



oreword

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persecution.”*

Our steps are muted on the forest trail, and the bamboo beneath a canopy of hemlock, pine, and birch crowds us. Occasionally a rhododendron with lavender blossoms gleams in the shadows. Here at 2500m in Sichuan’s Wolong Reserve, the air is cool with the chill of spring. Far away a Himalayan cuckoo calls. Naturalist Hu Jinchu suddenly points out two fresh panda droppings. Is a panda nearby? We listen and look with emotional intensity for a snapping twig or even a glimpse of this almost mythical creature. Sir Peter and Lady Philippa Scott, journalist Nancy Nash, and I then surround the droppings as we reverently photograph them and I measure them (the largest is 14x5.5cm). The 21 Chinese in our entourage watch patiently, rather bemused at our delight in these artefacts of a panda’s passing. But this moment on 15 May 1980 is historic for the panda: it is the first observation of a panda’s presence in the wild by a joint WWF/Chinese team, the beginning of long-term cooperation to help assure this rare and precious species a future in its wilderness home.

大熊猫



Painting of giant panda mother and cub by Wu Tso-Jen, Chairman of the Association of Painters in China and Head of China’s Academy of Art.

WWF/CANON PHOTOLIBRARY

The panda has long been known in China. A dictionary, the *Er Ya* from the Qin Dynasty, mentions the panda, known as *mo*, in about 220 BC, and during the Western Han dynasty (206 BC to 24 AD), the emperor's garden in Xian is said to have housed a panda. The grandson of Tang Taicong, the first emperor of the Tang dynasty (618 to 907 AD) may have sent two live pandas to Japan as a token of friendship, a gesture not repeated by China until the 1950s. In spite of this ancient knowledge and the panda's striking appearance, the animal remained a creature of shadow rather than substance. Chinese scrolls are crowded with tigers, cranes, turtles, and others that have spiritual resonance in allegory, but the panda is not among them. It seldom appeared in art until the mid-twentieth century. Perhaps its fog-bound mountain forests were too remote and its habits too elusive.

On 11 March 1869, a hunter brought a panda skin to the French Jesuit missionary Armand David who realized that the “fameux ours blanc et noir” was unknown to Western science. The discovery sparked a controversy about whether the panda is an “ours” (bear) or a member of the raccoon family. The issue was not resolved until over 100 years later when DNA analysis revealed the panda as an early branch of the bear family. However, the panda itself retained its aura of mystery. On 13 April 1929, the Roosevelt brothers, Theodore and Kermit, were the first foreigners to shoot a panda. During the next few years, the acquisition of their trophy led to several other hunts, sponsored by American museums.

The event that ultimately made the panda an icon of WWF and the conservation movement, as well as helping to evoke universal sympathy for the plight of the species, was the capture of an infant panda by Ruth Harkness in 1936. When she brought Su Lin, as it was named, to the United States, the animal enchanted the nation, creating a panda cult that survives still. It also led to an undisciplined international scramble by zoos to exhibit pandas. Between 1936 and 1946 a total of 14 pandas were taken from China by foreigners during a period of political turmoil. Then the country closed its doors to such exploitation. But within a decade, China began to use pandas as goodwill ambassadors, giving pairs to Russia, United States, Mexico, Berlin and others, a total of 24 between 1957 and 1983. Yet the panda as a species in the wild remained little known.

In the mid-1970s a number of pandas starved in the northern part of the animal's range after bamboo mass-flowered and died, as it does periodically, only to sprout again from seeds. A census at that time gave an estimate of about 1000 animals, a figure certainly too low, but it alerted the government to the panda's precarious position. Concerned about the survival of a species considered to be a national treasure and whose future was solely its responsibility, China initiated a panda study in 1978. A field camp was built on a steep, forested slope in the Wolong Reserve.

On that May day in 1980 when a group of us first visited the camp, named Wuyipeng, it consisted of a shack made of rough boards, tar paper and several tents – a monument to simplicity. There WWF began its collaboration with Hu Jinchu, Pan Wenshi, myself, and others to unravel the intricacies of the panda's inscrutable life, a task that occupied us for the next few years.

Natural history remains the cornerstone of knowledge about species and their role in the ecosystem. It provides the information upon which realistic, innovative, long-term conservation plans depend. We needed to know about birth and death rates, movement patterns, and social life. The panda is a paradox, a carnivore by inheritance that devotes its life to recycling some 12kg of bamboo a day. How is it adapted to such a vegetarian lifestyle? Answers to such questions provide an important first step in preparing a management plan for the species and its habitat. We needed to define problems and propose solutions. Naturally we were also intrigued by the uniqueness of the panda's personal world, by the lure of a rare and beautiful creature larger than life.

The project began with a headlong passion for a grand cause without realizing the magnitude of the task. Any project is part science, economics, and politics. Unanticipated problems constantly intrude. As a result of a bamboo die-off in parts of the Qionglai Mountains, which include the Wolong Reserve, the government organized a major panda rescue operation, even in areas that had ample food for animals. Between 1983 and 1987, many pandas were unnecessarily brought into captivity – where they remained. The vision



of endearing pandas starving in snow-covered mountains aroused worldwide compassion and much money was donated. Well over 100 pandas now languish in zoos and breeding centers, a population that still is not self-sustaining, with more animals dying than being born and raised. And the pandas in the wild are not safe from poachers. At least two pandas were killed in snares around Wuyipeng while I worked there. Wolong's pandas were reduced by half between 1974 and 1986. Hundreds have no doubt died similarly in the past quarter century throughout the panda's range, the skins sold as high-priced trophies to Japan, Taiwan, and elsewhere in spite of heavy penalties to poachers and middlemen.

In 1984, the Chinese government discovered that the panda was a lucrative commodity, and it began loans of animals to zoos, and for a brief period, even to sporting events, with fees of up to one million dollars a year. This rent-a-panda programme continues. To my mind the main justification for such rentals should be to raise money for conservation of pandas in the wild.

In spite of various disillusioning problems, WWF has continued with persistence and great commitment to work with China on the panda's behalf for some 20 years so far. Although I left the project in 1985, I have watched with admiration as the programme evolved far beyond its initial vision. A management plan for the panda appeared in 1989. With it, a second critical phase of the programme began. A total of 20 reserves has been added to the original 13 and these should protect 60 per cent of the panda's range. A new census is in progress. A logging ban will, it is hoped, reduce the rate of habitat destruction. There are conservation education programmes for local people, and efforts to help communities derive economic benefits from non-timber forest products, such as mushrooms. Reserve staff are being trained not only to patrol, but also to monitor wildlife. An ecotourism initiative

is in progress. It is a wide-ranging integrated programme designed to offer conservation benefits to local people and not just to wildlife and forests.

Most of this work is conducted by Chinese forest department staff and university biologists, an important development for the panda. Pan Wenshi left the Wolong project when I did, and he then initiated panda research in the Qinling Mountains of Shaanxi. After more than a decade there, he and his students

from Beijing University have gathered by far the best available information about the panda's social life and population dynamics. One of his students, Lü Zhi, now also advises students, in addition to having managed the panda programme for WWF. The spirit of that day in May 1980 will continue to expand from generation to generation, an enduring legacy from WWF.

Of course, the panda is not safe. Nor will it ever be. It will always be threatened by something, attracting adversity as readily as adoration. We know what the panda needs: a forest with bamboo, a den for its young, and freedom from persecution. A report such as this represents a proclamation of optimism and hope. The panda can and will endure as a symbol of our environment and a wonder of evolution. To protect this luminous fragment of life means that we must monitor its fate with vigilance, compassion, wisdom, and loyalty, with a commitment measured in terms not of decades but of centuries.



George Schaller with Wang MENCHU and Prof HU JINCHU in Wolong Nature Reserve in the 1980s.

大熊猫





The giant panda is a robust animal with a distinctive black and white coat. The species nomenclature or name, *Ailuropoda melanoleuca*, refers to its black and white coloration. The panda's taxonomy was debated for more than a century. Scientists questioned whether or not it was a species of bear, a mammal closer to the raccoon-like red panda, or if it belonged to a family of its own. Recent DNA studies indicate that the giant panda belongs to the bear family, but represents an early branch. Adults grow to a length of 120 to 190cm and weigh 85 to 125kg. Distinctive physical features include broad, flat molars, modified for crushing, and an enlarged wrist bone functioning as an opposable thumb, both of which are adaptations for eating bamboo. The giant panda and the sun bear, unlike the other six bear species, do not hibernate in winter.

When a panda baby is born, it is remarkably small, weighing between 100-200 grams, about 1/900th of the mother's weight. Pandas in captivity may live as long as 30 years or more, but in the wild they usually die before age 20. In the Qinling Mountains, a few brown-and-white pandas were found among the black-and-white ones.

**Diet**

The panda's diet is very specific, consisting almost entirely of various bamboo species found in high mountain areas. Pandas occasionally eat meat, mainly animal carcasses. The panda's unique eating habits have earned it the epithet 'bamboo bear' among local people. Low in nutrients, bamboo provides enough nourishment for survival but little extra. However, giant pandas have developed adaptations to this diet. In the wild, they spend as much as 14 hours a day eating, stopping only to sleep or to travel short distances. A panda can eat 12 to 38kg of bamboo per day, up to 40 per cent of its body weight, preferring the most nutritious and least fibrous parts of the plant: new stems, new leaves, and shoots. Usually, there are two or more bamboo species growing in any one area of panda habitat, enabling pandas to shift to another species when one flowers and dies, as bamboos do every 30 to 120 years. However, continuous habitat fragmentation is increasing the risk of only one bamboo species remaining in a habitat patch. When the bamboo dies, pandas in the area may face starvation.

**Breeding and social behaviour**

"Sex is a problem" has made the news headlines in describing the giant panda's breeding habits. However, field research has revealed that although giant pandas may live longer in captivity, breeding success is greater in the wild. In their natural state, all adult females and males appear to be involved in breeding. A female can mate with several males, who compete with each other to mate with her, and a male will seek out different females who are in heat. The mating

season is in spring between March and May when males and females associate, usually for no more than two to four days. Gestation takes about five months. Occasionally, there are reports of twins in the wild, but a female normally gives birth to only one cub at a time. Twins seem to be born more frequently in captivity, especially when artificial insemination is used. Just before giving birth the female selects the base of a hollow tree or a cave. She remains in, or close to, this shelter for over three months, carefully tending her young by holding it protectively in her massive paw. After anything from a few days to a month, the mother giant panda leaves the cub alone either in the den or in a tree while foraging for herself. She may be away for as long as two or more days. This is not abandonment of the cub, but a natural part of the cycle of rearing the young. Cubs start eating bamboo around 12 months of age, but until that time they are completely dependent on their mother. Infant mortality in the wild is lower than in captivity and is estimated at around 40 per cent (Pan *et al*, in press).

Long-term research in the Qinling Mountains has shown that the giant panda's reproductive rate is about 0.654 cub/female/year (Pan *et al*, in press), comparable to some natural populations of North American brown bears (Stringham 1990).

Giant pandas are solitary animals. Each adult has a well-defined home range. A male's home range is usually large, up to 30km<sup>2</sup>, and it often covers the ranges of several females. When males in an area meet, particularly when they gather around a female in heat, there is an obvious hierarchy among them; interactions sometimes result in fighting. A dominant male often has priority to mate with the female, but subordinate males also have opportunities afterwards. A female reaches maturity at 3 to 4 years, while males mature around 5. Young males usually have low positions in a hierarchy and do not get the chance to mate until age 7 or 8. A female gives birth once every 2 or 3 years, between the ages of 4 and 20.

Although the only "family unit" that pandas have is between mothers and cubs younger than one and a half years old, pandas communicate and interact fairly often, mostly through vocalization and scent marking. This interaction occurs even outside the

mating season. A panda cub is weaned after about one year, but the cub stays with the mother until the mother conceives again, usually when her offspring is about one and a half years old. If she does not conceive, the cub remains with its mother until it is about two and a half years old; at around this age its mother chases it away to fend for itself. After becoming independent, most young appear to settle in the vicinity of their mother. However, some giant pandas, especially females, seem to make long excursions away from their birthplace and settle elsewhere. More research is needed to understand their behaviour.

大熊猫



Drawing by Helmut Diller.

WWF/CANONPHOTOLIBRARY HISTORICAL AND PRESENT DISTRIBUTION



*istribution  
and status*

## **RANGE STATE: CHINA**

### **Historical and present distribution**

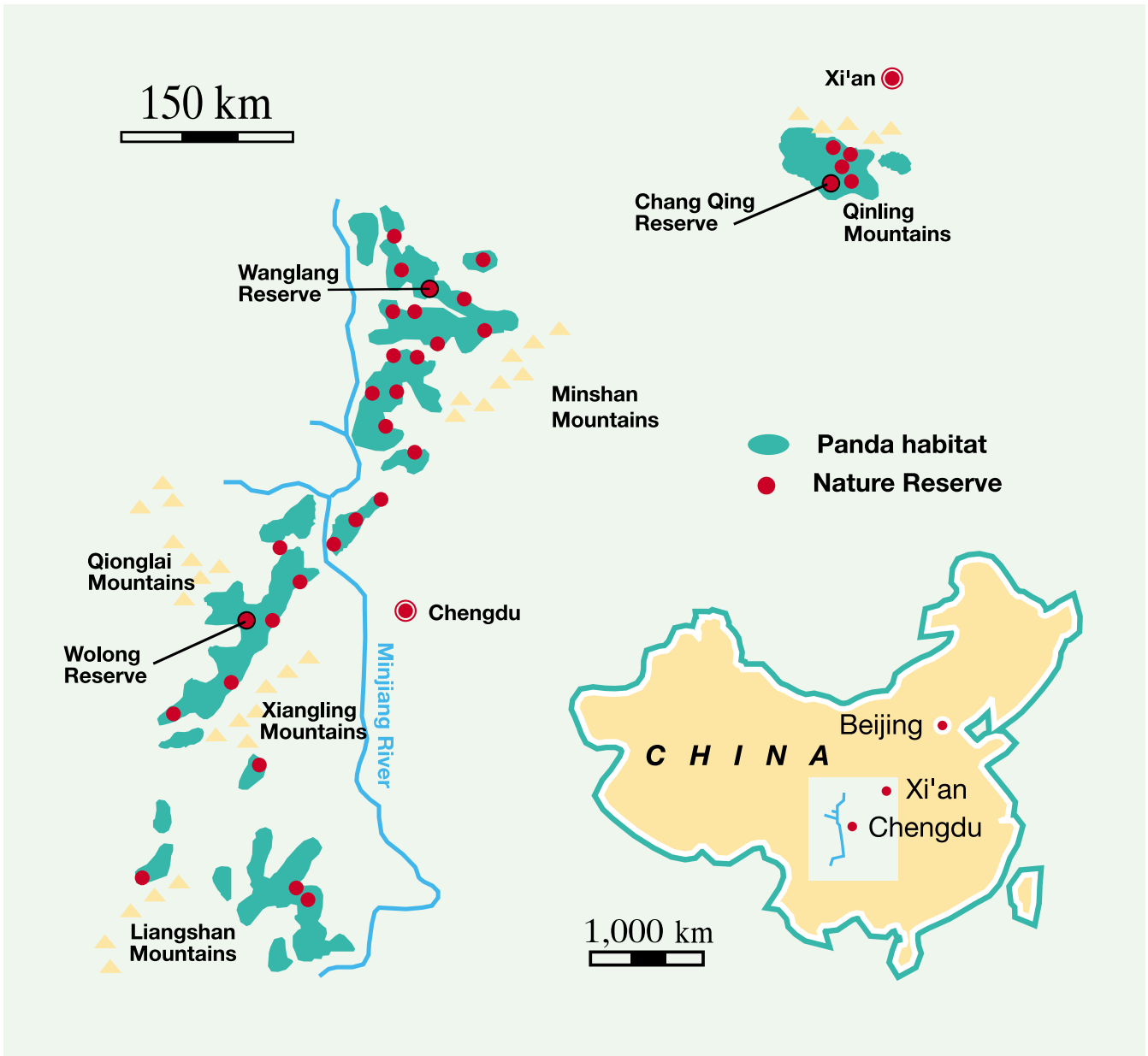
Fossil evidence suggests that in the early Pliocene, some two to three million years ago, ancestors of the giant panda were widely distributed over much of eastern and southern China as far north as Beijing. Panda fossils have also been found in northern Myanmar (Burma) and northern Vietnam (Schaller 1993). Fossils were often found at the elevation of 500-700m in warm temperate or subtropical forests. Remarkable changes in the panda's range may have happened rather recently. Much of the habitat loss occurred over the past several hundred years due to a dramatic increase in China's human population and encroachment into the panda's historical range. Formerly, pandas lived at lower elevations in hilly riverine valleys, most of which have been cleared for human settlement. Today, giant pandas are restricted to a height of 1,200 to 3,400m where bamboo grows.

How many pandas are there in the wild today? This is still a hard question to answer. Because giant pandas live in bamboo thickets on the steep slopes of high mountains, counting them is difficult. Giant panda surveys carried out in the 1970s and 1980s indicated that there were about 1,000 giant pandas remaining in the wild, although the number is now believed to have been underestimated. The third ongoing giant panda survey, which started in 1999, should provide more reliable estimates of the number of animals remaining in the wild. China's updated national survey, currently under way – the first in over a decade – is a top priority for WWF and is being carried out jointly with the State Forestry Administration (SFA) of China.

The giant panda is the rarest member of the bear family and one of the world's most endangered mammals. It lives in the temperate mountain forests of western China on the eastern edge of the Tibetan plateau, where bamboo is the dominant understorey forest plant. The giant panda's range is now restricted to half a dozen separate mountain ranges: Qinling in Shaanxi Province, Minshan in Gansu and Sichuan provinces, and Qionglai, Xiangling and Liangshan in Sichuan Province. In the 1980s, the total distribution area was estimated at around 13,000km<sup>2</sup> (Reid and Gong 1999).

### **Major populations**

On present evidence the greatest number of giant pandas, perhaps around 600, occur in the Minshan Mountains in Sichuan. The Minshan and Qinling Mountains may have the highest population density. The lack of current survey data has hampered the ability to develop a more detailed understanding of panda populations and distribution.



**Legal status**

The giant panda is protected by China's Wildlife Protection Law at the national, provincial, and local level. Under this law, offenders convicted of poaching giant pandas or smuggling giant panda skins faced the death sentence or life imprisonment. In early 1995, a Chinese farmer who shot and killed a giant panda was sentenced to life imprisonment; three accomplices were jailed for shorter periods (Anon. 1995). In the same year, China imposed death sentences on two men caught by border police with panda and golden monkey pelts in their possession (TRAFFIC USA 1996). After 1997, the law was changed and poachers faced a prison sentence of 20 years instead of the death penalty.

In 1984, the giant panda was transferred from Appendix III to Appendix I of the Convention on International Trade

in Endangered Species of Wild Fauna and Flora (CITES). Trade in the species or its products is subject to strict regulation by the ratifying parties, and trade for primarily commercial purposes is banned.

So far, the Chinese government has established 33 panda reserves, which provide protection for over 60 per cent of the country's giant panda populations. The government plans to create migratory corridors to facilitate increased interaction between isolated panda populations.





The giant panda requires an abundant bamboo understorey in good temperate forests. Like many other large mammals, giant pandas have a relatively low reproductive rate and populations take a long time to recover if individual animals are killed. Long-term research in the Qinling Mountains has shown that the giant panda is endangered mainly because of the negative impact of extensive human activities in its range. In order to combat the threats to the survival of the giant panda, a thorough re-assessment of the status of its shrinking habitat is needed, as well as an in-depth study of the socio-economic factors causing these growing negative impacts. A new plan of action should be drawn up as quickly as possible.

### Major extinction threats

#### *Habitat degradation/fragmentation*

Large areas of China's natural forest have been cleared for agriculture, timber and firewood to meet the needs of the country's growing human population, the largest in the world. Geographic Information System (GIS) analysis and surveys completed in 1974/5 and 1985/8 revealed that the area of habitat occupied by pandas had been reduced from over 29,500km<sup>2</sup> to only about 13,000km<sup>2</sup> (Reid and Gong 1999, Schaller *et al*, 1993). In Sichuan Province alone, suitable habitat occupied by pandas shrank by 50 per cent between 1974 and 1989.



Guards inspecting tree felled by poachers in Wolong Nature Reserve, China.



In 1998, the Chinese government banned logging of natural forests in the southwest of the country. Since commercial logging had, up until that time, been the major cause of panda habitat loss, this was a very positive development for the survival of pandas living outside protected areas. That same year WWF, together with the Sichuan Forestry Department, supported a pilot survey in Pingwu County, where the greatest number of giant pandas occurs. Pingwu County is located in the Min Mountains of northern Sichuan. The survey revealed that panda population density has been significantly reduced in the area where habitat has been degraded by commercial logging.

A recent pilot panda survey in 1999 in Qingchuan County in Sichuan showed that the current distribution area of giant pandas had shrunk to 253km<sup>2</sup> compared with 367km<sup>2</sup> in 1987, representing a 30 per cent decrease in panda habitat. Habitat fragmentation is especially dangerous for pandas, as they must adjust to the life cycle of bamboos, which flower and die periodically. Moreover, isolated small populations face a greater risk of inbreeding, which could lead to reduced resistance to disease, less adaptability to environmental change, and a decrease in reproductive rates.

### *Poaching*

Poaching of pandas still occurs, despite the animal's status as a Class I protected species in China. This threat poses a great danger for such a small population with a relatively low reproductive rate. Poachers and smugglers believe panda pelts will fetch a high price, but the final market for the pelts is unclear. Pandas are also accidentally caught in snares set for other animals, such as musk deer, takin and bears. In 1988, Chinese officials recovered the pelts of 146 giant pandas in Sichuan Province and investigated 115 cases of illegal dealing in panda furs (WWF-US 1988). In one patrol in the Wolong Nature reserve in 1992, over 70 snares were collected on one hillside in the core of the reserve (Chapman 1992). After a logging ban was launched in 1998, monitoring showed a significant increase in hunting in some counties, probably as a source to replace lost income. In an anti-poaching action in early 2000, one panda was found dead, caught in a snare set up by poachers. Poachers remain active today in panda habitat, but there is no concrete information on how many pandas are poached each year. However, there are reliable reports by the media in China on the prosecution of panda poachers. In the first four months of 1999, Chinese police confiscated six giant panda pelts (McElroy 1999), and in 1998 a Chinese farmer was sentenced to 20 years in prison for killing three giant pandas and selling their skins (Anon. 1998).

### *Root causes of threats/biodiversity loss*

Although 33 panda reserves have been established, habitat destruction and illegal hunting have not been eliminated. It is

necessary to understand the complex causes that are inextricably linked to the economic base of rural China where pandas live, and the system under which China manages nature conservation. The root causes of threats to the panda and of biodiversity loss in China could be summarized as follows:



- **Conflict between conservation and economic development** In many areas, establishing nature reserves has restricted access of local people to traditional economic resources, including grazing land and forest products. Local communities are seldom involved in such decisions. In the habitat outside reserves, development activities are often undertaken without considering the need of giant pandas and other wildlife. Conservation goals are often in conflict with the need for income. Despite the progress that China has made in improving the national context for conservation, implementation of existing policies and laws is exceedingly difficult. Conservation is hampered by an overwhelming emphasis on economic development and deficiencies in the government's approach.
- **Lack of clear conservation objectives and criteria in reserve management** Instead of having conservation objectives, the standard of reserve management in "good" reserves is often static and infrastructure is weak.
- **Low awareness and capacity** A lack of conservation awareness and capacity to implement conservation at all levels is a major cause of poor reserve management and low staff morale. Reserve staff are often assigned jobs without consideration of their interest or motivation. Training is seldom available and only marginally relevant. Incentive payments for arduous tasks like patrolling are minimal.
- **Insufficient policy support** Although sustainable development and environmental protection are key national policies, and significant progress has been made in the past decade, conservation is still not seen as a high priority in China. Lack of adequate funding, including from government sources, has become a significant problem in reserves. Consequently, the focus of many activities in reserves is oriented towards earning income, often through unsound exploitation of the reserves' natural resources. There is a need to find more environmentally friendly ways for reserves to earn income. The government should also increase its budget for protected areas and strengthen infrastructure.
- **Lack of scientific information for decision-making** Very little reliable data on each panda population and habitat are available. Scientific information has not yet been well integrated into decision-making. The lack of exchange of information among different agencies is an obstacle. Improved monitoring mechanisms and an accessible database are needed.

### Acting wisely – lessons learned

#### *Panda rescues*

In the 1980s, over 30 panda cubs were taken from the wild into captivity when they were observed without their mothers and thought to have been abandoned. Field research has proved that these young animals did not need to be rescued. Scientists have found that mother pandas will often leave their cubs when they go out to forage, so when a cub is found alone in the wild it should not be taken into captivity. Also, in the 1980s, bamboo flowering led to massive 'rescue campaigns' for pandas which were thought to be starving. Rescues are not necessary, as long as panda habitat remains sufficient in size and contains two or more species of bamboo. Every effort should be made to ensure that pandas remain in the wild and that the wild population survives. A recent government policy on rescuing pandas has been issued, which provides guidelines restricting rescue.



Panda cub is "rescued" from the wild and taken to a captive breeding centre. Field research has shown this practice is rarely needed as mother pandas leave cubs when they search for food and return to feed the cub.

#### *Captive breeding*

The problem with giant pandas raised in captivity is that they are often not interested in mating with the member of the opposite sex chosen for them – or they seem unable or unwilling to breed. In fact, most giant pandas that have grown up without having learned or observed natural mating habits in the wild are not eager participants in breeding programmes. Records from the November 1999 Panda Studbook reveal

that only 28 per cent of adult pandas in captivity are breeding. Historical records show that between 1936 and 1999, 497 pandas were kept in captivity, of which 273 were taken from the wild. Of these, 224 were born in captivity and of them about



Panda cub "rescued" and taken to captive breeding centre.

100 survived more than one year. So far, only 66 pandas in captive populations have been involved in breeding. Among them, only 12 breeders were born in captivity (12% of total captive-born pandas survived to over one year old).

Since 1991, significant progress has been made. For example, 17 cubs were born in 1997 (8 survived after 1 year), 9 in 1998 (8 survived), and 19 in 1999 (13 survived after 1 month). The reproductive rate of captive born pandas is poor. So far, of all the captive born males, only two have ever mated in captivity. In November 1999, there were 126 giant pandas living in captivity, of which 26 were involved in breeding (18 caught in the wild and 8 born in captivity). Of these, 33 are under age 3 and too young to breed.

Enhancing captive pandas' breeding behaviour remains a major challenge. It may involve further study of the pandas' social behaviour, nutrition and physical fitness, etc. Because all captive-born animals derive from a handful of parents, particularly from only a few fathers, genetic diversity of the captive population could decrease significantly. However, giant pandas should not be taken from the wild for the purpose of breeding them in captivity. There is still a long way to go before the captive population of giant pandas can become self-sustaining and, if necessary, contribute to the animal's survival in the wild.



### **Reintroduction**

As species' numbers decline, conservationists consider many alternatives in conserving the world's remaining wildlife. One of the tools being considered is reintroduction. In 1991 and 1997, experts convened to discuss the feasibility of reintroducing pandas into the wild. The overall conclusion of the 1997 workshop held in Wolong Nature Reserve in Sichuan, China, was: "Release of the giant panda is not recommended at this time. The participants conclude that the most important activities to promote panda conservation are habitat conservation and research into wild panda populations and habitat. This should be the focus of future activity." (Mainka and Lü 1997)

### **Panda loans**

Giant pandas are in demand by zoos all over the world. Naturally, pandas always attract numerous visitors, thus raising the zoo's prestige and economic status. In the 1980s and early 1990s, many zoos outside China took short-term loans of pairs of giant pandas, and paid a significant fee to Chinese agencies. This was criticised by the international conservation community for its largely commercial intent, its negative impact on captive breeding, and the potential demand it could create for taking more pandas from the wild. In 1996, the Convention on International Trade in Endangered Species (CITES) issued a

notification to all CITES parties informing them that "exports of wild caught animals should not be authorized except in limited circumstances" and that financial benefits from the loans should be ploughed back into wild panda conservation.

Some countries that receive pandas on loan are ensuring that benefits earned from giant panda exhibitions are funneled back into conservation efforts in China. U.S. zoos that receive captive giant pandas from China have a critical role in and responsibility for conserving giant pandas in the wild. This responsibility is dictated by the U.S. Fish and Wildlife Service (FWS) in its official policy on the import of giant pandas, finalized in 1998 after a 5-year moratorium on panda loans. The moratorium was needed because previous short-term loans had generated large profits for some zoos, a violation of CITES, while conferring very few benefits on giant pandas in the wild. According to the revised policy, more than half of the funds associated with a panda loan – funds amounting to as much as US\$1 million per year – must be channeled into conservation of wild giant pandas and their habitat. A co-ordinated monitoring system should be set up to ensure the earnings are invested in sound conservation programmes. Protecting pandas in their natural habitat is indisputably the highest priority in the conservation of this endangered species.

大熊猫



**Pandas' breeding success in the wild is much higher than in captivity. This mother is with her two-week-old cub and was photographed in the wild.**





Giant panda relaxing in the wild.

### *Panda Clones*

In 1997, an effort to clone the giant panda was initiated by scientists from the Chinese Academy of Sciences. This initiative has attracted widespread attention because it is thought that cloning may be a new technique to save this endangered species in the wild. However, while cloning is an interesting scientific breakthrough that may have useful applications in some species, its value for giant panda conservation is questionable. Cloning cannot solve the problems threatening the survival of the giant panda.

A widely held misconception is that giant pandas have trouble reproducing, so cloning could help increase their flagging population. Yet giant pandas in the wild do not share the breeding problems seen in their captive counterparts. Studies, especially long-term field research in the Qinling Mountains, have shown that, compared with captive giant pandas, the wild population has a much higher reproductive rate. If pandas and their habitat are protected adequately, their numbers will increase naturally. Habitat loss and poaching, not reproductive problems, threaten the giant

panda with extinction. Considering the wide-ranging benefit to be gained from protecting giant panda habitat, the meagre promise offered by cloning, for example, to provide the world with more pandas in cages, pales by comparison.

**Genetics**

Poaching of giant pandas, coupled with fragmentation of their habitat, is having a significant impact on genetic diversity and gene drift in small and increasingly isolated panda populations. Since the forest strongholds of the giant panda are not connected to each other, some conservationists feel that some of them may be too small to be viable in the long term.

These isolated giant panda populations could mean that historic patterns of gene flow will be disrupted in the future and that reduced population sizes will lead to diminished genetic variability. Recently, a genetic study using different genetic markers assessed current levels of genetic diversity in three panda populations in Qinling, Minshan and Qionglai. The purpose of the study was also to see if evidence of historic population subdivisions could be detected. (Lu *et al*, in press). From a strictly genetic perspective, the giant panda species and the three populations look promising, insofar as the research showed that they retain a major proportion of historic genetic diversity in each population. However, evidence of recent population reduction, probably due to habitat loss, is apparent. Inbreeding will become a serious concern if habitat fragmentation continues.



大熊猫





*anda  
conservation –  
the history*



**1979** – On top of white cloud peak, the highest mountain in northeast China, the former Vice-chairman of the People's revolutionary Council of Antu County, describes the area's wildlife and welcomes WWF's Chairman, Sir Peter Scott, and Director General, Charles de Haes.

### **WWF and China – 20 years of partnership**

*'A truly historic occasion for world conservation,' WWF International's Chairman announced in Beijing on 23 September 1979 as he signed a unique agreement in Beijing for conservation cooperation with the People's Republic of China. Sir Peter Scott led the five-member WWF delegation to China, the first non-governmental organization ever to receive an official invitation from the Chinese government.*

*The highlight of the agreement was the formation of the six-member WWF-China committee. Three were from WWF-International and three from the newly formed Association for Environmental Science of the People's Republic of China. The Committee was established to coordinate links between conservation organizations and authorities in China and WWF's worldwide conservation contacts. It initiated high-priority projects in China, the first of which was the conservation of the giant panda. Dr George Schaller, one of the world's leading wildlife authorities, Director of Conservation for the Wildlife Conservation Society (WCS), formerly the New York Zoological Society, was invited by the Chinese Government and WWF to study the panda. He was the first western scientist to be entrusted with leading WWF's work in China. His own*







organization also provided a great deal of support to the project, most notably in granting its top scientist the time to build, together with his Chinese colleagues and other invited experts, the cornerstone of giant panda conservation.

In 1980, when WWF became the first international conservation organization to begin field work in China, the giant panda was much admired, but little was known of it outside China other than from zoos. Starting in the 1940s, Chinese scientists began to make observations in the wild, but it was not until the 1980s that a breakthrough in the study and conservation of the giant panda was made. In December of 1980, supported by WWF, Dr Schaller initiated field studies together with his Chinese colleagues in Wolong Reserve in the Qionglai Mountains of Sichuan. The team's findings still form the basis of much of our knowledge of giant panda ecology and behaviour. Further research on wild pandas was undertaken in Tangjiahe Reserve in the Minshan Mountains and in the Foping and Changqing reserves in the Qinling Mountains.

According to Chinese conservationists, their nature reserves were mere shells in the 1980s, unable to provide protection to their extraordinary inhabitants. WWF's sponsorship of pioneering research and planning since then has paid dividends for giant panda conservation in a myriad ways. Initial field work was led by eminent Chinese scientists, including Hu Jinchu and Pan Wenshi, and invited scientists including George Schaller,

Donald Reid, Howard Quigley, Kenneth Johnson, Alan Taylor, Susan Mainka, Andrew Laurie, and Stuart Chapman among others.

The scientists conducted their research under the auspices of the Chinese Ministry of Forestry (MoF). They encountered hardships and made breakthroughs, shedding light for the first time on the animal's life history. Joint WWF-MoF panda surveys met the need to establish population numbers and distribution estimates. Analysis of satellite imagery confirmed the dramatic changes in panda territory, showing a 50 per cent loss of occupied habitat between 1974 and 1989. Panda conservation benefited from a deepened understanding of critical habitat areas and relative population densities, enabling conservation priorities to be established.

The most significant outcome of the first decade of cooperation between WWF and the MoF was the creation of a management plan for the giant panda. Adopted by China's State Council in 1992 as the National Conservation Programme for the Giant Panda and its Habitat (NCPGPH), the plan called for the establishment of an additional 14 nature reserves; tangible improvements in 13 existing reserves; and the creation of 15 migratory corridors to enable increased interaction between isolated populations.

The NCPGPH has made significant progress by establishing protected areas. As of the end of 1998, the Chinese government had gazetted 17 new reserves, and implementation of the programme had begun in 13. These 17 new reserves, when combined with the 15 existing ones, will provide protection for over 16,000km<sup>2</sup> of forest in and around giant panda habitat. When implementation of the NCPGPH is complete, 60 per cent of all giant panda habitat will be included within protected areas.

In addition to the national panda census and preparation of the giant panda management plan, WWF also supported a range of other panda conservation work between 1989 and 1995. This included:

- training courses and the provision of equipment for guards, scientists, and managers, particularly in Wolong Nature Reserve;
- veterinary work in Wolong Captive Breeding Centre and
- bimonthly monitoring in Wuyipeng Area in Wolong

**Evolution of a symbol**

When some of the world’s scientists and conservationists met in 1961 to plan how to publicise the threat to wildlife and wild places and to raise funds to support conservation projects, they decided to launch the World Wildlife Fund (WWF), known outside Canada and the United States today as the World Wide Fund For Nature.



They needed a symbol, and at the time Chi Chi, the only giant panda in the Western world, had won the hearts of all that saw her at the London Zoo in the United Kingdom. She was a rare animal, like her wild panda cousins in China, and her form and colour were the ideal basis for an attractive symbol. Scottish naturalist Gerald Watterson made some preliminary sketches, from which Sir Peter Scott, world-renowned wildlife conservationist and painter, designed the WWF’s giant panda logo. The design of the logo has evolved over the past four decades, but the giant panda’s distinctive features remain an integral part of WWF’s treasured and unmistakable symbol. For years, the giant panda has been thought of by many Chinese as an unofficial national symbol, too. Today, WWF’s trademark is recognized not only in China but also in most countries as a universal symbol for the conservation movement itself.



This recognition stems from the understanding that protecting a “flagship” species such as the giant panda benefits more than the single species itself. Conservation of this animal and its habitat provides protection for the whole community of wildlife that coexists with pandas, thus maintaining their entire ecosystem. The mountain forests where the last giant pandas survive shelter over a hundred other mammal species,

including the endangered golden monkey, more than 200 bird species, such as the endangered crested ibis, and dozens of reptiles and amphibians. The habitat also contains a rich diversity of endemic species – plants and animals found nowhere else in the world. All these species endure under the protective umbrella provided by giant panda conservation efforts. Panda habitat also encompasses important watershed areas. Keeping the forests healthy maintains the river systems that flow through them, ensuring the livelihoods of millions of humans downstream.



Sketches by naturalist George Watterson (in left column) which Sir Peter Scott used as the basis for his design of WWF’s famous logo, which has evolved over the years.



Giant Panda on WWF flag at Peking Zoo on the historic welcome of WWF in 1979 as the first non-governmental organisation in China.

### Giant panda conservation – a priority for China

The first four panda reserves were established in early 1960s and a national decree was issued prohibiting hunting of a list of animals that included the giant panda. Additional reserves were established in the 1970s and 1980s. During this time (1983), a wildlife protection law was published which greatly increased the protection status of the giant panda along with other endangered species. Meanwhile, as environmental issues began to attract public attention, in 1993 the State Council approved the National Panda Programme

and committed RMB60,000,000 (US\$5 million) to support conservation of its national treasure. The Chinese government continues to provide the majority of funding for panda conservation. Conservation of the giant panda fostered international collaboration and became an avenue for global co-operation. For decades, giant panda conservation has been a priority conservation issue and is accorded the government's highest level of support. The backing of the Chinese government and the country's people remain essential for the survival of the giant panda in the wild.





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conservation –  
WWF's current  
programme*



Autumn in Wanglang Nature Reserve, home to many of China's giant pandas.

**WWF's role**

It is important to recognize that WWF and other NGOs are significant, but peripheral players in China. After many years of observation and practice it is clear that WWF's main role in China is to assist and influence policy level conservation decisions through information collection, demonstration of conservation approaches at all levels, and capacity building. In addition, WWF also serves as a facilitator, a source of information and a communicator in panda conservation.

**WWF's panda action plan: 1996-present**

With the understanding of the threats to the species and their root causes, WWF has been addressing the following components since 1996:

- *Demonstration of Integrated Conservation and Development Projects*
- *Building conservation capacity and awareness for decision makers, reserve directors and staff, and community members*
- *Effective reserve management in pilot reserves*
- *Establishment of a database on the panda population and habitat*
- *Nature reserve policy study.*

**Integrated Conservation and Development Project (ICDP) in Pingwu**

Pingwu County is located in the center of the Minshan panda population in Sichuan Province. It supports the largest number of pandas of any county in China, with some 230 resident animals. Unfortunately, most of the panda's habitat falls outside the county's three panda reserves, one of which is Wanglang Nature Reserve.

In 1996, WWF was invited by the Ministry of Forestry to support the Wanglang Reserve in the county. Through research and discussions with local staff, it was discovered that the main threat to the Wanglang panda population was coming from outside the reserve. At the time, commercial logging provided over 60 per cent of the county's revenue. But logging was also destroying panda habitat at a rapid pace. In order to address this tug-of-war between the needs of the pandas and other species and the needs of people, WWF together with the Chinese government established a community-based conservation programme. In 1997 WWF launched an Integrated Conservation and Development Project (ICDP) in Pingwu that is becoming a model for other panda reserves.

For China, the ICDP approach was a new way of achieving biodiversity conservation. This approach seeks to harmonize the relationship between conservation and development needs and to promote local participation in decision making.

Another innovation of the Pingwu ICDP, is that it addresses land-use issues at the county level. In Pingwu, the county government, WWF, and consultants cooperate together to form the project management team.

Home to over 180,000 people, Pingwu County has already undertaken extensive nature protection efforts, including the designation of 780km<sup>2</sup> of protected areas. But these protected areas became a source of conflict when local people found that the pasture and forest resources, on which they traditionally depended, were no longer available.

When the Pingwu County ICDP began in 1997, extensive baseline data were collected from its residents. This information was supplemented by specific assessments of:

- the environmental impact of logging
- the physical flow of timber production and the financial benefits that accrue along the way
- the potential for alternative income sources, including exploitation of non-timber forest products such as cultivated mushrooms or honey
- potential resources on which ecotourism could be based, focused around trekking, birdwatching or other activities
- conservation awareness of local communities.

Initially, the primary objective of the Pingwu programme was to reduce or eventually stop logging. Staff working on the project sought to find ways in which alternative sources of income could improve livelihoods. The project also strengthened local capacity and heightened awareness. Between 1996 and 2000, WWF trained over 300 panda reserve staff and local government officials in nature reserve management, wildlife monitoring, anti-poaching patrolling, and pioneering community-based conservation approaches.

In 1998, massive flooding devastated large areas of Sichuan, and in response to this disaster Pingwu officials declared an indefinite ban on logging. The logging ban drove home the need to deal with the consequential economic loss and potential social conflicts.

The analysis carried out and participatory planning by communities and officials, demonstrated by the Pingwu ICDP, encouraged the Sichuan Forestry Department to adopt similar approaches in the implementation of the National Natural Forest Protection Programme (NFPP). As an extension of the Pingwu ICDP, three 'panda counties', Baoxing, Yuexi, and Pingwu, have been selected by the Sichuan Forestry Department as pilot sites for a project on Forest Zoning and Sustainable Management Planning.

It may be too early to talk about the success of the Pingwu ICDP, but increased capacity and awareness of local staff is significant. Through this project, the concept of participation among key interest groups has been adopted in Sichuan among conservation officials, researchers and reserve staff. WWF is helping the Sichuan Forestry Department to develop a revised management plan for the reserve. The Pingwu ICDP will continue to serve as an example whose influence will go beyond the conservation of an individual species.

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### Enhancing management of nature reserves

Work in Wanglang and Anzihe, two pilot reserves selected to demonstrate effective management, began with baseline surveys. These were followed by development of management



WWF is working with the Baima community as part of the Pingwu (County) Integrated Conservation Development Project. Pingwu supports the largest number of pandas of any county in China.

plans, involving all related parties, particularly nearby communities. In the process of developing the management plan for the Wanglang Nature Reserve, a co-management zone of 140km<sup>2</sup> outside the protected areas was proposed and agreed by local communities. Co-monitoring by the reserve staff and the community has also been designed for this conservation zone. Wanglang is the first panda reserve to apply systematic monitoring, having started in 1997. This close monitoring has resulted in detailed documentation showing where pandas occur. In addition, patrolling has uncovered several poaching incidents and helped curb illegal hunting.

Baseline and monitoring information has been put into a GIS database, which is used for reserve management on a daily basis. Staff in Wanglang, all of whom have received different types of training, are now much more motivated.



The relationship with nearby communities is no longer tense. Their joint activities in conservation and community development have helped raise morale and build partnerships. Thus, the progress made by the staff of the Wanglang Reserve and the neighbouring communities has offered encouragement to other panda reserves.

### Awareness and capacity building

The influence of awareness and capacity building will have a long-term effect on conservation in China. To ensure this long-term need in conservation and its sustainability, WWF has supported capacity building at all levels, including provision of basic skills for reserve staff and training in participatory planning and reserve management. Trainees are from governmental agencies, reserves, communities, and local research and training institutes. Training has proved to be an effective tool for establishing common understanding among partners and for raising conservation awareness at all levels. A systematic training plan is also being developed jointly with the Sichuan Forestry Department, based on a detailed training needs assessment in all 25 panda reserves in Sichuan.

WWF has invested in strengthening training capacity in the Sichuan Forestry College, and supported the establishment of a Sichuan Natural Resource Conservation and Management Training Centre (SCTC). In addition to receiving training opportunities, SCTC staff are involved in field projects in order to gain first-hand experience.

Most of all, dozens of projects that are supported by WWF provided extraordinary opportunities for Chinese conservationists, researchers, officials and reserve staff to practice and accumulate conservation experience. This is the best learning process.

### Developing a dynamic database

Is the giant panda population increasing or decreasing? Where are the key panda habitats and how can these be maintained over the long term? Can corridors be established between key habitats and populations? In order to make sound conservation decisions and set realistic priorities, it is critical to know how pandas are faring across their range. Unfortunately, available information on panda population status, habitat quality, and threats to survival is incomplete and most is out of date. Thus WWF, with a number of Chinese agencies, is helping to develop a dynamic panda conservation database for tracking and analysing information critical to the long-term protection of the species and its fragmented habitat.

Dense bamboo thickets and rugged terrain made panda counting a challenging task. Scientists and researchers survey the steep slopes of the panda's range, facing hardship and undertaking tedious tasks, such as collecting panda faeces; this method is the means by which researchers determine most accurately how many pandas there really are. No one knows yet, but the latest national panda survey, sponsored jointly by WWF and China's State Forestry Administration (formerly the Ministry of Forestry), which started in 1999, may hold some answers. The survey is being carried out wherever pandas live: across six mountain ranges in Sichuan, Gansu, and Shaanxi Provinces. It will probably take three years to complete this major overview.

Meanwhile, ongoing monitoring provides up-to-date insight into panda population trends and helps identify emerging issues and threats that require immediate response. Right now WWF is promoting and sponsoring daily monitoring in nine panda reserves.



Prof Hu Jinchu measuring a panda den in Wolong Nature Reserve in Sichuan.

WWF / GEORGE SCHALLER

With assistance from researchers at Beijing University, a Geographic Information Systems database is being designed to integrate baseline information from the national survey with the latest data gathered from monitoring, patrolling and satellite imagery from the panda's range. Panda reserve staff and provincial forestry departments will update the database regularly. This will help them monitor trends in population dynamics and habitat quality and adapt management efforts accordingly.

Conservation programme seeks to strike a lasting balance between nature conservation and economic development. This is the key to securing survival of the giant panda in the wild. China is a crowded country with one of the world's most rapidly developing economies. China has made great strides forward in its conservation policies, but there are formidable hurdles to overcome. "Paper" panda reserves must become realities and government policies be strengthened and implemented. Despite China's growing commitment

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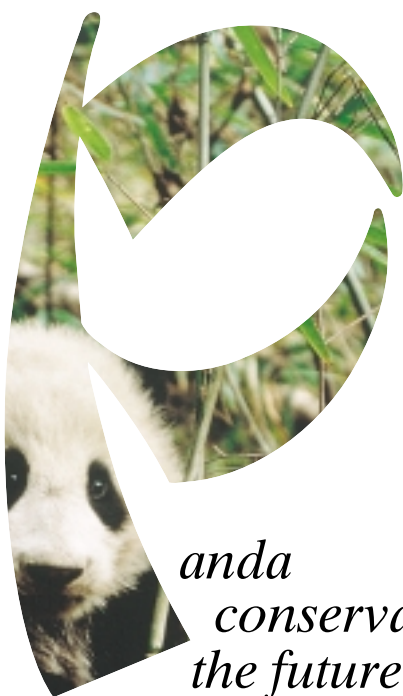
The Chinese government declared a logging ban in the southwest of the country in 1998. Pictured here is illegal timber that poachers attempted to smuggle out of a nature reserve beneath a load of stone.

### Supporting conservation policies

The benefits of giant panda conservation go far beyond this internationally recognized flagship species. The panda is not only a flagship for the habitats and other species living in the shadow of the panda, but also has become a symbol for the entire conservation movement. The panda is one of the strongest global brands of conservation. WWF's panda con-

servation programme seeks to strike a lasting balance between nature conservation and economic development. This is the key to securing survival of the giant panda in the wild. China is a crowded country with one of the world's most rapidly developing economies. China has made great strides forward in its conservation policies, but there are formidable hurdles to overcome. "Paper" panda reserves must become realities and government policies be strengthened and implemented. Despite China's growing commitment





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conservation –  
the future*



WWF/GEORGE B. SCHALLER

Habitat restoration is needed in much of the panda's habitat.

Panda conservation activities are at their highest ever, but at the same time the giant panda is facing its greatest challenge: lightning speed economic development. In the past decade, environmental awareness among the Chinese public has increased enormously, and the national government has positioned environmental protection as one of its top priorities. A series of large-scale national environmental programmes has been launched, including a national natural forest logging ban, and ecological restoration in western China. But the country's promotion of its booming economy is often perceived to be at the cost of natural resources, sometimes even outside China's borders. Sustainable resource use and management is an issue that requires urgent attention. Panda conservationists should seize the opportunity to use China's national programmes to the advantage of the giant panda. We should move the conservation agenda forward in China in a bold and positive manner.

## WHAT NEEDS TO BE DONE

### *Habitat restoration*

Maintaining the integrity, or wholeness, of China's giant panda population is one of the most important criteria for understanding the success of panda conservation. The ongoing national panda survey will provide a good baseline for understanding the current status of the panda population and the fragmentation of its habitat. Researchers are also looking at the factors that cause habitat fragmentation and population isolation. Therefore, one of the first steps is to identify new panda corridors and where they would be best located. For example, it is necessary to find panda areas that are linked, even loosely, and provide these with protection. Some deforested areas could be restored to create new corridors in order to establish a link or foraging path that pandas may pass through while moving from one forested site to another. It is also possible to simply extend or enlarge panda habitat.

The 1998 logging ban and a newly-launched "sloping-farmland regeneration" project provide much needed policy level support for adjusting land-use patterns in and around panda habitat. These land-use plans should include restoration of habitat to allow expansion of China's giant panda population.

### *Population recovery and management*

If habitat restoration is successful, many giant panda populations that have been isolated from each other could be physically linked. This would potentially create the conditions for genetic exchange and thus create larger, more viable populations. If properly managed, this would go a long way to ensuring the species' long-term survival.

**Anti-poaching**

Poaching pressure will continue, so anti-poaching measures need to be put into place indefinitely. What is needed in the future is a well-planned strategy with sufficient support ensuring that anti-poaching activity is consistent and continuous. Community participation in combatting poaching will be critical, especially in the areas not protected by nature reserves.

**Monitoring, scientific research and database for better decisions**

Good management decisions must be based on up-to-date and scientific information. Systematic monitoring requires trained staff and a refined method that is easy to master, and is informative. Current monitoring activity should be improved so that it can provide necessary information and analysis.

Although intensive giant panda research has been going on for two decades, there are still many questions regarding the species' behaviour and ecology. A genetic study of all existing panda populations, especially those that are small and isolated, is also necessary.

All information derived from monitoring, surveys and research should be integrated into a database, analysed and shared. A preliminary GIS system is being set up in Sichuan, which should be user-friendly and managed by reserve and local staff so their daily management decisions are better orientated and more effective.

**Strengthening existing panda reserves and protected areas**

Nature reserves in China are often not managed according to conservation objectives. For example, by the end of 1988, China had nearly 926 nature reserves covering 7.6 per cent of its total land area, yet there has never been a permanent fund to support them. The result is that many reserves face chronic financial shortages and are left to make up their budget deficits on their own, frequently through activities not in keeping with protected area goals. WWF is providing guidance to the Chinese government to help secure a stable funding mechanism for the nature reserve system.

**Training more qualified conservation staff**

With increasing demands for more conservation projects, limited human resources are becoming an obstacle to panda conservation. Different types of training on varied subjects, both short and long term, should be emphasized in order to ensure the sustainability of conservation programmes. WWF is funding training of reserve staff, but much more is needed.

**Participatory conservation approaches**

Harmonizing development and conservation is a long term and difficult job. One effective approach is to involve more "stakeholders" (i.e. the people directly affected) in conservation projects. Pilot Integrated Conservation and Development



Improving livelihood and finding alternative sources of income are part of China and WWF's long term panda conservation priorities.

Projects (ICDPs) have begun to show positive results. Such integrated efforts for panda-related land-use planning and management, and sustainable forest resource use, will enable local communities to improve their livelihoods, and promote local and higher-level policy changes. The lessons learned from these pilot projects need to be shared with other interested groups, especially in panda conservation areas. Rather than losing out from the presence of giant pandas, local people should derive economic benefits from them. A further benefit would be derived from improved ecological protection, on which all of us depend.

**A new national panda action plan**

The previous National Conservation Programme for the Giant Panda and its Habitat was developed in the late 1980s and has been implemented since 1993. An evaluation of this programme is necessary. With more information and new challenges and opportunities, this is the time to develop a new national plan. The ongoing national survey will provide updated information and scientific insight into the current status of the giant panda, and experience accumulated over the past decade should also be used. Meanwhile, more international organizations have shown interest in panda conservation, and a new national plan that incorporates the interests and requirements of all parties will help guide future action in a more integrated and effective way.

If the goal of WWF's panda conservation programme – to secure the long term survival of giant pandas in the wild – is achieved, it would result in motivated and competent staff being employed in all panda reserves, with the support of all levels of government and society. Ideally, habitat outside reserves would also be managed sustainably, and the current trends of habitat degradation and fragmentation reversed. Additional suitable habitat should become available, so that giant panda populations can expand gradually. At the same time, panda conservation projects would raise conservation awareness, test the effectiveness of different approaches, build capacity in China, and promote environmental conservation through sound government policy.

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REFERENCES

Anon. 1994. *China: Biodiversity Conservation Action Plan*. National Environmental Protection Agency, Beijing, China.

Anon. 1995. *Panda poacher in jail*. *Oryx* 29(4):234.

Anon. 1996. *WWF Action Plan for the Conservation of the Giant Panda and its Habitat*. Unpublished.

Anon. 1998. *Panda thug pays price*, *The Express*, London, U.K., November 26, 1998.

Aune, K E, Mace, R D and Carney, D W. 1994. *The reproductive biology of female grizzly bears in the northern continental divide ecosystem with supplemental data from the Yellowstone ecosystem*. *International Conference Bear Res. and Management*, 8: 451-458.

Chapman, S. 1992. WWF internal report, Godalming, U.K.

Lü Zhi, Johnson W, O'Brien, S, *et al*. In press, *Patterns of Genetic Diversity in Giant Panda Populations. Implication for natural history and conservation strategy*, *Conservation Biology*.

Lü Zhi. 1998. Pers. comm.

Mainka, S and Lü Zhi. 1997. *Proceedings of the Feasibility Workshop on the Giant Panda Reintroduction*. China Forestry Publishing House, Beijing, China.

Mc Elroy, Damien, *China hunts panda poachers*, *The Sunday Telegraph*, London, UK, April 25, 1999.

McKinnon, J and de Wulf, R. 1994. Designing protected areas for giant pandas in China. In: Miller, R I (ed.). *Mapping the Diversity of Nature*. Chapman & Hall, London, UK. pp127-142.

MoF. 1992. *National Conservation Programme for the Giant Panda and its Habitat*. Ministry of Forestry, Beijing, China.

MoF/WWF. 1989. *National Conservation Management Plan for the Giant Panda and its Habitat*. Ministry of Forestry, Beijing, China and WWF International, Gland, Switzerland. 157pp.

Nowak. 1991. *Walker's Mammals of the World. 5th edition. Volume II*. The Johns Hopkins University Press. pp1095-1097.

Pan Wenshi, Lu Zhi, Zhu Xiaojain, *et al*. In press. *The Giant Panda in Qinling: behaviour and ecology*, Peking University Press, Beijing.

Reid, D G and Gong, J. 1999. *Giant Panda Conservation Action Plan* In: Servheen, C, Herrero, S and Peyton B (eds.). 1999. *Bears Status Survey and Conservation Action Plan*. IUCN/SSC Bear and Polar Bear Specialist Groups. IUCN, Gland, Switzerland and Cambridge, UK.

Schaller, G B, Hu, J, Pan, W and J Zhu. 1985. *The Giant Pandas of Wolong*. University of Chicago Press. Chicago, Illinois, USA. 298pp.

Schaller, G B. 1993. *The Last Panda*. University of Chicago Press. Chicago, Illinois. 291pp.

Stringham, S F. 1990. *Grizzly bear reproductive rate relative to body size*. *International Conference Bear Res. and Management*, 8:433-443.

TRAFFIC USA. 1996. *Panda Poachers Sentenced to Death*, TRAFFIC USA Newsletter, December 1996. 15(4).

WWF-US. 1996. *Panda Poaching Rampant in China*. News Release, April 6, 1988, Washington, D.C.

Zhu, J and Long, Z. 1983. *The vicissitudes of the giant panda*. *Acta Zool. Sinica*.

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The future of the giant panda is in the hands of the Chinese people, especially its younger generation.

WWF/CANGNI/NANCY NASH