

# Construction of Water-Saving Society in China a Pilot Test at Zhangye City

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## 1. Introduction

The Heihe River flows through the arid inland region of Northwest China. The annual precipitation of the upper reaches is 300 mm. The annual precipitation of the middle reaches is 140 mm. This area is rich in sunlight and heat resources, and thus, it has been an important agriculture zone since ancient times. The lower reaches is mainly Gobi and desert, where the annual precipitation is only 47 mm. Because the water for agricultural irrigation on the middle reaches is from the Heihe River, the runoff of the lower reaches disappeared, the lakes dried up, and the ecologic system deteriorated.

The city of Zhangye is an oasis on the middle reaches of the Heihe River, where the cultivated land, the population, the water consumption, and the GDP occupy 95%, 91%, 83% and 89% of the basin total respectively, thus, constructing Zhangye city into a water-saving society is very important to the sustainable development of entire river basin. Besides, the agriculture water consumption of Zhangye city occupies 95% of the total of the city, so the economization on agricultural water is the key to the construction of a water-saving society.

## 2. Measures for construction of the water-saving society

Implementation of "Three Prohibits, Three Expands, and Three Reduces" Policy. The economic structure is adjusted. Wasteland reclamation, resettlement at Zhangye, and planting of high water consumption crops, such as rice, are prohibited; The area of farming land is reduced while the area of forest and grass is expanded, the area of grain crops is reduced while the area of economic crops is expanded, and the area of high water consumption crops is reduced while the area of low water consumption crops is expanded.

1) Control of total water consumption, management of quotas, and estimation of crops on the basis of water consumption. According to the water allocation plan for the Heihe River decided by the State Council, a fixed volume of water is allocated to the lower reaches. The available volume of water resources is allocated to each county, to each township, and finally to each village. The quotas for domestic, industrial, agricultural, and ecological uses are formulated and basic prices fixed. The actual irrigated area in 2000 taken as the basis, initial water rights are allocated. The total volume of water consumption is checked based on the quotas, and, if the total volume is deficient, the structure of crops is adjusted. Water consumption within the quota is paid for on the basic price basis; water consumption exceeding the quota is paid for on an additional price basis: for water consumption exceeding the quota by 1%-3%, additional 50% of the basic price is paid, exceeding the quota by 31%-50%, 100%, and exceeding the quota by 51% or more, 200%.

2) Public participation and water allocation to each family. Water users' associations are set up, participating in the supervision of water rights, water prices, and water consumption. The associations break soon the total volume and distribute it to each piece of land for each round of irrigation. On this bases, the responsible department issues water right licences to the farmers.

3) Supply by ticket and trade of water. The farmers buy water from water management institutions with

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the licence for each round of irrigation and the water management institutions charge them on the basis of the fixed prices. Surplus water can be sold, and the buyer and seller can negotiate over the price within the range of government's guiding price. The water users' associations(WUA) coordinates water supply.

### 3. An Example of Implementation- Liyuanhe Irrigation Area

The Liyuanhe Irrigation Area is a large irrigation area of 20,000 ha on the middle reaches of the Heihe River. The construction of the water-saving society began in 2001, and the year of 2003 witnessed the following preliminary effects.

1) WUA had been popularized. 45 water users' associations had been set up, and 10,680 licences had been issued. Farmers' awareness of using water, managing water, and saving water had been enhanced. 2) The agricultural structure had been successfully adjusted. The grain crops-economic crops-forest and grass proportion for 2000 was 56:14:30, while the proportion 2003 is 22:46:32. This adjustment only helped save 5,700,000 m<sup>3</sup> of water and increase farmers' income by RMB ¥ 2101 per person on the average. The farmers had also changed, from passively accepting adjustment to actively adjusting the structure of crops according to economic benefit and market demand. (Table 1) 3) The efficiency and benefit of water resource utilization had been raised. The net irrigation quota had decreased from 1275 m<sup>3</sup>/ha to 1200 m<sup>3</sup>/ha, and the utilization rate of the canal system had increased from 0.49 to 0.54. The volume of water diverted for the irrigation area in 2003 decreased by 25,000,000 m<sup>3</sup>. 4) The load of water fee had been lowered. The agricultural water fee had reduced by RMB ¥ 105/ha, and the rate of water fee collection had increased obviously.

Table 1 Comparative analysis of economic benefits of various crops

Name of crop	Water consumption (m <sup>3</sup> /ha)	Economic benefit (RMB)	Productivity of water (RMB ¥ /m <sup>3</sup> )	Water fee (RMB)
Wheat-maize	1210	860	0.71	72.8
Maize as seeds	780	1150	1.48	46.8
Tomato	780	1350	1.73	46.8
Chinese traditional	780	3000	3.84	46.8
High efficiency herbage	520	650	1.25	31.2

### 4. Conclusions and Discussions

1) The construction of the water-saving society at Zhangye has yielded significant effects, and it has helped the fulfillment of the plan of water allocation to the lower reaches.

2) Although water consumption is restricted and water is saved, both farmers' income and social productivity have been raised. 3) A

whole set of effective ways has been found out for the operation of water rights and water markets.

Some problems need to be further studied. 1) Saving water is an effective way to alleviate the pressure of water shortage; however, it cannot solve all the water-related problems. 2) The construction of a water-saving society is a gradual process, and it needs long-term efforts. For example, great efforts must be made to better water users' associations and to bring their functions into full play. 3) A water-saving society must be sustainable, and thus it needs to be supported by regulations and mechanism. For example, the mechanism of compensation for saving water should be established and enforced; otherwise, the effect of saving water in the irrigation area would be in inverse proportion to the income and the enthusiasm for saving water would be affected. If things go on like this, the effect of saving water would be ruined. 4) The pilot construction under study was supported by the state policy and state input. Nationwide popularization needs both financial support and policy support.