Quenching Beijing's Thirst: The Need for Integrated Management for the Endangered Miyun Resevoir

By Christoph Peisert and Eva Sternfeld

Miyun reservoir, a large reservoir northeast of Beijing municipality, is the Chinese capital's most important source of drinking water. For many years the Beijing municipal government has made great efforts to protect the reservoir and its catchment area. However, successful implementation has been hampered by numerous user conflicts. This paper investigates the origin and various types of conflicts, which include inter-provincial, city-county disputes, as well as conflicts between county government and local residents living in the water protection zone. The magnitude of these conflicts and continued deteriorating quality of the reservoir underline the need for integrated watershed management approaches as stipulated in the 2002 revised Water Law, and the adoption of a water economy that includes the costs for water protection and compensation for those required to carry out watershed protection activities.

The large Miyun reservoir, built during the Great Leap Forward period (1958-1960) in the northeast of Beijing municipality, is a critical source of drinking water for the 14 million people living in this booming metropolis. Considering the huge population reliant on the catchment for drinking water, Miyun reservoir is one of the most important water protection areas in the world. As Beijing has been hit by ongoing droughts since 1999, the reserves of Miyun are almost exhausted and—according to Chinese news media reports—may last only until fall of 2004.[1] Moreover, there are rising concerns about the reservoir's deteriorating water quality and fears that Miyun might face a similar fate as Guanting reservoir, Beijing's second largest reservoir, built in 1952 in the northwest of the municipality. Due to wastewater discharges and washed out fertilizers and pesticides from the upstream areas, Guanting has been so severely polluted that in 1997 Beijing's government decided to cease using its water for urban supply. In recent years, Miyun's diminishing water quality and shortage have intensified competition between urban and rural users, as well as sparked inter-provincial conflicts. Beijing is facing a severe drinking water crisis that cannot be solved by simply seeking new water supplies.

The purpose of this paper is to investigate the nature of water conflicts surrounding Beijing municipality and to discuss potential strategies for the integrated management of China's catchment areas for drinking water reservoirs such as Miyun.

Natural Determinants of the Beijing Water Crisis

Beijing municipality is located in the dry northeast edge of the North China Plain bordering the Mongolian Plateau in central Hebei province. Since the last administrative reforms in 1958, the Chinese capital and its rural hinterland were expanded to cover a total area of 16,800 square kilometers (km^2) with about 1,000 km^2 of built-up urban area. The 1958 expansion of the municipality also incorporated Miyun county, the location of the reservoir. What began as a small municipality of four million inhabitants in the 1950s has developed into one of China's most important industrial bases, with a very productive agricultural region and a current population of 14 million.

While Beijing has become a dynamic political, economic, and cultural center in China, its expansion has come at a serious ecological cost, for the region is one of very limited water reserves. Beijing's rivers belong to the catchment area of the Hai River, which among the larger Chinese river systems ranks as the lowest in terms of total runoff as well as average per capita quantity. In Beijing municipality, the average annual renewable freshwater supply available per person is less than 300 cubic meters (m^3) (Duan, 2003).

Since surface water runoff due to climatic conditions can vary greatly (See Box 1), and has been reduced considerably in recent years as a result of the higher demand in upstream areas, Beijing has become increasingly dependent on groundwater supply. The alluvial plain area, covering 40 percent of the

Box 1. Insecure Water Availability for Beijing

Beijing's surface water supply comes mainly from two sources: Yongding River in the west and Chaobai River in the east of the city. Both rivers are controlled by large reservoirs that were built in the 1950s. The reservoirs regulate the surface water inflow, which not only depend on withdrawals in upstream regions, but also are dictated by the sub-humid continental monsoon climate. At first glance, a mean annual precipitation of almost 600 millimeters (mm) would appear to provide abundant water supply to the region, but precipitation varies greatly from season to season. Major rainfalls usually occur in summer, accounting for up to 75 percent of the annual precipitation, whereas winter and spring are usually extraordinarily dry. Much of this precipitation in the Beijing municipal area is lost through an annual average evaporation of 1,800 mm.

Water availability also varies from year to year, making the region vulnerable to both droughts (with annual precipitation of less than 400 mm), and floods (with annual precipitation of higher than 900 mm). Droughts as well as wet periods may last for several consecutive years, and therefore influence water management policies. For example, during the extremely wet 1950s, water conservation efforts concentrated on flood control, whereas persistent droughts at the beginning of the 1980s, and more recently a drought that has been ongoing since 1999, demanded the immediate implementation of water-saving actions.[1]

Notes

[1] In 1999, a historical low of 279 mm rainfall was recorded, followed by 371 mm (2000) and 338 mm in 2001. (*Guojia Tongjiju*, 2000,2001,2002)

municipality, has rather abundant and readily accessible groundwater resources. However, over the past 50 years, flood protection and diversion works have reduced natural recharge while abstraction increased, particularly during drought periods. Between 1980 and 2002, the groundwater table in the urban area sank by about 11.78 meters (m), creating a funnel of emptied aquifers stretching across an area of 2,200 km^2 (Duan, 2003).

Human Pressures on a Limited Water Supply

Short Supplies and Burgeoning Demand

In years with average rainfall conditions the mean renewable water supply in Beijing is about 4.1 billion m^3, of which 1.7 billion m^3 are surface water and 2.4 billion m^3 are groundwater (Beijing Municipal Waterworks Company, 1993). But in 2001, the city received only 1.92 billion m^3 of freshwater supply (780 million m^3 surface water and 1.5 billion m^3) with demand far exceeding the renewable supply (Shuilibu Haihe Shuili Weiyuanhui, 2002). Specifically, in 2001, the municipality used 3.8 billion m^3; of which 1.2 billion m^3 (almost 30 percent) were supplied by surface water and 2.6 billion m^3 (more than 70 percent) were abstracted from groundwater (Beijingshi Shuiliju, 2002). These 2001 data highlight a huge gap between renewable supply and demand, which indicates a very unsustainable water balance. The gap was closed by diverting water from Miyun reservoir and abstracting groundwater in amounts far exceeding natural recharge, thus accelerating the exploitation of the reservoir's storage down to a critical level and depleting groundwater tables.

In light of these water scarcities it is not surprising that competition between different user groups is becoming more severe. Agricultural water consumption considerably declined in recent years, though the greatest part of the municipality's freshwater annual resources (44.6 percent or 1.74 billion m^3) was allocated for this sector. Industrial and domestic water use in the municipality has increased considerably in recent years receiving 23.6 and 31 percent of water allocations, respectively. A mere 0.8 percent (30 million m^3) was classified as environmental water use[2] (Beijingshi Shuiliju, 2002).

With drought and the decline of freshwater supply due to withdrawals in upstream areas, problems related to water quality in the watershed surrounding Beijing are getting worse. According to the China's national standard for surface water quality the Guanting reservoir is labelled grade 5 (severely polluted), and therefore this water is presently not suitable for urban supply. Many rivers, especially in the east of the city, are likewise severely polluted, with 27 percent labelled as grade 5 or higher (Beijing Shuiliju, 2002). The greatest concern for water management authorities is how to maintain water quality at Beijing's main water supply reservoir in Miyun county, the main supplier for the Water Works Number 9, Asia's largest drinking water treatment plant.

Supply-Side Management

For many years, the water crisis in Beijing was dealt with as a purely technical issue, requiring engineering solutions to increase supply. The South-North Water Transfer (*nanshui beidiao),* a giant water transfer project that will construct three canals to divert water from the Yangtze to the North China Plain and to the Chinese capital, has been on and off the agenda since the 1950s. In 2001, in face of the present water crisis and the challenge to secure water supply for the 2008 Olympic Games the government gave a green light for one of the costliest water transfer projects in the country's history.[3] By the end of 2003, construction of the middle route that will supply Beijing directly began. If construction proceeds smoothly the first water deliveries are expected to reach Beijing by 2007 and the final construction is slated to finish by 2010 ("New phase of vast project," 2003).

The middle route is supposed to divert up to 14 billion m^3 of water to the north. The question on how the water will be distributed is not settled yet, but in light of the thirst for water all over the North China Plain, experts agree that Beijing can not expect more than 2 billion m^3 additional supply from this project. So the project will bring some relief but not solve the city's water shortage in the long term. The current water crisis, however, needs immediate water conservation measures to improve protection of scarce water resources. A brief review of how Beijing's over-dependence on the Miyun reservoir arose exemplifies the severity of the municipality's water crisis and need for a strong water demand management strategy.

The Decline of Guanting and Rise of Miyun Reservoir

When in the 1950s the modern foundations for Beijing's water supply system were built, it was not foreseen that Miyun reservoir would later play such a crucial role for the urban water supply. Until the 1980s, drinking water was mainly supplied by groundwater, whereas Guanting reservoir, which was completed in 1954 at the north-west border region of Beijing municipality and Hebei province was designed to deliver water for industrial use and urban waterways.

The reservoir is managed by the Guanting Reservoir Management Department, which was under the administration of the Ministry for Water and Electricity between 1951 and 1970, and only in 1971 came under the administration of the Municipal Water Conservancy Bureau. However, the major part of the reservoir and its huge catchment area of 43,304 km^2 are located in the neighbouring provinces Hebei, Shanxi and Inner Mongolia. According to the initial design Guanting reservoir had a planned storage capacity of 2.3 billion m^3, but in recent years storage has been reduced to less than 220 million m^3 (Duan, 2003). When the reservoir was constructed, planners obviously did not take into consideration the economic development and rising water demand for agricultural irrigation and industries in Beijing's neighboring provinces.

By the 1970s, 2 larger reservoirs, as well as 17 medium and 248 small reservoirs had been built within the catchment area of Guanting. These reservoirs as well as intensive groundwater mining caused a considerable reduction of Guanting's inflow. Originally, the reservoir's average runoff was calculated to be 44 m^3/second, this number has now been reduced to a mere 6 m^3/second. Moreover, the reservoir faces a severe siltation problem, as it is estimated that the reservoir presently contains more than 640 million tons of sediments, with several million tons being added every year (www.wasy.de/WE-BB/en). Severe pollution by untreated sewage from the cities of Zhangjiakou and Datong, as well as effluents from small rural industries and washed out fertilizers and pesticides already became severe in the early 1970s.

In an early move of environmental politics the Chinese government in 1972 responded by establishing the Leading Group for the Protection of Guanting Reservoir, which labored for years to create regulations to protect the reservoir's water resources. The Water Resource Protection of Guanting Reservoir Measures *(Guanting Shuixi Shuiyuan Baohu Guanli Banfa)* were ratified by the governments of Beijing municipality and Hebei and Shanxi provinces in 1985. Despite the years of preparation, this legal attempt did little to improve the reservoir's severe eutrophication problem, mainly because the municipality and involved provinces never agreed on who should pay for the clean up. Every year in the upstream areas approximately 100 million m^3 of untreated or inadequately treated wastewater are discharged into the rivers, amounting to almost one-third of the reservoir's average annual inflow. Until recently, even in the larger urban areas such as Zhangjiakou, Xuanhua and Hailai urban waste was discharged without any treatment. It is further estimated that upstream rural counties use approximately 1,500 tons of pesticides and between 50,000 to 70,000 tons of chemical fertilizers each year, with large amounts of residues washing into the reservoir. In 1997, the reservoir's continued severe pollution levels led Beijing to cease using water from

Guanting for urban supply. Only in recent years has the Beijing Municipal Water Conservancy Bureau initiated projects to improve the water quality of the polluted reservoir and attempted to reintegrate the reservoir into Beijing's water supply cycle.[4]

The Rise of Miyun Reservoir

With deteriorating water quality of Guanting reservoir and the depletion of groundwater tables in urban areas, Beijing's second reservoir in Miyun county became increasingly important for urban water supply in the 1980s. The large reservoir with an original capacity of 4.1 billion m^3 was originally planned to supply the rural areas of Beijing as well as Lanfang county in Hebei province and Tianjin municipality. In the early 1980s, a severe drought caused the fast depletion of groundwater tables in urban districts of Beijing, and consequently severe shortages in urban water supply and electricity production. The crisis induced the State Council to issue a formal order granting the capital exclusive rights to the reservoir's supply. Tianjin in exchange was assured of the immediate construction of a diversion canal from the Luan River.

During the 1980s and 1990s Beijing has gradually switched from groundwater to treated surface water for drinking water supply, which means the Miyun reservoir gained crucial importance for the capital's water supply. Since 1989, the newly constructed Water Works Number 9 began treating raw water from Miyun to supply drinking water to Beijing. In the mid-1990s, this modern water works facility reached a daily capacity of one million m^3, thus providing up to 75 percent of Beijing's tap water. During the 1990s, the use of this new treatment plant led the Beijing water works company to abandon pumping from some of the older groundwater wells in the urban area. The depleted groundwater tables gradually recovered and the areas supplied by Water Works Number 9 experienced major improvements in drinking water quality.

The Beijing government is now undertaking considerable effort to protect the city's most important source of drinking water. In 1985, the Beijing government issued a trial regulation (*banfa*) titled the "Protection of the Miyun Reservoir, Huairou Reservoir and Jingmi Canal" that represents a model for Chinese water protection legislation. In 1995 this regulation was substituted with a more detailed administrative regulation (*guanli tiaoli)* that divided the reservoir's catchment area inside the boundaries of Beijing municipality into three water protection zones with different protection requirements.[5] The regulation bans certain economic activities, particularly inside water protection zone 1 (which encompasses the reservoir, the area inside the lakeside road and all areas 4 km off the shoreline). This regulation has helped the authorities control tourism and industrial development in the protection zone 1, as well as enforce the closure of some mines and smaller enterprises in protection zones 2 and 3. In recent years, the Miyun protection regulation has sparked programs to limit fishery and agricultural impact on the reservoir; however, it does not apply to 70 percent of the 15,788 km^2 catchment area in Hebei province, which includes about two-thirds of the 860,000 people living in the Miyun watershed.

The conflict concerning the protection of the headwaters of Miyun reservoir gained intensity during the drought year of 1999 when the inflow to the reservoir was reduced from a 400 to 800 million m^3 (in years with average rainfall) to a mere 73 million m^3. During the following drought years, the reservoir's inflow did not increase. While the reservoir has supplied approximately 600 million m^3 for urban use per year, it has experienced dramatic drops in its storage, with only a few hundred million m^3 left at the end of 2003. Thus if Water Works Number 9 maintains current production it will have to rely on additional supplies of groundwater. Moreover, with decreasing inflow to the reservoir there are rising concerns about deteriorating water quality and an increase in inter-jurisdictional water conflicts in the region.

Water Conflicts

Managing the city's water crisis and dealing with various cross-jurisdictional and cross-sectoral conflicts have become some of the most demanding tasks of the Beijing government. The two main water conflicts stemming from Beijing's growing thirst include: (1) regional conflicts over water distribution and quality, and (2) Beijing municipality limiting Miyun county's development aspirations—particularly under dispute are Miyun's control of mining and intensive fish farming and programs for restructuring the agricultural sector.

Regional Water Quality Conflicts

Beijing Versus Hebei

Many of these conflicts surrounding Miyun are regional in nature, crossing provincial boundaries. Since two-thirds of its catchment area belongs to Hebei province, the water quantity and quality of Miyun reservoir depend considerably on the land and water use systems in this province. How much Hebei is

Box. 2 Upstream Pollution Woes

The development of small enterprises—including iron mines, sawmills, and quarries—in the upstream areas has accelerated the deterioration of Miyun's water quality. Iron mines upstream from Miyun not only cause severe water pollution but also promote erosion as the low quality ore is quarried from open pits. One author who recently undertook extensive research on upstream pollution problems in the Bai and Chao rivers noted one particularly egregious upstream polluter is a brewery in Fengning county that annually discharged 1 million m^3 of untreated wastewater into Chao River just 80 km off the reservoir (Yu Xinxiao 2003b). Yu correlated the water quality at different parts of the Chao and Bai rivers to the main locations of mines and industries and then concluded "Miyun might become a second Guanting." Industrial discharges flowing into Miyun county are often at the valueless water quality grade 5—the main standard exceeding components are ferrum[1] and phenol, which are used for volatiling (Yu Xinxiao 2003b). The same author notes that in some upstream areas poverty of the rural population leads to over-tilling and deforestation, which promotes erosion and siltation in the reservoir. In Fengning county it is common practice for peasants to go to the mountains to cut brushwood and grass for fuel, thereby causing serious damage to the natural vegetation. To secure the annual demand of one peasant household 10 mu of natural vegetation are damaged (ibid).

Notes

[1] In 1995, ferrum was three times above the acceptable rate, and by 1997 and 1998 rose to 39 to 150 times higher than acceptable standards, respectively

shaping the water quality is an issue strongly disputed between Beijing and Hebei.

Authorities in Hebei maintain that while more than two-thirds of the water in Miyun reservoir comes from their province, their per capita consumption is less than that of Beijing. Consequently, Hebei officials will argue internally that the government in Beijing should pay their province an adequate compensation for delivering water to Beijing—money that could be used to protect the upstream basin. Beijing's position is more elaborate: inflow from Hebei is already basically limited to the rainy season in summer, during which time wastewater and solid waste residues are being rinsed into the reservoir. Given this fact, Hebei should consider itself lucky for not being charged by the capital for water pollution.

Because of its sensitive nature, the question of the provincial shares of Miyun water has been difficult to resolve, particularly since detailed data on the amount and quality of the inflow to Beijing have been kept quite confidential. This secretive approach has started to change after a rare public statement was published in 2000 by the Beijing Municipal Water Conservancy Bureau, which frankly attributed the water shortage of the capital to the rising consumption outside the municipality:

> Many new dams and reservoirs have been built in Hebei and Shanxi Provinces, which have reduced the average yearly flow of water into the Miyun Reservoir from 1.2 billion m^3 in the 1960s and 1970s to 800 million m^3 in the 1990s, and into Guanting from 1.93 billion m^3 in the 1950s to 400 million m^3 in the last decade (Yan, 2000).

On its city web page, the Beijing government attributes the record low of Miyun reservoir "mainly to the large numbers of dam projects in the upstream areas…[where] more than 30 dam projects have been built to irrigate over 0.3 million mu[6] of land and to support some industry" (www.bjsd.gov.cn).

Beijing has also garnered support for its position from the city's Environmental Protection Bureau, which has identified wastewater from upstream middle-sized settlements (towns, county seats, small cities) and from the light industries—mainly food processing—as the major source of pollution of the reservoir (Ding, 2001). More than 80 percent of the main pollutants in the reservoir are phosphates and nitrates originating in the upper reaches of the Chao and Bai rivers in Hebei province (Yu, 2003a). In addition to restricting industrial development within the municipality, within the Miyun catchment area Beijing's population density is below average, which further indicates that Hebei is the larger polluter of the reservoir area. The Chengde and Zhangjiakou areas in Hebei, which while not heavily industrialized contribute significantly to Miyun's headaches. (See Box 2 for more details on upstream polluters and land degradation).

Trying to solve Miyun's upstream pollution and

land degradation problems will require the creation of new, institutionalized approaches. One ad hoc attempt to solve the problem began a few years ago when the Beijing government paid an undisclosed sum of money to compensate Hebei for water obtained from the province. It is not known how this sum was calculated or whether it obligated Hebei to undertake any water protection activities. According to sources in the Beijing government this kind of ad hoc downstream-upstream compensation payment is occurring annually. The fact that a formal repayment from Beijing to Hebei based on present water issues already exists but has not yet been sufficiently institutionalized, shows the need for more analysis and agreements based on natural resource economics between Hebei and Beijing. A more precise involvement of the budgets of those departments, which help to protect the water resources, is logically the next step. Any form of payment for environmental services upstream must be transparent and should include mechanisms to directly reward upstream farmers and cities for protecting the watershed.

Compensation systems related to water reservoirs in China mainly have concentrated on reimbursing for the losses of arable land due to the construction of a reservoir. Such land compensation is relatively straightforward to calculate and execute. The establishment of compensation systems that relate to the availability of water is much more complicated and has a much wider range of impacts. In the case of Miyun, both the water shares with Hebei province and the water quality aspects would have to be taken into account in any calculation of compensation. In other words, an inter-provincial system of environmental economics would have to be established.

Beijing Water Disputes with Tianjin

The decision to designate Miyun as a water resource exclusively for Beijing in 1983 immediately caused a major water problem in the second metropolis in the region, Tianjin, for which a support diversion from the Luanhe River was built. Water from the Luanhe River began flowing in 1985 from the newly built Panjiakou reservoir, which has its main catchment area in Hebei. This new water diversion was only a short-term solution for Tianjin, which has been suffering from continuous droughts since 1997—exacerbated in 2000 when the water supply from the Panjiakou reservoir was exhausted. An emergency canal connecting Tianjin to the Yellow River in Shandong province has been used over the past few years, demanding frequent route changes to follow the varying flows of the river. Most likely these additional diversions to Tianjin from the notoriously dry lower reaches of the Yellow River are causing constraints for water users at the middle reaches. Since institutionalized compensation systems such as between Beijing and Hebei have been difficult to establish, setting up compensation mechanisms over a wider range to include Tianjin and some western provinces at the middle reaches of the Yellow River, would be even more challenging.

In order to promote better coordination and fewer conflicts over Miyun and other water resources in the region, in 2001 the State Council ratified the "Plan for a Sustainable Use of the Capital's Water Resources in the Beginning Period of the 21st Century (2001-2005). This plan paved the way for a successive rise of water fees to promote water saving, water treatment and water construction projects, and approved the inauguration of an inter-sectoral and inter-provincial coordination group responsible "for the protection of the water resources of the Miyun and the Guanting reservoirs and for inter-provincial water distribution" (Zhonghua Renmin Gongheguo Guofuyuan, 2001).

The group is chaired by the Ministry of Water Resources, co-chaired by the National Development Planning Commission, the Ministry of Finance, and the Beijing municipal government, and joined by the Ministry of Construction, the State Environment Protection Administration, the State Forestry Bureau and Hebei and Shanxi provincial governments. This multi-agency group formulates project management and implementation schemes to strengthen water resource protection and inter-provincial water allocation (Ministry of Water Resources et al., 2001). The State Council's plan requires that projects within Beijing mainly be financed by the municipality's budget, with adequate support from the central government. Water projects undertaken in the provinces of Hebei and Shanxi that benefit the capital should be financed by the central government (Zhonghua Renmin Gongheguo Guofuyuan, 2001). Together with the 2002 revised Water Law the formation of this group seems to be at least a significant first step in establishing a framework of new forms of cooperation between provinces and agencies, a step urgently required for improved watershed management.

City Versus County: Beijing Constraining Miyun County's Development

The requirement to protect the reservoir's water for supply to Beijing has complicated and constrained how the Miyun county government pursues economic

development.

This burden on Miyun's economy is at the center of contentious urban-rural water conflicts sparked by Beijing's growing thirst for drinking water.

With the establishment of water protection zones for the Miyun reservoir and its connections (Huairou reservoir and Jingmi canal) under the 1985 and 1995 regulations, a new legal framework with far-reaching land use and production restrictions was enforced in the Beijing part of the catchment area. Although not in all of its aspects fully coherent (Bucksteeg, 2001) and thus giving insufficient guidance to local leaders, these regulations strongly restrict the production and income opportunities of the three counties (Miyun, Huairou and Yanqing), that share the Miyun water protection zones in the Beijing area (140,000 inhabitants, 4,500 km^2). While the regulations lay out some compensation and alternative economic development strategies for the counties, these have not yet been fully carried out.

This burden on Miyun's economy is at the center of contentious urban-rural water conflicts sparked by Beijing's growing thirst for drinking water.

The most fragile parts of the reservoir are under the greatest pressure to limit economic activities. According to the 1995 water protection regulation, protection zone 1 of the Miyun reservoir is basically marked by the ring road around the reservoir (Yu, 2003a).[7] The areas inside zone 1 used to have the highest population density and the best access to water. Ironically, these land use limitations for the local farmers are triggering alternative economic activities that are harmful to the reservoir—such as mining, intensive fish farming, and excessive breeding of other aquatics (Yu, 2003a). While tourism activities have been forbidden within all the protection zones since 2000, mining and small restaurants that have been set up within protection zone 1 are major pollution sources on the upper reaches of the reservoir within Miyun county.

In addition to regulations limiting many different types of economic activities in the reservoir—mining, aquaculture, and agriculture—there has also been a broad resettlement of residents away from the reservoir's banks since 1999.

There is little information available on the scope and impact of this resettlement policy, but lowering population pressures around the reservoir was seen by the Beijing leadership as a difficult, yet crucial policy to protect water quality.

Mining Around Miyun

All 47 small iron mines in Miyun were reportedly closed in 2000 by intervention of the local government to halt toxic pollutants and soil erosion into the reservoir. These illegal mini-enterprises usually used phenol for volatizing, which was carelessly allowed to wash into the soil and the reservoir. After the sudden closure the miners gathered at the county government seat, demanding compensation (a member of the county government informed us later, that the government officials "could not leave the offices for one week"). In the weeks after the incident, the pits were emptied of already mined ore and left abandoned with no environmental remediation measures taken. In 2003 the municipal environmental and forestry bureaus started to discuss a program to afforest the open pits, in order to halt continued erosion of tailings and soil from the mines.

The closure of the mines around Miyun reservoir was made easier by increased production costs and declining product prices in recent years. Insufficient productivity is a common problem not only in small mining industries, but also has been a typical excuse by many enterprises in Miyun for their inability to invest into pollution prevention as required by the law.

Intensive Fish Farming near Miyun's Interlake

Commercial fish farming in one part of the reservoir's interlake began in the mid-1980s by introducing two new species of edible fish from southern China (e.g., variegated and silver carp). In 1986, fish farming in cages, a new farming technology from Japan, was introduced and subsequently sparked much debate about the economic advantages and ecological damage of intensive fish farming in the reservoir that carries drinking water (Liu, 1989). However, in 1995 this business expanded to 2,013 cages covering an area of almost 50 hectares (ha). In peak times, 1,500 tons of fish were produced per year using the cage technology, causing 2,250 tons of waste,

Map 1. Catchment of Miyun Reservoir

nitrates and residues to be dumped in the reservoir. By 2002, while only 1,080 cages owned by 80 fish farmers were left, they had increased production, which led to a yearly output of about 3,500 tons of fish and approximately 4,000 tons of waste (Yu Zhimin, 2003). Only in 2003 did the Beijing government issue a regulation prohibiting cage fish farming in the Miyun reservoir.[8] (In the weeks thereafter, consuming fish was jokingly called a "patriotic" diet). However, this does not necessarily mean that fish farming in the reservoir and its vicinity has been totally abandoned.

The present Five-Year Plan of Miyun county indicates that the development of fish farms with a production volume of 1,000 tons is still promoted. Restaurant business (or at least the investment into it) directly at the reservoirs' tributaries and within protection zone 2 is booming. One restaurant sign advertises: "Catch your fish (and we offer very exotic ones from south China) in artificial ponds and get it prepared within 30 minutes!" As these mini fish farms in artificial ponds need a constant flow of water, they directly dispose their wastewater into the reservoir.

Programs for the Restructuring of Agriculture in Miyun

As a special local variation of the nationwide "land conversion program," in 2001 the government of Miyun county announced it would completely abandon growing cereals, and instead develop perennial cultures, mainly fruit trees. Funds for compensation of the peasants during a five-year adjustment period were said to be available. The program expanded quite rapidly in Miyun and today small fruit tree seedlings have been planted on almost all of the cropland in the county, even on the larger plains, which during the first years of this land conversion program continued to be used for grain production. When asked about the conversion to fruit trees, peasants informed us they were not all that convinced about the shift, for the seedlings appeared to be mismanaged. Poor seedling quality and lack of management know-how, as well as uncertain marketing opportunities are common conditions of large-scale programs like this. While this land conversion program eventually could help to reduce the agricultural water demand in the county, it would probably raise the input of chemicals for plant protection. Notably, while writing this article we heard that the county's initial demand for a complete shift from grain crops to fruit trees was going to be modified.

Another major shift in the county's agricultural sector came in 2001, when the Miyun county government announced a complete ban on chemical fertilizers within the next five years; several fertilizer companies were set up to produce organic fertilizers instead. Much of the county is using organic fertilizers, but there is still a long way to go for the transition to be complete. Since more limits were being placed on agricultural activities and fertilizer use, some peasants have attempted to set up dairy farms. After 2001 cowsheds suddenly appeared in large number throughout the county, notably close to rivers and evidently without any ground seal. Today, most of these sheds are empty, because—as we have been informed by local officials—the peasants had insufficient command of the new milking business.

Miyun's land conversion and organic programs are in line with a general restructuring of Beijing's agricultural policy, as announced in March 2001:

> Grain-growing areas will be reduced to save ground water and more trees will be planted. Animal breeding and other 'highly efficient' agriculture

with modern water-saving irrigation methods will be developed. It is predicted that the water used in agriculture will drop to 35 percent of the city's water consumption in 2010 from 43 percent in 1998, and the figure will continue to drop to 28-30 percent in 2020.[9]

Miyun's local restrictions to protect a watershed are unparalleled in China where no other small or large watershed requires such strict controls on land use. Beijing has only slowly acknowledged the extreme economic burden being placed on Miyun county. Acknowledging the dramatic social and economic disparities between the city districts and the countryside in Beijing and the vast water-saving potential in Beijing, the city government has started to strengthen and improve overall water management. For example, water fees have been increased sharply twice since 2000[10] and are expected to double by 2005. In a detailed Beijing government notice issued in 2002 the city's water and urban construction units were reminded to properly collect and deposit water fees—including the fees for industrial waste water recycling, water supply in city districts and townships, groundwater used for urban and rural supply systems and by township and village industries, as well as groundwater used for agricultural production (Beijingshi Renmin Zhengfu Gongbao, 2002, No.12).

The improvement of the water price management can be seen as very positive economic and political developments.[11] Despite the fee increases, water remains under priced in the Miyun watershed region, which has led to wastage. For example, the average production value of 10,000 Yuan in the Miyun area requires the consumption of 250 m^3 water, whereas the creation of the same production value in the national average requires 103 m^3 (Yu, 2003b).

In addition to rationalizing water prices in 2002, the Beijing government issued a bulletin (Beijingshi Renmin Zhengfu Gongbao, 2002, No.14) to strengthen water management overall. This government bulletin set up a detailed list of targets for municipal bureaus and commissions responsible for water, agricultural, political affairs, and city planning. Besides a long list of technical projects such as urban wastewater control and treatment, water plants or pipe improvement to reduce loss caused by leakages, the list of targets includes:

1) Introducing irrigation with treated water on 14,700 ha of farm land, and the closure of 1,000 groundwater wells in the districts of Chaoyang, Tongzhou and Daxing, where groundwater has been over-depleted;
2) Constructing 4,000 small water storage dams in mountainous areas;
3) Abandoning 1,400 ha of rice cultivation;
4) Installing water meters in 25,000 motor-pumped wells;
5) Extending water saving irrigation systems in 2.6 million m^2 garden and park areas;
6) Building 100 water catchment dams in mountainous areas and other water collection facilities, a further 13,300 ha to be subjected to water saving irrigation, erosion control on 300 km^2; and,
7) Planting a total of 4,667 ha water resource protection forests.

Most of these tasks were assigned to the Beijing Agricultural Commission and Water Resource Bureau. Two tasks exclusively concerning Miyun (and Huairou) county were given to the Beijing Environmental Protection Bureau to: (1) close mining industries; and (2) increase the use of organic fertilizer in protective zone 1 and reduce chemical fertilizer input in 2002 by 30 percent in Miyun (with 70 tons being reduced in protection zone 1), and in Huairou by 1,000 tons.

Despite the important role given to the Agricultural Commission in this constellation of tasks, this list does not address all land use aspects sufficiently. Extension of water-saving irrigation, closure of deep wells and partial reduction (as opposed to a full retreat) of rice growing areas are without a doubt urgently needed and represent proper remediation measures. Dams and other water-collecting structures as well as erosion control should be useful if properly located and constructed—which is often not the case in such projects. The small amount of area designated for water protection forestry is however a surprise, but the Beijing government has issued some ambitious forestry activities in other city planning documents.[12]

Concerns about implementing the targets on this list are nevertheless justified. Many water dam and erosion control projects in China are often too ambitiously designed and then poorly funded. Local water bureaus tend to over-emphasize impressive engineering projects (especially dams) and neglect measures to promote their sustainability—particularly the project's susceptibility to erosion and siltation. A similar inclination for big engineering projects can be observed in the forestry departments, in which new

plantations and the beauty of accurately lined plant pits are emphasized, instead of the ecological functions of the vegetation (Rothe, 2000).

Another one-size-fits-all national strategy that needs adjustment in Miyun is the prioritization of soil and water erosion control in mountainous areas, which aims to keep as much soil and water on the slopes in order to overcome drought periods and to improve local economic village conditions. In many regions of China halting erosion through self-sufficient grain production and development of fruit tree planting have been excellent strategies to help address rural poverty and watershed degradation. In the semi-arid Miyun county, which must protect a large reservoir for a major city, however, the erosion protection strategy must be adjusted. Currently, Beijing's policy is ecologically and economically unsustainable in that it demands strict erosion control measures in Miyun while simultaneously draining increasing amounts of water from the reservoir *and* from new remote water supply sources. A part of the funds now used for the construction of expensive new supply systems would be better invested into local water resource protection and land management efforts that address both Miyun's development and Beijing's water needs.

Present Emergency Water Management in Beijing

Emergency plans for the present water supply to Beijing were worked out approximately three years ago. These plans rely on expensive diversions from other water-short areas with high transportation losses and on expanded extraction of groundwater resources. At the end of September 2003 a transfer from the Cetian reservoir, 157 km away in Shanxi province, marked the beginning of Beijing being supplied by a trans-regional water diversion. 50 million m^3 were sent through the Sanggan River to the Guanting reservoir in a transfer, which lasted approximately 10 days with half of the consignment lost to leakage and evaporation along the way.[13] As part of the "Plan for a Sustainable Use of the Capital's Water Resources in the Beginning Period of the 21st Century (2001-2005)" the transfer from Cetian reservoir will be repeated several times in the next years to help quench the capital's increasing thirst, supplemented by another major diversion project from Shijiazhuang (capital of Hebei province), which was launched October 2003 and connects Beijing to four reservoirs in the Hebei area of the Taihang Mountains. The provinces of Hebei and Shanxi are expected to annually contribute approximately 150 and 90 million m^3, respectively, which equals about half the total volume of tap water the city demands.[14] Currently, the most important (and most ecologically precious) emergency supply resource is a 300-meter deep groundwater reservoir in Huairou county. Pumping officially started in September 2003; this aquifer potentially will provide the city 40 million m^3 a year, a rate of pumping that exceeds the natural recharge, so this source of water can not solve the city's long-term water needs (Zhang, 2003).

Strategies and Conclusions

Beijing's water shortages and Miyun's conservation problems are complex and intimately linked. Solutions are also complex, but could most fruitfully be found by: (1) demanding improvements in Beijing's infrastructure, (2) requiring economic analysis of water transfer projects to the city, (3) enforcing better inter-sectoral coordination in the region, and (4) promoting true integrated watershed management in the Miyun catchment.

Beijing has already built up a fairly high quality urban water engineering system, however there exists considerable potential for water saving—particularly in improving urban water recycling technologies and making water use more efficient. One crucial investment would be to repair pipes to reduce water losses caused by leakages, which presently lose approximately 30 percent of piped water. In addition to repairing and upgrading the water infrastructure in the city, urban water saving systems also must be expanded to areas outside the city. Education and incentives to promote water conservation among citizens should also be emphasized. Ultimately, Beijing must shift its water management philosophy from an engineering supply management approach towards resource and demand management approaches (Yu, 2003b).

In addition to improving infrastructure, changes must be made in creating a water economy to strengthen water protection. Thus, the economic impacts of water conservancy projects must be better analyzed. Beijing already has no choice but to pay a much higher price for water supplied from the south than for water supplied by Miyun reservoir. However, a fully protected Miyun reservoir and a restored Guanting reservoir catchment could in the future provide the city with two much cleaner and cheaper water sources. It would be a big mistake to neglect these protection alternatives and let the pressure of the current emergency lead Beijing to focus solely on the "big supply remedy" from the south.

The establishment of the inter-sectoral and inter-provincial coordination group mentioned above is a very important first step towards sustainable water management in this huge country, but one should not expect such groups to produce immediate miracles. On the surface this coordination group looks comparable to effective international institutions created in Europe in the 1960s (e.g., International Water Protection Commissions for the Bodensee or the Rhine River). However, inter-sectoral cooperation is traditionally as weak in China as inter-provincial cooperative initiatives. One positive sign of change is that the National People's Congress (NPC) is currently working on a law to lay out a framework that commits different government departments to work together on water and other issues. Successful cooperation will require intensive collaboration at the technical level and steady inter-disciplinary work, not occasional meetings where the different departments claim their political interests.

By empowering river basin commissions, the 2002 revised Water Law significantly strengthens the strategy of using the natural boundaries of watersheds as a more relevant frame for water-related land use decisions than administrative boundaries. When the NPC was adopting this progressive water law, NPC representatives also discussed the option of improving the protection of Miyun reservoir by incorporating several Hebei provincial counties that lay in reservoir's watershed under the Beijing administration. Although this would be advantageous for integrated water management administration, it is not enough to help resolve the urban-rural conflicts and would only serve to increase tensions with Hebei. A more ambitious step would be for Beijing to extend—and help fund and enforce—the water protection zones beyond the municipality's borders into the Hebei areas of the watershed.

The protection of Miyun reservoir could be greatly improved by the integrated management of the entire catchment area. We suggest that the Miyun and other similar reservoir catchments in China apply the following key strategies:

- Promote and better control water discharge from the villages in catchment areas;
- Require the establishment of compensation systems in water protection zones that are not only transparent and protected by law, but also ensure upstream stakeholders who undertake water conservation work receive funding and are involved in the land use decision-making process;
- Introduce and fund rural solid waste and wastewater management measures;
- Restrict agriculture to water saving crops and water saving irrigation methods in terms of both water quantity and quality. One strategy could be to establish special land use types such as water resource protection forests and water resource protection orchards; and,
- Promote the development of water resource protection forestry, which requires a shift from the present focus on afforestation practices to a nature-oriented management of young trees, with forest types, vegetation patterns and vegetation intensity completely defined by their ecological and hydrological characteristics.

Acknowledgements

The authors would like to thank Tanja Ploetz for the input and careful revision of this paper.

Christoph Peisert works in the Beijing Forestry Bureau as a consultant for the Sino-German Technical Cooperation Project "Protection and Management of the Watershed Area of the Miyun Reservoir," which is jointly conducted by the Chinese State Forestry Administration and GTZ, and is carried out by the Beijing Forestry Bureau and GFA Terra Systems. He has studied Geography in Kassel and Berlin, and has been working in China since 1988. He can be reached at: cpeisert@gmx.de

Eva Sternfeld studied Sinology and Geography in Berlin and Beijing, and has published a book on water management and urban development in Beijing. She has worked as a consultant for various German and international organizations such as EU, GTZ, and INWENT. Since 2000, she has been working as Director for Research and Institutional Exchange at the China Environment and Sustainable Development Reference and Research Centre (CESDRRC, www.chinaeol.net/cesdrrc) in Beijing. Her position is sponsored by the German Center for International Migration and Development programme. CESDRRC is an environmental information center and public library run by China's State Environmental Protection Administration, which focuses on environmental education and awareness building. Dr. Sternfeld she can be reached at: aiwastar@163bj.com

References

Beijing Municipal Waterworks Company. (1993). *Managing Water Resources to Meet Megacity Needs.* Case Study Report. ADB TA No. 5506. Typoscript.

Beijingshi Renmin Zhengfu Gongbao (*Gazette of the People's Government of Beijing Municipality*). *(*2002). No.12 & No.14. Beijing, China.

Beijingshi Shuiliju (Beijing Municipal Water Conservancy Bureau). (2002). *Shuiziyuan Gongbao (Water Resources Bulletin)*. Beijing

Bucksteeg, Klaus. (2001). "Schutz und Bewirtschaftung des Wassereinzugsgebiets des Miyun-Stausees VR China." Unpublished mission report for GFA/GTZ. (Available with authors).

Chen Lihua. (2001). *Beijing Shui Ziyuan Taishi (Present State of the Water Resources of Beijing)*. Unpublished Ph.D. thesis. (Available with authors).

Ding Jianhua. (2001). Beijing Environmental Protection Bureau. Unpublished research paper. (Available with authors).

Duan Wei. (2003). "*Cong Beijingshi Shuiziyuan Xingshi Kan Yuhong Liyuong he zai Shengshui Huiyong de Biyaoxing*." (The necessity of rainwater utilization and wastewater recycling with perspective of water resources in Beijing). In *Beijingshi Shuili Ju, Beijing Shuili Xuehui, Zhongguo Shuili Xuehui Chengshi Shuili Zhuanye Weiyuanhui* (Beijing Municipal Water Bureau, China Water Conservation Association, China Water Conservation Association Special Commission for Urban Water Management. Eds.), *2002 Beijing Yushui Yu Zaisheng Shuili Guoji Yantaohui (Proceedings of the International Seminar on Rainwater Harvesting and Recycling 2002)* Beijing.

Guojia Huanjing Baohuzongju Zhenci Faguisi. (1999). *Difang Huanjing Baohu Fagui Xuanbian* (*Collection of Regional Environmental Protection Regulations).* Beijing: Xueyuan Press.

Guojia Tongjiju. (National Statistical Bureau). (2000, 2001, and 2002). *Zhongguo Tongji Nianjian (Statistical Yearbook of China).* Beijing: China Statistics Press.

Guo Nei. (2003, October 3). "Shanxi water reaches Beijing." *China Daily,* p. 1.

Li Chunyuan. (1985). "*Guanting Shuixi Shuiyuan Baohu Guanli Banfa Banbu Shishi*." (Management regulation for protection of water resources of the Guanting system came into effect). *Huanjing Baohu* No. 1, p.8.

Liu Guixian. (1989). *Shengming zhi Yuan de Weiji (Crisis of Life Source)*. Beijing Kunlun Chubanshe.

Liu Yansheng. Ed. (1995). *Guanting Shuixi shuiyuan Baohu, Beijingshi Ziran Baohu (Protection of the Guanting Water System, Nature Conservation for Beijing Municipality).* Beijing Zhongguo Huanjing Kexue Chubanshe.

Ministry of Water Resources, People's Republic of China, The People's Government of Beijing Municipality, June 21, 2001, "To Guarantee Sustainable Economic and Social Development with Sustainable Water Resources Utilization." [On-Line]. Available: www.china.org.cn

Miyun Watershed Management Project Office (n.a.): *Sino-German Forestry Cooperation Beijing Miyun Watershed Management*. Project information brochure. Beijing.

Miyun Xian Renmin Zhengfu. (2003). *Miyun Xian Renmin Zhengfu Guanyu Quxiao Miyun Shuiku Luoxian Yangyu Jinxing Shui Huanjing Zonghe Zhengzhi de Gonggao*. (Announcement of Miyun county government concerning abolishment of Cage Fish Farming in the Miyun Reservoir in order to promote the integrated management of water resources).

"New phase of vast project to bring water to the north begun." (2003, December 31). *South China Morning Post*.

Rothe, Andreas. (2000). "Protection and Management of the Miyun-Catchment, PR of China. Report on the short-term mission" Resource-Economics Economic valuation of forest effects in the Miyun catchment on Beijing drinking-water resources: Principles, Unpublished mission report for GFA/GTZ. (Available with authors).

Shuilibu Haihe Shuili Weiyuanhui (Ministry of Water Resources Hai River Commission). (2002). *Haihe Liuyu Shuiziyuan Zhuangkuang (Status of Water Resources in the Hai River Basin),* unpublished report. (Available with authors).

Sternfeld, Eva. (1997a). *Beijing: Stadtentwicklung und Wasserwirtschaft. Sozioökonomische und ökologische Aspekte der Wasserkrise und Handlungsperspektiven (Beijing: Urban development and water management. Socio-economic and ecological determinants of the Beijing water crisis and strategies for water management.* Berlin: Technische Universität Berlin.

Sternfeld, Eva. (1996). "Water resources problems and strategies for sustainable water management in the rural areas of Beijing municipality." In C. Willeke-Wetstein, M. Romich, J. Steinbach. (Ed). *Rural China in the nineties: Environmental and social development at the change of the centuries.* (pp. 135 – 158). Aachen: International Centre for Comparative Social-Economic Development Studies.

WE-BB Water Experts Berlin-Brandenburg e.v. (2003). "Technical solutions for sustainable water supply of Beijing from the Yongding River Basin /Guanting Reservoir." [On-Line]. Available: www.wasy.de/WE-BB/en

Yan Changyuan. (2000). "Beijing could face water shortage crisis by 2010." Press release 10/27/2000, [On-Line]. Available: www.acca21.org.cn

Yu Xinxiao. (2003a). *Miyun Shuiku Liuyu Kechixu Fazhan Zhanlue*. (Strategy for sustainable development of the Miyun Reservoir watershed). Excerpts from an unpublished research and investigation paper for the Ministry of Water Resources. (Available with authors).

Yu Xinxiao. (2003b). *Miyun Shuiku Miyun Shuiku Chaobai He Shangyou Shui Ziyuan Wenti yu Duice*. (Problems and countermeasures concerning the upper reaches of the Bai and Chao rivers). Excerpts from an unpublished research and investigation paper for the Ministry of Water Resources. (Available with authors).

Yu Zhimin. (2003). *Shuiyuan Baohu yu Yuye Fazhan* (Water resources protection and development of fishery). Beijing Forestry Bureau, unpublished. (Available with authors).

Zhang Tingting. (2003). *China Daily.* (August 28). [On-line]. Available: China.org.cn.

Zhao Shouyan. (2000). "Miyun Shuiku Shuiziyuan Baohu Duizi Yanjiu." (Research on strategies for protection of water resources of Miyun Reservoir). In *Beijingshi Kexue Jishu Xiehui, Zhongguo Shuili Xuehui, Beijing Shuili Xuehui*. Ed. (Beijing Municipal Association for Science and Technology, Chinese Association for Water Conservation, Beijing Association for Water Conservation). *Mianxiang 2049 Nian Beijing de Shuiziyuan yu Chengshi Shui Huanjing Wenti Xueshu Yantaohui Lunwenti (Proceedings of the seminar Beijing's Water Resources towards 2049 and Urban Water Environment Problems.* Beijing.

Zhonghua Renmin Gongheguo Guowuyuan. (State Council of the People's Republic of China). (2001). Document No. 53, *Guowuyuan Guanyu 21 Shiji Chuqi /2001-2005 Nian) Shoudu Shuiziyuan Kechixu Liyong Guihua de Pifu* (Ratification of the plan for sustainable use of the capital's water resources in the early phase of the 21st century / 2001-2005).

Endnotes

[1] According to a *China Daily* report in October 2003, Beijing's existing freshwater reserves from Miyun are sufficient for fulfilling the city's needs for approximately ten more months (Guo, 2003).

[2] Water used for irrigation of urban green space.

[3] The costs of building all three of the canals from south to north are estimated to be 486 billion Yuan ($60 billion) ("New phase of vast project," 2003).

[4] One such project has been a joint Beijing Municipal Water Conservancy Bureau and Sino-German project titled "Technical Solutions for Sustainable Water Supply for Beijing from the Yongding River Basin/Guanting Reservoir." This project, which started in 2002 and is supposed to continue until 2005, concentrates on technical solutions and pilot projects for reducing the inflow of sediments and pollutants into the reservoir, as well as focusing on improvements in water quality of the Yongding River and artificial wetland construction. (www.wasy.de/WE-BB/en). However, these pilot projects will only bring minor improvements as long as inflow of untreated wastewater and sediments from upstream areas continues.

[5] The complete text of the regulation in *Guojia Huanjing Baohuzongju Zhengci Faguisi* 1999 was translated into German in Sternfeld 1997a.

[6] 1 Mu = 1/15 hectare.

[7] The zone 1 area is approximately 217 km^2. A more topographical oriented area that would better protect the reservoir would not only include the ring road but also smaller nearby watersheds and to riverbanks, which would result in an area of about 600 km^2.

[8] Document No. 47/2003 of Beijing Municipal government (Yu Zhimin 2003, *Miyun Xian Renmin Zhengfu*, 2003).

[9] www.china.org.cn/english/2001/may/13001

[10] With different levels for different user types and consumption quota, and including extra fees for water resource protection, tap water supply and wastewater treatment: (People's Daily 9/21/2000, 11/02/2000, 10/03/2003, Xinhua News Agency 01/21/2003).

[11] Yu Xinxiao (2003b) notes the desperation of the poor farmers in the upper reaches of rivers feeding the Miyun who have started small industries to improve their economic situation. Many of these industries use up natural resources and are seriously destroying the watershed's ecology. When their profits are low they intensify the degree of destruction. Similarly, if the profits are high, the farmers will extend their production, which also extends the ecological destruction.

[12] Such as the 2003 Beijing Water Resources Forest Protection Construction Plan (*Beijingshi Shuiyuan Baohulin Jianshe Guihua*) and the Beijing People's Government 2003 Announcement (*Beijingshi Renmin Zhengfu Gongbao*).

[13] Xinhua News Agency, September 28, 2003 www.china.org.cn/english/2003/Sep/76227.

[14] The Shijiazhuang project will be completed by the end of 2006 (Xinhua News Agency, September 8, 2003). Most likely any transfers prior to that date will use existing waterways, similar to the diversions now taking place from Cetian reservoir.

Animals Asia Foundation: The China Bear Rescue

Across China, Asiatic Black Bears, (known as Moon Bears after the golden crescents of fur across their chests), are incarcerated for up to 22 years in tiny metal cages no bigger than their own bodies. According to the last official government figures, 7,002 bears are factory farmed under the most deplorable conditions and painfully milked each day for their bile, through crude metal catheters implanted into their gall bladders, or via permanent, open and infected holes in their abdomens - known as the "free-dripping" technique. Bear bile has been used in traditional medicine for over 3,000 years, but today, doctors agree that it can be easily replaced with numerous herbal and synthetic alternatives, which are both cheap and effective.

Following her horrific discovery of bear farming in 1993, Jill Robinson (MBE) campaigned tirelessly within China, resolutely building relationships and negotiating with government departments to bring an end to this cruel practice. The breakthrough came in July 2000 with the signing of a landmark agreement between the Animals Asia Foundation, the China Wildlife Conservation Association (CWCA) and Sichuan Forestry Department (SFD), which pledged to rescue 500 bears from the worst farms in Sichuan and work towards the final elimination of bear farming. Sanctioned by the central government in Beijing, this historic agreement was the first accord between the Chinese government and any outside animal welfare organization.

Since October 2000, dozens of bear farms have been closed and nearly 140 bears have been released into the care of the Animals Asia team at our Moon Bear Rescue Centre in Chengdu. On arrival, the bears undergo extensive surgery to repair their damaged bodies and months of patient rehabilitation, integration and enrichment, before release into a semi-natural bamboo forest sanctuary, where they will live out their lives free from pain and fear. Central to the Rescue Centre will be the Education Village, providing a unique opportunity for Animals Asia to spread a message of respect for all animals, whilst advancing the concept of animal welfare in China.

Already, growing interest is now being seen in China itself, following extensive coverage from Chinese print and television journalists, whose stories are spreading across the country in support of rescuing the bears and closing the farms. As a result, the groundswell of encouragement from the general public within China continues to escalate and shows how supportive people are towards ending a shameful and unnecessary practice.

Background to Bear Farming

The practice of farming bears for their bile has a relatively short history: Introduced in Korea in the early 1980s, the procedure of surgically implanting metal catheters into the bears' gall bladders to milk them daily was soon adopted by China. It was hoped that the introduction of bear farming would provide an easy solution to satisfy the local demand for bile, whilst reducing the number of bears taken from the wild. However, bears are still poached from the wild for their whole gall bladders or as an illegal source of new stock for the farms and the availability of farmed bear bile has saturated the market and fueled an increased demand for bear bile and bile products.

The Asiatic Black Bear (*Ursus Selenarctos Thibetanus*) is listed under the Convention on International Trade in Endangered Species (CITES) as Appendix 1 - the most critical category of endangerment. The growing demand for bile and body parts, combined with dwindling habitats has decimated the population of Asiatic Black Bears and it is estimated that only 16,000 remain in the wild in China.

To find out more about the historic China Bear Rescue please visit our website at ***www.animalsasia.org***