

## Addressing water shortages through quota control and economic incentives, Shiyang River Basin in China

**Problem statement:** During the early 2000s, the Shiyang River Basin, an inland river basin in Northwest China, was witnessing significant decline in both surface water and groundwater levels owing to increase water demand, resulting in severe water conflict among the water users in the different reaches. From 1950 to 2003, irrigated area in this region increased by 30% while water use increased by 75%. The increasing water demand led to a decrease in surface water flow from 500 million m<sup>3</sup> in 1950s to 98 million m<sup>3</sup> in 2003 while the number of tubewells in the Minqin County alone peaked to 14,000.

**Intervention:** To mitigate the water shortages and the ecological crisis, a River Basin Management Bureau was set up and a comprehensive water management plan (CWMP) was approved by the Ministry in 2006 outlining the following targets – increase in surface water availability in downstream Minqin area from 98 million m<sup>3</sup> in 2003 to 290 million m<sup>3</sup> by 2020, decrease in groundwater extraction from 517 million m<sup>3</sup> in 2003 to 86 million m<sup>3</sup> by 2020 in the Minqin area and from 747 million m<sup>3</sup> to 418 million m<sup>3</sup> in the whole basin during this period. A number of institutional mechanisms and economic measures have been initiated to meet the targets, the most notable being introduction of water consumption permits, as discussed in detail below:

- Water consumption permits have been granted to the individual households, which were determined based on the number of household members and type of crops cultivated. For example in the Minqin County, the permit allows water consumption for developing 2.5 mu of irrigated area per capita while household with more than 2.5 mu irrigated area per capita could obtain additional water through plantation of horticulture crops and transforming land to greenhouses.
- An Integrated Circuit Card (IC card) technology was introduced to monitor water consumption permit. The electronic systems were installed in the tubewell and the respective WUAs were allotted the IC card. Each farmer was entitled to purchase maximum water permits of 415 m<sup>3</sup> per mu. The WUAs coordinated the consumption patterns of the members to ensure equitable distribution.
- In irrigated areas dependent solely on groundwater or a mixture of both surface water and groundwater, a two-part (basic + volumetric) has been introduced. Also, different tariff levels were set for various cropping patterns – water for greenhouse and drip irrigation were exempted from the basic water fee and also eligible for availing 20%

and 50% discounts in surface water and groundwater fees respectively while tariff for water intensive crops attracts a premium of 50% for groundwater and 30% for surface water respectively.

- Steep premiums, to the tune of 150% to 300%, were imposed on fees charged, in case of consumption exceeding the permissible limits.

**Impact:** Water cost recovery in the area has significantly improved over time, with surface water fee per m<sup>3</sup> in the middle reaches increasing from 0.08 yuan to 0.2 yuan during 2007 to 2017, while that in the lower reaches recording increase from 0.1 yuan to 0.24 yuan. Water consumption permits facilitated adoption of water efficient practices with the economic output per m<sup>3</sup> of water increasing from 1.3 yuan in 2009 to 9.33 yuan in 2015. These measures facilitated the shift from traditional grain crops to cash crops in the SRB province with farmer's income registering a two-fold increase. As reported, implementation of various provisions of the CWMP led to a jump in average agricultural water-use coefficient from 0.53 to 0.58 and reduction in water use per irrigated land from 626 m<sup>3</sup> to 430 m<sup>3</sup> during 2007 to 2015.

**Sustainability:** As per the evaluation reports released by the Gansu government, significant improvement in water usages during 2007 to 2015 have been reported owing to these measures. To ensure sustenance of these benefits, measures like water consumption benefits were supplemented by adequate changes in institutional and funding mechanisms like development of WUAs and special fund/ subsidy allocations.

However, it may be noted that the water permit trading has been limited to only between the WUAs within the same ID. Also, a decline in trade volume was recorded between 2015 and 2016. At the local level, the trade was limited due to heterogeneity issues, while at the national and state levels, it was impaired by lack of necessary regulatory framework and legislation.

(Reference: Liuyang Yao et al., MDPI, "China's Water-saving Irrigation Management System: Policy, Implementation and Challenge", December 2017)