Adapting to Water Scarcity: Improving water sources and use in urban agriculture in Beijing

Beijing is facing a shortage of water. Because of a downward trend in rainfall, surface water is gradually drying up and the level of groundwater is declining. This decline in availability of water is affecting urban agriculture in the city. Innovations are being sought by both the government and farmers focusing on the use of new water sources, like reuse of wastewater and rainwater harvesting, and improved water management.

Although groundwater is still the main water source for urban agriculture in Beijing (90 percent in 2003), in some areas groundwater is not accessible anymore. In April 2007 the Beijing municipal government started to charge a fee for agricultural use exceeding a certain quota. Thus farmers are confronted with a rising cost of agricultural production. On the other hand, water use efficiency in agriculture is still comparatively very low.

The available surface water in Beijing decreased from 1.743 billion m³ in 1980 to 0.447 billion m³ in 1995 and to 0.142 billion m³ in 2003. The average water table of groundwater is more than 20 metres deep, and in some places more than 30, making it impossible for the farmers to use it.

The SWITCH programme supports the demonstration of multiple uses of rainwater, including an agro-tourism component, and by conducting research into water flows, water quality and the cost-benefit ratio of collecting rainwater (see UA-Magazine 19 for more details). This article puts the SWITCH activity in Beijing into a broader context.

Wastewater use

The use of wastewater has a long history in China. But not until 2000 did farmers around Beijing start to use treated water from the central wastewater treatment plants, which was initiated by the municipal government in an attempt to reduce depletion of groundwater. In 2004, only 70 million m³ of treated water was used for urban agriculture in Beijing. This amount increased to

In a SWITCH visioning workshop in Beijing in 2008, the Water Vision 2030 for Beijing was summarised by the SWITCH team as:

By 2030, the city of Beijing will have reached a higher level of sustainable urban water management. Balanced availability, supply and consumption of water will avoid depletion of groundwater levels, which will be restored to 1960s levels, and pollution will be minimised. Rivers and lakes will be protected or rehabilitated to meet Surface Water Quality Standards grade III and above, and rivers will flow all year round. Water quality at the tap will meet international drinking water standards.

There will be a high degree of equity and efficiency in water use, and different quality water will be used in different sectors as appropriate. Harmonised regional water use will be achieved through fair spatial allocation of water resources; conflicts between upstream and downstream areas will be avoided through negotiation and appropriate compensation. Good water governance, open public access to information, and participation of stakeholders in decision making will ensure a water-conscious society; and adequate planning will mitigate disaster damage.
Rainwater harvesting

In addition to the use of (treated) wastewater, the use of rainwater is an important (potential) source for the water needs of parks, gardens and agriculture in Beijing municipality. Rainwater harvesting systems are currently being promoted in residential areas in Beijing and in periurban agriculture.

Capturing rainwater in residential areas of the city has been promoted since 2000. This includes techniques like porous pavement and roadside gutter collection of stormwater (rainwater from the roof and road) and storage in local deposit pools, after which this water is transferred to larger water-saving ponds for primary treatment (sedimentation). This water can be used for many purposes, such as irrigation of parks and gardens, aquifer recharge, maintaining water levels at small ponds and lakes in the city, and other uses like car washing (after some simple treatments). The number of projects introducing these uses has been increasing in Beijing, especially in the last two years. For example, in the Beijing National Stadium for the Olympics captured rainwater will be used for toilet cleaning, cooling towers, fire fighting, and irrigation of green areas (Scholes and Shutes, 2008). In 2006 more than 300 rainwater-collecting projects were implemented, and the capacity for collecting water in Beijing has consequently increased to 40 million cubic metres.

Rainwater harvesting using roofs of houses in rural China has been practiced for thousands of years. Using the roofs of houses to capture rainwater for irrigation of crops has been promoted since June 2005. Experiences with this were reported in UA-Magazine no. 19. These projects became popular because they are relatively simple to use and maintain, and because they are subsidised by the government. So far, twenty of these rainwater harvesting systems have been installed. On average, 200-300 m³ of rainwater can be collected per greenhouse (with a roof of 667 m²) each year, which can irrigate 2-3 times the same area with efficient irrigation (drip irrigation). The demonstration project of SWITCH in Beijing supports this work by analysing water flows, adding the use of wastewater, by conducting cost/benefit analyses of typical farming systems, and by linking other productive activities, like mushroom production and agro-tourism.

Challenges remain in terms of financial sustainability

So the potential of this technique is high, and given that there were some 20,000 ha of agriculture land under glasshouses in 2005 in Beijing, the current proportion of irrigation using rainwater harvesting is very low, accounting for less than 1 percent.

Improving water management

The Beijing Municipal Water Authority was founded in 2004, illustrating the beginning of reforms in the water management system of urban and periurban Beijing. Integrated urban-rural water management is being developed at four levels: municipality, districts and counties, water stations and at user (farmer) level. At the latter level, the Beijing Water Authority has village water managers and stimulates the organisation of farmers’ water use associations or cooperatives. These village level associations manage issues such as access to water (and developing alternatives, like using wastewater and building rainwater harvesting structures), water pricing, irrigation practices, and quota management. By the end of 2006, Beijing had established more than 3,339 of these farmers’ water use associations. Every villager (except the village leaders in order to prevent power from becoming too concentrated in the hands of few people) has the right to apply for the position of water manager, and selected villagers will receive capacity building training from the Water Authority. In December 2006, 10,800 farmers were appointed as water managers of their villages in Beijing (the total number of periurban villages in Beijing is 3,954).

Future perspective

Integrated reuse of wastewater, rainwater harvesting, and more
The SWITCH programme collaborates with the Huairou Fruit and Vegetable Cooperative. The cooperative is located in An ge zhuang village, Beifang town, in Huairou district of Beijing, and was initiated in March 2004. The cooperative specialises in the production of vegetables, grapes and Chinese dates. At present, there are 1108 households in the cooperative who participate voluntarily. In an interview, the cooperative’s chairperson, Ms Zan, discussed the importance of rainwater harvesting: (..) The farmers of the cooperative used to use groundwater for irrigation, but in recent years, the water table has been drying up very quickly, and some wells cannot be used anymore. Digging deeper and pumping up water increases cost. (..) Rainwater harvesting is therefore very important to the cooperative. A problem is the funding for the building of the rain harvesting systems. Despite the subsidies, not all farmers have access to it. SWITCH helps us improve the rain harvesting system. (..)

We are now using the underground space to plant mushrooms. The environment of the basement by the side of the water storage pool is quite good for growing mushrooms in terms of temperature and humidity conditions. Using the ground space can save us lots of money by making it easier to control growth conditions and it allow us to gain more benefits. (..) Agro-tourism is another opportunity to raise the value of our products. (..) In addition, opportunities and constraints experienced by our cooperative as a result of rapid urbanisation need to be tackled by involving several institutions and stakeholders in the development of our cooperative and our search for sustainable use of the water. We are collaborating with RUAF on this. (..)

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References