouchable pine trees into money. Large pines (>30 cm dbh) all over the reserve are tapped so thoroughly
that they are sometimes killed. Though the reserve managers discourage such activity, it is not prosecuted, and some Majiaping households earn over 50% of their income from pine resin. Illegal timber and wildlife harvests probably comprise a considerable percentage of income for many households as well, since Majiaping is richly endowed with natural resources and seldom visited by reserve or other government officials.

In contrast, economic diversification in the households of Long Gui village has made them prosperous by local standards (though this particular sample of households may not adequately reflect it). The long history of road access has allowed the village to capitalize on the export of truckloads of timber (pine) from the collective forestry area and bamboo poles from household stands. Rather than being forced into diversification, as in Majiaping, Long Gui households have used timber and bamboo revenues to pursue commercial activities such as resin collecting, livestock raising, wild boar hunting and marketing, tractor driving (transporting goods to other villages), and opening small businesses outside of the reserve. After these interviews were conducted, a number of households had begun to process their bamboo in a gas powered mill that had been brought to the village on a temporary basis. This was the first sign of mechanized bamboo industry in Meihuashan, and it could further enrich the people of Long Gui.

Unlike Majiaping and Long Gui, households in Taipingliao are almost completely reliant on bamboo exports for their income (98% of income). With relatively good road access (via a "tractor road"), they can earn money by hand processing zhupian and

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* In 1994, the sale of timber from the village timber area netted about 500 yuan per person.
chopsticks and transporting these products to outside markets. The largest family in the village, which has 12 members, transports its own and other households' bamboo strips to Zhangzhou, earning greater profits by selling at urban market prices. Though the family is the second largest surveyed and hires the most outside laborers to cut and haul bamboo (14 people), it has the highest per capita income (3,509 yuan) (Table 9.1). It is clear that the family has created an economy of scale through extensive cooperation among its members and the coordination of labor, processing, and marketing functions. The emergence of such families may signal the beginning of monopolies, and increased potential for exploitation of poorer neighbors.

Other families surveyed, which do not appear to have reached such a high level of cooperation in labor and marketing, are much less prosperous. In these households, the relationship between family size and per capita earnings may follow a somewhat predictable pattern up to a point, though the small sample size is problematic. Eighteen of 26 families (69%) surveyed had between three and seven members. Families with between three and six members earned more money per capita than did most larger or smaller families.\footnote{Exceptions to this pattern occurred among five-member families, which included some extremely poor families in Guizhuping and Majiaping. A larger sample of households would probably have smoothed the curve shown in figure 9.1.} This pattern implies that larger families tend to show a decrease in per capita productivity. This is due to the fact that most of the large families, especially those with more than six members, include many children (and probably a number of elderly people), with few members of an age to qualify as laborers (Fig. 9.1). For this
Figure 9.1. Average Per Capita Income By Family Size.
reason (among others), family planning can have a direct impact on household economic conditions.

Another factor differentiating household economies of villages that are otherwise quite similar is the degree to which resident families pursue commercial enterprises, like managing their own stores and restaurants. This may serve two purposes, first it provides supplementary income and a wider variety of economic opportunities, and second, it removes pressure from family bamboo forests. Entry into the service sector has had a marked influence on a number of households in Gonghe, giving certain families a considerable economic advantage over most of their counterparts in neighboring Guizhuping. Both of the natural villages comprising the administrative village of Guihe have about the same population, average family size, number of laborers per family, and percentage of income from bamboo. Bamboo-related income, however, is markedly different, with Gonghe households earning more than twice the Guizhuping average (and nearly three times more on a per capita basis) (Table 9.1). This difference may be due, in part, to the higher quality and higher density of bamboo stands in Gonghe. Since there is less economic pressure on families with supplementary income, there is less of an impetus to cut bamboo, and stands can grow denser and contain higher quality poles through time. The strongest poles for scaffolding are those cut from culms that are 5-7 years old. Denser stands of superior bamboo are equivalent to increased capital. Each

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4 The average highest stand density (based on five household estimates of densest stands) in Gonghe in 1994 was 136 culms/mu. In Guizhuping, the figure was 110 culms/mu.
pole can be sold at a higher rate, and more bamboo can be harvested on a sustained basis year by year. While poor families must cut bamboo whenever they need money, which may be many times through the course of the year, wealthier families may cut once a year or less. One Gonghe resident, who also operated a restaurant in Shangfu (Buyun) was able to forego harvesting bamboo for over a year (Ma SX, pers. comm.). Families with outside business contacts are also able to arrange for more profitable bamboo sales, since they have a wider network of business associates.

In the case of Guihe Administrative village, Gonghe's better geographical position on the access road also gives the village a distinct advantage over Guizhuping. Both natural villages have lost money, however, because few truck drivers are willing to negotiate the steep, rutted access road. A number of trucks have lost part of their loads on the rough trip down the mountain, and in 1994, many drivers would not go beyond Liling village to purchase bamboo. While the reserve managers recommended that the villagers use money from bamboo sales and team up to repair the road (as was done in Dapingshan and Qiushan villages), Guihe villagers had not dealt with the issue in a cohesive fashion. In 1993-94, many households hauled their bamboo on tractors to Liling, which perpetuated the problem. Villagers cite a lack of leadership and cohesion as the main problem, and in 1994 there were no meetings to resolve the problem (Ma SX, pers. comm.). Under these conditions, households with personal or financial access to transportation have had a great advantage over those without it.
Table 9.2a. Labor Structure and Bamboo Stand Characteristics

<table>
<thead>
<tr>
<th>Family Laborers</th>
<th>Hired Laborers</th>
<th>Ratio of Family Members to all Laborers</th>
<th>Bamboo Area (Total, Per Cap)</th>
<th>Bamboo Area Per Laborer</th>
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<tbody>
<tr>
<td>Gonghe</td>
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<td></td>
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<td></td>
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<td>2</td>
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<td>250</td>
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<tr>
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<td>.7</td>
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<tr>
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<td>2</td>
<td>1.5</td>
<td>2.0</td>
<td>100</td>
</tr>
<tr>
<td>Average</td>
<td>3.3</td>
<td>5.2</td>
<td>1.7</td>
<td>290</td>
</tr>
</tbody>
</table>

7 Majiaping households hire many more laborers on average than do households in other villages. Because of the difficulties of transporting finished products along the mountain trails to Jiangxie and Miaojian, each family hires porters from other villages and towns in the region. Many Majiaping families also hire people to cut bamboo. Labor demands depend upon the amount of orders for chopsticks, zhupian, and other bamboo products. The number of hired laborers fluctuates from year to year, and is highly seasonal. Hiring practices vary, for example, in 1994, some families hired many porters for a few days of work, while others hired one or two laborers for a 1-2 month period. The data were insufficient for the calculation of laborer-days in each family in each village.
<table>
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<tr>
<th></th>
<th>1</th>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Taipingliao</td>
</tr>
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<td>.9</td>
<td>175</td>
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<td>100</td>
<td>20</td>
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<td>100</td>
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<td>1.7</td>
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<td>2</td>
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<td>1.2</td>
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<td>2</td>
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<tr>
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**Wealthiest households of those surveyed in village.**
*Poorest households of those surveyed in village.*
### Table 9.2b. Labor Structure and Bamboo Stand Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Number of Stands</th>
<th>Avg. Stand Area</th>
<th>% Cleared</th>
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<td>90**</td>
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<tr>
<td>3</td>
<td>5</td>
<td>60</td>
<td>80**</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>33</td>
<td>100*</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>3.8</strong></td>
<td><strong>46</strong></td>
<td><strong>86</strong></td>
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<td>1</td>
<td>45</td>
<td>80**</td>
</tr>
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<td>2</td>
<td>1</td>
<td>33</td>
<td>100*</td>
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</tr>
<tr>
<td>4</td>
<td>3</td>
<td>50</td>
<td>90*</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>125</td>
<td>100**</td>
</tr>
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<td><strong>Average</strong></td>
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<td><strong>76</strong></td>
<td><strong>92</strong></td>
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<td><strong>Majiaping</strong></td>
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<td>6</td>
<td>50</td>
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</tr>
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<td>30**</td>
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<td>7</td>
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<td>50**</td>
</tr>
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<td><strong>Average</strong></td>
<td><strong>8.8</strong></td>
<td><strong>34</strong></td>
<td><strong>52</strong></td>
</tr>
<tr>
<td><strong>Taipingliao</strong></td>
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<td>7</td>
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</tr>
<tr>
<td>5</td>
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<td>90**</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>3.8</strong></td>
<td><strong>49</strong></td>
<td><strong>79</strong></td>
</tr>
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</table>

*(table con'd)*
**Wealthiest households of those surveyed in village.**
*Poorest households of those surveyed in village.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Long Gui</strong></td>
<td><strong>1</strong></td>
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<td><strong>40</strong></td>
</tr>
<tr>
<td><strong>2</strong></td>
<td><strong>4</strong></td>
<td><strong>25</strong></td>
<td><strong>50</strong> ** **</td>
</tr>
<tr>
<td><strong>3</strong></td>
<td><strong>8</strong></td>
<td><strong>38</strong></td>
<td><strong>80</strong> ** **</td>
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<td><strong>24</strong></td>
<td><strong>50</strong></td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>5.3</strong></td>
<td><strong>29</strong></td>
<td><strong>50</strong></td>
</tr>
</tbody>
</table>
In an attempt to discern a relationship between income levels and other household characteristics, households with the highest incomes were compared with those in the lowest income range (the one or two households in each village with incomes under 1,000 yuan per capita) (Table 9.2a & b). There are only small differences between rich and poor households in factors like family size (rich households have an average of 6.2 members, while poor households have an average of 7.5 members), and ratio of laborers (including family members and hired help) to family members (rich families average 2.0, while poor families average 1.9).

The most notable difference between rich and poor families is in bamboo forest tenure patterns. The per capita average area of bamboo forest managed by wealthier households (35.6 mu) is 32% greater than that of poor households (26.9 mu). Families with more bamboo forest land are able to harvest more bamboo, and certain families are able to let their stands develop longer without disturbing them, so that the plant density and quality of the culms improves and the value of processed poles increases. In 1994, bamboo-related earnings among wealthier families averaged 8,575 yuan per household and 1,559 yuan per capita, whereas among poor families the averages were 1,963 yuan per household and 261 yuan per capita.

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In 1994, wealthier households had a slightly higher number of stands, averaging 5.1, as opposed to an average of 4.5 stands among poor households. Of interest is the fact that poorer households claim to have done a more thorough job of clearing underbrush within their stands, averaging 79% of total bamboo forest. Wealthier families averaged 72%. This may be due to the greater stand area that wealthier families have to manage.
As stated above, wealthier families have also developed alternative sources of income, either from collecting or processing natural resources harvested in the reserve, or from enterprises that extend beyond the boundaries of the reserve (Table 9.2a). Wealthier households that do not have a large area of bamboo forest land per person have been especially adept at developing other lines of commerce. Though the ratio of alternative income to bamboo-related income is only slightly higher among wealthier families, actual household and per capita income is much higher. In 1994, supplementary income accounted for an average of 37.3% of total income among wealthy households. The average supplementary income for these households was 3,378 yuan (with an average of 393 yuan per capita). Among poor households, supplementary income averaged 31.6% of total income. Supplementary income in these households averaged only 1,280 yuan (with an average of only 171 yuan per capita).

**Bamboo Forest Propagation and its Effects on Broadleaf Forests**

Present bamboo management practices are causing the destruction of more valuable types of wildlife habitat, especially through the conversion of broadleaf and mixed forests to stands predominated by bamboo. Most stands of managed bamboo forest have few understory or higher canopy taxa. Since these taxa can, at high densities, impede the growth of bamboo, villagers remove them when possible. In order to observe vegetation clearance and other bamboo management strategies, and to analyze their...
effects on in situ and adjacent vegetation stands, the author conducted a field study of 12 quadrats, each of which was located near one of the five study villages.  

To understand how household management of bamboo affects ecological conditions in adjacent habitats, the physiological properties of maozhu bamboo must be taken into consideration. The rapidity with which well-managed bamboo forests can overtake adjacent vegetation stands is due, in part, to the fact that young maozhu bamboo can grow 10 centimeters (four inches) in one day, which makes it the fastest growing plant in the world (Huang, 1992). Shoots sprout in early spring and culms can grow to their full height of over ten meters in about two months. Shoots develop from rhizomes, which also grow rapidly along or just beneath the soil surface. The leptomorphic ("slender type," as opposed to pachymorphic and metamorphic) rhizomes of maozhu bamboo, which are found in a number of other tropical and subtropical species of bamboo as well, can grow many meters in one year, sending out roots below and shoots above

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9 The researcher designed the "Bamboo Forest Expansion Survey" form (Appendix) to record data in 15 X 15 meter quadrats demarcated in the incursion zones at bamboo forest margins on lands under the jurisdiction of the five study villages. In Gonghe, four quadrats were surveyed, and two quadrats were surveyed in each of the other villages (a total of 12 quadrat surveys). All surveys were conducted with the aid of local assistants, who were knowledgeable about familial and village-wide bamboo management techniques and strategies in the survey areas. Forest stand locations were recorded, along with direction from the village, slope, aspect, and elevation. A brief description was made of the soil type and the ecological characteristics of the adjacent (invaded) forest (forest type, average height and dbh of trees, age of largest trees, and features of the understory). The presence or absence of ringed trees and soil turning (for the purpose of accelerating the growth and spread of bamboo) was noted, and the number and average dbh of ringed trees was recorded.
(EFCANTU, 1980). The rapid horizontal growth of these rhizomes and the speed with which shoots develop to full height makes bamboo an ideal commercial forest crop.

Since asexual reproduction from rhizomes does not require pollination or the sowing of seeds, the most efficient method of propagation is to insure that soil and vegetation conditions are optimal, and to simply let genetically identical culms grow from the same rhizome until flowering occurs (which may not happen for up to a century). While rhizomes often spread into broadleaf forests and other vegetation stands, new shoots develop best in areas where dense undergrowth has been cleared. Bamboo shoots can, and often do, grow in dense, unmanaged broadleaf, pine, and mixed forests, but in humid broadleaf forests the culms often succumb to mold and other diseases at an early age. As a general rule, dense, healthy stands of *maozhu* bamboo do not occur in unmanaged forest stands.

New bamboo shoots, or those that have developed from the rhizome in the past year, are distinguishable from older bamboo by their lighter color and the absence of mold on the stalk (among other features). New shoots develop in larger numbers in a particular area only every other spring. As explained in chapter 8, years of abundant shoot production are known as big years (*da nian*), while in little years (*xiao nian*) there is little or no shoot production. The areal extent of growth year synchronization may include all or most of one village's land, so that a whole village may be on the same cycle.

In these surveys, nine of 12 quadrats were located in areas of abundant new shoot growth, which made it easy to distinguish between older bamboo and <1 year old shoots.
Another characteristic of the wild propagation of this species is that it tends to grow up slope or laterally, seldom spreading roots down slope. Therefore, the survey was designed to determine the lateral and/or up slope rate of reproduction in one two year period (since there is only one major growth year in two spring seasons).¹⁰

Clear boundaries between managed bamboo and adjacent vegetation stands were observed in seven of the 12 quadrats. In the other five quadrats there was no discernible "edge" to the managed bamboo forests, since bamboo had invaded adjacent stands even without the aid of understory clearance. Rapid bamboo forest development (in managed stands) was observed in quadrats at elevations ranging from 890 to 1,320 meters asl. The rate of incursion in these stands ranged from 0 to 8.2 meters (during a growth year), averaging 3.7 meters. Above average incursion was observed where there were thick soils, or dark, humus-rich soils, well-shaded by broadleaf trees. These stands were found

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¹⁰In cases where there was an obvious boundary line dividing most of the older bamboo from many new shoots at the periphery of the bamboo forest, this line defined one side of the quadrat and ran roughly perpendicular to the slope on which it grew. The other three 15 meter long sides of the quadrat were demarcated in the zone of incursion into adjacent vegetation, beyond the edge of the "old" bamboo patch of the previous year(s). In areas where the old bamboo boundary was less obvious or not straight enough to define one edge of the quadrat, a median line was demarcated (perpendicular to the aspect of the slope) between the five most peripheral old plants. After the quadrat was demarcated, the distance to the most distant visible shoot or group of shoots, was measured. This distance exceeded the quadrat boundary in only one case, and in that case only by one meter. The researcher and assistants then counted the number of old and new shoots in the quadrat and noted whether the area was in a shoot growth year or an alternate year. In cases where there was an obvious line of advanced new shoots in the incursion zone, the distance from the old bamboo line (lower side of the quadrat) to the new shoot line was measured. Where no clear new shoot line was evident, the average distance of the five most distant visible shoots was calculated. The circumferences of the five largest bamboo (new and old) were then measured and recorded, and other observations were made with the input of the assistants.
on slopes between 17 and 25 degrees. Steeper slopes rarely have thick enough soil layers for the rapid spread of bamboo.\textsuperscript{11}

In four of the five stands where there was no discernible edge between managed and unmanaged bamboo forests, quadrats were set up well within the most intensively managed portions of the stand. As in other quadrats, culm densities and diameters were measured. From these data it is clear that the best conditions for the development of dense stands of large bamboo are gentle slopes with thick, moist, relatively humus-rich soils. Since these are among the best conditions for bamboo growth, there is some degree of competition for such areas among villagers (Huang Zhaofeng, pers. comm.).

In all of the quadrats the understory had been cleared during the past year. The trimmings from cropped understory trees and shrubs are used as firewood. In some cases, broadleaf logs are used in mushroom propagation, an activity that is discouraged in the reserve due to its toll on broadleaf trees. The trimming of the underbrush must be repeated on an annual or biennial basis. In some villages, like Long Gui, this has been done since about 1983, when the access road was completed and bamboo pole exports began. Despite the relatively long history of understory clearance in Long Gui, about half of the bamboo stand area remains to be cleared. This is probably because of the low population and the high per capita area of bamboo forest. In villages like Majiaping, understory clearance began as late as 1994, and bamboo stands are established by clearing

\textsuperscript{11} There were no clear patterns of slope aspect, and shade conditions caused by surrounding vegetation no doubt counteracts the drying effect of insolation on sunny southern slopes.
the underbrush and cutting down all broadleaf trees wherever bamboo is found within other vegetation stands. Under these conditions most households had only cleared about half of their bamboo stands by the end of the year. In the other villages, household bamboo forests were estimated to average between 79% and 92% clear of underbrush.

Tree ringing was observed in only two of the quadrats (though it was seen in other areas with some frequency). Most managed bamboo stands have already been cleared of nearly all trees under 30 cm dbh, and, in many stands, the only remaining trees are larger broadleaf species. These trees are said to create shade for the bamboo, which keeps the soil moist and improves overall growth. Though this sounds like a promising strategy for maintaining some canopy cover, informants in many villages stated that when bamboo culms reach a density of about 200/mu (3,000/ha), the large trees will be removed because soil moisture will be maintained by the shade created by the bamboo itself.

In Majiaping, where broadleaf trees are numerous, and broadleaf forests extensive, such trees are seen as a problem, and their total removal is the main strategy for bamboo propagation. In essence, broadleaf forests are being removed from around the sparsely distributed bamboo culms that have managed to survive there. As one Majiaping stated, "We will clear all the broadleaf trees until only bamboo is left." Since

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A Majiaping native explained that until the 1950's, when burning was banned, bamboo forest often spread into burned over areas after annual fires. Bamboo forests were extensive enough to meet the demands of paper making and shoot collecting without regular understory clearance (Luo CS, pers. comm.). This may well have been the case in other villages as well. It is also likely that firewood was collected in bamboo stands near the village, so that the most accessible stands were kept clear of underbrush.
Cunninghamia is a valuable timber tree, it is, in most cases, left standing. This is common practice throughout Meihuashan, and one variation of using tree cover to conserve soil moisture is to plant Cunninghamia trees within the bamboo forest or, more commonly, to protect existing Cunninghamia trees for shade and for later harvest. Gonghe village has a large stand of bamboo and planted Cunninghamia that appears to be thriving. To derive maximum profit, these trees will be harvested only after some 30 years of growth.

Conclusion

The spread of managed bamboo forests presents a real threat to the broadleaf and mixed forests of Meihuashan and indirectly imperils many species of wildlife as habitat is converted to a forest monoculture. Although there are laws prohibiting the unauthorized cutting of broadleaf trees over 40 cm dbh, enforcement has been difficult, and some villagers have assumed that girdling is still legal (Huang Zhaofeng, pers. comm.).

Reserve managers recognized this problem in the mid-1990s, and in February 1995, they issued stricter regulations on tree cutting, girdling, and the expansion of household bamboo forest land onto adjacent lands. Under these laws, both tree cutting and girdling are prohibited, and villagers must seek authorization from both the county forestry committee (xian linye weiyuanhui) and the reserve before expanding the area of their bamboo forest lands. Permits for expansion are granted only after a sight inspection has been made by the reserve authorities. Under this law, no permit is required for

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13 This notice was entitled: "On the Strengthening of Regulations Protecting Broadleaf Trees Within Bamboo Forests."
bamboo forest expansion into unforested scrub and grasslands as long as they are within collective lands outside of the core area (Wang Honggao, pers. comm.). In conjunction with these regulations, a series of "miniature protected areas" (baohu xiaqu) (discussed in chapter 7) was delineated to protect broadleaf forests outside of the core area. According to the regulations, there will be no tree cutting or any other economic activities within these scattered patches of mature broadleaf forests (Huang Zhaofeng, pers. comm.). In 1995, reserve staff were in the process of demarcating the areas with signs.

Although new laws have been promulgated to prevent the conversion of biologically diverse ecosystems to bamboo forests, the problem of enforcement remains. Reserve staff will have to step up their reconnaissance and patrol work considerably to monitor bamboo forest boundary changes (see chapter 12). In the event that stricter management is achieved, it is likely that the relationship between reserve authorities and villagers will be negatively affected. Villagers resent the reserve's interference in their forest management patterns, and unless villagers' land use problems and concerns are incorporated into reserve policy, stricter enforcement is likely to engender ever greater animosity toward the reserve on the part of local people.

To address this problem, reserve managers should work closely with village leaders and village households to insure that bamboo land tenure and resource management patterns are as equitable as possible. Village and household economies are heavily affected by transportation and access to roads and vehicles. Each household is deeply affected by access to sufficient bamboo land, and there are indications that
inequitable land tenure and land distribution practices are becoming entrenched in a number of villages. Along with inequities in resource tenure patterns, there are disparities between households and villages in the degree of access to outside markets and subsidiary income. Some households have even begun to develop commercial enterprises unrelated to bamboo and forestry, while holding onto a growing share of bamboo resources. As these households develop economies of scale, they may continue to out compete poorer households, and systems of social and economic exploitation reminiscent of feudal landlord-peasant relations could be revived, albeit in a new form.

To avoid greater inequity between households and between villages, nature reserve administrators should help local people develop community-wide bamboo processing, transport, and marketing structures that insure all members more equal access to commercial markets. In the Wuyishan Nature Reserve, as will be seen, many villages and individual households produce their own bamboo products *in situ*. As a first step toward greater autonomy, reserve residents should add value to their local products. As bureaucratic and political strictures are removed or relaxed, and tourism is developed, local people may be able to enter the service sector and the reserve management force as equal partners and, in the end, as leaders. These issues are discussed at length in chapter 12.
CHAPTER 10

WHITE TIGERS AND AZURE DRAGONS: FENGSHUI FORESTS, SACRED SPACE, AND THE PRESERVATION OF BIODIVERSITY IN VILLAGE LANDSCAPES

"Of the people who live in Meihuashan's eighteen hollows, some remain in a condition of self-sufficiency, with a natural [subsistence] economy. Their ancestors, nevertheless, understood the importance of forest conservation; they regarded forests near the villages as sacred, inviolable "fengshui forests." In comparing these people to the fully-modern and civilized farmers of the towns and villages today, who wantonly and recklessly chop down the forests, one really wonders if there have been any advances in wisdom" (Zhang, L., 1990: 59).

In countless villages of the Southeast Uplands, be they clustered within the confines of a mountain ravine or spread out upon the plain of a broad river valley, sacred forests or individual sacred trees grace the landscape. Known as "fengshuilin" ("wind-water forests" or geomantic1 forests) or "fengshuishu" (fengshui trees), they are protected by ancient custom as a critical component of village landscape and cosmology. This chapter describes the cultural and ecological characteristics of village fengshui forests in Meihuashan and provides comparisons with such forests in other areas of western Fujian.

In the course of field research, the author attempted to answer the following questions: How do sacred forests figure in local ideology? Are there different types of sacred forests as defined by local lore (emically) and by scientific observation, measurement, and comparison (etically)? Which species are protected and why? How do villagers manage the forests today and how might this differ from past management

1 "Geomancy" is a common translation of "fengshui," but many scholars see the term as incomplete or misleading. Other translations gleaned from the literature by Fan (1992) include "topomancy," "astro-ecology," "topographical siting," "siting," and "mystical ecology."
practices? How did the forests survive periods of political upheaval and ecological destruction, like the Great Leap Forward and the Cultural Revolution? Are sacred forests surviving the unprecedented environmental degradation associated with an emergent capitalist economy? And finally, how do sacred forests fit within the matrix of other vegetation types and contribute to or detract from the quality of wildlife habitat and biodiversity?

*Fengshui, Fengshui Forests, and Sacred Space*

*Fengshui* is a colloquial term for the ancient Chinese way of conceptualizing and regulating power in the physical landscape. It has been used for siting and designing settlements of all sizes, buildings, and tombs within the natural and supernatural parameters of the landscape, in order to promote harmony between the human realm and the realm of heaven (*tian*), or the cosmos. More formal, literary terms for Chinese geomancy include "*dili*" ("earth principles)," which is also the modern word for geography, and "*kanyu*" ("the canopy of heaven and the chariot of the earth"), a term that emphasizes the cosmic relationship between heaven and earth (Bennett, 1978; Fan, 1992; Feuchtwang, 1978).

The ideational and theoretical systems found in fengshui are inseparable from classical Chinese systems of correlative cosmology (discussed below) (Henderson, 1984), and there is a tradition of canonical *fengshui* theory that can be traced back to the Former Han dynasty (202 B.C. - 89 A.D.) (Feuchtwang, 1974).² Parallel with this "great"

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² While ancient classics of the Zhou dynasty, known as the *Book of Songs* (*Shi Jing*) and the *Book of Documents* (*Shu Jing*), discuss methods for siting capitals (Lee, 1984), more explicit works on *fengshui* method can be traced to later periods. The *History of the Former Han* (*Hou Han...*)
tradition, there have been many local folk traditions, which have both drawn and informed the broader traditions. These customs can be collectively defined as indigenous forms of environmental management, with possible antecedents in non-Han cultures of southern China.³

As a theory of siting, fengshui seeks to delineate the links between universal (and often invisible) forces and visible landscapes, and to mitigate all negative effects such forces may have upon humans, while simultaneously enhancing the positive effects. In this context, the fengshui forest is a living expression of the collective desire to maintain peace and harmony with the cosmic powers inherent in the natural environment (Lovelace, 1983).⁴

Shu) has records of writings on fengshui called "The Golden Box of Geomancy" and "Palaces and Houses," neither of which survive. The oldest surviving descriptions of fengshui are found in imperial encyclopedias, which contain works said to date from the 3-5th centuries (Feuchtwang, 1974).

³ An example of sacred forest conservation among non-Han people of southern China is the Dai people's custom of protecting holy ("Dragon") hills (nongman and nongmen). The Dai have practiced wet rice cultivation in the valleys and hills of Xishuangbanna, in southern Yunnan, for two millennia (Pei, 1983), and the protection of village forests, although framed within a polytheistic and Hinayana Buddhist world view, serve important soil and water conservation functions. One must not discount the possibility that the She, Yue, or other pre-Han inhabitants of the Southeast Uplands had similar practices, customs which influenced Han settlers in later centuries.

⁴ Conversely, fengshui ideology has also given rise to the desecration of tombs and buildings, and the alteration of geomorphic features as a means of revenge. These "fengshui feuds" between families and villages continue to occur, as documented by Huang in coastal Fujian (1989). Such conflicts have also occurred in Meinuashan, and Gonghe village has been involved in several over the past century (Ma, SX, pers. comm.).
Figure 10.1a. (Top) Ideal Model of Village Fengshui - the House. Texts on fengshui often explain household fengshui through analogies to the human body. This diagram also shows yin (female forces), yang (male forces), mingtang (the bright or cosmic court), xue (the lair, or perfect center for houses, buildings, or tombs because it is where celestial and earthly qi are balanced), baihu (the white tiger, a hill or mountain to the west), qinglong (the azure dragon, a hill or mountain to the east) (Source: Fan, 1992).

Figure 10.1b. (Bottom) Ideal Model of Village Fengshui - the Village. Mountains labeled 1-4 comprise the main dragon. The village is located at the xue (lair), where yin and yang are balanced. Other features are important for regulating the flow of qi, which moves through earth and sky, and is mediated by geomorphic features (including mountains, hills, and streams) and by large-scale vegetation features like forests, groves, and trees (Source: Fan, 1992).
The life force known as *qi* ("cosmic breath" or "life essence") is traditionally believed to flow from heaven and from the earth. Together these types of *qi* combine to form varying concentrations of *yin* energy, associated with the female, and known as "Terrestrial Breath," and *yang* energy, associated with the male, and known as "Celestial Breath" (Fan, 1992; Feuchtwang, 1974). The flow of *qi* and the balance of *yin* and *yang* are mediated primarily by geomorphic features like mountains, hills, rivers, and lakes, and by the climatic forces of wind, water, and sun (insolation being a main source of *yang* energy). *Qi* flow is especially strong in mountains, following ramifying systems of serpentine ridge lines that are known as *long* (dragons). Within these ridges are *longmai* (dragon veins), which are conduits for *qi*. The best sites for villages, as well as for individual homes and tombs, are found within an embracing horseshoe-shaped pattern of mountain ridges and hills (Feuchtwang, 1974; Lee, 1986; Lovelace, 1985) (Figs. 10.1 & 6.1).

In simple terms, those whose settlements, households, temples, shrines, and tombs are built upon sites where *yin* and *yang* are in balance may enjoy health, longevity, wealth, and a long line of progeny. Houses are known as *yangzhai* (*yang* houses) because of their association with the positive (*yang*) energy of the living. Tombs are known as *yinzhai* (*yin* houses) because of their association with the negative forces of the dead. Although tombs and houses require different fengshui conditions, ideal sites for

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5 The quality of alignment of a tomb or house can bring fortune to many generations of descendants, and it is commonplace in China to invoke *fengshui* dynamics to explain the rise and fall of great leaders like Mao Zedong and Chiang Kai-shek.

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both are known as xue, which means "lair," "hole," or "cave" (Fan, 1992). Building on sites where yin and yang are out of balance can lead to illness, injuries, death, poverty, and other misfortunes.

Qi, in both its malevolent and benevolent forms, also works through the media of wind (feng) and water (shui), hence the term "fengshui." The ghosts and other evil spirits associated with sha (or sha qi - "pernicious qi") are believed to be most active along straight lines in the landscape, be they natural streams, hollows (or mountain gaps), or manmade paths, roads, railroad tracks, or power lines (Feuchtwang, 1974: 115-119). Sha is particularly likely to flow through areas prone to high winds or rapid stream currents. Ideal fengshui sites are thus found where landforms are undulating rather than linear; places blessed with the gentle winds and slow, meandering streams that promote good qi flow. Without the influence of gentle circulation, qi will not enter an area, will not remain long, or will stagnate there (Lovelace, 1985).

There are two main schools of fengshui tradition, which developed after the Song dynasty (960-1279). The older is known as the Form (xingshi) School (or Jiangxi [Province] School), the younger is known as the Compass (luopan) School (or Fujian [Province] School). By the nineteenth century, fengshui practitioners often used both

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6 The term xue also denotes important acupuncture points in the human body (Fan, 1992), which reinforces the complementary notions of the body as a microcosm of the cosmos, and of the earth as a living being, or at least subject to the same dynamic flows of yin and yang energy that humans are. The connection between the human body, the landscape, and the cosmos is thus reified by the interactive, all-encompassing flow of yin qi and yang qi.

7 The Compass School was developed in northern Fujian by Wang Ji, in the 12th century (Feuchtwang, 1974).
methods, and the two schools are no longer separated except by the fact that they represent distinctive paradigms for theory and practice (Feuchtwang, 1974).

In the Form School sites are evaluated according to their geomorphology; the physical configuration of mountains and watercourses being regarded as the most important determinant of qi flow. In this tradition, the practitioner, or "fengshui master" (dili xiansheng) must make a thorough reconnaissance of the area around the site, employing visual observation, sensitivity, and intuition in assessing the conditions of qi flow (Feuchtwang, 1974). The Form School was especially popular in the provinces of Jiangxi and Anhui (Feuchtwang, 1974; Lee, 1986).

In the Compass School, which is based on Song Neo-Confucian cosmological theory, sites are evaluated on the basis of the cosmological significance of landforms lying in different compass directions from the site. According to this tradition, fengshui masters must be skilled in the use of the fengshui compass, which has up to 38 layers of cosmic symbols surrounding the small central dial (Lee, 1986).8

In Meihuashan the compass is the standard tool and insignia of the fengshui master. The masters claim, however, that there is no separation in their practice between the two schools, and they employ both complex fengshui manuals as well as compasses in assessing sites (Zhou Ke An; Ma Shuwen, pers. comm.).

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8 The center of the compass, said to represent the center of the universe, is called the "Heavenly Pool" (Tian Chi). It is embedded in a square wooden board, typically painted red. Around the central, circular, encased dial lie concentric rings of cosmological symbols painted on a black background. The first set of symbols represents the eight trigrams (of the I Jina, or Book of Changes), this is followed by symbols representing the yin and yang, the three houses, and so on (Feuchtwang, 1974)
Though there have been a number of studies on the literary tradition of fengshui theory (Bennett, 1978; Feuchtwang, 1974; Lee, 1986), relatively little has been written about fengshui forests or the practice and significance of fengshui in rural villages (important exceptions include Hase and Lee, 1992; Huang, 1989; Lovelace, 1985; and Menzies, 1996). According to Feuchtwang (1974), even Chinese classics on fengshui say little about the benefits of trees, focusing almost exclusively upon inanimate land forms. In contrast, Lee (1986) states that many fengshui texts on house siting (yangzhai) discuss the impacts of trees on human dwellings and their occupants.

In practice, since forests create shade, block the wind, and control the overland flow of water, they moderate the flow of sha qi. For this reason, they are another important landscape feature in common fengshui practice. As Feuchtwang (1974: 128) states,

"Although little of trees is mentioned in the manuals, they are one of the most common fengshui symbols in practice...Trees are wild, entirely natural, yet they live as mountains and watercourses do not, and they are vulnerable...They are the most ubiquitous and sensitive focuses of interest in feng-shui" (italics mine).

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9 A highly informative study of the use of Chinese and Tibetan geomancy in urban design and construction is included in Gaubatz's work on the historical development of frontier cities (1996: 132-145, 156-162).

10 Lee (1986) states that in the Yin-yang Fengshui Commentaries (Yin-yang Fengshui Jiangyi), trees are evaluated according to five criteria: the symbolic value of particular species, (e.g. coniferous evergreens like pine represent longevity); the morphological and metaphorical aspects of certain species (e.g. weeping willows planted near the front gate could lead residents to commit suicide by hanging), practical and pragmatic issues (e.g. trees to the north block the north wind); the location of family members within a house (e.g. household heads sleep in the NW rooms, so large trees should not be planted near that part of the house); and the physical condition of particular trees at a site (indicating the status of qi circulation, i.e. if trees are luxuriant, there is healthy qi and vice versa).
This may be especially true in southern China (He Lian, pers. comm.), where *fengshui* is a "ritual focus" (Feuchtwang, 1974) for descent groups, and alteration of the village environment is directed toward enhancing *fengshui* for the community and the individual. A family genealogy from Sichuan states, "When building manors and mansions, the gentry will not fell trees." Another family genealogy from Anhui states, "*Kanyu* experts consider it a good practice to preserve vital life-force (shengqi) by piling up earth and planting trees. This practice must be observed and never violated."

Similarly, a village history from Anhui warns that "Every family must take care of the mountains and water around. Plant trees and bamboo as shelters. Anyone who acts contrary to this shall be punished...keep an eye on the environment and protect it from damage. This is a chore for people of one hundred generations to undertake" (Fan, 1992: 42).

Though the exact distribution of *fengshui* forests in South China today is unknown (and apparently unresearched), Hase and Lee (1992) and Lovelace (1985) have discussed their persistence in Hakka villages in the New Territories of Hong Kong. Within Fujian, a mission report for a social forestry project in Shouning county (in the Eastern Min culture region) by the New Zealand Ministry of External Relations and Trade states that *fengshui* forests are "well protected by the villagers" (Hung, 1993).

Since *fengshui* has become heavily imbricated with complex overlays of traditional correlative thinking schemes (Henderson, 1984; Feuchtwang, 1974; Lee, 1986), one must look beneath a highly stylized surface to see a core of sound physical principles for choosing appropriate settlement, building, and burial sites. At its heart,
fengshui is an ancient, indigenous environmental science that is inextricably linked to the soil and water conservation problems specific to wet-rice agriculture (Lovelace, 1985). Eugene and Marja Anderson (1973) have characterized fengshui as a system through which rice farmers maintained homeostasis with the environment.\textsuperscript{11}

Lovelace (1985: 359) stresses that fengshui is also "an agent of environmental modification." In an analysis of Hakka settlement in Hong Kong's New Territories during the fifteenth century, he demonstrates how the "armchair" pattern of surrounding hills and southern exposure was an ideal geomorphic configuration for village settlement and rice cultivation (Fig. 10.1b). Indeed, this topographic pattern is characteristic of nearly all of the villages in Meihuashan (see chapter 4):

"...streams begin in the surrounding higher elevations and converge on the valley floor...the presence of multiple streams ('branches') meandering across the valley floor would, if controlled, enhance the ease and potential field expansion and overall production by increasing the number of possible taps, places for discharge, and terraces. The presence of numerous streams also serves to aid in the natural control of the drainage's overall water flow at times of intense runoff, such as during monsoon rainstorms, by dispersing and distributing the overall amount of water. As in fengshui,

\textsuperscript{11} They describe fengshui as "basically a very practical system whereby a village is situated such that it does not take up farmland or lay itself open to floods and typhoons...A well-sited village is protected from the elements. Typhoons, heat, waves, storms and the like are broken in their force by the hills, spurs and groves. Erosion is limited by trees and terraces. Floods do not affect the sites for they are on elevated spots. The flowing streams assure a constant water supply, and (with frequent rains) flush salt from the fields...The village does not take up the best farmland, which lies below it in the valley...Wealth flows into the villages as the streams do, according to popular belief, and grows there like the lush vegetation" (Anderson, E. and M., 1973: 34, 50).

Hong-Key Yoon (Gaubatz, 1996: 132) has also described fengshui as a way of conceptualizing the natural environment in ways that ultimately serve the ecological needs of human communities.
water in the paddy system should not be allowed to flow too quickly or to stagnate. Instead, a gentle but steady flow is needed. This ensures a constant supply of nutrients that, paralleling the qi of feng shui, should be allowed to penetrate the soil gently. The gradual movement of water also provides for the conversion of nitrogen into ammonia, creating the neutral or alkaline conditions that make phosphorous available" (Lovelace, 1985: 363-364).

That generations of villagers have not relied on purely pragmatic terminology to guide them in transforming the environment is not surprising; fengshui is an ethno-science, providing a blueprint for ecological adaptation. but it is also a magico-religious practice, a spatial framework for social interaction. As settlers converted the "natural landscape" into a "cultural landscape" (Sauer. 1925 in Leighly, 1969) transforming "space into place" (Tuan, 1974), they sought to insure that the village space was a sacred place, protected from the disharmonies of the profane (Eliade, 1961; Graber, 1976).12

In villages where water control is the foundation of human existence, fengshui forests are the guardians of cosmological and hydrological well-being. They reinforce the notion of cosmic centrality by defining boundaries around the sacred living space of the village: by protecting the tombs, homes, temples, and fields that lie within. Their preservation by villagers is not merely a passive acceptance of custom, but an active process, a timeless, communal rite of solidarity (Harris, 1983; Wallace 1966). As will be seen, villagers have had to make sacrifices to protect these groves. With these

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12 As Graber (1976: 6) writes, "Ancient religious man is thought to have enjoyed a unified cosmos, where institutional religion, society, and economic life were one. Man felt that all his doings were rooted in cosmic order, giving a complete and fulfilling attitude toward life which many believe is now lost. Religious man attempts to live a sacred life in sacred space, which is the same for him as living in the center of reality."
difficulties, however, the villagers maintain the geographic certainty that their community is securely located within the greater flow of qi that permeates all of China.13

A Typology of Fengshui Forests in Meihuashan

This study focuses on villages within and outside of the nature reserve boundaries, providing a wide spectrum of settlement configurations. These include four satellite villages of Gutian township, which lie in the broad valleys and surrounding hills, between 650-850 meters asl, and seven clustered villages in narrow valleys within the reserve (the five study villages and two others), all but one of which lie at elevations between 700-1200 meters asl (Fig. 4.1).

Fengshui forests vary greatly in size, shape, and height, commonly intergrading with extensive mixed and broadleaf forests and extending great distances from the village. They are a sanctuary for rare tree species, and without exception, the largest specimens in the region survive because they have long been granted sacred status. Fengshui forests also provide vital habitat for wildlife, especially birds, and at greater distances from the villages they are important for ungulates and other large mammals.

After observing a number of settlements in Meihuashan, one begins to notice that the fengshui forests grow in specific sites among the buildings and landforms that

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13 The Ma family genealogy delineates in great detail the dragon veins that flow through China. The source of qi is said to arise in the Pamirs of western Xinjiang, heading east through the Kunlun Range, from which it divides into three branches. One flows south into Yunnan and Guizhou, the second flows toward Hunan before splitting into branches in northern and southern China, and the third flows into Guangdong and Fujian. Entering Fujian in the Western Min region, it goes through Wuping county, from which one branch heads into Liancheng county, through the village of Majiaping and to the summit of Youpoji (a mountain in the reserve's core area). Two of the veins extend south through Gonghe village, one of which goes all the way to the coastal city of Xiamen.
comprise the major contours of the village environment. Some of the forests are found in places within the built environment of the village, while others cover the high slopes of surrounding mountains, passes, and ridges. All are within sight of, or within the same valley as, the village which has protected them. From the similar locations of the forests in each village, a general (and preliminary) typology can be constructed. The typology can facilitate in locating forest sites where degradation or deforestation may have occurred. This is common in villages where religious conversion, political upheaval, or other factors have led to the removal of sacred forests.14

The four most common types of fengshui forests in Meihuashan are the shuitou ("headwater") forests, shuiwei ("water tail" or water gate) forests, fengkou or shanao ("windgap" or "mountain cleft") forests, and forests that grow on knolls, summits, or slopes in or near the village (Fig. 6.1). Headwater forests are located along the main water course, either in the mountains high above the village, or where the main stream enters the village. Headwater forests help prevent excessive runoff during heavy rainfall, check erosion, and block down valley winds (shaqi). They may be dense stands of old growth broadleaf or groves of enormous Cryptomeria (Chinese cedar) trees, which are said to have been planted by village ancestors hundreds of years ago. This species is adapted to moist ravine soils (FZZBXZ, 1991), and may spread naturally along the steep

14 This occurred in Wuyishan, for example, where many villagers converted to Catholicism or Protestantism during the pre-1949 period when missionaries were most active. Many of these villages destroyed or abandoned their earthgod shrines, adopted Western-style tombs with crosses, and cut down their sacred forests (or allowed them to be cut by others).
water courses over the centuries, as they have received special protection by village custom (Figs. 10.3, 10.4).

Water gate forests are found along stream banks and upper slopes where the main water course exits the village. The author uses the English term "water gate," to represent the shuiwei forest's function of retaining or controlling water flow. These forests are said to hold in the village's wealth, preventing it from flowing away with the water. Water gate forests may be composed of old growth broadleaf or Cryptomeria trees.

Windgap forests are found in ravines or gaps in surrounding ridges, where wind (or shaqi) can enter the village. These forests are composed of huge Cryptomeria trees. Due to their location within a steep-sided valley with many gaps in the ridges above, Gonghe and Guizhuping villages have many of these Cryptomeria groves. A map of Gonghe in the Ma family Genealogy, said to have first been drafted in the Ming Dynasty, carefully depicts these groves, which are still standing today (Fig. 10.5).

Other fengshui forests, which usually cover hills and slopes in and around the village, are often found behind ancestral temples (citang), earth god shrines (tudigong), and other temples (Fig. 10.4). A distinctive example is the crescent moon-shaped forest on an elongated hillock behind the main ancestral temple in Gonghe village, which is also depicted on the old map and labeled yueshan ("moon mountain") (Fig. 10.5). This particular fengshui forest provides a good example of how such forests fit within the correlative thinking of village cosmology. Lying on the eastern side of the village, a village fengshui expert explained, "the forest represents the moon in the eastern sky day and night, keeping the village from ever darkening" (Ma Shuwen, pers. comm.). The
Figure 10.2a. (Left) A Sacred *Cryptomeria* in a Longxishan Village. Belts woven from straw are a traditional emblem of honor. In recent years, these have also been soaked with pesticides to fend off parasitic caterpillars.

Figure 10.2b. (Right) *Cryptomeria* Stump in a Guizhuping Sacred Forest. This tree was cut by local entrepreneurs, who produce decorative carvings for sale in Japan.
Fig. 10.3. *Cryptomeria* Trees in the Mawu Village Watergate *Fengshui* Forest.
power of the "moon forest" also derives from Chinese myths about trees on the moon. Furthermore, there are seven stars (the seven stars of the big dipper in Ursa Major), represented by the seven manmade pools in front of the forest, and by seven peaks west of the village. These "stars" are believed to follow and protect the moon forest and bring great blessings to the village. Directly across the valley from the ancestral temple and moon forest, there is a mountain called the wenfeng (scholar peak). Following custom, village ancestors are said to have placed an essay between two woks and buried it on top of the peak. The peak was built up with rocks, clay and dirt on a number of occasions, to make it taller and sharper. This was to insure that descendants would be talented scholars. A number of other villages in Meihuashan have designated certain mountains as wenfeng, and in traditional times, these were built up artificially until the summits appeared to pierce the sky.

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15 The moon, which is the ultimate representation of the female (yin) essence, is said to be inhabited by the jade rabbit (yu tu). The rabbit sits at the foot of a cassia tree (gui - the same "gui" as in Guihe village), pounding the drugs of immortality. Another myth holds that cinnamon trees grow in great abundance on the moon. Wu Gang, a man condemned to live on the moon for displeasing certain spirits, must cut the trees. With every blow of the axe, an incision is made, but as soon as the axe is withdrawn, the incision closes" (Williams, 1974).

16 The relationship of the stars to the moon is described as "Qi xing gan yue" (seven stars follow the moon) (Ma Sw, pers. comm.). Most of the ancestral temples in villages of Meihuashan still have reflecting pools in front. These serve to reflect and intensify qi. The seven pools in Gonghe were designed to conform to the moon forest cosmology.

17 Villagers' collective aspirations to produce scholars were apparently not in vain, for in mountain villages such as Jiaotan, Pingshui (now abandoned), Shangfu, Jinhu, and Zhuling (the latter three of which lie outside of the reserve), there are stone columns marking where the houses of Qing (and possibly Ming) dynasty (1644-1911) scholar-officials once stood. These were village men who had passed imperial exams and entered the civil service, effectively becoming part of the rural gentry.
Figure 10.4a. (Left) Long Gui (Dragon Turtle) Village Fengshui Broadleaf Forest. Village houses are visible (white dots) on the most distant ridge, where they appear to rest on the back of a dragon (long).

Figure 10.4b. (Right) A Small Temple in a Fengshui Forest in Zhongcun Village.
Figure 10.5. Old Map of Gonghe Village With Fengshui Forests. This map, which was drafted in 1937 from a Ming Dynasty original, is said to date from the late 14th century. The main ancestral temple and many of the sacred forests and groves have remained virtually unaltered down to the present. These include the windgap Cryptomeria forests and a moon-shaped broadleaf forest behind the main ancestral temple, which remains the locus of annual festivals and daily worship. The village is depicted as roughly circular and embraced on all sides by mountains. A configuration that reinforces the idea of cosmic centrality.
Threats to the Fengshuilin After 1949

The socio-cultural milieu in which village *fengshui* evolved has been undergoing radical change since the 1940s. Collectivization, communization, the Great Leap Forward, the Cultural Revolution, and the Four Modernizations have all had an impact on village life and the conceptualization of space and place. *Fengshui* was debunked as feudal superstition, Buddhist and Daoist icons were smashed, and temples were converted to storage buildings. One of the most potent conceptual forces in the Communist effort to reform and unify China was the drive to rid the countryside of all forms of parochialism. By the mid-1950s, Maoist gospel held that only by destroying place-specific rituals and beliefs, which permeated China down to the level of the village, could central authorities succeed in creating a modern socialist state. Village cadres banned all religious practices, and it was considered treason even to talk about *fengshui* (Luo Zhiming, pers. comm.). Villagers referred to the *fengshui* forests as *fengjing* (scenic) forests, and when Red Guards or authorities threatened to harvest trees in the forests (Luo Zhiming, pers. comm.), brigade leaders or elders often argued that the "scenic forests" provided protection against floods and high winds, and that they were an important reserve supply of timber.

The village chief in Zhuling saved one of the village's forests from zealots by convincing the head of the commune that the forest provided shade and improved the scenery (Zhang Mou, pers. comm.). During the Great Leap Forward (1958), some villages in the valley near Gutian (such as Bajia) lost most of the trees in their sacred forests to iron smelting operations. Today these forests are paltry shadows of their former...
glory. It was not until the Cultural Revolution (1966-1976) that *fengshui* forests in mountain villages like Zhongcun and Long Gui were cut, against the impotent protests of the elderly. Even then, only in Zhongcun, was a forest entirely cleared, and most village *fengshui* forests in Meihuashan were spared.

Given the overall impacts of such waves of change, one might reasonably suspect that *fengshui* concepts and traditions would, over time, have been eroded to mere fragments of their original forms. Contrary to expectation, *fengshui* is still part of daily life. Trees, which are living symbols of communal *fengshui* ideology, have largely withstood the barrage of political movements. One might argue that the effort made to preserve trees and forests in times of duress has helped keep communal *fengshui* alive. The forests and groves still hold tremendous aesthetic and symbolic power in village identity and collective memory, and, with few exceptions, there is little indication that this will change in the near future. The reconstruction or renovation of earthgod shrines, in the early 1980s, marked a landscape renaissance, and for the last 15 years temples have regenerated like mushrooms across the mountains. It appears that the religious landscapes of the past, and the cult of landscape that engendered them, were never obliterated, just temporarily concealed.

**Village Fengshui and Fengshuilin in the 1990s**

Today, *fengshui* is of considerable import in daily life, and the *fengshui* forests are protected by the entire community. The placement of each new tomb, shrine, temple, and house, is made in consultation with *fengshui* masters (*dili xiansheng*), who, as mentioned, use special compasses to divine favorable locations for houses and tombs. In some
households, the widths of doors, the lengths of tables, and the dimensions of rooms are measured with fengshui rulers to insure security and blessings.

Fengshui also provides explanations for the events of village life. In 1994, the suicide of a Guizhuping woman was attributed, in part, to the bad fengshui of her husband's house. The loss of a business, illnesses of all kinds, and physical injuries have all been attributed to bad fengshui. A family in Majiaping, after adding a master bedroom to their house, suffered a series of financial losses, and family illness. The son who had built the addition for himself and his wife suffered from lead poisoning from a lead wine pitcher he had purchased and he later lost his job with the nature reserve. It was evident to the family members that the new room had bad fengshui since it was facing the slope directly behind the village (instead of the alluvial plain in front of the village). Within a year of its construction, the room was no longer used by the family. Some objects were stored there, and only guests were allowed to sleep there.

Fengshui problems in an individual house or tomb can often be adjusted by the family through architectural changes, by planting trees, or through the use of charms placed somewhere within the structure. The fengshui of the village as a whole, however, depends on the cooperation of the entire community, and sacred forests have to be respected by all. The customary punishment for cutting a tree from the sacred forest is the loss of a full-grown pig or the equivalent amount of money (Ma Shuwen, pers. comm.). Today, this price may depend more upon the market value of the tree or trees that have been felled. The proscription on tree harvests is generally respected in Meihuashan, and there are no village forest guards. The only case of cutting sacred trees
reported in recent years was conducted in the form of a business transaction, the details of which are described below.

Some sacred forests now serve dual economic and spiritual purposes. In most villages it is permissible to collect fallen firewood from the forest floor, and at certain times in the past it was acceptable to trim small trees for fuel used in paper making. In a number of villages, there is open access to the under story of sacred forests, and medicinal herbs can be gathered by anyone in the village (Table 10.1). Almost half of the villages surveyed had allowed the planting of trees and plants within their sacred forests, including *Cunninghamia*, *Cryptomeria*, *Maozhu* bamboo, palm (*Trachycarpus fortunei*), and tea. Some villages collectively harvest cultivars like bamboo, *Cunninghamia*, and mushrooms. For example, a forest in Xiache village was completely denuded of underbrush at some point in the past, and today bamboo is grown underneath a high canopy of huge *Altingia* trees. In Gonghe, bamboo that grows in sacred forests can only be used for the benefit of the entire community.

Aside from the rare harvest of communally defined resources, there is little human activity inside of the *fengshui* forests. In larger forests some distance from villages, hunting was observed. There are apparently no prohibitions on killing wildlife in the

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18 These trees, known as *xibing ahding feng* (or *xiangye shu*) (*Altingia gracilipes*), are relatives of the sweetgums, in the family Hammamelidaceae. One giant tree that the village of Xiache showed to the author measured 182 cm in dbh and approximately 30 meters in height. Regional newspapers credited the author with the "discovery" of the largest tree found in Meihuashan since the establishment of the reserve. The reserve director boasted that the tree was over 1,000 years old. A reserve forester noted that the species is fast-growing, and that the tree could not exceed 300 years old. The press used the first figure, which shows, among other things, that the age and size of trees is still very important in China, a culture that has long venerated "king trees" (*shumu wang*).
Table 10.1. General Characteristics of Fengshui Forests in Meihuashan

<table>
<thead>
<tr>
<th>Village</th>
<th>Number of Forests</th>
<th>Diameter of Largest Tree (Cm)</th>
<th>Tree Planting</th>
<th>Other Maintenance</th>
<th>Other Economic Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gonghe</td>
<td>5-8*</td>
<td>213</td>
<td>Yes</td>
<td>Tree Trimming</td>
<td>Bamboo</td>
</tr>
<tr>
<td>Guizhuping</td>
<td>5-8*</td>
<td>146</td>
<td>Yes</td>
<td>Pesticides applied</td>
<td>Fuelwood (dead)</td>
</tr>
<tr>
<td>Majiaping</td>
<td>4</td>
<td>135</td>
<td>No</td>
<td>No</td>
<td>Not mentioned</td>
</tr>
<tr>
<td>Taipingliao</td>
<td>3</td>
<td>128</td>
<td>No</td>
<td>No</td>
<td>Not mentioned</td>
</tr>
<tr>
<td>Long Gui</td>
<td>3</td>
<td>90</td>
<td>No</td>
<td>No</td>
<td>Not mentioned</td>
</tr>
<tr>
<td>Zhongcun</td>
<td>3</td>
<td>107</td>
<td>Yes</td>
<td>Deadwood collected</td>
<td>Fuelwood (dead)</td>
</tr>
<tr>
<td>Xiache</td>
<td>2</td>
<td>182</td>
<td>Yes</td>
<td>Under story cleared</td>
<td>Bamboo and Cunninghamia</td>
</tr>
<tr>
<td>Jinhu</td>
<td>3</td>
<td>82</td>
<td>No</td>
<td>No</td>
<td>Not mentioned</td>
</tr>
<tr>
<td>Zhuling</td>
<td>4</td>
<td>100</td>
<td>Yes</td>
<td>No</td>
<td>Cunninghamia Mushrooms</td>
</tr>
<tr>
<td>Bajia</td>
<td>2</td>
<td>42</td>
<td>No</td>
<td>No</td>
<td>Not mentioned</td>
</tr>
<tr>
<td>Wulong (Gutian Memorial)</td>
<td>1</td>
<td>130</td>
<td>No</td>
<td>No</td>
<td>Not mentioned</td>
</tr>
</tbody>
</table>

*The two villages of Guihe have many forests because these settlements lie in a valley with many windgap forests along the ridges above.*
forests, though their proximity to villages makes large game scarce. Religious activities are commonly carried out on the periphery of the sacred forests, since the forests are in close proximity to earth god shrines and ancestral temples. On the first and fifteenth day of each lunar month, members of each household in the village usually offer some combination of rice wine, incense, and fireworks at dawn and often at dusk. In some villages, offerings are made at the ancestral temple every day at dawn. It is common to place incense or rice wine at the base of a sacred tree in order to receive blessings from a tree spirit.  

Village festivals are also carried out at ancestral temples beside the forests. Through the course of the seasons, the forests serve as a backdrop and even a center for a wide variety of communal and familial rites, and their place in village ritual is renewed regularly during festivals like the Lunar New Year and Kang Pusa (described below), when villagers gather in small groups next to the moon-shaped forest to play gambling games in the shade.

There is great variation in the areal size of fengshui forests, and some intergrade with other forests, so that boundaries are imperceptible. Determining the cumulative areal dimensions of fengshui forests in each village surveyed was highly problematic for several reasons, first because there were a number of such forests in each village, and second, because only the largest forests are recorded on the vegetation map as discrete

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19 Offerings to individual trees are usually made when parents pray for the recovery of a sick child. After asking a Daoist priest or a Buddha (through the divination process known as chou qian) for aid, the parents are told to sacrifice to one of the five elements (from Five Elements or wu xing theory). If they are told to sacrifice to the "wood" element, they often tie a red cloth to a tree trunk or burn incense at the foot of the tree.
stands. Visual estimates of length and width were made for thirteen of the stands that were surveyed, however, and the average estimated area of these stands was 6.3 hectares (15.6 acres). This estimate should be viewed as within an order of magnitude only.

There are some exceptionally large forests, as well, and at least two forests (in Xiache and Guizhuping) were too large and irregular to measure accurately. In general, forest area varied from a few *Cryptomeria* trees to broadleaf forests of nearly one square kilometer in area (in the case of Guizhuping).

**Threats to the Fengshui Forests in an Era of Capitalism and Resource Competition**

Ironically, the communal cults that were strong enough to protect sacred forests, even under duress from powerful authorities, may not be strong enough to protect the forests in an age of individualism and the private accumulation of wealth. Some of the few negative impacts on *fengshui* forests reported in Meihuashan have occurred in the 1990s, as a result of the ascendance in value of the household economy over the communal good. A single entrepreneur in Gonghe village, a man who happens to be the chief of Guihe administrative village, has converted dozens of *Cryptomeria* trees from *fengshui* forests in the region into woodcarvings in a village workshop that employs woodcarvers from Jiangxi province. The carvings, which depict fabled landscapes, are sold to Japanese middlemen for up to roughly $3,000 U.S. apiece.

The village chief of Guihe has paid villagers in Guizhuping and other villages outside of the reserve to cut *Cryptomeria*. Along two ravines SW of Guizhuping, the author counted 26 fresh *Cryptomeria* stumps, with sizes ranging from 60-172 Cm dbh. Tree ring counts showed that the older trees were roughly 200 years old. Since the grove
of giant trees had spread down along stream banks of the long mountain streams, and contained over 80 trees, villagers may have felt that there was little harm in selective felling (there are a few other Cryptomeria groves of comparable size in the village that were not cut).

The Guihe Party Secretary, a native of Guizhuping who was out of town at the time of the cutting, stated that local people were "not wise enough to protect their own forest," and had accepted minimum payoffs (Guan Yanzeng, pers. comm.). There were also allegations that the village chief had bribed reserve and forestry officials up to the regional (Longyan Forestry Committee) level, coercing them to give him a permit to cut the trees under the pretense that they were dead. Many villagers in Guihe are angry that the woodcarving factory not only despoliates the sacred forests, but also provides no income for other local people. In 1994, aside from a couple of co-managers, all of the employees were outsiders.20

20 Meihuashan is certainly not the only place in China where commercial interests have led to the destruction of sacred forests. Economic pressure threatens fengshui forests all over the Southeast Uplands and perhaps in other parts of China as well. An essay by Fang Ye (1994), who grew up in a rural village, indicates that the problem may be gaining notice beyond the villages themselves. Fang, writing in the Fujian Daily (Fujian Ribao), states that fengshui trees and forests are a "national treasure" and decries their destruction due to the "explosion of the materialist demands" of emerging capitalism. In a poignant conclusion the author writes, "...is it the surging economic tides or the excessive poverty of the nation's people that have caused them to start destroying and selling even the shady bracken (grottoes beneath sacred trees and forests) that the ancestors have left for us? In a developing economy, it is no wonder that even a few ancient trees at the foot of a village cannot remain! They have been eyewitnesses through the years of wind and rain, they are history, they are shadows of our ancestors! My honorable and pitiable fengshui trees" (Fang, 1994).
Another threat to sacred forests comes in the form of insect depredation. Many lower elevation Cryptomeria forests are attacked by a parasitic wooly caterpillar ("da mao chong" - species unidentified). Villagers say that the insects were never a problem before the advent of chemical fertilizers for local agriculture, and it appears that some natural predator of the caterpillars has been wiped out. Above elevations of about 1,250 meters there are no pests, so windgap forests do not suffer from parasitism. In fengshui forests adjacent to settlements, the bugs are such a problem that locals soak handwoven ropes in insecticide and tie them around the boles of the trees. In this way, the caterpillars are deterred from climbing the trees and consuming the leaves, which is what ultimately kills trees. This practice was also observed in Longxishan Nature Reserve, and is apparently very common in the Southeast Uplands. Some villagers have also stated that these rustic and aesthetically pleasing belts have a ritual significance, honoring the venerable old trees individually.21

Fengshuilin and Watershed Protection in Meihuashan

As tropical storms hit southern China in the summer and fall, rainfall is often violent and flooding is common. On the night of June 1, 1995, the author was visiting friends in a small village in Luxi Township (northwest of the nature reserve) when a violent squall hit the area. Within three hours, 20 centimeters (8 inches) of rain fell, and a

21 The placement of woven belts or ropes around large sacred trees is also practiced in Japanese Shinto.
torrent of water covered roads and fields in many valleys of the region. It was the worst local flood in at least fifty years.

The Luxi town center and many villages are located along a river in the bottom of a wide valley - a tributary of the Pengkou/Jiuxian River (itself a tributary of the Tingjiang), at an elevation below 400 meters. In this low valley and its major tributaries, there has been almost total deforestation. Like other heavily degraded landscapes in the region, Luxi's mountains have a semi-arid appearance due to the lack of water storage capacity. Young pine forests are all that hold the runoff on the steep slopes, so drought and flash floods are common.

The massive flash flood of June 1, brought devastation to some 1,900 families in nine villages. Flood waters toppled 226 houses, washed out roads in 80 places, destroyed 111 hectares of rice paddy, and ruined numerous fishponds, causing an estimated 30 million yuan ($3.75 million) of damage (Yang. Y.S. and Chen, X.S., 1995).

A few kilometers across the mountains to the southeast, the villages of Meihuashan, though hit by equally severe rainfall, suffered very little damage. While this is due partially to the geomorphology of the region, namely the absence of multiple village settlements in broad floodplains, the amount of vegetation cover undoubtedly played a critical role as well. Sacred forests and other dense vegetation protected the Meihuashan villages quite effectively. A well-built cement and stone bridge near Xiache

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The author was with a group of four other men who were trying to return to Luxi town late at night from the village of Xiyuan, over some 10-15 kilometers of rutted dirt roads on two motorcycles. As the roads turned into rivers, we had to turn back. Two men reached the village on foot early the next morning.
village, which connects Long Gui to the outside, was washed out, providing strong
evidence that rainfall was comparably intense in that area. There was no other damage in
any of the reserve villages themselves, however. From this example alone, it appears that
*fengshui* and *fengshui* forests are aptly named. They are part of an ancient tradition of
hydrological control that deserves further examination and wider emulation.

**Fengshuilin and Biodiversity in Meihuashan**

The second series of sacred forest surveys, conducted in May and June of 1995,
benefited from the expert assistance of a forester who is also the director of a
management station in the nature reserve. This phase of research complemented the first
phase, and provided more comprehensive data on broadleaf forest ecology in a slightly
smaller sample of selected forests (Fig. 10.2).

The purpose of this research was to compare tree composition and tree size among
five broadleaf *fengshuilin* in different villages. A small sample of two other (non-
*fengshui*) broadleaf forests was included in the survey to determine if *fengshui* broadleaf
forests contained larger (and therefore older) trees, or if either contained purer, less
diverse stands. These data were combined with observations on land use patterns and
other observable phenomena at the study sites. Since our purpose was to compare sacred
forests with remnant broadleaf patches, we did not survey the monospecific, coniferous
*Cryptomeria* or *Cunninghamia fengshui* forests.

Broadleaf sacred forests and broadleaf "old growth forests" (the latter were not
undisturbed primeval forests, but among the older relict successional broadleaf forests in
the reserve) were selected on the basis of areal dimensions and tree size, with a preference
for larger forests containing larger trees. After choosing a particular forest for study, the researchers marked off a 15 X 15 meter quadrat near the center of the forest. All trees >20 centimeters in diameter at breast height (dbh) were identified by species and their dbh calculated on the basis of circumference (circumference / \pi = diameter) and recorded. Under story trees, shrubs, and herbaceous plants were identified, and dominant taxa were recorded. The researchers then selected a 1 X 1 meter quadrat within the larger plot based on the representative quality of its taxonomic and structural features for the plot as a whole. The Under story plants in these quadrats were identified and recorded. In the larger forests of Guizhuping and the Gutian Memorial, large (15 X 15) quadrats were selected. The final step was to describe the degree of canopy closure, estimate the heights of dominant trees, estimate the ages of large trees, and record signs of forestry activity, relict land use features (e.g. abandoned agricultural terraces), and other notable features.

With two notable exceptions, there was a general relationship between the density of trees in each quadrat and the size of the trees: forests with a smaller average tree size had more trees (>20 cm dbh) (Table 10.2). This trend is probably a reflection of two factors. The first is the fact that in younger forests there are more trees, since competitive exclusion has not yet led to fewer, larger trees. The second, perhaps more important

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23 The Gutian Huizhi (Gutian Meeting Site) was once an ancestral temple behind which is found one of the most beautiful fengshui forests in the region. The temple was converted to a school where Mao Zedong held the historic Ninth Meeting of the Fourth Red Army. Today the site is part of an important museum of revolutionary history.
### Table 10.2. Broadleaf *Fengshui* and Relict Forest Survey Results

#### Fengshui Broadleaf Forests

**Plot 1** Location: Zhongcun Water Gate Forest  
Elevation: 795 m  
Slope: 15°  
Aspect: NE  
**Trees >20 cm dbh:** (Diameter in Cm.)

<table>
<thead>
<tr>
<th>Tree Species</th>
<th>Diameter (Cm.)</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Altingia gracilipes</em></td>
<td>80</td>
<td>1</td>
</tr>
<tr>
<td><em>Castanopsis eyrei</em></td>
<td>26</td>
<td>5</td>
</tr>
<tr>
<td><em>C. carlesii</em></td>
<td>32</td>
<td>3</td>
</tr>
<tr>
<td><em>C. lamontii</em></td>
<td>37</td>
<td>4</td>
</tr>
<tr>
<td>Average dbh:</td>
<td>45</td>
<td></td>
</tr>
</tbody>
</table>

**Plot 2** Location: Xiache Water Gate Forest  
Elevation: 552  
Slope: 20°  
Aspect: W-NW  
**Trees >20 cm dbh:**

<table>
<thead>
<tr>
<th>Tree Species</th>
<th>Diameter (Cm.)</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>C. carlesii</em></td>
<td>31</td>
<td>1</td>
</tr>
<tr>
<td><em>C. carlesii</em></td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td><em>C. lamontii</em></td>
<td>63</td>
<td>3</td>
</tr>
<tr>
<td><em>Schima superba</em></td>
<td>21</td>
<td>4</td>
</tr>
<tr>
<td><em>Elaeocarpus spp.</em></td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>Average dbh:</td>
<td>35</td>
<td></td>
</tr>
</tbody>
</table>

**Plot 3** Location: Long Gui Backslope Forest  
Elevation: 858  
Slope: 20°  
Aspect: SE  
**Trees >20 cm dbh:**

<table>
<thead>
<tr>
<th>Tree Species</th>
<th>Diameter (Cm.)</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Altingia gracilipes</em></td>
<td>55</td>
<td>1</td>
</tr>
<tr>
<td><em>Altingia gracilipes</em></td>
<td>44</td>
<td>2</td>
</tr>
<tr>
<td><em>Altingia gracilipes</em></td>
<td>35</td>
<td>3</td>
</tr>
<tr>
<td><em>Altingia gracilipes</em></td>
<td>50</td>
<td>4</td>
</tr>
<tr>
<td><em>Altingia gracilipes</em></td>
<td>49</td>
<td>5</td>
</tr>
<tr>
<td><em>Altingia gracilipes</em></td>
<td>30</td>
<td>6</td>
</tr>
<tr>
<td><em>Altingia gracilipes</em></td>
<td>38</td>
<td>7</td>
</tr>
<tr>
<td><em>Altingia gracilipes</em></td>
<td>28</td>
<td>8</td>
</tr>
<tr>
<td><em>Altingia gracilipes</em></td>
<td>47</td>
<td>9</td>
</tr>
<tr>
<td><em>Altingia gracilipes</em></td>
<td>23</td>
<td>10</td>
</tr>
<tr>
<td><em>Altingia gracilipes</em></td>
<td>24</td>
<td>11</td>
</tr>
<tr>
<td><em>Castanopsis carlesii</em></td>
<td>23</td>
<td>12</td>
</tr>
<tr>
<td>Average dbh:</td>
<td>37</td>
<td></td>
</tr>
</tbody>
</table>

**Plot 4** Location: Guizhuping Eastern Sideslope Forest  
Elevation: 1,350  
Slope: 25°  
Aspect: W  
**Trees >20 cm dbh:**

<table>
<thead>
<tr>
<th>Tree Species</th>
<th>Diameter (Cm.)</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Tsuga longibracteata</em></td>
<td>46</td>
<td>1</td>
</tr>
<tr>
<td><em>Tsuga longibracteata</em></td>
<td>73</td>
<td>2</td>
</tr>
<tr>
<td><em>Castanopsis eyrei</em></td>
<td>57</td>
<td>3</td>
</tr>
<tr>
<td><em>Castanopsis eyrei</em></td>
<td>49</td>
<td>4</td>
</tr>
<tr>
<td><em>Castanopsis eyrei</em></td>
<td>40</td>
<td>5</td>
</tr>
<tr>
<td>Average dbh:</td>
<td>53</td>
<td></td>
</tr>
</tbody>
</table>

(table con’d)
### Plot 5
Location: Guizhuping Eastern Sideslope Forest  
Elevation: 1,350  
Slope: 30°  
Aspect: W

**Trees >20 cm dbh:**
1. *Castanopsis eyrei* 54  
2. *Castanopsis eyrei* 25  
3. *Castanopsis lamontii* 24  
4. *Castanopsis lamontii* 75  
5. *Myrica rubra* 31  
6. *Tsuga longibracteata* 75  
7. *Anneslea fragrans* 25  

Average dbh: 44

### Plot 6
Location: Gutian Memorial Hill Forest (Wulong Village)  
Elevation: 695  
Slope: 7°  
Aspect: S

**Trees >20 cm dbh:**
1. *Tsuga longibracteata* 126  
2. *Schima superba* 40  
3. *Castanopsis fargesii* 25  
4. *Neolitsea chuii* 38  
5. *Neolitsea chuii* 25  
6. *Neolitsea chuii* 37  

Average dbh: 49

### Plot 7
Location: Gutian Memorial Hill Forest (Wulong Village)  
Elevation: 695  
Slope: 12°  
Aspect: S-SE

**Trees >20 cm dbh:**
1. *Tsuga longibracteata* 65  
2. *T. longibracteata* 64  
3. *T. longibracteata* 38  
4. *T. longibracteata* 38  
5. *T. longibracteata* 27  
6. *T. longibracteata* 65  
7. *T. longibracteata* 53  
8. *T. longibracteata* 77  
9. *T. longibracteata* 45  
10. *Neolitsea chuii* 35  
11. *Neolitsea chuii* 25  
12. *Neolitsea chuii* 45

Average dbh: 48

### Plot 8
Location: Gutian Memorial Hill Forest (Wulong Village)  
Elevation: 695  
Slope: 12°  
Aspect: W

**Trees >20 cm dbh:**
1. *Neolitsea chuii* 29  
2. *Tsuga longibracteata* 105  
3. *Schima superba* 21  
4. *Castanopsis carlesii* 48  
5. *Elaeocarpus japonicus* 29  
6. *Caesalpinia spp.* 24  
7. *Caesalpinia spp.* 22  

Average dbh: 40

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**Non-Fengshui Broadleaf Forests**

### Plot 1
Location: Between Zhongcun and Qiushan (riverbank)  
Elevation: 748  
Slope: 12°  
Aspect: N-NE

**Trees >20 cm dbh:**
1. *Castanopsis eyrei* 57  
2. *Castanopsis eyrei* 63  
3. *Ormosia xylocarpa* 31  
4. *Cyclobalanopsis glauca* 22
<table>
<thead>
<tr>
<th>Rank</th>
<th>Species</th>
<th>DBH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Tsuga longibracteata</td>
<td>92</td>
</tr>
<tr>
<td>2.</td>
<td>Castanopsis fordii</td>
<td>57</td>
</tr>
<tr>
<td>3.</td>
<td>Castanopsis tibetana</td>
<td>70</td>
</tr>
<tr>
<td>4.</td>
<td>Elaeocarpus spp.</td>
<td>82</td>
</tr>
<tr>
<td>5.</td>
<td>Elaeocarpus spp.</td>
<td>70</td>
</tr>
<tr>
<td>6.</td>
<td>Altinaria chinensis</td>
<td>35</td>
</tr>
<tr>
<td>7.</td>
<td>Altinaria chinensis</td>
<td>57</td>
</tr>
<tr>
<td>8.</td>
<td>Phoebe spp.</td>
<td>48</td>
</tr>
<tr>
<td>9.</td>
<td>Fagus longipetiolata</td>
<td>83</td>
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</table>

Average DBH: 66

Plot Location: Daxie Tou
Elevation: 1,158
Slope: 15°

Trees >20 cm dbh: (9)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Species</th>
<th>DBH</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.</td>
<td>Castanopsis carlesii</td>
<td>28</td>
</tr>
<tr>
<td>4.</td>
<td>Castanopsis carlesii</td>
<td>25</td>
</tr>
<tr>
<td>5.</td>
<td>Ormosia xylocarpa</td>
<td>20</td>
</tr>
<tr>
<td>8.</td>
<td>Cyclobalanopsis glauca</td>
<td>24</td>
</tr>
<tr>
<td>9.</td>
<td>Altingia gracilipes</td>
<td>67</td>
</tr>
</tbody>
</table>

Average DBH: 37

Aspect: NE
factor, is that in many of the younger forests, there has not been as much selective felling of trees by humans.

The two exceptions to this pattern lay at opposite ends of the spectrum in terms of elevation and proximity to human communities, but their remarkable similarities reflect low levels of anthropogenic disturbance. Both stands had exceptionally large trees (on average) at high to moderate densities. One stand was a fengshuilin sample from the Gutian Meeting Site forest, the other an old growth (non-fengshui) forest near the abandoned village known as Daxie Tou.

The Daxie Tou stand is at a high elevation (1,158 m), far from any signs of human disturbance. The Gutian stand is on a hill within a plain, at a low elevation (695 m). It is near the village of Wulong, within the town of Gutian, surrounded by rice paddies, houses, and roads. In Daxietou, there is virtually no human disturbance because there are few humans around. The nearest village is Dapingshan, and there is no need to cut broadleaf trees in a remote high elevation area like Daxie Tou. In the Gutian forest, which lies behind a national historical monument,24 there has been state protection of the sacred forest for many years (in addition to customary rules). Therefore, these two forests represent mature forests under a low disturbance regime, one afforded by strict protection, the other by remoteness from humans.

24 This forest has probably received especially stringent protection even though it lies in the heavily-deforested Gutian valley. This is largely due to the fact that it is adjacent to a nationally famous site that commemorates the Chinese Communist Party's revolutionary history. The forest grows upon a hill immediately behind an old school (originally an ancestral temple) where Mao Zedong held the famous "Gutian Meetings" with Zhu De and the Red Army in 1929.
The other forest stands in the sample exhibit varying degrees of human disturbance. The two quadrats from the Guizhuping sacred forest, for example have among the largest tree size averages in the sample, and yet the trees are relatively sparse. There is an impenetrably dense Under story of young trees 1-2 meters in height. Villagers report that fuel wood harvests, including the cutting of young trees, was an important practice for many years. This has ceased in the last few years, and many young trees have begun to compete for the available light. Similarly, the second of the two remnant (non-geomantic) old growth forests in the survey was successional to rice paddy lands (as evidenced by relict terraces) and was long selectively cut for the production of charcoal (Huang Zhaofeng, pers. comm.). In only one forest patch were Under story trees and seedlings in the one square meter quadrats significantly different from the trees composing the canopy (see below). This is an indicator that these predominantly broadleaf forests, if not subjected to major disturbance, will not undergo substantial changes in composition in the near-future.

In general, there do not appear to be significant differences in arboreal diversity between old growth remnants and broadleaf sacred forests. Some fengshui forests, however, do contain an unusual number of trees of the same species. Long Gui's back slope Altingia forest (Table 10.2, Plot 3) is a good example, although it is unclear why one tree species predominates. The presence of numerous Under story broadleaf trees of other species seems to indicate that the dominance of Altingia will be short-lived if Under story trees are not harvested.
Another sacred forest in which one broadleaf tree species predominates is the hilltop *Castanopsis* grove in Zhuling village (Table 10.2). The trees, which now form a tall canopy over a cultivated forest of younger *Cunninghamia*, were either planted by village ancestors or selectively protected as seedlings. This management effort appears to have been pragmatic, for villagers have long used fallen or cut logs from the grove to cultivate mushrooms. With *Castanopsis* trees growing in tandem with the multi-purpose timber tree (*Cunninghamia*), the Zhuling hilltop sacred forest has economic value to match its cosmological importance.

In summary, current ecological conditions and oral historical accounts support the fact that sacred forests have been protected over the course of centuries, and through the sociopolitical upheavals since 1949. They have also functioned as woodlots for fuel wood collection and as sources for medicinal herbs and mushrooms. Therefore, over the longterm, sacred forests have served a number of community functions relating to cosmology, conservation, subsistence, and energy supply.

The forests have also included rare and valuable tree species that are uncommon or absent in remnant broadleaf forests. The most prominent in these surveys was *Tsuga longibracteata* (*changbaotieshan* or *Chinese hemlock*), which is under state protection. Other rare trees that are well-protected in the *fengshui* forests of Meihuashan include Chinese Yew (*hongdoushan* - *Taxus chinensis* var. *marei*) and Fujian cypress (*jianbai* - *Fokienia hodginsii*). Many if not most of the 47 species of protected plants in Meihuashan are more likely to be found in sacred forests than in any other vegetation patches (Huang Zhaofeng, pers. comm.).
Centripetal Forces in the Religious Geography of Meihuashan

Fengshui forests are critically important refugia for plant species, birds, and other wildlife in Meihuashan. An understanding of traditional village fengshui, the modus operandi of fengshui forest protection, is therefore essential for conservation planning throughout the region. While fengshui provides a unity of place and meaning for each lineage village as an enclave, however, it does not provide a spatio-temporal framework for cosmological unity among the villages of Meihuashan (or any other region) as a whole. Although the ethos and language of fengshui have circumscribed intervillage negotiations over land boundaries and the contestation of sacred space, the insular motives of village fengshui have seldom tied groups of villages together in an explicit way.

Even after half a century of political restructuring and the formation of administrative villages without respect for intervillage kinship patterns, the patrilineal, patrilocal villages of Meihuashan may still form closer political and economic relations with geographically distant same-surname villages than with neighboring villages of different lineage. This is illustrated by the continuing village boundary conflicts, which have taken on added urgency with the partial privatization of bamboo forests.

In 1994-95, there were ongoing boundary disputes in a number of villages, including two that lie south of the divide: Long Gui (in conflict with Dagaoxie, which lies north of the divide) and Gonghe (in conflict with Luodi, north of the divide and with Liling, its neighbor to the south). These conflicts have a direct bearing on forest resource degradation. In the case of Long Gui and Dagaoxie, for example, a secret remittance of
illegally harvested timber was paid by the latter village to the former after Long Gui villagers discovered timber cutting on their land. Neither village wanted to inform reserve authorities since the reserve would have required a share of the profit.

Before the era of communist rule, conflicts between neighboring villages were sometimes severe, and *fengshui* feuds were not uncommon. In many cases this led to the desecration of tombs and the digging of trenches to cut a neighboring village's "dragon veins" (*long mai*). Conflicts between villages that shared neither consanguinity nor proximity could be even more severe, especially when banditry, warlordism, and other forms of predation were involved. Thus, Luodi and Pingshui villages (the latter of which is now abandoned), lying to the north of Meihuashan's main drainage divide frequently attacked villages south of the divide, and formed alliances with other northern villages like Majiaping.

During the Civil War, *Guomindang* troops and Communist militias were united with local communities and fought battles that pitted one village against the other. The

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21 Even in the neighboring villages of Gonghe and Guizhuping, which have no lineage relations, there have been at least two *fengshui* feuds in the last few centuries. One Gonghe villager's explanation (obviously biased) is as follows. The first conflict occurred when people from Guizhuping dug graves on a high slope some 2 kilometers south of Mount Youpoji. The graves severed a dragon vein (*long mai*) into Gonghe (apparently this was not intentional), and dogs and chickens there fell silent for 3 days and nights. The villagers of Gonghe realized that the graves were bad *fengshui*, so they dug a trench up slope, above the graves, cutting off the *qi* flow. The graves were abandoned thereafter and the curse was broken (Ma SX, pers. comm.). The second conflict also involved a new graveyard, in this case, the people of Gonghe found an excellent site for a graveyard. It consisted of an overhanging rock on the edge of a wetland along a trail south to the villages of Gulu and Buyun. The rock looked like a frog with its mouth open, and was called "Xiamaxiajing" ("frog leaping into a well"). The *fengshui* was excellent since the "frog" faced a pool just as in manmade tombs and ancestral shrines. As in Gonghe, the people of Liling were alarmed when dogs and chickens fell silent for 3 days. They removed urns and bones from the graveyard and it was never reestablished.
mutual antipathy between certain villages has never fully died down, and actually appears to be reemerging with the degeneration of central control and the rise of exploitative entrepreneurialism. Villagers from Luodi, which has jurisdiction over large tracts of reserve land north of the drainage divide, have operated the most destructive illegal logging operations in the core area of the reserve. They also complain of unjust persecution by reserve officials, who they say discriminate against them in matters relating to timber quotas and illegal logging.

Given the fractious history of village fengshui and territorial disputes, conflicts that insularize villages and lineages, it is important (for conservationists, planners, and residents themselves) to recognize the customs that have served to link villages that might otherwise have reverted to continuous feuding and resource expropriation. Perhaps to counteract the isolating and insularizing tendencies of village fengshui and lineage traditions, to insure good relations with villages where daughters were to spend the duration of their married lives (which is another important unifying social force), and to group together for defense against aggressive warlords and bandits, some traditional religious rites of solidarity have extended beyond the immediate compact settlement to embrace the community of other villages within the same or nearby drainage basins.

Within one group of villages this might mean building a communal temple, as in the efforts of Long Gui, to reconstruct the historical "Five Towns Temple" (Wu Xiang Si"). The Wu Xiang (Five towns) Temple, across the Malinxi River from Long Gui, was under reconstruction in 1995, having been destroyed during the Cultural Revolution. The five villages whose members traditionally worshipped Daoist and Buddhist deities there pooled funds and other
fire-walking ceremonies (described in chapter 11) that tie them together in common
devotion to a heavenly deity known as Wugu Zhengxin. For another group of villages that
lie south of the divide, the most important rite of solidarity is the annual Kang Pusa
("Carry the Buddha") ritual, which revolves around a local historical figure, the living
Buddha, and the sacred mountain where he is worshipped, Horsehead Mountain
(Matoushan). A brief description of the religious geography of this (essentially)
communal cult provides an emic view of how the villages in the southern part of the
reserve and to the south of the reserve are united within a low-level ecclesiastical
framework.27 In terms of daily social life, this type of alliance with over 20 villages in the
area may be more important to a particular village than is its grouping with the 25 other
villages that happen to fall within the boundaries of the Meihuashan Nature Reserve.

The Living Buddha was a man named Zhang who lived in the village of Xiaowudi
over 500 years ago. His descendants still live in Xiaowudi today, a village bordering
today's reserve on the southwest. Zhang was born in 1430. While still a young man, his
resources to renew the temple and restore traditional ties. The member
villages were Xiache, Long Gui, Taipingliao, Jiaotan (formerly called
Linxie), and Beiyang. In 1995, the main construction of the temple was
nearing completion, having cost some 26,000 yuan ($3,250) to date. Completion of the interior was expected to bring the total to 50,000
yuan ($6,250).

27 The term communal cult indicates that non-specialists are
responsible for performing the important rituals, returning to secular
life as soon as the ceremony is over. Ecclesiastical cults are found in
societies with a high degree of political economic stratification (where
individual, shamanic, and communal cults may also continue to exist).
These function through the control and leadership of a group of
religious specialists, clergy who often have connections to the
political powers controlling society (Harris, 1983). The cult of the
living Buddha of Matoushan involves mostly villagers, with only one or
two full-time temple priests in charge of annual ceremonies.
mother sent him to Jidang Shan, a Buddhist temple in the mountains southeast of Gutian (that has recently been renovated), to study Buddhism with a master priest.

In time he became well known as a healer, a living Buddha, who could cure all kinds of illnesses, and who had disciples of his own. In 1488, at the age of 58, suffering from leprosy and dysentery and near the end of his life, Zhang set off into the mountains to find a sanctuary where he could meditate and enter nirvana before he died.

From Xiaowudi he walked north along a mountain trail that (still) runs to the west of Gonghe, and enters Guizhuping. With lesions on his face and having gone completely bald, he knew he had limited time to attain his spiritual goals. People in Guizhuping did not know him and feared the diseased man who had drifted into their midst, so they repelled him with brooms dipped in the latrine buckets full of urine (which are still, incidentally, an essential facility in every Meihuashan household).

Zhang then headed south to Gonghe village, where he was welcomed with tea and hospitality. From there he was led to Liling, where he had a close friend. The Liling villagers dug a cave where the living Buddha meditated and attained nirvana. After 49 days, Zhang emerged enlightened and walked back to Matoushan28 to die. There his students put him in a large iron burial urn sealed with a heavy lid. After all funeral

28 The small cave that was excavated for Zhang in Liling is still there. It was hollowed out of the yellow-orange soil of a hillside near the village. There are no monuments or markers there save for some ceremonial red paper stuck to one side of the door. The interior is quite clean. In 1995, villagers were discussing ways to develop it as a pilgrimage and tourism site. Horse Head Mountain lies between Zhang's home village, Xiaowudi and the village of Shangfu, which is the administrative center of Buyun Township.
ceremonies were consummated, the students went to Hangzhou, an important center for Buddhist studies, and did not return for 6 years.

Upon opening the urn, they discovered that the lid had somehow shifted, bending the corpse's head and neck to one side, but the body was completely dried out (Ma Shengxue, pers. comm.).

The desiccated body was dressed in fine clothing and used as a buddha image for worship. A little over 20 years after his death, over 480 years ago, the temple at Matoushan was established as a site for making offerings and requests to the Buddha, who sat like a statue upon an ornate and colorful dais. The temple was certainly not the most famous in Shanghang county, for by the Qing dynasty (1644-1911), there were 76 temples, monasteries, and other centers of Buddhist activity there (SHXDFZBZWYH. 1993). What was more important for local villages was the annual fall procession that apparently developed soon after the establishment of the temple.

The procession, known as Kang Pusa, or Carrying (as on a palanquin) the Buddha, has been an important harvest time festival for some 20 villages in the Buyun-Gutian area for centuries. From Matoushan Temple, the Buddha and a number of attendant deities are carried on litters with shoulder poles to a village, where they reside in the ancestral temple (citang) for 2-3 days amid grand celebration, eating, drinking, fireworks, family reunions, gambling, outdoor movies, and intense worship. This is the largest holiday aside from the Chinese New Year in late winter - early spring.

When the event is over in one village, the Buddha and his attendants are carried toward the next village, along with gods from the village ancestral temple who escort the
procession to a hand off point. Villagers from the next village meet the procession along the road to accept the Buddha and his attendants, and after placing the visiting gods upon the dais in their own ancestral temple, the celebration begins anew.

Matoushan temple and the Kang Pusa ceremony lasted until the Cultural Revolution, when Zhang the Buddha's body was burned and the temple was razed by Red Guards. After the Cultural Revolution ended, a wooden replica of the living Buddha was carved from camphor wood, and in 1980, the temple was rebuilt. The Kang Pusa ceremonial cycle resumed in 1989, and today over 20 villages "invite the Buddha."

Among these are two villages that lie within or have land within the boundaries of the nature reserve (Gonghe and Liling). At least ten other reserve villages participate in Kang Pusa, and make regular trips to Horsehead Mountain to worship in the temple of the Living Buddha.

According to tradition, Guizhuping can never host the Buddha because of its transgressions against Zhang in his last days. It is said that when they draw lots (qiu qian) with the Buddha, they rarely get good fortunes. People from Liling, on the other hand, are nearly always blessed with good results. Another historical irony is that Matoushan is said to be especially favored by those seeking cures for dysentery and diarrhea (Ma Shengxue, pers. comm.).

Today Matoushan and the Kang Pusa are among the most definitive cultural focal points in the southern part of the Meihuashan high peaks area. The ancient religious geography of the ritual procession, centered on the most important holy mountain in the area, acts as a powerful centripetal force for local people at a time when southern China is...
undergoing a religious renaissance of historical significance. Mountain areas of China have long been centers of religious hermitage, monasticism, and pilgrimage, and nature conservation in many parts of China will depend on incorporating these cultural activities into reserve planning. Like many such sites, Matoushan is surrounded by a large expanse of ancient sacred forests. Though Matoushan lies outside of the reserve boundaries, the managers of the Meihuashan Nature Reserve have already begun plans for operating tourism and pilgrimage facilities there. These plans are discussed in more detail in chapter 12.

**Conclusion: Sacred Landscapes and Conservation Efforts in Meihuashan and Beyond**

The religious geography of Meihuashan is a critical part of local identity and sense of place. It is worthy of research in its own right. As far as protecting biodiversity, sacred forests and holy mountains are a form of indigenous nature preservation that has much greater historical precedence in the region than does any form of state-sanctioned conservation. One of the challenges for reserve managers and residents today is to combine these modes of conservation, to find common ground, and to insure that local efforts and national policies are in synchrony. There may be considerable room for cooperation between traditional sacred forestry schemes and modern, "scientific" approaches. This should not be attempted without extensive participation and planning by local people. Attempting to adopt a "sacred forest approach" will be futile if it is not motivated by local initiatives and indigenous perceptions. A report from the New
Zealand government’s Shouning County (Fujian) Social Forestry Project (Hung, 1993) recommends that project members should

"Launch a 'geomantic trees' planting activity in the project villages. A technician will go to the village in the planting season to show the villagers slides of tree planting technology and slides about New Zealand. The farmers will choose a place near the village for geomantic trees themselves and be provided seedlings freely. Refer to village's tradition (sic) to select the tree species...Chinese cedar and camphor...are the most popular species for geomantic trees. The trees must be planted strictly according with the technology introduced by the project so that the geomantic tree activity can play a role in the technology transfer."

There is indeed a demonstrated need for the regeneration of forests in much of Fujian, including parts of Meihuashan. To protect biological diversity, there should be more effort to cultivate forests, especially broadleaf forests.

Hung (1993) suggests that local people would respond to a native sense of geomantic necessity, and work with central authorities to cultivate "sacred" forests, but this may be an optimistic view based on a somewhat paternalistic approach to local culture. There is no evidence that broadleaf trees (unlike Cryptomeria and Cunninghamia) have ever been planted by local people. Still, the communal tradition of protecting sacred broadleaf forests may bode well for future efforts to preserve remaining broadleaf forests (both fengshui and remnant forests) and to cultivate new broadleaf forests.

Broadleaf forests now protected within the newly established "baohuxiaoqu" (miniature protected areas), which lie outside of the core area (see chapter 12), could conceivably receive local protection, in part because of their superficial similarity to
fengshui forests. However, the ultimate criterion for which forests can be considered "geomantic" will most likely depend, as Hung recognizes, upon proximity to villages.

In many parts of China, the Maoist ban on "feudal superstitions" such as fengshui, the vandalism of temples and tombs, and the building of roads and other infrastructural features not only reshaped the physical appearance and function of rural lands, but also transformed the principal structure and meaning of the cosmologized landscape. In parts of rural China, this geographical holocaust could have amounted to a change of "world order." In the mountain communities of Meihuashan, however, these changes appear to have amounted to a hiatus rather than to a "permanent revolution."

Fengshui and local religion still survive and thrive, though perhaps in modified forms, and local people can still claim responsibility for having protected most of the remaining rare tree species in the reserve. Ironically, the influences of a growing capitalist system have placed some of the sacred forests in jeopardy. The dynamic forces of a market economy combined with the unforeseen pressures of a declining welfare system appear to be much more detrimental to the environment than were the ideological revolutions of the past. The time may soon come when central authorities must step in and make "fengshuilin preservation" an official policy.
CHAPTER 11

EATING FROM THE MOUNTAIN: HUNTING TRADITIONS, THE WILDLIFE TRADE, AND WILDLIFE MANAGEMENT

Kao shan chi shan, kao shui chi shui.
"Those living in the mountains eat (from the) mountains; those living by the water eat (from the) water." (Ancient Chinese proverb)

Nature conservation has emerged as a scientific and practical discipline in China only in recent years, and wildlife management techniques are, by Western standards, non-existent or rudimentary in all but a few internationally famous nature reserves, like Wolong in Sichuan (CNCMAB, 1995; CEN, 1995; He Lian; Luo Mingxi; Daniel Viederman, Pers. Comm.; Schaller, 1993).

Indigenous forms of land and wildlife management, on the other hand, date from the earliest use of fire by hunter-gatherers of the later Pleistocene. The burning and clearing of forest and scrub temporarily deterred large carnivores from entering villages. More importantly perhaps, firing gave rise to fresh green shoots, attracting grazing animals and other game to hillside clearings. The cumulative effects of such activities probably had a dramatic impact on many ecosystems over increasingly large areas, and some naturalists have referred to the earliest use of fire for wildlife management as a cultural ecological revolution (McNeely and Wachtel, 1988).¹ In the neolithic, burning the land became an integral part of subsistence agriculture; fire converted biomass to soil

¹ In Soul of the Tiger: Searching for Nature's Answers in Exotic Southeast Asia, McNeely and Wachtel refer to the early use of fire for game management in Southeast Asia as "the first ecocultural revolution," the practice of swidden being the second. These watersheds in cultural ecological history led to dramatic alterations of the environment, and the second in tremendous increases in human population density.
nutrients and cleared space for swidden cultivation. Throughout historical times and continuing down to the mid-twentieth century, Han and non-Han peoples used fire as a wildlife management tool, as was discussed in chapter 6. Traps and weapons were also developed to hunt game and remove dangerous carnivores, and these indigenous tools diffused throughout China and across Asia during periods of intercultural contact and waves of migration that may never be fully reconstructed.

In southeast China, rural villagers were not the only people involved with controlling wildlife, however, and the history of human-tiger encounters described in chapter 3 shows that representatives of the imperial government relied on both cosmological strategies (prayers and supplication to heaven) and practical techniques (military aid, hunting, and trapping) to subdue what was seen as a quasi-divine adversary.

This chapter examines local wildlife management in Meihuashan and the rich body of local lore concerning wildlife and hunting. As mentioned above, fire was only one of many tools and methods used to shape the faunal landscape into forms that met the needs and desires of human communities. The technologies and techniques of hunting and trapping, which are worthy of study in themselves, also provide a guide to the historical process of adaptation to local ecological conditions. In the Southeast Uplands, one can still find traps and weapons composed entirely of local natural materials, evidence of a long tradition of hunting and trapping that has only begun to be modified by new technologies in recent decades. Documentation of these living artifacts has been one of the primary goals of this study, and one that the author hopes will further our knowledge of the culture history of China.
In the Southeast Uplands region during the 1990s, local people continue to make wildlife and landscape management decisions of significant consequence, even as the government seeks to standardize rules and procedures, and minimize local deviation from national and provincial conservation policies. This research indicates that conservation officials in Southeast China could enhance their effectiveness through a deeper understanding of indigenous wildlife management practices. With sufficient incentives, nature reserve officials can work cooperatively with local residents, devise policies sensitive to local needs, and draw on the expertise of those who are closest to the country's protected wildlands and wildlife.

Research on Indigenous Forms of Wildlife Management

For the purposes of this study, wildlife management can be defined as "making decisions and taking actions to manipulate wildlife populations and their environments" (Hardin, 1992) usually with the aim of increasing or stabilizing the populations of favored species and reducing the populations of undesirable species. While official efforts to manage wildlife in the Meihuashan Nature Reserve since the reserve's founding in 1985 are critically important, these must be placed within the broader spatial and temporal contexts of traditional wildlife management in the Southeast Uplands. For this topic, the most reliable information on changing perceptions of hunting and wildlife management has come from interviews with local hunters. The researcher conducted standardized ethnographic surveys within the villages of the Meihuashan Reserve and beyond. Indoor and field interviews focused on local hunting practices, seasonal patterns, traditional
perceptions of wildlife and wildlife management, the government fur trade of the 1960s-80s, and current perceptions of wildlife conservation.

During the first day of field research in the Meihuashan Nature Reserve, the researcher discovered that certain local hunters were not only willing to discuss the history of hunting, but were also eager to display their weapons and their quarry, and even to demonstrate their hunting ability "in the field." Although the researcher generally avoided illegal hunting forays because of the obvious legal ramifications and the ethical issues involved, poaching was observed inadvertently on a number of occasions, and wild game was served fairly frequently in village homes and in restaurants within larger settlements outside of the reserve. Certain informants also discussed hunting methods during walking interviews and wildlife research. This method was especially useful since wild animals and their signs were frequently discovered in the field, and it was not unusual to see hunters, hunting dogs, pitfalls, snare traps, explosives, and dummies (to scare animals away from bamboo groves) while walking along the mountain trails.

There was less difficulty than anticipated in building rapport with hunters and former hunters. As in other phases of the research, the researcher developed working relationships (guanxi) and friendships through a number of ritualized exchanges, including the giving of gifts, the sharing of meals and lodging, the consumption of locally produced rice wine, and the celebration of and participation in holidays and festivals.

Interviews on hunting, as with all other interviews in this study, were conducted by the researcher, usually without the use of formal research assistants. For obvious reasons, the presence of reserve staff members made good interviews impossible.
Fortunately, the researcher was granted the freedom to work alone with local people in a
relaxed atmosphere of mutual respect.

A preliminary interview based on a questionnaire (Survey of Hunting Practices
and History - see Appendix G) was administered to individual hunters in ten different
villages. Six of the villages were within the nature reserve, and four of the villages were
outside of the reserve. A modified, less-structured version of the same survey was
conducted in the Longxi and Wuyishan Nature Reserves as well. In the Meihuashan
region, certain informants were also interviewed in a less-structured fashion that allowed
for more historical detail than do questionnaires.

The questionnaire was designed to collect information on hunting practices such
as: weapons and other devices used, seasonal patterns, diurnal and nocturnal practices, the
use of dogs, the use of headlights, and the species hunted (before and after the
establishment of game laws and the nature reserve). The survey was also designed to
collect data on the quarry and its uses: the number of animals of different species killed
per year, the habitats where these species are found, parts consumed by the hunter's
family and friends, and parts sold or traded. The third part of the questionnaire focused
on the current popularity and traditional cultural aspects of hunting: the number of local
hunters the interviewee knew, the number of hunters in the village, the number of
generations of hunters in the family, methods used by ancestors (or former generations in
the area), and religious beliefs and practices associated with hunting (e.g. prayer for
divine help in the hunt or the attribution of magical powers to animals). The final part of
the survey covered observations of animal population change and whether the informant
believed hunting should be regulated in terms of bag limits, seasonality, licensing, or in any other ways.

The questionnaires led to further research with many of the informants, so this phase of the study may be viewed as a point of departure into a much richer realm of research into hunting and environmental knowledge that was gleaned from less structured interviews and outdoor field work. A number of interviews involved ancient tiger hunting techniques that are today familiar only to a few elderly specialists. Since these methods appear in some of the earliest written records on hunting in the region, they are discussed first.

**Hunting and Trapping: Traditional Technologies and Techniques**

Gazetteer records mention various methods for capturing and killing wildlife, especially tigers. Since tigers presented the gravest threats to the populace and to the legitimacy of state power, there are more records of their depredations and of the human responses to such problems than of those concerning other species. As mentioned in chapter 3, when supplication to the gods failed, there were a number of ways to capture or kill a tiger, including the use of granite or bamboo cage traps and deadly groundset crossbows triggered by triplines.

Granite cage traps have long been known as *hu chu*, literally "tiger closets." There were at least two types, the first was a rectangular roofed enclosure made of granite pillars (Fig. 11.1), the second was a portable cage made of large maozhu bamboo poles. Both types had an entrance with a sliding door that slammed shut when triggered, and a separate compartment in the back that was used as a holding pen for the bait, usually a
live goat or dog. Tiger closets were probably most effective in areas where tigers were numerous or particularly bold. To enter a cage trap, a tiger would have to be unafraid of manmade structures, a characteristic trait of maneaters. Though the gazetteer records mention cases in which traps were used successfully, only two people interviewed could remember a time when traps were effective. In the second half of this century, tigers have generally been too scarce and too wary to be lured into baited cages.

Granite traps had the advantage of durability, but they could not be moved after construction. A granite *hu chu* trap said to date from the Tang dynasty (618-907) still stands near a Buddhist temple on Jiuxianshan (Nine Immortals Peak) in the Daiyunshan Nature Reserve (Fig. 11.1). The remote mountain temple, located amid granite boulders in the high grasslands, probably suffered from recurrent tiger depredation, and the immoveable trap may have been quite useful. Bamboo traps had the advantages of being portable, cheap, and easy to construct. The elderly caretaker at the Jiuxianshan temple recalled the successful capture of tigers in bamboo traps, noting that the slick, cylindrical poles could not be chewed apart like boards could.

A more effective method for killing tigers was to use a crossbow with a tripline (Fig. 11.2), known locally as *digong* (ground bow) or *nu* (a very old word meaning crossbow, as mentioned in chapter 3). When triggered by an animal striking the tripline, the bow shot two bolts, the metal points of which were coated with a lethal toxin.

As mentioned in chapter 3, gazetteer records contain a number of records of She people being hired to kill problem tigers, and the crossbow diffused into Han culture from
Figure 11.1. A Granite "Tiger Closet" Tiger Trap. This trap is near a recently-reconstructed 9th Century Buddhist temple on Jiuxian Mountain in the Da-yunshan Nature Reserve. This particular trap measured roughly 5 meters in length, 1 meter in width, 2 meters in height in the front, and 1 meter in height in the rear. It is reputed to be as old as the original temple.
Figure 11.2a (Top Left). Former Tiger Hunter With Crossbow - Setting the Bow. The bolts are placed on the cocked crossbow and the tripline is set.

Figure 11.2b. (Top Right) Former Tiger Hunter With Crossbow - the Crossbow Bolt. Before setting up the bow, poison was applied to the steel heads of the bolts.

Figure 11.2c. (Bottom) Former Tiger Hunter With Crossbow - the Set Bow. The bow's spring action comes from flexible multi-ply strips of *maozhu* bamboo.
indigenous hunters like the Miao, Yao, and She many centuries ago (see Chapters 2-3) (Lebar et al., 1962; Temple, 1986).

The poison used on crossbow bolts remained a secret, however, and the techniques of locating and killing tigers and other large game does not appear to have diffused beyond a few tiger hunting families. The secret plant-based ingredients of this substance have been passed down within these families for generations. It is derived from the roots of a number of plant species, but the species and the techniques by which the raw materials are processed into a deadly compound are not revealed to others (another type of poison used on arrow points is discussed below). Observers state that a drop of the substance placed on the tongue causes an immediate local anesthetic effect, and that 30 grams comprised a lethal dose. For unknown reasons, extreme humidity could render the substance ineffective. It is said that the poison entered the animal's bloodstream through the injury and through ingestion when the wound was licked, and the animal died almost instantaneously (He Lian; Huang Zaiqiu, pers. comm.).

A Hakka village chief in the Meihuashan Nature Reserve, described using a ground bow to kill wild boar. He studied the technique with a master, who taught him to use bee poison, collected by placing the gall bladder of a pig into an underground wild bee nest. After many bees had stung the tissue, it was used as a toxin on crossbow bolts (Zhang Shisheng, pers. comm.).

In addition to tigers and wild boar, groundset crossbows have been used to hunt a variety of large mammals, including big cats (leopards and clouded leopards), red dogs.
and ungulates (serow, and members of the deer family). This technique persisted into the 1980s and may still be used today.

Until the 1960s, men trained in the use of the crossbow for killing tigers were much sought after whenever villagers suffered from tiger attacks. Even in the 1960s, when automatic rifles were available, tigers were so scarce that only specialists could kill them. These men knew how to read the tracks and signs necessary to predict which trails tigers would traverse (tigers tend to walk on paths when possible). They would then set their crossbows out and make periodic checks on them, just as a trapper does with a trapline (Huang Zaiqiu, pers. comm.).

The best known tiger hunter in the Meihuashan region, Huang Zaiqiu, is today in his early seventies. He is an extremely active man who can climb a steep mountain path faster than most local people half his age. Huang, who is known as a "liehu shijia" (master tiger hunter), is a member of the She minority.² He was hired by the reserve during the late 1980s and early 1990s to help with tiger research, and still performs field checks when the reserve receives credible reports of tiger signs. Huang comes from a line of at least four generations of tiger hunters, all of whom relied exclusively upon crossbow

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² Although no one in the reserve mentioned that Huang was a She (who, as mentioned in chapter 2, normally have the surname Zhong, Lan, or Lei), upon visiting his house in Tongxian township the author discovered that the tiger hunter and his family lived high in the hills between a She village and the Guanzhuang She Autonomous township. Not wanting to appear rude, the author did not inquire about Huang's ethnic identity. Huang is also a worshipper of Panhu, the She dog-god. The gazetteer records contain a number of records of She being hired to kill problem tigers, and the crossbow diffused into Han culture from indigenous hunters like the Miao-Yao-She peoples many centuries ago (see Chapters 2-3). The poison used on crossbow bolts remained a secret, however, and the techniques of locating and killing tigers and other large game does not appear to have diffused beyond a few tiger hunting families.
traps. Though he remembers when some people used cage traps in the 1920s, these have not been effective henceforth since tigers became less common and more wary.

In his prime, Huang knew at least one other crossbow hunter, a man from Guangdong with the surname Li (or Lei), with whom he hunted. Li was also a member of the She minority and Huang indicated that Li and other tiger hunters were worshippers of the She god *Panhu (Panhu Wang)* (described in chapter 3), which means that they follow She traditions.¹

Huang became well known in the Minxi region between the 1940s and the 1980s, when he killed a total of "about ten" tigers (as he puts it) and numerous leopards, clouded leopards, dhole, ungulates, and other animals that happened into the bow traps. Huang killed two tigers in the 1940s, when he says they were abundant throughout the region. His first quarry was a maneater that had roved through Datian county (Sanming prefecture) boldly entering a bathhouse to kill one of its victims and an outhouse to kill another. The government gave him a reward of 1,000 yuan in silver *bi* (coins) as a bounty. He then killed three others in Shanghang county, including one that weighed over 440 pounds. Most of the tigers were sold in the market in Nanyang, where one can imagine the pandemonium surrounding such an item. Echoing Caldwell's accounts, an

³ The She use the name *Panhu* and *Pangu* somewhat interchangeably, as in songs to the god called "*Panhu ger*" or *Pangu ger" (Shi, 1985). There may be some syncretic connection between the dog god, *Panhu* and the Han peoples' legendary "first king," *Pangu*. The latter was the "Chinese Adam," the first person, who was also the creator and first ruler of the universe (Williams, 1988). In any case, there is a clear connection between She (and Miao-Yao) ethnicity and traditional methods of tiger hunting (Lebar, 1962). On another note, though other hunters in the Meihuashan area did not mention particular deities associated with the hunt, *Chengsan*, a great hunter, is allegedly still worshipped by some hunters in the Fuzhou area (He Lian, pers. comm.).
elder resident of Gutian recalled how before being brought to market a sack was tied over a dead tiger's head so that onlookers would not be able to remove the whiskers, invaluable elements in Chinese medicine. Every bit of the carcass could be used in medicine: organs, bones, meat, skin, and fur. Claws and teeth were made into children's necklaces to ward off evil spirits.

When asked about the habitats where he set his traps, Huang said that tigers preferred to travel along paths through the grasslands (maocao). These human and animal trails followed the ridges and peaks of the mountains and high hills. In contrast to Caldwell and other Western hunters of the early twentieth century, Huang did not seek out tiger dens, preferring to place his crossbow in favorable locations along a trail frequented by tigers. To determine the tiger's whereabouts, Huang raked patches in the middle of the trails to serve as track pits. These were roughly 30 cm square, and recorded the passage of tigers and other animals (He Lian, pers. comm.; see also Koehler, 1991).

Huang confirms the observations made by Western naturalists that tigers were common even in areas that had little forest cover, though he disagrees with regional lore which holds that tigers avoided the forests.4

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4 As mentioned in chapter 3, there is a saying in the Southeast Uplands that tigers preferred the montane grasslands and avoided the forests for reasons of vanity, namely because in the latter habitat, birds could defecate on their coats. This saying was common not only among Western Min Hakkas, but also among other Han groups throughout the region. In the Wuyishan Nature Reserve, a man from Sangang village stated that this was why tigers were never very numerous in Wuyishan (Luo, MX; Zhan, M, pers. comm.). Others attribute the supposed rarity of tigers (in historic times) to the extremely steep terrain, to overhunting, or to both (see chapter 12). There is actually no conclusive evidence that tiger population densities were lower in Wuyishan than in other parts of the Southeast Uplands.
Huang killed his last tiger in 1982 (Fu Yongcheng, pers. comm.). He quit hunting in the late 1980s, when the reserve gave him money to help with tiger recovery efforts. He last saw tiger signs in the late 1980s and early 1990s, adding that he has not looked for them since.

Huang is one of the last of a long line of tiger hunting specialists, men who knew more about the habits of the South China tiger than anyone else. His passing will mark the end of a primordial era when humans and tigers held a more equal sway over the uplands. The groundset crossbow, a weapon invented in southern China for killing tigers, is still being used by at least one hunter interviewed, but with the recent influx of modern weapons, it too will probably disappear in the next few years.

One might argue that the extinction of the South China tiger was set in motion when Western naturalists and missionaries entered the Southeast Uplands and introduced modern weaponry, modern science, Christianity, and new modes for exploiting, processing, transporting, and marketing natural resources. The successful extirpation of tigers was not merely a matter of technological innovation, it was also the result of the introduction of new conceptions of nature. Ideological developments that culminated in the Marxist-Leninist and Maoist doctrines of using nature to serve the needs of the people are discussed in Chapter 3. The hunting techniques of early 20th century Westerners like Harry Caldwell were a catalyst for more sophisticated attacks on tigers.

If the people of Fujian were awed by Caldwell's impressive firepower in the 1920s, they proved that they could achieve the same results on their own after "liberation." In contrast to Caldwell's intense fascination with the life history of the tiger,
his unique blend of naturalism and fundamentalism, and his Western notions of "sportsmanship," however, the Chinese government was singularly bent on removing tigers from the stage of human progress. Wild animals became targets in a Maoist ideological war on nature. Peasants became crusaders in countless "battles" against the wild, the uncultivated, and the unsettled. Wildlife conservation, never a well-articulated agenda, was relegated to the realm of bourgeois capitalist ideology, a null concept.

As mentioned in Chapter 3, the decade of the 1950s was a watershed of faunal destruction. The government organized a "Kill the Tiger Movement" (Da Hu Yundong) in which teams of farmers, hunters, and ex-soldiers used traditional muzzle loaders, modern rifles, machine guns, grenades, and other weapons widely available during the war and its aftermath to extirpate the big cats. In the mid-1950s, the government provided guns for the local guard (min bing), battalions in which all adult males were expected to receive training on a yearly basis. These guns were used more for hunting than for military action. A case study from the Daiyunshan region provides an example of how tiger hunting was carried out repeatedly in mountainous areas throughout southern China.

In rural villages of Dehua county there were tiger problems in the mid-1950s. A child was killed and there were numerous livestock losses. Local people complained to the new government that they could not go into the mountains, and they asked for official help. A former revolutionary guerilla named Mao Piao, who is now known locally as "Mao the Tiger Team Captain" (Mao Laohu Duizhang), recalls how in 1956 a squad of over 30 local men was enlisted by the county government. Because of his military
experience he was made the leader of what was officially designated "The Fujian Green
Mountain Hazard-Elimination Hunting Team" (Fujian Qingshan Chuhai Dalie Dui); a
group whose responsibility was to exterminate the tigers of Dehua and Yongchun
counties. The team pursued tigers non-stop for three months, but to no avail. Under
intense pressure and increasing criticism from the government, and under the scrutiny of
the national news media, they finally succeeded in locating a tiger in Huyang township,
Yongchun county. In hot pursuit among the granite boulders of the grasslands, they shot
the tiger in the leg and it retreated to a nearby mountain top. Unable to see the tiger, the
men hurled grenades into the grass and slowly closed in to discover that they had killed it.
The tiger was taken to the local township government office, dressed, and hung up for
display for three days. The vanquished enemy was a 220 pound female that was pregnant
with two cubs (Mao Piao, pers. comm.).

In the aftermath of numerous local, state-sponsored anti-predator campaigns like
this one, tigers were increasingly confined to isolated highlands, where only traditional
crossbow specialists were capable of locating and killing them.

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1 It was probably incidental that the media selected Dehua for their documentary. There were many other places in Fujian and other
provinces that could have produced the same or better results. In an
interview held in 1991, Mao described how propaganda film makers sought
footage of a live tiger. Since the team was unable to find one, a
stuffed tiger was held by two men squatting in high grass behind it.
They emulated a tiger's walking motion by easing the dummy forward
through the grass. Later a clouded leopard was caught. After seriously
injuring the film director, it was tethered with a cable through the
back leg and made to stand within an encircling group of "victorious
hunters" (Mao, pers. comm.).
Hunting and Trapping: Current Technologies and Techniques

Today there are few tigers and few tiger hunting specialists, but destructive weapons are surprisingly common, and a variety of quarry is taken for home consumption and commercial exchange. Ethnographic surveys on hunting in the villages of what are now the Meihuashan, Longxishan, and Wuyishan Nature Reserves have revealed a rich body of local knowledge concerning many species of vertebrates, and an array of hunting techniques and management strategies. These include traditional devices and techniques like pitfall traps (Fig. 11.3), bamboo and stick leghold traps (Fig. 11.4a & b), groundset and hand-held muzzle loaders (Fig. 11.5 & 11.6), and the use of specially-bred hunting dogs that are used to pursue boar and sometimes serow (Fig. 11.7). Modern hunting devices and techniques include shotguns and small caliber rifles, headlights for night hunting, exploding bait, and steel leghold traps (11.5). The following techniques were observed in the Meihuashan Nature Reserve, and this discussion is most applicable to the Hakka who inhabit mountain villages of the Meihuashan region.6

Pitfall traps have long been used in Meihuashan to capture wild boar, though they are less frequently used today. The remains of these traps are a fairly common sight in the mountains of western Fujian, but few hunters have continued to maintain the pits in recent years, since more effective guns have become common. To construct a pitfall trap, the hunter would dig a hole 3-4 meters deep and 1-2 meters in diameter. The dirt was

6 The current demographics of hunting are discussed in the section entitled "The Hunters and Their Quarry: A Survey of Hunters in Meihuashan" (below).
Figure 11.3. A Pitfall Trap for Boar Near Gonghe Village. Sweet potatoes were placed in the trap and grown in and around the trap to attract boar, which would jump over the fence and plunge into the pit. Such traps are rarely, if ever, used today.
carried far from the trap site, since the boar's sense of smell is very keen, and piles of fresh dirt are believed to make them suspicious. After the hole was dug, a bamboo fence was built around it, and sweet potato cuttings were placed inside, where they would begin to germinate and grow. The top of the hole was covered carefully with sticks, leaves, and dirt. When a boar smelled the sweet potatoes, it would leap over the fence and crash down into the bottom of the pit, where it could be shot and removed. Since wild boar are said to cross ridges at the lowest points, pitfall traps were dug in saddles, as is evident from the location of many crumbling holes and encircling fences there today (Fig. 11.3).

The most common type of traditional trap in Meihuashan and probably other parts of the Southeast Uplands as well, is a type of rat trap or vertical leghold trap. In Meihuashan, these are made with a thick strip of maozhu bamboo bent into a bow-shape, the flexion of which holds tremendous potential energy (Fig. 11.4a). Yellow bamboo is used for the cordage that keeps the bow bent, and white leaf bamboo is used for the trigger mechanism. In Wuyishan there is a variant of this trap made of sticks, with a bent sapling providing power (11.4b). The bamboo bow trap stands about 60-70 cm in height when flexed. It is set across tiny animal trails in the underbrush to capture large rodents like bamboo rats (Rhyzomis pruinosus), a favorite food item, bandicoot rats (Bandicota indica), "mountain rats" (Rattus spp.), small Indian civets (Viverricula indica), Chinese bamboo partridges (Bambusicola thoracica), and other pheasants and partridges. New traps are made each year, and trap lines are set in winter, when the animals are more prone to follow trails. In other seasons food is more abundant and animals spend more
Figure 11.4 a. (Top) A Bamboo Bow Trap in Meihuashan. These traps are used for small animals like bamboo rats, bandicoot rats, partridges, pheasants, and small Indian civets.

Figure 11.4b. (Bottom) A Snare Trap in Wuyishan. This trap was made on a trail near Guadun village, Wuyishan Nature Reserve. It is powered by a bent sapling.
time off trail consuming the abundant forage. Trap lines consist of between 20-30 traps, with up to 100 traps in exceptionally good habitat like the wetlands of Xiaoyang, in the core area of the reserve. A couple of trappers from Gonghe are said to have caught roughly 20-30 animals and birds after each set on a 100 trap line in Xiaoyang in the winter of 1993 (Ma Shengxue, pers. comm.). Dried rat meat is a well-known local specialty, and reserve directors have discussed the possibility of organizing a marketing system for its export to improve village economies.

Other traditional traps and snares include tripline-triggered bamboo tubes that shoot a poison arrow, string or rope snare traps,7 rockfall traps, and gun traps. The gun trap, a derivative of the ground set crossbow, is also placed on the ground or on rocks next to a trail, and triggered by the impact of a passing animal when it makes contact with a tripline. One version of the gun is a short-barrelled muzzle loader that can be made at home. These are still used in Meihuashan and other areas today (Fig. 11.5).

The most common hunting weapon in the Southeast Uplands is the black powder muzzle loader, a long-barrelled musket. In some parts of China, these firearms are known

7 Though the author never observed the bamboo-barrelled arrow-shooting trap, one Long Gui resident described the device in great detail. Its power is derived from the spring action of a bent tree 5-6 meters tall and about 20 cm in diameter. The meter-long bamboo barrel is secured about 40 centimeters above the ground. Sometimes poison is put on the tip of the arrow. The trap has been especially popular with mushroom growers who want to protect their production logs from Reeve's muntjacs. Rope or cord snare traps were also never seen by the author, though they have been used in the area for a long time. Mushroom growers have been known to use them for trapping people who come to steal their produce from the forest, although a more vicious method is to place poisoned arrows or stakes in the ground nearby. Sometimes the sharp points are repeatedly soaked in urine, which is said to cause infection in the wound. (Luo ZM, pers. comm.)
as *niao qiang*; in the Southeast Uplands, they are called *niao chong*. Both terms can be found in Chinese dictionaries translated as "bird gun or fowling piece." In Meihuashan, these guns, which resemble artifacts from the American frontier era, adorn the walls of many village homes (Fig. 11.6).

Some newer models may be breech loaders, which would make them much easier to load and shoot, and thus more problematic for wildlife conservation. The muzzle loaders, while common, are mostly used by non-specialized hunters who take mostly wild boar, muntjac, and other common animals. The cumulative impact of such activities throughout the region, however, is probably substantial, especially since there is little enforcement of game laws, and no particular concern among villagers for hunting seasons or bag limits. Hunting regulations and patterns of enforcement are discussed below.

Dogs are another tool in the indigenous hunting complex. Locally bred boar hunting dogs, known as *tu gou* (local dogs), are part of a native hunting tradition that may have roots in the pre-Han Miao-Yao-She culture complex.9 The longterm association

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1 They are also known as "*tu qiang*" (local guns or homemade guns), and in fact, it is common for villagers to repair or rebuild their own guns rather than replace them. As a result, accidents due to exploding barrels are not uncommon. While these weapons are primitive, it should be noted that Tibetan hunters on the Qinghai-Xizang Plateau still use matchlock rifles, which are fired by lighting a wick and placing it in an external powder bowl. For accuracy, these heavy muskets are mounted on gun rests made from antelope horns. The dearth of more powerful modern rifles and shotguns may be due to government control and to the expense of purchasing such weapons and ammunition on the black market (Goldstein and Beall, 1989).

9 As mentioned, among the She, there is a taboo against eating dogs that stems from the worship of the dog-god *Pangu*, a totem throughout southern China in the She-Miao-Yao culture complex (Shi, 1985). The She are to this day, avid hunters (He, pers. comm.), and the *tu gou* breed may well have its origins in the prehistoric She culture or in earlier endogenous or exogenous cultures.
Figure 11.5. A Short-barrelled Muzzle Loader (Used With a Trip Line) and a Steel Leghold Trap
between people and dogs in the Southeast Uplands is evident in a number of ways. Dogs are a favored food among the Hakka, and puppies sold in the periodic markets are mostly for consumption; dog meat being held as particularly nourishing and medicinal. In the mountain villages of Meihuashan, however, dogs are raised for hunting, and the author never observed the raising of dogs for meat. There was also no indication that this was practiced in the villages in historical times.

The relationship between Meihuashan hunters and their dogs is close and even affectionate to a degree that one might find surprising after repeatedly witnessing the culinary sacrifice of puppies during festive occasions. Though hunters live and work closely with their dogs, training the dogs to hunt boar does not seem to require much time. Good dogs pursue game and avoid clashes with boar instinctively. If no game is located, or if the hunter calls off the hunt for lack of time at the end of the day, a few sharp blasts on a thumb-length bamboo whistle summons the dogs across great distances.

Hunters take great pride in fine hunting dogs. Care is taken to insure that individual dogs are healthy and that their offspring are not mutts. Nevertheless, the recent introduction of many other breeds to the region may threaten the tu gou stock, which has not been registered in official international registries (Ray Coppinger; Lehr Brisbin, pers. comm.).

*Tu gou* have a distinctive morphology and coloration (Fig. 11.7). They are relatively small, standing roughly 45-50 cm at the shoulder and have stocky bodies. Their broad heads taper to medium-length narrow muzzles. The ears are medium length and erect. Their coats are typically gold to tan, sometimes with dark or black along the back,
though some individuals observed in Wuyishan were solid black. The tails are fairly long, somewhat curled, and bushy. In color and morphology the dogs bear a strong resemblance to the dhole (*Cuon alpinus*).\(^{10}\)

Since the breed has been developed as a "catch dog" to pursue and restrain wild boar, they are strong and fierce, and can be very intimidating to strangers.\(^{11}\) Most of these dogs are now kept on chains to keep them from ingesting rat poison, which has caused the death of many dogs and cats in recent years. Once they are set loose, the dogs enter the mountains eagerly and begin to rove widely in search of quarry. In addition to wild boar, the dogs will pursue serow, bear, and other large animals. Though hunters mention the practice less frequently, the dogs are also used to hunt serow in the boulder fields and cliffs of the montane grasslands, where the large ungulates reside.

On a typical boar hunt, hunters enter the mountains with one or two dogs. The dogs may run a kilometer or more away from their master, charging through underbrush along animal trails as they pursue the quarry through the mountains. When the dogs range too far, a few sharp blasts on a small bamboo whistle bring them circling back. When the scent of an animal is strong, the dogs bark repeatedly in a high pitch. When the

\(^{10}\) Although no scientific studies (electrophoresis or even simple examination of dentition) have been conducted to the author's knowledge, some scientists who specialize in the history of canid domestication believe that certain so-called "aboriginal hunting dogs" may descend from species other than the wolf (*Canis lupus*) (I. Lehr Brisbin, pers. comm.). Others state emphatically that there is no evidence, and probably never will be, that any wild canid aside from the wolf has ever been domesticated (Bob Wayne, pers. comm.).

\(^{11}\) For descriptions of boar hunting dogs in the Southeastern United States see "The Use of the Pit Bull Terrier as a "Catch Dog" in the Hunting of Big Game and Control of Domestic Livestock," by I. Lehr Brisbin (unpublished monograph) of the Savannah River Ecology Laboratory.
Figure 11.6. Short-barreled and Standard Long-barreled Muzzle Loaders. In Meihuashan, these are found in nearly every village household. They are used primarily to kill wild boar.
game animal stops to "take a stand," the dogs face it. and the rhythm of their barking becomes slower and more regular. The hunter hurries to the scene as quickly as terrain and foliage will permit. While the dogs are expected only to keep the animal at bay, it is common for a cornered boar to charge the dogs with great ferocity, biting and slashing with its sharp tusks. During the author’s tenure in Meihuashan, two dogs in Guihe village were seriously injured in skirmishes with wild boar; one dog had a broken leg (which the owner treated with great care until the dog had recovered fully) and the other had a large patch of skin and fur torn from its shoulder (Fig. 11.7).

Dogs are not the only ones to suffer casualties during the hunt, and hunters must exercise great care in approaching the melee for a shot at the boar. As one experienced hunter, a local village chief, said, "Hunting requires skill and good eyesight. Boars are dangerous, if you miss and only hurt the boar, it will get you, and many people around here have been injured. If you can't deal with it, you shouldn't try it. Boar are worse then bears and tigers (in this case referring to big cats in general)" (Zhang Shisheng, pers. comm.).

The danger of boar hunting was illustrated by an incident in Meihuashan while the author was living there. One day, a fifty year old Majiaping man was hunting wild boar in the northwestern part of the reserve. Happening upon a huge boar, which he estimated to be about 300 pounds, he raised his muzzle loader and fired. The boar was only injured and it charged the man. The man jumped down into an old bamboo soaking pit (a relict from a paper operation), and the boar jumped in after him, tearing a huge gash in the man's rear. It then proceeded to jump out of the pit and take a stand at the edge,
Figure 11.7a. (Top) Hunting Dogs in Meihuashan. *Tu gou*, the "local dogs" have long been bred for hunting.

Figure 11.7b. (Bottom) Hunting Dogs in Meihuashan. A dog that was injured by a wild boar (Guizhuping village). In the last stage of the hunt, when a boar stands its ground, injuries to men and dogs are common. This dog lost a large patch of fur and skin to a pair of sharp tusks.
watching the man for almost half an hour. The man was later treated in a hospital in the
town of Xinquan, and his medical fees totaled over 2,000 yuan ($250), roughly the
equivalent of a year's earnings.

While hunting and trapping techniques and technologies of more recent origin
could soon replace the use of muskets, snare traps, and dogs, these latter, older
components are still widely used in tandem with the new. Many hunters and trappers
employ a wide range of traditional and modern methods to take different prey species.
depending on the conditions of terrain, season, or time of day. Some techniques have
been used for a long time but have become more popular or developed into a modified
form in recent years, often due to the availability of new materials or production methods.

Two types of traps that have a substantial history but have become especially
common in recent years are the exploding bait trap and the steel leghold trap. Use of the
steel leghold trap has been banned in the Meihuashan Nature Reserve, but the explosive
trap, which is used specifically to keep wild boar from eating bamboo shoots, is
permitted.

The explosive trap was used as far back as the 1950s, and perhaps earlier, but has
become more common since the advent of cheaper and better commercial gunpowder.
The trap, which is used mostly for wild boar, consists of a contact sensitive explosive
wrapped in a rat skin and placed in a shallow cylindrical hole. The top of the hole is
covered with a small cap rock. A number of these traps are placed in a given area within
a bamboo grove, especially during the spring, when bamboo shoots emerge. Wild boar,
which have extremely sensitive noses, root around in the groves in search of underground
shoots. Smelling the rat skin, they move the rock and bite the rat skin, causing the powder charge to explode. In the bamboo groves of Meihuashan one sometimes finds small signs stuck in the ground to warn humans of these mine fields.

Factory-produced steel leghold traps are another relatively recent addition to the local panoply (Fig. 11.5). Since these traps are far more powerful than traditional bamboo or stick catch traps, they are believed to have caused tremendous damage to wildlife since the 1980s (He Lian, pers. comm.). More than one half of the hunters interviewed had used leghold traps, though they did not reveal how often and under what conditions these were employed. The most poignant evidence of the destructive effects of illegal trapping on tiger and leopard populations came from incidents involving steel leghold traps. The first occurred on the author's first trip to Meihuashan at the end of 1992, when a clouded leopard that had been confiscated live in a local market died in captivity at the reserve. The animal had been caught in leghold traps, two or more of which are sometimes placed together to insure success (Fig. 8.11). This was probably the handiwork of a commercial trapper who could afford to set up an entire trap line of steel legholds.

Another incident occurred near the village of Dayuan, which lies in a deep valley (790 m asl) among high mountains just west of the Meihuashan reserve boundary. While Gary Koehler was conducting tiger surveys in Meihuashan in 1990-91, he was led high into the broadleaf forest on steep slopes above the village. The objective of the jaunt was a small nanmu tree (*Phoebe bournei*) growing at the edge of a steep ravine far from the nearest trail, at an elevation of about 1,225 meters. The Dayuan villager who led the
researchers to the tree explained that in November 1989, he had "discovered" scratches on
the tree and a steel leghold trap attached to its trunk. In the jaws of the trap there was a
tiger's toe. The team also found a tiger's canine tooth embedded in the trunk of the tree,
and surmised that in its agony, the large cat had bitten and scratched the bark repeatedly
up to a height of several meters until it managed to free itself.

Though there was not much evidence that steel legholds were still common in the
higher mountains in the mid-1990s, it would be difficult to prove. From the examples
cited above, however, it appears that professional poachers may still use them.

Probably the most destructive modern weapons in the Southeast Uplands are the
shotguns and rifles that, while still uncommon, have been increasing since the economic
boom of the 1980s. Though, as mentioned above, machine guns and rifles were supplied
to local militias (minbing) in the 1950s, they were expropriated by the government in the
1980s. The massive overkill of local fauna, especially under state support through the
waimaozhan (foreign trade stations), could occur again if uncontrolled hunting continues.

Among the most popular game species in the Southeast Uplands today are masked
palm civets (Paguma larvata), pangolins (Manis pentadactyla) (a type of scaly anteater).
Reeve's muntjacs, wild boar, and bamboo rats. Most, if not all of these species are eaten
in homes and restaurants throughout the region, and poaching is on the rise as consumer
demand for game increases.

By law, only boar hunting is permitted within reserve boundaries. To hunt boar
legally in the reserve, a hunter must obtain a hunting permit from the reserve and a gun
license from the public security office. Hunting can only take place in the reserve's buffer
zone. No hunting is allowed in the core area of the reserve. Hunters can, in special circumstances, gain permission to hunt other wildlife, but licenses for such hunting can only be obtained at the provincial ministry of forestry in Fuzhou.

In Meihuashan, many people routinely hunt without gun or hunting licenses and villagers are rarely monitored or prosecuted for poaching. In Wuyishan, however, many villages have had their guns confiscated as a result of poaching incidents in the late 1980s and early 1990s (Wu, Haohan; Zhan Jianhua, pers. comm.).

In practice, reserve officials turn a blind eye to the unlicensed hunting of wild boar and Reeve's muntjac inside and outside of reserves. This presents a grave threat to similar species in the mutiacinae, like crested deer, common muntjac, and black muntjac (further north in Fujian province). The rationale for this policy is that the populations of these species are abundant and the former must be controlled to prevent excessive agricultural damage, especially to rice plants and bamboo shoots.

As of 1995, there was no effective management mechanism in place to patrol the reserve for poaching, nor was there a means of monitoring and prosecuting illegal hunting anywhere in the region. It should be noted, however, that fines and imprisonment have been imposed on a few hunters caught poaching monkeys and other animals within the reserve and in the region. Although there have never been systematic patrols by game wardens, and poaching can be conducted throughout the region with impunity, a number of people have been arrested for attempting to sell wildlife in township markets. One of the most outstanding cases involved a man prosecuted for selling a clouded leopard in Zhangping county and for having set a trapline with 14 steel leghold traps (Wang
Honggao, pers. comm.). The man was sentenced to three years in prison. In the Meihuashan Nature Reserve, a 28 year old man from Taipingliao was fined 6,000 yuan (U.S. $750) in 1993 for shooting and selling a Rhesus macaque (Luo Mou, pers. comm.).

While these punishments may be a strong deterrent to selling wildlife on the open market, lax enforcement means that poachers can continue to kill and sell wildlife as long as they do it discreetly.

The Hunters and their Quarry: A Survey of Hunters in Meihuashan

In this context, informants' discussions of hunting and a few invitations extended to the researcher to participate in hunting were seen by locals as polite ways to provide more detailed information and experience relating to local wildlife and hunting techniques.

Hunting is also seen as a means by which villagers can assert control over local natural resources in covert defiance of the claims of the state (Luo Bing, pers. comm.), and to display their knowledge and capability in the wilds. Nonconfrontational noncompliance allows local people to maintain longstanding traditions without increasing the frequency and intensity of conflicts with reserve authorities.

The popularity of boar hunting, and its general acceptance by reserve managers, stems in part from the tacit assumption that it is a cultural and economic necessity; it is, from an ecological perspective, considered relatively harmless. Though the latter assumption may not be true, it is well known that if reserve managers tried to enforce

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12 In fact this has been stated openly by several informants (discussed below).
game laws regarding wild boar, the already simmering local hostility toward the reserve would intensify to unmanageable levels.

Most people who hunt wild boar do so only during the rice harvest season, when they spend nights in huts by the paddy to shoot at invading boar. Other types of hunting and trapping, discussed above, include hunting boar with dogs and the taking of economically and ecologically valuable species through a variety of means that often require specialized skills and knowledge. Thus one can discern two broad categories of hunting and trapping in Meihuashan: defensive boar hunting and the more specialized pursuit of boar or other species with dogs or using other techniques requiring knowledge and a greater investment of time and energy.13

Defensive surveillance hunters use primitive muzzle loaders to shoot wild boar. Rabbit hunting could also be categorized as a non-specialized type of hunting. Non-specialist hunters can cause a considerable amount of damage in their often random encounters with wildlife, since they will tend to shoot any wild animal they happen to see. Generally however, they do not devote much time to hunting, so there is little chance that they will encounter rare species of animals. Unfortunately, in recent years hunting has become more popular, and more non-specialists are spending more time hunting. This is probably due to the greater availability of commercially produced headlamps, which has

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13 These categories are very general, and in the mid-1990s', many novice hunters appear to be devoting more time to hunting (for reasons discussed below). In the near future, there may be many more villagers in Meihuashan who are proficient at hunting a wide variety of game (He Lian, pers. comm.; Ma Shengxue, pers. comm.).
induced many young men to get involved with nocturnal spotlight hunting. In time, these hunters may become specialists (Ma Shengxue, pers. comm.).

In the mid-1990s, more specialized hunters in Meihuashan shared a number of traits: all were over 36 years old, all had at least fourteen years of hunting experience, and nearly all pursued a wide range of wildlife, in some cases commercially. Most of these men (no female hunters were encountered or mentioned by informants) were in positions of power within their natural or administrative villages, having been elected village secretary or village chief in recent years. Their social status and relative wealth may have allowed them to hunt with a sense of impunity and given them leisure time for hunting as well as money for the purchase of guns, ammunition, and dogs. These men considered hunting one of their most important pastimes, and a few have made a substantial portion of yearly income from the sale of meat, hides, organs, and bones. Many have killed endangered species, which have only received state protection in recent years.

The researcher was most interested in the category of experienced hunters. Since, by consensus, there were generally no more than one or two of these men in any given village, the methodological tack was to maximize the amount of information gathered from these limited sources, while insuring a relatively broad areal network of informants, rather than to seek information from a larger pool of neophytes. Though the cumulative effects of novices may be very damaging to wildlife populations, there was no way to interview enough of that group in a fashion that would yield reliable and meaningful results.
The nine hunters interviewed in this survey, all Hakka, indicated that within their natural villages, between 30-100% of the males hunted on a defensive basis during harvest time. According to the hunters, there were usually only one or two men in each natural village who, like themselves, qualified as real hunters. Oddly, this talent was generally not passed on across generations within families, but acquired through personal interest and perseverance. All of the hunters claimed to be the first or second generation of real hunters in their own families. In most cases, knowledge about hunting methods was gleaned from friends, especially older men in other families and from other villages.

The nine hunters interviewed ranged in age from 36 to 55 years old, with an average age of 44. They had an average of 21.5 years of hunting experience, with a total of 194 years of experience. All but one lived in or near the reserve and had hunted in the reserve on numerous occasions. All but one had mostly hunted close to home, sometimes ranging farther afield, but always within the Longyan municipality and Liancheng and Shanghang counties. One man, a professional boar hunter, had also hunted in a number of other counties in western Fujian.

The kinds of guns and other devices used by these men reveal both the breadth of their collective experience and the lack of effective government regulations on hunting and trapping techniques. While all have used muzzle loaders to hunt, two now own 12 gauge shotguns and one owns a semi-automatic rifle that holds up to 20 rounds of

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14 This survey did not include the 71 year old tiger hunter, Huang Zaiqiu, since his hunting methods are unique.
ammunition. None of these guns have been legally registered, and some hunters requested that I refrain from discussing their hunting practices with the reserve staff.

Guns and ammunition are often made and/or repaired by hand. Powder can be purchased in the market towns; shot, balls, and wadding can be fashioned from scrap materials at home. Even commercial shotgun shells are made of brass so they are durable and can be reloaded many times, which makes the use of shotguns much more convenient in a place where shells are not available on the market. Hunters make their own slugs out of wheel bearings, so even without commercially available shells, shotguns are likely to proliferate. Muzzle loaders take a long time to load, are cumbersome to carry, and are generally less effective.

There was also a fairly high rate of use of steel leghold traps among the sample group, with six hunters stating that they employed or had employed the devices for trapping game. The frequency and location of use was a subject that few were eager to specify, so this information was not pursued. The hunters explained that while small traditional bamboo traps were used for birds, large steel legholds (which were introduced in the 1980s) were used for wild boar, serow, muntjac, and "foxes" (a term that can include civets and mongooses). In reality, the traps can catch any animal that happens into them, including the large carnivores, as discussed above.

The hunters relied on a number of other pernicious traps as well. A couple used gun traps, though only in certain remote areas, since the triplines could easily be struck by other humans. One hunter still used a bow trap. A few responded that they employed rope snares and rock crush traps for a number of species. To kill wild boar, two still used
pitfall traps, four used explosive bait, and one used electrocution (though the technique was not described).

Hunters do not curtail their activities at any time of year, but spring and fall are peak boar hunting seasons. Although the rainy season, which lasts from December to April, makes hunting very difficult, it is the time of year when bamboo shoots emerge, and hunting take place on days and nights when the weather permits. Intensive hunting also takes place in the fall, when boar invade the rice paddies at harvest time. Peaks in boar hunting activity in the fall and spring may be as much a response to the predictability of the boars' seasonal movement as a response to a real threat to the farmers' livelihoods.

In pursuit of other game species, some farmers hunt all year long. Others are less active in the hottest months of mid-summer, when snakes and heat make mountain traverses uncomfortable and somewhat risky. Since there are far fewer opportunities to hunt in winter and early spring (because of the incessant rains of the wet season) many people do little but stay inside for a few months, run household businesses or stores, and wait for the skies to clear.

Hunters have their own personal preferences as to the time of day when they pursue their prey, and there are certain methods associated with diurnal and nocturnal hunting. Responses were evenly divided between those who preferred daytime hunting, those who preferred hunting at night, and those who hunted during night and day. Most hunters use dogs for daylight pursuit of boar and headlamps (without dogs) for night hunting.
While spotlight hunting, the men move quietly through broadleaf and mixed forests in search of species like the masked palm-civets (*Paguma larvata*), the meat of which is the most favored of wild delicacies (discussed below). At night, these forests and adjacent rice paddies and bamboo groves also harbor Reeve's muntjac, rabbits, an occasional boar, and many other species. Day or night, most men hunt individually or in groups of one or two. This was not true before the 1980s.

Both Caldwell (1924) and regional gazetteers (LYDQDFZBWYH, 1992) refer to the regional tradition of encirclement hunting (*weilie*), a technique in which a group of hunters forms a line or a circle, typically in the open montane grasslands, driving game in front of them until someone has a clear shot. This technique was closely connected to the tradition of annual burning, since only grasslands could be negotiated on foot and allow for clear views of the quarry. Before the 1950s, fire was sometimes used as a component of the game drive, an indication of its traditional role in game management. The encirclement method became especially effective after rifles were distributed to local militia units during the first decades after 1949. In Dayuan village, a hunter explained that groups of 5-6 people often worked together very successfully until 1984, when the

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15 In the Longxishan Nature Reserve, villagers described how professional monkey hunters from Hunan province once operated in the area. A group of about 30 people would surround a montane forest where a troop of macaques resided. A series of fires were set around the perimeter until the forest was an isolated patch, and the monkeys had no way to escape. One person went into the forest, dug a hole and placed sweet potatoes, rice, and other bait at the bottom. The monkeys would eventually enter the hole, where they were netted, sometimes ten or more at a time. In the small forest patch the monkeys faced starvation unless they ate the bait, and the hunters could catch a hundred before moving on.
guns were confiscated by the government. This marked the end of weilie hunts, and only muzzle loading niaoqiang and leghold traps have been used there up to the present.

The nine hunters who participated in this survey had hunted and trapped over 35 species of animals and an unknown number of bird species (Table 11.1). Some hunters mentioned that before the opening of the nature reserve, they hunted a much wider variety of species, but for fear of fines and imprisonment, they were limited to hunting boar and muntjac. This statement may have been true in some cases, but mostly it allowed for a freer discussion of hunting practices under the pretext of discussing "the way we used to hunt." The truth was revealed on several occasions, however, when informants contradicted themselves by shooting animals that they professed to no longer hunt.

Aside from wild boar and Reeve's muntjacs, the most commonly killed ungulates include serow, common muntjac, and crested deer. Other common prey include large and small mammals: masked palm-civets, large Indian civets, small Indian civets, monkeys (rhesus and stump-tailed macaques), porcupines, "foxes" (including foxes, racoon dogs, mongooses, weasels, and badgers), flying squirrels, bamboo rats, other rats, rabbits, pangolins, and leopard cats.

Hunters bag large carnivores and omnivores less frequently, but these species are rarer and more vulnerable to exploitation. In the past decade in Meihuashan, hunters have killed leopards, clouded leopards, golden cats, Asiatic black bears, and dholes (or red dogs). A hunter from the wild and remote village of Dayuan even claims to have shot two tigers on separate occasions in the 1970s, a story that seems credible since tiger signs
were discovered by the same villager there and verified by experts in the early 1990s (described above).

Birds may be especially hard-hit by random hunting, and while hunters favor gallinaceous game birds like pheasants and partridges (of which there are at least six species in the region), all other species seem to be fair game. Owls and other raptors seem to be specially targeted for annihilation, probably because of their size and beauty.

Amphibians and reptiles are also caught in a variety of ways for medicinal and culinary ends. These include mostly frogs (especially *Rana spinosa*, which inhabits mountain streams), turtles, and snakes, the latter of which are killed also because they are perceived as a threat to the villagers. Be they venomous or non-venomous species, all snakes are regarded as harboring poisons with varying degrees of toxicity. Oddly enough, certain species of lizards (apparently geckos and possibly skinks as well), known locally in Meihuashan as "four-legged snakes" (*sijiao she*), are feared as the most lethal "serpents" in the area. This belief seems especially remarkable considering the fact that cobras and king cobras are still common in the region, as are a number of other poisonous snakes, including three other species in the cobra family (Elapidae) and five species in the viper family (Viperidae). These and other poisonous snakes cause a number of injuries and fatalities in the region every year. Local snake lore is discussed below.

The hunters also gave estimates of the number of animals harvested in an average year, but these figures are to be taken as general approximations (Table 11.1). In some cases the question was posed in terms of the number of kills per year before the establishment of the game laws and the nature reserve (in the mid-to-late 1980s).
Table 11.1. Ethnozoology and Hunting Practices in the Meihuashan Region

(Indigenous Taxonomy and Average Estimated Number of Kills Per Year)

<table>
<thead>
<tr>
<th>Species</th>
<th>Local Name in Mandarin(^6) &amp; (English Equivalent)</th>
<th>(Number of Hunters Who Hunt This Animal)</th>
<th>Average Killed/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ungulates:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wild boar:</td>
<td>ye zhu (wild pig)</td>
<td>(9)</td>
<td>9.6</td>
</tr>
<tr>
<td></td>
<td>shan zhu (mountain pig)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reeve's (Chinese) muntjac:</td>
<td>huang ji (yellow muntjac)</td>
<td>(9)</td>
<td>18.5</td>
</tr>
<tr>
<td></td>
<td>shanzhang (mountain muntjac)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>common (Indian) muntjac:</td>
<td>chi ji (red muntjac)</td>
<td>(9)</td>
<td>25.7</td>
</tr>
<tr>
<td></td>
<td>wuzhang, hei ji (black muntjac)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total muntjacs and crested deer:</td>
<td></td>
<td>(9)</td>
<td>25.7</td>
</tr>
<tr>
<td>serow:</td>
<td>shanyang (mountain goat)</td>
<td>(8)</td>
<td>1.7</td>
</tr>
<tr>
<td><strong>Common Smaller Mammals:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>masked palm-civet:</td>
<td>guozili (fruit fox)</td>
<td>(7)</td>
<td>8.3</td>
</tr>
<tr>
<td>&quot;foxes&quot; (&quot;li&quot;) Includes:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fox:</td>
<td>hu li (fox)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>racoon dog:</td>
<td>kuntian gou (kuntian dog)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(table con’d)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^6\) Some of these words are Mandarin versions of names from local Hakka dialects. In cases where local names were undetermined or did not differentiate one species from another (as in the case of muntjacs), the common Mandarin name is used.
“foxes” (continued)
badger: *kuntian zhu* (*kuntian* pig), *zhuhuan* (pig badger)
ferret badger: *youhuan* (weasel badger), *liang tou wu* (two-heads black)
mongoose *shi xiemeng* (crab-eating mongoose)
weasel

monkeys (two species of macaques) *houzi* (5) 9.8
porcupine *hao zhu* (*hao* pig) (1) 25
flying squirrel *fei li* (*fei li* flying fox) (2) 15
bamboo rat *tulun* (meaning unclear) (2) 5.5
Bandicoot rats and Other rats
*shan laoshu* (mountain rats) (I.D.)
rabbit *shan tuzi* (mountain rabbits) (3) 7.5
pangolin *lianli* (carp) (5) 1
leopard cat *baomao* (leopard cat) (I.D.)

 Estimates were non-quantifiable. While all hunters kill these species periodically, many people are unable to identify them except as “li.” Civets are also frequently included in this category. When the survey was conducted, there was insufficient information to frame the question in a more quantifiable manner.

 This figure is probably accurate for the early 1980's and before, but today monkeys are relatively rare in Meihuashan, with perhaps 3-5 troops in the entire reserve. Hunters still encounter them today, but annual culls do not seem to be high.

 Though only two hunters mentioned 'tulun,' others may not have thought of catching bamboo rats as 'hunting.' Virtually everyone in the region will, upon finding a sandy mound and a hole near a patch of bamboo, set about digging up the rat burrow until the large rodent or rodents have been seized. Hundreds or thousands of rats are culled in the reserve each year.

 Other names for the pangolin include the common name *chuanshanjia* ("wears mountain armor" or "pierces the mountains best"), and the widely used vernacular name *dilong* ("earth dragon").
Less-Common Smaller Mammals

<table>
<thead>
<tr>
<th>Animal</th>
<th>Chinese Name</th>
<th>English Translation</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>large Indian civet</td>
<td><em>da lingmao</em> (big spirit cat)</td>
<td>(1) 1.5</td>
<td></td>
</tr>
<tr>
<td>small Indian civet</td>
<td><em>xiao lingmao</em> (small spirit cat)</td>
<td>(1) &lt;1</td>
<td></td>
</tr>
</tbody>
</table>

Large Carnivores & Omnivores

<table>
<thead>
<tr>
<th>Animal</th>
<th>Chinese Name</th>
<th>English Translation</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>tiger</td>
<td><em>laohu</em> (tiger)</td>
<td><em>huinan hu</em> (South China tiger)</td>
<td>(1) &lt;1</td>
</tr>
<tr>
<td>leopard</td>
<td><em>bao</em></td>
<td></td>
<td>(3) &lt;1</td>
</tr>
<tr>
<td>clouded leopard</td>
<td><em>yunbao</em> (clouded leopard)</td>
<td></td>
<td>(5) &lt;1</td>
</tr>
<tr>
<td>golden cat</td>
<td><em>youxi hu</em> (stream-following tiger)</td>
<td></td>
<td>(I.D.)</td>
</tr>
<tr>
<td>Asiatic black bear</td>
<td><em>gou xiong</em> (dog bear)</td>
<td></td>
<td>(4) &lt;1</td>
</tr>
<tr>
<td>dhole (red dog)</td>
<td><em>caigou</em> (dhole dog), <em>chai</em> (dhole)</td>
<td></td>
<td>(2) &lt;1</td>
</tr>
</tbody>
</table>

Birds

<table>
<thead>
<tr>
<th>Animal</th>
<th>Chinese Name</th>
<th>English Translation</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>pheasants, partridges,</td>
<td><em>ye ji</em> (wild chickens)</td>
<td></td>
<td>(6) (I.D.)</td>
</tr>
<tr>
<td>&amp; relatives</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>raptors (owls, hawks,</td>
<td></td>
<td></td>
<td>(2) (I.D.)</td>
</tr>
<tr>
<td>&amp; eagles)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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21 Lingmao could be translated as "quick cat," "fairy cat," or "spirit cat." All three combined could best illustrate the feeling that these animals can appear and disappear at the wink of an eye. Harry Caldwell (1924) devotes a chapter to "foxes" and "spirit cats" that were believed to possess magical powers.
the question in the present tense would have elicited very different responses. First, since hunters would not want to implicate themselves, but also because some appear to have actually curtailed some of their hunting practices under the threat (however mild) of prosecution. Other sources of inaccuracy include problems of local taxonomic tradition; the tendency to lump many species together, as in the case of "foxes" or to use local names interchangeably for a number of species. This problem is further complicated by the fact that hunters periodically bag animals that they simply cannot identify. As one man put it, "Sometimes we shoot things that we don't understand." The mustelids (weasels and badgers), viverrids (civets) and herpestids (mongooses) probably give rise to the greatest confusion. For these reasons, rather than being a comprehensive checklist of prey species, the survey was a first exploratory attempt to see what the hunters were willing to discuss and to elicit information accordingly. Quantitative results should therefore be viewed as preliminary figures that could be used to develop a more comprehensive survey.

With these caveats in mind, the survey results provide a simple profile of hunting in the region. Of particular note, are the high numbers of wild boar and muntjacs (especially Reeve's muntjacs) that are killed each year. All of the hunters surveyed focused primarily on these ungulate species, since they are the most abundant and provide ample meat and medicinal material (discussed below).

Wild boar and Reeve's muntjac have high reproductive rates and can adapt to a wide variety of environments and disturbance regimes (see Chapter 8). They favor areas where less-disturbed habitats like montane wetlands and broadleaf forests intergrade with
anthropogenic landscape patches, like rice paddies, fruit orchards, and recently cleared *Cunninghamia* plantations. Under a regime of ongoing ecological disturbance, landscape heterogeneity, and generalized hunting, adaptability and high reproductive rates give these species a considerable advantage over other ungulates. Continued hunting constitutes less of a threat to their continued survival than it does to more specialized, less common ungulates like crested deer, serow, and common muntjac.

Obviously the ungulates that are extinct or virtually extinct in the region could not withstand the compounded pressures of habitat degradation and hunting, and this group includes the water deer (*Hydropotes inermis*), the sambar deer (*Cervus unicolor*), and the sika, or Meihua deer (*Cervus nippon*). Though a couple of hunters believed that a few individual sambar deer might still survive in the core area of the reserve, there was little evidence to support this claim. Ironically, reserve officials seemed unaware of the fact that, for all intents and purposes, the three deer species no longer existed in the reserve.

Because of their delectable meat, masked palm-civets have, since ancient times, been sought after by hunters throughout China (Academia Sinica, 1987), and hunting pressure in Meihuashan appears to be fairly intense. Spotlight hunting, the most effective means of bagging the "guozili" ("fruit fox") occurs from late summer to early winter, when this mostly-arboreal member of the civet family can be found in fruit trees, especially those bearing sweet, tart fruits, like the yangmei (*Myrica rubra*). The impacts

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22 The fact that the masked palm-civet is frugivorous may explain why it is considered a delicacy, for fruit-eating mammals are the most favored game species in a number of other cultures that rely on wild meat for subsistence and commercial purposes. In Amazonia, for instance, the meat of frugivorous animals is described as "fat" or "tasty," and such generally frugivorous species as spider monkeys, wooly monkeys, tapir, peccary, and pacas are the most desirable game
of hunting on local and regional palm-civet populations are difficult to gauge without a more detailed study.

The large and small Indian civets, however, have been in serious decline in the past couple of decades, according to local hunters. The same holds true for a number of other "foxes," especially those that once inhabited the scrub thickets and forests adjacent to rice paddies. Since the advent of rat poison and chemical pesticides and fertilizers, certain once common mustelids like the crab-eating mongoose (*Herpestes urva*) and the ferret badger (*Melogale moschata*) have virtually disappeared. The wiles of these predatory omnivores were once legendary, but villagers' reports of losing half a flock of ducks in an afternoon to one rapacious mongoose or weasel badger are now a thing of the past.

Pangolin trapping and trading is another topic in urgent need of long-term research, for pangolins are being decimated at an unprecedented pace and there is little if any reliable evidence on the size and sustainability of the natural population. The scales, tongue, and meat of this scaly anteater are highly valued in the marketplace. The meat is considered a delicacy and, along with the other parts, a highly efficacious traditional Chinese medicine. In the urban restaurants of Guangdong, a live pangolin can fetch 1,000 yuan, which is the equivalent of a Meihuashan family's annual per capita income. When the meat is sold, it always has a bit of the tongue in it, for the tongue is one of the most valuable parts medicinally. For this reason, tongues are never sold whole. The meat is sold for 80-100 yuan per jin. Scales are sold for 30 yuan per jin. They are then

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ground into a powder that is believed to have antiseptic properties. It is rubbed on wounds to kill germs or eaten to cure carbuncles.

Pangolins are attracted to recently burned areas where ants nest around dead stumps. After an area is burned, the pangolins colonize quickly, digging neat shafts down to their burrows. Adult pairs and offspring reside in the burrows, leaving only to eat ants and other insects and larvae. Locals believe that pangolins use their tongues as bait, sticking it out and letting it rest on the ground or in an ant nest. After the ants cover it, the pangolin retracts its tongue and has a meal, a trick that is done many times during the course of a day.

Hunters set steel leghold traps near the burrows and sell their quarry locally or in urban markets. The hunters surveyed stated that they no longer trapped many pangolins since fines or even imprisonment could be imposed if they were caught. One man expressed disapproval about pangolin poaching that was done by outsiders who entered the reserve to set up clandestine camps, but he did not hesitate to sell pangolin soup in his restaurant whenever he got the chance. A pangolin poacher's camp discovered between the villages of Gonghe and Mawu was made by people from Tongxian and Nanyang, in Shanghang County. Two men lived there for six months in 1994. Although local people opposed the poachers' activities, they could not catch these intruders.

There is no question that this species, which is under second level state protection, is being poached and eaten by the tens of thousands, in homes and restaurants throughout
southern China. Though most people are said to avoid live pangolins because of the bad luck they bring, there are magical spells and charms that can counteract pangolin power. Local pangolin lore, which is substantial in its own right, is discussed below.

Hunters bag large carnivores and omnivores much less frequently than they do ungulates and smaller mammals, but these species are also rarer and more vulnerable to generalized hunting. Though hunters kill fewer than one of these animals per year, and some never kill a bear, leopard, clouded leopard, or golden cat in a lifetime of hunting, there is little to stop them from doing so if the opportunity arises.

The monetary value of wildlife at the local level and in regional markets provides further incentives to kill wild animals. All but two of the hunters surveyed sometimes sold their quarry or parts of it, though only one of the men was considered a commercial hunter. All of the hunters also provided meat and medicine to their own families and friends. While most hunters occasionally sold their products within the informal village economy, the commercial hunter earned about 60% of his annual income by selling wild boar (presumably in rural townships or to middlemen connected to urban retail markets).

While the medicinal values ascribed to wildlife are questionable from a Western scientific perspective, post-slaughter waste is minimal; meat, organs, blood, bones, hide, fur, whiskers, and other parts are important ingredients in the vast Chinese pharmacopoeia.

An ironic case in point occurred while the author was treated to a dinner by a faculty member and graduate students at Fujian Normal University after giving a presentation on this research. Discussing the prevalence of pangolin poaching in Fujian, a group of graduate students noticed fine bones in one of the soups, our group was told that we were dining on "dilong" (earth dragon), a common name for the pangolin.
Hunters are in a unique position to judge how animal populations have changed in recent decades, and all have noticed increases of some taxa and decreases among others. Although this information is anecdotal, there are no wildlife population studies being conducted in the area, and hunters are the most reliable data source. Since the 1950s, the big cats have suffered the most dramatic and obvious population decreases. Before 1949, livestock depredation by leopards and to a lesser extent by tigers was a recurring problem. In the last 30 years, attacks have seldom occurred. While most of the hunters have seen leopards and clouded leopards, and several have shot these animals, only one man claims to have seen tigers (and to have shot two). Most of the hunters seemed to have a logical grasp of the causes of this decline, and a few cited anthropogenic environmental impacts and ecological factors: over-hunting, an increase in road building and general construction, the use of chemical pesticides and rat poisons, the proliferation of leghold traps, and the low reproductive rates of large carnivores.

A number of people in Meihuashan commented on the more recent decline of dholes, which are said to have virtually disappeared in just the last 5-7 years. This phenomenon is attributed by most to the affects of rat poison in the food chain. Since their own dogs and cats died off from eating poisoned bait and dead rodents, people surmise that this is what has happened to the caigou.

Most hunters also believe that, for the reasons discussed above, pangolins, monkeys, sambar deer, snakes, frogs, "foxes," ferret badgers, and mongooses have also suffered dramatic declines in recent years. As might be expected, ecological disturbance has had the opposite effect on some species, and a number of taxa are believed to have
increased in abundance. These include wild boars, Reeve's muntjacs, rats, snakes, pheasants, rabbits, and serow. Some hunters attribute these changes to the decline of predators like big cats, foxes, and dholes.

**Attitudes Toward Conservation, Wildlife Management, and Reserve Authority**

As part of the interviews on hunting practices, subjects were asked about their own views on game management in the nature reserve and other areas. Opinions ranged from strong support for heavy regulation (some even stated that the reserve was not doing enough to protect wildlife) to hostile opposition to wildlife management and the nature reserve. Within the broad spectrum of beliefs, there was underlying consensus that the interests of the reserve and the state are, at present, in conflict with the interests of the village and the villager. The state and the village represent two levels of organization with different philosophical approaches and economic relationships to local natural resources. Even those who support the idea of the reserve and wildlife conservation see rampant poaching as evidence that the two systems are not in accord.

At one extreme, villagers in Majiaping and Luodi feel cut off from the reserve management, deprived of any possible benefits of association with the reserve, and severely hindered by restrictions on land use and hunting. They are bitter about fines and short periods of imprisonment imposed on villagers alleged to have poached or illegally cut timber in the reserve. Villagers in Majiaping are angry about the lack of government support for health care, education, transportation, and communications. They are keenly aware of the fact that their land encompasses the most extensive broadleaf forest and the best wildlife habitat in the reserve. Some say that if conditions do not improve, they will
consider their land separate from the reserve and all resources would become the \textit{de facto} property of the village. As one Majiaping hunter put it:

"Protection is only needed for rare species. There is no need for protection of boars, muntjacs, and monkeys. I will only help the reserve do their job if they manage the villages better. In the meantime, we will all hunt like crazy...wildlife is my enemy and I am its enemy. If it comes in front of my gun, I will shoot it. Only if the reserve uses local people and supports them will people support the reserve in research and management. We can wipe out a lot of animals...You can sell a monkey in Fuzhou for 1,000 yuan, or a monkey brain for 100 yuan...The reserve people have 'full bellies and [empty brains].' Without international support the government won't be able to handle this, the Communist Party is too corrupt. I supported the reserve in the beginning, now I hate the reserve workers. The reserve has cancer, it's already spread and it can't be cured. The villagers are the real masters and owners (\textit{zhuren}) of the reserve, and the management better recognize this."

The same man also stated that if things did not improve for his village, the villagers would not hesitate to set fire to the mountains, which would also insure the firing of the reserve leaders. Residents from other villages expressed similar hostility, though it was usually expressed with less passion. Some hunters suggested that the reserve would fail in its basic goals if hunting, woodcutting, and corruption were not strictly curtailed. One man quipped in disgust that the reserve should be called, "The Meihuashan Nature Destruction Area" (Meihuashan Ziran Huimie Qu). Another hunter and wildlife enthusiast accused the reserve managers of dereliction and greed:

"If you're going to protect wildlife, you must be really strict and control hunting, especially poaching by outsiders...Poachers from Changting (county) and Jiangxi (province) camped up near the Qingcai wetland last year. They never came down to the villages and villagers never fooled with them, no one cared...(Also) the reserve staff should not eat what they confiscate, nor should they eat wildlife in the villages. The headquarters buys snakes, frogs, and pangolins! [Note: this practice was gradually discontinued while the author was living there.] They have more power [than others] and they should be fairer, but they should use that power to
protect wildlife. The reserve people eat more wildlife than old, experienced hunters do!"

Other hunters felt that there was "no need for protection because animals just eat the crops." These people were unhappy that they could not hunt legally and they did not want to be 'managed' in any way. While these people recognized the significance of nature conservation for the nation as a whole, they felt that it had no significance for themselves or for other locals. In contrast, some hunters felt that wildlife could be a magnet for tourism, and an "animal world," could be developed to bring jobs and money to the villagers. One of the most passionate statements in support of conservation came from a man believed to have killed some of the last tigers inhabiting the reserve, a man who had strong beliefs about the value of wildlife (as a number of hunters did):

"This area has so many wild animals and birds! There should be one or two people in each natural village who will be employed as wildlife managers. If (the reserve) doesn't do this, they really can't protect wildlife. Right now they aren't really an effective organization. From 1984 to now they still haven't let people know what they can and can't hunt. We understand the goals and the rules, but as long as there's wildlife around, we'll hunt...There's no contact between the reserve and the villagers, they never come down and investigate the real situation. The reserve doesn't protect animals, they tell us not to hunt. How can we not hunt in our spare time? They need to have us protect resources. I get mad when I see them...If you're going to manage, manage well, if you're not going to manage, don't [pretend to] manage!"

On the subject of tiger conservation, the reserve's primary mission in the 1980s and 1990s, this hunter had some passionate words of wisdom:

"Tigers will be like dragons, there will be paintings, but no evidence of their real existence. If you scare people with a dragon and it doesn't exist,  

24 The pragmatic village chief who made this comment added that locals would not shoot woodpeckers because they eat bugs.
it's a lie. Have you seen dragon paintings? Your descendants will call you a liar if you paint a fine picture of a tiger and it no longer exists!"

From these statements and the data collected on hunting patterns, it is clear that a system of wildlife management and hunting regulations must be developed as soon as possible. While gun licenses and boar hunting permits can be purchased at township government headquarters for about 30 yuan, few hunters bother to buy them because there is little chance that they will be checked. Bag limits and hunting seasons have not yet been established. These would be constructive first steps if the rationale of local hunting practices were taken into account and if villagers were incorporated into a wildlife conservation system based on a sound legal and scientific framework. Such a system would have to insure that villagers and village leaders were responsible for managing local hunting practices. This idea will be discussed in chapter 12. Before addressing policy issues in the final chapter, however, the closing section of this chapter explores traditional conceptions of animals and nature as expressed in the 'modern' context of Meihuashan village life.

Animals and Landscapes: Magic, Ritual, and Superstition

Sometimes, when muzzle loaders and steel leghold traps fail to keep wild boar out of the rice crop, it takes a thin strip of bamboo paper with some characters scrawled on it to do the job (Fig. 11.8). The Daoist tradition of writing charms (fu - 閤) to ward off evil or to bring good fortune is used by at least one man in Meihuashan, a village chief, to protect his community from boar depredation. The village chief, a master hunter who may have shot as many boar as he has frightened, places the fu in the four corners of the village and, he says, there are no boar problems. The same man writes fu to be ground up
Figure 11.8. A Daoist Charm (Fu) for Keeping Wild Boar Out of Rice Paddies (Shangche Village, Meihuashan).
and drunk in medicine and for a number of other purposes. According to local people, it is the writing - the symbolic force of sacred script - that holds talismanic power over animals and spirits.

The connection between animals, gods, ghosts, and sacred writing is also embodied in the performance of fire-walking ceremonies. These village rites of purification are performed in Long Gui, Xiache, and a few other communities in the southern and eastern parts of the Meihuashan Nature Reserve. The geographical extent and ethnographic origins of this practice have yet to be explored, and the infrequency with which it occurs makes the spatial patterns less than obvious. In a given village. the fire-crossing is held at irregular intervals, once every 5-10 years, when village gods inform the people that the community is in danger, and a purification ceremony is needed.

Speaking through a medium at a wen shen ("ask the spirits") seance held in March of 1995, a heavenly god called Wugu Zhengxin told the people to hold a fire walk in April. The god warned that there would be a number of calamities (zainan) striking the village in the spring and summer, and people would need protection from ghosts. The people were also warned to stay out of the woods for a number of days, because snakes would be especially numerous.

In preparation for the ritual, villagers followed a strict vegetarian diet for three days. On the day of the ritual they bathed and assembled at the small building that served

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25 Hakka villagers in Longxishan (Jiangle county), who are descendants of Western Min Hakka in Changting, said that they had held small versions of this ceremony before 1949. This suggests that the Western Min Hakka were closely associated with the ritual in the past, and that it may have diffused to other areas where the Hakka settled in later migrations.
as a schoolhouse and assembly hall. Two shamans led the ceremony, going in and out of
trance from sunrise to sunset, dancing, chanting, waving swords, writing characters, and
sanctifying the blazing pyre that had been constructed in front of the building with liberal
libations of rice wine. The two men repeatedly asked for Wugu Zhengxin's blessings and
tossed the crescent-shaped divining blocks to the ground, waiting for a response. In
Chinese Buddhist temples, only when one block faces up and the other faces down is the
god's response positive. The striking difference in this case was that the crescents were
not made of wood but from serow horns cut lengthwise and suspended from a long red
string. Both shamans tossed the horn-crescents many times during the ritual, picking
them up with a jerk of the string only to cast them out yet again. When asked why the
blocks were made from serow horns, they answered that it had always been done that way
throughout the Minxi region.

After dark, the barefooted shamans crossed the glowing coals repeatedly,26 while
villagers waited anxiously to take their turns. The purpose of the crossing, according to
villagers, is to insure health and safety in the coming years, through the blessings of the
gods (bao you). According to local belief, ghosts or other malignant spirits could follow
close behind a person, threatening to cause fatal accidents or illness, but the potential
victim would have no way of knowing. By crossing the pit of red-hot coals, a person is
freed from evil spirits because the latter cannot follow and are effectively exorcised.27

26 The lead shaman, a man from Qiushan village, crossed the pit
many times without getting burned. The shaman from Long Gui, an older
man, was burned twice and failed to cross the pit successfully.

27 By the time the ceremony had ended at midnight, some forty of
Long Gui's one hundred residents had crossed the pit and another sixty
people from neighboring villages did so as well. Participants included
From an etic perspective, fire has served to "purify" the mountains in the Southeast Uplands for centuries (as discussed in chapter 6); its role in burning away "ghosts" in the ritual may reflect a deep association between people, animals, and fire. In this ceremony, as in other magic rituals and daily acts, humans assert their control over wild landscapes and wild animals through the use of powerful tools like fire, writing, and pyrotechnics.

The serow is the largest and most majestic ungulate of the rocky montane grasslands and cliffs. People of the Southeast Uplands have long marvelled at the animal's agility in steep terrain, and they attribute its sure-footedness to a sticky substance it secretes from its hooves, which allows it to adhere to rocks. Since the serow has always thrived in the annually burned montane meadows, it has been closely associated with the mountain spirit (shan shen) or "mountain genie" (Caldwell, 1924). Given these connections, the importance of serow horns in communicating with local gods should come as no surprise.

According to Caldwell (1924), villagers in southern and central Fujian (Eastern and Southern Min peoples) considered the serow a "son of the hill genii (sic)" and were "afraid to molest the animal when alive, (but) they barter and even fight over flesh, bones, and blood of the victim." Even hunters who would pursue serow (probably under some form of magical protection as with pangolin hunters today) were concerned about the mountain spirit. Hunters worried that "the genii of the mountains, known as the "The Booster of the Hills," would warn all the serow of our plans to invade their sanctuary, and they would all scurry far back into the range and hide themselves in the home of this god" (Caldwell, 1924). Hunters in Meihuashan hold similar beliefs about the "shan shen's" protectiveness toward frogs today (discussed below).
The religious significance of the serow is also expressed in two other ways. First, when a serow (or muntjac) wanders into a village, town, or city and is caught, rather than killing and butchering the valuable animal, people tie a red ribbon around its neck and return it to the mountains for good luck. This is seen as a great blessing, occurring more frequently than one might expect, and often drawing newspaper coverage (Fu Yongcheng, pers. comm.). Second, while hunters sometimes offer incense and trophies of the hunt to village gods at temples and earthgod shrines, the latter are mostly limited to birds and boar heads. Serow (and some say muntjac) cannot be offered. Though there was some confusion over why the rule persisted, some thought that it had to do with the fact that serow were related to cows (and they are in fact members of the Bovidae) and that there was an ancient taboo against offering cows and other grazing animals to the gods.

Reptiles and amphibians seem to hold a particularly prominent place in local animal lore; this is especially true of snakes. While snakes are alternately venerated and despised in nearly every culture around the world, and the same is true in China, a treatise on the significance of snakes in Chinese culture could fill volumes. For this reason, the following comments are limited to a few of the beliefs encountered in Meihuashan. In general, snakes are feared by the villagers, and so are killed on sight. There are at least ten species of poisonous snakes in the area (including cobras and king cobras), as well as a subspecies of the Indian python (*Python molurus bimittatus*), which can grow up to 6-7 meters (20-23 feet) in length. Snakes are feared not only because they turn up in all kinds of places in and around the villages, including inside of houses and even in beds, but also because they are believed to hold grudges. Snake bites are scrutinized, for they provide
an indication of the degree of revenge intended by the serpent. If one fang mark is present it is considered a mistake on the part of the snake, which can be attributed to bad luck. The presence of two fang marks means that the snake meant to bite a person but that it was a case of mistaken identity. Three fang punctures mean that the snake was seeking revenge against a person (probably for killing one of its relatives), and a four-hole bite shows that the snake intended to kill the person. A bite from a protective "mudsnake" (*ni she*), a species said to live near streams, means a person need never fear snakebite again, for he or she will never be bitten by any kind of snake thereafter.

An animal that superficially resembles a snake, but has much different magical powers, is the earthworm, particularly a very large species (up to 40 cm in length) for which the scientific name was not identified. Local men will not step over such a worm, preferring to walk around it, because they say the worm can spray an invisible liquid. If the liquid hits a man in the crotch it will make his scrotum swell up to the point that walking is difficult or impossible (Ma Shengxue, pers. comm.). While the obvious phallic association with these worms needs no further explication, the source of the belief may be slightly more complex. Swelling of the scrotum has probably been observed, over generations, in males suffering from filariasis (elephantiasis), and the cause of the disease has been attributed to the earthworm.

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29 Local people also believe that the worms make high-pitched vocalizations at night.

30 Ironically, filariasis, which is widespread in tropical and subtropical regions around the world, is caused by nematode worms such as *Wuchereria bancrofti* and *Brugia malayi*. The larvae of these worms are spread by mosquitoes. In humans, the parasites live in lymph nodes and lymph vessels of the limbs, breasts, and genitals, where they cause lesions, swelling, and impaired circulation. Advanced cases sometimes
An equally fanciful set of ideas surrounds the *shanshen*, or mountain spirit. According to frog hunters, this apparition sometimes makes its presence known at night by leaving large, wet, humanoid footprints on rocks in the streams where the hunters seek their quarry. Though the spirit will not harm humans it will help the frogs escape, making further hunting quite futile. Frog hunters use sharp rice-cutting knives to clean their catch. When footprints are found, the men rap on each track ten or more times, which scares off the *shan shen* and allows the hunt to continue (Ma Shengxue. pers. comm.).

Certain reptiles and amphibians may be regarded with awe and dread because they can live in water, underground, above ground, or in all of these realms. Many hunters even refrain from shooting land mammals after they enter water; according to tradition, muntjac and other ungulates should not be shot while in the water or just after emerging from water. Conversely, turtles and other aquatic animals should not be taken when found on land. Animals that appear to have an ambiguous or protean relationship to aquatic, subterranean, or terrestrial habitats are especially dreaded, and this may explain the longstanding blend of fascination and trepidation that surrounds the pangolin.

The pangolin, with its armor of thick scales (which are actually relict hairs), neatly excavated tunnel-home, and ability to eat ants and curl up in a ball when disturbed defies categorization; its very existence lies at the heart of ambiguity and mystery. Because of

lead to elephantiasis, typically involving the swelling of the scrotum and legs. Diamond (1993: 260-261) describes the centrality of this disease in a New Guinean origin myth in which the protagonist, unable to walk or sit comfortably on the ground, spent his life sitting in a tree with his testicles hanging down to the ground.
its scaliness, locals consider it a type of "mountain fish" (shanyu) (Guan Yanzeng, pers. comm.). In fact, some of the common names for the pangolin reflect its ethno-taxonomic location among the fishes.31

Because of their strange and powerful magic, people avoid live pangolins, for a careless encounter with the lianli could cause illness, injury, loss of money, or any number of other misfortunes. Although it is considered safe to eat a pangolin if someone else catches it and cleans it, no one dares to catch or kill a pangolin without first chanting an incantation, a verbal aegis against any evil that the little anteater may conceal beneath its own plated shield.

Generally speaking, people in industrial and post-industrial societies of the late twentieth century do not sing or talk to wild animals. Mao Zedong and other architects of socialist China did not have this type of behavior in mind when they envisioned a "modernized China." In the past fifty years, the bulk of Communist Party propaganda has promoted science and industry, and debunked the supernatural. Wild animals have been trapped, hunted, denounced as enemies, butchered and sold in markets and pharmacies at home and abroad, and yet they have yet to be successfully demythologized.

31 The most formal Chinese name for the pangolin, found in scientific writings, is chuangshanjia ("wears mountain armor," "wears a mountain shell," or "first-rate mountain climber"). The term most common among the Hakka of western Fujian, lianli, appears to be a local pronunciation of the Mandarin word lingli ( or ). Ling ( ) means carp or dace (fish). Alternately, ling ( ) means mound or tomb. Li ( ) means carp as well. The English translation would thus be "mound carp" or just "carp." Other names for the pangolin in the Southeast include "dilong" (earth dragon), long li (dragon carp), and qianlijia ("money carp shell").
A brief examination of the structure and contents of the pangolin chant reveals some important facets of the relationship between people and wildlife in the Southeast Uplands. There are different versions of the chant in different villages, even within a relatively small area like Meihuashan. Undoubtedly there are numerous variations in other subregions of the Southeast Uplands as well. The chants translated in Table 11.2 were collected in a few Hakka villages of Meihuashan and Longxishan. Three functional features appear to be universal in these chants: first the establishment of an affinal relationship - the pangolin is a neighbor who is addressed more or less respectfully, second the assertion of dominance by the human who is addressing the pangolin, and third an explanation of how the human is going to benefit by catching or killing the pangolin. The invocation may be humorous (perhaps more so to outsiders than to locals) or even taunting, but its intent is serious. The pangolin cannot be dallied with and a formal explanation or challenge is the best way to escape revenge. Whereas the tiger may disappear when government is good and society is at peace, the pangolin is rooted in its home place - the dilong (earth dragon) is a master of the mountain.

The first two lines of the chant begin by addressing the pangolin ("You are a pangolin - lianli") and establishing a relationship with it ("I am a lilian"). Though the inverted word "lilian" has no meaning in itself, it identifies the person as an equal (if opposite) of the pangolin. One hunter stated that it is much more generous: "It means we are 'tongnian' (literally born in the 'same year'); we are pals." The second couplet may continue to describe the parallel but separate workaday worlds of the pangolin and the peasant ("You work the mountains, I work the fields"). The final couplet attempts to seal
Table 11.2. Local Versions of the Pangolin Chant of the Southeast Uplands

<table>
<thead>
<tr>
<th>Ni lianli</th>
<th>You're a lian li (pangolin)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wo lilian</td>
<td>I'm a li lian (reciprocally inverted nonsense word)</td>
</tr>
<tr>
<td>Ni kai shan</td>
<td>You work the mountain</td>
</tr>
<tr>
<td>Wo zhong tian</td>
<td>I work the fields</td>
</tr>
<tr>
<td>Ni gei wo chile</td>
<td>When I've eaten you</td>
</tr>
<tr>
<td>Wo geng hui zhuan qian</td>
<td>I'll be able to make even more money.</td>
</tr>
</tbody>
</table>

Long Gui village (Meihuashan) pangolin hunters' incantation spoken before the kill to guard against bad luck.

<table>
<thead>
<tr>
<th>Ni lianli</th>
<th>You're a pangolin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wo lilian</td>
<td>I'm a lilian</td>
</tr>
<tr>
<td>Pao shang ye shi ni si</td>
<td>If you run up it is you who will die</td>
</tr>
<tr>
<td>Pao xia ye shi ni si</td>
<td>If you run down it is also you who will die</td>
</tr>
</tbody>
</table>

Gonghe village (Meihuashan) pangolin hunter's incantation.

<table>
<thead>
<tr>
<th>Ni lianli</th>
<th>You're a pangolin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wo lilian</td>
<td>I'm a lilian</td>
</tr>
<tr>
<td>Ni jiu yan qian</td>
<td>You're right here before my eyes</td>
</tr>
<tr>
<td>Wo jiu qian nian</td>
<td>So I'm sure to live a thousand years.</td>
</tr>
</tbody>
</table>

Shipaichang village (Longxishan) pangolin hunter's incantation.

<table>
<thead>
<tr>
<th>Ni lianli</th>
<th>You're a pangolin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wo lilian</td>
<td>I'm a lilian</td>
</tr>
<tr>
<td>Ni jiu yan qian</td>
<td>You're right here before my eyes</td>
</tr>
<tr>
<td>Huan ni na huan you yan</td>
<td>So I'll grab you and trade you for soy sauce and salt.32</td>
</tr>
</tbody>
</table>

Shipaichang village (Longxishan) pangolin hunter's incantation.

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32 Soysauce and salt (you yan) are two of the traditional four basic necessities, the others being firewood and rice (chai mi).
the pangolin's fate, coercion it to submit and explaining how this _fait accompli_ will benefit the human in terms of wealth or longevity gained.

Failure to respect the pangolin can lead to death. A Gonghe villager described the fate of his neighbor who caught and ate a pangolin but somehow failed to placate its spirit. A month afterward, the man's hair fell out, and after another month he died. While this fatality may have had nothing to do with the pangolin, it reaffirmed ancient patterns of belief.

**Conclusions:**

The relationship between rural people and wildlife in the Southeast Uplands is distinctive in several ways. First, much of the age-old lore concerning the magico-religious characteristics of wild animals has survived the ideological pressures and influences that have swept through China in the last half-century. Second, the region is a source area for the Chinese medicinal market. The importance of wild animals in Chinese medicine is undiminished in the 1990s, and the market demand for wildlife appears to be growing (He Lian; Ma Shulin, pers. comm.).

While many Westerners think of the Chinese penchant for wildlife consumption as an unthinking type of gluttony, it is more accurately, part of a complex cultural tradition. In China, wild plants and animals are fundamental components of an ancient, canonical ethno-medical system (and myriad local traditions), which has no analogue in the West. In China, even urban people rely on wild fauna and flora for food and medicine, and the degree of interdependence between people and natural resources is becoming increasingly clear as the latter become rarer and more expensive. The demand
for vanishing species and their body parts continues to grow. Though there may be little remorse in China for the passing of rare species, there is a high degree of psychological and cultural dependence upon the tonic effect that these species are believed to contain. Whether this can be transformed into constructive conservation action remains to be seen.

As people accumulate more disposable income, they will either have to change their tastes or seek alternative sources of animal products, either in the form of substitutes or pen-raised animals. Nature reserves like Meihuashan will play a very important role for both outsiders who come to visit (and perhaps purchase wildlife products, as discussed in chapter 12) and for residents, who engage in an ongoing and changing encounter with wildlife on a day to day basis.

It is clear that the present relationship between residents and the reserve managers is discordant, and that this has a direct bearing on wildlife and habitat management. The final chapter presents a proposal drafted by the author and a resident of the nature reserve which would incorporate local villagers in all aspects of research, management, and economic development.
CHAPTER 12

VITAL CONNECTIONS: LINKING NATURE CONSERVATION AND CULTURAL ECOLOGY IN THE SOUTHEAST CHINA UPLANDS

This chapter includes recommendations for improving the management policies in the Meihuashan Nature Reserve; a comparative look at conservation conditions and planning in the Wuyishan and Longxishan Nature Reserves; methods for connecting the nature reserves of the Southeast Uplands region (especially those of western Fujian) with corridors of wildlife habitat; and recommendations for protecting biodiversity in the Southeast Uplands as a whole. There is also a brief description of the Chinese Biosphere Reserve Network and comments on its efficacy, as well as a few concluding remarks on the importance of cultural ecology and landscape ecology in the study of China's conservation problems.

Prospects for Co-management in the Meihuashan Nature Reserve

In general terms, the most effective way to resolve resource management problems in inhabited protected areas is to insure as much input and involvement on the part of local residents as is politically possible. Stevens (1997) divides indigenous involvement into three levels: consultation, co-management, and indigenous management. While consultation with local inhabitants is seen as the most basic foundation for successful management, co-management, or even full management by local people (indigenous management) provide a much more comprehensive framework for sustainable conservation. A new approach (or perhaps a new paradigm), known as "community-based conservation" (Western and Wright, 1994), is beginning to take root in international conservation circles, and the "Yellowstone Model" of uninhabited
protected areas is undergoing intensive reevaluation (Stevens, 1997; West and Brechin, 1991; Western and Wright, 1994).

Even in the most democratic, pluralistic societies, however, there are often substantial legal, institutional, and cultural barriers to local involvement in protected area administration (Stevens, 1997). In nearly-totalitarian political systems like that in China today, these barriers may, at first glance, appear to be even more severe. But rural land tenure conditions in China are unique, and local involvement in protected area management is, ironically, much more promising in many ways than it is in the United States and many other democratic capitalist countries.

Though many of the civil rights that Westerners hold as "inalienable" are not yet part of the Chinese legal code, the land tenure systems developed for rural collectives over the past half-century and modified in the past fifteen years provide a strong foundation for protected area co-management. In rural southern China, communes and collectives have kept agricultural and forest lands in the hands of administrative and natural villages. and the Household Responsibility System has returned a growing portion of these lands to household management since the early 1980s. Unlike land tenure conditions in developing countries undergoing economic growth in a classical capitalist mode (and in some socialist countries as well), relatively few villages in southern China have had their common forest lands and common property resources entirely requisitioned by the central government, or (as often occurs subsequently in capitalist systems) by agribusinesses, land speculators, miners, grazers, or other entrepreneurs who
lease the "government lands." For this reason, the context of all resource management conflicts in protected areas of southern China is very different, and in some ways much more positive, than is the case in many other developing countries.

On the negative side, the hundreds of recently-created inhabited nature reserves in China are run by forestry bureaus and the environmental protection agencies in the Confucian and Chinese Communist traditions of top-down administration. Beyond basic issues of village subsistence and land tenure that fall within the legal purview of the responsibility system, there is little or no consultation with local people on nature conservation and other reserve management policies and practices. In this political context, co-management may prove to be a long, uphill struggle, and indigenous management will, in most cases, be still more difficult to achieve.

Perhaps the greatest hope for community-based conservation will come from within the village-level democracy that has begun to develop since the national implementation of village elections in the early 1990s.¹

¹: Even in many democratic countries, including India and the United States (among many others), the government owns huge tracts of forest and range land that was usurped from ethnic minorities or others who lacked formal legal entitlement, or through the power of eminent domain. Without legally certified documentation, there is little hope for indigenous people or other longterm local residents to regain control of former common lands and common property resources. By means of well-developed connections to the government, powerful corporations often gain control over land tenure and resource extraction on these "national lands," leasing large tracts for the propagation of monocultural tree plantations. Gadgil and Guha (1992: 185-193) describe four stages in the historical development of industrial forestry in India.

²: Under this new policy, villagers elect members of the local community to serve three year terms as officers and representatives in the administrative village council. In Meihuashan, these six positions are: secretary (shuji) - the highest level position, chairperson (zhuren) - the second highest position, forest officer (linyeyuan)
Conditions in the Meihuashan Nature Reserve in the mid-1990s show that there is a strong desire on the part of local people to have a greater voice in reserve policy-making and management practice. All of the reserve’s administrators and the vast majority of the workers are non-local people (though most are Hakkas from Longyan Prefecture), assigned to the Fujian Forestry Bureau after graduating from regional forestry technical institutes. In 1994, the only villagers who were on reserve payrolls were the elected or appointed village forestry representatives (linyeyuan) and the cooks and occasional laborers who worked at the two main management stations in Xiache and Chendi, and in the reserve headquarters in Gutian.3

A much greater degree of consultation and co-management could bring tremendous benefits to the reserve’s social, economic, and physical environments. The

(although these may also be appointed or removed by the reserve at any time), treasurer and record-keeper (wenshu), public safety officer (zhibao zhuren), and women’s representative (fudai zhuren) - in charge of family planning and women’s issues.

1 Without a forestry degree, local people have little chance of obtaining work in reserve management. The village forest managers (linyeyuan) are the main exception, and their pay is quite low compared to that of regular reserve staff. According to one reserve administrator, there were 13 village forest managers in 1995. They were responsible for enforcing local forest management regulations and for acting as liaisons between the reserve and the administrative villages. Most of the work revolves around monitoring timber and bamboo harvests. The linyeyuan were first appointed by reserve administrators in 1986, a year before Meihuashan became a national-level reserve, and many have retained their positions to the present. In 1994, a village forest manager with eight years of experience was earning 1,440 yuan ($180) per year. This was roughly equivalent to one-third the salary of a regular forester employed by the reserve in the same year (discussed below).

Some linyeyuan have been selected by villagers in local elections (after candidates were approved by reserve authorities). One linyeyuan was fired from his post in Majiapeng in May of 1995, after refusing to report to a new management station (a day’s walk from the village) for 5-6 workdays per month. When he was replaced by another villager (who was selected by the reserve administration), the more outspoken villagers in Majiapeng were extremely angry, threatening (among themselves and with the author) to burn the forests if the reserve did not make more efforts at reconciliation.
most pertinent conservation challenge in Meihuashan today is to enable villagers to
develop the local economy in ways that benefit wildlife and habitat conservation. If more
villagers in Meihuashan can begin to view nature conservation as being in their own best
interest, there will be less poaching, less deforestation, and more harmony between the
reserve administration and local people. With these goals in mind, the following general
framework could lead to more consultation and co-management - the groundwork for
eventual administration by local people as directors, managers, and researchers.

A Strategy for Implementing Co-management in the Meihuashan Nature Reserve

In the first phase of consultation, reserve directors and other high-level
administrators would conduct annual meetings in each reserve village to discuss
socioeconomic and resource management issues. This would provide a regular forum in
which villagers and directors could voice expectations, resolve conflicts, and engage in a
continuous planning process. Many villagers complain that reserve directors have never
even visited their villagers. This situation has led to local antipathy toward the reserve as
a whole.

While consulting with villagers on a regular basis, reserve administrators would
also need to assume more responsibility for improving socioeconomic conditions in the
villages. As social service advocates, reserve managers could work alongside trained
staff from government agencies in the two counties and one municipality to improve
education, healthcare, telecommunications, transportation, and poverty-relief programs in
the villages.
In many villages, residents asked that the researcher make a special request to the reserve administration on their behalf to have telephone lines reconstructed. Certain villages, Majiaping for example, are severely poverty stricken, and lack transportation, access to good health care, electricity, and decent elementary education (see chapter 5). Middle school and high school students must board at schools in township administrative centers like Buyun, Gutian, and Luxi. While the reserve administration has tried to help in small ways, many villagers see their efforts as completely inadequate.

To improve village self-sufficiency and raise household incomes, administrators could pursue an economic development program that subsidizes value-enhancing, non-polluting bamboo processing, and connects village production to external market networks. More specific economic measures of this type are discussed below.

Reserve managers and high level forestry bureau workers complain that the Meihuashan Nature Reserve poses especially complex management problems because it straddles two counties and one municipality. Governmental administration of the area is divided among numerous county and municipal agencies and the nature reserve itself, resulting in uncoordinated and sometimes conflicting policies and procedures. They consider the Longxishan Nature Reserve a much more soundly managed reserve because it is a discrete administrative unit, where all government functions and services are united under one roof (discussed below). It is conceivable that this type of political unit should be created for Meihuashan and other reserves. This process could streamline every aspect of reserve management and make local participation in reserve administration and
management more tenable. Some of the costs and benefits of this plan are discussed below.

Finally, village committees could assume full responsibility for much of the forest and wildlife resource management work, including the planning, monitoring, and patrolling of timber, bamboo, and wildlife utilization practices. The linyeyuan could lead village forest resource committees in these activities, in coordination with goals set at annual meetings with reserve directors. Village wildlife management and patrol committees could work within these groups or separately. Specific projects that these village organizations could engage in are discussed below.

Strategies for Habitat Protection and Economic Development in the Meihuashan Nature Reserve

The following recommendations would ideally be carried out in a managerial context where consultation and co-management were developing rapidly and continuously. In the absence of such conditions, or in the most likely scenario, in which limited consultation and co-management are developing very gradually, the following proposals are meant to reinforce the developmental process.

Bamboo Forest Allocation and Management

Since the cultivation of maozhu bamboo represents both the greatest near term economic hope and the greatest long term threat to wildlife habitat in the reserve, it is an

\footnote{A comparable system is found in the Annapurna Conservation Area in Nepal, where villagers have received training and technical support in order to assume responsibility for all aspects of forest management. Stevens (1997: 248) makes the critical point that "...what has been achieved in the Annapurna region is the result of a partnership, and not solely either grass-roots or top-down initiative."}
issue of central importance. In 1991, bamboo forests (including those that had not been cleared of underbrush and adjacent trees) covered some 20.3% (4,510 Ha) of the total land area of the reserve and understory clearance has been occurring at an unprecedented rate (see chapters 8 & 9). The most immediate sustainable forestry problems in Meihuashan, therefore, surround household bamboo management practices and the question of equity in the system of village allotment of household bamboo plots. Without equitable land tenure patterns and more or less equal opportunities for economic profit, it is unlikely that bamboo forests can be well-managed and the conversion of ecologically valuable forest types to pure stands of bamboo will continue to accelerate.

As discussed in chapters 7 and 9, households have been allotted a certain amount of what was once collective bamboo forest land in order to manage their own plots. Allotments were made in the early 1980s on the basis of family size, old family land deeds from the era before collectivization, or both. A few villages agreed to redistribute land at given intervals (of between 5-20 years) as family populations changed, but many villages made no such agreements.

In the mid-1990s, after nearly 15 years of household management, there were already complaints that some families have amassed a disproportionately large area of bamboo forest, while others have relatively little. Though no appropriate standard amount of bamboo forest per capita has been determined, household data presented in

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1 As noted in chapters 8 and 9, only 4,522 mu (301 Ha) or less than 1% of the reserve area was estimated to contain completely pure stands of maczhu bamboo (in which all or most of the other canopy species had been clear) (Wu, 1991). This can hardly be accurate however, since the average bamboo forest area of the natural villages surveyed was 4,280 in 1994, and each village was in the process of clearing these forests rapidly (see household bamboo management in chapter 9).
chapter 9 (Tables 9.1 & 9.2) show that there are land tenure disparities between households. These disparities may reflect unfairness in the allocation of plots, but they also reflect different rates of bamboo forest expansion (resulting from differences in management practices between families) and different rates of household population growth.

Disparities in per capita bamboo holdings affect income levels, although there are important intervening variables like family size (number of laborers and dependents) and degree of household economic diversification. Some families have been successful cultivators and entrepreneurs while others have sunken into poverty. Among poorer families (those with per capita incomes of between 200-999 yuan per year), there is greater pressure to harvest bamboo a number of times per year; bamboo is used like a bank account and withdrawals are made whenever cash is needed. With few or no other major sources of income, these families are under the greatest pressure to expand the area of their present bamboo groves by encouraging lateral displacement of adjacent forest stands. Wealthier families are often able to let bamboo grow for a longer time, getting larger (and more economically valuable) and forming denser groves. Those whose entrepreneurialism is focused on bamboo exports have, in most cases, already expanded their original plots and continue to do so. Since this expansion often causes the loss of broadleaf and mixed forests, it constitutes a serious threat to the ecological integrity of Meihuashan.

It is obvious that the economic reforms of the early 1980s unleashed productive labor forces that had, for the most part, lain dormant under communal ownership and
collective management schemes. Families gained a new stock in bamboo forests as private managers and most responded by working hard to maximize production and profit. Even under present conditions of growing inequity it is unlikely that villagers would ever choose to revive a collective system of bamboo management, and it would be draconian to enact such a plan without local support. Given the potential ecological damage of "bamboo desertification" and the inequities of household bamboo land tenure patterns, however, it may be most prudent to make adjustments to the system as it now stands. It is critical, however, that such changes do not adversely affect village and familial bamboo management strategies and that they are fully supported by a majority of villagers.

The first measure to prevent the continued spread of bamboo into broadleaf and mixed forest habitats would be to clearly demarcate boundaries around acceptable bamboo cultivation zones in the reserve and to implement a system for internal regulation of these zones by the villagers themselves. Since the area per capita of bamboo forests varies between villages, the areal extent of bamboo zones could be limited to a standard maximum per capita area for each village according to population size. Given the

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6 According to a director of the Fujian Forestry Bureau, "pure" bamboo forests, that is forests which have been cleared of underbrush and most arboreal components of the canopy will only be permitted to reach 8% of the reserve area, or 26,602 mu (1,773 Ha) (Ruan, YQ, pers. comm.). Judging from surveys in the five study villages, it is possible that this maximum has already been exceeded.
paucity of adequate data on per capita bamboo land tenure a recommended standard would be premature at this point.  

The important point is that the plan would limit bamboo expansion to an agreed upon areal maximum and within zones determined to be least detrimental to surrounding ecosystems. Once the outer boundaries of these zones were demarcated with stakes or other immobile markers, villagers could be subsidized by the reserve to increase the density of culms within their plots. In this way the productivity of the labor force would not be diminished, it would simply be concentrated on a set area with an increasing density of bamboo culms.

Villages in the Wuyishan Nature Reserve have been highly successful in propagating dense stands of *maozhu* bamboo. After almost 20 years of effort, including technical support and training from the nature reserve staff, villages have raised the average culm density to roughly twice that of Meihuashan. In 1995, the average density in Meihuashan was 90-120 culms per *mu* (1.350-1.800 culms/ha) whereas in Wuyishan the average had reached 160-220 culms per *mu* (2.400-3,300 culms/ha) (Ruan Yunqiu; Luo Mingxi; Wu, Haohan, pers. comm.; Coggins, 1996). In some Wuyishan villages

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7 This is a highly complex and critical issue. At one extreme, the area per capita limit could be set at the per capita level already attained by the most bamboo-rich villages in the reserve (Chijiashan, Qingcaoyuan, and Xiaogaoxie in the ENE section of the reserve), but forests in these areas have already been largely converted to bamboo, and the per capita rates there are probably too high to prevent bamboo desertification in other areas. A number of other important variables come into play, including variation in land quality; variation in the degree of reliance on bamboo between villages; the lack of an objective standard for per capita income level; and the lack of an agreed upon percentage of the reserve land area that could be devoted to bamboo. These issues would have to be discussed by reserve administrators and villagers until acceptable standards were devised. It is obvious that a great deal of flexibility and creativity would be required on all sides.
there are densities of 400 culms per *mu* (6,000 culms/ha) (Wu Haohan, pers. comm.).

With Wuyishan as a model, reserve directors in Meihuashan set a goal of 180-220 culms per *mu* (2,700-3,300 culms/ha) as an average for the reserve villages to attain within ten years. According to this plan, increased density and longer growing periods would eventually allow for harvests of 50 fully developed poles per *mu* (750 poles/ha) as opposed to the 1995 average of 5-10 poles per *mu* (75-150 poles/ha) (Luo Mingxi, pers. comm.; Coggins, 1995).

Once the area and location of bamboo growth zones is established, it would be useful to address the problem of inequitable land tenure conditions. In villages like Long Gui, Gonghe, and Taipingliao, where household allotments of bamboo forest were based on family size, and redistribution meetings are held every five, ten, or twenty years, there may be no need for adjustment; the villages have created what are arguably the fairest land tenure arrangements possible. In Majiaping, Guizhuping and many other villages in the reserve, however, the situation is much less equitable (see chapter 7 and 9). Not only did many of the villages divide bamboo forests on the basis of outdated land deeds, but they have no plans to hold redistribution meetings. Certain families are becoming wealthier (and in some cases more powerful), and those who hold the most land may be entrenched and unyielding on the issue of land reform. Since this situation is likely to intensify and create greater competition and pressure on unconverted forests, it would be in the best interest of local people and local ecosystems to standardize and regulate village land tenure systems. This would mean that all villages would adopt the policy of holding regular meetings to redistribute household bamboo allotments. This could only
be successful if villages adopted the policy willingly, and it is possible that some villages or powerful people within villages would not support such a policy. For this reason, a referendum in each village would be the most feasible way to address the issue, and reserve administrators could facilitate in this process, as described below.

**Adding Value: Bamboo Products and Marketing**

Reserve administrators could play a leading role in bamboo forest tenure reform by paying large landholders for their losses and encouraging them to invest in non-polluting cottage industries that would add value to bamboo by creating finished products. Administrators and villagers have already discussed this possibility. In the fall of 1994, administrative village leaders accompanied reserve directors on a tour of the Wuyishan Nature Reserve, and there was some consensus that village bamboo industries provided an economic model that should be emulated in Meihuashan (Guan Yanzeng; Luo Mingxi. pers. comm.). Families that establish such micro-industries and employ other villagers could win greater subsidies for lost land. In 1995, the most critical barrier to village- and household-based industry was the lack of a secure market network. Without significant start-up capital or retailers to sell products to, people could not risk investing in production (Guan Yanzeng; Luo Zhiming, pers. comm.).

The reserve could also help villagers in this economic transition by developing a market network in which to sell finished bamboo products. This plan, if supported by villagers, could bring the most benefit to the most people, helping families diversify their labor and income structure.
New Policies for Containing the Bamboo Desert

Before 1995, there were laws prohibiting the cutting of broadleaf trees, but these were not strictly enforced, and there were no laws against ringing the trees to make them die later on. According to a forest manager in Meihuashan, leaders of the provincial forestry bureau had not realized that there was a problem, so it had not been discussed as a policy issue. A director of the Fujian Forestry Bureau, however, stated that the spread of pure bamboo forests (in which other most of the other vegetation has been cleared) was a problem that would be dealt with very seriously. Starting in the summer of 1995, cleared bamboo forests would only be allowed to spread across 8% of the land area of any given nature reserve in Fujian (Ruan Yunqiu, pers. comm.). Unfortunately, there do not appear to be accurate figures for the total extent of forest clearance in around household-managed bamboo forests. It is clear, however, that the 1991 figure for pure bamboo forest (which amounted to <1% of the reserve area) is no longer taken seriously.

In 1995, the reserve administration adopted several measures to protect broadleaf forests. The first was to issue a decree protecting broadleaf trees in and around bamboo forests (discussed above). This regulation prohibited tree cutting and tree ringing, and stated that expansion of bamboo forests into adjacent forests was illegal unless approved by reserve officials and the county forestry committee (Wang Honggao, pers. comm.). Proposed expansion sites were to be inspected by reserve officials before permits would be issued. According to this rule, bamboo forest expansion without a permit was only legal if adjacent areas consisted of grassland or other "wasteland" (huangdi) (defined as
non-forested land) under collective ownership. By August 1995, when field research was finished, there had been no known attempt to enforce the new regulation.

The second measure was the demarcation by reserve foresters of 32 critical broadleaf forest zones, designating them "protected subareas" (baohu xiaojia). These protected subareas have been designed to protect the reserve’s remaining fragments of broadleaf forest (Fig. 12.1). Twenty-six of these strictly protected areas, most of which fall within collective lands, lie within the buffer zone, and six lie at the borders of the core area. They do not appear to overlap with village sacred forests, and reserve officials see customary protection of geomantic forests as sufficiently viable to obviate the need for their inclusion in the subarea system. All of the subareas, which appear to range from a few hectares to about 65 hectares (no formal measurements had yet been made), were to be off limits to any form of commercial exploitation. Unfortunately, the local villagers upon whose collective lands some of these forests lie, had not been consulted about this plan. The areas were demarcated late in the research period, so the researcher did not have the opportunity to gauge villagers’ responses. An inventory of the cultural-historical status of these forest patches could make this scheme more viable. Since no one has been given license to cut timber on these lands, the reserve has a great deal of legal (if not actual) regulatory control over them. If there is local support for the mini-protected areas, they could be a very effective complement to the proposed bamboo containment strategy discussed above.

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\(8\) This figure was derived from tabular data on the total area of one group of vegetation stands slated for special protection. It is possible that some parts of these stands will not be demarcated as part of the area if they do not include significant broadleaf cover.
Figure 12.1. The Distribution of Bamboo Forests and Broadleaf Forest Fragments In Meihuashan Nature Reserve. Bamboo covers large parts of the more densely settled eastern buffer zone. In 1995, many of the remaining broadleaf forest patches were slated for preservation in protected subareas (baohu xiaoqu).
Extractive Activities and Grazing on Collective Lands

On collective lands of the buffer zone that have not been allotted to families for agriculture or bamboo cultivation, preserved as village sacred forests, or granted one of the last few permits for legal timber harvesting, villagers may raise cattle and goats, gather wild medicinal and food plants, tap pine resin, and extract pine roots to produce tar (the latter is usually done by outside specialists who set up camps in the reserve). Regulation of these activities is the responsibility of village leaders, and the most common conflicts relating to resource utilization appear to center around the demarcation of village boundaries (see chapter 7).

On government lands, most of which lie in the core area, no economic activity is legally permitted, though cattle grazing and illegal plant and timber harvesting continue. Though a wide variety of relatively low-impact economic activities continue on government and collective lands, these lands still encompass a wide variety of plant and animal habitats that account for most of the reserve's biological diversity.

Grazing by cattle and sheep may be destructive to understory vegetation and should be carefully monitored. Cattle may be especially destructive to the montane wetlands, where their hooves compact the mud and trample wetland plants. Herd numbers should be controlled and wetlands should be used by cattle only at levels determined to be sustainable for the bog ecosystems. Goat herds may cause much greater damage to the flora of the forest understory and grasslands. For this reason, household goat raising should be monitored carefully until the ecological effects of this activity are better understood.
Forest extraction activities, such as pine resin and pitch collection and distillation should also be carefully controlled. Damage from these activities should be assessed on a regular basis. According to one reserve administrator in 1995, pine resin collecting would soon be banned because of the extensive damage already caused to pines throughout the reserve (Wang Honggao, pers. comm.).

**Ecosystem Restoration**

A top priority for wildlife conservation should be to insure that a high degree of habitat heterogeneity is maintained, with ample tracts of the most valuable habitats - broadleaf and mixed forests, montane wetlands, and montane grasslands (see chapter 8).

The vast stands of stunted pines that have replaced open grasslands since the prohibition of burning, have very little value as wildlife or plant habitat. Though they help prevent erosion, the prevalence of wind, cold weather, and thin soils impede their development into forests of significant stature and biodiversity. Their very density makes them impenetrable to many species of mammals and they impede access to montane wetland and grassland habitats (see also Koehler's assessment of pine and other conifer forests in the region, 1991).

To promote the development of higher quality habitat that is more representative of less disturbed subtropical montane ecosystems, high elevation pine forests should be largely replaced by broadleaf and mixed forests, with patches and large tracts of open shrubby grasslands at elevations above 1,500 meters asl. This long-term habitat restoration could be accomplished with village labor hired by the reserve to work under the direction of village forest resource management committees. The program would be a
sound investment by the nature reserve, providing jobs and small timber for local people, and giving them a greater role in land management and nature conservation.

In 1995, the reserve managers had already begun to conduct a small-scale tree propagation project at the reserve headquarters (outside of the reserve boundaries), at an elevation of about 700 meters asl. While this may be a good pilot project for similar reforestation projects in the lower and middle elevations (between 700-1,300 meters asl), ecosystem reconstruction on the more severely degraded granitic soils of the higher elevations would require soil enhancement in an agroforestry regime utilizing rapid revegetation techniques. These methods have proven successful in degraded landscapes in other parts of southern China (Parham, 1995; Wadley, 1995) and would be suitable in Meihuashan at elevations up to roughly 1,500 meters and in ravines and other sheltered areas at higher elevations.

The first step is to plant leguminous cover crops (mostly vines and shrubs) and trees to fix nitrogen and retain soil moisture. Deep-rooted plants can be grown with

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7 A walled mountainside enclosure of some 5-10 hectares was being converted into a small park, where visitors will be able to observe muntjacs and other animals. Local people from outside of the reserve transplanted dozens of trees from nearby broadleaf forests. The first transplants died because the trees' root systems were severed, but later transplants survived.

10 Cai and Yao (1991) point out that 11.52% of the reserve total land area consists of grasslands above 1,500 meters (this includes lands that are actually covered by short pines) and that some of the lower elevation areas within this zone, where windforce is not severe and the soil level is relatively thick, should be reforested.

11 Leguminous cover crops and trees have been used in ecosystem restoration and agroforestry systems in Guangdong province, Xishuangbanna (in southernmost Yunnan province), and Hainan island. As Parham (1995) explains, "Moisture infiltration of soil under creeping legumes, which have string root systems and a dense leaf canopy, is nine times higher that of bare land, while soil wash is only 17 percent that of bare land. Legume covers also enhance the soil's organic
shallow-rooted plants, and fast-growing leguminous trees can be grown with other fast-growing tree species to establish a forest cover within a few years. After some degree of forest canopy cover has been established, the seedlings of slower-growing trees that form the most important components of indigenous forest ecosystems can be planted (and tended when necessary). Once these members of the Fagaceae (especially Castanopsis and Cyclobalanopsis), Lauraceae, Magnoliaceae, and Camelliaceae have become established, the return of broadleaf forests would be relatively rapid, requiring only a few decades (Parham, 1995; Wadley, 1995).

In exposed areas with thin soils above 1,500 meters and in wetland areas at all elevations, dense pine stands that impede grazing and ungulate movement should be cleared by regular cutting and burning. The opening of montane meadowlands and connective pathways would be of tremendous benefit to ungulates and the large carnivores that prey upon them. Periodic burning of these meadows would increase the soil nutrients and promote the growth of tender herbaceous forage (as in the young Cunninghamia stand discussed in chapter 8). Though controlled burning has not been practiced in Fujian (at least not under the guise of scientific forestry), there is ample precedent (despite controversy) for this forestry practice in the United States (Pyne, 1995).

Local forest management committees could oversee the conservation of these anthropogenic meadows, and certain less ecologically sensitive grasslands could be

matter content, and continue to do so for years after cover crops have died." In Fujian there are 79 genera in the Leguminosae family, with 212 species. A number of native tree species in this family could also be used for multiple economic purposes.

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grazed by village cattle. This would relieve pressure on the wetland grazing areas, some of which are already being trampled by cattle herds. These unique alpine headwater zones are critically important foraging and watering areas for wildlife, especially during the dry season. Until they are better understood, cattle grazing should be kept within acceptable levels.

**Enlisting Local Support to Control Illegal Timber Harvests**

Another critical role of the forest management committees would be to control illegal timber harvests in the reserve. In 1995, there were numerous incidents of illegal timber extraction, even in the core area of the reserve. If village committees had a greater vested interest in conservation, such as permanent full-time or stable part-time or seasonal employment with the nature reserve, they could become much more effective forest monitors than are the forest police who are currently employed. In general, there is very little interest among reserve staff members to endure the difficulties of entering the mountains on foot to make the necessary inspections that sound management would entail. Villagers, on the other hand, are eager to hike deep into the mountains, especially if there are wages to be earned for their efforts.

At another level, reserve administrators must guard against corrupt forestry practices, such as the payment of bribes to villagers and forestry officials in exchange for permission to cut *Cryptomeria* trees in village sacred forests. If the nature reserve's

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12 In 1994–95, there was no evidence that the several dozen forest police employed by the reserve ever patrolled the interior of the reserve in a systematic fashion. Most of their monitoring took place at inspection stations on roadways entering the reserve. They mostly inspected trucks that exited the reserve area, while large amounts of timber were being carried out of the reserve on the shoulders of porters who stuck to mountain paths.
position on such matters were unequivocal and backed by legal action, village forest committees could be the most effective watchdogs.

While shifting more responsibility for forest management to village forestry committees, the reserve could also allow selective tree felling by villages. While large-scale commercial timber operations are not appropriate, the felling of trees for village construction materials should be permissible, especially under a permit system.

Promoting Sustainable Agriculture

As with bamboo land tenure conditions, there should be some long-term monitoring of agricultural land tenure patterns in the reserve villages. Cropland tenure disparities, however, while already apparent, do not appear to be an urgent issue since households are not in competition to maximize grain production. In fact, since rice is grown mostly to meet familial subsistence needs rather than government quotas or market demands, rice paddy land may continue to decrease as families require less grain for self-sufficiency. In an increasingly commercial and cash-oriented economy, rice production is not profitable for Meihuashan villagers. Only if the cultivation of other agricultural products becomes highly lucrative for Meihuashan villagers will competition for cropland intensify.

At present, the most important goal is to recreate a system of sustainable agriculture, but one that is more intensive than traditional, pre-industrial methods. While the land-extensive organic agriculture of the premodern period had few harmful effects on the environment (aside form the conversion of biologically diverse ecosystems into agroecosystems), farmers cannot return to such a low-production, labor intensive
approach. Indeed, villagers would have no desire to revive the old agriculture. Instead, there should be smaller-scale, high-yielding organic agriculture, low in chemical pesticides, rodenticides, and synthetic fertilizers, and high in green manures and traditional household wastes.

Cai and Yao (1991), writing on natural resource utilization in Meihuashan and the need to protect non-agricultural lands from reclamation as the reserve population expands, have suggested that local farmers should increase productivity within smaller areas by implementing thorough agricultural reform. Arguing that land quality and crop productivity could be substantially improved, they call for the construction of a better irrigation network, the practice of winter plowing and soil aeration, an increase in the use of fertilizers - especially organic household and livestock wastes, and the selection of varieties more suited to local conditions. Some families have already begun to grow modified varieties of red rice, which locals have a food preference for, and which is more productive (per unit area) than traditional tall varieties. If these varieties are not already more resistant to pests, continued experimentation may yield varieties that are.

The nature reserve should be a model for sustainable montane agriculture; with the objective of not simply minimizing environmental degradation but of enhancing the landscape ecology and cultural diversity of the Meihuashan region. Administrators and local people should work together to improve subsistence and commercial agriculture.

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13 These geographers from Fujian Normal University characterize grain production in Meihuashan as "low in productivity primarily because the mountains are high, the water is cold, paddies are excessively muddy, too small, too far from villages in an area of poor transport, (and generally) difficult to cultivate...most of the land falls within the third and fourth (the lowest) classes of agricultural land."
Some specific goals might include: to propagate more pest-resistant heirloom varieties, to practice integrated pest management, to promote organic fertilization, to increase subsidiary agricultural production and household incomes by improving vegetable market gardening and fruit orchard management, and to sell produce in the growing urban specialty markets.¹⁴

To their credit, reserve directors have allowed villagers in Mawu village to establish 100 mu of tea and 170 mu of fruit orchards, and there are plans to expand both of these activities to 500 mu each. Bee keeping is also practiced in a number of villages, and the reserve agreed to subsidize the expansion of apiaries in Mawu, Guizhuping, and Dapingshan (Huang Zhaofeng, pers. comm.). Proposals involving village-based commercial wildlife husbandry are discussed below. It should be emphasized that none of these proposals will be successful if not initiated by the villagers themselves. The reserve administrators must be receptive to local peoples' ideas on development and reserve management, and local people must be part of a partnership for conservation rather than being reduced to a modern form of serfdom.

**Recruiting Local People as Wildlife Managers**

Hunting and wildlife management are also activities with which local people have long historical experience, having developed a priceless body of knowledge concerning local wildlife and habitat. This collective knowledge and interest is the most important asset and hope for nature conservation in Meihuashan, and with good planning, local

¹⁴ Along with rising incomes in China, there is a growing demand for healthy, uncontaminated foods. By 1995, the demand for organic produce in major cities like Beijing had led to a revival of commercial organic farming in the hinterlands.
people can become the most active wildlife managers and researchers, and the most successful entrepreneurs.

Village wildlife management could be integrated with the proposed system of forest resource management committees. In a proposal co-authored by the author and a local villager, and submitted to the nature reserve directors (Coggins and Ma, 1995), it was suggested that the following steps be taken to implement indigenous co-management of wildlife resources (slight modifications have been made in this latest draft):

1. Establish a wildlife management and research committee. Committee members should include elected representatives from each of the 26 natural villages, who are chosen on the basis of their experience with and knowledge of wildlife. The committee head should be selected from among this group by the reserve administrators and by other committee members. When necessary (and possible) the leader (and if possible other committee members) will receive training in wildlife management techniques from NGO's and governmental organizations. Committee chairs should, after completing a term of perhaps 1-3 years, given the option to work as a full-time staff member of the nature reserve, responsible for wildlife and habitat management. At this time, a new chair will be chosen (and gradually recruited, into the reserve staff).

In 1995, one young reserve manager, who had the equivalent of a technical or associate's degree in forestry, earned about 15 yuan (U.S. $1.88) per day, although this varied according to the tasks he was assigned on a given day. Assuming an average of six work days per week for about 48 weeks per year (one month off for Chinese New Year), his total annual salary was roughly 4,320 yuan (U.S. $540). In contrast, a forest worker (linyeyuan) in Majiaping earned 120 yuan (U.S.$15) per month, or (assuming 11 months of work per year) 1,320 yuan (U.S.$165). It is clear that some villagers are willing to work as forest workers for low wages, perhaps because working for the reserve gives them power, but in that position they also have time to earn income from the same sources as other households, i.e. bamboo and other enterprises.
2. Initiate a series of wildlife research and management projects. Reserve staff and committee members will jointly draft and implement specific project goals and procedures. These could include the following: i. Monthly village wildlife surveys. Committee members and other experts will agree upon the most feasible method for conducting track and sign surveys of village lands (one feasible approach could be to use the trail survey system used for this research project - Appendix E). When a method has been agreed upon, committee members will conduct monthly surveys of habitats surrounding their home villages. ii. Use observation posts, blinds, cameras, camera traps, video, radio telemetry, or other technology as these become available, to document the locations, numbers, and diversity of wildlife. iii. Report legal and illegal hunting, trapping, and fishing activities and incidents in each village.

3. The wildlife management committee will draft a set of hunting regulations for the reserve (in accordance with national and provincial laws). The goal of such regulations would be to establish a higher level of wildlife management in the reserve. These comprehensive codes will include specifications on compensation for crop loss due to wildlife depredation, the delineation of specific areas were boar hunting (and potentially other types of hunting) will be permitted, and appropriate punishments for those who violate wildlife regulations.

4. Committee members should file monthly reports that include the following information about wildlife in the natural villages where they reside: i. results from the monthly wildlife surveys, and a record of all wildlife sightings; ii. all agricultural and silvicultural damage caused by wild boar, monkeys, rats, and other animals; iii. any
problems related to wildlife; iv. the weight, body dimensions, age, stomach contents, and any other data on all illegal and legal game observed.

5. The committee chair, along with reserve officials, should collect and analyze monthly reports. Wildlife research should be used in a longitudinal study of wildlife population and habitat utilization patterns. Data could contribute to a GIS (already in development stage in 1995) and other databases. Reports should also be used to evaluate wildlife management and to design longterm planning and project development.

6. Photographs, video, reports, and other information should be distributed to local news media to develop interest in the nature reserve and in wildlife conservation as a whole.

7. After establishing a number of observation areas and blinds (2.ii.), the committee can select the most reliable of these as visiting sites for scientists and eco-cultural tourists to observe wildlife firsthand.

Within six months after this proposal was submitted to the directors of the Meihuashan Nature Reserve, the villager who co-wrote the proposal became the first villager hired by the reserve to work in wildlife research. The establishment of a wildlife committee is somewhat contrary to Chinese top-down administration, as some reserve leaders were quick to point out, and even the prompt hiring of one villager came as a surprise to those outside of the reserve leadership.

Raising Wildlife for Commercial Purposes

While the reserve administration has yet to implement co-management of wildlife or to include local people in wildlife research projects in a comprehensive fashion, there
are plans to allow villagers to raise wildlife for commercial purposes. In 1995, specific plans included, frog-raising schemes in Dapingshan and Guihe villages, projects to raise rhesus macaques (*Macaca mulatta*) in Fukeng village, and a plan to raise sika (*Meihua*) deer (*Cervus nippon*), an indigenous but regionally endangered species, the antlers of which are highly valued in Chinese medicine. The deer would be raised (presumably in enclosures) outside of the core area, in the montane meadows around the high peaks of Youpoji and Daxie. While the sika deer husbandry project had not yet taken concrete form, there were more tangible ideas about how to implement village-based frog and macaque husbandry (Huang Zhaofeng, pers. comm.).

The frog species that is most popular in the region is the so-called "rock cave" frog (*shidong - Rana spinosa*), which inhabits mountain streams at all elevations (see chapter 11). The *shidong* is large (with a body length of 100-129 mm) (*ZGYWDWZXZZ. 1981*). Although the frog is protected by law, frog poaching is rampant in the reserve and there is a tremendous market for the medicinal meat, which is typically eaten in a soup with mint leaves.

If frog raising is permitted, it will take place along wooded, flat, gentle sections of mountain streams, where controlled breeding and harvesting would be most efficient. To attract insects, lights will be mounted along the stream banks. Judging from the popularity of frog meat and the frequency of frog poaching in the reserve, frog raising could be very lucrative (Huang Zhaofeng, pers. comm.).

In 1995, there were plans to raise macaques in the broadleaf forests of the eastern outlying portion of the reserve. First a group of 10-20 monkeys would be introduced to
the nearby broadleaf forests. These might breed with a wild population known to inhabit the same area. Fukeng village would then be responsible for the feeding, management, and limited harvest of the monkeys. Since rhesus monkeys are highly valued for scientific experiments, the reserve managers estimated that exports could earn the villagers approximately U.S. $2,000 per animal (Huang Zhaofeng, pers. comm.).

According to reserve plans, the macaque management site would also have a viewing pavilion for tourists (discussed below) (FJMHSGJJZRBHQGLC, 1991).

Macaques near the Wuyishan Nature Reserve Headquarters have been managed in this fashion, and there is a large troop there that lives in a semi-wild state, accepting handouts and allowing humans to approach them at close range.

Potential management problems affecting wildlife husbandry in Meihuashan would include poaching, exceeding carrying capacity, and ecosystem disruption. There could also be issues relating to which villages are allowed to raise which species, how animals are treated (especially in captivity), and how wildlife products are marketed. These problems warrant a comprehensive study before large-scale wildlife husbandry is initiated.

**Developing Nature Tourism and Cultural Tourism**

There is some evidence in the mid-1990s that the economy of the Meihuashan region is beginning to diversify and that service sector occupations will soon absorb a more substantial portion of the labor force. The development of nature tourism and other economic initiatives could play a key role in this transition (ZHKCBGWYH, 1991; Wu, 1991).
Nature tourism may become a significant part of the economy of Meihuashan. Wu (1991: 188) believes that Chinese tourists (especially those from large coastal cities) will visit Meihuashan to enjoy the health benefits of breathing in the invigorating compounds found in fresh mountain air, an activity which he refers to as "forest shower tourism." Additional attractions could include a hotspring in the village of Xiache, which has already been enclosed in an open-air bath house; a reservoir under construction near Xiache, and nearby reservoirs at Wan An and Shangfu (in Buyun); the monkey-viewing pavilion in Fukeng (discussed above); and the sacred Buddhist mountain of Matoushan (discussed in chapter 10).

Since residents of Xiamen and Zhangzhou can now reach Meihuashan in one day by car, the potential for nature tourism appears to be very significant. In the summer of 1995, guest rooms were being prepared in anticipation of the first tourism. According to one management plan, the headquarters could hold 28 guests per day, the management station in Xiache could house 20 visitors per day, and since other lodging could become available, the reserve could accommodate up to 20,000 lodgers per year (FJMHSGJJZRHBHQLC, 1991).

If tourism develops as expected, it will be important for villagers to share in the profits from such things as entrance fees; the provision of food and lodging; local transportation; and reserve tours. Since tourism is not permitted in the reserve without

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16 In a unique, but perhaps accurate approach to what would draw Chinese tourists, Wu (1991: 188) states that the mountain forests produce air that is rich in tonic substances. These include anions and terpenes, which he says, have anti-bacterial, anti-carcinogenic, and anti-inflammatory properties. Most interesting of all, however, is his assertion that these compounds promote hormonal secretions.
the consent of reserve directors, and there has been no commercial tourism within the reserve boundaries. There will be ample time and opportunity to control the develop of the industry if it becomes a significant part of the economy. In that event, reserve administrators and villagers should reach an agreement on standards for minimum impact nature tourism, including regulations on lodging, building codes, signs and advertising, vehicular transportation, and controls on visitor numbers and activities that could have serious impacts on vegetation, wildlife habitat, local landscapes, or cultural identity.

Given the rapid economic and political changes in Meihuashan during the past decade, further dramatic and synergistic changes should be expected in the coming decade. For this reason, if the reserve is to meet the objectives of nature conservation and local economic development, there must be regular and ongoing interaction between reserve administrators and local people; only in this way can land use, tourism, and conservation regulations be continuously adjusted to meet the complex goals of sustainable development.

Conservation and Development in the Wuyishan and Longxishan Nature Reserves

Brief comparative research in the Wuyishan and Longxishan Nature Reserves (Fig. 1.1) focused on historical settlement, cultural patterns of environmental change, and economic development. Interviews with reserve managers and villagers revealed regional consistency in such patterns as the historical practice of burning the mountains (see chapter 6); a long history of mountain-valley trade that included international

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17 Wildlife habitat surveys were also conducted in both reserves with the aid of local assistants. These surveys focused on broadleaf forests >1,000 meters in elevation. The results may be incorporated with data from Meihuashan.
linkages;¹⁸ village economies based largely upon the cultivation of maozhu bamboo; and little tourism (in Wuyishan there is a tourism area, but it is outside of and separate from the reserve). These traits are common to much of the Southeast Uplands. There are also, however, historical patterns, economic conditions, and administrative features that make each reserve unique, and warrant extensive comparative study. Historical patterns of village settlement, ethnicity, agriculture, fengshui practice, and hunting were discussed in chapters 2, 10, and 11. The following comments pertain to current economic development and reserve administration in Wuyishan and Longxishan. Since these reserves are widely regarded by forestry officials and local people as having more harmonious relations between residents and managers than is the case in Meihuashan, an analysis of their economic and administrative strengths would be instructive.

The Wuyishan Nature Reserve was established in 1979 as a national nature reserve run by the provincial forestry bureau. In 1987, the reserve became one of ten UNMAB (United Nations Man and the Biosphere Program) Biosphere Reserves in China. Since its founding, Wuyishan has been the largest reserve in the region, with a total area of 556.7 square kilometers.

Within the reserve, there are three administrative villages (Tongmu, Aotou, and Dapo) encompassing 17 natural villages in the transition zone of the reserve (outside of the core area) with a total population of over 2,600 in 1994. Surveys conducted by the

¹⁸ In Wuyishan, however, tea, rather than paper, was the most important export item before 1949. Market towns were further away, so villagers only went to market once a month. Tea was processed and sold to rich merchants (da fu), who transported it to Guangzhou, Zhangzhou, Fuzhou, and Xiamen, and other coastal entrepots, from which it was exported to other countries in Asia and the West (Wu Haohan, pers. comm.).
author in five natural villages (Guadun, Aotou, Sangang, Huangxizhou, and Jiangdun) showed that in 1994, there was an average of 176 inhabitants per village, and between five and seven families (with different surnames) in each village. Most of the villagers belonged to the Northern Min or Jiangxi dialect groups, with between 2-6 generations of in situ settlement, but there were two Hakka families, one in Guadun and one in Sangang whose ancestors had migrated from Ninghua and Changting some 5-6 generations before. Many of the Jiangxi-related peoples settled the area in the late-Qing, escaping starvation, overcrowding, and political turmoil in the lowlands to the west (Wu Haohan, pers. comm.).

In the five villages surveyed, there was an average estimated annual per capita income of 1,600 yuan. Though estimated average per capita income is much lower than the estimated average of 2,300 yuan (1994) (Wu Haohan, pers. comm.) for the reserve as a whole, it compares very favorably with income estimates in Meihuashan.

Higher incomes in Wuyishan are due to greater investments of time, money, and collective effort in the development of bamboo cultivation, processing, and marketing. Although there were some forest resource tenure conflicts between local people and the

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19 This figure may be skewed since the figure given for Aotou (380) may include both natural villages of the administrative village.

20 This figure is based on semi-formal interviews that were conducted in each of the study villages. It should be considered a rough estimate, since the researcher was given only one estimate per village and there were no means for calibrating the data with official reports or other verbal estimates of village or individual household incomes.

21 The five villages surveyed in Meihuashan had average populations of 191, and average per capita incomes of 731 yuan (see Tables 4.2 and 5.3a).
Figure 12.2. The Wuyishan Nature Reserve
reserve management when the reserve was first established, reserve and forestry officials
say that these subsided as bamboo sales brought a steady increase in household income
(Ruan Yunqiu; Wu Haohan, pers. comm.). Unlike the villagers of Meihuashan and
Longxishan (discussed below), Wuyishan villagers mentioned no ongoing conflicts or
disagreements between local communities and the nature reserve management. A few
villagers mentioned that hunting guns had been confiscated from all of the villages, but
no one evinced any bitterness about the policy.

When the reserve was established, villagers and reserve managers began to seek
ways to improve bamboo cultivation and marketing. All of the villages surveyed
distributed collective forests on the basis of household size, rather than old land deeds.
and two agreed to redistribute land every fifteen years. Although the per capita income
was only 200 yuan (CNCMAB, 1995), almost all of the villages had access roads (in
1995 all but one village had an access road or a tractor road, or were in the process of
building roads). and all of the villages had electricity. As in Meihuashan today, villages
with road access sold bamboo poles, which were trucked out of the reserve for use as
scaffolding. Between 1985-1991, villages began to convert bamboo to more valuable
products, responding to market demands for chopsticks, thin sticks for barbecuing,
bamboo mats, car seat covers, and fine floor tiles (Wu, Haohan). Some poles are still
sold for scaffolding, but most are used in secondary processing.

One reserve administrator and a Tongmu village leader stated that villagers
initiated the shift to industry independently. They emphasized however, that households
did not undertake the transition individually, but under an umbrella of collective support
that remained undiminished in 1995. The 12 villages of Tongmu, for instance, formed a cooperative bamboo processing company named after a government slogan: the "Company (That) Enriches the Farmer" (Gongsi Jia Nongfu). Although the company is owned and managed by locals, the Fujian provincial government arranged with the provincial Foreign Trade Bureau (Waimao Bu) and private companies to order and purchase products from the Tongmu company, and this trade continues. The company in turn, orders products from individual villages and households (depending on their specialties and capacities) on a consignment basis. In 1995, an estimated 72% of household income in the five villages surveyed was derived from bamboo.

Some villages and some individual households have machines in village or household workshops. These are leased, purchased (often with bank loans), or used on a subcontract basis and allow the villagers to sand, shape, polish, or heat-dry bamboo parts (depending on which products they specialize in). The parts can be sold to the Tongmu company or other private companies. In one village (Guwangkeng), which is far from Tongmu and has only tractor road access, residents started their own multi-product bamboo factory and wholesale business. In Sangang village, the administrative center of Tongmu, increased local capital has been invested in a tea processing plant and other cottage industries (Wu Haohan; Zhan Mou, pers. comm.).

The demand for labor has necessitated the hiring of workers from Jiangxi, Sichuan, Zhejiang, and other counties in Fujian. These people are given temporary residence permits and they are not allowed to build houses or settle in the reserve (Wu Haohan, pers. comm.).
According to one Wuyishan reserve manager, administrators were in disagreement about whether the spread of bamboo was adversely affecting adjacent ecosystems, but the situation did not appear to merit forest protection measures like those taken in Meihuashan, and there were no protected subareas. A 1994 study stated that there were 7,938 hectares of *maozhu* bamboo in the reserve (He, 1994), which is equivalent to 14.04% of the total land area.

Commercial land use, settlement, roads, and other human activity and infrastructure in Wuyishan are mostly confined to the long narrow graben valley bottoms and adjacent mountain slopes. Many villages lie at elevations between 650-1,000 meters, and above the villages, tea plantations, and bamboo, lie extensive broadleaf forests and mixed forests up to 1,600 meters. Because of this distinctive altitudinal zonation pattern, there appears to be little wildlife at lower elevations and abundant wildlife at higher elevations. In a wildlife survey along a ridge above Guadun, at an elevation of 1,300-1,460 m, there were abundant signs of muntjacs, crested deer, wild boar, pheasants, and Asiatic black bear. The assistant, a former hunter from Guadun, stated that wildlife was rare in the valleys and on slopes, but abundant on the long ridgelines that run for many miles through the reserve (Zhan Jianhua, pers. comm.).

According to one administrator and a number of villagers, poaching was not thought to be a serious problem. Except for some poaching by outsiders (mostly for

22 Village bamboo cutters take advantage of the long, straight valleys and parallel ridges of Wuyishan, and they never have to carry bamboo. Bamboo poles are cut, slid down chutes to the valley bottoms, and dragged along the gently-sloping trails to the villages. In the rugged hills and mountains of Meihuashan, all bamboo is laboriously shouldered up and down slopes, often by women. There are no long, straight grabens, and few bamboo slides down the mountain slopes.

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frogs, especially _Rana spinulosa_), there was little hunting by villagers, for most of the
guns were confiscated in the late 1980s (Wu Haohan; Zhan Mou; Zheng Fengchun, pers.
comm.). Snares made by villagers from tree branches and natural fiber were observed
above Guadun. Unfortunately, there have been no systematic wildlife censuses since the
founding of the reserve, so there are no data indicating how conservation policies have
affected animal populations (Wu Haohan, pers. comm.).

The more variegated topography of Meihuashan and other reserves has led to a
more complex mosaic of habitat types, and human activities are not so clearly separated
from wildlife habitat by elevation. For this reason, the development of cottage industries
that create significant levels of noise pollution (as in Wuyishan), should be undertaken
with great care in other reserves.

While economic development in Wuyishan has been highly successful and
apparently free of significant environmental degradation, there has also been a substantial
flow of national and international funding for the reserve, including grants and loans from
the U.N. (via the China Biosphere Reserve Network) and the World Bank (Ruan Yunqiu.
pers. comm.).23 It would be surprising if none of this funding had been allocated to the
improvement of socioeconomic conditions in the reserve, and it would be premature to
assume that Wuyishan is a flawless prototype for grass-roots sustainable development,

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23 For instance, in the late 1980’s, the reserve received a
930,000 yuan (U.S.$250,000 in 1988) loan from the World Bank. Specific
figures on other grants and loans were not provided.
just as it would be to assume that Dazhai was a faultless model for land reclamation (Salter, 1992).

The Longxishan Nature Reserve

The Longxishan Nature Reserve, was established as a provincial level reserve in 1989 and became a member of China's Man and the Biosphere Program (along with the other two reserves) in 1993. With an area of 63.7 square kilometers, Longxishan is much smaller than the other reserves, but it encompasses montane broadleaf and mixed forests along the ridges and upper slopes of a u-shaped massif, with elevations up to 1,620 meters. Wildlife habitat in the reserve is regarded by experts as very good (He Lian, pers. comm.), and Koehler (1991) found two ground scrapes made by tigers within the reserve boundaries (JLXJSJ, 1994).

The reserve is also touted as a model for unified management, because all of the roughly 1.122 residents occupy 10 natural villages within the equivalent of one township. In other words, the nature reserve has taken on the role of a township, with full administrative control over all aspects of village life. Before being designated a reserve.

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Dazhai was a model village carved out of the loess plateau in eastern Shanxi province in the early 1960s. The village of 160 people was purported to have used its own labor force and funds to reclaim heavily eroded farmland by terracing the loess slopes with stone bunds and constructing stone-lined drainage ditches to divert flood waters. During this time, housing was improved and grain yields increased to the point where the village was not only self-sufficient, but also augmented its sale of grain to the government. These achievements were celebrated by Mao Zedong, who exhorted the masses with the famous slogan: "In agriculture, study Dazhai." The large red characters bearing this command can still be seen on decaying walls in villages of the Southeast Uplands. Salter (1992), after a visit to Dazhai in 1977, concluded that there may have been outside support. As he notes rather cynically, "To believe...that such monumental modification was authored by fewer people than in a good-sized introductory cultural geography class becomes...a problem..." (Salter, 1992: 207).
the area was administered as a special collective forestry, bamboo, and pastoral production zone established in 1979 and known as the "The Longxishan Forestry, Pastoral, and Paper Multiple Production Area." Today the reserve headquarters contain the offices of family planning, business management, land management, the national guard, taxation, criminal justice, fire prevention, and public security.25

Most of Longxishan's inhabitants are Hakkas whose ancestors migrated from over-populated areas of Changting county in the Qing dynasty. In Longxishan they settled, apparently as shed people, to produce bamboo paper for international export. They built paper workshops in the mountains above what became the village settlements (although settlements may have been founded by earlier immigrants). Many remote workshops in the reserve are still operational (Fig. 12.3). During the period of unrest in the first half of the 20th century, many villages reverted to banditry in order to survive. Today most of the villages have 3-7 family groups (each with a different surname), with 3-7 generations of in situ settlement (see chapter 2).

In 1994, the nine villages had a population of 1,128, with an average of 125 inhabitants per village. The average per capita income was 1,708 yuan (U.S. $213) (JLXJSJ. 1994) for the reserve as a whole. In interviews conducted by the author in three of the ten township villages (Shipaichang, Yujiaping, and Shangdi), estimates of per capita income averaged 1,190 yuan.

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25 One village (Jiangjunding) is technically still outside of the reserve boundaries because of a land use conflict. The villagers have not agreed to allow their collective lands to become part of the reserve, but the village is still governed by the reserve.
Figure 12.3. The Longxishan Nature Reserve.
In stark contrast to the village economies of Meihuashan and Wuyishan, the three villages surveyed derived only 30-50% of their income from bamboo. This is a fairly accurate reflection of village economies in the reserve as a whole (JLXJSJ, 1994). The most important products include poles for scaffolding, bamboo shoots, handmade paper (used for calligraphy or for burning as an offering to ancestors, depending on the grade), small sticks for barbecuing, chopsticks, and bamboo mats. Villagers are also heavily reliant upon income from raising livestock, especially yellow cattle, goats, and pigs. Many also work outside of the reserve as laborers, and a few as shopkeepers.

In 1994, the nine villages of Longxishan had a total of 1,800 goats, 200 head of cattle, 2,000 rabbits, and an average of 20 ducks, chickens, and other fowl per household. The reserve had also recently begun a sika deer husbandry project, raising the deer in an enclosure for eventual harvest for the medicinal market. Within the reserve there are also three mechanized paper factories, a down factory, a small foundry, a bamboo mat factory, a printing factory, and several companies that buy and distribute handmade paper (JLXJSJ, 1991).

Economic diversification in Longxishan is a necessity born of scarcity. Bamboo forests comprise about one-third of the reserve area (30,000 mu or 20 square km), and there is an average of only 26.7 mu (1.78 ha) of bamboo per villager, which has been distributed according to family size (JLXJSJ, 1994). In the village of Shipaichang there is an average of only 5 mu (.3 ha) of bamboo forest per person.

Since the reserve administrators wanted to protect as much forest land as possible, only bamboo forests and the small areas of rice paddy (totaling only 24-33 ha) were...
designated as collective land. The rest of the forest land was designated as the core and buffer (or experimental) areas of the reserve. Villagers complain that they do not have enough bamboo to make ends meet without relying on other sources of income.

While administrators from other reserves hail Longxishan as a great success, where conflicts between residents and managers have been minimal, a number of villagers expressed dissatisfaction with the system of resource management and administrative control. During the brief (three day) research period, residents in two villages complained about inequitable land tenure conditions, contracts for bamboo shoot harvesting that were granted to outsiders, excessive control and corruption among reserve leadership, and an alleged imbalance of power among villages due to their former positions within pre-existing (communal and post-commune) administrative structures. One lesson that the Longxishan Nature Reserve provides is that unified administration gives reserve leaders tremendous power, but it also requires the reserve to take responsibility for all aspects of village life. Whether a nature reserve can effectively assume the comprehensive role of a township government remains to be seen.

Conclusions: Recommendations for Nature Conservation in the Southeast Uplands

To insure the longterm survival of rare fauna and flora in the Southeast Uplands, suitable habitat must be conserved over larger areas, including those lying outside of the few, small, and widely-scattered nature reserves. Nature reserves can serve as nodes of superior habitat in a matrix of habitat corridors, but they will not protect biological diversity for long if they become islands in a sea of degraded lands (Schelhas and Greenberg, 1996). Mountain conservation corridors are becoming a key strategy in
Figure 12.4. Nature Reserves, Broadleaf Forest Remnants, and Bamboo Cultivation Zones of Fujian Province. The fourteen nature reserves in the Southeast Uplands region of Fujian are widely scattered among remaining broadleaf forest areas. Bamboo cultivation threatens many of these areas. Masson pines and shrub species predominate in the surrounding areas (shown in white).
**Table 12.1. Nature Reserves of Fujian Province**

Note: The official name of each reserve begins with the county, municipality, or region in which the reserve is located. Reserves are administered nationally (N), provincially (P), or by a county or municipality (C). Members of the International Biosphere Reserve Network are designated "IBRN." Members of the Chinese Biosphere Reserve Network are labeled "CBRN."

**Reserves in the Southeast Uplands**

<table>
<thead>
<tr>
<th>Name &amp; Administrative Status</th>
<th>Area (Square Km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Wuyishan (N, CBRN, IBRN)</td>
<td>565.27</td>
</tr>
<tr>
<td>2. Shaowu Jiangshi (C)</td>
<td>11.87</td>
</tr>
<tr>
<td>3. Jianou Wanmulin (C)</td>
<td>1.76</td>
</tr>
<tr>
<td>4. Sanming Shi Luobuyan (C)</td>
<td>3.27</td>
</tr>
<tr>
<td>5. Sanming Geshikao (C)</td>
<td>11.25</td>
</tr>
<tr>
<td>(Sanming Chinakpin -</td>
<td></td>
</tr>
<tr>
<td>Castanopsis kawakamii Reserve)</td>
<td></td>
</tr>
<tr>
<td>6. Minxi Meihuashan (N)</td>
<td>221.33</td>
</tr>
<tr>
<td>7. Pingnan Yuanyang - Mihou (P)</td>
<td></td>
</tr>
<tr>
<td>(Pingnan Mandarin Duck and</td>
<td>10.40</td>
</tr>
<tr>
<td>Rhesus Monkey Reserve)</td>
<td></td>
</tr>
<tr>
<td>8. Dehua Daiyunshan (P)</td>
<td>97.31</td>
</tr>
<tr>
<td>9. Mingjing Huangzhulin (C)</td>
<td>2.32</td>
</tr>
<tr>
<td>10. Yongchun Niumulin (C)</td>
<td>1.56</td>
</tr>
<tr>
<td>11. Nanjing Yaredai Yulin (C)</td>
<td>.21</td>
</tr>
<tr>
<td>(Nanjing Subtropical Rainforest Reserve)</td>
<td></td>
</tr>
<tr>
<td>12. Jiangle Longxishan (P)</td>
<td>63.71</td>
</tr>
<tr>
<td>13. Nanping Mangyangshan (C)</td>
<td>42.78</td>
</tr>
</tbody>
</table>

(table con’d)
14. Yongan Tianbaoyan (C)  18.45

**Reserves in Coastal Fujian**

15. Longhai Hongshulin (C)  2.0  
(Longhai Mangrove Forest Reserve)

regional conservation planning worldwide. The World Commission on Protected Areas (WCPA) of the IUCN (International Union for the Conservation of Nature) is actively promoting schemes that link isolated mountain protected areas to lowland habitats and to other highland protected areas. IUCN and the WRI (World Resource Institute) are making an inventory of conservation schemes around the globe that protect "ecoregion corridors" (Hamilton, 1997: 1).

The Meihuashan, Longxishan, and Wuyishan reserves are regarded from a biological standpoint as the most valuable reserves in the Southeast Uplands. In 1995, they were the only regional members of China's Biosphere Reserve Network. None of these reserves, however, nor the Daiyunshan Nature Reserve in Dehua county, is sufficiently large to protect a viable tiger population (Koehler, 1991).

To protect large carnivores, which require the most extensive habitats, and to insure the survival of many species of plants and animals that share their habitat, these four reserves and eleven smaller provincial, county, and municipal reserves of the Southeast Uplands region should be linked by montane corridors of grassland, wetland, and broadleaf forest (Fig. 12.4). Although the latter reserves are even smaller than Longxishan, they are evenly distributed across the region and protect important montane ecosystems.

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26 This approach is being used in tropical and subtropical forest habitats around the globe (as well as in other biomes) (Schelhas and Greenberg, 1996; Western and Wright, 1994). Western and Wright (1994) provide numerous examples of how local resource management affects habitat conservation outside of protected areas. Schelhas and Greenberg provide numerous case studies on the importance of forest patches and the restoration of habitat corridors to connect them. This has been proposed and attempted not only for large carnivores, but for a wide variety of vertebrate taxa within many types of landscapes (Bookhout, 1994; Schelhas and Greenberg, 1996; Western and Wright, 1994).
The distribution of relict broadleaf forests, although highly fragmented, covers most of the Southeast Uplands and parts of the coastal lowlands (Fig. 12.4). These areas and smaller patches of broadleaf forest should be targeted for conservation as quickly as possible.

Although mapping, demarcating, and protecting montane habitat corridors will require the coordinated efforts of the Fujian Forestry Bureau and local people, it should not require the amount of state and international support used for the management of nature reserves. Current patterns of land use at elevations above 1,200 m could be integrated into a large-scale nature conservation plan. These sparsely populated areas are predominantly grasslands, conifer forests, mixed forests, bamboo forests, and broadleaf forests. Economic land use in high elevation zones is already legally restricted by state-controlled timber quotas on collective land and even stricter regulations on nationally owned land.

Land management initiatives to improve habitat could include the periodic clearance of pine and Cunninghamia monocultures to keep grasslands open for ungulates; stricter state and local protection of sacred (fengshui) forests; broadleaf forest restoration; demarcation of bamboo forests, and the establishment of protected subareas on collective lands within the reserve. Wildlife management initiatives should include controlling poaching; controlling the proliferation of guns, traps, and explosives; and banning the most persistent rat poisons and pesticides. Management practices in high altitude zones within the nature reserves could eventually become useful models for corridor management.
Recruiting local participation in a project of this scale would not be a simple undertaking, but it would be the most effective way to harmonize economic land use practices and nature conservation goals. This has been initiated with considerable success in large protected areas in other parts of the world. One of the best examples of participatory conservation and development at the macroscale is the Annapurna Conservation Area in Nepal, a 7,600 square kilometer region with 118,000 inhabitants (Stevens, 1997).27

As this chapter has suggested, the preservation of biodiversity in the Southeast Uplands depends upon the well-being of local human communities and upon their support for conservation actions. Nature reserve administrators understand this dynamic and are engaged in a longterm effort to promote sustainable development. While it would be brash to make predictions about the future of conservation and development in the reserves discussed above, future relationships between people and wildlife in the vast areas lying between these reserves is of even greater import, and is much more difficult to forecast (Western, 1994).

27 Other fine examples are provided by De Lacy and Lawson, Eaton, Herlihy, and Nietschmann (though the last two are still in the planning stages) in Stevens (1997).
CHAPTER 13
CONCLUSIONS

This dissertation has described historical relationships between humans, wildlife, and landscapes in China's Southeast Uplands Region. It has also attempted to place current nature conservation issues in the context of a vast stream of modern social, political, and environmental change. Archival research, historical documents, and oral histories reveal a long and continuous pattern of interaction between the state, local people, and wildlife. A number of ancient beliefs, customs, land use patterns, hunting technologies, and wildlife management strategies have survived to the present. Others have been developed or introduced recently, and all have important implications, both positive and negative, for wildlife conservation.

The Southeast Uplands region, like many peripheral mountain areas around the world, has experienced periods of relative isolation and internally-mediated development on the one hand, and intensive management by central authorities or occupation forces on the other. It is clear, however, that during the tumultuous course of the past two centuries, the Hakkas and other long-term inhabitants of the region have not been passive survivors. They have instead remained actively engaged in adapting to and exploiting exogenous and endogenous social, economic, political, and environmental forces.

In Meihuashan, Longxishan, and Wuyishan, village subsistence, commerce, and custom have shaped the montane landscapes and wildlife habitats in distinctive and dynamic ways. The firing of the mountains, the building of agricultural terraces, and the propagation of bamboo forests have left these areas with a complex and fragmented
vegetation mosaic. Still, wildlife populations and habitat conditions are far superior to those of the surrounding lowlands, where human settlements, anthropogenic grasslands, pine and coniferous monocultures, and extensive agriculture replaced original biotic assemblages long ago.

Subsistence and commercial production continue to claim a significant part of the landscape in all three reserves, however, and local people are likely to adapt to and, as much as possible, to tailor nature conservation schemes and other policies imposed by central authorities to suit their own needs and values. For this reason, among many others, it is essential that reserve administrators and local people work together in a coordinated fashion to define and achieve the goals of sustainable nature conservation. The Fujian Provincial Forestry Bureau and local governments must recognize the significance of local cultural traditions and environmental knowledge, and to allow local people to assume a greater role in reserve management.

Village landscapes are rich with vernacular architectural features and land use patterns, some of which (like fengshui forests) have actually contributed to local and regional biological diversity. Houses, ancestral halls, temple bridges, earthgod shrines, and fengshui forests are important cultural symbols, which endow village landscapes with local character, meaning, and historical significance.

It would be a mistake, however, to assume that cultural identity in these small, insular communities, bounded as they seem by a communal ethos defined by fengshui, ancestor worship, and a certain degree of communal labor, are uniform, or that dynamic shifts in the relationships within and between communities are not likely. If anything,
village histories reveal that political, demographic, socioeconomic, and ecological flux have been an almost constant feature of upland life. In the mid-1990s, individual responses to the economic constraints of living in the Meihuashan nature reserve have varied considerably, evincing personal initiative, ingenuity, and sometimes a high degree of self-interest. Some people have found employment outside of the reserve, a few have found work within the reserve administration, a few have profited from cutting trees out of the sacred forests or by selling wildlife parts, but the vast majority remain heavily dependent upon bamboo cultivation for a living.

This study has included an evaluation of wildlife habitat preferences with recommendations for land use controls to insure sustainable bamboo cultivation. It is argued that local culture, including agriculture and silviculture, can be a valuable asset to nature conservation if wildlife habitat and critical ecosystems within the landscape mosaic are strictly protected or properly managed. The importance of bamboo forest management and equitable land tenure (as defined by a majority of households in each village) cannot be overstated. In the near-term of the next decade, the improvement of bamboo cultivation within existing stands, the prevention of bamboo forest expansion, and the development of bamboo product manufacturing and marketing can provide a sound foundation for sustainable development in Meihuashan. The same appears to be true of Longxishan, and Wuyishan provides a useful if not ideal model.

Perhaps the greatest human resource in the Southeast Uplands in the 1990s is the strong sense of community that is discernible in the cultural ecology and social interaction of each village settlement. This feature may never be fully comprehended by
outsiders, since it is a product of long centuries of being in place, of generations of making and remaking a particular village, its fields, its forests, and its mountains. In Meihuashan, for example, the ideational and physical elements of ancient, single-lineage Hakka villages are intertwined in the landscape and in daily life. *Fengshui* and sacred forests; lineage records and ancestral halls; communal rites of solidarity; wet rice agriculture, and bamboo cultivation have all shaped and bounded each community. Although these aspects of life were altered and sometimes jeopardized by the ideological passions and socio-ecological engineering of Maoism; they could not be uprooted. Each village in its own valley, in its own basin, or on its own promontory, surrounded by the biological wealth of montane forests, meadows, and wetlands, makes the concept of the inhabited nature reserve all the more compelling. As a community of interlinked villages, part of a new system of nature conservation in an ancient landscape, it is a place that we can all learn from.

Western researchers of the Chinese environment have tended to focus on rural natural resource degradation, overlooking cases in which local people have played a positive role in conservation (Smil, 1984, 1993; Edmonds, 1994; Schaller, 1993; exceptions include Pei, 1987; and to a lesser extent MacKinnon, 1996). It would be simplistic to characterize montane land use patterns throughout the Southeast Uplands as contributing to an "environmental crisis" (Smil, 1994). There are important exceptions at regional and microgeographic scales, and this probably holds true for many subregions throughout China's tropical and subtropical zones as a whole (Menzies, 1988; Pei, 1985).
The diversity of land use patterns and local culture in southern China deserves more nuanced observation informed by the perspectives of landscape ecology and cultural ecology. The methodological approaches of landscape ecology and cultural ecology provide spatial frameworks for analyzing regional environmental history, environmental perception, and the relationship between resource utilization patterns and biological diversity. These processes are interrelated with patterns of ethnicity, local knowledge, environmental perception, belief systems, and economic development.

In the context of the Southeast Uplands, agriculture, forestry, fengshui, hunting, and perceptions of wildlife (as medicine, as a cause of crop depredation, and as supernatural agency) have had, and continue to have, profound affects on the relationship between people and nature. Nature conservation efforts throughout China, as well as Asia and much of the developing world, should be seen in broader regional and microregional contexts such as those that this study has attempted to provide for the Southeast Uplands. Sustainable development, co-management (or indigenous management) of protected areas, and the preservation of habitat corridors between protected areas will not happen through legislation alone. Local people are often the final arbiters of ecological change. The success of nature conservation will therefore depend ultimately upon our collective understanding of local and regional landscapes and of the people who have inhabited and shaped them and who continue to call them "home." As a reprise to the preface, then, nature conservation in the Southeast Uplands must focus not only upon the vast territorial needs of the tiger, but also upon the day to day workings and survival of the pangolin.
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APPENDIX A

TRANSLATION OF FUJIAN PROVINCIAL WILDLIFE CONSERVATION POLICY STATEMENT

“Introduction to (a Draft of) ‘Methods for Implementing China's Wildlife Protection Laws in Fujian Province’” (Bao, 1993)

(Presented on May 5, 1993, at the Third Meeting of the Eighth Plenum of the Standing Committee of the Fujian Province People's Congress Standing Committee)

By Bao Yingsen, Vice-Head of the Fujian Forestry Bureau

I. The Critical Need for Drafting this Legislation

Fujian province is located on the southeast seacoast of the mother country, straddling the central and southern subtropics. Due to favorable natural conditions, wildlife resources in the province are very rich. According to statistics, our province has 44 species of amphibians, 115 species of reptiles, 543 species of birds, 110 species of mammals, over 800 species of fish (comprising approximately 38% of all species in China), and over 5,000 species of insects (comprising about 25% of the species in China). The 157 species under first and second level state protection comprise about 38% of the 409 species under such protection nationwide. But because of historical factors, the destruction to wildlife resources in our province has been fairly severe. For instance, in the 1960's, the internationally endangered crested ibis (*Nipponia nippon*) could still be seen in the outskirts of Fuzhou and other places. Since the 1970's, not even a trace of these birds can be found. The South China tiger, the leopard, the golden eagle, whales, the white dolphin, the river dolphin, the lancelet (amphioxus); a whole group of precious animals is on the verge of extinction. Some that have important economic value...
and are useful in scientific research, such as the Rhesus macaque, pangolin, river deer, crested deer, mandarin duck, owl(s), and others, have radically decreased in number. In the 1950's, our province produced 1-2,000 bushels of the *Xiamen* lancelet, in the 1960's production decreased to 800-1,000 bushels, since the 1970's the resource has nearly been exhausted. In the last few years, the destruction to wildlife resources has been extremely severe. Some criminal elements have linked up with foreign dealers to export precious endangered species for personal gain. This kind of activity has become rampant, and has made our province a hot spot for illegal trafficking in wildlife and wildlife parts. There are some municipalities, townships, prefectures, and scenic/travel areas where guest houses, hotels, and restaurants wantonly ignore national laws and solicit more business by serving wild game. There are street markets where nationally protected wildlife and derivative products are sold openly. In many places, the indiscriminate capturing, hunting, and selling of wildlife is a severe problem. Last year there were over 320 cases of illegal destruction to wildlife (in Fujian). This proves that if we do not adopt protection measures, the wildlife resources of the province will soon face the risk of exhaustion. The primary causes of wildlife destruction in the province are: 1. the indiscriminate capture and hunting of wildlife, (a form of) exploitation that exceeds the resource base; 2. the forests and waterways on which wildlife depend for existence are altered and destroyed; reckless cutting and timbering, reclamation of unused land for agriculture, forest fires, and other problems have reduced the area of forests and aquatic habitats for many animals; 3. the widespread use in agriculture of
chemical fertilizers and pesticides, in addition to severe pollution from industry, directly
and indirectly harm many species of wildlife.

In recent years, the world community has become more and more concerned
about the protection of wildlife. This has already become a prominent international
issue, with ever-increasing connections to economic, political, and foreign affairs issues.
Our nation ranks among the countries with the richest wildlife resources in the world. In
these past few years, our country has participated in a series of wildlife protection pacts
and signed many types of wildlife protection agreements with Japan, Australia, the
United States, and other countries, assuming the responsibilities of fulfilling international
agreements and intergovernmental, bilateral tasks and responsibilities. The quality of
our country's wildlife conservation efforts is not only our own affair, but also a critical
international issue with ramifications for the international image and prestige of our
country. We must be especially aware of the overseas hostile forces and those with
ulterior motives, who often seize on problems with our country's wildlife management as
a means of causing difficulty. Photographs and articles are published in newspapers
and magazines showing how wildlife destruction is a problem in some areas, and these
items are used to criticize our country. Some international organizations plot to use these
problems, openly talking about taking action to impose sanctions against us. America has
expressed that, if these problems are not solved, they may remove our most favored
nation trade status. We should take note of the fact that in recent years, our province has
become the country's coastal hot spot for illegal wildlife smuggling. Some overseas
criminal elements have merged with criminals in the interior to smuggle panda skins and
other endangered species and their products, making huge profits, and resulting in extremely bad effects at home and abroad. So today, wildlife protection is not only an economic problem, an environmental problem, and a scientific and cultural problem, but in a sense, it is also an undeniable political and diplomatic problem.

Since the (Communist) Party's Eleventh Plenum, our province has conscientiously implemented the Party's and the country's wildlife protection principles, policies and laws, rules, and regulations. Since the Seventh National People's Congress Fourth standing Committee proclaimed the "Wildlife Protection Laws," in November 1989, our country has gradually headed down the path toward (a working system of) legislative protection for wildlife. In the process of implementing "The Wildlife Protection Laws" in our province, all levels of the people's government have adopted a series of measures to try to reverse the status quo of passivity in the management of wildlife protection (problems). Some wildlife resources have been recovered and developed, and protection of wildlife by the masses is already (gradually) becoming a societal custom. These preliminary achievements need to be strengthened through legislation.

ii. The Drafting and Amendment Process

According to the 30th and 41st regulations of "The Wildlife Protection Law," as of 1990, the Fujian Provincial Forestry Bureau and the Bureau of Fisheries and Aquaculture (Shuichan Ting) were required to organize a subcommittee to draft "The (Wildlife) Protection Measures" over a period of three years, on the basis of extensive research, and to consist of five drafts. In the beginning of 1991, after the completion of a
working draft, the opinions of regional, county, and municipal forestry and fisheries departments were solicited. After revisions from the first round of reviews, there was another round of reviews involving all significant government agencies. There was also a separate review of terrestrial and aquatic (wildlife laws) by panels of experts assembled by the provincial Bureau of Forestry and Bureau of Fisheries, respectively. (Throughout these proceedings) frequent reference was made to the wildlife protection laws issued by Beijing, Sichuan, Gansu, Nanjing, Guangzhou, and other of our brother provinces, administrative areas, and cities. After this series of revisions, it was then sent to the provincial government legislative bureau, the provincial forestry bureau, the fisheries bureau, and to the administrative regions (prefectures) of Nanping, Sanming, Zhangzhou, Xiamen, etc., where meetings were held and opinions on "The (Wildlife) Protection Measures" were solicited (once again). This was followed by two major revisions (of the proposed legislation). Now the provincial government has given (the proposed legislation) to the People's Congress for deliberation.

iii. Important Contents

"The (Wildlife) Protection Measures" has a total of seven sections and 41 articles. It integrates the practical management problems of wildlife protection in our province, and emphasizes the standardization of wildlife protection; hunting management; the management of captive raising, domestication, and propagation; the management of commercial utilization; and other aspects (of wildlife management).
iv. Explanation of Important Problems

(1) On Management Problems Relating to Specially (Zhongdian) Protected Wildlife Under National and Local Protection (Schemes)

Specially protected wildlife are divided into two subgroups: national and local. "The National List of Specially Protected (or Key Species of) Wildlife" was approved by the State Council for promulgation on January 14, 1989. The nationally protected species are divided into two levels of protection (first and second): among these there are 114 species under first level protection and 295 species under second level state protection. Nationally protected key species with distributions in our province include 24 species under first level protection and 133 species under second level. Local key protected species are those protected in certain provinces, autonomous regions, or central government-administered cities (Zhixia shi). The 30th article of "Wildlife Protection Measures" stipulates that: wildlife management methods for local key protected species and other non-national key protected species will be determined by committee members within the people's congresses in the provinces, autonomous regions, or central government-administered cities (in question). Overall, this would apply to the vast majority of wildlife species in our province, all of which are beneficial or have important economic or scientific value, and play a role in maintaining balanced ecosystems. To suit the needs of our nation's economic reform and development, and to guarantee the legal rights of our citizens to utilize wildlife resources in a lawful manner, combined with (considerations of) the real conditions of our province, "The Wildlife Protection Measures" contains detailed and specific regulations concerning these matters. Local key
protected species are under the protective status of second level national key species and are therefore subject to the same protective measures. Standardization of these measures will continue with due consideration of actual conditions as found within the province.

(2) On Government Agency Responsibilities in Administering Wildlife Management in Specific Areas

According to the seventh article of "The Wildlife Protection Law:" the designation of administrative agencies in charge of terrestrial wildlife management in autonomous prefectures, counties, and municipal governments will be conducted by the governments of the provincial, autonomous region, or central government-administered cities in which they (the smaller administrative units) lie. On February 26, 1989, the People's Government of Fujian issued telegraph (#89) promulgating rule 27: forest and fishery management offices at all levels in the province will separately execute the tasks of managing terrestrial and aquatic wildlife respectively. For this reason, "(Wildlife) Protection Measures" clearly asserts the legal status of forest and fisheries bureaus at all levels as valid administrative bodies in (issues pertaining to) wildlife management.

(3) On the Delimitation and Management of Nature Reserves, Mini-reserves (Baohu xiaoqu), and Site Reserves (Baohu dian)

The eighth article of "(Wildlife) Protection Measures" legislating the establishment of nature reserves, subreserves, and sites, refers to such areas intended for the protection of forests and wildlife. Nature reserves (literally "nature protected areas"), are relatively large in area, and after official delimitation, are required to establish an organization for training management personnel. Mini-reserves and
protected sites are smaller, and can be entrusted to pre-existing forestry and/or personnel departments for specialized management. National State Council regulations require that forest and wildlife protection areas (nature reserves), are to be administered by wildlife authorities in a unified system, with (appropriate) division of labor and responsibilities. It is forbidden for any other organizations or citizens to act on their own authority in the establishment of organizations and/or revision of (protection) measures.

(4) On the Establishment of Funding Sources for the Development of Wildlife Protection (Programs)

Lack of funding and investment is a major impediment for the development of wildlife protection in this province. Wildlife protection is a new and emerging enterprise, and one that involves protecting the natural environment and its resources, all of which provide benefits to the general public. Presently, all aspects of wildlife protection work are in their incipient phases, the establishment of basic facilities and institutional order is in a preliminary phase, dependence upon the (financial resources) of the forestry and fisheries bureaus alone will not meet the demands of developing this (new) field of work. All departments at all levels must support wildlife protection not only in terms of (committing) human and material resources, but also in terms of (raising capital) through the marketing of products. For this reason, enthusiasm (jijixing) toward wildlife protection must be awakened throughout society, funds for wildlife protection must be established. Insufficient funding can be remedied through the donations of society, the aid of international organizations, the allocation of public funds from departments at all levels, (the collection of) income from wildlife-related industries, wildlife fines and
capital gains taxes (bianjia kuan), in addition to a number of other methods. It is absolutely essential to solve the problem of severe funding shortage for wildlife protection, therefore, article 12 of "The (Wildlife) Protection Measures" stipulates that wildlife protection funds must be established.

(5) On Hunting Management Issues

There are already specific rules on the hunting of nationally protected wildlife in "Wildlife Protection Law" and its "Implementation Rules." This "Wildlife Protection Measures" (law) has specific rules concerning key protected animals and other animals pertaining to the following topics: hunting in no-hunting/trapping zones and in no-hunting/trapping seasons; the use of forbidden weapons or methods; and the establishment of legal hunting and/or fishing areas or spots.

Hunting of provincial key protected species must be in accord with conditions for application to hunt key species, and hunting permits are to be issued (only) by authorized provincial wildlife officials (author's note: the office for these permits is in the Fujian Provincial Forestry Bureau in Fuzhou). Permits to hunt other (non-key) species shall be issued by the provincial wildlife authorities on the basis of a yearly quota, licensing authority will go to county-level wildlife administration offices, but licenses may not exceed the provincial government's yearly limit.

The hunting/trapping of wildlife in forbidden zones, seasons, and with the use of forbidden methods is in principle forbidden (sic). (Exceptions may be made for hunting that has scientific value and/or for resource research and other special conditions). Article 15 of "Wildlife Protection Measures" addresses these issues specifically. Fujian
People's Government Announcement #69 (1987), states that no-hunting zones include: nature reserves, tourism areas, scenic areas, ancient landmarks, parks and cities/towns, mining areas, schools, government bureaus, military areas, national and collective forests, timber areas. Forbidden hunting/trapping implements and methods include: groundset crossbows, groundset guns, poison, explosive ("medicine"), "Yanwang's (the king of hell) pestle" (a rock crush trap), "jue hou jiao" (translation?) and using mechanized vehicles to chase game, night hunting with lights, encirclement hunting, fire (for game drives), smoke fumigant, pitfall traps, the collection of birds eggs, etc.

(6) On the Management of Enterprises that Utilize Wildlife

The utilization of wildlife for business purposes is a very broad and complex subject. The there are thousands of varieties (of species) that must be managed, it is a very specialized undertaking, presently there exist numerous problems in the field. In order to strengthen the management of wildlife utilization practices, section five of "Protection Measures" declares that for the utilization and processing of wildlife (and related products), a system of wildlife utilization enterprise permits should be implemented. At the same time, government wildlife agencies should get involved with the management process (that these enterprises are engaged in). In this way, the government bureaus' supervisory function will be enhanced, and (a system of) inspection will be implemented within the industry.
(7) On Punishments and Penalties for Violations of Wildlife Protection Laws

The most important aspect of the "Wildlife Protection Law" is its enactment of a system of penalties for dealing with violations of law (since the above legislation only addressed certain principles concerning punishment). To this end, "Protection Measures" has made use of legislation from Sichuan, Gansu, Hainan, Beijing, and other provinces and regions, building on the basis of the standards of punishment established in those areas, combining these with the practical realities of our own province, for practical use by law enforcement units.
APPENDIX B

NATIONAL LEGISLATION ON THE ESTABLISHMENT AND MANAGEMENT OF NATURE RESERVES IN CHINA

"The People' Republic of China Nature Reserve Regulations" Decree #167, October 9, 1994, to take effect on December 1, 1994.

Section I: General Principles

Articles:

1. To strengthen the establishment and management of nature reserves and protect the natural environment and natural resources, these regulations are enacted.

2. These regulations refer to nature reserves as those areas that have representative natural ecosystems, natural assemblages of rare and endangered species of plants and animals, are the terrestrial, terrestrial aquatic, or marine sites of natural historical features of special significance, that have been demarcated according to law and given special protected and managed territorial status.

3. All nature reserves within the territory of the People's Republic of China, or under its jurisdiction within its ocean territories, must respect these rules.

4. The country has adopted economic and technological policies and measures for the special benefit of developing nature reserves, (with the ultimate aim of) hastening the integration of the reserve system with economic and social development planning schemes.

5. The development and management of nature reserves includes the appropriate management of problems associated with local economic development and local people's production and living conditions.
6. Nature reserve management offices or their administrative boards can receive donations from domestic or foreign organizations or individuals, to be used for the establishment and operation of the recipient reserve(s).

7. People's government organs from the county level up should take a leading role in working on behalf of nature reserves. All work units and individuals must engage in the task of protecting the natural environments and resources within nature reserves. (Work units and individuals) also have the right to report and accuse individuals or work units that invade upon or destroy the natural environment or resources within nature reserves.

8. The nation shall implement a comprehensive management system that divides and coordinates management work among agencies. The State Council's environmental protection administrative departments assume comprehensive management of nature reserves throughout the country. The State Council's forestry, agriculture, mining, water conservation, maritime affairs, and other agencies must assume responsibility for all nature reserves within their respective (geographical and bureaucratic) realms of responsibility. Local people's government offices at the county level and above must assume responsibility for installing management offices for nature reserves, under the direction of provincial, autonomous region, and national municipality governments, according to specific local conditions.

9. There will be rewards from the people's government for work units and individuals for outstanding contributions toward the establishment and management of nature reserves.
nature reserves, and for outstanding scientific research on topics that are pertinent to nature reserves.

Section II: The Establishment of Nature Reserves

10. Nature reserves should be established in all (places) that meet the following criteria:

I. classical natural geographic features, representative natural ecosystems, or, in areas where human disturbance has been great, those places which, under protected management, could be restored to the same (implying representative local) ecosystems;

ii. areas with concentrated natural assemblages of rare endangered wild plants and animals;

iii. marine, coastal, island, wetland, terrestrial aquatic, forest, grassland, and desert areas of high value for protection;

iv. areas with high scientific and/or cultural value due to geological characteristics, famous caves or grottoes, areas with abundant fossils, glaciers, volcanoes, hot springs, and other natural features;

v. all other areas that have passed the approval of the National Assembly, provincial, autonomous region, national municipalities, as in need of special protection.

11. Nature reserves are classified as national-level nature reserves and local (difang) level nature reserves (among the latter are provincial level and county level nature reserves). National level nature reserves are thus classified on the basis of national and international significance, international scientific acclaim, or special scientific value.
Other reserves with significant ("classical") features or important scientific value are listed as local level nature reserves. These reserves can be managed at different levels, with specific procedures to be determined by the nature reserve administrative bodies of the National Assembly, provincial government, autonomous region, or national municipality, according to local conditions, after referral to the environmental branches of the National Assembly.

12. Applications for the establishment of national level nature reserves are to be submitted by the People's Government of the concerned province, autonomous region, national city, or by nature reserve administrative bodies within the national assembly. After assessment by the National Nature Reserve Evaluation Committee, the National Assembly's environmental protection offices proceed with coordination efforts, offer recommendations, and announce approval by the National Assembly.

Applications for local level nature reserves are to be submitted by the People's Government of the concerned county, autonomous region, municipality, or by environmental protection offices of the concerned provincial, prefecture, or national city. After assessment by a local level nature reserve evaluation committee, environmental protection offices of the People's Government in the concerned province (or region/locale) for coordination and additional suggestions. Approval is then reported to the People's Government at the aforementioned level. The case is then filed with the environmental protection agencies and nature reserve administration offices of the National Assembly.
Applications for establishment of reserves that span two or more administrative areas must be coordinated among the areas concerned and follow the above procedures for approval.

Maritime reserves must pass National Assembly approval.

13. Applications for the establishment of nature reserves must be in accord with regulations for listing applications in the Nature Reserve Application Book.

14. The areal extent and boundary lines of nature reserves will be determined by the People's Government office that approves establishment of the reserve. Demarcation must be made clear and will be subject to public announcement.

The delineation of reserve areas and boundary lines must be executed taking into consideration the attainment of protection (conservation/preservation) goals, moderation, local economic development, the productivity of local people, and their basic needs.

15. The termination of a nature reserve, and changes or adjustments in basic function, area, or boundary lines must pass the approval by the same People's Government office that approved its establishment.

No work unit or individual may move boundary markers without approval.

16. Nature reserves will be named using the following methods:

National-level nature reserves: the name of the location of the reserve will be followed by the words "national level nature reserve." Local-level nature reserves: the name of the location of the nature reserve will be followed by the words: local-level nature reserve (province, county, etc. - level). If there is a special feature or purpose for a particular reserve, then this may be reflected in the name, after the location.
17. The national assembly’s environmental protection administrative agencies should join with the national assembly's nature reserve agency, drafting a national plan for nature reserve development based on (their own) research into the natural environment and natural resources throughout the country. The plan is to be reviewed by the national assembly planning board for adjustment and then passed and implemented by the national assembly.

Nature reserve management organs or their administrative bureaus should form working groups to draft reserve establishment rules, and according to regulatory orders, enter them into national, local or (higher) bureaucratic investment planning for joint implementation.

18. Reserves can be divided into core areas (hexin qu), buffer zones (huanchong qu), and experimental areas (shiyuan qu). Areas within a reserve where intact natural ecosystems and/or assemblages of rare/endangered species of plants and animals continue to survive, should be designated as core areas. No person or work unit is to enter, and aside from those who have received permission under article 27 (below), no one is allowed to enter the core area for purposes of scientific research. Around the core area, a zone of a certain area can be designated as a buffer zone, where only scientific research and observation will be permitted.

Beyond the buffer zone can be the experimental area, where scientific experiments, education programs, visiting inspections, tourism and the taming of animals, the breeding of precious and endangered wildlife, and other such activities can be carried out.
If the People's Government organ that approves establishment of a reserve finds it necessary, an external protective zone (belt) of certain area can (also) be designated outside of the reserve.

Section III: The Management of Nature Reserves

19. National technical norms and standards for nature reserves will be jointly formulated by the environmental protection administrative management agencies and nature reserve management agencies of the national assembly.

The nature reserve administrative agencies of the national assembly, according to their responsibilities, will separately formulate standards for reserves of various levels, reporting the results to environmental protection organs of the national assembly.

20. Environmental agencies of the people's government at the county level and above have the power to conduct supervisory inspections of any reserve in their jurisdiction. Nature reserve management agencies at the county level and above have the same right. The work units under inspection should allow present the actual conditions that prevail within a given reserve and provide all necessary materials for inspection. Inspectors should protect their subject area's technical and professional (yewu) secrets.

21. National level nature reserves are to be managed by the nature reserve agencies of the people's government or of the national assembly in the province, autonomous region, or national city in which they are found. Local level nature reserves are to be managed by the nature reserve management organs of the local county or higher-level people's government.
The managing agencies should establish management organizations within the nature reserves staffed by specialized technicians who will deal with specific management problems.

22. The primary responsibilities of the reserve management staff are:

i. to implement the pertinent national laws, regulations, guiding principles, and policies related to nature reserve administration;

ii. to design all phases of a unified nature reserve management system;

iii. to research natural resources and establish records of these resources, organize environmental monitoring, and protect the natural environment and resources within the reserve;

iv. organize or coordinate (with other agencies) the development of scientific research activities within the nature reserve;

v. conduct education (and propaganda) campaigns for the nature reserve;

vi. organize visitation and tourism in the reserve, on the premise that it not in any way interfere with the natural environments and resources of the reserve.

23. Management of the financial needs of reserves must be carried out by people's government at provincial or higher levels of government in the area where the reserve is located. The nation will provide suitable subsidies for the management of national nature level reserves.

24. The public security organs of the region in which a reserve lies, may according to need, establish police substations within nature reserves to maintain public order.
25. Work units, residents, and permitted workers (living) within nature reserves must respect the management system of the reserve and must yield to management as executed by reserve management organs.

26. Tree felling, grazing, hunting, fishing, picking of medicinal herbs, land reclamation (opening of uncultivated land), burning (for land clearance), mining, rock collecting, sand extraction, and other such activities are forbidden unless otherwise permitted by other applicable laws.

27. It is forbidden for anyone to enter the core area or areas of a reserve. Anyone who must enter a core area to conduct scientific research, observation, or similar activities, is required to first apply to the management agency of the reserve for permission.

Permission must also be granted by the nature reserve management agencies at the provincial level or above, and for those who wish to conduct research in a national level nature reserve, permission must be granted by nature reserve agencies of the national assembly (author's note: this means the National Ministry of Forestry in Beijing).

Cases in which original residents of a core area must absolutely be moved out of the core area will be handled by the people's government in which the reserve is located, and residents will be resettled in an appropriate fashion.

28. Tourism and other commercial activities are forbidden in reserve buffer zones. If educational or research activities are to be conducted in buffer zones, including non-destructive research and standard specimen collecting activities, permission must first be
obtained from the reserve management through application, including the submission of an activity plan.

Work units and individuals pursuing the above activities within reserve buffer zones must submit a report of the results of the activity to the reserve management agency.

29. Proposals for tourism in the experimental zones of national level protected areas will be submitted by the reserve management body, and must pass the nature reserve management agency of the province autonomous region, or national city in which the reserve is located. Proposals are also to be filed with nature reserve management agencies of the national assembly. Visitation and tourism activities in the experimental zones of local level nature reserves will (also) be submitted by the reserve management agency and must pass approval by the reserve administration bodies of the provincial, autonomous region, or national city in which the reserve is located.

All visitation and tourism organized within reserves must engage only in the plans and management activities proposed. Work units and individuals engaged in visitation or tourism within a reserve must obey the management (regulations) of the reserve.

All visitation and tourism schemes inconsistent with reserve protection agendas are strictly prohibited.

30. Reserves in which internal zones have not been designated or delineated will be managed under the regulations pertaining to core areas and buffer zones as defined above.
31. Foreigners who wish to enter local level nature reserves must receive permission from nature reserve management agencies in the people's government of the province, autonomous region, or national city where the reserve is located. Requests for permission are to be filed by the host agency (the work unit with which the foreigner is affiliated). Permits for the entrance of foreigners into national level nature reserves should be requested from the nature reserve administrative bodies of the national assembly by the host unit.

Foreigners who enter nature reserves must respect all laws, rules, and regulations.

32. Within the core and buffer zones of a reserve, there should be no establishment of any production facilities. Within the experimental zones, there should be no establishment of any facilities that cause pollution or the destruction of natural resources or natural scenery. Other establishments should not surpass local and national standards of pollution emission. Pre-existing interests within reserve experimental zones that exceed local or national pollution emission standards must solve the problem in a timely fashion, and, in cases of damage, must implement corrective measures.

Projects established in the protected belt surrounding a nature reserve should not have adverse impacts on environmental quality within the reserve. Those projects that have caused such damage must implement timely corrective measures.

Timely corrective measures will be determined by the laws and the lawmaking organs (within whose jurisdiction the incident occurs). The party subjected to this ruling must complete the procedures for remediation on time.
33. Those work units or individuals who, because of accidents or other unexpected incidents, may cause pollution or other damage or potential damage to a nature reserve, must immediately adopt mitigation measures and report the incident to all work units and individuals who may be harmed. These incidents must also be promptly reported to the nature reserve and the local environmental protection and nature reserve management agencies and subjected to investigation.

Section IV: Legal Responsibilities

34. Offenders of the above regulations are categorized in the following groups, all of which will be subject to fines of between 100 (\$12.50 U.S. in 1995) and 5,000 (\$625.00) yuan, according to specific circumstances:

i. willful movement or destruction of nature reserve boundary markers;

ii. unauthorized entrance into a nature reserve or violation of a reserve management principle;

iii. failure to present a record of the results of activities under authorized entrance into a reserve buffer zone by a work unit or individual, such as for conducting scientific research, educational activities, or specimen collection (author's note: see article 28 above);

35. Those work units and/or individuals who violate the above regulations regarding tree felling, herding, hunting, fishing, medicinal herb collecting, land reclamation, burning, mining, rock collecting, sand extraction, and other activities, with the exception of those permitted to conduct such activities in a legal manner and exempt from fines under the applicable regulations, will have all goods thus obtained confiscated.
by a nature reserve management agency of the provincial (or a higher) people’s government, or any nature reserve management agency thus empowered. The illegal activity will be terminated, and offenders will be charged with the timely restoration of damaged resources or other just compensation, which may range from 300 to 10,000 yuan ($37.50 - $1,250).

36. Nature reserve administrative bodies that violate the above laws, who refuse to allow environmental protection bureaus or relevant nature reserve administrative bureaus to conduct supervisory examinations, or whose errors or violations are exposed during (routine) inspections, will be subject to fines by provincial level or higher environmental protection or nature reserve administration bureaus. The fines will range from 300 to 3,000 yuan ($37.50 - $375.00).

37. Violations by nature reserve management organizations are placed in the following categories and responsible persons, work units, or higher organs will be under orders from the nature reserve management organs of the provincial or higher level people’s government to make timely reparations:

i. the unauthorized development of visitation or tourism activities in a nature reserve;

ii. the operation of visitation or tourism activities in a manner inconsistent with the overall reserve program;

iii. the development of visitation or tourism activities in a manner inconsistent with existing schemes for such development.
38. Violators of the above laws, causing losses to a nature reserve, will be ordered by the nature reserve management agencies of the people's government to make necessary compensations.

39. Those who obstruct the execution of public duties by reserve management staff will be dealt with by public security under the "People's Republic of China Public Security Law Enforcement Measures," with fines, or in serious cases that constitute criminal offenses, criminal investigations will be conducted.

40. Offenses that result in disastrous pollution or other heavy destruction within a nature reserve and/or lead to large public or private losses of property, or life or limb, will constitute criminal offenses and the responsible culprit(s) will be subject to criminal investigation.

41. Reserve management staff who abuse their legal powers, are negligent or derelict in their duties, demonstrate partiality and irregular enforcement of regulations, if constituting a criminal offense will be subject to criminal investigation, and if of a less serious non-criminal nature, will be dealt with by the home work unit or a higher body.

Section V: Additional Regulations

42. The nature reserve management agencies of the national assembly can, on the basis of these laws, formulate management methods for various types of reserves.

43. The people's governments of all provinces, autonomous regions, and national cities, can on the basis of these laws, establish measures for implementation (of these laws).

44. These laws go into effect beginning on December 1, 1994.
APPENDIX C

IUCN CATEGORIES OF PROTECTED AREAS

(Devised by the International Union for the Conservation of Nature, 1994, in Stevens, 1997)

I. Strict Nature Reserve/Wilderness Area

Protected area managed mainly for science or wilderness protection.

Ia. Strict Nature Reserve. Area of land and/or sea possessing some outstanding representative ecosystems, geological or physiological features and/or species, protected primarily for scientific research and/or environmental monitoring.

Ib. Wilderness Area. Large area of unmodified or slightly modified land and/or sea, retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition.

II. National Park

Protected area managed mainly for ecosystem protection and recreation. Natural area of land and/or sea, designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area, and (c) provide a foundation for spiritual, scientific, educational, recreational, and visitor opportunities, all of which must be environmentally and culturally compatible.

III. Natural Monument

Protected area managed mainly for conservation of specific natural features. Area containing one, or more, specific natural or natural/cultural features of outstanding or
unique value because of its inherent rarity, representative or aesthetic qualities, or cultural significance.

IV. Habitat/Species Management Area

Protected area managed mainly for conservation through management intervention. Area of land and/or sea subject to active intervention for management purposes to ensure the maintenance of habitats and/or to meet the requirements of specific species.

V. Protected Landscapes and Seascapes

Protected area managed mainly for landscape/seascape conservation and recreation. Area of land, with coast and sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological, and/or cultural value, and often with high biological diversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance, and evolution of such an area.

VI. Managed Resource Protected Area

Protected area managed mainly for the sustainable use of natural ecosystems. Area containing predominately unmodified natural systems, managed to ensure long-term protection and maintenance of biological diversity, while providing a sustainable flow of natural products and services to meet community needs.
APPENDIX D

VILLAGE LAND USE SURVEY FORM

村名：(Village Name)

海拔高度：(Elevation) 家庭数量：(Number of Families)

主要姓：(Main Surname)

村龄：(Village Age)

1. 人口与劳动力量 (Population and Number of Laborers)

人口：(Population) 男：(Male) 女：(Female)

1990年: (1990 Population)

1980年代人口：(1980 Population)

1950年代人口：(1950 Population)


1994男/女劳动力：(Workforce Male/Female)


农业人口：(Agricultural Workforce)

农业人均收入：(Average Annual Farm Income Per Capita)

林业人口：(Forestry Workforce)

林业人均收入：(Average Annual Forestry Income Per Capita)

耕作农业与林业人口：(Number of Workers in Both Forestry and Agriculture)

主要村内其他工作：(Other Important Village Occupations)

村内其他职业人口：(Number of Workers Engaged in Other Village Occupations)

村内其他职业人均收入：(Average Annual Per Capita Income from Other Village Occupations [Earned By Those Engaged in Such Practices])
村外职业人均收入： (Average Annual Per Capita Income from Occupations Outside of Village)
村外职业人口： (Number of Workers Engaged in Occupations Outside of Village)
兼作村里外职业人口： (Number of People Engaged in Village and Outside Occupations)
只作村里外职业人口： (Number of People Engaged in Outside Occupations Only)
主要村里外职业： (Important Outside Occupations)

3. 本村移民记录 (Village Immigration Record)

第一次移民 (First Group of Immigrants [or Founders, if Village Established by Resident Lineage])
年代： (Generation Number)
原籍： ([Village, Town, City, or County of] Origin)
人口： (Population)
至今共几代： (Number of Generations to Present [From First Settlers or First Progenitor - Clarified by Interviewer])

第二次移民 (Second Group of Immigrants)
年代： (Generation Number)
原籍： ([Village, Town, City, or County of] Origin)
人口： (Population)
至今共几代： (Number of Generations to Present [From First Settlers or First Progenitor - Clarified by Interviewer])
4. 土地利用状况  (Land Use Conditions)

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1994年  (1994)  

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APPENDIX E

WILDLIFE HABITAT SURVEY FORM

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<td>(14)</td>
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<td>(25)</td>
<td>其他</td>
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<td>(27)</td>
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</table>
(1) Distance from Road
(2) Distance from Village
(3) Degree of Human Disturbance
    (Very little, Little, Great, Very Great)
(4) Time
(5) Location
(6) Topography and Site
(7) Altitude
(8) Slope and Aspect
(9) Vegetation Type
(10) Animal Species
    (11) Chinese (Reeve's Muntjac)
    (12) Common (Indian Muntjac)
    (13) Crested (Tufted) Deer
    (14) Serow
    (15) Wild Boar
    (16) Tracks
    (17) Scats
    (18) Feeding Signs
    (19) Scratches
    (20) Nesting/Denning/Bedding Signs
    (21) Bird Species
    (22) Gallinaceous Birds
    (23) Forest Species
    (24) Field Species
    (25) Other Species
    (26) Forest Species
    (27) Field Species
(28) Sightings
(29) Scratches
(30) Feathers
(31) Calls
APPENDIX F

HOUSEHOLD BAMBOO MANAGEMENT SURVEY FORM

1. How much income did your household earn from bamboo in 1994?

2. How many people are there in your household? How many of these count as bamboo workers? How many workers do you hire in a year (in recent years)?

3. What other economic activities did you pursue in 1994 and how much did you earn from this (these) activity(ies)?

4. How many mu of bamboo does your household have? In how many patches?

5. What is the approximate density of culms per mu in your densest patch?

6. How big are your largest and smallest patches?

7. Do you clear the underbrush in all of your patches? Approximately what percentage of your bamboo grove area has been cleared of underbrush? When will the remainder be cleared (if ever)?

8. Do you clear trees in all patches? If so, up to what size (approximate diameter at breast height)? When will the remaining trees be cut (if ever)?

9. How many times of year do you harvest bamboo and in what seasons?

10. What bamboo products do you produce for the market?
APPENDIX G
SURVEY OF HUNTING PRACTICES AND HUNTING HISTORY

Name_________________________Age_______Generation__________
Village______________In reserve? Y / N
How long have you been hunting?_________
Where (areas)?__________________________
What kinds of guns or other devices have you used and when?
What times of year do you hunt and why?
Do you hunt at night or in the day? What methods do use (dogs, lights)?
What animals do you hunt?
How many animals do you kill per year and in what terrain?

<table>
<thead>
<tr>
<th>Species</th>
<th>Number</th>
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Which animals do you eat or use yourself?
Do you sell animal parts or specimens? Which parts of which species? To whom?

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How many hunters do you know locally? ____________

How many hunters are there in this village? ____________

How many generations of your family have hunted? _________

What methods did your ancestors use and which species did they hunt?

Did they burn incense or give offerings to insure successful hunts, or did they believe local earth gods could help or hinder the hunt? Do you have similar beliefs?

Did your elders believe that any animals had magical or extraordinary powers or significance? Do you share these beliefs?

Have animal populations decreased in your memory? Which species?

What has caused the decrease?

Do you believe hunting should be regulated as to bag limits, seasons, hunting licenses, or other regulations?

Other comments:
APPENDIX H

FENGSHUILIN (GEOMANTIC FOREST) SURVEY

1. Basic Situation

Village name__________________ UTM location______________

Age_________ Elevation___________

Predominant family(ies)______________________________

Population________

2. Settlement History

Origins of settlers______________________________

Number of generations to the present_________________

3. Forest and Tree Size

Diameter N-S______ paces______ m tudigong Y/N

Diameter E-W______ paces______ m Dir. from Vill._________

DBH of 3 largest trees 1______cm 2______cm 3______cm

Estimated age of largest trees________

4. Relief:

i. plain (<10m Rel.)_____ low hill (100m)_____ hill (150-200m)_____ 
   small mountain (400-1,000m)_____ mountain (1,000-1,800m)______

ii. summit_____ slope______ piedmont_______ ravine____

iii. aspect_____

5. Local Knowledge of Forest

Age________

Plantings Y/N Describe________________________________

Maintenance Y/N Describe________________________________

Directional significance/purpose (local fengshui):

Activities observed:
Tudigong & other observations:

History of disturbance:

5. Composition

<table>
<thead>
<tr>
<th>Broadleaved Evergreen Taxa</th>
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<tr>
<th>Ferns and Flowers:</th>
<th># in Transects</th>
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VITA

Chris Coggins was born in Tampa, Florida on March 21, 1963. He grew up in Gainesville, Florida and spent much of his childhood canoeing and swimming on the Suwanee River. After graduating from P.K. Yonge Laboratory School, in 1981, he attended Wesleyan University in Middletown, Connecticut. His undergraduate course work included a semester in the Duke University Study in China Program. After graduating with a bachelor of arts degree in East Asian Studies, in 1985, he and his wife-to-be, Tanya Kalischer, moved to Taiwan to teach English and to study Chinese and Taijiquan (the martial art). While based in Taiwan, he travelled in Mainland China and Southeast Asia. Returning to the United States in 1987, he enrolled in a series of courses on biology and environmental studies. In 1989, he married Tanya Kalischer and enrolled in the graduate program in Geography at Louisiana State University. He earned his master of science degree in Geography in 1991, and began his doctoral course work. In 1992-93, he made his first research trip to China. In 1993, his wife gave birth to their son, Aaron. In 1994-1995, he and his family lived in the Meihuashan Nature Reserve, in Fujian province, China, where he conducted field research for his dissertation. Since autumn of 1995, he and his family have resided in the Berkshire Mountains of western Massachusetts, where he has taught Geography and Asian Studies at Simon’s Rock College of Bard.
DOCTORAL EXAMINATION AND DISSERTATION REPORT

Candidate: Christopher R. Coggins

Major Field: Geography


Approved:

[Signatures]

Co-chair

Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

[Signatures]

Co-chair

Date of Examination:

10/27/97

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