



## Compensation payments for maintaining – saving Beijing's Miyun Reservoir's Water Quality

**Mainly based on:** Wenming, L., Landell-Mills, N., Jinlong, L., Jintao, X. and Can, L. (2002)

**Short title:** Compensation payments for maintaining forests for controlling erosion and water quality, China.

**Key Message:** Local farmers receive compensation to manage forest resources and to prevent siltation into the Miyun reservoir which maintains 80% of Beijing's drinking water supply

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### 1. What was the problem?

Miyun Reservoir is the main source of drinking water of Beijing and supplies around 80 per cent of Beijing's water (Zheng, H. and Zhang, L. 2006). This reservoir and a dam were designed as a multi-purpose project, for controlling floods, generating power, irrigating farmland, and providing water to the population of the city of Beijing. However, the Miyun reservoir was threatened by increasing siltation and pollution. The average rate of soil erosion is 1200–1600 tonnes/km<sup>2</sup>/year. In addition, the heavy use of fertilizer and pesticides in surrounding farmlands over time increased pollution in this area (Wenming, L. et al. 2002). The quality of groundwater has deteriorated since the 1980s. After 1999 the amount of water in the reservoir also decreased due to a 6 year continuous drought, dropping the quantity by 40% of the previous storage (Jing, L et al.). Moreover, there are rising concerns that Miyun might face a similar fate as neighbouring Guanting reservoir which has been severely polluted by waste water discharges, pesticides and fertilizers from upstream areas and cannot be utilized as a source of drinking water anymore (Peisert, C. and Sternfeld, E. 2005).

### 2. What was done to solve it?

The concept of payments for ecosystem services (PES) was selected to solve the problem of Miyun reservoir and its surrounding forests. Direct negotiations between the recipients of water in municipalities of Beijing and Tianjin and the suppliers in Fengning County (Chengde Prefecture) resulted in the establishment of an Environmental Forest Compensation Fund. The fund receives US\$120,000 (1 million RMB) from the city of Beijing and US\$48,000 (400,000 RMB) from the city of Tianjin every year. In addition, a fee of US\$0.02 (0.2 RMB) per cubic meter of water consumed (equivalent to about 12 per cent of total charges) is collected and transferred to forestry protection activities. Thus, funds are used to pay farmers and locals to manage forest resources and prevent the siltation of Miyun reservoir (Wenming, L. et al. 2002).

The Beijing municipality made payments to the cities of Chengde and Zhangjiakou which are located upstream in the nearby Hebei Province for taking environmental protection measures in the watershed. The aim was to increase the water quantity as well as to improve the water quality of the Miyun reservoir (Zheng, H. and Zhang L. 2006). From 1995 onwards, the payments for protecting forests to Zhangjiakou and Chengde amounted to US\$250,000 per year and increased the total payments to US\$2.25 million, of which Zhangjiakou receives US\$ 1 million (Jing, L. et al).

### **3. Which ecosystem services were examined, and how?**

The ecosystem services included control of soil erosion, improvement of Miyun watershed area, conservation of surrounding forest areas, provision of clean drinking water and also the maintenance of the quality of ground water.

Payments for environmental services can be classified into voluntary contractual agreements (VCA), public payments schemes (PS) and trading schemes (TS). In the case of the Miyun reservoir watershed, mainly PS schemes were applied in the form of remittances between state institutions.

Certain activities with high levels of water consumption and pollution (i.e. paper-making, metallurgy, mining and intensive fish farming and agriculture) as well as grazing activities were either completely forbidden or severely restricted and monitored. On the other hand, improvement measures were put in place which needed the participation of the work force of local people i.e. for afforestation projects or other activities aimed to prevent further soil erosion and improve the quantity and quality of water of the Miyun reservoir.

### **4. Did the examination of ecosystem services generate impacts on decision-making or policies and, if so, how?**

According to a study of Wu local communities benefit directly from recreation and indirectly from environmental services such as watershed protection, even though they may not be fully aware of the value of the indirect benefits they receive (Wu, S. et al, 2010). Local beneficiaries, living in close proximity to the forests, received 31.2% of the benefits from environmental services. Global beneficiaries received 21.5% of the benefits, through services such as carbon storage, biodiversity conservation and international tourism (Wu, S. et al, 2010). In 2003, the farmer's income per capita of the upstream Chicheng, Fengning and Luanping counties of Hebei was US\$144.8, US\$121.5 and US\$182.5 respectively, while the farmer's income per capita of Huairou district, Miyun county and Yuanqing county of Beijing was US\$726.8, US\$735.6 and US\$707.3 respectively (Hebei Yearbook, 2004). However, it has not been thoroughly analysed to what extent these policies and restrictive measures have affected especially the livelihoods of poor people with limited options of income generation living in and from the ecosystems in the watershed. Being the direct beneficiaries, the citizens in Beijing had a disposable income per capita of US\$1735.3 in 2003, more than two times that in the upstream Beijing counties. The average water fee in Beijing was 0.46 RMB/m<sup>3</sup> (in 2008, the water price was already above 2 RMB), while the high water-consuming enterprises like bathing, car-washing and bottle water companies were charged high fees of 7.7 RMB/m<sup>3</sup> and 5.2 RMB/m<sup>3</sup> (Jing, L. et al).

Forest preservation was needed to control soil erosion. In the Beijing area, soil erosion on non-forested lands is estimated to be 3.7 tonnes/hectare/year higher than erosion on forested lands (Wu, S et al. 2010). Measurements over a period of four years indicated that on average forests reduce soil erosion by 85 per cent (Wenming, L. et al. 2002). The importance of forests in controlling soil erosion, and thus water quality and supply, is therefore key to the Miyun County.

The provision of water to the urban centres of Beijing and Tianjin has been a challenging task for a long time. The experience of a period of six years with low rainfalls (since 1999) made the problem even more urgent and obvious. Little rainfall upstream resulted in insufficient inflows into rivers and to a large decrease of poundage in Miyun and Guanting reservoirs, which further accelerated the conflicts between water demand and supply in Beijing. The introduction of PES systems became even more urgent since the scarcity and low quality of water could not be improved by other methods.

The PES policy in Miyun Reservoir is co-sponsored and organized by different state institutions. The efficiency and the effectiveness of PES could be even improved if, for instance, the funds were managed by a single institution with an approach of an integrated watershed management instead of several government sectors. Further progress could be accomplished if the schemes of monitoring and evaluating the value of environmental services were improved and the cost of implementation was lowered, due to a clearer distribution of duties and obligation between upstream and downstream stakeholders (Zheng, H. and Zhang, L. 2006). The legitimacy and acceptance among the landowners and users who had to change their land use practices could also be improved if the flow of payments to the farmers and forest managers was reliable and sustainable. The PES scheme is fragile in the sense that it can be easily undermined by short-term measurements. A landfill in the upstream of Miyun, for instance, can affect the water regime in quality and quantity.

## **5. Lessons learned**

PES can bring better results than other instruments in providing urgently needed water to megacities in sufficient quantity and quality. It is, however, necessary to provide an efficient and transparent administrative framework, to control the sources of pollution (polluting industries and agribusinesses), to stimulate the recovery of healthy ecosystems, for instance, through afforestation measures and to guarantee that the compensation measures flow in a fair and meaningful manner.

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