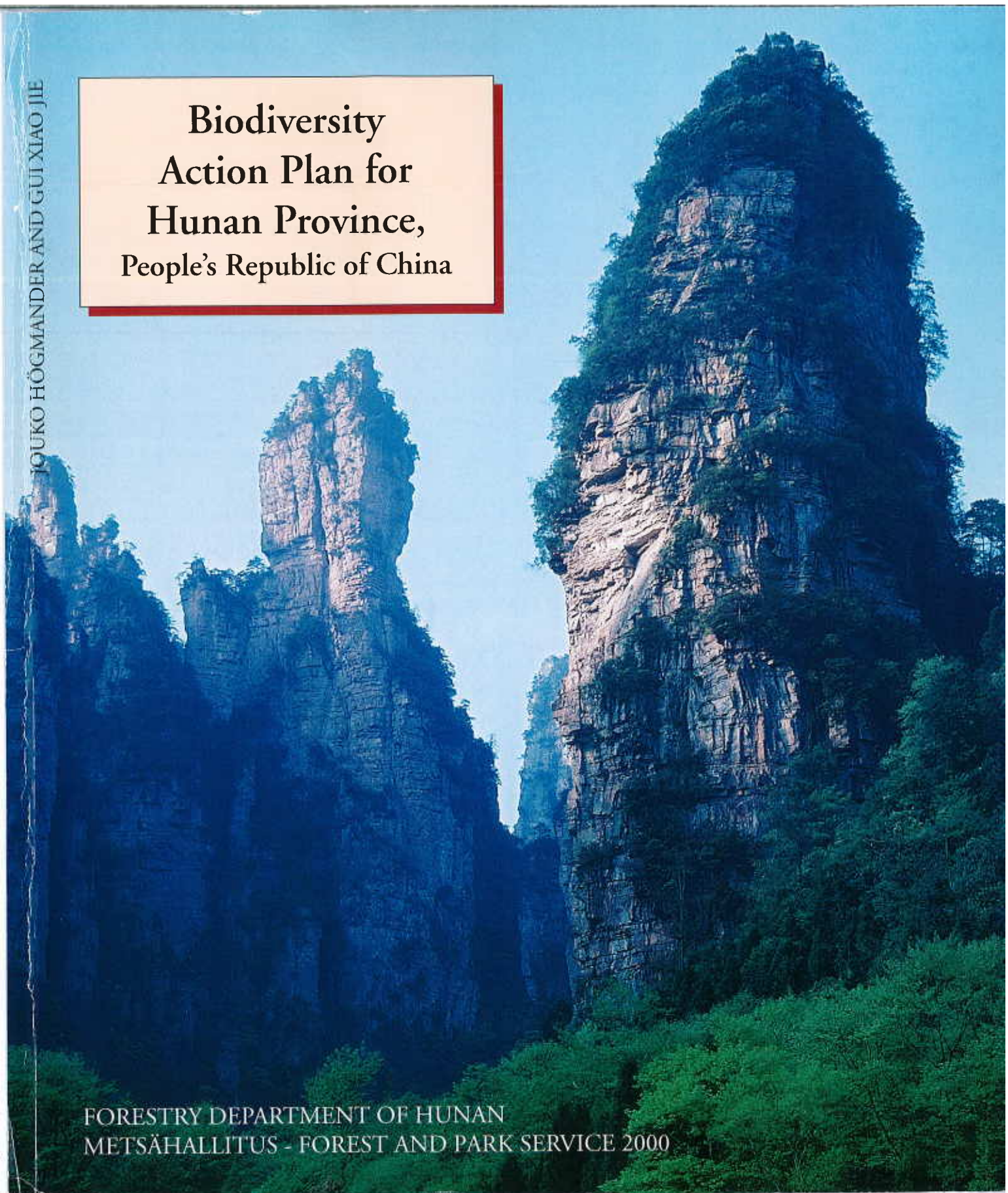


JOUKO HÖGMÄNDER AND GUI XIAO JIE

**Biodiversity  
Action Plan for  
Hunan Province,  
People's Republic of China**

FORESTRY DEPARTMENT OF HUNAN  
METSÄHALLITUS - FOREST AND PARK SERVICE 2000



JOUKO HÖGMANDER AND GUI XIAO JIE

**Biodiversity  
Action Plan for  
Hunan Province,  
People's Republic of China**

FORESTRY DEPARTMENT OF HUNAN  
METSÄHALLITUS - FOREST AND PARK SERVICE  
2000

Forest and Park Service  
Natural Heritage Services  
B.O. Box 94  
FIN 01301 Vantaa  
<http://www.metsa.fi>

Forestry Department of Hunan Province  
39 Nan Da Road  
410007 Changsha  
Hunan Province  
People's Republic of China

Front cover: Pillar mountains in Zhang Jia Jie national forest park.  
Photos: Jouko Högmander  
Gui Xiao Jie (pages 35, 50, 100)  
Drawings: Jari Kostet  
Map on page 6: Hannu Sipinen  
Design: Oy Edita Ab

ISBN 952-446-206-0

Printer: Oy Edita Ab



# TABLE OF CONTENTS

Preface	5
1 Introduction	7
1.1 Background to the Project	7
1.2 Objectives of the Planning Process	8
2 What is Biodiversity?	9
2.1 Why to Conserve Biodiversity and Why to Use It in a Sustainable Way?	10
3 Present Status of Biological Diversity in Hunan	11
3.1 Characteristics of Hunan	11
3.2 Main Ecosystems in Hunan	12
3.3 Current Land Use in the Province	13
3.4 Forests	13
3.5 Wetlands and Aquatic Ecosystems	19
3.6 Agricultural Land	22
3.7 Ecotourism	22
3.8 Other Ways to Use Natural Resources	26
3.9 What Hunan Can Contribute to Global and Chinese Biodiversity	26
4 Biodiversity Conservation in Hunan	27
4.1 Ecosystems	27
4.1.1 Threatened Ecosystems	27
4.2 Species	28
4.2.1 Plants	28
4.2.2 Mammals	34
4.2.3 Birds	37
4.2.4 Reptiles	39
4.2.5 Amphibians	40
4.2.6 Fish	41
4.3 Genes	42
4.3.1 Ex-situ Conservation of Species	42
4.3.2 Genetic Variation of Cultivated Plants and Domestic Animals	43
4.3.3 Cultivated Plants	44
4.3.4 Domestic Animals	45
4.4 Protected Areas	47
4.4.1 Nature Reserves	47
4.4.2 Forest parks	49
4.5 The Use of Biodiversity for Research and Tourism	51
4.5.1 The Role of Scientific Research in Biodiversity Conservation	51
4.5.2 The Role of Tourism in the Use of Nature Reserves and Other Valuable Areas	51
5 Economic Use and Value of Biodiversity	53
5.1 Current Use and Value of Natural Products	53

5.1.1 Medicines	53
5.1.2 Natural Products as Food	53
5.1.3 Agriculture and Forestry	55
5.1.4 Fisheries	55
5.1.5 Industrial Processing	55
5.1.6 Aesthetic and Tourist Uses	56
5.2 Potential Uses and Value	56
5.2.1 Domestication	56
5.2.2 Biomonitoring	57
5.2.3 Breeding resources	57
5.2.4 Medicinal exploitation	57
6 Institutional Framework	58
6.1 Relevant National Legislation	58
6.2 Relevant Provincial Legislation	58
6.2.1 Relevance of Legislation	58
6.3 Central Governmental Institutions and Functions Related to Biodiversity Conservation	59
6.4 Hunan Provincial Institutions and Their Functions	60
6.5 Economic Instruments	60
6.6 Educational System	61
6.7 Training of Personnel	61
6.8 International Co-operation	61
7 Assessment of Current State of Biodiversity Conservation in Hunan	63
7.1 Achievements and Threats	63
8 Overall objectives	65
9 Strategy for Preserving and Improving Biological Diversity in Hunan	67
10 Implementation of this Action Plan	71
10.1 Working Schedule and Budget	71
10.2 Monitoring and Evaluation	73
11 References	74
12 Annexes	76
12.1 List of Priority in Hunan	76
12.2 List of Priority Plant Species in Hunan	76
12.3 List of Priority Wildlife in Hunan	83
12.4 Selected Project Profiles	89
12.5 Brief Presentation of the Protected Areas of Hunan	91
12.6 IUCN Categories for Protected Areas	101
12.7 Ten Principles for Ecotourism	102
12.8 Administrative Map of Hunan Province	105
12.9 Population Density	106
12.10 Protected Areas in Hunan Province	107
12.11 Protected Areas in Hunan Province	108

## Preface

This Biodiversity Action Plan has been created as part of Sino-Finnish co-operation, supported during 1995-1998 by Europarc, the Federation of Nature and National Parks of Europe. Metsähallitus (the Finnish Forest and Park Service) and the Forestry Department of Hunan province have collaborated to develop the quality of nature conservation work in Hunan.

The Biodiversity Action Plan was initiated in March 1996 on a visit to Hunan. In April 1997 a seminar on Biodiversity Conservation was held in Changsha, the capital of Hunan. Almost 100 participants from the field organisation and administration of the Forestry Department, other environmental agencies, the Ministry of Forestry as well as from many universities and research institutes attended the seminar. Altogether 34 presentations were made and the Action Plan received wide support from the participants. The Proceedings of the presentations were compiled in English, but are so far unpublished. Large amounts of information from the seminar has been utilised in this Action Plan.

Work on this Action Plan did not advance free of problems and obstacles. There is not enough knowledge available about nature and the use of natural resources in Hunan to produce a comprehensive report. Different sources sometimes gave conflicting information, and only a fraction of the existing knowledge can be read in English. However, these problems were known in advance, and one of the ideas behind this plan was to produce more information for both foreign and Chinese administrators, scientists and nature enthusiasts. It is hoped also to here demonstrate how to bring the recommendations of the Rio de Janeiro Convention and the Chinese National Action Plan (Biodiversity Conservation Action Plan for the People's Republic of China, 1994) closer to grassroots level.

In spite of many gaps and the thin layer of knowl-

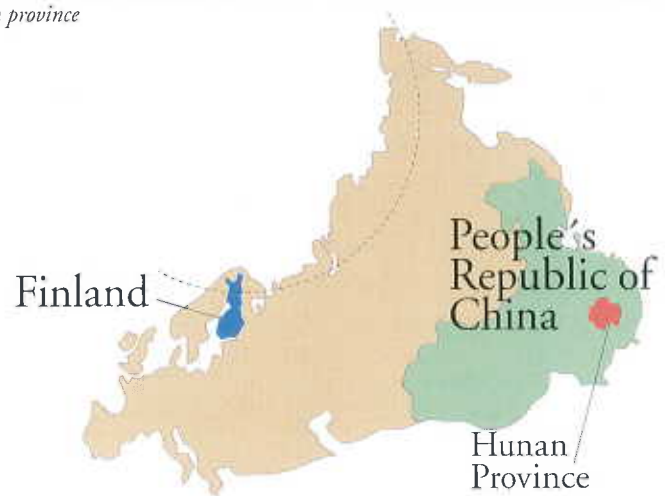
edge, the authors are convinced that the Biodiversity Action Plan of Hunan will fulfil its main goals.

The authors are aware of the defects of this plan. However, it should be seen as a first comprehensive inventory and action plan for Hunan, of great importance in engaging all the authorities dealing with natural resources to develop its procedures further. Our knowledge of the main subjects will be improved during the implementation. Hopefully this first Biodiversity Action Plan will generate ideas for gathering more information and statistics for the next version due in about five years. In that time some of the activities initiated in this plan will have already lead to results and the experience gained utilised to favour biodiversity.

The Forestry Department of Hunan and its officials have worked admirably to gather all the information used in this report. The plan itself has been compiled through the cooperation of Jouko Högmander, who wrote chapters 1-4.3.1, 4.4-4.5, 7-9 and 11-12, Gui Xiao Jie (chapters 6 and 10), and Rao Pengcheng (chapters 4.3.2-4.3.4 and 5). The authors received both foreign and domestic assistance during this work. Mr. Ge Han Dong, Director-General of the Forestry Department of Hunan Province and Dr. Rauno Väisänen, Director of the Natural Heritage Services of Metsähallitus (Forest and Park Service of Finland) gave comments and encouragement, Mr. Zhang Jian, Director of the Wildlife and Forest Protection Bureau, Mr. Wang Ming Xue, Chief of the Forest and Plant Protection Bureau, Dr. Lei Guang Chun and Mr. Rao Peng Cheng provided valuable information and comments on the manuscript, as did Dr. Wei Mei Cai, professor Yang Dao De and professor Liu Ke Wang from the South Central Forestry College, and professor Deng Xue Jian and professor Wang Bin from the Hunan Normal University. Mr. Wang Ming Xue has also translated parts of the Action Plan into Chinese. The authors express their warmest thanks to everyone who supported this work.



*Changsha, with its 1,7 million inhabitants, is the capital of Hunan province*



# 1 Introduction

## 1.1 Background to the Project

In June 1992 a total of 153 states signed the Convention on Biological Diversity at the United Nations Conference on Environment and Development in Rio de Janeiro. Since then some other states have also signed or acceded to the Convention, making it one of the most widely supported international agreements ever. The Convention came into force on 29 December 1993 and, with its broad approach, has the potential to play a co-ordinating and leading role in international nature conservation efforts.

The objectives of the Biodiversity Convention are 'the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources'. The Convention sets out a number of guiding principles for the conservation and use of biological diversity, including provisions on the establishment of protected areas, the development of methods to ensure the sustainable use of biological resources, the environmental responsibility of different sectors of society, and for education and research. It recognises that states have sovereign rights over their own genetic resources, and makes recommendations concerning financial support for the efforts of developing countries to implement the Convention. The Convention calls on states to develop national action plans or programmes for the conservation and use of biodiversity. Its structure is nevertheless sufficiently flexible to allow each country to design its own policies in this area.

China was among the earliest contracting countries to the Convention, and has now undertaken her obligations in conserving biodiversity in the country. Actually, the huge task of studying the situation of Chinese biodi-

versity started already in 1991 in co-operation between Chinese scientists and authorities and several international bodies. During the last few years many reports have been published by different branches of China's administration in order to promote conservation of biodiversity. Three reports stand out: Biodiversity Conservation Action Plan for China (1994), Review of China's Biodiversity - a Conservation Action Plan (1995), and Forestry Action Plan for China's Agenda 21 (1995). A complete list of references used in this work is presented in Chapter 11. This action plan follows the guidelines and recommendations of the above three plans.

With its ca. 63 million inhabitants, Hunan is by Chinese standards a medium-sized province situated in the south-central part of the country. Among the 32 Chinese provinces the nature of Hunan has some highly appreciated features such as numerous endangered animals and plants and precious ecosystems, especially in the subtropical mountains and on the lakes connected with the Yangtze River. Even today forests cover half the province.

Co-operation between the Finnish nature conservation authorities and the Forest Department of Hunan was initiated in the late 1980s. Connections between the Finnish Forest and Park Service and the Forestry Department of Hunan also developed and led to an agreement being signed in 1995. This concerned co-operation between the protected area systems of Hunan and Finland, and was included in the Partnership and Exchange Programme, 'Technical Co-operation between Protected Areas in Europe, Asia and Latin America', run by the Federation of Nature and National Parks of Europe (FNNPE), with financial support from the European Union (Bruggemann 1999). The Biodiversity Action Plan for the province of Hunan is a result of this co-operation.



## 1.2 Objectives for the Planning Process

This Action Plan was initiated in 1996. Hunan was the first province to start this kind of work in China: the planning process combines the Hunan citizens' expertise on the nature, people and administration of their own province and Finnish experience in biodiversity conservation.

From the beginning there were two main goals on which the Action Plan focused: firstly, to maintain and improve human welfare and local livelihood in the countryside, and secondly to recognise that in the long run this is possible only if the use of natural resources is sustainable and if some tangible results can be achieved in the conservation of local biodiversity. In these processes the Action Plan can be characterised as

- a tool in waking up the people and administration to realise the irrecoverable values Hunan province has in its nature, and an assessment of the current condition of biodiversity in the region.
- a package of information covering a territory where the nature and state of biodiversity so far has been poorly known to both national and international forums.
- a populariser of scientific information which will encourage scientists to fill gaps and thicken the current thin layers of information through active fieldwork and publishing of earlier studies in international series
- a basis for a provincial program and co-operation between different stakeholders for improving the state of nature in the region.
- a fundraising document, useful in planning projects for developing sustainable development and conservation of biodiversity

The planning process started with collecting information. The first draft was considered at a comprehensive seminar in Changsha on 15-17 April 1997 where almost a hundred experts from different parts of the province and different branches of environmental interests participated. The aims of the seminar were 1) to present this project thoroughly to the nature conservation officers, other environmental officers and scientists of the province, 2) to get feedback and complementary material from these experts, and 3) to convince all experts about the ways this Action Plan can improve biodiversity and thus to get them behind the implementation process.

The Action Plan was completed in the beginning of 2000. Its successful implementation will be possible only if the proposals are realistic and can be included in other development strategies of Hunan province. Funding, native as well as foreign, will be needed.

There are not many proposals in this plan which could rapidly improve the state of nature or biodiversity. Many of the proposals in Chapter 9 aim at obtaining more information about the province's nature and its diversity. In some subjects there is already enough knowledge for drawing up plans in order to improve conservation and more sustainable use; it is warmly recommended that these plans be compiled in co-operation between all the relevant authorities. Any clear improvement in the field will not be realised before such plans have been accomplished.

The Biodiversity Action Plan can be seen as a tool which needs to be sharpened regularly – in five years it will certainly need reviewing. Experience gained from the practical problems encountered in implementation will be useful when drawing up a revised Action Plan.

## 2 What is Biodiversity?

**B**iodiversity has become a commonly used concept since June 1992, when most of the nations of the world signed the Convention on Biological Diversity in Rio de Janeiro. But what is the content and significance of this concept?

Biodiversity refers to all the earth's living organisms, the range of species of plants, animals and invertebrate life, their genetic makeup, and the ecosystems of which they are integral parts. It is generally understood that there are three main components of biodiversity: ecosystems, species and genetic diversity. Besides these it is important that nature's natural processes and functions work well as entities.

It is essential to study all components of biodiversity in the field, in this case in the province of Hunan. Some are fairly easily recognised, and there is a lot of material about some components of the province's biodiversity. However, most of the components are not very well known in any country of the world: the state of biodiversity is often hard to estimate or measure, even for well-known components such as birds or the number of distinct ecosystems in a region.

The diversity of *ecosystems* in a province can be expressed as a list of different natural and semi-natural ecosystem types together with their areas. For example, the present number, types and areas of subtropical forest ecosystems can be compared, if known, with the original ecosystems known to have been present or with the ecosystems known in the neighbouring province or within the same ecogeographical zone. These are clear enough concepts for an expert. In contrast, the state of an ecosystem is far from easy to determine. Regardless of these conceptual problems, the biodiversity of ecosystems is an extremely important indicator, because only well preserved ecosystems offer the premise of the appearance of other

parts of biodiversity, species and genetic variance.

Since the time of the first explorers a few features of flora and fauna have repeatedly been used to describe interesting or precious places. If opportunities existed to carry out surveys, lists or even the number of *species* are very informative to an expert. Thus there are lists of vascular plants, mammals, or birds from some nature reserves in Hunan which quantify well the province's biological richness, even for a foreigner. Over the years species information will usually be complemented and expanded to less known taxonomic groups. Some species are known as excellent indicators of the state of the ecosystem and are therefore often objects for monitoring. For example, some lichens decline or disappear when the air becomes polluted with sulphur compounds, just as some intolerant fish species will when their habitat becomes too eutrophic. Conversely, other species of lichens or fish may replace receding ones.

The number of endangered species in some particular area often appropriately indicates its conservation value provided the area is fairly well known. There exists a Chinese Red Book - a list of endangered plants and vertebrates - that is at the same time a list of Priority Species for the country made at the Biodiversity Conservation Action Plan Workshop in 1992 (Biodiversity Conservation Action Plan for China, 1994). There is also a list of protected species in the Wildlife Protection Law (1988). These lists were made in order to describe the situation in a vast country and this report is based on them. They give some guidelines for consideration even at a provincial level. It is clear that one of the most urgent things for biodiversity conservation is to focus on these species, above all to learn to know them and to guarantee them suitable environmental conditions. When a list of endangered species becomes available for Hunan, a lot of the atten-

tion in scientific work, management and conservation will be addressed specifically to it. By safeguarding the most vulnerable species from extinction the impoverishment of nature can be prevented or at least slowed down.

Perhaps the broadest field in biodiversity is genetic diversity. It extends from nature to domestic animals, crops, and the tiniest microbes, for example those used in preparing many foodstuffs such as cheese or wine. Preserving genetic resources, also those not currently utilised, is vital for the continued sustainable use of renewable natural resources.

Species diversity is the richness of animals, plants and micro-organisms that form the basis for human survival and development. Species resources are the objects of production activities in agriculture, forestry, animal husbandry, fisheries, and their subsidiary industries, providing essential sustenance for mankind. With the continuing development of the medical and pharmaceutical sciences, more and more new biological substances of value are being discovered from wild species.

## 2.1 Why to Conserve Biodiversity and Why to Use It in a Sustainable Way?

Biodiversity is valuable from many different points of view. The Biodiversity Convention highlights the ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic values of biological diversity and its components.

At least four general arguments justify the conservation and sustainable use of biodiversity. Firstly, biodiversity is of a fundamental importance in that, to a large extent, it is a prior condition for *life-sustaining* processes and the functioning of ecosystems. All of the millions of species existing today play a part in maintaining the environmental conditions on which both we and they themselves depend. While these conditions could well be sustained by fewer species, we do not know how far the earth's flora and fauna can be impoverished without risk of un-

favourable, perhaps life-threatening, environmental changes. In addition, we have an inadequate understanding of which species perform such important ecological functions that their loss would disrupt key ecological processes or affect the survival of many other species. Biodiversity is thus essential to properly functioning ecosystems capable of producing the resources on which we human beings depend. Ultimately the maintenance of biological diversity is essential to the survival of both humankind and other forms of life.

Secondly, *the practical values* of biodiversity are evident in many different spheres. We use biological resources in a variety of ways, for instance as food. The plant and animal kingdoms also supply us with raw materials, in the form of genes and substances, and we use them for a range of industrial purposes including the production of medicines. The turnover of the economic sectors in question is enormous. We do not know at present which species or genes will prove useful in the future, but with every species lost we are losing forever an opportunity to draw on nature's rich variety, and with it a potential resource.

Thirdly, *aesthetic values* are also important. Access to a varied natural environment is a basic human need. The aesthetic side of biodiversity is not just a matter of being able to enjoy the beauty of exotic places, but has to do with far deeper-seated needs and functions. In many cases, this aesthetic dimension also provides the basis for economic sectors such as tourism and recreation. For example the scenic beauty of the Zhang Jia Jie National Forest in Hunan has today, and will certainly still more in future have great importance for the development of tourism in the whole province, but only if tourism is developed in a sustainable way.

Fourthly, maintaining biological diversity is an *ethical question*. It would be a shame if species that are a natural feature of the Chinese countryside were to disappear as a result of human activities. We should have failed to pass on to our descendants something entrusted to us by earlier generations.

## 3 Present Status of Biological Diversity in Hunan

**H**unan is located in the subtropical part of south-central China, where unique geographical and natural conditions provide diverse habitats for wildlife. The area is rich in biodiversity and natural resources. The entire province can be described in four landscape types as mountain forest, hill forest, agricultural land, and wetlands. The forest ecosystems belong to evergreen broad-leaved and coniferous forest types. According to reports from scientists, 4324 vascular plant species have been recorded belonging to 248 families and 1245 genera. Correspondingly recorded are 820 species of vertebrates, 392 birds, 89 mammals, 59 amphibians, 87 reptiles and 194 fish. These biological resources are not only important parts of the ecosystem, but are also valuable resources for forestry, agriculture, animal husbandry, fisheries, the medicine industry, ecotourism, etc.

The importance of forests and waters in Hunan can be illustrated with a few figures. The annual turnover of the forest industry is about 14,0 billion yuan from timber production; the volume of fish harvested is 0,98 million tons worth 7,0 billion yuan. It is estimated that in the late 1990s at least 6,5 million tourists visited the province's forest parks and nature reserves grossing a revenue from ecotourism of 5 billion yuan (Ge 1999).

### 3.1 Characteristics of Hunan

Hunan, whose name literally means 'lake-south', is so called because much of its land area is situated south of Lake Dong Ting, the second largest lake in China. The province covers an area of 211 829 sq. km between 24°38'-30°08'N and 108°47'-114°15'E, south of the middle reaches of the Yangtze river.

The population of the province has almost doubled since 1949 and reached 63 million in 1995. The capital

of the province is Changsha with 1,7 million inhabitants. The average population density in Hunan is 297 inhabitants per square kilometre.

The province is a hilly basin surrounded by hills and low mountains on all sides, except in the north where part of the extensive Dong Ting Hu Plain is situated. The Wu Ling mountain range is in the north-west, the Xue Feng Mountain Range in the south-west and the Nan Ling Mountain Range to the south. The Mufu, Lian Yun, Wu Gong and Jiu Ling mountainous regions are located on the eastern side of the province. Most of the mountains are between 500 m and 1500 m, with a few peaks of over 2000 m. About half of the province (51%) is regarded as mountainous, with the rest classified as plains (13%), undulating terrain (14%), and hills (15%).

The river Yangtze Jiang intrudes slightly into the northernmost part of the province. The longest rivers in Hunan are the Yun Sui (1033 km) and the Xiang Jiang (856 km). Along the Xiang Jiang river, which flows into Lake Dong Ting from the south, is the Xiang Jiang plain, which consists of low hills, valleys and a series of red-rock basins. With a decrease in elevation from south to north, the layer of red earth covering the basins becomes thicker until it meets alluvial soil. Red earth (36%), heavy, clayey and acidic, dominates the hills, while paddy soil (19%) is more typical of valleys. Acidic yellow earth (15%), purple earth (6%) and lime soil (7%) of neutral alkalinity also occur.

The climate is subtropical monsoon characterised by a strong continental influence and contrasting seasons. The mean annual temperature lies between 16°C and 18°C and the total amount of sunshine is 1300-1800 hours annually. The mean temperature for the coldest and hottest months are 3-8°C and 28-30°C respectively. Annual total rainfall ranges between 1200 mm and 1800 mm, half of which is



*Chinese hosts and their Finnish guests in the Zhang Jia Jie forest park.*

obtained from April to June, leading to serious floods. In contrast, droughts strike the province in late summer and autumn.

The original vegetation type is broad-leaved evergreen forest, with its upper limit at 1200-1400 m in the south and 500-800 in the north. Characterised by species from Fagaceae, Magnoliaceae, Styraceae, Lauraceae and Theaceae, these forests are now limited to the mountainous areas in the south-east, south and south-west parts of the province.

In place of the once profuse primary forests are today mostly Horsetail Pine (*Pinus massoniana*) and Chinese Fir (*Cunninghamia lanceolata*) forests. These occur on low hills below 800 m, with scrublands of *Rhododendron simsii*, *Vaccinium bracteatum*, *Loropetalum chinense*, *Eurya nitida* and *Quercus fabri* in red basins or spiny thickets on limestone ground.

The whole province is classified as belonging to biome 01 of "Chinese Subtropical Forests" (Udvardy 1975, 1984). In the latest divisions made for assessment of biodiversity (MacKinnon *et al.* 1996) the province is divided by the river Xiang Jiang into "the Gui Zhou Plateau" subunit (01a) in the west and "the Southeast coastal" subunit (01c) in the east.

### 3.2 Main Ecosystems in Hunan

Humans have occupied the area for at least 6000 years. Civilisation has gradually spread out, rising from the fertile riversides towards the hills and mountains. Agriculture has always been the dominating means of livelihood here. This means that over millennia peasants have claimed new fields by slashing and burning broad-leaved evergreen forest, the original vegetation type. By the end of the 20th century the changes in the environment have been huge. An appraisal of how the main natural habitats of Hunan have fared is given in table 1.

The loss of original habitats is high in Hunan, as in most Chinese provinces. The overall loss of natural habitats as presented here is 66%, with about 82% of the original forest cover estimated as destroyed by 1992. Howev-

er, MacKinnon *et al.* (1996) have most probably overestimated the size of protected areas in their report. Even accounting for some recently established nature reserves and forest parks in the province, their total coverage is only 3,4% (not 7,5%) of the area (see chapters 4.4.1 and 4.4.2). The areas of remaining forests and wetlands are not entirely consistent with information from the Forestry Department of Hunan.

Through investments in afforestation the region's coniferous forests have been gaining land from broad-leaved forests. Where seeding of trees or forest cultivation has not been as successful scrub of different kinds have taken over.

### 3.3 Current Land Use in the Province

The extremely effective land use in Hunan today is striking. Forestry and agriculture have taken most of the land area, but a breakdown of livelihoods shows use of both natural and man made habitats (table 2).

### 3.4 Forests

The land area of Hunan is only 2.2% of the total area of China, but holds at least 6.6% of the country's forests. Today, forests cover more than half the land area of the

Table 2. Share of natural and man made habitats in the land use of Hunan in 1997 (statistics from the Forestry Department of Hunan, 1999).

Type of land use	Area, sq. km	Area, %
Forest	109 000	51,7
Farmland	41 000	19,4
Unused land	25 000	11,9
Water	15 000	6,9
Pasture	9 000	4,1
Cities and enterprises	8 000	3,8
Resort areas	3 000	1,3
Road network	2 000	0,8
Total	212 000	99,9

Table 1. The status of the main original wildlife habitats in the province of Hunan in 1992 according to MacKinnon *et. al.* (1996).

Habitat	Original area of habitat in Hunan	Remaining		Remaining of the whole province area	Protected of the remaining	
	Sq. km	Sq. km	%	%	Sq. km	%
Cultivations		29 580			752	
Freshwater lakes	3 687	3 381	92	1,6	2 748	74,5
Riverine habitat	2 099	2 099	100	1,0	87	4,1
Deciduous/evergreen broad-leaved forest	55 506	1 697	3	0,8	1 569	2,8
Subtropical evergreen broad-leaved forest	103 070	3 456	3	1,6	3 491	3,4
Subtropical coniferous forest	16 372	28 061	171	13,2	2 590	15,8
Subtropical broad-leaved scrub	10 430	25 215	242	11,9	2 195	21
Subtropical limestone scrub	21 093	9 254	44	4,4	2 445	11,6
Total	212 257	102 743		48,4	15 877	7,5

province (see table 3 below). The importance of forests has led local government to pay high attention to developing forestry and forest industries in the province. The Forestry Department has the responsibility for the use and protection of the forests.

A nationwide campaign is being carried out in China to afforest bare mountains and hills. In 1993 all the hills suitable for growing forest in Hunan were already planted and the target was to have the province's planting allocation fulfilled by 1998. The major plantations are of Horsetail Pine (*P. massoniana*) and Chinese Fir (*C. lanceolata*), with a small proportion of bamboo and other economically useful trees or shrubs. There are also other projects on afforestation and utilisation of forest resources, some of the largest being 'Yangtze River Defence Forest', an afforestation project supported by the World Bank, The Garden Forestry Project, 'Exploitation of Mountains', The Higher Profits Forestry Project, and protection of forests as nature reserves. On a provincial level forestry has developed fairly well and, coming towards the end of the afforestation campaign, Hunan is the third in forest area among all provinces.

Most of the forests are in mountains: almost 90% of the forests are in areas which can be characterised as mountainous but these hold only 20% of the timber

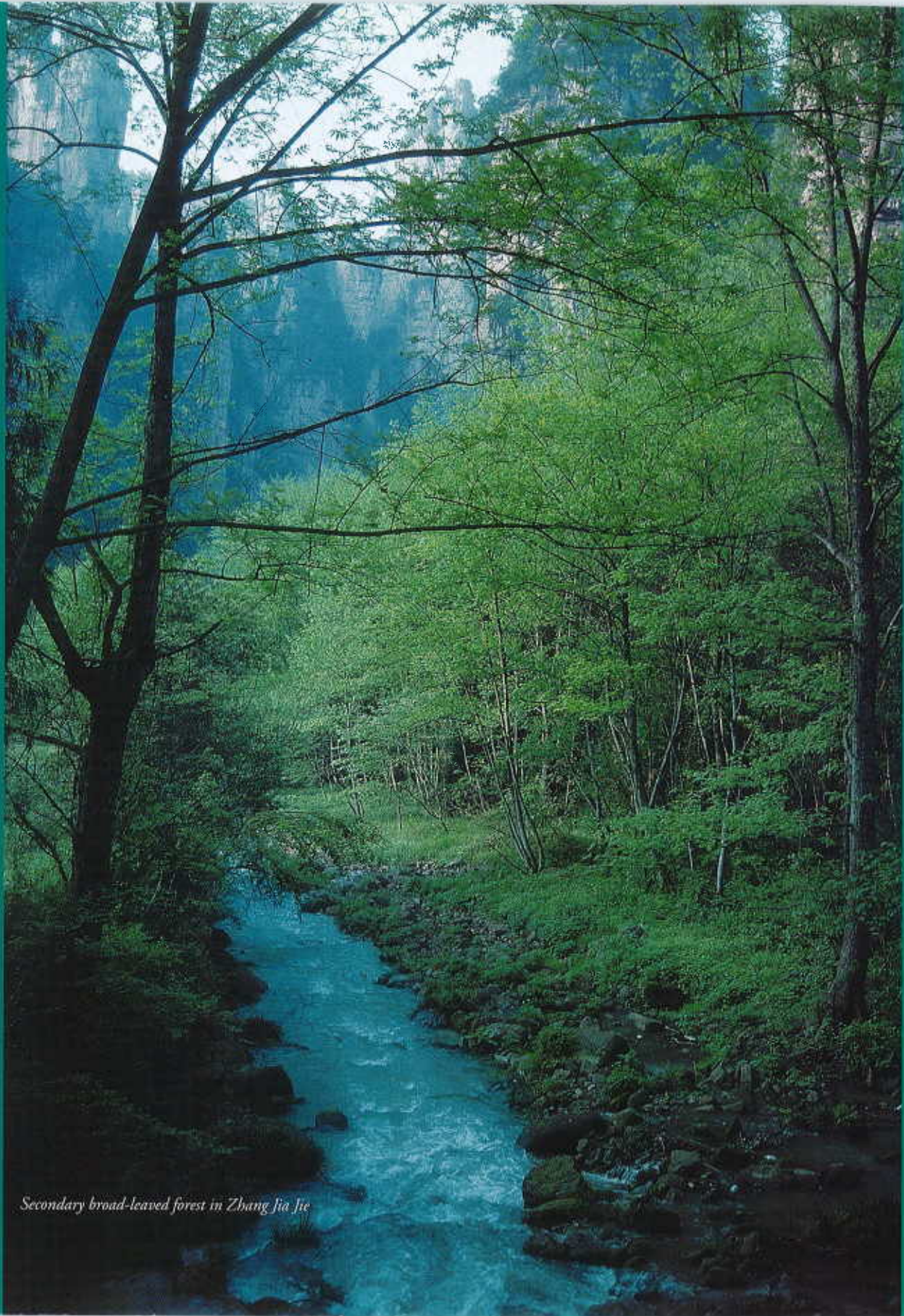
volume. In general, distribution of the forests is unfavourable in regard to harvesting costs. Most of the forests are in widely-separated small patches, and many areas with mature or natural forest have been saved only because of the difficult terrain. The location of forest resources can also be described using the large rivers in the province: 47% of the forest area is on the upper course of the river Yuan, 31% on the river Xiang, 11% on the river Zi, 4% on the river Li and 7% on the other rivers. These mountain forests have an important role in protecting the rivers, preventing floods and landslides, and keeping their water clean.

The most productive forests are down in the river valleys. On average, Hunan's forests are young. Mature forests cover 23,5% of the forest area and most of them are in forest plantations.

The amount and state of natural forest is a good indicator of biodiversity, and this is one of the key questions of nature conservation in the province. Hunan has 56 430 sq. km of natural forest left (Forestry Department, 1997), which would mean that approximately 53% of the province's forests were created naturally. However, it is estimated that the main part of this natural forest is secondary forest, and only 10% of it, in other words about 5% of all forests or about 10 000

Table 3. Some figures on forest area and volume in Hunan since the 1950s. Figures correspond to the situation at the end of the respective planning period. Unfortunately information was not available (indicated by two dots) for all periods. Source: Forestry Department of Hunan.

Time period (Five-year plan)	Forest area, sq. km	Forest area, % of Hunan	Forest volume in million m <sup>3</sup>	Forest volume m <sup>3</sup> per hectare
-1955	..	..	..	..
1956-1960	60 500	31	282,25	58,1
1961-1965	..	..	..	..
1966-1970	..	..	..	..
1971-1975	72 700	39	187,71	32,6
1976-1980	..	..	..	..
1981-1985	75 400	40	184,84	32,9
1986-1990	..	..	..	..
1991-1995	108 038	51	245,04	35,3



*Secondary broad-leaved forest in Zhang Jia Jie*



sq. km, is primal forest. Here the concept 'primal' means a wooded area where no or hardly any signs of felling or cultivation of trees is visible. However, altogether only 2 433 sq. km of forests exist within current nature reserves, and a large part of the forests even there seem to have experienced thinning, selective logging or artificial sowing of other tree species. Therefore some primal forests exist outside the network of nature reserves.

As seen from table 1, only 3% remains of the original broad-leaved forests of Hunan. At the same time the area

of coniferous forests has increased 1,7 times from the estimated original area (Mackinnon *et. al.* 1996). This is due to the enormous afforestation activity in the province. The results from forest resource inventories of the eight five year periods show that 83% of afforestation is still carried out using coniferous trees (Peng and Chen 1997). In the long run this is a serious threat to biodiversity because the biological value of broad-leaved and even mixed forests is much higher than that of coniferous ones.

There are some threats to the smooth implementation of current forestry policy in Hunan. They are tak-

*Young forest with Chinese Firs in the foreground.*



en in to consideration by the forest authorities, but still problems occur, typically the following:

**1** Over-exploitation of forest resources. This concerns both timber and other resources such as herbs, game etc. As an example, the natural production of the orchid *Gastrodia elata* was in the 1990s only 10% of that twenty years earlier. The rhizomes of this flower, which grows as a perennial saprophyte on the edges of broad-leaved forests, are medicinal. Tall specimens are left only in remote mountains with poor access.

**2** Habitat damage has lead to loss of forestable land from 140 000 sq. km in 1955 to only 109 000 sq. km in 1997.

**3** Large scale forest logging and afforestation reduce the area of natural broad-leaved forests. The decrease in biological diversity has been high. Other consequences include floods and loss of soil along rivers.

**4** Monocultures are replacing rich forest ecosystems. Particularly Horsetail Pine and Chinese Fir have been used over large areas, and there is a lack of availability of appropriate broad-leaved tree species for creating more mixed stands.

**5** Natural forests are split into small unconnected remnants in different parts of mountainous areas. The risk of extinction for a great number of organisms is much higher in isolated forests than in a network of natural forests with more genetic exchange.

In forest management forests are divided into six administrative types presented in table 4.

Table 4. The area of six administrative forests types in Hunan (Annual Forest Report, 1997, Forestry Department of Hunan).

Administrative Forest Type	Area in sq. km
Timber forest	56 610
Commercial forest	20 290
Fire wood forest	2 650
Bamboo grove	6 560
Protected forest	4 480
Special forest	1 000
Total	91 590

In 1997, the forest harvest in Hunan produced about 12,64 millions cubic meters, of which 26.9% timber. The total forest industry turnover that year was 8,0 billion yuan (Annual Forest Report 1997, Forestry Department of Hunan).

Clearcut near the Zhang Jia Jie forest park.



Unfortunately, it is difficult to obtain accurate data on forests. Depending on the source of information and the date of the statistics even higher figures than the above are presented. This is the reason why, for example, the figures of the total forest area in the province do not coincide in tables 2, 3 and 4. According to the latest information the figures in table 2 are the most accurate available.

The Forestry Department of Hunan (FDH) is the sil-

vicultural governmental agency in the province. Its function is to take care of forest management, develop forestry, and protection nature. The main divisions of the FDH are afforestation, forest protection, forest industry, supervision (forest police), forestry policy, forestry scientific research and education, and the state forest farms. Altogether 110 000 employees work under the Forestry Department in the province.

*Clearcut in the Wu Ling Yuan mountains.*



### 3.5 Wetlands and Aquatic Ecosystems

Hunan has a typical subtropical monsoon climate with heavy rainfall in April – August. Water running down from mountains and hills is caught in innumerable reservoirs, ponds, dams, channels and rice paddies before it has made its passage through the whole province and been discharged into the river Yangtze in the north-eastern part of Hunan.

There are 5341 rivers longer than 5 km in Hunan and the total length of all rivers is 86 000 km. The main rivers are the Xiang, Zi, Yuan, and Li; they all run through lake Dong Ting, the second largest freshwater lake in China. The fifth main river of Hunan, the Chang, is connected with lake Dong Ting through man-made channels.

Due to the long history of settlement and the high pressure of human population in Hunan, there are no longer any lakes in a natural state. Heavy rainfall and changing water levels form wetlands such as marshes, meadows and reedbeds along the creeks and streams. The area of natural wetlands thus formed is estimated to be 9100 sq. km, but these too are used in various ways by locals. Along Hunan's rivers are almost 13 000 water reservoirs and 1,9 million man-made ponds constructed since the 1950s (Gui and Chen 1997). They as well as the more natural wetlands are used for irrigation, pasture, fishing, duck farming, collecting aquatic plants (for food, fuel, fodder and fertiliser), producing hydropower, recreation, and transport. The area of man-made wetlands is 35 900 sq. km, including water reservoirs and ponds (4 433 sq. km), and paddy fields (31 467 sq. km). The production of wetlands is estimated to be worth about 2,5 billion yuan and that of fish and rice production 17,5 billion yuan, respectively (Annual Report of Agriculture in Hunan, 1997).

The real pearl of the wetlands in Hunan and all China is East Dong Ting Lake. It still has an ancient role as a water level regulator of the river Yangtze and is composed of numerous small lakes and marshes with strongly fluctuating water levels. Water is lowest in winter, at which time huge flocks of wintering ducks, geese and cranes occupy the meadows and mudflats. During spring and autumn migration other ducks and waders feed and rest here on their way to or from northern regions.

The maximum area of East Dong Ting Lake is nowadays 2690 sq. km, only a fraction of its former size. At low water levels it holds 530 sq. km of reed belts, 800 sq. km of grass meadows and 675 sq. km of mud flats. The annual water fluctuation level is 18 m, which means that the lake

*Rivers course through deep valleys in the mountains*



plays a vital role in flood control. It is not yet clear how the hydrology of East Dong Ting will change after the completion of the Three Gorges Dam higher up the Yangtze. East Dong Ting produces 600 000 tons of reeds, used mainly for manufacturing paper, and 13 000 tons

*Waterfall in Hu Ping Shan nature reserve.*

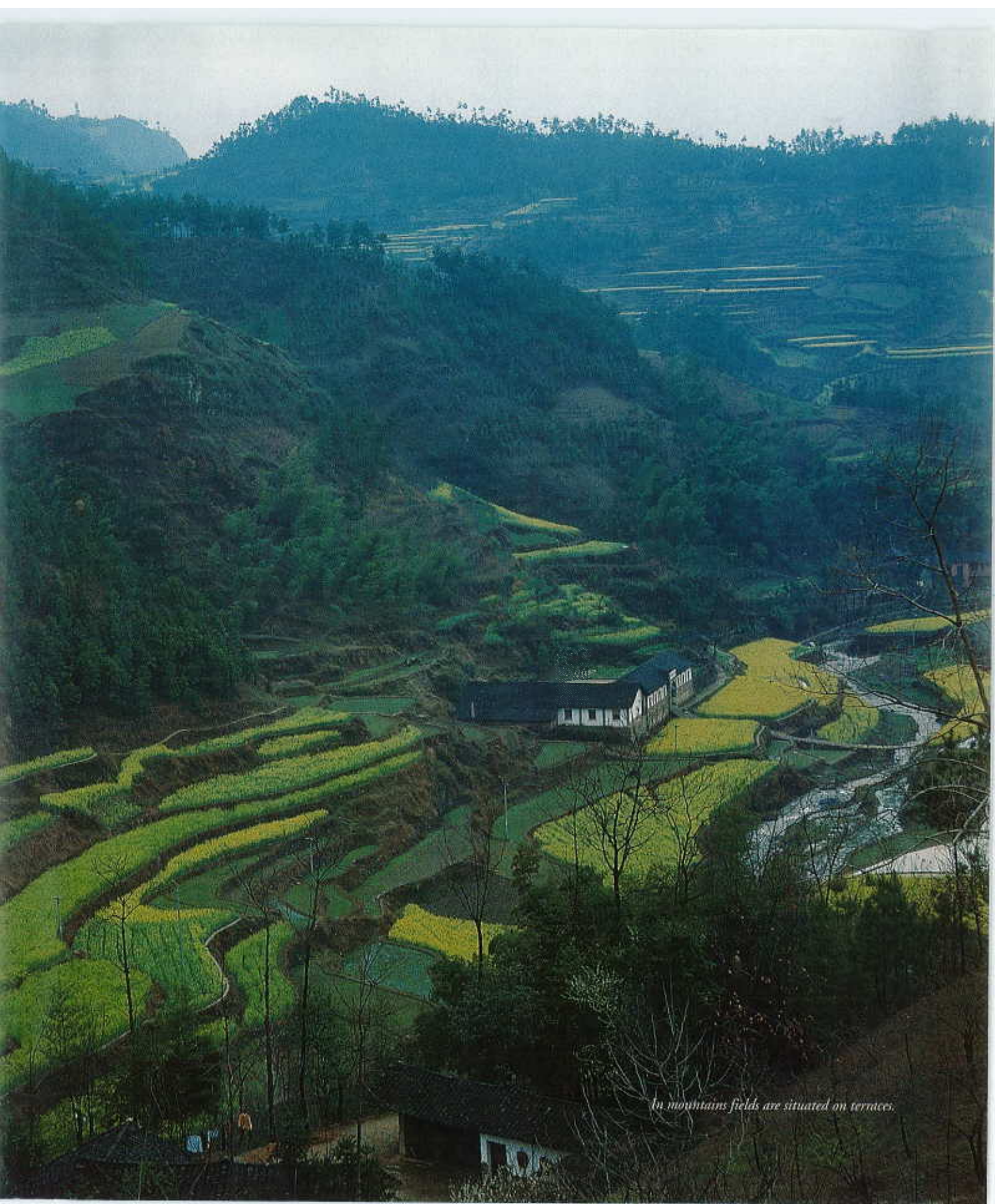


of fish. Since 1982 part of the lake has been protected as a nature reserve (1903 sq. km), but human pressure remains strong.

During the dry season in autumn and winter, large areas of shallow water and grassland occur along the rivers, lakes, ponds and reservoirs all over the province. These wetlands have a rich fauna and flora of diverse aquatic plants, invertebrates, and a variety of higher animals. Mountain streams abound with life, including most of the 40 species of amphibians such as one of the specialities of China, the Giant Salamander. Riverine forests growing along the upland river basins in remote regions are fairly undisturbed, and they have high biodiversity with a great number of endangered species. Most ungulates and forest birds prefer riverine forests.

The wetlands are endangered. They are biologically very productive and thus objects for large industrial projects as well as small local undertakings aiming at maximum utilisation. The main threats to the wetlands and rivers systems of Hunan are

- 1** Silting, particularly from mountain slopes due to logging.
- 2** Reclamation of wetlands by poor local people. For example, since the 1950s about 1600 sq. km of wetland has been reclaimed around the lake system of Dong Ting. Today 1300 sq. km is still in danger. The area of the three protected wetlands (East, West and South Dong Ting Lake) is 3850 sq. km.
- 3** Construction of new hydroelectric stations. Sometimes, as in Mang Shan in the early 1990s, new power plants are established even within nature reserves.
- 4** Pollution of water by towns, cities, and the province's ca. 2000 factories, which produce a total of 2,1 billions tons of waste water per year.
- 5** Lack of co-ordination between the various governmental agencies dealing with wetlands. For example, the Agriculture, Hydropower, Irrigation, and Forestry Departments each have their own objectives, and these sometimes conflict. Some of these agencies are far more interested in increasing rice or fish production, electricity production or flood control than in protection of wildlife and biodiversity in the rivers and lakes.



*In mountains fields are situated on terraces.*

### 3.6 Agricultural Land

Hunan province has played a very important role in agriculture in China; food production approaches 27,5 million tons, that of cotton 0,2 million tons, food oil 1,1 million tons, fruits 1,2 million tons. About 5,2 million water buffaloes graze on 874 200 hectares. The value of agriculture production is about 104,6 billion yuan (Annual agriculture report, 1995); main agricultural activities are presented in table 5.

Table 5. Main agricultural products of Hunan in 1995 (Annual agriculture report, 1995). Full statistics have not always been available (indicated by two dots.).

Product	Production in tons	Area in thousands of hectares
Food crops	2 752 100	5 115
Rice	2 650 000	4 083
Cotton	223 500	185
Food oil	1 120 400	89
Sugar cane	1 415 200	28.96
Tea	61 438	78
Fruits	1 169 400	400
Oranges	1 015 000	240
Meat	3 455 200	..
Aquatic products	862 800	..
Wheat	320 000	168.7
Corn	590 000	137.8
Tobacco	92.9	62.2

### 3.7 Ecotourism

Nature-related tourism, here called ecotourism, started growing fairly late in China, not before the mid-70s. Hunan was among the first provinces to develop this kind of tourism. In 1982, the people's government of Hunan launched a proposal to build up the first national forest park in China in Wu Ling Yuan (Zhang Jia Jie), based at the local forest farm. The park's pillared mountains have been a famous tourist attraction for hundreds of years. The proposal was submitted to the State Council and the Ministry of Forestry, and the first National Forest Park in China was established in

1983. In 1988, the Wugai Shan international hunting forest park, the first in South China, was opened. These two enterprises have shaped ecotourism in Hunan.

Statistics from the Eighth Five-year Plan (1990-95) show that the number of visitors to forest parks in Hunan increased 10-16 percent annually during the period and reached 2,62 million in 1996. It is worth mentioning that Zhang Jia Jie alone reached about 1,8 million visitors that year. At the same time income from tourism increased 10-18 percent annually, and the total output value of all forest gardens hit 275 million yuan. Compared with the Seventh Five-year Plan, the number of visitors increased 2,8-fold and revenue 3,6-fold.

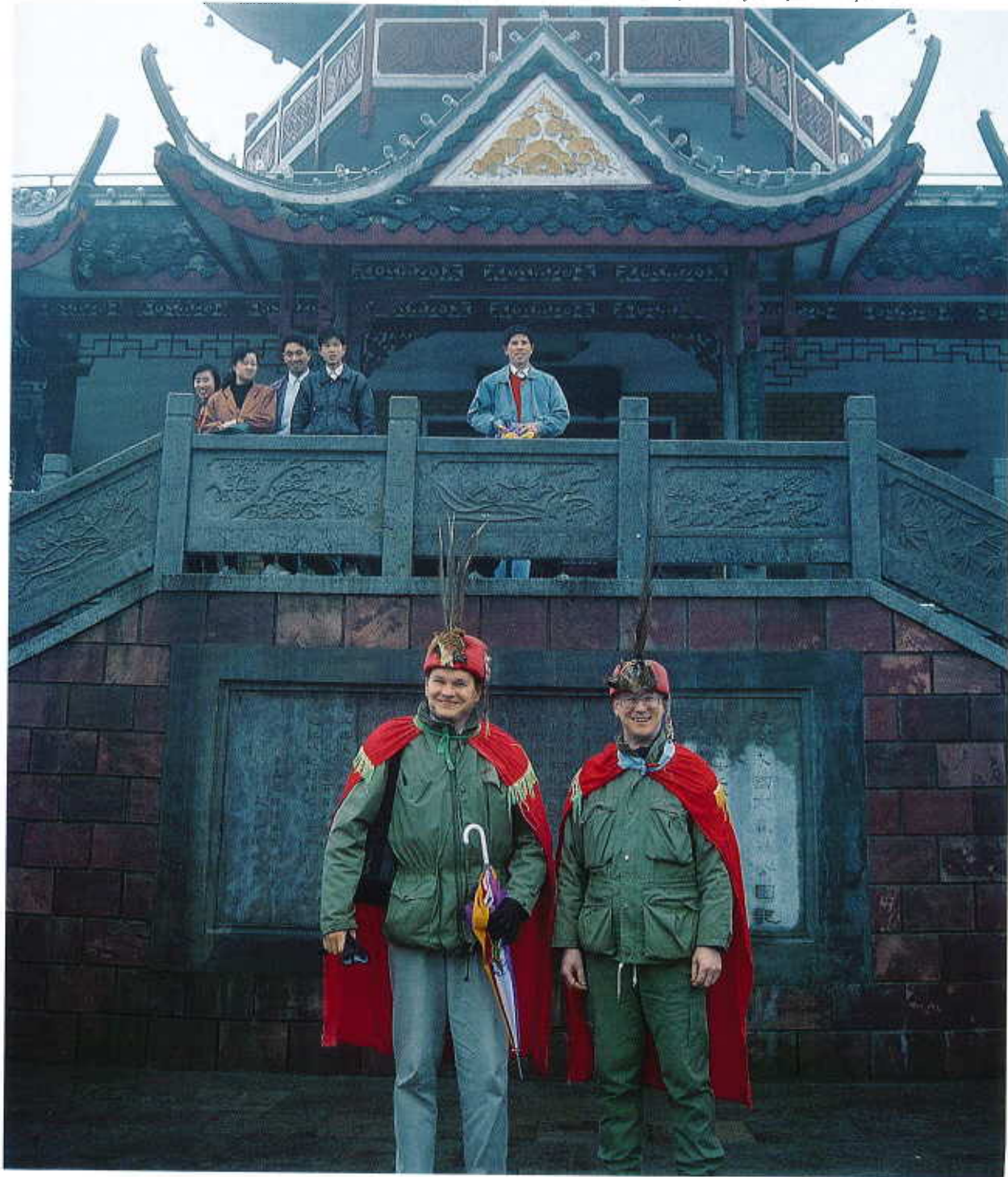
The main emphasis of ecotourism is in the 35 forest parks, but also some of the 38 nature reserves (especially those in connection with forest parks) have a role in tourism. In the late 1990s there were annually about 6,5 million visitors making up 20 million accommodation days in the forest parks and nature reserves. Ecotourism gave job opportunities to 6000 local people and generated a 5 billion yuan turnover (Ge 1999). The industry continues to develop rapidly.

Hunan, one of the important forestry provinces in south China, consists mostly of mountains and hills. Hunan was earlier called the 'land of seven mountains, two waters and one field'. Since the 1950s the party, government, and people of the whole province have been working hard and devoted much effort to afforestation, and great progress has been made in protection and restoration of the natural environment. Due to this work ecotourism can today be based on forests and forest parks all over the province.

Ecotourism in Hunan has several types of attractions, which are utilised in developing the branch. The main attractions are:

- 1 Wildlife and peculiar land forms. Rare plants and animals, fresh air, no pollution and fine scenery - in most cases mountain landscapes - are the attractions. This type of ecotourism dominates, for example, in Zhang Jia Jie National Forest Park, Tian Men Shan National Forest Park, Mang Shan National Forest Park, Liang Shan Forest Park etc. Zhang Jia Jie National Forest Park is listed as a UNESCO World Natural Heritage Site.

*Souvenirs are sometimes made of endangered animals, as with these head-dresses containing tail feathers of rare pheasant species.*





**2** Rivers, lakes and reservoirs. Large lakes and forest environments are typical destinations of ecotourists. Jiu Ni Mountain Forest Park with its unique artificial lake, the Huang He River reservoir, is an example of water tourism and is famous in domestic and overseas regions. Other famous resorts are Tianer Mountain Forest Park, where Chinese fir populations of all strains are surrounded by a large artificial lake called Dong River Reservoir, Tao Hua Jang Forest Park, and Chu Kou National Forest Park.

**3** Cultural heritage sites. Characteristic of cultural destinations are e.g. old and famous trees, and a history of poems and works about trees often over a thousand years old. The folklore often includes Buddhism or Taoism, and temples. Nan Yue National Forest Farm is an example where a famous mountain and the nearby forest farm are concentrating on promoting tourism using the history of old and famous trees. National forest parks such as Yun Mountain around Gou Lou peak in Heng Yang, Huang Shan Tou in

*Souvenir shops thrive near popular tourist routes.*



An Xiang, Tao Yuan in Tao Hua Yuan , Jia Shan in Shimen, Da Yun Mountain in Yue Yang, Dong Tai Mountain in Xiang Xiang, and Buer Men in Yong Xun all belong to this type. They are making the mountains and their thousand-year culture famous both inside and outside China.

**4** Scientifically interesting sites. These offer many kinds of scientific attractions, such as well preserved vast tracts of forest, wildlife, peculiar land forms etc. For example, Mang Shan National Forest Gardens, located in the transitional regions of the southern and middle subtropical zones, is rich in rare animals and plants. It could be called a natural plant specimen garden and forest safari in one. The Natural Yellow Fir populations in Yang Ming Shan Forest Park and some other populations of rare trees in Yue Yian national forest park are all important resources for ecotourism.

**5** Minority cultures. Minority nationalities, with their own songs, dances, marriage ceremonies, handicrafts, architecture and souvenirs are interesting to many tourists. Characteristic minority nationalities of Hunan are the Tujia, Miao, Dong, and Yao. National character is also reflected by the surrounding forest scenery: preferences may be given to certain tree species and wild animals, special requirements may exist for specific forest types, and so on. The forest gardens of Qiu Xi in Baojing, Huago mountain in Hua Yuan, Buer Meng in Yong Xu and Jiu Ni mountain in Ling Yuan all belong to this type of site. The forest parks of Huang Shan Tao in An Xiang, Tao Yuan Dong in Yan Ling , Yun Yang in Cha Ling, Mang Mountain in Cheng Zhou, Shun Huang Mountain in Xing Ling, and Liang Mountain are located in remote areas near the provincial border. Locally, visits to agricultural forest gardens with a snake farm in Yun Yang, and a black goat and dog-raising farm are all good ecological tourism attractions.

**6** Urban nature. This type of ecotourism is based on some large city with suitable facilities. Forest, wildlife and scenery near the city is often used as a vacation resort. For example, Da Wei Shan national Forest Park, situated in the remote suburb of the provincial capital Changsha, has fine forest scenery, pleasant forest weather, high mountains and grassland, marshes, and lakes. Another example is Tianji Ling national forest park, adjoining central Changsha city, which holds forest environments and a wealth of plant species. It is

also a forest plant garden of Hunan, and a rearing centre for wild animals. In recent years the number of visitors has increased rapidly, and good social and economic benefits enjoyed. There are also many other ecological tourism locations possessing an urban character such as Gou Lou Feng in Heng Yang, He Hu and Tai Y Yang Shan in Changde, Zhong Po in Huai Hua, Nan Hua Shan in Feng Huang, Wujian Shan in Lin Xiang, and Zi Jing Shan in Heng Shan.

The province of Hunan has invested a lot in nature-related tourism. Positive results are visible in some areas, where the great number of visitors has created work for local people in hotels, restaurants and souvenir shops. Their impact is such that some areas have been saved from logging due to their added tourist value. To some extent construction of visitor services and paved paths has also improved the state of the environment, but there are also serious risks to tourist development. In a country with a huge human population in big cities, there is a potential for great increases in visitor numbers that may lead to numerous problems. So far there is very little information available on these problems, and statistics are also inadequate. Based on experiences from other countries and some very popular tourist resorts in Hunan, the following concerns can be expected in relation to ecotourism development:

- 1 Mass tourism wears out nature. In spite of good roads and paved paths, vegetation becomes impoverished, and litter and noise become more widespread.
- 2 Hotels change the outlook and living style of small mountain villages in a way that is not always positive. The original grace of these villages disappears and at the same time new livelihoods bring social problems.
- 3 New constructions serving a great number of tourists destroy surrounding nature. Often new broad roads, car parks, restaurants, souvenir shops, cable railways etc. squeeze nature into smaller areas and split natural ecosystems.
- 4 Tourists leave waste in forests and villages. New refuse tips may become located inside nature reserves and small streams are often eutrofied or polluted by wastes from hotels.
- 5 When tourism becoming profitable it is often taken over by businessmen from remote cities. This way locals benefit much less than from smaller scale tourism organised by

local people. However, all the drawbacks stay in the local communities and in nature.

6 Nature products are popular souvenirs, especially in China. Often the manufacturing of these products damages nature or even endangered species. For example, rare flowers or tail feathers of endangered pheasants are commonly for sale in some Chinese tourist resorts.

Nature conservation authorities have a great responsibility for preserving the value of nature reserves and forest parks in Hunan. These territories with their irrecoverable values in terms of nature conservation and cultural heritage are at the same time almost the only accessible green areas in the province. While becoming more and more famous, the pressure of tremendous amounts of visitors is growing.

Chapter 12.7 presents the ten principles of ecotourism. These principles are useful for administrators of nature reserves and forest parks developing tourism in a way less harmful to nature.

*Local people singing and dancing for tourists.*



### 3.8 Other Ways to Use Natural resources

Abundant biological resources also support other developing industries such as Chinese medicine manufacturing and hunting. Over 2384 species of plant have been used in preparing medications, of which more than 700 are flowering plants. Sport hunting is an important part of ecotourism in the province; less than 50 wildlife species are classed as huntable game, but the number of hunters in Hunan is in the tens of thousands with hunting grossing an annual turnover of 200 million yuan

The flower industry produces about 200 million yuan annually.

### 3.9 What Hunan Can Contribute to Global and Chinese Biodiversity

The province of Hunan is characterised by forests and mountains. After the huge afforestation campaign forests now cover 51% of the province. Because of the mountains, only 19% of the province is agricultural land. On the other hand, the original broad-leaved forests have almost disappeared and been replaced by coniferous forests and scrub of different kinds. Despite this, some of the treasures of the province, in terms of biodiversity value, live in the remaining evergreen and subtropical broad-

leaved forests. Also wetlands have gone through development, with human impact strong and visible everywhere. However, some of the most precious areas are today protected. The most valuable features of the province can be summarised as follows:

**1** Hunan possesses some unique landscapes such as Zhang Jia Jie National Forest Park. This is a typical subtropical forest area, with high mountain peaks. The park is listed as a World Heritage Site by UNESCO.

**2** Natural evergreen broad-leaved forests represent a sample of subtropical forests with over 5000 plant species; 1948 sq. km of natural evergreen forest is protected in the province.

**3** Numerous endangered and rare species survive in Hunan, such as South China Tiger, Leopard, Clouded Leopard, Yellow-billed Tragopan, Crimson-billed Tragopan, Silver Pheasant, Golden Pheasant, Copper Pheasant, Koklas Pheasant, White-crowned Pheasant and White-necked Pheasant. Most of them are endemic to China.

**4** East Dong Ting Lake is the country's second largest natural wetland, which, together with West and South Dong Ting Lakes, plays an important role for migrant and wintering birds. Four crane species, two stork species and a large number of waterfowl use the lake as winter habitat. The lake supports a viable population of River Dolphin, an endemic mammal. East Dong Ting Lake belongs to the Ramsar Convention.



*Panthera tigris amoyensis*

## 4 Biodiversity Conservation in Hunan

The conservation of biodiversity works on many levels. Protection of ecosystems and species as well as preservation of genes of both wild and cultivated plants are all of great importance. Besides these, the sustainable use of natural resources, such as cultivated plants, domestic animals and protected areas, needs to be taken into consideration in developing the province and its economy.

### 4.1 Ecosystems

An ecosystem is a combination of physical nature – rocks, soil, waters and climate – and its living organisms. Comprehensive scientific information of all the ecosystems in Hunan was not available for this report but in the following a short presentation is given based on its landscape types. Of these, the forests are well classified due to their commercial utilisation.

The whole province is characterised by three landscape types: forests, wetlands, and farmland. Of these forests are the largest, representing nearly half the province. According to the principles of Chinese forest classification Hunan provincial forests are divided into three vegetation types (coniferous, broad-leaved and bamboo forest), nine forest vegetation subtypes (lower elevation coniferous, middle elevation coniferous, evergreen broad-leaved forest, evergreen deciduous broad-leaved forest, deciduous broad-leaved forest, middle elevation top forest, middle elevation bamboo forest, lower elevation bamboo forest, and river valley bamboo forest), and forty forest formations. Some forest formations in Hunan are unique or endemic such as those characterised by *Abies ziyuanensis*, *Cathaya argyrophylla*, *Pseudotsuga sinensis*, *Fokienia hodginsii*, *Castanopsis carlesii* and *Davidia involucrata*. These unique formations can be con-

sidered very valuable to China and indeed globally. They have survived in remote mountains for thousands of years and deserve recognition as virgin forest and a real natural treasure.

Wetlands are the second largest landscape type in the province with a total area of about 45 000 sq. km, including 9 100 sq. km of natural wetlands (lakes and rivers) and 35 900 sq. km of man-made wetlands (water reservoirs and paddy fields).

#### 4.1.1 Threatened Ecosystems

**Forests (including coniferous and broad-leaved forest).** Coniferous forests represent 83% of commercial forest in terms of surface area and 75,6% of timber storage (Wang *et al* 1984). Coniferous forests are the most important type of commercial forest but are also valuable in terms of biodiversity. Coniferous forest is divided into two types, *lower elevation coniferous forest* and *middle elevation coniferous forest*. In general, coniferous forest cannot exceed 2 000 meters in elevation in Hunan province; its distribution in southern mountain ranges consists of a series of different forest vegetation subtypes and forest formations, e.g. *Pinus massoniana*, *Cunninghamia lanceolata*, *Cupressus funebris*, *Tsuga chinensis* var. *Tchekiangensis*, *Abies ziyuanensis*, *Pseudotsuga sinensis*, *Cathaya argyrophylla*, and *Fokienia hodginsii*. It is estimated that only 1% of the coniferous forest types are protected in nature reserves.

**Broad-leaved forest.** These consist of evergreen broad-leaved, evergreen deciduous broadleaf mixed, deciduous broad-leaved, and middle elevation top broad-leaved forest. This vegetation is typical of southern subtropical China. Hunan is located in the centre of the subtropical region and is recognised as a typical evergreen broad-leaved forest area. The total area of natu-

ral evergreen broad-leaved forest is around 28 600 sq. km accounting for 26,7% of total forest area. Nearly half of this forest type is protected through nature reserves and forest parks.

Broad-leaved forests have characteristics which made them very valuable for biodiversity conservation. Broad-leaved forest is a gene pool, itself rich in biodiversity. It is inhabited by more than 90% of all plant and 50% of animal species in a range less than 3% of the total area of Hunan. Broad-leaved forests easily adapt to various environments and their vertical distribution limit is here fairly high, at 4300 meters. Thirdly, their capacity to conserve water and soil, enhance soil fertility, and alleviate natural calamities is outstanding. Broad-leaved forests have more obvious effects on controlling soil loss than any coniferous forest. (Peng and Chen 1997).

**Wetlands.** East Dong Ting Lake and its surrounding mosaic of lakes, ponds and rivers is the second largest freshwater wetland in China. The lake system supports a great variety of aquatic fauna and flora, and is an extremely important sanctuary for wintering waterfowl. Besides its economic value Dong Ting Lake is an important base for agriculture, fishing, flood control, water transport, irrigation, and ecotourism. It also has unique habitats that act as staging and feeding posts for huge flocks of overwintering and migrating birds and many aquatic animals, among them numerous endangered species such as Siberian White Crane, Lesser White-fronted Goose, and River Dolphin. The number of natural or semi-natural lakes is very low in the province.

There is a list of the valuable ecosystems in Hunan in Chapter 12.1.

## 4.2 Species

The species in an ecosystem are the second level of biodiversity. Species are always connected to the environment they live in, to the ecosystems themselves. Rare species and great numbers of individuals in a given area

are good indicators of ecosystem value. On the other hand species also have an absolute value in their genes, and species can be thought of as a link between genes and ecosystems.

In spite of the high level of research at the universities of Hunan, the information available about the fauna and flora of the province is unfortunately not complete. Therefore only the best known groups of plants and animals are presented in the following. The small amount of information available on some very large groups such as invertebrates, lichens or fungi has been omitted.

### 4.2.1 Plants

The flora in Hunan is estimated at about 4324 vascular plant species: 69 species of gymnosperms, 3904 species of angiosperms and 351 species of pteridophytes. Typical botanical features in Hunan are its many ancient elements, obvious endemism, complexity of the flora, and the narrow altitudinal distribution of many species (Liu and Xue 1997).

According to the national list of endangered species in China, the number of endangered vascular plant species in Hunan is 59, of which three are first class protected species and 23 are second class (see Chapter 12.2 List of Priority Plant Species in Hunan). All three first class protected plants are endemic to south and south-east China. They are

Cathay Silver Fir (*Cathaya argyrophylla*)

Dove Tree (*Davidia involucrata*) and

Dawn Redwood (*Metasequoia glyptostroboides*).

Now regarded as a living fossil, the Dawn Redwood was widespread in Europe, North America and East Asia before the latest ice age. It is now restricted in the wild to a small region on the border between the provinces of Hunan, Sichuan and Hubei. However, it has been widely reintroduced to various parts of Asia, Africa, Europe and America.

The number of endemic vascular plant species in Hunan is 133. They belong to 33 families with 80%

in just ten of these, which are presented in table 6. Southern and central China are part of an ancient botanical regime termed Ginkgo, named for the subspecies of Ginkgo trees that developed there in the Jurassic era.

The majority of endemic plants are situated in the western and southern part of the province.

Chapter 12.2 (List of Priority Plant Species in Hunan) presents 57 plant species considered priority species in Hunan. Ten species characteristic of the province are introduced in an attached box.

Table 6. The major families containing endemic plant species in Hunan.

Family	Total number of species in Hunan	Number of endemic species	Share of endemic species in %
Ericaceae	59	18	30
Gesneriaceae	35	14	40
Theaceae	95	11	12
Rosaceae	199	11	6
Bamusoidae	45	11	24
Fagaceae	85	8	10
Labiatae	108	8	7
Urticaceae	67	6	9
Corylaceae	22	5	23
Tiliaceae	24	5	20
Total	739	97	

Table 7. Vascular plants of Hunan by conservation category.

Vascular plants		
Category	Number of species	List of species (Scientific name)
Recorded in Hunan	4324	
Nationally endangered		
A-I class	3	<i>Cathaya argyrophylla</i> , <i>Davidia involucrata</i> , <i>Metasequoia glyptostroboides</i>
A-II class	22	<i>Abies ziyuanensis</i> , <i>Pseudolarix amabilis</i> , <i>Glyptostrobus pensilis</i> , <i>Fokienia hodginsii</i> , <i>Cephalotaxus oliveri</i> , <i>Pseudotaxus chienii</i> , <i>Liriodendron chinense</i> , <i>Manglietia patungensis</i> , <i>Tsoongiodendron odorum</i> , <i>Tetracentron sinense</i> , <i>Cercidiphyllum japonicum</i> , <i>Camellia grijsii</i> , <i>Disanthus cercidifolius</i> var. <i>longipes</i> , <i>Eucommia ulmoides</i> , <i>Eurycorymbus cavaleriei</i> , <i>Bretschneidera sinensis</i> , <i>Annamocarya sinensis</i> , <i>Davidia involucrata</i> var. <i>vilmoriniana</i> , <i>Diplopanax stachyanthus</i> , <i>Sinojackia dolichocarpa</i> , <i>Emmenoterys henryi</i> , <i>Changnienia amoena</i> ,
A-III class	33	<i>Keteleeria calcarea</i> , <i>Pinus kwangtungensis</i> , <i>Pseudotsuga sinensis</i> , <i>Tsuga chinensis</i> var. <i>tchekiensis</i> , <i>Tsuga longibracteata</i> , <i>Amentotaxus argotaenia</i> , <i>Magnolia officinalis</i> , <i>Magnolia officinalis</i> ssp. <i>biloba</i> , <i>Magnolia sieboldii</i> , <i>Magnolietia insignis</i> , <i>Parakmeria lotungensis</i> , <i>Euptelea pleiosperma</i> , <i>Cinnamomum micranthum</i> , <i>Phoebe bournei</i> , <i>Phoebe zhennan</i> , <i>Dyosma versipellis</i> , <i>Ixonanthes chinensis</i> , <i>Stewartia sinensis</i> , <i>Gleditsia vestita</i> , <i>Zenia insignis</i> , <i>Glycine soja</i> , <i>Semiliquidambar cathayensis</i> , <i>Corylus chinensis</i> , <i>Pteroceltis tatarinowii</i> , <i>Artocarpus hypargyreus</i> , <i>Archiboehmeria atrata</i> , <i>Dipteronia sinensis</i> , <i>Tapiscia sinensis</i> , <i>Halesia macgregorii</i> , <i>Pterostyrax psilophylla</i> , <i>Gastrodia elata</i> , <i>Coptis chinensis</i> , <i>Toona ciliata</i>

## The most valuable plant species of the natural heritage of Hunan

The plants listed in the following are endangered due to the low number of individual populations, the low total number of individuals themselves, and limited geographical distribution. They are habitat specialists or limited to a few districts, threatened by the fragile state of their environment or by lack of protection of their habitats. Special protection measures are needed without delay.

### 1. *Cathaya argyrophylla* Chun et Kuang (Pinaceae).

Priority A-I. An evergreen tree, 20 m high, with a breast-high diameter of up to 45 cm. The bark is split into thin scales, limbs spread out. The tips of twigs grow slowly, calarate, with a swollen pulvinus at the base. Leaves are linear, 4-6 cm long, 2.5-3 mm wide, crowded closely near the branch tip, spirally arranged into a radiate appearance, with rounded apices and the tapering bases developing into indistinct short stalks. Cones are egg-shaped, drooping; the woody cone scales are persistent, densely covered with short downs; bracts are short, hidden. Seeds are slightly flat, winged. Flowering in May; cones ripen the following November.

This species is only distributed in mountainous regions of 900-1870 m altitude in the central subtropics. Its habitat is cold in winter and cool in summer, rainy and foggy, humid. Grows in soils of hilly yellow or yellow-brown, pH is 5.0-6.5. Seedlings and young trees are tolerant of shade and mature trees light-loving. The root system is well developed. The tree has great vitality and most often grows on cliffs, precipices and rock crevices. The harsh conditions of its habitat have made it drought and wind resistant, with endurance of both cold and aridity. It grows slowly.

*Cathaya argyrophylla* was first found in Hua Ping, in the Longsheng county, Guangxi province, of China, and later on in Hunan, Gui Zhou and Sichuan. It is discontinuously distributed; about 50 trees in all were found at three localities in Luo Han Dong where Xin Ning and Chengbu county of Hunan province meet, Jiao Peng Liao of Bamian Shan mountain in Gui Dong county, and Maoji Xian of Longzha town, Yan Ling county. These districts or sites have been protectively set aside at the above three localities. The habitat of *Cathaya argyrophylla* has not been improved as it was in a good state. Its growth, development and propagation are increasingly degenerating due to historical or

present conditions; its natural regeneration is difficult and the population remains hard to increase. *Cathaya argyrophylla* is still in danger of extinction because of the difficulties in its artificial propagation. In implementing a programme of protection for this species, protection of growing sites should be supplemented by a plan for studies of its biology, ecology and biocenology. Elucidating the mechanisms of growth and development of *Cathaya argyrophylla* may shed light on the causes of its decline and help solve the problem of its propagation - as was achieved earlier for the Chinese Panda.

### 2. *Abies ziyuanensis* L. K. Fu et S. L. Mo (Pinaceae).

Priority A-I. An evergreen tree, 26 m high, 110 cm in breast-high diameter. The trunk is straight, the bark furrowed into scales; annual shoots are pale-brown, bald, with scales persistent at the base. Leaves are linear, of varying sizes, irregularly biseriolate or radially arranged on twigs, 2-5 cm long and 3-3.5 wide, with the apex bifid and the margin reflexed. There are 2 outer resin canals; the back of a leaf having two white stoma strips. Cones are cylindrical, erect, 10-11 cm long, 4-4.5 cm in diameter; cone scales fan-shaped, woody, breaking off axially at maturity; bract tips are slightly emergent, recurved. Seeds are triangular, with wings 2-2.5 cm long. Flowering in April and May, cones ripen in November.

This species is distributed in mountainous regions between 1500 m-1800 m altitude in the central subtropics. Its habitat is both cool and humid, with abundant rainfall and a long sub-zero temperature period each year. The soils are brown-yellow, pH 5.0-6.0. The tree is a shade plant, often in the middle and lower layers of mixed broad-leaved - conifer forests. It grows slowly and natural regeneration is easy under the canopy.

This species only occurs in Hunan and Zi Yuan county of Guangxi province. Its distribution in Hunan province covers Ying Zu Lao Shan and Er Bao Ding of Chengbu county, Xun Huang Shan mountain in Xin Ning county, Da Yuan of Yan Ling county and the northern slopes of Xun Huang Shan mountain in Dongan county. There are about 1000 parent trees in all in Hunan province, but most of them are over-mature old trees (e.g. one individual 26 m high with 112 cm breast-high diameter is about 2000 years old), and wind and snow occasionally break them. Thus the trees are decreasing in quantity. Although protective

areas or sites have been set up, sluggish management has resulted in relatively serious destruction of the vegetation and thus caused the loss of shading habitat which the young trees need. This has meant the disappearance of natural regeneration. At present seedlings and young trees have almost disappeared in Da Yuan of Yan Ling county due to grazing, digging bamboo shoots, felling firewood, and tourism. Things were better in the 1980s. In respect to propagation, the seed germination rate is very low, less than 10 percent, as is the seed-bearing rate of the parent trees. Sources of this species are therefore poor. The key measures are strict protection of its habitat and parent trees, with environment improvements to promote natural regeneration. Meanwhile, research on seed collection, seedling raising and planting need to be initiated in order to start a seed base and experimental plots.

### 3. *Glyptostrobus pensilis* (Staunt.) Koch (Taxodiaceae).

Priority A-I. A deciduous or semi-evergreen tree, 25 m high, up to 100 cm in breast-high diameter. The bark is split into linear scales, often with bent-knee respiratory roots. Limbs spread horizontally, with thin branches and leaves. Leaves heterophyllous; the linear leaves are soft, falling off together with bud-absent twigs in winter; scale leaves are crowded closely in twigs, usually persistent. Plants monoecious; flowers unisexual. Cones obovate, 2-2.5 cm long, 1.3-1.5 cm in diameter; woody cone scales are flat with 6-9 recurved spines on the upper margin of the back and 1 recurved mucro in the middle. Each cone scale bears 2 seeds with wings at the base. Flowering is in March and cones ripen in October and November.

This species is mainly found in the delta of the Zhu Jiang river in Guang Dong province, in warmer areas of the lower reaches of the Ming Jiang river in Fujian province, and in the eastern part of the northern tropics. The large and precious natural trees found in Hunan have important scientific value in the study of the systematic development of *Taxodiaceae*, palaeobotany, ancient climates and flora. The tree is a sun plant, adapted to the environment of low elevations with a warm climate, rich rainfall and plentiful sunlight. It thrives equally on low sites, swamplands or in places near water, and is very tolerant of wet, but not cold. Its seeds do not germinate easily under natural conditions, but it is quick-growing, with a long life. Big and old trees can be found in its region of distribution.

Twelve parent trees of *Glyptostrobus pensilis* are located in the vicinity of Zhang Jia village of Yong Xing county and 1 tree, 23 m high, 203 cm in breast-high diameter, 800 years old and still

flowering, in Yanwo village of Yan Ping town in Zi Xing city. Other parent trees of this species are mostly very old and senile with thin branches and leaves. This bears evidence of the climate changes in south Hunan and makes the species important scientifically. These trees grow near villages, and problems are caused by villagers tying cattle to the trees, stacking rice straw or enjoy the shade underneath, all of which affect tree growth. How to supervise care for these old trees, recover their habitat and improve the natural regeneration is a top priority.

### 4. *Davidia involucrata* Baillon (Davidiaceae).

Priority A-I. This tree belongs to the single-species family Davidiaceae, endemic to China. A deciduous tree, 25m high, 105 cm in breast-high diameter, with long and short shoots; the bark breaks off in thin slices. Leaves alternate on long shoots, fascicular on short shoots, broad ovate, with the base cordate and the apex acuninate, pinnately veined, with big arista-like teeth on the margin; the upper surface is bald but the lower covered with white down; petioles are 4-5 cm long. Flowers are polygamous, born on the same individual; there is one bisexual flower with numerous staminate flowers making up a head or pure staminate; heads subtended by a pair of large, petaloid bracts 7-15 cm long, 3-5 cm wide and spread slantingly such as a dove in flight, hence *Davidia* is called the dove-tree. Fruits droop, are ovate, 3-4 cm long, 1.5-2 cm in diameter, with yellow spots; the exocarp is leathery, mesocarp flashy, and endocarp hard and stony; there are 3-5 seeds. The tree blooms in May, bearing fruit in October.

*Davidia involucrata* is distributed from the subtropics to the temperate zone above 1200 m altitude. Sites where it propagates naturally are cool in summer and cold in winter, rainy, foggy, icy and humid. The mountainous yellow and brown-yellow soils it grows in contain plenty of humus. The species, which grows in the protected district of Ba Da Gong Shan mountain in Sangzhi county above 1500 m altitude, is scattered in mixed evergreen-deciduous broad-leaved forests and seldom makes up pure stands. Introduction throughout the country shows that when *Davidia* is introduced to low mountains and hills in autumn the high temperature and drought seriously affect its growth, even causing death. The stone-like fruit kernels cannot easily be permeated by water, and, because the embryo ripens late, under natural conditions the kernels can germinate after years without decay.

Hunan province is one of the core distribution areas of *Davidia*. Most of the trees are found locally in the Wu Ling



Shan mountains in north-west Hunan, on Ba Da Gong Shan mountain in Sangzhi county, Tianmen Shan mountain in Da Yong city, and Hu Ping Shan mountain of Shimen county. A few are scattered in Xiao Xi of Yongshun county and Ba Mao Xi of Bao Jing county. There are some 3000 parent trees. One of them, 25m high, 105 cm in breast-high diameter and about 300 years old, grows in Gong Tong Wan of the natural protection district of Ba Da Gong Shan mountain in Sangzhi county. This was a rare case, but *Davidia* has become the subject of conservation attention. The above distribution areas of *Davidia* now all have established protection districts. Its environment has been protected effectively and the characters of *Davidia*, in varying degrees, have been regained. The technique of artificial propagation has greatly progressed. The success in obtaining seedlings from seeds and flower bud grafting have created a potentially good species source and possibilities for ex situ conservation.

##### 5. *Tsoongiodendron odorum* (Magnoliaceae).

Priority A-II. An evergreen tree, up to 30 m high, 1.5-2 m in breast-high diameter; the bark pale-brown, scabrous; twigs are covered with brown hispid, with ringed stipule scars; more hairs present on the buds, the lower surface of the leaf, and flower peduncles. Leaves thinly leathery, single, elliptical, 10-17 cm long, 4-7 cm wide; petiole 2-2.5 cm long. The white flowers are bisexual, auxiliary, solitary, and fragrant, perianth in 3 series with 9 sepals; stamens numerous, free and distinct. Fruit approximately spherical at maturity, 10-13 cm long, 9-10 cm in diameter; the carpels are concrescent forming a fleshy aggregate follicle, the woody and thick fruit sections breaking off axially. Seeds have red testa. Blooms in April, fruit born from October to November.

This species is distributed from the southern subtropics north to the southern part of the central subtropics. It loves warm, moist climates and acidic soils, mostly scattered in evergreen broad-leaved forests of below 600m altitude, thriving better in gullies and ravines. The young trees are tolerant of shade but the mature light-loving. The trees fill with white flowers in full bloom, with the fragrance spreading in all directions. Only the flowers on the lateral short shoots can mature into fruit, so the fruit yield of a tree is low. The seeds are favourite food of birds, so natural regeneration is poor.

This species is distributed in Yuan Kou of Jiang Young county, in Gan Xi of Tong Dao county, in Zhu Zhu Kou, Shang

Xiao Zhu Yuan, Liangchahe of Jiang Hua county, in Shuang Pai county, in Ning Yuan county, and Mang Shan mountain of Yiz Hang county. The total number of trees is about 50, a very low figure, and they have a scattered distribution. The species is in danger of extinction and to save it requires urgent action. Proposals are that breeding nurseries of *Tsoongiodendron odorum* be established in Gan Xi of Tong Dao county, in Yuan Kou of Jiang Yong and by artificial breeding seedlings be raised to supplement the natural vegetation. In the meantime, suitable districts for replanting should be located.

##### 6. *Gleditsia vestita* Chun et How ex B. G. Li (Caesalpiniaceae).

Priority A-II. A deciduous tree, 8 m high, 86 cm in breast-high diameter, with branching thorns; the bark pale-brown, asperous but not split; twigs brown, smooth with lenticells. Leaves paripinnate, closely crowded on short shoots; leaflets ovate, 3-6.5 cm long, 1-2.5 cm wide; the leaf apex mucronate; the leaf base approximately rounded and asymmetrical; the leaf margin serrate; the leaf back apparently reticulately veined. Flowers polygamous, in racemes in the short shoots; peduncles are covered with dense yellow-brown down; the sepals, petals and ovaries are golden in colour. Fruit legume-like, strip-shaped, twisted, 15-40 cm long, 2.5-4 cm wide, covered with yellow felthairs; seeds numerous, flat, elliptical, tan, lustrous. Flowers May to June; fruit maturing October to November.

This species only occurs in a valley of 770 m altitude near Guang Ji temple of Nan Yue mountain, where the climate is warm with abundant rainfall, a long foggy period, and an annual average temperature of 12-18°C. Annual rainfall is 2000 mm and relative humidity 88%. *Gleditsia* is a sun plant, deeply rooted, bearing little, with poor natural regeneration. The germination rate is higher when seeds are sown. It grows well under artificial cultivation, flowering in about 15 years.

This species was found in 1954 and formally named in 1957. In the past there were 5 trees protected by monks, but since the 1960s the woods around the temple have been repeatedly destroyed and three *Gleditsia* trees have died. Of the two trees remaining (recent news report only one remaining) the trunks are hollow inside and rotted, with very few branches and leaves. They are in imminent danger. Once "the rustle of leaves in the wind" happens, the species will disappear from the earth. Fortunately, a small number of seeds were collected by Hunan Forestry School in 1958 and eight seedlings raised. The parent trees conserved in the school have already flowered and born

seeds. The Nan Yue tree garden successfully raised seedlings from the seeds offered by the school, putting the species's survival on a surer footing. However, the task of protecting it will still be very arduous.

7. *Annamocarya sinensis* (Dode) Leroy (Juglandaceae).

Priority A-II. This genus is a single-species one. A deciduous tree, up to 38 m high, 125 cm in breast-high diameter; the bark dark-grey, not split. Twigs are stout, brown, bald; the naked buds overlap, and have brown down. Leaves imparipinnate, 20-30 cm long; leaflets 7-9, thinly leathery, single, gradually enlarging from the base to tip of the rachis, oblong to elliptically lanceolate; the apex acuminate; the base is wedged. Plants monoecious; flowers unisexual; staminate flowers in drooping aments, often in bundles of, 13-15 cm long. Fruits droop, are ovately elliptical, 6-10 cm long, 5-6 cm in diameter, tipped with a mucro; the exocarp is ligneous, 4-9 valvularly-dehiscent; the fruit-stone ovate, hard, tipped with a long beak. The tree blooms in May, with fruit bearing in October to November.

The distribution of this species covers the northern tropics and southern subtropics. In the south it extends to valleys of low elevations in the southern tropics. Tong Dao county of Hunan province is the northern fringe of the species's distribution. The main range is in the valley of Gan Xi in south Tong Dao county with an altitude of 230 m and red slate soils of pH 5.0. The vegetation is well preserved and the surrounding climate around the tree's habitat is warm and moist with fertile soils. Young trees are tolerant of shade, but mature trees light-loving. Many seedlings and young trees are found around parent trees. The biggest tree there is about 38 m high, 125 cm in breast-high diameter, and is growing well. In general the tree grows rapidly.

This species was first found in Hunan in 1984, when there were seven parent trees over 20 cm in breast-high diameter. Five of them were protected in 1990. Since its discovery, seeds have repeatedly been collected and wild seedlings dug out at will. The vegetation of and around the parent trees has been destroyed, and the flowering and natural regeneration has been seriously affected. The departments concerned should pay attention to the protection of this species. Seeds should be collected in a planned and organised way and wild seedlings left in peace.

8. *Sinojakia dolichocarpa* C. J. Qi (Styracaceae).

Priority A-II. Species endemic to Hunan. A deciduous tree, 7-15 m high, 15-27 cm in breast-high diameter; the bark brown,

hairless; twigs are red-brown, hairless. Leaves are papery, ovately oblong, 8-12 cm long, 3-4.8 cm wide; the apex acuminate; the base is rounded with 8-10 pairs of lateral veins; the basal midrib of the upper surface has astroid hairs; the axillae of the back are lanate, petioles are 4-7 mm long. Fruit nut is obconic, 3-angulate, 4.2-5.5 cm long together with a long beak, densely covered with brown long villi; the fruit stalk is 4.5-6 cm long, crinite from the middle to the terminal; exocarp suberous; endocarp ligneous; one seed. Flowers in April, bears fruit in September.

This species grows in mountainous areas of elevation 400-800 m with an annual average temperature of about 14°C. Annual rainfall is 1600-1800 mm, the climate warm and moist, with yellow or calcareous soils. Its natural distribution is in forests or on the fringe of forests on mountain sides in ravines or by streams, sparsely scattered in the forest's middle and lower layers. It is light-loving, with a well-developed root system, enduring drought and aridity relatively well. The pericarp is ligneous and hard. The natural germination rate is low and regeneration poor.

*Sinojakia* occurs only on Hu Ping Shan mountain of Shimen county and Long Tan Ping town of Sangzhi county. The number of individual trees is about 30. Although protective districts have been set up in the above two areas, once its habitat is damaged the chances are ten to one that the species will go extinct due to the small population, the low natural reproduction rate and weak ability to compete. Therefore, in addition to strict management of its primary habitat and the improvement of its natural regeneration, the technology of its artificial breeding should be studied and cultivation expanded to ensure the reliability of ex situ conservation measures.

9. *Tetracentron sinensis* Oliv. (Tetracentronaceae).

Priority A-II. A deciduous tree, 30 m high, 1.5 m in breast-high diameter; the bark pale brown; long shoots slender; short shoots calcarate with dense ringed bud scale scars, leaf scars and with pointed subpetiolar buds. Leaves simple, alternate, papery, ovate to broad ovate, 5-7 palmately-veined, 7-14 cm long, 4-10 cm wide, the apex acuminate, the margin having dense glandular teeth; both sides of the blade bald and the lower side covered with white bloom; the petiole and stipule are concrescent and enclose the young buds. Flowers in spikes, axially in short shoots, drooping, small-sized. Fruit capsule is oblong, 2-4 mm long, 4-dihiscent at maturity, seeds angulate. The fruit bearing stage is in late September.

This species is distributed in mixed evergreen-deciduous

broad-leaved forests. The climate is cold in winter and cool in summer, with plenty of rainfall, a long foggy period and heavy humidity. The soils are yellow-brown and loose acidic soils with a high humus content. The plant is sun-loving, deeply rooted, growing rapidly on precipices and crevices of rocks.

Within its range the species is found in Tian Ping Shan mountain of Sangzhi county, in Hu Ping Shan mountain, in Zhu Lao Shan mountain of Chengbu county, Xun Huang Shan mountain of Xin Ning county, and scattered in Feng Huang county and Gaowangjie of Guz Hang county. Natural populations of parent trees are sparse. The three biggest parent trees are found in Xun Huang Shan mountain of Xin Ning county; they are 20-25m high, 80-150 cm in breast-high diameter, but are senile and rotted inside. The tree's ecological environment has been greatly damaged and natural regeneration is very poor. The existing parent trees should be better protected and their habitat be improved to promote natural regeneration. Seed collecting, seedling raising and planting is needed.

10. *Taxus chinensis* var. *mairii* (Lemee. et Levl.) Cheng et. L, K. Fu (Taxaceae).

Priority A-I. A Chinese species, a first class protected plant on a national level. An evergreen tree, 20 m high, up to 160 cm in breast-high diameter; the bark brown and split into scales; annual shoots light yellow. Leaves are linear, sickle-shaped, spirally biseriate, 2-4.5 cm long, 3-5 mm wide; the midrib swollen on the upper surface and having two green stoma strips on the lower surface. Partially cuticular papillate, rarely papilla wanting. Plants monoecious. Flowers unisexual, solitary, axially; staminate flowers pedunculate. Seeds nut-like, enclosed in red flesh crateriform aril, obovate, slightly flat, with two longitudinal ridges, the tip slightly emergent. Flowers March to April, bearing fruit October to November.

This species is scattered throughout Hunan province,

growing in mountainous areas or on hilly lands below 1300 m altitude. In South and South-West Hunan old individuals hundreds of years old have been found. It is tolerant of shade and thrives in valleys, brooks or wet sites in dense forests. Scattered light is favourable to its growth, too bright or too dim light can affect flowering and fruit-bearing. The tree loves acidic soils with rich humus and good drainage, but also grows well on mountainous lands with neutral and calcareous soils. The on-year, off-year bearing periodicity is a notable characteristic. Seeds have a dormant period and the germination rate may be increased by storing the seeds in sand at lower temperatures. The main root is indistinct, but the lateral roots are well developed and heavily tangled. Branches are tough and not easily broken by wind or snow.

This species is scattered in evergreen broad-leaved forests throughout the province, most of the oldest trees have been found. A big tree of 500 years old, 18 m high, 168 cm in breast-high diameter, with 15 m<sup>2</sup> crown cover, is located in Xiao Cha village of Da Kui Shang town in the Suxian district of Chen Zhou city. With the destruction of evergreen broad-leaved forests, the tree's environment has been disappearing and the number of individuals reduced sharply. Moreover, with the slow growth of the species and the almost exhaustive cutting of big trees for timber, few trees remain. The plants are dioecious, with staminate flowers commoner than pistillate ones under natural conditions. Seed bearing shows on-year and off-year periodicity. The natural propagation rate is low, and natural regeneration poor: *Taxus chinensis* var. *mairii* is in danger of extinction. Protection and artificial breeding must be started immediately. Because it contains an anti-cancer drug, yew alcohol, and can be exploited as a medicinal plant, this species has drawn people's attention. However, the relevant conservation departments concerned need to distribute correct guidelines or the few remaining natural sources will suffer even greater destruction.

The vascular flora of Hunan has been studied comparatively well, but the bryophyte flora is inadequately known. According to Rao *et al.* (1997), only 269 bryophytes, including 197 mosses, 69 hepatics, and 1 hornwort, have been reported previously from the province.

Four of the known bryophyte species are endemic to Hunan: the mosses *Glyphomitrium hunanese*, *Pseudoleskeopsis integrifolia* and *Meiothecium angustivete*, and the he-

patic species *Taxilejeunea latilobula* belong to these rare plants (Rao *et al.* 1997).

#### 4.2.2 Mammals

The fauna of Hunan is not very well known today. It is not known if some rare species still exist in the province and in some cases some older observations seem not to be reliable. Large scale logging, pollution, over-exploitation

of natural resources, and illegal hunting have destroyed and fragmented the habitats of many species. Most of the rare species live only in nature reserves. These problems are most apparent in mammals, especially large ones.

The number of Hunan mammal species is estimated at 89, which is close to the average for all provinces (see Chapter 12.3 List of Priority Wildlife in Hunan). These include eight first class protected species and 15 of the second class. The first class protected mammals recorded in the province are

- South China Tiger (*Panthera tigris amoyensis*),
- Leopard (*P. pardus*)
- Clouded Leopard (*Neofelis nebulosa*)
- Sika Deer (*Cervus nippon*)
- Black Muntjak (*Muntiacus criniformis*)
- Pere David's Deer (*Elaphurus davidianus*),
- White Flag Dolphin (*Lipotes vexillifer*)
- Assam Macaque (*Macaca assamensis*)



Tiger and leopard habitat in south part of Hunan

Table 8. Mammals recorded in Hunan presented by conservation category.

Mammals		
Category	Number of species	List of species (Scientific name)
Recorded in Hunan	89	
Nationally endangered		
A-I class	8	<i>Panthera tigris amoyensis</i> , <i>Panthera pardus</i> , <i>Neofelis nebulosa</i> , <i>Cervus nippon</i> , <i>Muntiacus criniformis</i> , <i>Elaphurus davidianus</i> , <i>Lipotes vexillifer</i> , <i>Macaca assamensis</i>
A-II class	14	<i>Macaca mulatta</i> , <i>Macaca thibetana</i> , <i>Manis pentadactyla</i> , <i>Cuon alpinus</i> , <i>Selenarctos thibetanus</i> , <i>Neomeles phocaenoides</i> , <i>Lutra lutra</i> , <i>Peionodon pardicolor</i> , <i>Felis temmincki</i> , <i>Cervus unicolor</i> , <i>Moschus berezovskii</i> , <i>Hydropotes inermis</i> , <i>Capricornis sumatraensis</i> , <i>Naemorhaedus goral</i>
Endemic to China, recorded in Hunan	19	<i>Hemiechinus hughi</i> , <i>Sorex cylindricauda</i> , <i>Soriculus hysibius</i> , <i>S. sodalis</i> , <i>Talpa longirostris</i> , <i>Scaptochirus moschatus</i> , <i>Mogera insularis</i> , <i>Rhinolophus rex</i> , <i>Myotis pequinus</i> , <i>M. capaccinii</i> , <i>M. ricketti</i> , <i>Nyctalus velutinus</i> , <i>Ia io</i> , <i>I. longimana</i> , <i>Murina puta</i> , <i>Macaca assamensis</i> , <i>Macaca thibetana</i> , <i>Rhinopithecus roxellanae</i> , <i>Rb. Bieti</i>
Need special protection in Hunan	16	<i>Macaca thibetana</i> , <i>Macaca mulatta</i> , <i>Macaca speiosa</i> , <i>Manis pentadactyla aurita</i> , <i>Selenarctos thibetanus</i> , <i>Viverra zibetha ashtoni</i> , <i>Prionodon pardicolor</i> , <i>Neofelis nebulosa nebulosa</i> , <i>Panthera pardus fusca</i> , <i>Panthera tigris amoyensis</i> , <i>Lipotes vexillifer</i> , <i>Moschus berezovskii</i> , <i>Hydropotes inermis inermis</i> , <i>Cervus unicolor</i> , <i>Nemorhaedus goral</i> , <i>Capricornis sumatraensis argyrochaetes</i>

1. *Tragopan caboti*

Yellow-bellied Tragopan. Priority A-I. A large pheasant, 50-65 cm in length. Buff below, maroon red, spotted buff above. Crown and ear coverts are black, eyebrow orange red, sides of neck orange red bordered on each side by a black band. The bands bordering the throat join to form a black collar; hind neck is orange red. The upperparts of the bird are maroon red, thickly spotted with deep buff, the spots circled in black, the feathers with white shafts. The lappets are orange with purple spots surrounded by cobalt blue, and the sides have nine large patches of pale greenish grey, seen only when expanded. There are two subspecies, *T.c. caboti* and *T.c. guangxiensis*. The birds in Hunan are *T.c. caboti*.

The Yellow-bellied Tragopan is resident at over 600 m in mountainous forests. It feeds on ferns, roots, stems, leaves, flowers, and fruits of various plants as well as on a few animals. It breeds in March - June. The courtship display of the male tragopan is fantastic. The nest is built in a tree. This Tragopan is endemic to China and occurs in Zhe Jiang, Jiang Xi, Guang Dong, Fujian, Guang Xi, and Hunan. In Hunan it occurs in the Nan Ning Mountains in the south, in the counties of Yiz Hang, Gui Dong, Ru Zheng, Zi Xing, Xing Ling, Xu Ling and Yan Ling, including the nature reserves Mang Shan, Bamian Shan, Huangs Hang, Xu Huang Shan, Wang Feng Shan, and Tao Yun Dong. The Yellow-bellied Tragopan is a species dependent on forests, and is also an indicator of a healthy forest ecosystem. The main threats to the species are deforestation, which causes loss of forest cover and its food.

2. *Syrnaticus ellioti*

White-necked Long-tailed Pheasant. Priority A-I. A large pheasant: the crown is dark grey, hindneck light grey, sides of neck greyish white, throat and foreneck black. Mantle and breast are a metallic copper, the chestnut spotted with black. The lower back, rump and upper tail coverts are blue black, conspicuously barred with white; tail is silvery grey with broad chestnut bars. The belly is white, but flank feathers are black at the base.

The White-necked Long-tailed Pheasant lives mainly in evergreen broad-leaved forests, evergreen broad-leaved and

deciduous broad-leaved mixed forests, evergreen broad-leaved and coniferous mixed forests and coniferous forests. It feeds on seeds, nuts, leaves, buds, roots, stems and insects. The breeding season begins in early April.

This pheasant is endemic to China. It is resident in Anhui, Zhei Jiang, Fujian, Hunan, Jiang Xi, and Guang Dong. In Hunan it is to be found in the west, south and east in the counties of Liu Yang, Anhua, Dongan, Jishou, Sang Zhi, Yuan Ling, Wu Gang, Xu Ling, and Dong Kou.

3. *Syrnaticus reavesii*

White-crowned Long-tailed Pheasant. Priority A-I. Large pheasant, the total length of the male is 174-200 cm while the female is 60-71 cm. The male's tail is enormously long and narrow, 100-140 cm. The crown is white, forehead pale, with the sides of the head and nape black. There is a spot below the eye, with the throat, lower part of the cheeks, and sides of the neck collar all white. Feathers are long, the lower edges broadly golden yellow, ochre on the lower back and margined with black, giving a scaled appearance. Breast and flank feathers are white, each feather with two broad black bars and broadly edged chestnut.

The White-crowned Long-tailed pheasant is endemic to China, occurring in mountainous areas in the central part of the country. It inhabits subtropical evergreen deciduous forests or evergreen, deciduous mixed forests. Egg-laying starts in April-May. In Hunan it occurs in mountainous forests in the north-west and south, for example in Ba Da Gong Shan, Zi Yun, Wan Yong Shan, and Fu Ping Shan nature reserves.

4. *Grus leucocervanus*

Siberian Crane. Priority grade A-I. Large, pure white crane. China is the most important, almost only overwintering area of this rare species. Its breeding range is not exactly known, but every winter about 2500 individuals are seen on lake Po Yang (in Jiayi) and a smaller number on lake Dong Ting in Hunan. In the 90s the following numbers have been recorded on lake Dong Ting: winter 92-93 37 individuals, 93-94 22 ind, 94-95 24 ind, and 95-96 61 ind. The Siberian Crane is also regularly recorded on lakes Wanzi, Lu and Mu Ping, but

there is no exact information available on numbers. The overwintering population in China declined at the end of the 1980s to about 500 individuals, but since then the population has gradually recovered. Extensive surveys show the winter population has risen to 2 000, 10% of them wintering on lake Dong Ting in Hunan. Threats to overwintering birds are habitat loss and disturbance from human activities (Gui 1993a, Gui 1993b).

5. *Grus vipio*

White-napped Crane. Priority A-I. This crane is one of most threatened and endangered bird species in the world. Hunanese experts found over 100 individuals in the 1980s, but today only a few can be found on lake Dong Ting. Scientists do not know why the wintering population of this crane has declined so rapidly at the lake.

6. *Grus monacha*

Hooded crane. Priority A-I. Compared with other cranes, the Hooded Crane is more common on its overwintering areas in South China than others: over 150 individuals were observed in the 1980s and early 1990s on lake Dong Ting. In the late 1990s the lake's population of wintering Hooded Cranes has declined gradually to 100 birds.

7. *Ciconia boyciana*

Oriental White Stork. Priority A-I. Lake Dong Ting is the most important winter habitat for the Oriental White Stork. This subspecies is distributed widely in the Far East, including Russia and Northeast China as a breeding region, with overwintering in the Yangtze River valley on such lakes as Dong Ting, Po Yang (Jiang Xi province), Shengjin (Anhui province), and Hong (Hubei province). The population seems

to be stable nowadays, this theory being based on research results from lake Dong Ting. The size of the overwintering population is estimated at around 300 on East Dong Ting Lake and 600-800 individuals for the Dong Ting area as a whole. The main threats to this species are illegal hunting and overfishing, which reduces the stork's food supply

8. *Ciconia nigra*

Black Stork. Priority A-I. A rare and endangered species worldwide, especially in China. A few Black Storks were found on lake Dong Ting in the winter season. Recently it was estimated that less than 10 individuals overwinter on East Dong Ting Lake, with only seven observed on East Dong Ting in 1997.

9. *Anser erythropus*

Lesser White-fronted Goose. Priority A-II. In East Asia during the twentieth century Lesser White-fronted Goose populations have suffered drastic declines everywhere in their breeding areas, staging posts, and wintering ranges. According to the latest surveys (Rose *et al.* 1997), the total population in eastern Asia is estimated at 6 000 individuals. Some 1 000-2 000 birds have been observed during migration in Kamchatka (Gerasimove 1989), and in China the goose has been seen on four lakes: 360 in Hannan, 2 450 in Po Yang, 410 in Shijiu (Perennou *et al.* 1994). However, 9 000 individuals have been recorded on lake Xiao Xi in the East Dong Ting lake complex (Liu *et al.* 1994) with an estimated 1 800 in one flock (Below *et al.* 1996). The largest number ever counted is 13700 on lake Dong Ting in 1997 (Iwabuchi *et al.* 1997). There are nowadays almost no sightings from Japan or Korea. The main threats to the species are habitat loss and illegal hunting, which also occurs within nature reserves.

fowl and waders, are concentrated on lakes Dong Ting and Mu Ping in the northern part of the province. Some of the most valuable species only overwinter: of the list above, only Yellow-bellied Tragopan, White-necked long-tailed pheasant and Imperial Eagle breed annually in Hunan.

A short list of 50 wildlife species including 30 birds is

in Chapter 12.3 (List of Priority Wildlife in Hunan). Nine of the most characteristic ones for Hunan are also presented in a separate box.

#### 4.2.4 Reptiles

The spatial geography and topography of Hunan has formed unique habitats for reptiles and amphibians; over

Table 10. Reptiles recorded in Hunan presented by conservation category.

Reptiles		
Category	Number of species	List of species (Scientific name)
Recorded in Hunan	87	
Nationally endangered		
A-I class	1	<i>Python molurus</i>
A-II class	25	<i>Chinemys reevesii</i> , <i>Cistoclemmys flavomarginata</i> , <i>Geoemyda spengleri</i> , <i>Pycidea mouhotii</i> , <i>Sacalia bealei</i> , <i>Manouria impressa</i> , <i>Pelodiscus inensis</i> , <i>Ophisaurus harti</i> , <i>Dibamus bourreti</i> , <i>Xenopeltis hainanensis</i> , <i>Elaphe carinata</i> , <i>Elaphe mandarinus</i> , <i>E.porphyracea</i> , <i>E.taeniura</i> , <i>Enhydris chinensis</i> , <i>Ptyas korros</i> , <i>Pmucosus</i> , <i>Zaocys dhumnades</i> , <i>Bungarus multicinctus</i> , <i>Naja naja</i> , <i>Ophiophagus hannah</i> , <i>Agkistrodon blomhoffii brevicaudus</i> , <i>Azemiops feae</i> , <i>Deinagkistrodon acutus</i> , <i>Trimeresurus mangshanensis</i>
Endemic to China, recorded in Hunan	13	<i>E.g. Shinisaurus crocodilurus</i>
Need special protection in Hunan	10	<i>E.g. Trimeresurus kaulbacki</i>

#### Fascinating snakes

##### *Trimeresurus mangshanensis* Mang Shan Pit Viper.

Priority A-I. Large, venomous snake. About two metres long with some distinctive features. The tail spine is short and hard, the head triangular, the tip of the snout narrow and rounded with a sharp canthus rostralis.

The Mang Shan Pit Viper is a new species and endemic reptile found in Mang Shan nature reserve in southern Hunan in the 1980s and named by Zhao Ermi in 1989. The nature reserve in Yizhang county is its total range. The snake belongs to the genus *Trimeresurus* of the Viperidae. According to preliminary study the population is around 1000 animals (Zhao et al 1989). The Mang Shan Pit Viper requires very special habitat and has special behaviour, moist forest and vegetation being the key elements of its habitat. The main threats to this species are logging and illegal hunting. More research is needed to learn about its biology, ecology and habitat requirements.

80 reptiles have been recorded, of which one belongs to the first class of protected species in China. *Testudo im-*  
*pressa* is known only from the Shao Yang region, *Andris davidianus* and *Rana tigrina* are found in every county in Hunan, and *Tylotriton asperrimus* is only found in West and East Hunan - but all are endemic species.

#### 4.2.5 Amphibians

Nearly sixty Amphibians have been recorded in the province. The Giant Salamander, an endemic Chinese species fairly common in areas with lower human pressure, is in many ways characteristic of the amphibian conservation problems in the province. Canal building and construction works along natural rivers and brooks, irrigation, clearcuts around streams, and pollution all threaten the future of this giant Amphibian.

Table 11. Amphibians recorded in Hunan presented by conservation category.

Amphibians		
Category	Number of species	List of species (Scientific name)
Recorded in Hunan	59	
Nationally endangered		
A-I class	0	
A-II class	8	<i>Andrias davidianus</i> , <i>Echinotriton asperrimus</i> , <i>Vibrissaphora bolingii</i> , <i>Rana shini</i> , <i>R. spinosa</i> , <i>R. boulengeri</i> , <i>R. yunnanensis</i> , <i>R. rugulosa</i>
Endemic to China, recorded in Hunan	17	E.g. <i>Andris davidianus</i> , <i>Tyloriton asperrimus</i>
Need special protection in Hunan		E.g. <i>Andris davidianus</i> , <i>Tyloriton asperrimus</i>

#### Symbol of precious Amphibians

##### *Andris davidianus* Giant Salamander.

Priority A-I. This is the largest amphibian in the world – the body length of adults is over 20-30 cm. The body is strong, thick and flat. The head is very wide and flat, with head tubercles arranged in many paired columns.

The Giant Salamander is endemic to China. Its range covers large areas except the provinces Xinjing, Xizang, Heilong Jiang, Jilin, Liao Ning, and Taiwan. It lives mainly in mountainous brooks of the upper reaches of the rivers Chang Jiang, Huanghe, and Zhu Jiang and is especially common in the provinces of Sichuan, Gui Zhou, Hunan, Hubei, and Shan Xi. In Hunan 8 cities or prefectures (34 counties) have Giant Salamanders, including Xiang Xi Autonomous Prefecture, Changde city Zhang Jia Jie city, Huai Hua city, Shao Yang city, Youg Zhou city, Chen Zhou city, and the Loudi area.

The Giant salamander is one of the endangered species of the mountain streams of Hunan, here held by the Director-General of FDH, Mr. Ge Handong.



#### 4.2.6 Fish

Chinese Sturgeon (*Acipenser sinensis*), White Sturgeon (*Psephurus gladius*) and a great number of other poorly known fish, some of which are endemic (e.g. *Acipenser sinensis*), live in lake Dong Ting and other lakes in the same river-lake system.



Table 12. Fishes recorded in Hunan presented in the conservation categories.

Pisces		
Category	Number of species	List of species (Scientific name)
Recorded in Hunan	194	
Nationally endangered		
A-I class	3	<i>Acipenser sinensis</i> , <i>Psepharus gladius</i>
A-II class	1	<i>Myxocyprinus asiaticus</i>
Endemic to China, recorded in Hunan	2	<i>Acipenser sinensis</i> , <i>Psepharus gladius</i>
Need special protection in Hunan	2	<i>Acipenser sinensis</i> , <i>Myxocyprinus asiaticus</i>

### 4.3 Genes

Besides the protection of valuable ecosystems and species, the conservation of valuable genes is one of the key questions in attempts to preserve the biodiversity of Hunan. Some special efforts have been made to promote this kind of nature conservation. Wild species are cared for

*Rhesus macaques (Macaca mulatta) live in mountain forests. They are easily tamed, as here in Zhang Jia Jie.*



using ex-situ conservation methods, and domestic species can be protected by encouraging people to make use of them. In the following we present methods for ex-situ and domestic species conservation.

#### 4.3.1 Ex-situ Conservation of Species

Botanical gardens, tree gardens, and nurseries are the main ways to develop the ex-situ conservation of plants. Hunan has a botanical garden called Tianji Ling Forest Botanical Garden, a tree garden, and about 90 state-owned nurseries around the province. Nurseries mainly provide seedlings for afforestation and economically important plants, but they also collect seeds from rare and precious plant species for artificial propagation. Botanical and tree gardens collect, propagate and preserve indigenous plant species, produce plants for commercial, e.g. medicinal, food-related or other use, and – perhaps most importantly – promote scientific research and develop propagation techniques.

At the moment, about 80% of the ca. 1800 species of wild trees in Hunan have already been collected and cultivated in the gardens. These include almost all the endangered species of China, and the artificial propagation of *Cathaya argyrophylla*, *Metasequoia glyptostroboides*, and *Davidia involucrata*, has been successful.

Ex-situ conservation is also a commonly used method for saving animals from extinction. However, it is to a certain extent controversial, because the risks are often higher than for other conservation methods.

In Hunan there are two main systems for raising wild animals in captivity. The Ministry of Construction has established commercial zoos in many cities in the province, including the zoos of Changsha, Zhu Zhou, Heng Yang, and Xiang Tan cities. The largest is the Zoo of Changsha, but it is still small compared with those in some other provincial capitals of China. Changsha zoo holds 110 species.

Wild animals are raised for non-commercial use in the Wildlife Saving, Protecting and Breeding Centre of Changsha, which is funded by the Ministry of Forestry. It was established in 1990, with the first stage of construction completed in 1995. The centre has so far saved about 10 000 individuals of more than 30 species, many of them endangered. There are also about 60 smaller wildlife-raising farms around the province that raise several commercial species such as Common Pheasant (*Phasianus colchius*), Large Indian Civet (*Viverra zibethica*), Rhesus macaque (*Macaca mulatta*), and wild boar (*Sus scrofa*). Wild geese are frequently bred on all the farms.

In general, the ex-situ conservation of plants as well as animals has suffered from inadequate funding and small raising units. This has resulted in problems concerning the quality of animal treatment, increased risks of epidemics and the mixing of genetic material. Costs per animal in the wildlife centres and wildlife-raising farms become high and results for the more demanding species – often the rare, endangered ones – are not good enough. The scientific aspects of the work could also be developed further.

#### 4.3.2 Genetic Variation of Cultivated Plants and Domestic Animals

Hunan Province, one of China's earliest inhabited areas, has a long history of livestock raising and economic plant cultivation. Archaeological studies have shown that primitive agriculture began 5000-7000 years ago in the province. Rice and other cereal crops were cultivated early in

the Shang Dynasty (1600 –1100 BC). In the West Han Dynasty (206 B.C – 24 AD) mulberry (*Morus alba*), cudrania (*Cudrania tricuspidata*), and ramie (*Boehmeria spp.*) were widely planted, and domestic animals such as water buffaloes, chickens, sheep, dogs, silkworms, and honey bees commonly raised by local people.

As a result of the long association of man with domestic animals and plants, many valuable varieties of some species have been taken up for use by local people. In recent decades many of these have been used as important genetic resources for hybridising. Some of the animals and plants yield special products, e.g. the Ning Xiang pig, Dongan duck, Jun Shan tea plant, Heng Nan plum and Hui Tong Chinese fir, which are famous in Hunan Province and elsewhere.

Biodiversity among domestic animals and cultivated plants in Hunan has nonetheless been poorly documented and studied. It is in fact impossible to publish a full catalogue, so that one can here only enumerate a small part of the biodiversity of either domestic animals or plants, and seek to give a general picture by dividing them according to specific economic use.

There are altogether 17 local breeds of livestock and poultry in Hunan Province, among which are 5 breeds of pigs (i.e. Ning Xiang pig, Da Wei Zi pig, Sha Lin pig, Xiang Si black pig, Qian Shao Hua pig), three breeds of cattle (Bin Hu buffalo, Xiang Si cattle, Xiang Nan cattle), two breeds of goat (Ma Tou goat and Xiang Dong black goat), 2 breeds of chicken (Tao Yuan chicken and Huang Lang chicken), 2 breeds of duck (Lin Wu duck and You Xian duck), and three breeds of geese (Xu Pu goose, Wu Gang goose and Ling Xian white goose). These breeds have advantageous characteristics (but of course also shortcomings) which have and will continue to play an important role in developing animal husbandry in the future (Deng *et. al.* 1994).

The genetic foundation of wild animals undergoes directed modification during their domestication process, as humans keep on practising selection on principles quite different from those that would apply in the wild. This leads to variations of varying degree in appearances, physiology, and reproduction. In general the trend is to

wards an animal satisfying primarily human rather than environmentally driven needs.

Since the 1980s animal husbandry has developed very rapidly in Hunan. However, numbers of some local breeds continue to decrease annually because they are unable to compete with a few high-yield breeds introduced from abroad which are attractive to short-term economic interests. People also unsystematically crossbreed local and other varieties, driving the former to the verge of extinction. Of all breeds, pigs suffer the greatest influence, with chickens ranking second. Geese have suffered the least.

The animal husbandry sector in Hunan Province has taken conservationary measures to protect local breeds of livestock and poultry such as Ning Xiang pig, Da Wei Zi pig, Sha Zi Ling pig, Bin Hu buffalo, TaoYuan chicken, Huang Lang chicken, and the Xu Pu goose. Special funds are allocated each year to conservation breeding, and farms for this purpose are in operation. More sophisticated breeding bases are planned. Selection and breeding among a single strain protects its original advantages as well as generating improvements, and these measures have proved satisfactory.

Some problems remain in conservation breeding of livestock and poultry in Hunan. Some local breeds have not been brought under protection, and the availability of others is too small to satisfy the requirements of safe conservation. Funds are also too limited to ensure the implementation of the conservation measures needed, and local methods of conservation breeding too backward to ensure ideal effects.

As to the conservation of wild ancestors of livestock and poultry in Hunan Province, some measures have been taken but they are far from enough. Excessive hunting of wild animals still happens in many places, and ecological conditions have also changed. This have led to a decline in the number of surviving livestock/poultry wild ancestors in Hunan province.

#### 4.3.3 Cultivated Plants

It is inferred that ancient people depended on plants to a larger extent than on animals for their basic requirements because of ecological necessity. In fact people have bene-

fited a lot from plants in many ways besides. The following lists some of the main plants specific to Hunan divided by their uses:

**Food.** The ancient people of Hunan were certainly frequently bothered by lack of food; this may help to explain why edible plants remain the principal ones cultivated. In Hunan province many food plants have also been well preserved and their characteristics developed. The following are some of the precious traditional cultivated varieties:

##### Cereal

- 1) Lian Yuan fragrant rice (*Oryza sativa*)
- 2) Xiang Xi corn (*Zea mays*)

##### Fruit

- 1) Qi Dong golden & sweet shaddock (*Citrus grandis*)
- 2) Ma Yang mandarin orange (*Citrus sinensis*)
- 3) Heng Nan plum (*Prunus salicina*)
- 4) Dong Ting water caltrop (*Trapa bicornia*)
- 5) Yubei lotus root (*Nelumbo nucifera*)

##### Nut

- 1) Shao Yang duoli (chestnut) (*Castanea mollissima*)
- 2) Shao Dong peanut (*Arachis hypogaea*)
- 3) Xiang Lian (Hunan lotus-seed) (*Nelumbo nucifera*)
  - i) Xiang Tan cun-san
  - ii) Tao Yuan Jiu Xi Hong
- 4) Hunan hickory (*Carya hunanensis*)

##### Cooking oil

- 1) Heng Dong Datao (tea-oil tree) (*Camellia oleifera*)
- 2) Yong Xing Zhong Bao Hong Qiu (tea-oil tree)
- 3) Youxian baoke Xiang You Cha (tea-oil tree)

##### Vegetable

- 1). Hunan small hot pepper (*Capsicum frutescens*)
- 2) Hunan balsam-pear (*Momordica charantia*)
- 3) Bamboo shoots (*Phyllostachys pubescens*)

##### Drink

- 1) Gu Zhang Mao Jian (green tea) (*Camellia sinensis*)
- 2) Nan Yue Yun Wucha (green tea)
- 3) Jun Shan Maojian (green tea)
- 4) Sui Ning gymnostemma tea (*Gymnostemma sp.*)

**Medicines.** Apart from edible plants, the Chinese have planted medicinal plants for at least 2500 years. Plants form a part of the traditional Chinese medical science and Hunan is among the most active provinces in producing Chinese medicines. Important medicinal plants produced in Hunan are the Cili Eucomia (*Eucomia ulmoides*), Pingjian Atractylodes (*Atractylodes macrocephala*) and Xiang Xi philodendron (*Phellodendron chinense*).

**Timber.** Timber has been used by human beings since prehistoric times. Traditional Chinese architecture, furniture and some handicrafts have relied heavily on wood in various forms. Its special features continue to make it an irreplaceable material in many respects.

Hunan Province has been one of the important timber producers in China. The Chinese fir (*Cunninghamia lanceolata*) and horsetail pine (*Pinus massoniana*) are of special significance and they have become the main plantation trees in Hunan. These species have a nationwide reputation for fast growth rates and a straight trunk with small branches. Clonal seedlings of Chinese fir and seeds of the horsetail pine have good markets in China.

Bamboo (*Phyllostachys pubescens*) has been planted in Hunan for a long time and Hunan ranks first among all the provinces of China in terms of the area devoted to its cultivation. Bamboo is famous for its tremendous growth rate (7-8 years rotation) and multiple uses. It can be used for architecture, crafts, floorboard, and plywood. Bamboo shoots are a delicious and healthy food. However, local varieties of bamboo remain poorly studied. Yi Yang, Heng Yang, and Shao Yang are the bamboo centres of Hunan; further studies on the diversity of bamboo timber quality and the nutritional/taste values of different bamboo shoots are urgently needed.

**Ornamental plants.** Traditional Chinese culture has paid much attention to ornamental plants and believed that plants can be used to imply human aspirations and ideals. Three favourite plants cherished by Chinese people are the pine tree, bamboo, and the plum tree, symbols of tenacity (the leaves of the pine tree remaining green in all seasons), integrity (the bamboo's straight trunk) and bravery (plums often blossoming even in snow).

Hunan's traditional famous ornamental plants are the lotus (*Nelumbo nucifera*) and the cottonrose hibiscus (*Hibiscus mutabilis*), giving the province the nickname "the lotus state". Another famous garden plant, the red Chinese loropetalum (*Loropetalum chinensis* var. *rubrum*), is endemic to Hunan.

**Other usage.** Plants have multiple uses. In Hunan, the tung tree (*Vernicia fordii*) is planted for the extraction of tung oil. The lacquer tree (*Toxicodendron vernicifluum*) for its lacquer. Many other plants such as *Linum usitatissimum*, *Coreborus olitorius*, *Boehmeria nivea*, *Melochia corchorifolia*, and *Alchornea davidii* are cultivated for fibre. *Ricinus communis* and *Sapium sebiferum* are used for industrial oil, and *Morus alba* for feeding silkworms. Moreover, there are many plants used in the manufacture of glue, soaps, cosmetics, plastics, dyes, lubricants and polishes etc. Hunan is particularly famous for its three traditional varieties of tung tree (*Vernicia fordii*): Dami tung, Xiaomi tung and Putao tung, which all produce high-quality oil, yield a lot of seeds, and have a high oil extraction ratio.

Some plants have multiple uses; for example, the camphor tree can be used for high quality timber as well as camphor extraction.

#### 4.3.4 Domestic Animals

Animal husbandry has never dominated the agriculture of Hunan but has served as a profitable supplement. We know that in the process of domestication only small numbers of wild animals were enfolded into human societies. Most have been totally controlled by man during breeding, so that genetic variations have been well preserved.

The genetic variation of domestic animals in Hunan is still poorly studied and documented, and literature on genetic variation remains rare and fragmentary. The categories enumerated here have been compiled from local product information from people and businessmen.

**Food animals.** Domestic animals serve various purposes, above all as a food supply. The main food animals in the province are pigs, oxen, goats, rabbits, and poultry. The principal noteworthy varieties are listed below:

Cheng Bu milk cow (black and white high-yielding cow)  
Xiang Nan ox (*Bos sp.*)  
Xiang Xi ox (*Bos sp.*)  
Xiang Dong black goat (*Capra hircus*)  
Wuxue goat (*Capra hircus*)  
Matou goat (*Capra hircus*)  
Nin Xiang pig (*Sus domesticus*)  
Da Wei Zi pig (*Sus domesticus*)  
Shazilin pig (*Sus domesticus*)  
Xiang Xi black pig  
Qian Shao spotted pig  
Dongan duck (*Anas platyrhynchos*)  
Lin Wu duck (*Anas platyrhynchos*)  
You Xian duck (*Anas platyrhynchos*)  
Tao Yuan chicken (*Gallus gallus*)  
Huang Lang chicken (*Gallus gallus*)  
Dongan chicken (*Gallus gallus*)  
Xupu goose (*Anser anser*)  
Wu Gang goose (*Anser anser*)

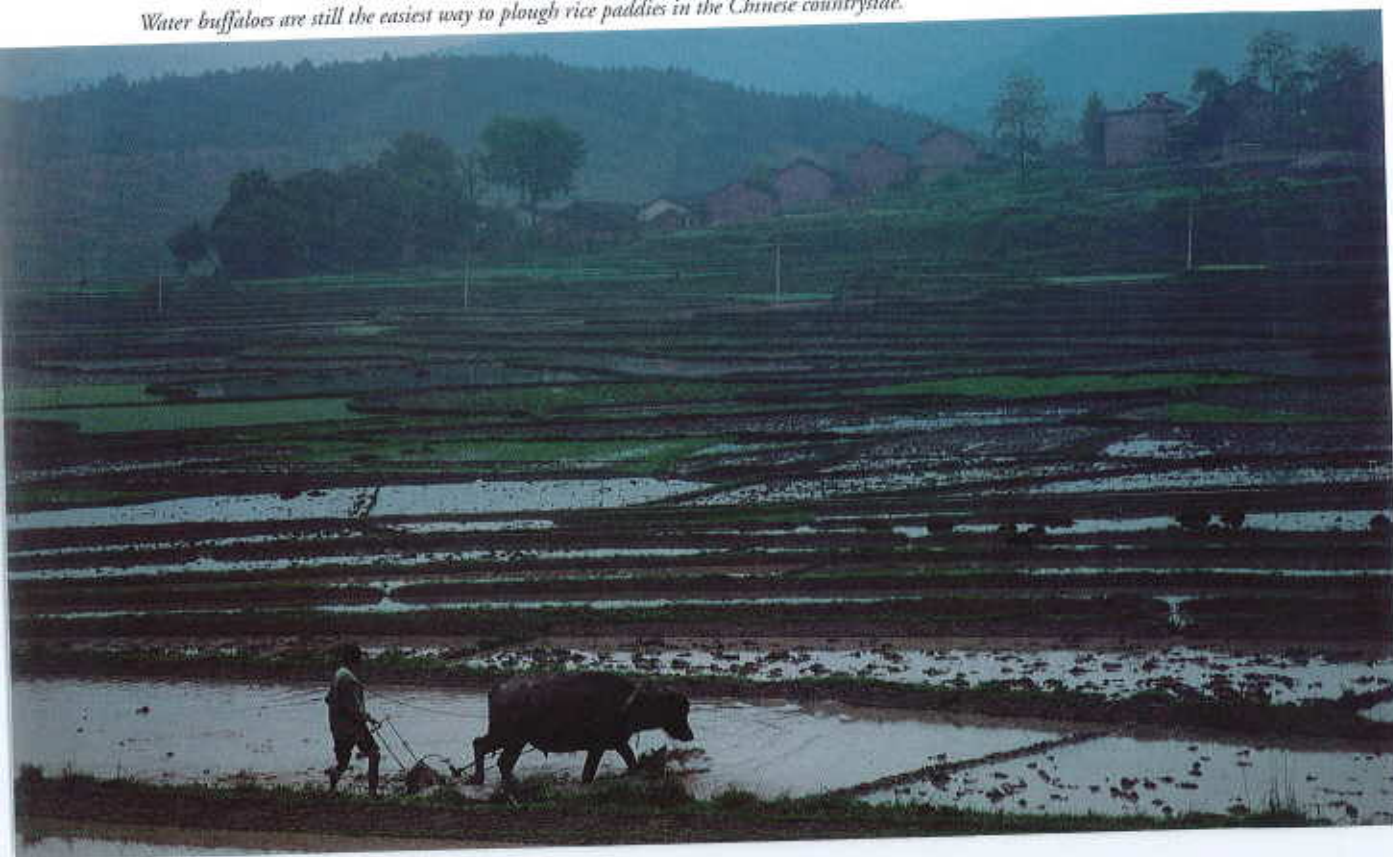
Ling Xian white goose  
Yue carp (*Cyprinus carpio*)  
Lotus carp (*Cyprinus carpio*)  
Hunan crucian carp (*Carassius carassius*)

**Beasts of burden and pets.** People in Hunan have a long history of raising water buffaloes (*Bubalus bubalis*) as working animals. Long ago they were of great importance to farmers and are still regarded as a symbol of hard work and selfless contribution. Apart from the "Binhu water buffalo", there are no other varieties known from Hunan because of the lack of detailed studies.

Dogs, cats, and pigeons have been raised as pets in Hunan for a long time. However, no literature about their genetic variation in Hunan is available.

Some animals have been domesticated for other purposes, for instance the tortoise and soft-shelled turtle are domesticated for medicine as well as food, the muntjak and some snakes for leather, the duck for feathers etc. Because most of them are still at the initial stages of domestication, no genetic variation has been reported.

*Water buffaloes are still the easiest way to plough rice paddies in the Chinese countryside.*



Attention should be given to one current problem in domestication. At present, more and more people are interested in raising so called "improved species" of domestic animals such as pigs and chickens, because of their fast growth. Few care for their local counterparts, which will certainly lead to the loss of valuable genes before they are even discovered. As a part of biodiversity, the genetic variation of domestic animals should be extensively studied and protected.

## 4.4 Protected Areas

### 4.4.1 Nature Reserves

At the moment there are 38 nature reserves in Hunan with a total area of 6 795 sq. km. This is 3,2% of the area of the province. All the reserves can be classified as category IV using IUCN (the World Conservation Union) criteria. Thus there are no scientific (restricted access) nature reserves or national parks in an IUCN sense, al-

though Zhang Jia Jie National Forest is rather similar to many national parks. The definitions of all the IUCN categories are presented in Chapter 12.6.

The first nature reserve in Hunan was established in 1958, when the Mang Shan state tree farm drew up a management plan for its protection. Unfortunately management there was disturbed and stopped in the 1960s and 70s. Mang Shan Nature Reserve restarted its work in 1982, but a part of the original reserve was excluded. The next new nature reserve was established in 1977 (Su Xian Ling), with most of the others following in the 1980s, and the two latest ones in 1991.

Most of the nature reserves are covered by natural, some even by primeval forests, which are considered very precious. At least Ba Da Gong Shan, Hu Ping Shan, Huang Shan, Mang Shan, Nan Yue, Xiao Xi, and Zhang Jia Jie are of a high value even internationally as there are only very small numbers of subtropical mountain forests left at these latitudes in the world, this being the northernmost part of their range.

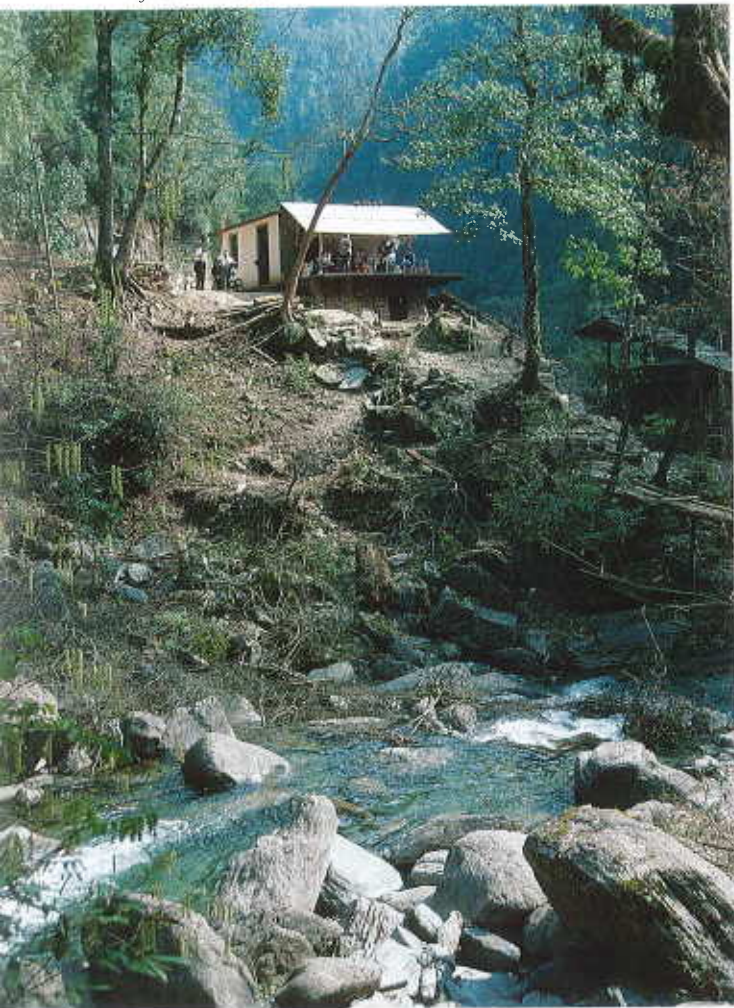
*Paths following mountain streams in Hu Ping Shan nature reserve.*



There are three main purposes for establishing reserves for administration by the Forestry Department: the conservation of forest ecosystems, wetland ecosystems and wild fauna and flora.

Some small nature reserves are protected as geological sites, others for the protection of a single species or in order to preserve some special, limited ecosystem. On the other hand, East Dong Ting Lake consists of a very large area of wetlands and channels representing one of the most

*Hu Ping Shan nature reserve is situated in a remote mountain area of NW Hunan.*



important bird sanctuaries in Asia. The neighbouring nature reserves West and South Dong Ting Lake share some of the values of the eastern one because the overwintering cranes, geese and waterfowl move from lake to lake. However, East Dong Ting Lake is considered the single most valuable entity.

All the 38 nature reserves and their main habitats are briefly presented in Chapter 12.5 and below in table 13.

The network of nature reserves is fairly new since most of them were established in the 1980s. The Forestry Department administrates 33 of the nature reserves and is thus the main authority on nature conservation in the province. Both the Mineral Resources Department and Environmental Protection Agency are responsible for two reserves each, and the Agriculture Department has one.

The nature reserves are many, cover over three per cent of the province, and have people living within the reserve in about half of them. Many of the inhabitants and even visitors remain unclear as to the reserves' regulations and borders, although they represent the main part of unspoilt nature remaining in the province. Land use pressure is great, and accordingly there are problems in the everyday management of the reserves. The main difficulties are:

**1** The network of nature reserves is not comprehensive. Subtropical forests in Hunan have relatively high conservation value because there are very few such forests left anywhere at this latitude. However, Hunan's network of nature reserves covers neither all the ecosystems nor biogeographical features to be found in the province, nor even all the areas of international importance. Current nature reserves do not permit the conservation of endangered species to be carried out satisfactorily. The reserve network also does not cover different parts of the province evenly, e.g. there are still two administrative districts without any nature reserves. Particularly the Huai Hua region urgently needs areas designated for protection.

**2** The size and structure of nature reserves is not always satisfactory. In the current network of nature reserves there are only a few wetlands, even if their area is

fairly large. Only a part of the lake Dong Ting site is protected in three separate nature reserves (East, West and South Dong Ting Lakes), although the whole wetland complex have very high conservation value. On the other hand, the boundaries of the reserves often do not follow natural formations, which may result in erosion or illegal use of the reserve.

**3** Conservation regulations are not always sufficient. In 1985 the State Council past a resolution on "Management Measures for Forest and Wildlife Nature Reserves". In the same year the provincial government approved the "Instructions on Management Enforcement for Forest and Wildlife Nature Reserves". Although these regulations have now been implemented, some reclamation, construction and other activities continue within many nature reserves. For example, a hydroelectric power plant with dam and overhead electricity wiring has been established in the core of the Mang Shan Nature Reserve. Economic development continues very fast everywhere around the reserves, even within the borders of East Dong Ting Lake

Table 13. Main goals of the 38 nature reserves in Hunan (Forestry Department of Hunan, 1999). Note that the categories presented here (in 'goal of protection') overlap each other so that 88% of them (based on surface area) belong to those protected for the sake of wild animals or wild plants, 86% because of forests or wetlands, 3% because of their cultural heritage, and 1% because of geology.

Goal of protection	Number of reserves	Area in sq. km	Area in %
Geology			
— Geological formations	3	82	1
Ecosystems			
— Forests	16	1 948	29
— Wetlands	3	3 850	57
Fauna and Flora			
— Endangered species	22	5991	88
Cultural heritage			
— Natural relics	2	115	2
— Minority culture	1	37	1
Total	38	6795	100

Nature Reserve, which is clearly threatening and destroying its environment. Similar nibbling continues in many other reserves.

**4** Conflicts between nature conservation and economic development have not been solved satisfactorily. In some areas the local administration, sometimes also higher authorities, give greater priority to economic benefit than to conservation. A nature reserve may for instance be advertised as a new scenic spot and new infrastructure for tourists be constructed within the reserve. These activities result in a whole new township growing around the attraction resulting in the reserve losing its original value in a few years.

**5** There is a shortage of professional personnel. Most of the personnel of the Forestry Department and the other agencies responsible for the management of the nature reserves have no professional education or special training for this work. Usually the local forestry bureau takes care of the nature reserves in its district alongside other duties. Many reserves have no professional staff at all. Accordingly, scientific work or ecosystem monitoring is limited to only a few reserves.

**6** Nature reserves have not been developed for lack of adequate funding. Nearly one third of provincial nature reserves are only a name on official documents since there are no funds for temporary staff. The entire infrastructure needed for normal management, marking of boundaries or supervision of the area is missing.

#### 4.4.2 Forest parks

There are 35 forest parks in Hunan, of which 22 are considered national forest parks. Most of them are fairly small, as the total area of the forest parks is 1431 sq. km. However, ten forest parks include also nature reserves with an area of 906 sq. km. The area of forest parks (without nature reserves) is 0,2% of that of the whole province; all the 38 nature reserves together with the 35 forest parks cover 3,4% of the area of Hunan province.

The goals of forest parks and nature reserves are quite similar. Forest parks have more facilities and services for visitors, and movement and access are freer, while nature





*Huayanxi national forest park*

*Alpine meadows and shrubs are a beautiful part of Zhang Jia Jie.*

reserves concentrate more on conservation and scientific research. There is of course some overlap. The Forestry Department and the local forestry offices manage the forest parks, while national forest parks are, as with nature reserves, partly funded by the Ministry of Forestry. The Provincial Government, the Forestry Department and the local forestry authorities together fund the provincial forest parks. In some forest parks a considerable part of annual income comes from visitors.



## 4.5 The Use of Biodiversity for Research and Tourism

### 4.5.1 The Role of Scientific Research in Biodiversity Conservation

Some universities and institutes such as the Central Southern Forestry College, the University of Hunan, the Forestry Institute of Hunan, and Forestry Design and Planning Institute of Hunan have carried out surveys on the fauna and flora of the province. The forest resources of the region were estimated in connection with the first, sixth and eight five-year plans. Other surveys have been made on e.g. vegetation, forest insects, rare trees, snakes and the Asiatic Black Bear. In the nature reserves recent work includes a bird census and vegetation mapping at East Dong Ting Lake, and biodiversity research in Ba Da Gong Shan.

In 1984, the Forestry Department completed a zonation plan for the nature reserves, which has formed the basis of their later management. In 1988 the Chinese National MAB Committee established a monitoring station in the Ba Da Gong Shan and Hu Ping Shan Nature Reserves, and in the National Forest Park of Zhang Jia Jie. At Lake East Dong Ting nature reserve a bird ringing station has started up. All this research also serves the provincial monitoring network on wildlife and wetlands, which is administrated by the Forestry Department.

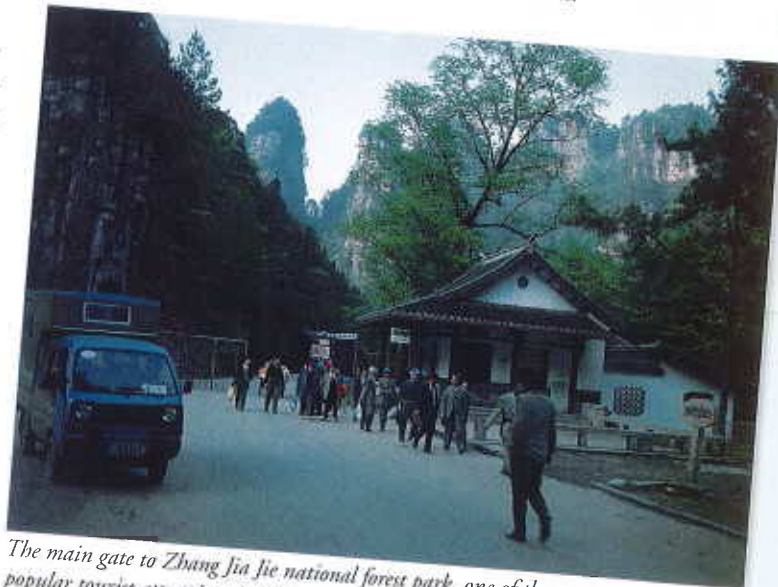
### 4.5.2 The Role of Tourism in the Use of Nature Reserves and Other Valuable Areas

A common goal in many countries is to make tourism more sustainable. This means reducing the tourist facility and enterprise-caused burden on the environment. This idea has caught on in many tourist resorts, because the clients themselves, the tourists, now demand it.

Besides sustainable tourism, tourism offering experiences in nature is often called *ecotourism*. The concept is not exactly defined and the name could be considered misleading, but it is so commonly used that it is applied also here. Ecotourism is one of the faster-growing branches



*Research station by East Dong Ting lake in northern Hunan.*



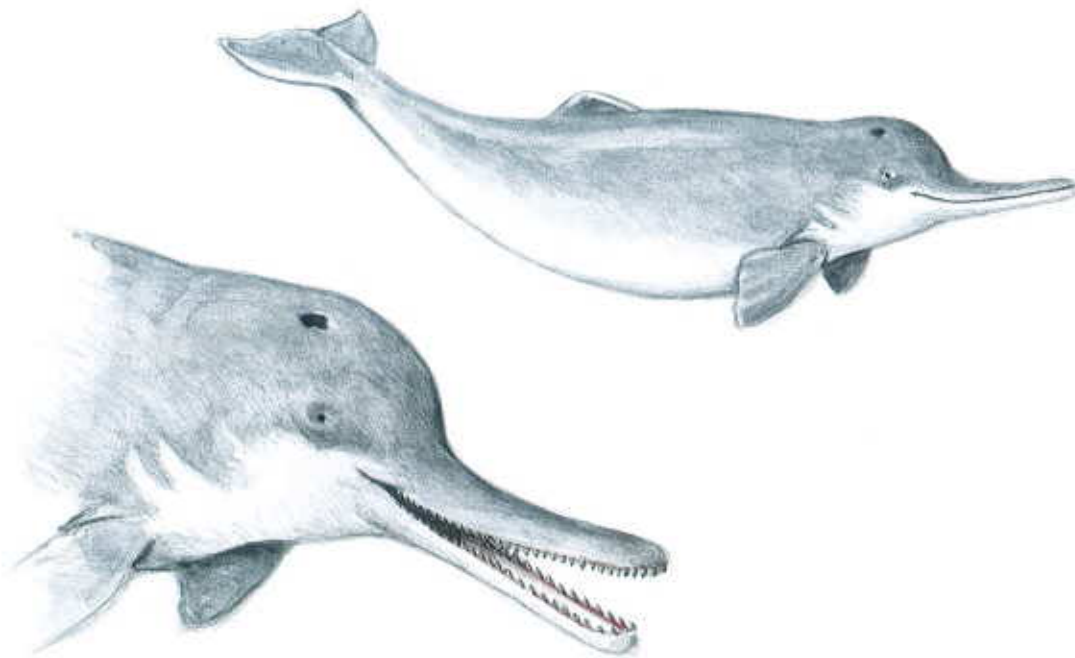
*The main gate to Zhang Jia Jie national forest park, one of the most popular tourist attractions in Hunan*

within the tourist industry, but unfortunately it has created serious problems in many densely populated countries with small areas of accessible nature (see reference 'Loving them to death', 1995). Even some national parks have suffered from too much popularity, and rules for visitors have had to be tightened, even to the point of closing some parts of the parks.

Lately some nature conservation organisations, such as the World Wide Fund for Nature (WWF) have proposed rules for ecotourism. The aim is to reduce harmful impact and increase positive ones for the environment and local communities. These ten principles, formulated by the Swedish WWF, are presented in detail in Chapter 12.7. Although they were aimed at Europe, many points are worthy of consideration also in China.

At the moment and for the near future it seems evident that tourism and ecotourism will continue to grow rapidly in Hunan. For more on problems facing ecotourism in Hunan, see also chapter 3.7. Some interesting details about the development of this livelihood can be presented. Ac-

ording to local officials there are annually over 1 million visitors on Temple Island, a small historical site and cultural monument within the large East Dong Ting Lake nature reserve. Zhang Jia Jie National Forest Park is also very popular: there the number of visitors has been estimated as high as 2 million (1996), with the number of visitors recently growing by about 10% per year. On one of the summits in the Forest Park Huang Shi there were between 10 000 and 20 000 visitors per year already before construction of a cable car, which was started in 1997. In contrast, Hu Ping Shan and Mang Shan nature reserves, among the richest areas in the province in terms of biodiversity, see only about 1000 and 5000 visitors per year respectively.



*Lipotes vexillifer*

## 5 Economic Use and Value of Biodiversity

Humans originally subsisted on collecting plants, fruits and small animals, and on hunting and fishing. Thousands of years ago primitive agriculture and animal husbandry little by little took over, but still today people utilise wild animals and plants in many ways: for food, fuel, medicine, ornaments and the manufacture of fur, furniture, soap, perfume etc.

The people of Hunan have taken advantage of their plentiful natural resources. Traditionally food, medicine and fuel were obtained from nature, and people still benefit much from the region's natural biological diversity. Industries such as medicine, agriculture, food, and fisheries use biodiversity in different ways and for different purposes. New uses and values (e.g. tourism) are being discovered and developed.

### 5.1 Current Use and Value of Nature Products

#### 5.1.1 Medicines

Although man cultivates the raw materials for a considerable number of Chinese medicines, a great deal of them still depend heavily on collection of wild plants and some animals. Tremendous numbers of wild plants (about 2060 species in Hunan) exist suitable for use as medicine, 150 species of which have an annual output of over 100 tons. It is not possible to list them all in this report. Plants such as *Akebia quinata*, *Sinomenium acutum*, *Coptis chinensis*, *Rumex madai*, *Siraitia grosvenorii*, *Poris cocos*, *Acanthopanax* spp., *Peucedanum praeruptorum*, *Saposhnikovia divaricata*, *Scrophularia ningpoensis*, *Clematis chinensis*, *Epimedium sagittatum*, *Polygala tenuifolia*, *Portulaca oleracea*, *Achyranthes bidentata*, *Gynostemma* spp., *Paris polyphylla*, *Ligustrum chinensis*, and *Pinellia ternata* are the main

medicinal species purchased from some local professional collectors or planters each year (Deng *et. al.* 1994).

There are 56 animals with medicinal use recorded in Hunan, such as tortoise, musk deer, many snakes, tiger, leopard, and hedgehog. Most of them are now very rare due to overhunting and their use for medicinal purposes strictly forbidden in order to save the remaining populations. Poaching is still a problem, especially in remote areas, but some of the desirable animals such as snakes, soft-shelled turtle, and rocky frog are being domesticated.

The great demand for medicines and the limited supply of natural and domesticated raw-materials have lead to a shortage of Chinese style medicines on the market. This has largely been caused by the unsustainable harvesting levels of previous decades. Because there is no effective mechanism to guide the collectors and no detailed information about the quantity of resources, it would appear difficult to ensure sufficient medicines for the future. A study on the conservation of medicinal biodiversity is urgently needed.

#### 5.1.2 Natural Products as Food

A great deal of biological diversity, both animals and plants, can be used for food. For the people of remote regions food from nature is still a welcome dietary supplement. In cities people are becoming more and more interested in so-called "natural food" which is believed to be healthier.

There are plenty of edible wild plants in Hunan: Incomplete statistics show that there are at least 550 plants in the region usable directly or indirectly as food. Some species are of special significance: *Rosa lavigata* is used to extract a kind of sugar called "lavigata sugar", which is delicious and full of vitamins and especially favoured by children. The fruits of *Kadsura coccinea*, *Vaccinium bract-*

*eatum*, *Phaseolus calcaratus*, and *Pyracantha fortuneana* were formerly used as a staple substitute during hard times. *Actinidia chinense* was domesticated from a wild ancestor, and the fruits of the improved species planted. *Hovenia dulcis* was used in Hunan to brew a special wine called Wangshouguo Jiu (long life wine), which sells well in China and abroad. *Gynostemma* spp, because of its special function in adjusting blood-pressure and rejuvenating cells, is used to process a kind of tea called "Southern ginseng tea" by Sui Ning County. Ginseng is exported to

other south-east Asian countries.

Wild animals can be used as food. The wild hare (*Lepus sinensis*), porcupine (*Hystrix hodgsoni*), badger (*Meles leptorhynchus*), sand badger (*Arthonyx collaris*), wild boar (*Suscrofa chirodonta*), frogs (*Rana* spp.), *Rhizomys* spp., sparrows, wild ducks and many other species have been common sources of nourishment in Hunan. However, the populations of these wild animals have declined and hunting of them has been regulated in recent years for the sake of conservation.

Many kinds of foodstuffs are sold on streets in cities and towns.



### 5.1.3 Agriculture and Forestry

In agriculture many wild species with valuable products are now farmed or cultivated (e.g. soft-shelled turtle, snakes, *Aloe vera* var. *chinensis*), used as hosts for an economic parasite (e.g. *Fraxinus chinensis* for the wax insect), and as sources of hybrids (e.g. the selection of male sterile individuals of *Oryza* spp. for the cross breeding of paddy rice).

The wild boar (*Sus scrofa*) has been hybridised with domestic pigs to improve immunity and the lean meat ratio.

In forestry, timber is one of the major uses of natural tree resources. About 51.7% of the total area of Hunan is regarded as forest, that is 109 000 sq. km. Of this about 80% is suitable for forestry. In 1997, the total standing volume of forest in Hunan was 245 million cubic meters. The number of woody plant species in the province reaches 2 200, belonging to 500 genera and 113 families. 500 species of these can be used for timber. Many precious high-quality timbers are from wild trees: Four famous Hunan timber trees are the camphor tree (*Cinnamomum camphorus*), catalpa tree (*Catalpa bungei*), nanmu (*Phoebe* spp) and chowmu (*Cyclobalanopsis* spp). Other high-quality trees found in Hunan are *Tsuga chinensis* var. *tchekiangensis*, *Zelkova schneideriana*, *Torreya grandis*, and *Michelia macclurei* var. *sublanaea*. People also use by-products of forest trees, resin, galls, and lacquer being common examples. Some wood-inhabiting edible fungi such as *Auricularia auricula-judae*, Xianggu mushroom, and tremella are food favoured by local people.

Some insects are used as natural enemies of pests in both agriculture and forestry. For instance, *Coccinella septempunctata*, *Leis axyridis*, *Trichogramma* sp. and *Syrphus* sp. are used to control pests in Hunan.

### 5.1.4 Fisheries

Hunan has been acclaimed as "the land of fish and rice". Fish are indeed of particular importance in the province. Water covers about 1,36 million hectares, accounting for about 6,4% of the province's total area. In addition,

there are about 0,87 million hectares of paddy fields that can also be used for raising fish. There are 168 indigenous fish species in Hunan, among them silver carp (*Hypophthalmichthys molitrix*), carp (*Cyprinus carpio*), bighead (*Hypophthalmichthys nobilis*), grass carp (*Ctenopharyngodon idella*), crucian carp (*Carassius carassius*), anchovy (*Engraulis encrasicolus*), bream (*Abramis brama*), triangular bream (*Megalobrama terminalis*), and black shrimp (*Crangon nigricauda*), which all have commercial importance. Annual fish production has increased from 43 400 tons in 1949 to 600 000 tons in 1990 (compare with figures for agriculture, table 5).

### 5.1.5 Industrial Processing

**Fur, Leather & Feathers.** In Hunan there are about 120 species of animals yielding fur, leather, and feathers. Common fur animals include *Mustela sibirica*, *Felis bengalensis* ssp. *chinensis*, *Lepus sinensis*, *Viverricula indica*, *Nyctereutes procyonoides*, and the fox *Vulpes vulpes hoole*. The principal leather animals of Hunan are *Muntiacus reevesi*, *Elaphodus cephalophus* ssp. *ichangensis*, *Sus scrofa*, *Cervus unicolor dejceni*, and *Moschus berezovskii*. Numerous birds provide feathers, especially ducks, geese, cranes, hawks, eagles and gallinaceous birds.

**Fibres.** There are over 200 species of fibre-producing plants in Hunan of which about 30 are significant. Some wild plants contain fibres of reasonable quality and are used to manufacture artificial cotton and paper. The famous paper raw material of Hunan is the reed *Phragmites communis*, grown mainly in the northern part of the province and widely utilised e.g. around the lake complex of Dong Ting. Other important fibre plants are *Pennisetum alopecuroides*, *Arundo donax*, *Alloteropsis semialata*, *Bothriochloa intermedia*, *B. ischaemum*, *Mallotus apelta*, and *Eulalia speciosa*.

**Chemicals.** *Cinnamomum bodinieri*, *Zanthoxylum* spp., *Lindera angustifolia*, *Artabotrys hongkongensis*, *Chloranthus spicatus*, and *Litsea cubeba* are used for essence or perfume oil extraction. As many as 206 species of essence or perfume-producing plants are known in Hunan, with others such as *Tamarix chinensis* and *Tsuga longibracteata* are used for tannin extract.

### 5.1.6 Aesthetic and Tourist Uses

Many wild plants and animals have much aesthetic value. Among plants the following species are highly appreciated: *Maglietia fordiana*, *Dianthus chinensis*, *Pitt-*

*Information boards with clear texts are important for teaching people to respect nature.*



*osporum* spp., *Camellia* spp., *Liquidamba formosana*, *Loropetalum chinensis* var. *rubrum*, *Buxus* spp., *Acer* spp., *Davidiana involucrata*, *Lonicera* spp., *Phyllostachys bambusoides* var. *tanakae*, *Cathaya argyrophylla*, *Woodfordia fruticosa*, *Enkianthus chinensis*, and *Cercidiphyllum japonica*. Some of them are cultivated by gardeners in Hunan.

The following beautiful animals are often on display as visitor attractions: *Milvus korschum*, *Bambusicola thoracica*, *Tragopan temminckii*, *T. blythii*, *Chrysolophus pictus*, *Streptopelia orientalis*, *Glaucidium cuculoides*, *Asio flammeus*, *Alcedo atthis*, *Garrulax canorus*, *Phylloscopus inornatus*, *Macaca mulatta* and some other birds. Some of them are priority species for conservation.

Biological diversity, especially ecosystem diversity, is used for ecotourism in Hunan. For instance, Zhang Jia Jie National Forest Park is used for visits to a particular landscape, Lake East Dong Ting for bird-watching, and the Wugai Shan International Hunting Field has been established for hunting. Ecotourism offers field experiences and, being not only recreational but also informative, has increased rapidly in popularity in Hunan in recent years.

## 5.2 Potential Uses and Value

Biological diversity resources should be used in a sustainable manner. The current situation in Hunan could be described as “tremendous consumption of a small number of species”, which could easily lead to the extinction of some. Suggestions follow for potential new uses of biodiversity and developing existing ones:

### 5.2.1 Domestication

Natural biological resources vary in an unpredictable manner. For economically important species assumed resources often exceed the populations’ resilience. Domestication seems the only way to satisfy the requirement of human beings without destroying genetic resources, but more research is needed to meet the demand for different purposes.

### 5.2.2 Biomonitoring

Studies show that many plants are very sensitive to environmental changes, and this can be used to monitor air and water pollution. For example, a technique of biomonitoring using bryophytes has been developed successfully in Finland. Hunan, due to its moist climate and varied topography, possesses a rich bryophyte flora - a recent study showed there are 271 species of bryophytes recorded from the province even though the study was based only on fragmentary reports.

Some plants such as *Liquidamba formosana*, *Ulmus parvifolia*, *Ficus carica*, *Magnolia grandiflora*, *Morus alba*, *Osmanthus fragrans*, and *Hibiscus syriacus*, can actually absorb dust and poisonous particles from air. *Nelumbo uncifera*, *Nymphaea tetragona*, *Phragmites communis*, and *Typha* spp. are able to purify polluted waters.

### 5.2.3 Breeding resources

With the development of more and more “improved species” and asexual reproduction, it will be necessary to expand gene banks of economic species to get the best products and avert problems such as inbreeding. The use of wild animals and plants as hybrid material is the best way to attain this. A successful example is the hybridisation of the pig and wild boar in Hunan.

### 5.2.4 Medicinal exploitation

Recent studies have revealed that some currently incurable diseases may be treated with chemicals extracted from wild plants or animals. *Lepidogrammitis drymoglossoides*, *Cephalotaxus* spp, and *Camptotheca acuminata* are believed to be effective against cancer. The leaves of *Ginkgo biloba* have been approved as helpful to blood circulation and preventing arteriosclerosis. More detailed studies would be of great significance.



Temple Island on Dong Ting lake has over 1 million visitors annually.

Birdwatching, as with ecotourism in general, shows promise in Hunan.





## 6 Institutional Framework

Nature conservation has been recognised as an urgent and permanent strategic task by the Central Government of China as well as the Government of Hunan Province, and legislation has been enacted to promote and support nature conservation measures. The most important objective is to protect rare, endangered species of flora and fauna throughout the province. It is also of vital importance to maintain and, in some areas, to reconstitute the ecological balance in order to meet the needs of social development.

At present the Government of Hunan is paying close attention to integrating utilisation and conservation of natural resources into the economic structure of the province. Special emphasis is being put on the concept of sustainable development. In accordance with this concept, equal emphasis is being placed on development and regeneration of natural resources, so that the utilisation of renewable natural resources, including biological resources, will not exceed their intrinsic growth rate.

### 6.1 Relevant National Legislation

In the past ten years, China has passed a series of laws and regulations related to biodiversity conservation. The major legislation in this context is (the year of enacting after the name) The Constitution of 1982, the Marine Environment Protection Law 1982, the Forest Law 1984, the Grassland Law 1985, the Fishery Law 1986, the Wildlife Protection Law 1988, the Environment Protection Law 1989 and the Criminal Law. Other significant laws and regulations include the Mineral Resources Law 1986, the Land Law 1986, the Law on Air Pollution Prevention and Control 1987,

the Water Law 1988, and the Law for Water and Soil Protection 1991.

Other relevant laws include the Regulation on Reproduction and Conservation of Aquatic Resources 1979, the Regulation on Rescue Management 1981, the Regulation on Environment Protection in Offshore Oil Exploration and Exploitation 1983, the Regulation on Terrestrial Wildlife Protection 1992, the Regulation on Wild Plant Protection 1996, the Regulation on Forest Fire Prevention and Control 1988, the Regulation on Forest and Wildlife Nature Reserve Management 1986 and the Regulation on Afforestation of Urban Areas 1992.

This huge amount of new legislation on the country level is due for implementation. In a large country it takes time before new laws are properly known and followed at a local level.

### 6.2 Relevant Provincial Legislation

In order to implement national legislation and conserve local biological resources, the Government of Hunan province have also issued regulations and rules of local significance, consistent with the State laws and regulations. The main regulations and rules are (the year of promulgation after the name) the Regulation on Forestry 1985, the Regulation on Wildlife and Plant Protection 1988, the Regulation on Wildlife and Forest Nature Reserve Management 1987, the Regulation on Forest Park Management 1995 and the Regulation on Forest Land Protection 1996.

#### 6.2.1 Relevance of Legislation

Most aspects of conservation are covered by state and provincial legislation, the most important being the For-

est Law, the Grassland Law, the Wildlife Protection Law, and the Environment Protection Law. Each law and regulation consists of different issues, with an emphasis on different aspects of nature conservation. Based on the Forest Law, the national forestry strategy is to protect and develop forest resources and to use forest resources in a sustainable way. Rare and endangered species of animals and plants, particularly those listed in the first and second category of nationally protected fauna and flora in China, must be protected against all use, including scientific research. Forest ecosystems rich in wildlife and precious habitats, and rare and endangered species, should be proposed as nature reserves for conservation by the provincial forestry department (Forestry Department of Hunan, Ministry of Forestry) and submitted to the Government for approval. Under the direction of the State Council and following the relevant legislation, each authority is responsible for the legal duties determined there.

#### *Wildlife Protection Law*

This law was passed by the State Congress in 1988 and is implemented by the Ministry of Forestry (MOF) and the Ministry of Agriculture (MOA) with responsibility for the protection of terrestrial and aquatic wildlife, respectively.

Special mention should be made of some aspects of the Wildlife Protection Law: The sustainable use of wildlife, protection of wild plants and animals, and promotion of domestication of wild animals are the main subjects of this law. The law declares a list of rare and endangered species as national protected species whose commercial use is forbidden. Hunting seasons are adjudicated based on species' population trends. Key habitats of many rare and endangered species are required to be declared as nature reserves by the government, and guidelines are given as to reserve management.

#### *Act on terrestrial wildlife protection*

This act was passed by the State Council in 1992 and is implemented by the Ministry of Forestry. The regulation

gives directions for wildlife censuses to be carried out once every decade.

#### *Act on protection of wild animals and plants*

The act was passed by the Provincial Congress in 1989 and revised in 1995. It is implemented by the Forestry Department of Hunan and gives directions on implementation of the Wildlife Protection Law and the duties and responsibilities therein.

#### *Act on nature reserve management concerning wildlife and forest*

This act was passed by the State Council in 1987. It is implemented by the Ministry of Forestry and the provincial forestry departments, setting goals for the management of nature reserves with forest and wildlife (classified as two types of reserves), zoning of reserves, and on measures allowed to facilitate management or scientific research.

### 6.3 Central Governmental Institutions and Functions Related to Biodiversity Conservation

Under the direction of the State Council, a 38-member State Environmental Protection Commission (SEPC) was appointed representing governmental organisations on different levels. The SEPC has recently designated the National Environmental Protection Agency (NEPA) as the leading agency to co-ordinate and monitor the management of biodiversity conservation. The Ministries of Forestry and Agriculture and 36 other agencies have the responsibility for carrying out biodiversity conservation on the ground.

The main functions and responsibilities of the major institutions for biodiversity conservation are as follows: The function of the SEPC is to examine and approve general principles and policies concerning environmental protection, to guide, organise and co-ordinate environmental protection efforts on the national level, and to co-ordinate and resolve difficulties in biodiversity conservation through

consultations between relevant institutions. SEPC shares responsibilities with NEPA for supervising the implementation of international conventions.

NEPA has responsibility for the overall management of biodiversity conservation, that is formulation of new laws, regulations and economic and technical policies on nature conservation.

The State Planning Commission (SPC) is responsible for national economic and social development planning under the State Council.

The State Science and Technology Commission (SSTC) is responsible for co-ordination of science and technology development, for overall management of science and technology, and for compilation of national plans for scientific research.

The Ministry of Forestry (MOF) has a great number of responsibilities in biodiversity conservation. It is responsible for 1) guiding the construction and management of nature reserves established to protect forest, wildlife and wetland types, 2) exploitation and conservation of terrestrial wild animals and plant resources, 3) managing and co-ordinating the import and export of endangered species under the Convention on International Trade in Endangered species (CITES), and species covered by state protection laws, and 4) conservation and managing different forest ecosystems.

## 6.4 Hunan Provincial Institutions and Their Functions

Comprehensive management departments have been set up in the provincial government similar to those established at the national level. All the departments assume responsibilities for biodiversity conservation under the guidance of the corresponding institution on the national level. However, the Forestry Department of Hunan Province (FDH) plays a most important role in biodiversity conservation. The main responsibilities of the FDH relevant here are the construction and management of protected areas, wildlife and plant protection, managing and constructing Forest

Parks, wetland conservation, and subtropical forest ecosystem protection.

## 6.5 Economic Instruments

Biodiversity conservation activities include biological and physical research, and social efforts. Compared with many economic factors, biodiversity conservation does not have sufficient criteria to evaluate its financial values. At present there is insufficient funding from the Government of Hunan Province for the management of the nature reserve network. The Ministry of Forestry is funding the construction of facilities in state nature reserves and national wildlife protection projects, e.g. wildlife conservation centres. MOF also part funds the annual wildlife resources census projects. The provincial Government is responsible for salaries of staff working in conservation and forestry management.

MOF and the Forestry Department are responsible for loans to promote rural area afforestation projects, both commercial and ecological. Some direct funding has also been provided by the Government and MOF for important afforestation projects such as the Forest Ecological Shelterbelt System in the Yangtze River (Chang Jiang River) Basin. The National Afforestation project of the World Bank covers the entire country, with the total budget of US\$ 300 million loaned from the World Bank in 1990. The Forest Development and Protection Project started in 1994 (budget US\$ 200 million) was also covered by a W. Bank loan.

Nature conservation is quite new to the FDH and to China in general. Programmes are funded by different sources on provincial and local levels. The forestry department is responsible for the upkeep expenses of national and provincial nature reserves, the total budget conservation of its wildlife protection bureau being about two million yuan annually. However, the total conservation-related expenses in the whole province are around 30 million yuan, and this is covered by the local forestry bureaus and local government. At present, the whole province employs more than 1 000 officials and workers in conservation.

## 6.6 Educational System

Education in nature conservation issues is conducted by a wide range of public education agencies and authorities on the provincial and national level. The emphasis is on the concept of nature conservation, relations between man and nature, the value of biological resources, and the content of legislation. Publicity and education on biodiversity conservation are mainly conducted together with publicity about legal matters through mass media such as radio, TV, films, newspapers and magazines. Many TV documents on nature protection have been compiled and introduced from other countries in recent years, such as "Man and Nature", a favourite TV weekly programme in China. The major magazines and newspapers on nature conservation in China include "Nature", "Wildlife", "China's Forestry", "China's Environment" and "China's Ocean". The journal "Chinese Biodiversity" commenced in 1993. Similar educational media has been produced also on a provincial level.

Organising national compulsory activities through legislation is a means for making biodiversity protection well known among people. Since 1981, the state regulation on "Compulsory Tree Planting" stipulates that 12<sup>th</sup> of March each year is a national tree planting day. In 1980, the state council decreed a "Love Birds Week" between April and May each year, which was followed by a "Love Birds Day" by the provincial Government. The timing of the latter depended on the birds' breeding season in the region. In 1982 the provincial Government in Hunan located the bird week at 1st-7th April every year, and the first day of April is the "Love Birds' Day". Many nature associations, schools, and education commissions organise camps for schoolchildren in nature reserves as "a second classroom", with classes about nature and outdoor activities.

Nature reserves are the best places for education and displaying public information on nature protection. Most city zoos, botanical gardens, city parks, and national forest parks use placards, bulletins, information boards and publicity slogans to spread knowledge to the public.

Primary and secondary schools teach basic biology courses compiled by the State Education Commission, and exams are held on these. In the past ten years a great number of academic articles and papers have been published on conservation themes, notably "Forestry Action Plan For China's Agenda 21", "China Biodiversity Conservation Action Plan", and "National Nature protection Strategy".

## 6.7 Training of Personnel

In order to improve the professional skills of staff engaged in biodiversity conservation and scientific research and management of sustainable bio-resource use, the Chinese Government is seeking to provide training. Long term training is multi-disciplinary; forestry and agriculture universities, and the departments of environmental and natural resources protection, have prepared to educate a great number of experts and professional staff on matters related to environmental protection and conservation of forest, wildlife and nature. The ministries and departments of the province frequently organise short training courses at different levels concerning techniques and management skills of biodiversity inventories and conservation. Numerous short and long-term training courses are also organised through international funding, typically wetland conservation, biodiversity conservation, and GEF project management. The Forestry Department of Hunan regularly organises specific courses for staff in wildlife protection, nature reserve management, and enforcement issues.

## 6.8 International Co-operation

There are some differences between the implementation of international co-operation programmes organised by the Central and local Governments. In general, local governments assist the Central Government and other national authorities in international projects. The province of Hunan has been involved in many projects related to

biodiversity conservation, the most important of them being:

**1** Joint survey of the South China Tiger and its habitats in 1990-92. World Wide Fund for Nature Conservation. (Koller and Gui 1992)

**2** Co-operation project in surveying on the South China Tiger in the Nan Ling mountains. The World Conservation Union (IUCN). (Jackson 1990).

**3** Joint survey on the status of overwintering cranes and storks in Lake Dong Ting Nature Reserve in 1987-1990. International Crane Foundation (ICF). (Archibald 1992)

**4** Joint survey on the status of wintering wild ducks geese and storks in the Lake Dong Ting Nature Reserve. Wild Bird Society of Japan.

**5** Forest Protection and Development for Hunan province in 1985. The World Bank.

**6** Increasing the production of local teas - programme in 1984. United Nations Food and Agriculture Organisation (FAO).

**7** Developing management at Lake Dong Ting Na-

ture Reserve as a part of the Ramsar site network in China in 1992.

**8** Overseas training courses hosted by the World Wide Fund for Nature. Officials from the Forestry Department have been sent to Hong Kong, India and the USA.

**9** Co-operation with the Finnish Forest and Park Service and the Forestry Department of Hunan since 1987. In 1995 an agreement was made on Partnership and Exchange. It was economically supported by the Federation for Nature and National Parks of Europe until 1998 (Bruggemann 1999).

International co-operation projects brought together different cultures of scientific method and administrative techniques. Western visitors seldom had time enough to acquaint themselves deeper with local problems, but there have also been communication difficulties simply because almost all the local literature and scientific reports are only in Chinese. So far only very few conservation officers in Hunan can fluently communicate in English, but the situation is improving.



*Aix galericulata*

## 7 Assessment of Current State of Biodiversity Conservation in Hunan

### 7.1 Achievements and Threats

Sustainable use of natural resources is becoming a familiar concept in Hunan. However, it takes time for new ideas to break through in every corner of a large province. The Forestry Action Plan of China's Agenda 21 (1995) is paving the way to sustainable forestry in the province where forestry traditionally has played an important role.

There is very little virgin nature left in Hunan. Because of the high population pressure almost every inch of arable land has been taken up. Forests have been reclaimed for agriculture. Almost all wetlands, mires, rivers, and lakes have been converted to rice paddies, crop fields or aquacultures. Most of the forests still left have been cut or at least thinned, and often replanted with Chinese Fir or Horsetail Pine.

In the present situation the value of the last natural or semi-natural forests is very high. There are some extremely precious areas of outstanding natural value in Hunan. At present some of them have their own personnel, but in most cases the staff of the local forest bureau has responsibility for nature reserves alongside other duties. The network of nature reserves comprises 38 protected areas in different parts of the province. Officials working with the reserves are in need of more training in nature conservation; in many cases they also seem enthusiastic to learn more about contemporary management, and the flora and fauna of their reserves. Chinese conservation legislation is relatively new and up to date, and contributes to effective management of nature. There are enforcement problems of the various laws, decrees and regulations, but conservation has got a good start and is being further developed in Hunan.

There is of course lots of work left. Problems and threats are the same as in the rest of China. The following

is a brief summary of external factors threatening biological diversity in Hunan:

**Afforestation with exotic trees.** In order to meet the needs of economic development and markets, and to promote commercial forest development, local people and forestry officials have created a lot of plantations, their total area being 5,08 millions ha - 47,4% of all forested land. Most plantations are made up of Chinese fir, Horsetail Pine, Pond Fir, and other native trees. A part of the land has been planted with exotic trees such as American Wetland Pine and Italian poplars. Huge plantations of a single tree species have brought many diseases and are subject to forest fires. These plantations change the original structure of forest ecosystems and significantly reduce biodiversity.

**Environment pollution.** In 1995, nearly 907 200 tons of industrial and agricultural pollutants were produced in Hunan, among them about 142 500 tons of polluted water, 306 000 tons of dust and 456 000 tons of solid waste. In 1996 about 73 600 tons of agricultural pesticides were used. Acid rain (pH range from 5,73 to 5,90) is very common. It is estimated that up to half of all rains are more or less acid.

**Forestry.** Although forestry is well planned and organised in Hunan, there are some serious problems which threaten the preservation of biodiversity in the province. Over-exploitation and illegal logging have increased and are difficult to control. In some areas adjacent to villages, reclamation of forest is common. More alarming is the illegal logging and land reclamation regularly appearing also within nature reserves, where the damages to natural forests and endangered species may be very serious. Everywhere they increase the risk of soil erosion and other disasters.

**Fuel collection.** Fuel collection is a traditional form

of forest use. According to the Annual Forest Report of 1997, 3,5 millions cubic meters of firewood were collected that year in Hunan province. In mountain areas wood is the main fuel of local people. Fuel collection damages flora and changes ecosystems with consequent loss of biodiversity.

**Illegal activities.** In general Hunan forests, wildlife and other biological resources are managed according to existing laws and regulations, but the large human popu-

lation makes some violations inevitable. Illegal logging is the major problem. It has been estimated that in 1997 about 0,45 million cubic meters of timber was illegally cut, this being 3,28% of the total forest harvest. Overfishing and the use of smaller mesh in nets is another fairly common violation, but there are fewer cases of illegal hunting. However, illegal activities are a serious disturbance to normal management procedures and more efforts are needed to reduce the destruction they cause.



*Grus leucogeranus*

## 8 Overall objectives

In the previous chapters of this report we describe Hunan's nature, its products, huge potential, as well as many problems. The report aims at giving a general impression of the current state of biodiversity in the province, this information serving as a background to the measures proposed to improve the situation. Work is needed for preparing better living conditions for the future generations of Hunan.

In this chapter we present the overall objectives for the improvement of biological diversity in Hunan, common principles that will contribute to the conservation and sustainable use of the rich biological diversity in the province. The main goal is naturally to safeguard the richness and productivity of the province for future generations. These objectives are a part of a strategy for a better environment where nature coexists with a high number of people without any further damage to the functioning of surrounding ecosystems.

In the next chapter the strategy for reaching these overall objectives is presented.

### *1. Sustainable use of natural resources*

Sustainable use of all natural resources needs to be developed to take account of every branch of economic activity and every level of administration. This is one of the cornerstones of the conservation of biodiversity. In the long run this is the way in which the resources of the province can sustain the pressure of the human population. Sustainability can be promoted in many ways, with forestry, agriculture, fishing, mining and other industries playing a key role. The use of forests, cultivated land, rivers, lakes and mountains must be planned so that ecosystems are saved regardless of whether they are nature reserves or in productive use. In a country of China's economic structure, the proc-

ess towards a higher grade of sustainability can be promoted with careful planning in each branch of administration.

### *2. Promotion of research and acquisition of knowledge*

More information and scientific research is needed on Hunan's nature. A lot of work is already done by the universities and institutes, but more is needed to cover the whole field of biological diversity. Exchange of information and experiences with foreign countries is of great importance for development. Many high level studies should be published in international series so that the problems and achievements of biodiversity conservation would become available to interested scientists and experts.

### *3. Conservation of valuable natural and semi-natural areas*

Biological diversity protection needs to be extended to better cover all parts of the province. A proposal for establishing new nature reserves and enlargement of existing ones is needed as a part of improving the conservation status of the most valuable parts Hunan nature. Very little virgin environment is left in the province; it is the responsibility of this generation to preserve these treasures for future generations.

### *4. Improving management in existing nature reserves*

Due to lack of resources and trained staff the management of nature reserves has not yet reached the level warranted by the value of the areas under protection. Investments are needed in improving and developing management and personnel skills. Some new management plans and revision of old ones are needed so that the best sides



of both international and Chinese traditional practises could be utilised.

***5. Improving public awareness in questions of sustainable development and conservation of biological diversity***

In a large country with a great human population it is extremely important to invest in public awareness so that children have access to information about the en-

vironment, sustainable development, and valuable features of nature in their own country and province. Equally important is to teach people how to move around in natural environments. The tradition of ecotourism – or tourism by people from cities or remote provinces – looking for experiences or a rest in the lap of nature is very young in China; a lot of education is needed for instilling in citizens a culture of celebrating the outdoors.



*Ciconia boyciana*

## 9 Strategy for Preserving and Improving Biological Diversity in Hunan

In this chapter goals are presented for drawing up a strategy for preserving and improving biological diversity in the province. The goals presented here are based on the overall objectives presented in the chapters above. These goals form the strategy and are the essence of the development plan. The goals are short but cover most of the critical problems of safeguarding biological diversity. After each goal is a short description of the background *in italics* and sometimes also examples.

This is the first strategy for preserving and improving biological diversity in Hunan and, at the same time, the first provincial strategy of its kind in all China. Due to the new approach and shortage of material on some areas of biodiversity, the goals and actions presented are fairly general. However, these goals provide a firm basis for the first round of implementation presented in chapter 10. Extending the limits of current knowledge and improving co-operation between all the parties concerned are among the leading aims of the Action Plan.

It would be a mistake to assume that the goals here cover the whole field of biological diversity. This is the first version of a strategy for the province of Hunan, and there are still shortcomings. This strategy should be upgraded and supplemented about every five years, aiming each time at a more extensive version. This will lead to better results both administratively and in the field.

### 1. Sustainable use of natural resources

#### Goal 1

Prepare recommendations for sustainable forestry in the province and integrate them into everyday procedures.

*Guidelines for sustainable forestry on a national level exist already in the Forestry Action Plan for China's Agenda 21. One of the actions presented there is to draw up recommendations for sustainable forestry on a provincial level.*

#### Goal 2

The responsibilities between different authorities in questions regarding environmental matters and use of natural resources should be clarified. Intersectoral co-operation between authorities should be promoted on both provincial and local levels.

*The current situation, where the responsibilities between different authorities are not clear, causes innumerable problems which have lead to serious environmental damage. For example, the unclear regulation of nature reserves and the insufficient responsibilities in supervision have made it possible to destroy valuable parts of some of the most important nature reserves in China.*

#### Goal 3

Detailed recommendations for sustainable agriculture in the province are very important and should be implemented as soon as possible.

*Agriculture is one of the main livelihoods and has great influence on land use in the province. Agriculture also plays a key role in improving sustainable use of natural resources. Results will be important for the future of food production of the province.*

#### Goal 4

As for agriculture, recommendations for sustainable fishing and aquaculture in the province are needed.

*All brooks, ponds, lakes and rivers in Hunan are heavily used. It is therefore extremely important to guarantee that the water systems will be useable by future generations.*

#### Goal 5

Enforcement of laws in nature reserves needs to be improved by training personnel, marking the nature reserve boundaries, and informing local people.

*Violations against regulations of nature conservation can be reduced by improved enforcement. In many cases the boundaries of nature reserves are unclear in the field. Boundary marks should be supplemented with information boards giving a short presentation of park rules.*

#### Goal 6

Development of ecotourism needs responsible guidelines. **The principles for ecotourism should be implemented** when developing tourism in nature reserves, forest parks and elsewhere in nature (see Annex 6). Priority should be given to tourist enterprises whose activities are sustainable.

*Tourism is growing everywhere in the province and measures are needed to minimise its harm to nature in general, and to nature reserves and forest parks especially.*

#### Goal 7

The current situation with regard to saving local breeds of plants and domestic animals should be surveyed and analysed. In situ and ex situ protection of this valuable genetic material should be supported by giving it more resources, which is currently carried out by the universities and many institutes.

*A lot of valuable genetic material is on the verge of extinction, but there is also a lot of know-how in the province as to procedures for saving it.*

#### Goal 8

A project should be planned and implemented promoting a co-operation program for rural people in nature reserves, people who practice agriculture or use firewood, hunt game, and fish there or in other areas of conservation importance in the province. The injurious use of natural resources from protected forests and waters should be replaced by other livelihoods based on sustainable use of natural resources.

*The pressure of human populations is high in many nature reserves and other areas still in a natural state. Many poor people have few alternatives but to seek food and firewood in these places. This project should aim to help people living within or close to valuable areas find new livelihoods.*

## 2. Promotion of research and acquisition of knowledge

#### Goal 9

More co-operation is needed between the authorities which take care of natural resources and scientists working at the universities and research institutes. The fruits of this co-operation can be used in everyday work of the Forestry Department in managing forests and nature reserves all over the province.

*Often both scientists and users of natural resources work with similar questions separately, but the former approach the problem theoretically and the latter do not follow recent scientific developments.*

#### Goal 10

Development of statistics about the use and current state of natural resources, and a provincial monitoring system in connection with the national one needs to be developed for following the changes in ecosystems.

*There exists a nationwide monitoring system, but it is too general and sometimes difficult to apply to the conditions of Hunan. There is a clear need for reliable information about trends in the province. This need is urgent in nature reserves and forest parks.*

#### Goal 11

**Integrated surveys and inventories in nature reserves** and other relevant potential areas for nature conservation are needed in order to complement existing information. Nowadays it is more important than ever also to prepare summaries in English.

*It has transpired that Hunanese nature is more important than previously appreciated. More information will make it easier to justify improvements, get through to political decision-makers, and pinpoint options for external funding.*

#### Goal 12

**A Geographical Information System (GIS)** would greatly support the authorities in saving information on nature and designing plans for nature conservation.

*GIS means the exact localisation of each known occurrence of a rare plant, animal or ecosystem. With such a data-*

base it is easy to give knowledge of what, where, and when. GIS also gives good opportunities to supply information to any national or international report on the state of nature in Hunan.

#### Goal 13

The level of information is already so high, that an official **Red Data Book of the fauna and flora** of Hunan could be prepared and applied.

*While more information is collected about the flora and fauna, the national list of priority and protected species should be complemented with a provincial list confirmed by an appropriate authority. This will improve the chances to address conservation resources to the right targets.*

#### Goal 14

**Provincial conservation plans for endangered species** in the province should be prepared.

*A conservation plan includes a description of the species, an analysis of the threats, proposals for land use relevant to the species, and an assessment of other human activities influencing it. In preparing and implementing the conservation plan good co-operation between different authorities is needed and the expertise of universities utilised. The work should commence with the most vulnerable species.*

### **3. Conservation of valuable sites and species**

#### Goal 15

**An assessment of the representativeness of the network of protected areas** in Hunan should be carried out.

*Most of the nature reserves in Hunan were established in the 1980s. Lots of work has been done in many nature reserves during the years, and an analysis is needed as regards their current state, representativeness, threats and needs for improvement. This information can be utilised in developing the network of protected areas in the province.*

#### Goal 16

The relevant documents for **enlargement of the existing nature reserves** should be prepared and realised where the assessment above has indicated such a need.

*Some of the nature reserves are rather small or isolated.*

*Conservation of some rare species requires larger areas and some unique ecosystems can also be preserved in this way.*

#### Goal 17

**The protection and establishment of new nature reserves** should be prepared and realised where the assessment has indicated the need.

*If the assessment shows that more protected areas are needed in the province, as seems to be the case, the process should be started and the documents needed for their establishment prepared.*

#### Goal 18

**Current practices and facilities of ex-situ conservation** should be improved in the province.

*Ex-situ conservation is needed only where in-situ conservation is no longer possible in the original habitats. A lot of knowledge of how to manage the plants and animals in question is needed for this work. When starting a new project, sufficient funding must be ensured so that the best possible management can be guaranteed. Only in this way can work for ex-situ conservation utilise the target species to a level worthy of the necessary investment.*

### **4. Improvement of management of the existing nature reserves**

#### Goal 19

**Guidelines for management plans of the nature reserves** should be designed. The best international knowledge should be used in forming the new guidelines, which then will be used in the management of all old and new nature reserves.

*A model is needed to structure modern management plans for nature reserves. This is the basis for good management. If needed, also local legislation should be developed.*

#### Goal 20

**Old management plans and other similar plans** should be updated for each existing nature reserve. The new guidelines proposed above (in goal 19) can be tested in this procedure.

*New management plans are needed so that the develop-*

ment of nature reserves can proceed based on the best available knowledge.

#### Goal 21

A detailed and comprehensive management plan for the nature reserves of East, South and West Dong Ting Lakes should be prepared together with all authorities active in the district in order to improve the conservation status of both aquatic and terrestrial environments in the area.

*The three protected Dong Ting Lakes and the adjacent lake systems are among the most valuable sanctuaries in all China. It is important to develop further the plan made for management of their wildlife (Wildlife Management Plan for Dong Ting Lake Conservation Unit, Hunan Province, People's Republic of China, 1993). Because of the large size of the area, many problems and many authorities involved it is important to have successful co-operation. Measures are urgently needed as is the commitment of all the parties to this work.*

#### Goal 22

Interprovincial co-ordination in nature reserve management should be developed.

*Some of the nature reserves (for example Hu Ping Shan and Mang Shan) near to the province boundaries are of crucial importance for protection of many extremely important ecosystems and species such as the South China tiger. Particularly when dealing with large animals, the measures provide large areas and smooth co-operation over all borders.*

### **5. Improving public awareness in questions of sustainable development and conservation of biological diversity**

#### Goal 23

Courses, seminars, meetings, field excursions and all kinds of training for personnel responsible for nature reserves and all associated authorities should be organised in order to educate them in questions of biological diversity and sustainable use of natural resources. Trainers from other agencies and the universities can be used in this work, which should be continuous with regular updates.

*Training is a essential part of work for ecologists, management officers, administrators and guides.*

#### Goal 24

Interpretation facilities should be developed in nature reserves and forest parks so that more information about nature and the needs of nature conservation is available.

*Most of the visitors are interested in more information and are also in need of it. Modern computer techniques would facilitate quicker production of information boards, brochures etc.*

#### Goal 25

Leaflet standards and model drawings for information facilities should be developed and spread to all facilities. Information in English is needed in some of the most popular nature reserves and forest parks.

*Models and standards for use everywhere in the province are needed.*



## 10 Implementation of this Action Plan

### 10.1 Working Schedule and Budget

The action plan will be implemented by the Wildlife Protection Bureau (WPB) of the Forestry Department of Hunan with intersectoral co-ordination, and reporting to the government of Hunan province. The detailed working schedule and estimated budget are given as follows.

In order to implement the Action Plan, a provincial leader group is needed in which at least the Financial Department, Development Planning Committee, Agriculture Department, Water Conservancy Department, Academy Committee, Education Department and En-

vironmental Protection Agency should be included. The leading group is to be chaired by the director general of the Forestry Department, and would be responsible for the policy and strategic management issues at the provincial level. This group sets the principles and policies for the action plan, approves the overall implementation plan, and co-ordinates the discussions with the relevant agencies. The leading group is supported by the project staff consisting of a few highly skilled experts (see Project planning in table 14). Each agency will be responsible for their duties to carry out projects proposed in this Action Plan.

Table 14. Schedule of different activities in implementing the Action Plan with their estimated expenditures.

Activity	Goals	1st year	2nd year	3rd year	4th year	5th year	Costs in millions of yuan
Project planning		+	+	+	+	+	5
1. Sustainable use of natural resources							
• Sustainable forestry	1	+	+	+	+	+	5
• Responsibilities between different authorities	2	+					1
• Sustainable agriculture	3	+	+	+	+	+	5
• Sustainable fishing and aquaculture	4	+	+	+	+	+	5
• Enforcement of laws in nature reserves	5	+	+	+	+	+	1
• Principles of ecotourism	6	+	+	+	+	+	1
• Saving local breeds of plants and domestic animals	7	+	+	+	+	+	74
• Program for rural people in nature reserves	8	+	+	+	+	+	80
2. Promotion of research and acquisition of knowledge							
• Co-operation between authorities and scientists	9	+	+	+	+	+	2

• Provincial statistics and monitoring	10	+	+	+	+	+	20
• Integrated surveys and inventories on nature reserves	11	+	+	+	+	+	45
• Geographical information system	12				+	+	10
• Red Data book of fauna and flora	13			+	+	+	20
• Conservation plans for endangered species	14	+	+	+	+	+	55
3. Conservation of valuable sites							
• Assessment of the representativeness of the network of protected areas	15	+	+				5
• Enlargement of existing nature reserves	16			+	+	+	5
• Protection and establishment of new nature reserves	17			+	+	+	42
• Practices and facilities of ex-situ conservation	18	+	+	+	+	+	15
4. Improvement of management of the existing nature reserves		+	+	+	+		
• Guidelines for management plans of the nature reserves	19						5
• Updating of old management plans and other similar plans	20	+	+			+	15
• Management plan for the nature reserves of East, South and West Dong Ting lakes	21			+	+		20
• Inter-provincial co-ordination and co-operation	22	+	+	+	+	+	1
5. Improving public awareness in questions of sustainable development and conservation of biological diversity		+	+				
• Training for personnel with responsibility for nature reserves	23			+	+	+	20
• Interpretation facilities	24	+	+	+	+		37
• Leaflet standards and model drawings for information facilities	25	+	+				5
Action Plan revising		+	+		+	+	1
Expenditures, total							500

When implementing this Action Plan, it is recommended to prepare a work plan for each of the goals separately, where the task is split into smaller groups of required measures. For each goal, sometimes also for each measure, a description of the problem, proposal of activ-

ities, the authority responsible, the authorities to co-operate, time schedule, budget and reporting responsibilities to the leader group shall be defined and approved by the leader group. Such work plans should be prepared by the project staff.

The time schedule and estimates of expenditure presented here are provisional. Certainly the level of investments given, 500 million yuans (62 million US\$) during a five-year period, is approximately what is needed. In the very beginning of the work the time schedule and budget will need revision by the provincial leading group organising and co-ordinating the project.

In preparing the implementation of the Action Plan the opportunities for international co-operation should be kept in mind. Already now there are many projects of this kind in action in Hunan (see chapter 6.8). A provisional description of some project profiles available both for domestic or international projects is in chapter 12.4.

## 10.2 Monitoring and Evaluation

This Action Plan contains a comprehensive monitoring and evaluation program. Each district and nature reserve will monitor impacts of project activities using the results of inventories, community consultation, and applied research. The monitoring process will be written into the individual management and development plans of each district and nature reserve. Baseline biophysical and socio-economic inventories will be conducted for the mon-

itoring program and data stored in the information system to be used by reserve, provincial, and MOF staff.

Each project area and nature reserve management plan will include a section on monitoring and an evaluation requirement. In addition to the primary collection of background information of each project, and the nature reserves proposed during the planning process, each plan will specify additional surveys or inventories that are needed to complete the resource inventory. This will form the baseline data against which future project success and impact can be measured. Indicator parameters will be identified for regular resampling and will form the basis for monitoring trends in biotic and socio-economic factors, and evaluating the effectiveness of the management prescription being applied or tried in the project. Each management plan will be required to identify its own specific goals and success indicators which can serve as targets against which to measure project progress. In addition, each management plan will specify an annual review and revision meeting and a final evaluation in the last year of implementation. These final evaluation reports will be brought together to form the overall action plan evaluation report.

WPB and FDH will carry out periodic overall monitoring and evaluation with assistance from international experts.



## 11 References

- Anonymous 1982. Report on A Comprehensive Scientific Investigation on Xiangxi Ba Da Gong Shan. Ecology Society of Hunan Province & Hunan Provincial Forestry Society (ESH & HFS). In Chinese. 328pp.
- Anonymous 1983. An Inventory Report on the Natural Resources of Qiang Jiadong Nature Reserve, Hunan Province. ESH & HFS. In Chinese. 217 pp.
- Archibald, George 1992. Status of overwintering Cranes and Storks on Lake Dong Ting Nature Reserve in 1987-90. Proceedings of International Workshop on Crane and Stork Conservation, ICF, 1992.
- Biodiversity Review of China. 1996. WWF, Hong Kong.
- Biodiversity Conservation Action Plan for China. 1994. National Environmental Protection Agency, Beijing, China.
- Biodiversity Profiles Project. 1995. Biodiversity Assessment of Forest Ecosystems of the Central Midhills of Nepal. Biodiversity Profiles Project Publication No 8. Department of National Parks and Wildlife Conservation, Ministry of Forests and Soil Conservation. His Majesty's Government of Nepal, Katmandu.
- Brief Account of Hunan's Forestry. 19XX. Leaflet, Forestry Department of Hunan.
- Bruggemann, Jens (ed.) 1999. Partnership and Exchange Programme. Final Report. Technical co-operation between protected areas in Europe, Asia and Latin America for the sustainable management of tropical forests 1994-1998. European Commission DG IB Project B7-5041/1/93/17. -- EUROPARC, Federation of Nature and National Parks of Europe, Grafenau. 41 p.+ Annexes I-V.
- Chen Qingquan, Liao Xiansheng and Ran Yongqing 1997. Status and Conservation Strategy of Biodiversity in Hu Ping Shan Mountains, Hunan Province. Proceedings of seminar on biodiversity, Changsha 15-17 April, 1997. Unpublished report in English, Forest and Park Service, Finland.
- Chen Xiaojian 1997. Impact of Human Activities on Dong Ting Lake wetland and Conservation Strategy. Proceedings of seminar on biodiversity, Changsha 15-17 April, 1997. Unpublished report in English, Forest and Park Service, Finland.
- Deng, H.-Z. *et al.* 1994. China Natural Resources Series - Hunan. Science and Technology Publishing House, Beijing. (in Chinese) 482pp.
- Finland's Forests, Timber and Biodiversity. 1995. Leaflet, Ministry of the Environment, Helsinki.
- Forestry Action Plan for China's Agenda 21. Ministry of Forestry, People's Republic of China 1995. Beijing.
- Ge Hangdong 1999. Realizing sustainable development of forest ecotourism in Hunan: problems and approaches. -- 34 p. (In Chinese and English). International Symposium on Ecological Environment Protection, Zhang Jia Jie, Hunan. 22-27 Sep. 1999.
- Global Biodiversity Strategy: Guidelines for Action to Save, Study and Use Earth's Biotic Wealth Sustainable and Equitably. World Resource Institute (WRI), The World Conservation Union (IUCN), United Nations Environment Programme (UNEP) 1992. (In Finnish: Maapallon biodiversiteetti, 1995. Vantaa).
- Gui Xiaojie. 1993a. Protection and Habitat Management for Wintering Cranes at Dong Ting Lake of the Yangtze River, China. (Report in an unknown publication)
- Gui Xiaojie. 1993b. Wildlife Management Plan for Dong Ting Lake Conservation Unit, Hunan Province, People's Republic of China. Manuscript, International Crane Foundation, Wisconsin, USA.
- Gui Xiaojie and Chen Liangchang 1997. The Current Status of the Wetlands in the Hunan Province. Proceedings of seminar on biodiversity, Changsha 15-17 April, 1997. Unpublished report in English, Forest and Park Service, Finland.
- Gui Xiaojie & Wang Wei. 1993. The Challenge and Strategies for Management of South China Tiger (*Panthera tigris amoyensis*). The proceeding of the International symposium on Tiger conservation. Tiger project of India.
- Hunan Provincial Forestry Department. 1985. A Comprehensive Scientific Survey of the Natural Resources of Bamian Shan Nature reserve of Hunan. (in Chinese) 162pp.
- IUCN 1978. Categories, Objectives and Criteria for Protected Areas. IUCN, Gland, Switzerland. 26 pp.
- Jackson, Peter 1990. South China Tiger in the Nan Ling Mountains. Unpublished report prepared for IUCN.

- Koeller & Gui 1992. Survey of the South China Tiger and its habitats in 1990-92. Unpublished report prepared for WWF.
- Koponen, T., Enroth, J., Fang Y-M., Huttunen, S., Hyvönen, J., Ignatov, M., Juslen, A., Lai M-L., Piippo, S., Potemkin, A. and Rao, P. 2000. Bryophyte flora of Hunan Province, China. 1. Bryophytes from Mang Shan Nature Reserve and Wu Ling Yuan Global Cultural Heritage Area. *Ann. Bot. Fennici* 37. Helsinki 2000.
- Lei Guang Chun. 1994. Report of a Study of the Finnish National Park System with a Comparison with the Chinese System. Unpublished manuscript, Finnish Forest and Park Service, Vantaa.
- Liu Kewang and Xue Shengguo 1997. The Floristic Features and Protection of the Rare and Endangered Plants of Hunan Province. *Proceedings of seminar on biodiversity, Changsha 15-17 April, 1997*. Unpublished report in English, Forest and Park Service, Finland.
- Loving them to death? 1995. Federation for Nature and National Parks of Europe. Grafenau, Germany.
- Mackinnon, J., Sha, M., Cheung, C., Carey, G., Zhu, X. and Melville, D. 1996. A Biodiversity Review of China. WWF International, Hong Kong.
- Maxey, C. & Lutz (editors). 1994. The Biodiversity Conservation Action Plan for China (unpublished manuscript). 106pp.
- McNeely, J., K. Miller, W. Reid, R. Mittermeier & T. Werner. 1990. Conserving the World's Biological Diversity. IUCN, Gland, Switzerland; WRI, CI, WWF-US, and the World Bank, Washington, D.C.
- Miller, Kenton, R. and Steven M. Lanou. 1995. National Biodiversity Planning: Guidelines Based on Early experiences Around the World. World Resource Institute, United Nations Environment Programme and The World Conservation Union. Washington D.C.; Nairobi; Gland, Switzerland.
- National Conservation Management Plan for the Giant Panda and its Habitat. Sichuan, Shaanxi and Gansu Provinces, the People's Republic of China. 1989. Joint report of the Ministry of Forestry and WWF - World Wide Fund for Nature. Hong Kong.
- Peng Shilong and Chen Biao 1997. Enhancing the Role of Broad-leaved Forests in Protection of Biodiversity. *Proceedings of seminar on biodiversity, Changsha 15-17 April, 1997*. Unpublished report in English, Forest and Park Service, Finland.
- Proposal for Biodiversity Conservation and Socio-forestry Development in Gao Ling Shan. 1996. Manuscript, Bao Shan Prefecture, Administrative Office, China.
- Qi, C.-J., X.-R. Sun & S.-R. Lin. 1987. The List of Hunan Flora. Hunan Science and Technology Publishing House. (in Chinese) 466pp.
- Qing J.-H. et al. 1990. Picture Album of the Protected Wildlife of National Importance. Northeast Forest University Publishing House. (in Chinese) 297pp.
- Rao, P., Enroth J., Piippo S. & Koponen T. 1997. The Bryophytes of Hunan Province, China: An annotated checklist. -*Hikobia* 12:181-203.
- Saethorsdottir, AD, Gisladottir, G., Grönningaeter, G., Zettersten, G. and Högmänder, J. 1998. Ekoturism i Norden (in Swedish with English summary). Nord 1998:13. Nordisk Ministerråd, Kobenhavn 1998.
- Survey of Comprehensive Science on Natural Resources of the Hu Ping Shan Mountain Preserve in Hunan. 1993. Forestry Bureau of Changde City Hunan, 1993. In Chinese, some figures with species names in Latin.
- Udvardy, M.D.F. 1975. A Classification of the Biogeographical Provinces of the World. IUCN Occasional Paper 18:1-48.
- Udvardy, M.D.F. 1984. A biogeographical classification system for terrestrial environment in McNeely, J.A. and Miller, K.R. (eds.). 1984. National Parks, conservation and development: the role of Protected Areas in sustaining society. IUCN/Smithsonian Institution Press, Washington DC. Pp. 34-38.
- Survey on Wu Ling Yuan area in Hunan. 1988. Central South Forestry University, Changsha. In Chinese, brief summary in English and some figures with species names in Latin.
- World Conservation Monitoring Centre. 1992. Global Biodiversity: Status of the Earth's Living Resources. Chapman & Hall, London. 594pp.
- WWF (World Wide Fund for Nature Conservation) 1995. WWF och turismen, miljöanpassad turism och ekoturism (In Swedish). Stockholm, 8 pp.
- Xiong Siqing 1997. Study on Measurement of Species Diversity in Ba Da Gong Mountains Nature Reserve. *Proceedings of seminar on biodiversity, Changsha 15-17 April, 1997*. Unpublished report in English, Forest and Park Service, Finland.
- Yang Daode 1997. The list of wildlife with protection priority in Hunan province. *Proceedings of seminar on biodiversity, Changsha 15-17 April, 1997*. Unpublished report in English, Forest and Park Service, Finland.
- Yang Daode, Shen Youhui, Ye Yiyun, Gui Xiaojie and Zhang Qi Xiang 1997. Primary Study on Species and Distribution of the Protected Wildlife of National Importance in Hunan Province. *Proceedings of seminar on biodiversity, Changsha 15-17 April, 1997*. Unpublished report in English, Forest and Park Service, Finland.

## 12 Annexes

### 12.1 List of Priority in Hunan

The most significant types of ecosystems from the point of view of the conservation of biodiversity and their location in Hunan are as follows.

- 1 Evergreen Broad-leaved Forest of the Southern Sub-tropics the Nan Ling Mountains: Mang Shan, Da Yuan Yuan Kou, Qian Jia Dong
- 2 Evergreen Broad-leaved Forest of the Central Sub-tropics the Xue Feng Mountains: Shun Huang Shan, Huang Sang, Yang Ming Shan
- 3 Evergreen Broad-leaved Forest of the Northern Sub-tropics the Wu Ling Mountains: Ba Da Gong Shan, Zhang Jia Jie, Tianzi Shan, Shuo Xiyu, Hu Ping Shan
- 4 Evergreen Broad-leaved Forest of Low Elevations Xiao Xi, Meng Donghe
- 5 Typical districts of Central Hunan: Nan Yue Mountain.
- 6 Districts holding Endangered Species the Mu Fu Luo Xiao Mountains: Da Wei Da, Tao Yuan Dong, Bamian Shan.
- 7 Wetland Ecosystems the Dong Ting Lake District: Mu Ping Hu, Wan Zi Hu, East Dong Ting Hu.

### 12.2 List of Priority Plant Species in Hunan

Here the term 'priority plant species' means those which from the Chinese and Hunanese point of view have a high conservation value. The species' conservation status in terms of the Chinese nationwide system of endangered species is referred to after each name.

The number of known endangered species in Hunan is 59 vascular plant species, of which 3 belong to the first

class, 23 to the second class and 33 to the third class (see 4.2.1 Plants and Table 7). 57 species are described here. The list does not cover all species because it was not always possible to get adequate descriptions.

#### 1. *Cathaya argyrophylla* Chun et Kuang

A class-1 state-conserved species

Features: an evergreen tree, adapted to aridity, slow-growing, slow to propagate itself.

Values: A rare species endemic to China, its populations sparse. Academically interesting and valuable. A good timber producer and can be grown as an ornamental plant for its fine-looking appearance.

#### 2. *Metasequoia glyptostroboides* Hu et Cheng

A class-1 state-conserved species (among the first so protected)

Features: Deciduous tree, moisture-loving, quick-growing, a relatively prolific bearer, propagates itself well.

Values: A relict species from the Tertiary Period, endemic to China. Of academic significance for the study of living fossils and ancient climates. Adds beauty to gardens; but is also planted for timber and paper.

#### 3. *Davidia involucrata* Baill.

A class-1 state-conserved species

Features: Deciduous tree, growing mostly in fertile, damp yellow soil in hilly districts; the fruit droops and has a hard exocarp; the germinating rate of seeds is low and natural regeneration is poor.

Values: Endangered species endemic to China. Of great importance to the study of the systematic development of plants. Also called pigeon tree from the two pigeon-shaped white bracts on the inflorescence when in bloom. A fine ornamental species.

**4. *Abies ziyuanensis* L. K. Fu et S. L. Mo**

A class-2 state-conserved species

Features: Evergreen tree, growing well at high-elevations in mountains; tolerant of freezing but choosy about soil; slow-growing, poor natural regeneration.

Values: Found in sub-alpine areas with sparse populations. A good timber producer.

**5. *Pseudolarix amabilis* (Nelson) Rehd.**

A class-2 state-conserved species

Features: Deciduous tree, likes warm and moist climates, not tolerant of arid soil, relatively quick-growing, propagates easily.

Values: Endemic to China. One of the worlds best-known ornamentals with a beautiful appearance. Also a fine lumber producer.

**6. *Glyptostrobus pensilis* (Stunt.) Koch.**

A class-2 state-conserved species

Features: Deciduous tree, light-loving, growing well in warm, wet environments; grows comparatively fast under favourable conditions; Rare.

Values: Relict species from the Tertiary Period, endemic to China. Of academic significance. Planted ornamentally, but also for timber.

**7. *Fokienia hodginsii* (Dunn) Henry et Thomas**

A class-2 state-conserved species

Features: Evergreen tree, light-loving, adaptable, quick-growing; natural regeneration good, larger stands of this species occur in the south of Hunan province.

Values: A valuable timber tree endemic to China; can be successfully replanted in favourable areas. The tree is attractive and has a high scenic value.

**8. *Cephalotaxus oliveri* Mast.**

A class-2 state-conserved species

Features: Evergreen shrub, tolerant of shade, moisture-loving, slow-growing.

Values: Contains cancer-inhibiting compounds; has scenic value; and its seeds produce oil used in industry.

**9. *Pseudotaxus chienii* (Cheng) Cheng**

A class-2 state-conserved species

Features: Evergreen shrub, tolerant of shade, loving shaded and humid niches, slow-growing, sparsely-distributed.

Values: Of value in plant taxonomy studies; also scenic value.

**10. *Liriodendron chinense* (Hemsl.) Sarg.**

A class-2 state-conserved species

Features: Deciduous tree, light-loving, slow-growing; not particularly choosy about environmental conditions; attains full size early; but germinating rate of seeds is low.

Values: The peculiar leaf shape and fragrant beautiful flowers make it a valuable ornamental tree. A producer of fine timber with beautiful grain. Valuable in taxonomic studies of *Magnoliaceae* due to its special morphology.

**11. *Manglietia patungensis***

A class-2 state-conserved species

Features: Evergreen tree, loves warm climates and damp soils; quite rapid grower.

Values: Rare in the wild, a priority species for conservation. Large flowers and dense foliage, can be grown as an ornamental. Yields high-quality timber for building materials.

**12. *Tsoongiodendron odorum* Chun**

A class-2 state-conserved species

Features: Evergreen tree, loving warm and moist climates; not very tolerant of cold conditions; scattered distribution at lower elevations in the south of Hunan province; grows relatively quickly, reproduces well from seeds.

Values: An ancient species endemic to China. Of importance to the study of flora in southern China. Also grown in gardens, along town pavements as an ornament, and for timber.

**13. *Tetracentron sinense* Oliv.**

A class-2 state-conserved species

Features: Deciduous tree, loves cool and moist climates, not tolerant of heat or aridity; requires strictly a certain soil type, mostly growing in woods above 1000 meters

Values: Ancient species endemic to China; has a high scenic value due to handsome appearance; A high-quality timber producer, wood is pure white and smooth in texture.

**14. *Cercidiphyllum japonicum* Sieb. et Zucc.**

A class-2 state-conserved species

Features: Deciduous tree, relatively tolerant of shade, loving damp and fertile soil, mostly growing in valleys or by ditches or other low, damp sites.

Values: An ancient species, endemic to China. Timber, good and smooth. Grown as an ornament for its attractive appearance and the peculiar leaf shape.

**15. *Camellia grijsii* Hance (*C. yuhsienensis* Hu)**

A class-2 state-conserved species (gradually endangered)

Features: Small evergreen tree, loving warm climates and acid soil, propagates by seed, quick-growing, adaptable.

Values: Endemic to China, of scientific value. Seeds are a source of edible oil. With its large and pure white flowers can be grown as an ornamental.

**16. *Disanthus cercidifolius* Maxim. var. *longipes* Chang**

A class 2 state-conserved species (classification: becoming endangered)

Features: Deciduous shrub, loving warm and moist climates, tolerant of shade. Thrives under trees, adapted to a wide range of soils.

Values: A relict plant and substitute species of Sino-Japanese flora. Has scientific value, lends insight to the systematics of plant development and geologic distribution in East Asia. The peculiar fruit shape gives it ornamental value.

**17. *Eucommia ulmoides* Oliv.**

A class 2 state-conserved species (classification: rare)

Features: Deciduous tree, loves temperately cool and rainy climates. Also needs sun, growing better (and quickly) in either alkaline or acid soil, artificial propagation easy.

Values: Alone in single-genus family and single-species genus, endemic to China. Has important scientific value in the study of systematic evolution of plants. Bark used for rare medicinal materials. The whole tree contains hard rubber used in industry.

**18. *Eurycorymbus cavaleriei* (Levl.) Rehd. et H. -M.**

A class 2 state-conserved species (rare)

Features: Deciduous tree, light-loving; mostly found in woods with red or yellow soils, grows quickly, and sprouts strongly.

Values: A relict species from the Tertiary Period, endemic to China. Of scientific significance to botany, esp. for systematics of Sapindaceae. Grown for timber and as a garden ornamental. Oil from the seeds used in industry.

**19. *Bretschneidera sinensis* Hemsl.**

A class 2 state-conserved species (rare)

Features: Deciduous tree, light-loving, enjoying warm and moist climates. Mostly scattered on gullies and ravines, and on slopes of intermediate-elevation mountains; usually part of mixed broad-leaved - conifer forest.

Values: An ancient relict species endemic to China. The only species of Bretschneideraceae and of scientific value in the study of the origin of angiosperms and ancient geographical features; the good timber is used in industry, building, and furniture making.

**20. *Annamocarya sinensis* (Dode) Leroy**

A class 2 state-conserved species (rare)

Features: Big deciduous tree, needs warm climate and sun, intolerant of freezing; mostly distributed in the southern subtropics, grows quickly. Occurs only in Tongdao county of Hunan province.

Values: Single-species genus relict species, good timber producer. Oil from the seeds used in industry.

**21. *Davidia involucrata* Baill. var. *vilmoriniana* (Dode) Wanger.**

A class 2 state-conserved species

Features: Deciduous tree, loving warmth in winter and cool summers, esp. foggy and rainy habitat with very wet air and fertile soil; requires yellow or brown-yellow mountainous soils.

Values: World-renowned valuable ornamental tree, occurred already in Tertiary Period. Endemic to China, of scientific significance to the study of ancient floras. A good timber producer.

**22. *Diplopanax stchyanthus* H. -M.**

A class 2 state-conserved species (becoming endangered)  
Features: Evergreen tree, needs yellow or brown- yellow soils of mountain regions. Intolerant of freezing, often scattered within broad-leaved forests. Fruit large, pericarp hard, hard to make sprout.

Values: Single-species genus relict species, occurring mainly in China. Scientifically important for systematics studies of Araliaceae. Occurs in only a few places in the wild.

**23. *Sinojackia dolichocarpa* G.J.Qi**

A class 2 state-conserved species (becoming endangered)  
Features: Small deciduous tree, sun-loving, growing at low elevations in limestone districts. Tolerant of arid and poor soils, slow-growing.

Values: Occurs only in Hunan province. Of great importance to the study of Chinese flora. Has impressive flowers and peculiar fruit shape of high decorative interest.

**24. *Emmenopterys henryi* Oliv.**

A class 2 state-conserved species (rare)  
Features: Deciduous tree, loving light and mild climates. Requires no particular soil conditions for growth, growing quickly and sprouting strongly. Natural regeneration easy, propagating by seed.

Values: Lone member of its genus, endemic to China. A good ornamental plant with pretty outward appearance, big showy flowers.

**25. *Changnienia amoena* Chien**

A class 2 state-conserved species (rare)  
Features: Terrestrial erect herb, tolerant of shade, moisture-loving. Mostly under trees with rich fog and humidity, also in valleys or on ravines and gullies, and in soils of rich humus. Sprouts in September while flower stalk shoots out. The plant has a single leaf and a single flower.  
Values: A single-species genus, endemic to China. Very high scientific value for systematics studies of Orchidaceae. The plants pseudo-bulbs are used as an antidote to snakebite. Spectacular flowers, good garden plant.

**26. *Oryza rufipogon***

A class 2 state-conserved species (becoming endangered)  
Features: Aquatic perennial herb with wide distribution in southern China; needs tropical or sub-tropical climate, not particularly choosy about soil conditions. Requires wet conditions, marshes with sufficient sunlight.

Values: Ancient species, close relative of Chinese cultivated rice. Many new varieties have been produced. The protection of wild rice plays an important part in rice breeding and the study of the origins and evolution of rice .

**27. *Keteleeria calcarea* Cheng et L. K. Fu**

A class 3 state-conserved species (becoming endangered)  
Features: Evergreen tree; Grows in limestone regions below 1000 meters; found in central subtropics where mixes with evergreen broad-leaved trees. Well-developed root system, grows quickly, propagating by seed.

Values: Ancient species endemic to China. Produces good timber of versatile uses, also useful for greening limestone areas.

**28. *Pinus kwangtungensis* Chun ex Tsiang**

A class 3 state-conserved species (becoming endangered)  
Features: Big evergreen tree; occurs in mountainous regions of the Nan Ling Mountains in China where found in mixed broad-leaved - conifer forests at intermediate elevations; light-loving, adaptable. Grows quickly in suitable conditions, natural regeneration of saplings good in open areas. Propagates itself by seed.

Values: A five-needle pine tree with range in far south of China. Important species for studying the geographical distribution of *Pinus*. Timber hard and long-lasting, superior to *Pinus massoniana* Good afforestation tree at intermediate altitudes.

**29. *Pseudotsuga sinensis* Dode**

A class 3 state-conserved species (becoming endangered)  
Features: Evergreen tree, light-loving, often growing on sunny hills or ridges. Adapts to a wide range of soil conditions, root system large, tolerant of drought, and quick-growing. Often makes up pure stands on slopes and mountain ridges.

Values: Endemic to China. *Pseudotsuga* is a genus discontinuously spread in East Asia and North America. Of importance to the study of the group's origin. The timber has many uses.

**30. *Tsuga chinensis* (Franch.) Pritz. var. *tchekiangensis* (Flous.) Cheng et Fu**

A class 3 state-conserved species (becoming endangered)  
Features: Big evergreen tree. Dominant relict companion species in mixed broad-leaved - conifer forests of intermediate elevations in mountains. Likes foggy and humid hilly districts. Young trees grow quickly, middle-sized ones even quicker. Propagates from seed with difficulty.  
Values: A relict species endemic to China. Wood is hard and the trunk straight, thus potentially good timber.

**31. *Tsuga longibracteata* Cheng**

A class 3 state-conserved species (becoming endangered)  
Features: Big evergreen tree, quite tolerant of shade, loving cool, foggy humid climates. Often grows in mixed broad-leaved - conifer forests in mountainous districts.  
Values: A valuable Chinese endemic, of significance to systematics studies of *Tsuga*. Timber is good with high economic value.

**32. *Amentotaxus argotaenia* (Hance) Pilger**

A class 3 state-conserved species (becoming endangered)  
Features: Small evergreen tree, a shade plant. Likes mild climates and fertile soils. Sparsely distributed within its range, slow-growing.  
Values: Endemic to China. Of high significance to the study of Taxaceae. A handsome tree, often planted for aesthetic value.

**33. *Magnolia officinalis* Rehd. et Wils.**

A class 3 state-conserved species (becoming endangered)  
Features: Deciduous tree, light-loving, and loving cool and humid climates; requiring thick fertile acid soils, slow-growing, and sprouting strongly; propagating itself by seed.  
Values: The most primitive species of *Magnolia*. Its large leaves and beautiful large flowers make it an ornamental tree. Its bark is valuable medicinal material.

**34. *Magnolia officinalis* ssp. *biloba* (Rehd. et Wils.)**

**Law**

A class 3 state-conserved species (becoming endangered)  
Features and values similar to those of *Magnolia officinalis*. Leaf tip is emarginate, that of *Magnolia officinalis* is not.

**35. *Magnolia sieboldii***

A class 3 state-conserved species (becoming endangered)  
Features: Deciduous shrub, prefers light. Grows mostly in valleys or on damp sites under trees, slow-growing. Propagates itself by seed.  
Values: Discontinuous distribution. Of scientific value in the study of the genus. Flowers are fragrant and beautiful, thus a valuable ornamental tree.

**36. *Manglietia insignis* (Wall.) Bl.**

A class 3 state-conserved species (becoming endangered)  
Features: Evergreen tree. Grows in hilly districts with temperately cool climates and abundant rainfall, but less sunshine. Average growth rate, but poor bearer, reproducing itself by seed or asexually.  
Values: A relatively primitive species, has value in the study of Magnoliaceae. The flowers are red, considered to have the highest scenic value of all the *Manglietia*.

**37. *Parakmeria lotungensis* (Chun et Tsoong)**

A class 3 state-conserved species (becoming endangered)  
Features: Evergreen tree, loving light and habitats with high temperatures, heavy moisture and rainfall. Requires acid and fertile red soil, not too tolerant of freezing. A poor bearer, its natural regeneration is difficult.  
Values: Endemic to China. Flower is polygamous with carpel occasionally degenerate. Of scientific significance to the study of Magnoliaceae. Has scenic value.

**38. *Euptelea pleiosperma* Hook. f. et Thoms**

A class 3 state-conserved species (rare)  
Features: Deciduous tree, needs light and climates of mountainous zones, mostly growing on slopes with fertile soils. Quick-growing, bearing well.  
Values: Characteristic species of East Asia. Flowers and fruit occur in clusters. A good ornamental tree.

**39. *Cinnamomum micranthum* (Hayata) Hayata**

A class 3 state-conserved species (becoming endangered)  
Features: Evergreen tree, loving light and warmth, not adapted to arid soil. Growth rate medium, but germination rate of seeds low.

Values: Discontinuously distributed on both Taiwan and Chinese mainland, with value in the study of the flora of both regions. A good timber producer, and the whole tree produces a fragrant oil.

**40. *Phoebe bournei* (Hemsl.) Yang**

A class 3 state-conserved species (becoming endangered)  
Features: Evergreen tree. A shade plant, loving humid and thick acid soils. Saplings grow slowly, bigger trees quicker. Natural regeneration easy.

Values: A well-known timber tree, the trunk is tall and straight, and the timber fragrant and durable.

**41. *Phoebe zhenan* S. Lee et F. N. Wei**

A class 3 state-conserved species (becoming endangered)  
Features and values as for *Phoebe bournei*, but rarer in the wild.

**42. *Dysosma versipellis* (Hance) M. Cheng**

A class 3 state-conserved species (becoming endangered)  
Features: Perennial herb, often growing in ravines, on slopes, on damp sites under trees, or next to water. Mostly tolerant of shade, needs a moist environment. Susceptible to strong sunlight and drought.

Values: Rare medicinal herb, with curative effects on furuncles, swellings, and bites by poisonous snakes. The peculiar leaves give it ornamental value.

**43. *Ixonanthes chinensis* Champ.**

A class 3 state-conserved species (becoming endangered)  
Features: Evergreen tree, warmth-seeking, intolerant of cold. Mainly occurs in monsoon forests of warm regions in south and south-eastern China. Grows relatively quickly, but natural regeneration difficult.

Values: A key species used for the systematics studies of *Linaceae* and general botany. Can be planted in gardens. The timber is used in industry.

**44. *Stewartia sinensis* Rehd. et Wils.**

A class 3 state-conserved species (becoming endangered)  
Features: Evergreen tree, light-loving. Requires cool and moist climates and thick yellow or brown-yellow soils. Growth rate medium, natural regeneration easy.

Values: An ancient plant endemic to China. Of scientific significance to the study of East Asia's flora. Timber hard and durable, and seed is a source of edible oils.

**45. *Gleditsia vestita* Chun et How ex B. K. Lee  
(*C. japonica* Miq. var. *velutina* L. C. Li)**

A class 3 state-conserved species (becoming endangered)  
Features: Deciduous tree, sun-loving. Needs warm climates and yellowish brown soils. Adaptable, with a developed root system. Artificially cultivated trees also grow well in acid red soils of hills.

Values: Rare tree endemic to Hunan province, occurring only on Nan Yue Mountain. An important timber tree with compact texture, the attractive crown has scenic value. The legume is used as a detergent.

**46. *Zenia insignis* Chun**

A class 3 state-conserved species (rare)  
Features: Deciduous tree, sun-loving, quick-growing, not tolerant of bitter cold. Sprouts strongly, requiring no specific soil conditions.

Values: Endemic to China. Economically promising in warm areas because of quick growth and good adaptive abilities. The dense crown and red fruit have scenic value.

**47. *Glycine soja* S. et Z.**

A class 3 state-conserved species (becoming endangered)  
Features: Annual herb, water-loving, mostly on damp sites of low elevations. Can withstand salinity, alkali and cold.  
Values: Has desirable characteristics, being tolerant of salt, alkali, cold, and many diseases. Can be hybridised with soybean to increase resistance in the latter and evolve new varieties.

**48. *Semiliquidambar cathayensis* Chang**

A class 3 state-conserved species (rare)  
Features: Evergreen tree, likes warmth, mostly in subtropi-



cal regions of South Asia. Requires thick and fertile soils, has medium growth rate and poor natural regeneration. Values: Only species of its genus, of importance to the systematics studies of Hamamelidaceae. The timber is good, and the peculiar leaf has scenic value.

**49. *Corylus chinensis* Franch.**

A class 3 state-conserved species (becoming endangered)  
Features: Deciduous tree, sun-loving. Needs temperate, cool and moist environments, yellow or brown-yellow soils of mountain areas. Grows quickly and spouts strongly, propagating by seed.  
Value: A valuable endemic, with wide uses. Timber good, seeds edible.

**50. *Pteroceltis tatarinowii* Maxim.**

A class 3 state-conserved species (rare)  
Features: Deciduous tree, sun-loving, needs calcareous soils. Well developed root system, tolerant of aridity.  
Values: Endemic to China, of general botanical importance and to the study of the germ plasm preservation of plants. Bark fibres important materials in manufacture of "Xuan paper". Can be used for greening limestone districts.

**51. *Artocarpus hypargyreus* Hance**

A class 3 state-conserved species (becoming endangered)  
Features: Evergreen tree, loves light and moisture. Mostly scattered in thin forests of low mountains in south China; intolerant of bitter cold, quick-growing.  
Values: Straight-trunked, quick growing. Timber good, long-lasting, economically attractive for planting. Also has high scenic value with dense, emerald-green crown.

**52. *Archiboehmeria atrata* (Gagnep.) C.J. Chen**

A class 3 state-conserved species (rare)  
Features: Deciduous shrub, adaptable. Grows in both tropics and the subtropics, best in shaded and wet sites.  
Values: The most primitive species in the family Urticaceae, thus of value in the classification of the family.

**53. *Dipteronia sinensis* Oliv.**

A class 3 state-conserved species (rare)

Features: Deciduous tree, sun-loving. Likes cool and wet climates, found in mountainous districts with heavy humidity. Grows quickly, good bearer. Propagates by seed. Value: Only member of its genus, endemic to China. Important for evolutionary studies of the origin and evolution of Aceraceae. Original fruit shape, prized ornamentally

**54. *Tapiscia sinensis* Oliv.**

A class 3 state-conserved species (rare)  
Features: Deciduous tree. Light-loving, likes warm and wet climates. Intolerant of high temperatures and drought, requires acid soils with high humus content. Grows quickly, propagates by seed.  
Values: An ancient tree endemic to China planted for both timber and scenic value.

**55. *Halesia macgregorii* Chun**

A class 3 state-conserved species (rare)  
Features: Deciduous tree. Sun-loving, well-developed root system tolerates dryness. The seed has a dormancy period.  
Values: Endemic to China, unusual fruit shape, prized ornamentally

**56. *Pterostyrax psilophylla* Diels ex Perk.**

A class 3 state-conserved species (becoming endangered)  
Features: Deciduous tree. Sun-loving, needing warm climates. Grows quickly, requiring no specific soil conditions.  
Values: Attractive appearance. A quick grower, good for both timber and scenic value.

**57. *Gastrodia elata* Bl.**

A class 3 state-conserved species (becoming endangered)  
Features: Perennial saprophytic herb, often growing on the edges of broad-leaved forests. Requires layers of humus and thick soils, moderate rainfall. Three-year interval from the germinating of the seed to the ripening of the seed of the next generation.  
Values: The rhizome is a rare medicinal material with curative effects of diverse maladies. Some value also for systematic studies of Orchidaceae.

## 12.3 List of Priority Wildlife in Hunan

Hunan Province, with its prime natural conditions and rich wildlife, is situated in the southern part of the middle reaches of the Yangtze River. To date 568 species of terrestrial and 253 species of aquatic vertebrates have been recorded in Hunan: 89 mammals, 392 birds, 87 reptiles, 59 amphibians, and 194 fish.

Surveys and past records list 84 species of Hunan vertebrates as belonging to wildlife protected as being of National Importance in China. 21 of these belong to the first rank, and 102 to the second rank. The list here is based on information provided by the Forestry Department of Hunan, but similar lists with minor deviations have been published for example by Yang (1997) and Yang *et al.* (1997).

Using information on the status and degree of endangerment of wildlife species in Hunan, a priority conservation list of Hunan provincial wildlife is formulated below. Such a list is useful for directing scientific protection and management measures.

### I MAMMALIS

#### (I) Primates

##### 1. *Tibetan macaque - Macaca thibetana*

Largest monkey in genus *Macaca*. Tail short, shorter than hind foot. Dorsal hair rufous, thick hair on forehead and cheeks. Male's face yellowish pink, female's face scarlet. Mountain forests in S. Hunan.

##### 2. *Rhesus macaque - Macaca mulatta*

Tail length about half body length, face and ears yellowish pink, shoulder hair greyish rufous. An important monkey in scientific experiments. Mountain forests in W. and S. Hunan.

##### 3. *Stump-tailed Macaque - Macaca speciosa*

Tail short, shorter than length of hind foot. Male's and female's faces all scarlet, little hair on forehead and cheeks. Mountain forest in S. Hunan.

#### (II) PHOLIDOTA

##### 4. *Chinese pangolin - Manis pentadactyla aurita*

Most of body covered by cuticular scales. Abdomen and insides of legs covered by hair. Tail long, third claw of foreleg thin and bent for digging holes in ant and termite nests. Important in Chinese medicine. Hill and mountain forests in Hunan.

#### (III) CARNIVORA

##### 5. *Asiatic Black Bear - Selenarctos thibetanus*

Body hair black, nose and face sepia, lower jaw white, breast with a V-shaped spot. Important in Chinese medicine. Mountain forest in W. and S. Hunan.

##### 6. *Large Indian Civet - Viverra zibetha ashtoni*

Two aromatic glands under anus. Alternate waved black and white stripes at sides of neck and throat, 3 black, 2 white. 5-6 black and white alternating colour rings in tail. Important in traditional medicinal, and for fur. Hill and mountain forests in Hunan, mainly in W. and S. Hunan.

##### 7. *Spotted Linsang - Prionodon pardicolor*

Two black column-like stripes from dorsal neck to fore-shoulder, dorsum with rufous and dusky circular or elliptical spots. Tail has 9-10 black rings. Important fur-bearer. Mountain and hill forests in S. Hunan.

##### 8. *Clouded leopard - Neofelis nebulosa nebulosa*

Body weight 20-32 kg, numerous clouded spots and stripes from forelegs to buttocks. Very rare, endangered species. Mountain forests in S, W, and E Hunan.

##### 9. *Leopard - Panthera pardus fusca*

Body weight about 50kg. Back rufous or rufous yellow. Circular or elliptical black spots all around the body. Very rare and endangered species. Mountain forest in S and W Hunan.

##### 10. *Chinese Tiger - Panthera tigris amoyensis*

Body entirely yellow with transverse black stripes, white

abdomen with obvious black stripes. Tail with transverse black stripes.

Mountain forests in Ba Da Gong Shan Nature Reserve and Hu Ping Shan Nature Reserve in Hunan, Mang Shan Nature Reserve, Tao Yuan Dong Nature Reserve in S Hunan. Critically endangered.

#### (IV) CETACEA

##### **11. Chinese River Dolphin - *Lipotes vexillifer***

Teeth in both upper and lower jaws, snout enlarged to a bill. Critically endangered.  
Dong Ting Lake in Hunan.

#### (V) ARTIODACTYLA

##### **12. Forest Musk Deer - *Moschus berezovskii***

Small-sized deer. Males and females have no horn, male's upper canines developed to long, sharp, protruding teeth. Males have a pair of musk bags important in Chinese medicine.  
Mountain forests in W and S Hunan.

##### **13. Chinese River Deer - *Hydropotes inermis inermis***

Medium-sized deer. Males and females have no horn, male's upper canines developed to long, sharp, protruding teeth. Tail short. Thick and long body hair yellow with some rufous.  
Widespread in Hunan, mainly in the Dong Ting Lake basin.

##### **14. Sambar - *Cervus unicolor***

Large-sized deer. Male has three-branched horn. Body all brown. Tail held up while walking.  
Hill and mountain forests in Hunan, mainly in S.

##### **15. Common Goral - *Nemorhaedus goral***

Medium-sized buffalo. Male and female all have short and straight horns, winter hair greyish brown, short black mane on dorsal side of neck, white spot on the throat.  
Mountain forests in W and S Hunan.

##### **16. Serow - *Capricornis sumatraensis argyrochaetes***

Large to middle-sized buffalo, like a huge sheep. Long ears like a donkey. Male and female both have a pair of short horns bent backward. Long mane on dorsal side of neck. Body black and brown, upper and lower lips white.  
Mountain forests in W and S Hunan.

## II AVES

#### (I). CICONIFORMES

##### **17. Oriental white stork - *Ciconia boyciana***

Large bird with long legs. Much as European White Stork, but with much heavier black bill which has an upward tilt and a tendency to be open in the middle. Legs dull orange red. Winter migrant to Hunan.  
Dong Ting Lake and Xiang- Jiang River basin in Hunan.

##### **18. Black Stork - *Ciconia nigra***

Large bird with long legs. Black, belly white, facial skin, bill and legs red. Winter migrant to Hunan.  
Dong Ting Lake basin in Hunan.

##### **19. Spoonbill - *Platalea leucorodia leucorodia***

Summer plumage all white, breast band yellowish. Ample yellowish crest in breeding season. Bill black, very broad and flat ending in a yellowish spatula. Facial skin yellow. Breeds in East Dong Ting Lake Nature Reserve, and on Dong Ting Lake and Xiang- Jiang basin in Hunan.

##### **20. White-fronted Goose - *Anser albifrons***

Much as Greylag Goose but with conspicuous white area around base of bill; belly more heavily splotched with black; shoulders less grey, more brownish. Bill pink, legs yellow.  
Winter migrant in Dong Ting Lake.

##### **21. Mandarin Duck - *Aix galericulate***

Arguably the most beautiful of all ducks. Head crested, centre of crown from forehead to behind eye shining bottle green, turning abruptly to coppery purple and then again to bottle green at sides of long crest. Cinnamon

chestnut edged with white on the very broad inner web, these feathers held erect like "sails". Male's bill red, legs yellow. Large inland lakes in W, S, and Central Hunan.

**22. Whooper Swan - *Cygnus cygnus cygnus***

Pure white. Bill black, yellow at base, the yellow more extensive than on the next species extending further forward along the edge of the upper mandible where it ends in a point. Neck carried straighter than in the Mute Swan. Winters in Dong Ting Lake basin in Hunan.

**23. Whistling Swan - *Cygnus columbianus jakowskii***

Large-sized waterfowl. White. Bill black, basal portion yellow, extending much less farther along bill and not ending in a point.

Dong Ting Lake in winter in Hunan.

**24. Chinese Merganser - *Mergus squamatus***

Large-sized duck. Underparts pinkish white, sides of body and lower back white with coarse, concentric black bars. Male in eclipse plumage as female, but with wings as in breeding plumage.

Fast-flowing mountain streams in W Hunan and in winter on Dong Ting Lake.

(II) FALCONIFORMES

All birds belonging to Falconiformes in China need urgent protection, these including *Ariceda leuphotes syama*, *Milvus korschun lineatus*, *Accipiter gentilis schvedowi*, *Accipiter nisus nisosimilis*, *Accipiter virgatus gularis*, *Accipiter nisus nisosimilis*, *Buteo buteo burmanicus*, *Circus aeruginosus aeruginosus*, *Aquila heliaca*, *Aquila chrysaetos daphanea*, *Haliaeetus albicilla*, *Microhierax melanoleucos*, *Falco peregrinus calidus*, *Falco subbuteo streichi*, *Falco amrensis*, *Falco columbarius insignis*, *Falco tinnunculus interstinctus*.

**25. Black-Crested Baza - *Ariceda leuphotes syama***

Glossy blue black above including long, prominent crest often held erect. Throat and neck black, with broad white crescent across upper breast. Lower breast and sides of belly broadly barred chestnut and whit, thighs, centre of

belly, and undertail coverts black. Tail black. Belly, wings and tail silver grey.

Mountain forests in Hunan.

**26. Black kite - *Milvus Korschun lineatus***

Mostly reddish brown, streaked black below. Front of head greyish, streaked black. Tail long, forked, with equally spaced black and brown bars. Underside of wings have distinct white patch visible in flight.

Virtually throughout Hunan Province.

**27. Chinese Goshawk - *Accipiter soloensis***

A small hawk, slate grey above, mostly pinkish brown below. Top and sides of head, back, closed wings and tail bluish slate grey, outer tail feathers barred black and slate; remiges blackish, unbarred. Chin and throat white with black shaft streaks. Breast and belly pinkish, darkest in young birds.

Wooded hills and mountain in Hunan.

**28. Besra Sparrowhawk - *Accipiter virgatus gularis***

Very much as Japanese sparrowhawk but distinguishable by broad black gular stripe, white under-wing coverts tinged rufous, auxiliaries rufous with dark bars and underparts sometimes intensely rufous.

Thick forest, open woodland; in winter in Hunan groves of trees on the plains.

**29. Golden Eagle - *Aquila chrysaetos daphanea***

Dark brown, feathers of hind crown, nape, and hind neck golden buff, narrow and pointed. Tail square, greyish brown with a blackish bar and terminal band. In flight wing tips upturned, the feathers separated in widely splayed fingers.

Steppes, river valleys with cliffs in W Hunan.

**30. Peregrine Falcon - *Falco peregrinus calidus***

Crown, nape, and broad streak below eye blackish, back slate grey barred with black. Tail evenly barred with black and grey. Ear coverts and throat white, rest of underparts buff white, spotted on breast. Barred black on rest of underparts, including thighs.

Virtually throughout Hunan Province.

### (III) GALLIFORMES

#### **31. Crimson-bellied Tragopan - *Tragopan lemminckii***

Front and sides of crown, nuchal collar and band around throat lappet black, centre of crown and crest orange red. Back and closed wings brick red, back more crimson toward rump. Entirely covered with black-encircled blue grey spots, longest upper tail coverts mottled black and buff, the distal third covert a light violet grey. Body below blue grey, the feathers broadly margined brick red giving a scaled appearance. Bare face and chin bright blue, horns greenish blue, lappet, dark blue spotted with light blue, with eight arrow-shaped scarlet marks at each side, all seen only when expanded (?). Legs pinkish to reddish. Dense evergreen, bamboo thickets.

Mountain forests over 800m in Hunan.

#### **32. Yellow-bellied Tragopan - *Tragopan caboti***

Buff below, maroon - red spotted buff above. Crown and ear coverts black, eyebrow orange -red. Sides of neck orange-red bordered on each side by a black band, the bands bordering the throat joining to form a collar; hindneck orange red. Upperparts maroon red, thickly spotted with deep buff, the spots margined with black, the feathers with white shafts. Lappet orange with purple spots, surrounded by cobalt blue, sides with nine large patches of pale greenish grey seen only when expanded (?).

Hill forest over 700m in S Hunan.

#### **33. White-crowned long-tailed Pheasant - *Syrmaticus reevesii***

Large-sized pheasant. Tail enormously long, narrow, up to 1520mm. Crown white, forehead, lores, sides of head, and nape black; a spot below eye, throat, lower part of cheeks, sides of neck, continued to form a nuchal collar, are white; feathers long, the lower edge broadly golden yellow, ochre yellow on lower back, bordered with black and giving a scaled appearance. Feathers of breast and sides of body white, each feather with two broad black bars and broadly edged chestnut.

Higher, wooded hills and mountains in W and S Hunan.

#### **34. White-necked long-tailed pheasant - *Syrmaticus ellioti***

Large-sized pheasant. Crown dark grey, hindneck light grey, sides of neck greyish white, throat and foreneck black. Mantle and breast metallic coppery chestnut spotted with black; lower back, rump, and upper tail coverts blue black conspicuously barred with white; tail silvery grey with broad chestnut bars. Belly white, feathers at sides of body black basely.

Resident in W and E Hunan.

#### **35. Silver Pheasant - *Lophura nycthemera nycthemera***

Large-sized pheasant. Long silky, ample blue black crest. White above, slightly to conspicuously marked with narrow black lines. Wings and tail white, coarsely marked with black lines. Wings and tail white, coarsely marked with black lines except on central tail feathers. Tail long, arched, the longest feathers curving outward.

Hill and mountain forests in S and E Hunan.

#### **36. Golden pheasant - *Chrysolophus pictus***

Medium-sized pheasant. Highly coloured species with crimson scarlet underparts, crown and very long crest of silky hair-like feathers emerging from nape and expanding to cover the upper mantle, each feather with a median and terminal blue black bar. Central upper tail coverts golden yellow; sides of upper tail coverts crimson. Central tail feathers black, profusely spotted with pale buff, rest of tail feathers cinnamon irregularly and densely barred with black. Centre of abdomen buff.

### (IV) GRUIFORMES

#### **37. Hooded Crane - *Grus monacha***

Large bird with long legs. Crown and lores bare, red, covered with black "hairs"; hindcrown, cheeks and neck white three quarters of their length, rest of plumage dark grey, inner remiges elongated, drooping beyond tail, legs black.

Winter migrant to Dong Ting Lake.

**38. White-naped Crane - *Grus vipio***

Large bird with long legs. Forecrown, lores, ocular region bare, red. Area above eye covered with black bristles. Hindcrown, hindneck, chin, and upper foreneck white, the white of foreneck narrowing to a point. Primaries black, secondaries grey barred with white, tertials white. Bill yellowish green. Legs crimson.

Winter migrant to Dong Ting Lake.

**39. Siberian white Crane *Grus leucogeranus***

Large bird with long legs. Crown and face bare, red. Plumage snow white, feathers of inner remiges lengthened, drooping beyond tail. Bill and legs dull red.

Winter migrant to Dong Ting Lake.

**40. Great Bustard - *Otis tarda***

Large-sized bird. Head and neck pale grey, hindneck tinged strongly with rufous; crown darker with a short, stiff crest; long tufts of stiff, bristly white feathers springing from the chin and sides of upper throat. Upperparts barred black and rufous chestnut. Wings appear white when closed. Foot has only three toes.

Dong Ting Lake basin in Hunan.

(V) STRIGIFORMES

All birds belonging to Strigiformes need protection. For example:

**41. Cape Barn Owl - *Tyto capensis chinensis***

Medium-sized owl. Very much as Barn Owl but larger, the upper side much darker, chocolate brown to blackish brown with much orange buff showing through. Tail paler, sometimes almost white, with ca. four conspicuous black bars; legs longer, feet much larger than Barn Owl. Resident in hill and mountain forests in Hunan.

**42. Scops Owl - *Otus scops malayanus***

Small-sized owl. Ear tufts prominent. Distinguished from Mountain Scops Owl by greyish tone of plumage and heavier black streaking below. Also differs by rufous tints in the plumage and streaks on the back much reduced or absent. Forests in E, W, and Central Hunan.

**43. Eagle Owl - *Bubo bubo Kiautschensis***

The largest owl in China. Ear tufts long, longest feathers mostly black. Above sandy grey to cinnamon buff, upper mantle with broad black streaks, rest of upper parts heavily spotted and marbled with black. Throat white, breast cinnamon buff to greyish buff broadly streaked with black, rest of underparts greyish to buff finely barred with black. Tarsi and toes feathered, plain buff.

Found virtually throughout Hunan.

**44. Barred Owlet - *Glaucidium cucuoides whiteleyi***

Reminiscent of the Collared Owlet but much larger and without a nuchal collar. Dark brown, closely barred on crown and nape, more widely barred buffy white on back and inner remiges. Scapulars and greater wing coverts edged with white. Centre of throat and extreme upper breast white, rest of breast barred brown and white. Belly white, streaked with brown. Tarsi feathered. No ear tufts.

Virtually throughout Hunan.

**45. Brown Hawk Owl - *Ninox scutulata burmanica***

Upperparts plain dark greyish brown, scapulars with white on outer web. White below, streaked reddish brown. Primaries dark brown. Tail brownish grey, much lighter than back with about four broad black bars. No ear tufts. Tarsi feathered. Iris yellow.

Mountain forests in W Hunan.

**46. Long-eared Owl - *Asio otus otus***

Facial disc buff, white in front of eye, anterior edge of eye black, facial disc surrounded by a narrow band of freckled black and white feathers. Buff white below, streaked broadly on breast with dark brown, more narrowly on belly and flank where the feathers are also lightly and narrowly barred dusky. Ear tufts long, prominent, black, outlined in white. Iris orange.

Hill and mountain forests in Hunan.

### III REPTILIA

#### 47. *Mang Shan Laotietou - Trimeresurus kaulbacki*

Second supralabial small and low, does not extend to the border of the loreal pit. Ventrals 189, anal entire. Tail laterally compressed, mainly at its posterior part; 63 subcaudals, the first 62 paired, the 63rd single, their outer margin being bent downwards up to the middle of the tail; dorsal part of the tail covered with relatively large, regularly arranged scales on rows of which the number progressively decreases backwards from 9 rows to 7, 4 rows at the end of the tail. Tail spine flats and hard. Head subtriangular, tip of snout narrow and hard. Head subtriangular, tip of snout narrow and rounded with a sharp canthus rostralis.

Mountain Mang Shan, Yizhang County, Hunan Province.

### IV AMPHIBIA

#### 48. *Giant Salamander - Andris davidianus*

The largest amphibian in the world, body length of adults over 20-30 cm. Body strong, thick and flat. Head very wide and flat, with head tubercles arranged in many columns in pairs.

Hill and mountain areas in Hunan.

#### 49. *Crocodile Salamander - Tylotriton asperrimus*

Body blackish brown, belly slate; fingers, toes, outside of anus and the lower part of the tail tangerine-coloured. Body length about 13 cm. A species endemic to China. Mountain forests in W and E Hunan.

### V PISCES

#### 50. *Chinese Sturgeon - Acipenser sinensis*

Body spindly, covered by five-column ganoid scales, skeleton mostly cartilage bone. Heterocercal. Lips especially enlarged, mouth underneath lips.

Dong Ting Lake in Hunan.

## 12.4 Selected Project Profiles

The following list of project profiles was collected during the work on this report. It is more a list of ideas than project descriptions, but three projects (numbers 1-3) are described in more detail due to their great importance. Some of the profiles here are included in the strategy (see Chapter 9), others omitted, mainly because the strategy in this first Action Plan has purposely been left on a general level. In spite of this, many of the profiles presented here are important, some even urgent, to accomplish. Some projects are appropriate for international projects, other more of a domestic character. All of them need more planning and developing before they will be ready e.g. for the preparation of funding applications.

### *Protection of the Lake Dong Ting complex*

The lake system of Dong Ting (covering both lakes within and outside the three nature reserves) is one of the most precious wetlands in all China. The arrangements for its protection have not been able to guarantee peace to the huge flocks of overwintering and migrating birds, which use the lake system. Many legal and illegal activities are little by little gnawing away at the internationally high conservation value of the area. The economic advantages conferred by this gradual degradation and destruction is probably a crucial limiting factor for many rare bird species, and is in no relation to the damages wrought to global biodiversity.

Objectives: Improvement of protection levels to the most valuable habitats and bird species using all methods available. Acquisition of more information about the site's wildlife. Informing people in Hunan and neighbouring provinces about the values of the lakes.

Proposed: Inventories of rare and endangered species, detailed planning of the protected areas and buffer zones together with the local administration, preparation of management plans of high international standard, definition of clear borders, preparing and implementing new regulations, planning and construc-

tion of visitor centre, information points, bird watching towers, walking routes etc, preparing of informative material (leaflets, booklets, books, films etc), capacity building for the staff of the nature reserves, improving regulation enforcement, organising ecotourism.

See for example chapters 3.5, 3.9, 4.1, 4.2.2, 4.2.3, 4.2.6, 4.4.1, 4.5.2, goals 10-17 and 20-24 in the strategy (chapter 9), and the brief descriptions of the nature reserves Dong Ting Hu, Mu Ping Hu and South Dong Ting Lake in chapter 12.5.

### *Protection of the subtropical forests of Hunan*

Hunan is one of the areas still containing north-ranging primeval and natural secondary subtropical forests. Obtaining exact information on the status of these forests was difficult, but it is clear that all of them, even those within nature reserves, are more or less threatened by many human activities, including uncontrolled and illegal ones.

Objectives: Inventories of all the natural subtropical forests in Hunan using both remote sensing and field inventories. Collecting up-to-date information about the state of the forests. Informing people in the neighbourhood and the whole province about the importance of protecting the forests. Preparing realistic management plans which safeguard the future of these areas.

Proposed: Survey of the natural forests using satellite imagery and modern interpretation methods. Gathering of existing information from institutes and universities, improving knowledge of rare and endangered ecosystems and species through new field inventories. Preparation of management plans of high international standard, preparing proposals of new protected areas and expanding of the existing ones, preparing a Conservation Program for the Subtropical Forests of Hunan, preparing the approval of the program by the provincial government, planning and constructing of visitor centres, information points, walking routes etc, preparing of information material, capacity building for the staff of the nature reserves, improving regula-



tion enforcement, organising ecotourism, development of new, sustainable livelihoods for the local rural people.

See for example table 1, chapters 3.4, 3.7, 3.9, 4.1, 4.1.1, 4.2.1, 4.4.1, 4.4.2, 4.5.2, 7.1 and at least the goals 1, 8-17, 20 and 22-24 in the strategy (chapter 9).

Management and monitoring of endangered ecosystems and species:

A large number of endangered species are found in Hunan, but information on them is scarce.

The overall status of fauna and flora in general is poorly known; inadequate knowledge of the species really in need of protection, and of their ranges and habitats, renders even the allocation of the current insufficient resources difficult.

**1** Objectives: Gathering all the existing information on the endangered ecosystems and species from institutes and universities. Preparing a Red Data Book for Hunan Province for use as a tool in administration, raising public awareness and capacity-building in biodiversity conservation.

**2** Proposed: Establishment of co-operation between scientists and administrators, collecting and evaluating existing information, carrying out new inventories, creating relevant status classification for the province, compiling and publishing a Red Data Book with pictures and maps, preparing the official approval of the Red Data Book by the provincial government, preparing new provincial legislation based on the information provided, preparing training and information material on endangered species, developing of an updateable monitoring system.

**3** See for example chapters 4.1.1, 4.2.1-4.2.6 and goals 9-14 and 23-24 in the strategy (chapter 9)

**4** The construction of a base for ex-situ conservation of wild animals in Hunan Province

**5** The construction of a base for ex-situ conservation of wild plants in Hunan Province

**6** Planning the management of nature reserves in Hunan Province

**7** Investigation, categorisation, and assessment of the insect diversity in Hunan Province

**8** Investigation, categorisation, and assessment of the plant diversity in Hunan Province

**9** Investigation and assessment of the generic biodiversity of economically valuable forest species (oil tea, chestnut, tung tree) in Hunan Province

**10** Investigation and assessment of the generic biodiversity of wild rice in Hunan Province

**11** Investigation and assessment of the generic biodiversity of livestock and poultry in Hunan Province

**12** Research on the reasons for and prevention of endangerment to some important and rare plant and animal species in Hunan Province

**13** Project of in-situ conservation techniques of *Davidia* and *Cathaya*

**14** Building project of a monitoring centre of Hunan biodiversity

**15** Building project of information centres of Hunan biodiversity

**16** Project on the development of tourism in nature reserves in Hunan Province

**17** Establishment of subtropical mountainous forest reserves in the Wu Ling Mountains

**18** Establishment of southern subtropical mountainous forest reserves in the Nan Ling Mountains

**19** Establishment of middle subtropical mountainous forest reserves in the Xue Feng Mountains

**20** Development of sustainable use of biological resources in Hunan Province

**21** Protection project for the South China Tiger, *Panthera tigris amoyensis*

**22** A project for the protection of monkeys in Hunan Province

**23** A project for the protection of large felids in Hunan Province

**24** A project on the policies and technical measurements needed in the management of forest resources and the conservation of biodiversity

**25** A project for monitoring the Dong Ting Lake wetlands and an assessment of the impacts there of the Three-Gorges dam

## 12.5 Brief Presentation of the Protected Areas of Hunan

All the 38 nature reserves in Hunan are presented here in alphabetical order. The transliteration of Chinese names varies in English. The information here is mainly from the Forestry Department. The value or the priority ratings of each nature reserve is expressed on a scale from A to D as follows: A = Globally significant, B = Nationally significant, C = Of local interest, D = Needs re-evaluation. When more knowledge becomes available, changes in some ratings may be necessary.

Name	Ba Da Gong Shan
Area	232 sq. km
Type	National Nature Reserve
IUCN Category	IV
County	Shan Zhi Xian
Agency	Forestry Department
Year	1982
Location	29(39'-29°49' N by 109°41'-110°6' E
Altitude	380-1890 m
Main value	Mainly subtropical mountain evergreen broad-leaved forest where many primitive plants are preserved. These include several endemic species. Blocks of luxuriant mixed forests dominated by the former are rare elsewhere.
Ecosystems	Subtropical evergreen broad-leaved forest
Species	1775 vascular plant species (30 of them endangered) and 146 vertebrate species known in the reserve. E. g. <i>Davidia involucrata</i> , <i>Liriodendron chinese</i> and <i>Cydlodayra paliurus</i>
Management Plan	No
Reports	Anonymous 1982, Xiong 1997
Human settlement	200 inhabitants
Visitors	20 000 per year
Problems	Logging around the reserve
Priority Rating	A

Name	Ba Mian Shan
Area	49 sq. Km
Type	Nature Reserve

IUCN Category	IV
County	Gui Dong Xian
Agency	Forestry Department
Year	1982
Location	25(57'-26(10' N by 113(42'-113°46'
Altitude	500-2014 m
Main value	Endangered species
Ecosystems	Deciduous evergreen broad-leaved forest
Species	<i>Panthera tiger</i> ; <i>Cathaya argyrophylla</i>
Management Plan	No
Reports	Yes
Human settlement	Few
Visitors	Few
Problems	Too small for tigers
Priority Rating	A

Name	Ban Tang
Area	65 sq. km
Type	Nature Reserve
IUCN Category	IV
County	Lan Shan Xian
Agency	Local Forestry Bureau
Year	1989
Location	
Altitude	
Main value	Reserve for protecting Spotted Bamboo
Ecosystems	Forest
Species	Spotted Bamboo
Management Plan	No
Reports	No
Human settlement	500
Visitors	Few
Problems	Small
Priority Rating	D

Name	Bo Yue Dong
Area	0,3 sq. km
Type	Geological Reserve
IUCN Category	IV
County	Leng Shui Jiang Shi
Agency	Mineral Resource Department
Year	1984
Location	
Altitude	
Main value	Geological

Ecosystems  
 Species  
 Management Plan No  
 Reports No  
 Human settlement  
 Visitors  
 Problems  
 Priority Rating D

Name	Cheng Bu
Area	30 sq. km
Type	Nature Reserve
IUCN Category	IV
County	Cheng Bu Xian
Agency	Forestry Department
Year	1985
Location	26(23'-26(32' N by 110°27'-110°34' E
Altitude	500-1500 m
Main value	Reserve for an endangered species
Ecosystems	Forest
Species	<i>Cathaya argyrophylla</i>
Management Plan	No
Reports	Yes
Human settlement	No
Visitors	No
Problems	Small
Priority Rating	C

Name	Cheng Xi Long Men Wa Wa Yu
Area	17 sq. km
Type	Nature Reserve
IUCN Category	IV
County	Chen Xi Xian
Agency	Environmental Protection Agency
Year	1984
Location	
Altitude	
Main value	Rare species
Ecosystems	
Species	Giant Salamander <i>Andrias davidiana</i>
Management Plan	No
Reports	No
Human settlement	
Visitors	
Problems	
Priority Rating	D

Name	Da Cheng Shan
Area	1 sq. km
Type	Nature Reserve
IUCN Category	IV
County	Lou Di Shi
Agency	Local Forestry Bureau
Year	1987
Location	
Altitude	
Main value	Forest ecosystem
Ecosystems	
Species	Giant Salamander <i>Andrias davidiana</i>
Management Plan	No
Reports	No
Human settlement	
Visitors	
Problems	
Priority Rating	D

Name	Da Wei Shan
Area	52 sq. km
Type	Nature Reserve
IUCN Category	IV
County	Liu Yang Xian
Agency	Forestry Department
Year	1982
Location	28(20'-28(25' N by 114(03'-114(11' E
Altitude	300-1600 m
Main value	Rare flora and fauna
Ecosystems	Deciduous evergreen broad-leaved forest
Species	Leopard and clouded leopard
Management Plan	Yes
Reports	Yes
Human settlement	Few
Visitors	1 million per year
Problems	Constructions
Priority Rating	C

Name	Da Yuan Yuan Kou
Area	104 sq. km
Type	Nature Reserve
IUCN Category	IV
County	Jian Yong Xian
Agency	Forestry Department
Year	1982

Location	24(56'-25(25' N by 110°59'-111(15' E
Altitude	300 – 1757 m
Main value	Rare flora and fauna
Ecosystems	Deciduous evergreen broad-leaved forest
Species	<i>Fokiena hodginsii</i> , endangered cats
Management Plan	No
Reports	Yes
Human settlement	500 inhabitants
Visitors	10 000 per year
Problems	Southern part rather degraded
Priority Rating	C

<b>Name</b>	<b>Ding Liao</b>
Area	10 sq. km
Type	Nature Reserve
IUCN Category	IV
County	Zi Xing Xian
Agency	Forestry Department
Year	1986
Location	26(05' N by 113(38' E
Altitude	600 – 2000 m
Main value	Rare flora and fauna
Ecosystems	Deciduous evergreen broad-leaved forest
Species	<i>Cathaya argyrophylla</i>
Management Plan	No
Reports	Yes
Human settlement	Few
Visitors	No
Problems	Small
Priority Rating	C

<b>Name</b>	<b>Dong Ting Hu (East Dong Ting Lake)</b>
Area	1903 sq. km
Type	Nature Reserve
IUCN Category	IV
County	Yue Yang Xian
Agency	Forestry Department
Year	1982
Location	29(00'-29(37' N by 112(42'-113(12' E
Altitude	30 – 35 m
Main value	One of the most important wintering grounds in China for migratory birds including many threatened ones, and habitat of the Chinese River Dolphin. Together with Mu Ping Hu (West Dong

Ecosystems	Network of freshwater lakes, marshes, wet grassy plains and channels
Species	It is estimated that about 10 million waterfowl, cranes, storks and waders overwinter here. During migration seasons, millions of migrating birds rest and feed here as well. The number of overwintering birds has been increasing in 1990s, perhaps because of drought in some other wetlands.

Management Plan	The lake is one of last sanctuaries for the Chinese River Dolphin, <i>Lipotes vexillifer</i> . Overwintering rare birds include Swan Goose <i>Anser cygnoides</i> , Lesser White-Fronted Goose <i>Anser erythropus</i> , Spoonbill, White Stork, a few individuals of Black Stork <i>Ciconia nigra</i> , Black-Faced Spoonbill, Hooded Crane <i>Grus monacha</i> , White-Naped Crane <i>Grus vipio</i> , Siberian White Crane <i>Grus leucogeranus</i> , Common Crane <i>Grus grus</i> , Mandarin Duck and Chinese Merganser, <i>Mergus squamatus</i>
Reports	Wildlife Management Plan for Dong Ting Lake Conservation Unit (Gui 1993b) Protection and Habitat Management for Wintering Cranes at Dong Ting Lake of the Yangtse River, China (Gui 1993a) Impact of Human Activities on Dong Ting Lake wetland and Conservation Strategy (Chen 1997)

Human settlement	Some settlements inside the nature reserve.
Visitors	More than 1 million per year, mainly on the Temple Island
Problems	Settlement, reclamation for agriculture, overgrazing, overfishing, water pollution, poaching, 18 000 fishing boats: the number is increasing but catches are decreasing (now less than 20 000 tons) 70 paper mills and a few thousand factories of other kinds around the lake, 240 million tons of waste water run into the lake, sewage water from towns and cities is increasing: 37% of sewage is treated. Poisons used for killing snails and other

harmful organisms. Poachers use poisons to kill birds. Poaching is difficult to get rid of, lots of geese and ducks for sale in neighbouring cities in winter.

Priority Rating

A

Name	Heng Nan Jiang Kou Niao Zhou
Area	2 sq. km
Type	Nature Reserve
IUCN Category	IV
County	Heng Nan Xian
Agency	Forestry Department
Year	1984
Location	26(40' N by 112(51' E
Altitude	30 - 50 m
Main value	Birds and their habitats
Ecosystems	Three forested river islands
Species	
Management Plan	
Reports	
Human settlement	
Visitors	
Problems	
Priority Rating	C

Name	Hu Ping Shan
Area	666 sq. km
Type	Nature Reserve
IUCN Category	IV
County	Shi Men Xian
Agency	Forestry Department
Year	1982
Location	29(58'-30(08' N by 110(29'-110(59' E
Altitude	251 - 2099 m
Main value	Forests, rare flora and fauna
Ecosystems	Subtropical evergreen broad-leaved forest (below 1000 m), mixed evergreen deciduous broad-leaved forest (1000-1500 m), deciduous broad-leaved forest (1500-1750 m), mountain shrub grassland and meadow (above 1750 m).
Species	Plants: 2062 vascular plants known, 31 endangered species, such as <i>Davidia involucrata</i> , <i>Ginkgo biloba</i> , <i>Taxus chinensis</i> var. <i>mairei</i> , <i>Bretschneidera sinensis</i> , <i>Emmenopterys henryi</i> . Animals: 55 species

of mammals, 80 species of birds known. First class endangered species 6 (*Panthera tigris*, *Panthera pardus*, *Neofelis nebulosa*, *Felis temminckii*, *Muntiacus criniformis*), second class 23 species (e.g. *Macaca speciosa*, *Macaca mulata*, *Manis pentadactyla*, *Viverra zibethica*, *Selenarctos tibetianus*, *Cervus unicolor*, *Elaphadus cephalophus*, *Chrysolophus pictus*, *Andrias davidianus*)

Management Plan  
Reports

Only zoning  
Many scientific reports in Chinese, including: Status and Conservation Strategy of Biodiversity in Hu Ping Shan Mountains, Hunan Province (Chen *et al.* 1997), Comprehensive survey of Science on Natural Resources of the Hu Ping Shan Mountain Preserve in Hunan (Forestry Bureau of Changde City 1993)

Human settlement

63 villages, 32 000 inhabitants within the reserve

Visitors

1000 visitors (estimated in 1996)

Problems

Settlements inside, goat flocks, poaching of snakes and salamanders, illegal collecting of medical herbs, land reclamation in valleys

Priority Rating

A

Name	Huang Sang
Area	254 sq. km
Type	Nature Reserve
IUCN Category	IV
County	Sui Ning Xian
Agency	Forestry Department
Year	1982
Location	26(17'-26(25' N by 110(00'-110(11' E
Altitude	368 - 1913 m
Main value	Forest succession community
Ecosystems	Deciduous evergreen broad-leaved forest
Species	<i>Pseudotsuga sinensis</i>
Management Plan	No
Reports	Yes
Human settlement	800
Visitors	50 000
Problems	Illegal forest cuttings
Priority Rating	B

Name	Hui Feng Ling
Area	13 sq. km
Type	Nature Reserve
IUCN Category	IV
County	Jiang Yong Xian
Agency	Agriculture Department
Year	1991
Location	
Altitude	
Main value	
Ecosystems	
Species	
Management Plan	No
Reports	Watershed forest
Human settlement	
Visitors	
Problems	
Priority Rating	D

Name	Huo Yan
Area	81 sq. km
Type	Nature Reserve
IUCN Category	IV
County	Long Shan Xian
Agency	Forestry Department
Year	1987
Location	
Altitude	
Main value	Forest, flora and fauna
Ecosystems	
Species	
Management Plan	No
Reports	
Human settlement	
Visitors	
Problems	
Priority Rating	D

Name	Jiu Yi Shan
Area	36.5 sq. km
Type	Nature Reserve
IUCN Category	IV
County	Ning Yuan Xian
Agency	Forestry Department
Year	1982

Location	25(08'-25(23' N by 111(50'-112(04' E
Altitude	500 - 1600 m
Main value	Minority culture
Ecosystems	Bamboo forest
Species	Spotted bamboo
Management Plan	No
Reports	No
Human settlement	300 inhabitants
Visitors	200 000 per year
Problems	Fairly small
Priority Rating	D

Name	Mi Liang Dong (Lan Wang Shan Mi Liang Dong)
Area	10 sq. km
Type	Nature Reserve
IUCN Category	IV
County	Xu Pu Shi
Agency	Forestry Department
Year	1985
Location	27(40' N by 110(30' E
Altitude	350 - 1300 m
Main value	Forest ecosystems
Ecosystems	Evergreen forest ecosystems
Species	
Management Plan	No
Reports	Yes
Human settlement	50 inhabitants
Visitors	Few
Problems	Small
Priority Rating	D

Name	Liang Tou Yang
Area	67 sq. km
Type	Nature Reserve
IUCN Category	IV
County	Feng Huang Xian
Agency	Forestry Department
Year	1985
Location	27(55'-28(04' N by 109(22'-109(30' E
Altitude	400 - 1600 m
Main value	Forests, scenery
Ecosystems	Deciduous evergreen broad-leaved forest
Species	Not known
Management Plan	No

Reports	No
Human settlement	Few
Visitors	Few
Problems	Very little forest
Priority Rating	D

**Name Luo Ta**

Area	0,2 sq. Km
Type	Nature Reserve
IUCN Category	IV
County	Long Shan Xian
Agency	Forestry Department
Year	1982
Location	29(25' N by 109(27' E
Altitude	900 - 1400 m
Main value	A rare tree species
Ecosystems	Semi- nature forest
Species	<i>Metasequoia glyptostroboides</i>
Management Plan	No
Reports	No
Human settlement	100
Visitors	Few
Problems	Very little forest
Priority Rating	C

**Name Mang Shan**

Area	200 sq. Km
Type	Nature Reserve
IUCN Category	IV
County	Yi Zhang Xian
Agency	Forestry Department
Year	1982
Location	24(52'-25(03' N by 112(43'-113(00' E
Altitude	452 - 1902 m
Main value	Rare fauna and flora
Ecosystems	Deciduous evergreen broad-leaved forest, mainly secondary forest
Species	Plants: 2314 species of vascular plants known from the reserve. Animals: <i>Panthera tigris</i> , <i>Panthera pardus</i> , <i>Neofelis nebulosa</i> , <i>Cervus unicolor</i> . An endemic snake, <i>Trimeresurus manshanensis</i> (Viperidae) was found here in 1989 and Mang Shan is its only known living place. 150 bird species recorded here.
Management Plan	No

Reports	Several in Chinese, inc. an inventory of Bryophyte flora in English (Koponen <i>et al.</i> 2000)
Human settlement	1500 workers
Visitors	5000 visitors per year
Problems	Illegal logging, poaching, construction of roads. A hydroelectric power plant was constructed in the early 1990s in the middle of the reserve. Lots of streams are now dry due to regulation of waters, and electric cables destroy habitats in the reserve.
Priority Rating	A

**Name Mu Ping Hu (West Dong Ting Lake)**

Area	267 sq. km
Type	Nature Reserve
IUCN Category	IV
County	Han Shou Xian
Agency	Forestry Department
Year	1991
Location	28(57'-29(06' N by 111(24'-112(18' E
Altitude	30 - 40 m
Main value	Important wintering grounds for migratory birds including many threatened ones. Together with Dong Ting Hu (East Dong Ting Lake) and South Dong Ting Lake it forms a large complex of lakes and rivers, which are very precious.
Ecosystems	Network of freshwater lakes, marshes, wet grassy plains and channels
Species	Large numbers of overwintering waterfowl, Siberian White Crane <i>Grus leucogeranus</i>
Management Plan	Yes
Reports	Yes
Human settlement	No
Visitors	10 000 per year
Problems	As in Dong Ting Hu
Priority Rating	B

**Name Na Xi**

Area	60 sq. Km
Type	Nature Reserve
IUCN Category	IV

County Dong Kou Xian  
 Agency Forestry Department  
 Year 1987  
 Location 27(00' N by 110(30' E  
 Altitude 400 - 1500 m  
 Main value Forests  
 Ecosystems Broad-leaved evergreen forests  
 Species Not known  
 Management Plan No  
 Reports No  
 Human settlement Not known  
 Visitors Few  
 Problems Cuttings  
 Priority Rating D

**Name Nan Yue**  
 Area 83 sq. km  
 Type Nature Reserve  
 IUCN Category IV  
 County Heng Shan Xian  
 Agency Forestry Department  
 Year 1982  
 Location 27(15'-27(20' N by 112(35'-112(42' E  
 Altitude 200 - 1900 m  
 Main value Complex forest ecosystems with clear vertical stratification  
 Ecosystems  
 Species *Gleditsia vestita*  
 Management Plan No  
 Reports Yes  
 Human settlement No  
 Visitors 2 million per year  
 Problems Waste  
 Priority Rating B

**Name Nei Xia Bai Shui Yuan Tou**  
 Area 0,5 sq. km  
 Type Nature Reserve  
 IUCN Category IV  
 County Qi Yang Xian  
 Agency Forestry Department  
 Year 1987  
 Location  
 Altitude  
 Main value Forests

Ecosystems  
 Species  
 Management Plan  
 Reports  
 Human settlement  
 Visitors  
 Problems  
 Priority Rating D

**Name Qiang Jia Dong**  
 Area 160 sq. km  
 Type Nature Reserve  
 IUCN Category IV  
 County Dao Xian  
 Agency Forestry Department  
 Year 1982  
 Location 25(29'-25(35' N by 111(17'-111(20' E  
 Altitude 600 - 1800 m  
 Main value Rare flora  
 Ecosystems Deciduous evergreen broad-leaved forest  
 Species *Fokienia hodgsonii*, *Tsuga longibracteata*  
 Management Plan No  
 Reports Anonymity 1983  
 Human settlement Little  
 Visitors 10 000  
 Problems Rather damaged in some parts  
 Priority Rating A

**Name Shun Huang Shan**  
 Area 181 sq. km  
 Type Nature Reserve  
 IUCN Category IV  
 County Xin Ning, Dong An Xian  
 Agency Forestry Department  
 Year 1982  
 Location 26(20'-26(40' N by 110(55'-111(08' E  
 Altitude 500 - 1650 m  
 Main value Rare flora and fauna, fir communities  
 Ecosystems Deciduous evergreen broad-leaved forest  
 Species  
 Management Plan No  
 Reports Yes  
 Human settlement Little  
 Visitors Few  
 Problems Very little forest  
 Priority Rating D



Name	South Dong Ting Lake (Wan Zi Hu and Lu Hu)
Area	1680 sq. km
Type	Nature Reserve
IUCN Category	IV
County	Yuan Jiang Xian
Agency	Forestry Department
Year	1989
Location	28(46'-29(07' N by 112(08'-112(40' E
Altitude	27 - 40 m
Main value	Important bird sanctuary for waterfowl including many rare species. Together with Mu Ping Hu (West Dong Ting Lake) and Dong Ting Hu (East Dong Ting Lake) it forms a large complex of lakes and rivers, which are extremely valuable.
Ecosystems	Wetland ecosystems
Species	Poorly known, probably as in Mu Ping Hu
Management Plan	Yes
Reports	Yes
Human settlement	Little
Visitors	100 000
Problems	Such as in Mu Ping Hu and Dong Ting Hu
Priority Rating	A

Name	Su Xiang Ling
Area	1 sq. km
Type	Nature Reserve
IUCN Category	IV
County	
Agency	Forestry Department
Year	1977
Location	
Altitude	
Main value	Forests
Ecosystems	
Species	
Management Plan	
Reports	
Human settlement	
Visitors	
Problems	
Priority Rating	D

Name	Tao Yuan Dong
Area	83 sq. km
Type	Nature Reserve
IUCN Category	IV
County	Ling Xian
Agency	Forestry Department
Year	1982
Location	26(25'-26(35' N by 113(56'-114(05' E
Altitude	550 - 1841 m
Main value	Rare flora and fauna
Ecosystems	Deciduous evergreen broad-leaved forest
Species	<i>Abies ziyuanensis</i> , <i>Panthera tigris</i>
Management Plan	No
Reports	Yes
Human settlement	500
Visitors	50 000
Problems	Rather degraded
Priority Rating	B

Name	Tian Men Shan
Area	12 sq. km
Type	Nature Reserve
IUCN Category	IV
County	Da Yong Shi
Agency	Forestry Bureau
Year	1986
Location	29(08' N by 110(27' E
Altitude	300 - 1200 m
Main value	Rare tree species
Ecosystems	
Species	<i>Davidia involucrata</i>
Management Plan	
Reports	
Human settlement	
Visitors	
Problems	Rather small
Priority Rating	D

Name	Xian Gu Shan
Area	3 sq. km
Type	Nature Reserve
IUCN Category	IV
County	Ping Jiang Xian
Agency	Forestry Bureau
Year	1982

Location 28(45' N by 113°40' E  
 Altitude 500 m  
 Main value Rare fauna  
 Ecosystems Forest  
 Species *Tyto capensis*  
 Management Plan No  
 Reports No  
 Human settlement Unclear  
 Visitors Few  
 Problems Small  
 Priority Rating D

Human settlement Few  
 Visitors Few  
 Problems Small  
 Priority Rating D

**Name** **Xiao Xi**  
 Area 130 sq. km  
 Type Nature Reserve  
 IUCN Category IV  
 County Yong Shun Xian  
 Agency Forestry Department  
 Year 1982  
 Location 28(43'-28(56' N by 110°11'-110(18' E  
 Altitude 205 - 1122 m  
 Main value Lowland, natural secondary forest  
 Ecosystems Evergreen forest  
 Species *Macaca mullata*  
 Management Plan No  
 Reports No  
 Human settlement 1000  
 Visitors Few  
 Problems Logging  
 Priority Rating B

**Name** **Yong Shun Liang Cha**  
 Area 244 sq. km  
 Type Nature Reserve  
 IUCN Category IV  
 County Yong Shun Xian  
 Agency Environmental Protection Agency  
 Year 1988  
 Location  
 Altitude  
 Main value  
 Ecosystems  
 Species *Andrias davidiana*  
 Management Plan  
 Reports  
 Human settlement  
 Visitors  
 Problems  
 Priority Rating D

**Name** **Yang Ming Shan**  
 Area 28 sq. km  
 Type Nature Reserve  
 IUCN Category IV  
 County Shuang Pai Xian  
 Agency Forestry Department  
 Year 1982  
 Location 26(05'-26(11' N by 111(50'-112(00' E  
 Altitude 700 - 1530 m  
 Main value Rare flora  
 Ecosystems Primary forest  
 Species *Pseudotsuga sinensis*  
 Management Plan No  
 Reports No

**Name** **Yun Shan**  
 Area 13 sq. km  
 Type Nature Reserve  
 IUCN Category IV  
 County Wu Gang Xian  
 Agency Forestry Department  
 Year 1982  
 Location 26(36'-26(43' N by 110(33'-110(45' E  
 Altitude 800 - 1372 m  
 Main value Site of type specimen collection  
 Ecosystems Forests  
 Species  
 Management Plan No  
 Reports No  
 Human settlement Little  
 Visitors Few  
 Problems Fairly small  
 Priority Rating D

Name	Zhang Jia Jie (also known as Wu Ling Yuan, including the nature reserves Suo Xiyu and Tianzi Shan)
Area	48 sq. km
Type	National Forest Park (including two nature reserves), Wu Ling Yuan is World Heritage Site
IUCN Category	IV, World Heritage Site VI
County	Zhang Jia Jie (since 1994, before that Da Yong)
Agency	Forestry Department
Year	1982, UNESCO World Heritage Site 1992
Location	29(18'-29(25' N by 110(25'-110(33' E
Altitude	330 – 1260 m
Main value	Unique mountain landscape, 3100 sand stone pillars 200-300 m high, fine subtropical forests
Ecosystems	Deciduous evergreen broad-leaved forest
Species	Plants: 751 tree species known Animals: 43 mammals, 97 birds, 24 reptiles, and 19 amphibian species known, including 6 first class endangered species and 13 in the second class. E.g. <i>Macaca mulatta</i> , <i>Andrias davidiana</i> , endangered pheasants
Management Plan	No management plan, a construction plan exists
Reports	Scientific reports such as one of Bryophyte

Human settlement	No
Visitors	2 million per year (1997), increasing rapidly
Problems	Tourism, constructions, river pollution, wastes
Priority Rating	<b>B</b>

Name	Zi Yun Wan Feng Shan
Area	36 sq. km
Type	Nature Reserve
IUCN Category	IV
County	Xin Ning, Cheng Bu Xian
Agency	Forestry Department
Year	1982
Location	26(30'-26(40' N by 110(29'-111(15' E
Altitude	300 - 1500 m
Main value	Rare flora and fauna
Ecosystems	Forest ecosystems
Species	<i>Cathaya argyrophylla</i> , <i>Abies ziyuanensis</i> , <i>Tsuga longibracteata</i> , <i>Chrysolophus amherstiae</i>
Management Plan	No
Reports	Yes
Human settlement	No
Visitors	Few
Problems	Small
Priority Rating	<b>C</b>



*Badagongshan national nature reserve*

## 12.6. IUCN Categories for Protected

### Areas

The World Conservation Union (IUCN) has drawn up guidelines and definitions for all types of the world's protected areas. What follows is a brief presentation of the topics and management objectives for the eight existing categories (IUCN 1978). A revision of the categories is in process.

#### *Category I. Scientific Reserve or Strict Nature Reserve*

Management objectives: To protect nature (communities and species) and maintain natural processes in an undisturbed state in order to have ecologically representative examples of the natural environment available for scientific study, environmental monitoring, education, and for the maintenance of genetic resources in a dynamic and evolutionary state. Research activities need to be planned and undertaken carefully to minimise disturbance.

#### *Category II. National Park*

Management objectives: To protect natural and scenic areas of national or international significance for scientific, educational, and recreational use. The area should perpetuate in a natural state representative samples of biogeographic regions, biotic communities and genetic resources, and species in danger of extinction, to provide ecological stability and diversity.

#### *Category III. Natural Monument or Natural Landmark*

Management objectives: To protect and preserve nationally significant natural features because of their special interest or unique characteristic and, to an extent consistent with this, provide opportunities for interpretation, education, research, and public appreciation.

#### *Category IV. Nature Conservation Reserve or Managed Nature Reserve or Wildlife Sanctuary*

Management objectives: To assure the natural conditions necessary to protect nationally significant species, groups of species, biotic communities, or physical features of the

environment where these may require specific manipulation for their perpetuation. Scientific research, environmental monitoring, and educational use are the primary activities associated with this category.

#### *Category V. Protected Landscape or Seascape*

Management objectives: -To maintain nationally significant natural landscapes which are characteristic of the harmonious interaction of man and land while providing opportunities for public enjoyment through recreation and tourism within the normal life style and economic activity of the areas. These are mixed cultural and natural landscapes of high scenic value where traditional land uses are maintained. These areas also provide for ecological diversity, scientific, cultural and educational purposes.

#### *Category VI. Resource Reserve*

Management objectives: To restrict use of these areas until adequate studies have been completed on how to best utilise these remaining resources; to protect the natural resources of the area for future use and prevent or contain development activities that could affect the resource pending the establishment of objectives which are based upon appropriate knowledge and planning.

#### *Category VII. Natural Biotic Area or Anthropological Reserve*

Management objectives: To allow the way of life of indigenous societies living in harmony with the environment to continue undisturbed by modern technology. Research into the evolution of man and his interaction with the land would be a secondary objective.

#### *Category VIII. Multiple Use Management Area or Managed Resource Area*

Management objectives: To provide for the sustained production of water, timber, wildlife (including fish), pasture or marine products, and outdoor recreation. The conservation of nature may be primarily oriented to the support of the economic activities (although specific zones may also be designated within these areas to achieve specific conservation objectives), or conservation may be a

primary objective in its own right and given equal importance to economic and social objectives. Within the overall area, zones may be established in which either the conservation of nature or sustainable development is the primary objective.

## 12.7 Ten Principles for Ecotourism

These ten principles have been prepared by the Swedish WWF (1995) and are translated from the Swedish (see an English translation in Saethorsdottir *et al.* 1998). They are aimed at world-wide use. Most of the principles can be applied as such also in China, but some local additions and supplements are useful. The point of view is that of a tour operator. Many of the principles reflect the high demands of western tourists, but even in the very young tourism markets of China they illustrate an ambition level to aspire to already now. The principles can easily be converted to requirements for any authority responsible for the management of a nature reserve or forest park.

### *1. Ecological and social sustainability must govern*

Ecotourism should contribute to the conservation of nature and culture. Revenue production from travel should therefore be adjusted to natural limitations, i.e. what nature and local culture can tolerate. Ten visitors may cause more harm than a hundred if the visit is badly planned and ill-implemented.

Ecotourism may in practice mean abstaining from arranging tours to over-visited or badly managed areas where either the social or ecological sustainability is neglected. It may also involve a joint decision with other stakeholders about what must be done to prevent further erosion and exploitation. The ultimate objective must throughout be to inflict as little damage to the natural environment and the culture of the area as possible. The size of visiting groups must be decided on the basis of the sensitivity of the target area. If the groups tend to grow too large they must be split up and equipped with more guides. These issues must be dealt with using common

sense on a case-by-case basis, particularly when fixed numbers cannot be generally applied. A group size of approximately 8 - 15 participants can be recommended, particularly when visiting e.g. indigenous populations. More than 25 people per tour guide are almost always too many.

### *2. All tour operators should appoint an environment officer and draw up an environment plan*

All tour operators should appoint a person responsible for environmental concerns and draw up a comprehensive environment strategy. The environment officer will then prepare a regular environmental assessment account of the business. Each workplace should also have an ombudsman for the environment.

Nature conservation and ecological awareness should be part and parcel of the company's in-house training schemes. The idea here is to influence attitudes in the company in a more environment-conscious direction, particularly among producers, marketers, sellers, site managers and tour guides.

The routine questionnaires to the customers should contain questions about what their trip was like from an environmental point of view, including space for suggestions for any improvements. Each questionnaire should be followed up by the environment officer and the tour producers.

The objective is to make every aspect of the industry more environmentally friendly - from the back of the office and booking desks to hotels, travel, buses, flights, camping sites, safari jeeps etc. Natural areas of intervention include recycling, elimination of wear and tear, use of eco-certified paper in catalogues, leaflets and copiers, assorting waste at source, waste disposal, handling of latrines, choice of heating and cooking fuel in field conditions, choice of environmentally friendly and energy-saving means of transport whenever feasible (e.g. train rather than car or aeroplane).

### *3. Environmental concerns pertain also to subcontractors at the site*

Tour operators' environmental contributions are important whether they arrange everything by themselves or

purchase the services from local organisers.

In choosing your local partners preference should be given to those who are most environmentally and culturally conscious.

All sub-contractors should receive a concrete list of both the customers' and the company's requirements concerning the ecotouristic dimension of their operations. The sub-contractors must be informed about the subsequent questionnaires which will be filled in by the participants also with regard to these requirements and how they were met in reality.

#### **4. Choose environmentally adjusted hotel accommodation**

When selecting accommodation for visitors, give preference to businesses with the highest regard for the environment and least adverse effects (energy, noise, waste, latrine, composting, water consumption etc.). The premises should preferably also have been constructed in the spirit of local tradition, using local materials and as much local personnel as possible. Tourist accommodations where wild animals and birds are kept in captivity should be avoided.

The facilities for the purpose of e.g. energy consumption, waste disposal, disposal of used chemicals, as well as the placement of the facilities in the surrounding landscape should all be well and thoroughly planned from an environmental viewpoint.

#### **5. Expert guides are key players**

Ecotourism equals knowledge tourism. It becomes impossible without highly qualified guides. Tour operators must invest in really knowledgeable and well-qualified guides and tour leaders both with respect to locally recruited staff and in-house tour guides.

The emphasis should rest heavily on local guides with high qualifications so that expertise, quality and environmental concerns constitute a competitive edge in their favour.

#### **6. Promote the local economy**

The objective should be the promotion of the local econ-

omy at the target site. The following should be observed:

- shop locally whenever possible for goods and services, at locally owned stores and businesses, including hotels, restaurants, local organisers, guides, bearers, markets etc;
- try to highlight local features in food and drink, thus utilising fewer imported goods;
- encourage visitors to purchase locally crafted souvenirs, not however in cases where the raw materials originate from endangered or vulnerable species.

#### **7. Promote respectful attitudes among travellers**

Travellers should be given "non-exotic" information about the area, and a non-disturbing, respectful attitude towards the local population and their customs, culture and nature should always be cultivated. You should try to arrange opportunities for the visitors and local populace to meet under circumstances reflecting mutual appreciation, away from the well-directed folklore typical of conventional tourism.

With regard to attitudes, an important responsibility will be shouldered by the tour guides in the field whose task it is, on a continuous basis, to shed light on the social, ecological and economic conditions, on local environmental conflicts, and on the conservation and development efforts currently under way in the area. The tour guides must underline the individual traveller's duty to avoid cultural collisions and environmental damage.

All participants must be informed about the local nature conservation regulations, given hints about how to behave in nature and during encounters with the locals, wild animals and sensitive flora. They should get information about waste disposal, clothing, rules about open fires, latrines etc. This information will be best received if coming from local conservationists or guides.

All participants must regularly be informed about specific cultural requirements both prior to and during the trip, particularly in the case of the third world and visits to areas populated by aboriginals.

Ecotourism implies, amongst other things, avoid-

ing visits among folk groups who prefer not to be visited. Taking photos of people, tipping, haggling the price or how one should react to beggars are other topics where visitors need information either from the tour leader, the local "Visitor's Guidelines", as it were, or from another source.

#### **8. Do not purchase their lives!**

Visitors should be advised in advance or on the spot by the guides not buy items crafted out of endangered fauna or flora, in particular but not limited to:

- all tortoise products
- items made of reptile skin
- all crocodile products
- lizard skin products
- items made of pangolin skin
- all ivory products
- living birds and other living animals
- parts or products made of apes, elephants, rhinos, bears, parrots, birds of paradise, birds of prey and butterflies
- all corals
- furs of all spotted felids and tigers
- all orchids and cactuses other than those purchased straight from the plantation.

WWF's information booklet "Do not purchase their lives" or other corresponding leaflet should be mailed free of charge to all travellers as an attachment to the travel documents,

#### **9. Ecotourists must be well-informed**

Knowledge tourism also implies that the customer must receive a comprehensive information package containing references to recommended reading, advice about travel gear, discussion about particulars regarding customs and traditions in that specific destination.

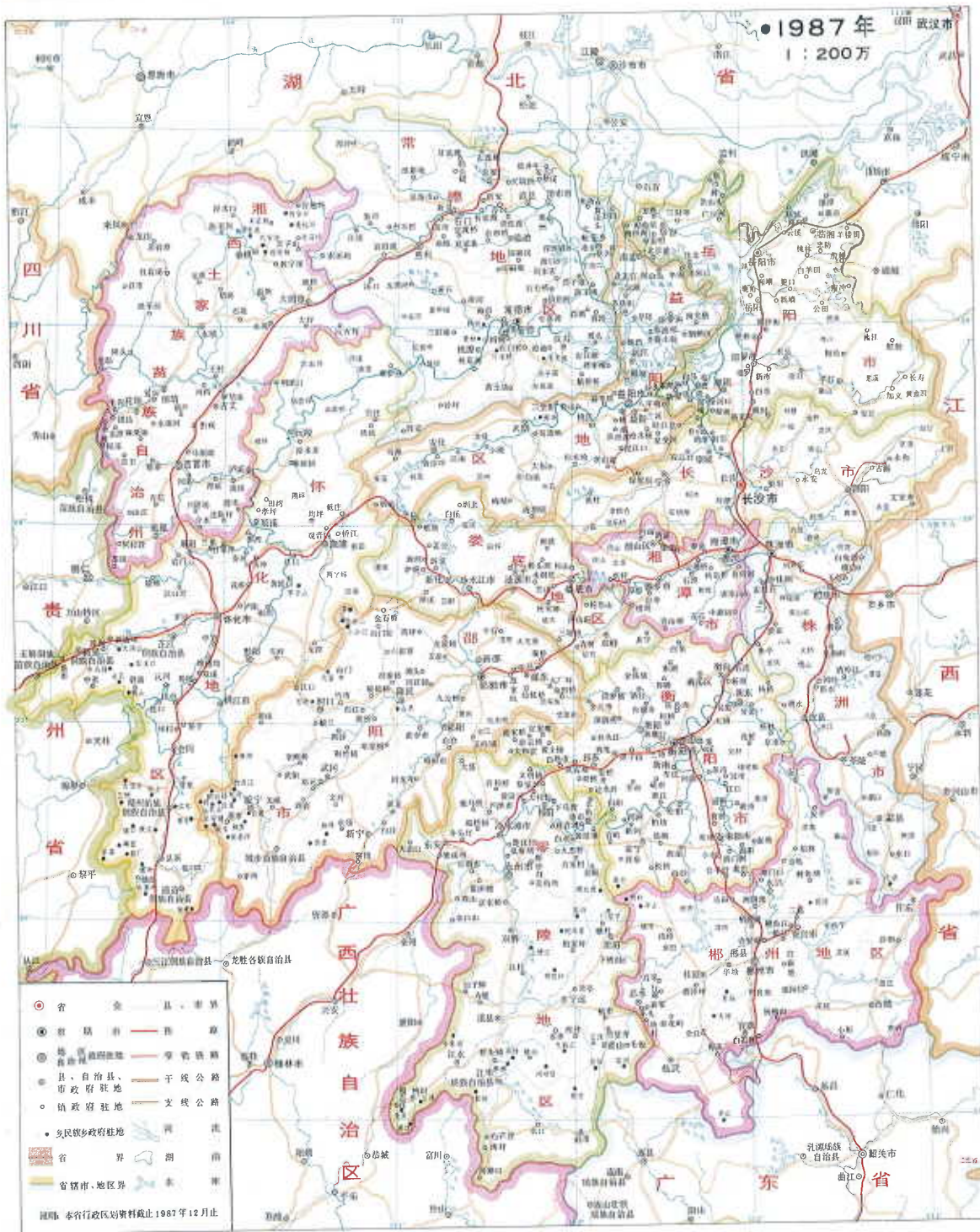
During group tours a limited travel library should be provided. Already when booking his trip the customer should get information about the tour operator's environmental considerations. The customer is advised against packing items that will unnecessarily add to the waste load of the destination area. The travel company's environmental programme should be distributed to the travellers and used actively in marketing.

#### **10. Ecotourism should promote nature conservation and local development**

Ecotourism must also imply direct or indirect economic support to nature conservation and local development. The tour operator must be able to show how this particular trip will promote that objective.

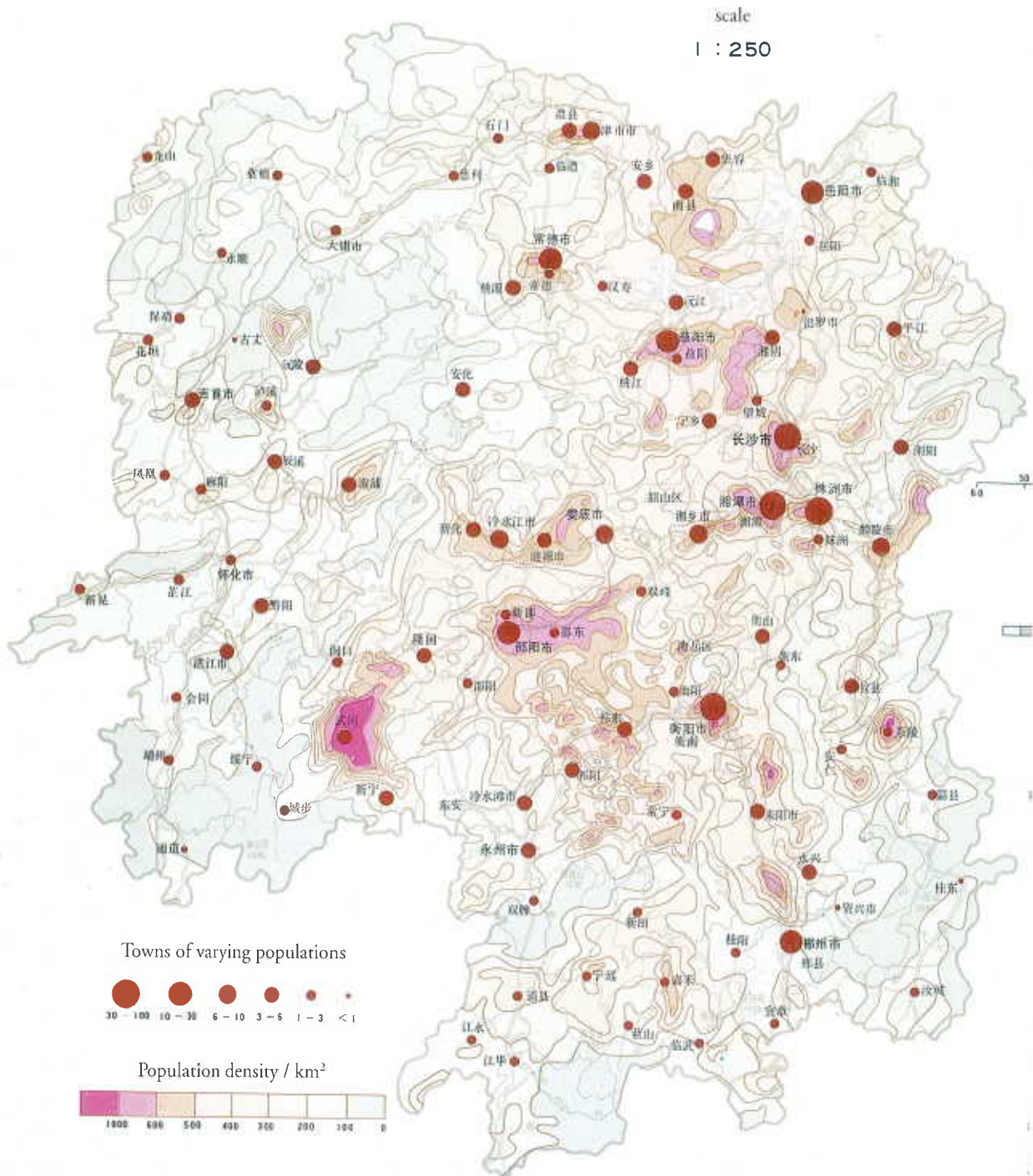
Those visitors who wish to contribute more directly to the conservation of nature, local development or socio-cultural inputs at site should receive assistance from the tour guides in order for them to be able to identify suitable channels for their contributions to be used properly (local nurseries, schools, aid agencies, local nature conservation and wilderness organisations, national parks authorities, WWF, forest conservationists etc.).

# 12.8 Administrative map of Hunan Province

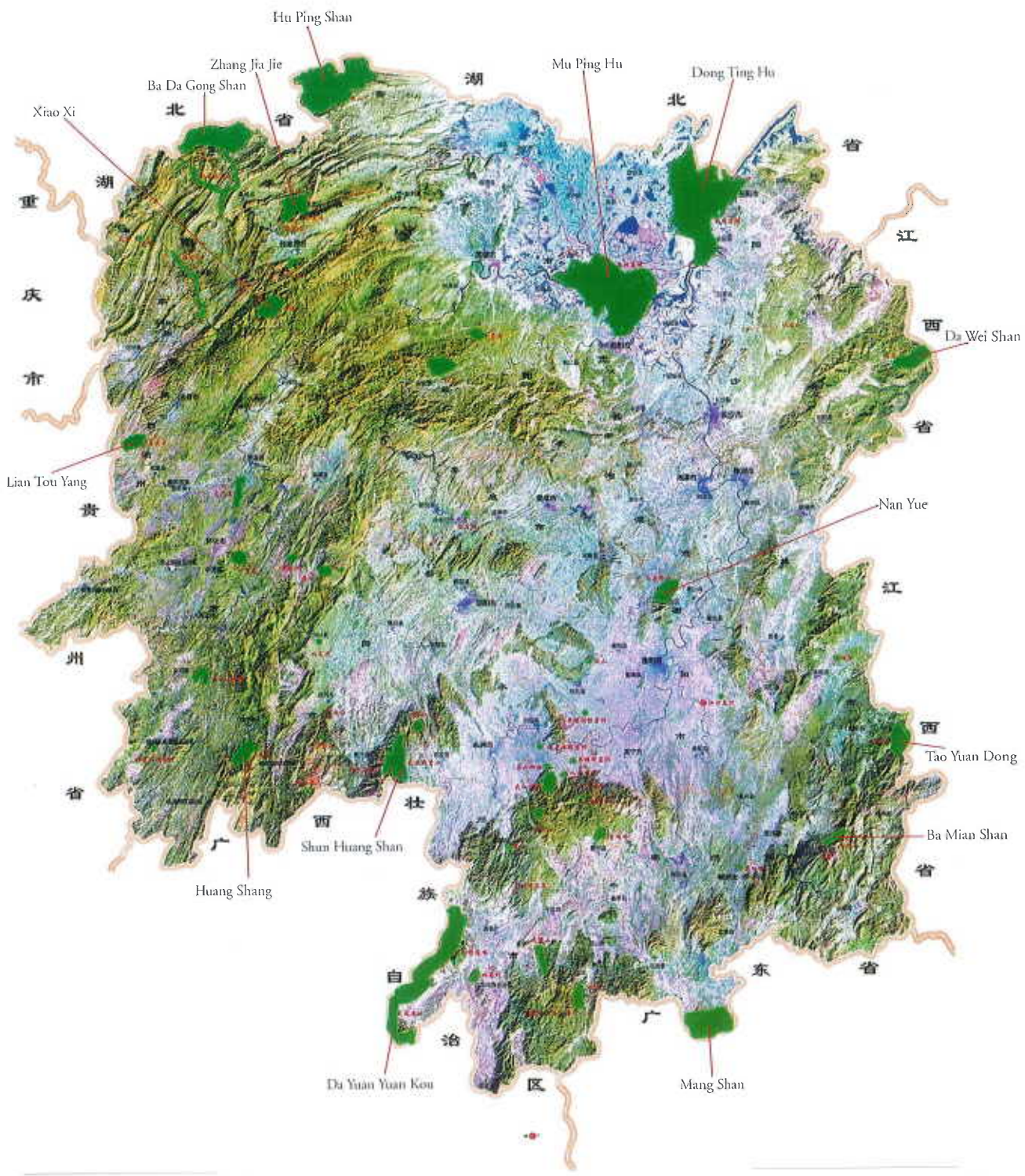




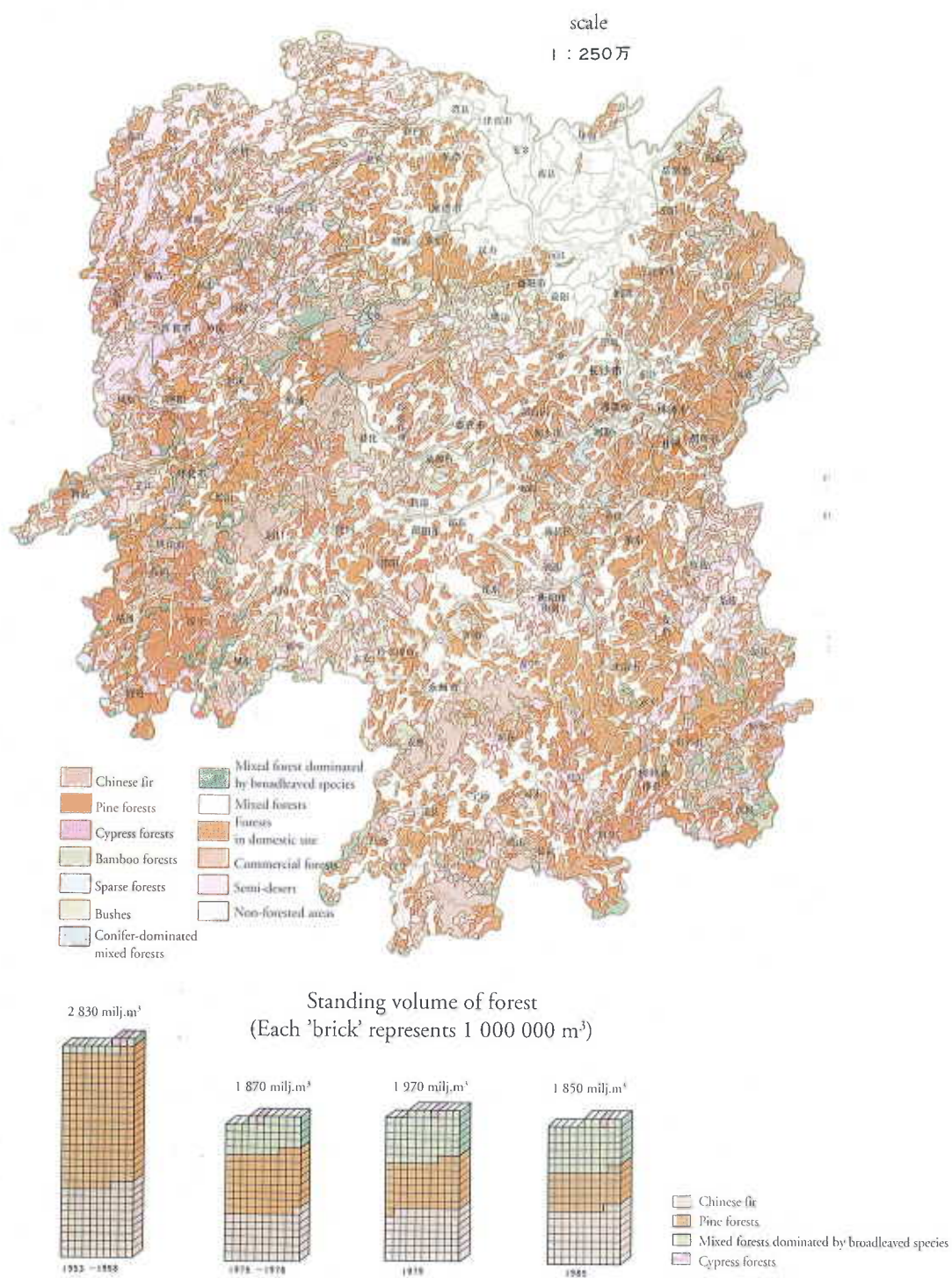
## 12.9 Population density



# 12.10 Protected Areas in Hunan Province



## 12.11 Forest Resources



ISBN 952-446-206-0



**METSÄHALLITUS**  
**FOREST AND PARK**  
**SERVICE**