

Study on the relationship between economic development and water demand structure in the Yellow River basin

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We studied on the theme of ‘Analysis of the relationship between economic development and water demand structure’ for the project. In particular, we examined following three sub-studies.

- (1) Water resource management policies and programs in the Yellow River basin
- (2) Water resource supply and demand structure in the Yellow River basin and issues relating to improvements in water resource utilization
- (3) Current situation and issues for water rights trading

The main findings of each sub-study are summarized in next chapters.

1. Water resource management policies and programs

We reviewed trends in water resource management in the Yellow River basin, and examined the current situation and issues for water resource management. Further information of the water resource management in the basin is documented by Shi *et al.* (2007) in the report of proceedings of YRiS joint meeting.

We found that water resource management issues that led to water shortages included the following: (1) There is an absence of punitive provisions in cases where a party draws more water from the river than its regulated allocation. (2) Water conservation measures have not been adequate to respond to increases in water demand. (3) Water usage fees were set too low, resulting in a lack of water conservation incentives for water users. (4) There was a ‘Prisoners’ Dilemma’ in connection with regional conflicts of interest relating to water resource conservation.

An effort is being made today to introduce resource management methods such as punitive provisions for excessive water withdrawals, market mechanisms, and so on. However, no information has been released about discussions leading up to the establishment of the systems and regulations, and no data has been released that would permit analysis and evaluation of the rationality of water resource allocation. It will be important to create an environment for more transparent and rational debate by the various stakeholders with different interests, coupled with a good understanding of the situation in the entire river basin.

2. Assessing the water resource supply and demand structure and improving water resource utilization

We constructed a water resource supply and demand model based on (1) a macro-level population and economy framework, (2) a water demand module, and (3) a water resource module (**Fig.1**). It then estimated the monthly water resource supply and demand balance for each county and city. This work indicated that the severe water shortages downstream since the mid-1990s were mainly caused by increases in water demand in the upstream and downstream irrigation districts, and by a drop in available water resources in the upstream area (**Fig. 2**). Further information is documented in Imura *et al.* (2005) and Onishi *et al.* (2007).

In addition, a comparison of agricultural water use efficiency between regions showed that the upstream region is less efficient than the downstream region. In particular, it became clear that efficiency in the irrigation districts of Inner Mongolia Autonomous Region and Ningxia Autonomous Region were significantly lower than in other regions (**Fig. 3**). As a result, in the future, the improvement of agricultural water use efficiency in these irrigation districts will be an important challenge if there is any hope to improve the water resource supply and demand balance in the river basin.

3. Current situation and issues for water rights trading

As China shifts to a market economy, there is also a growing debate about introducing market mechanisms in the area of water resource management in order to make water resource utilization

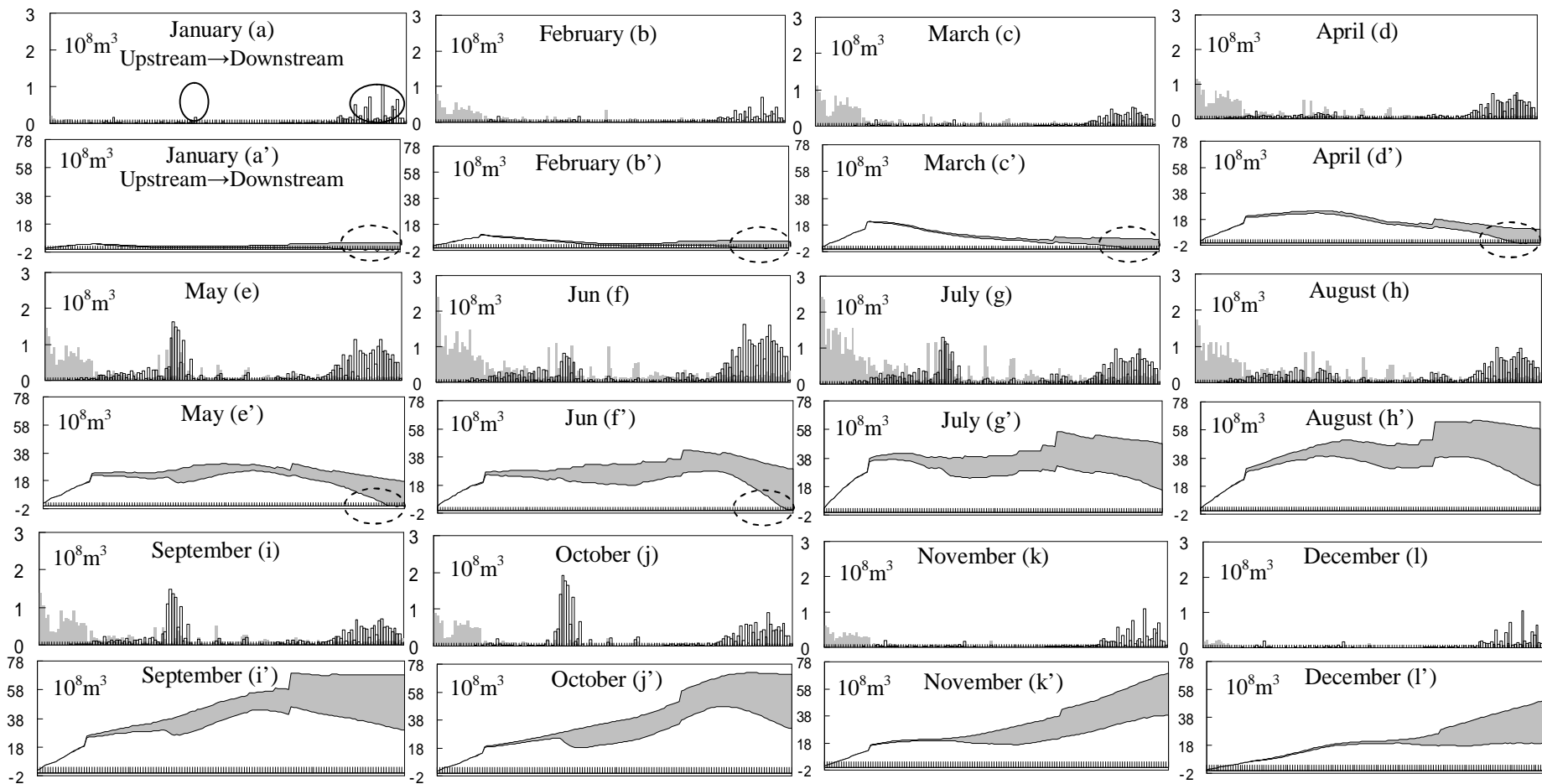


Fig.2 Monthly water supply and demand structure by county/city in 1997: (a)..(l) show spatial distribution of water resources and consumption; (a')..(l') show natural river flows and actual river flows; Lanzhou, Qingtongxia, Yinchuan, Baotou, Sanmenxia, Puyang, Jinan, HetaoID, downstream ID; the inflow from tributaries to the main channel, they join the Yellow River at the county/city where they pour into the main course of the river. The figure is referred from Onishi *et. al* (2007)

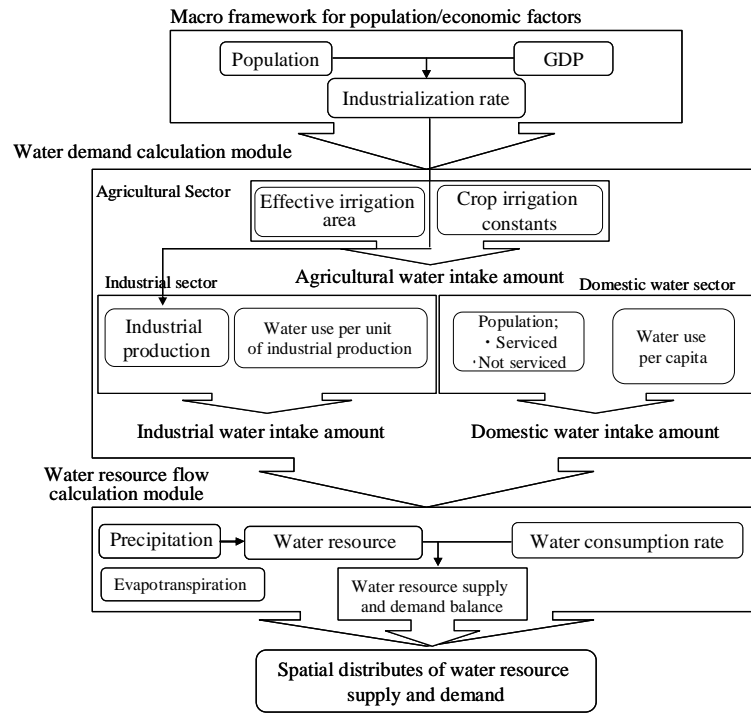


Fig. 1 Framework of water resource supply and demand model: The figure is created by Onishi.

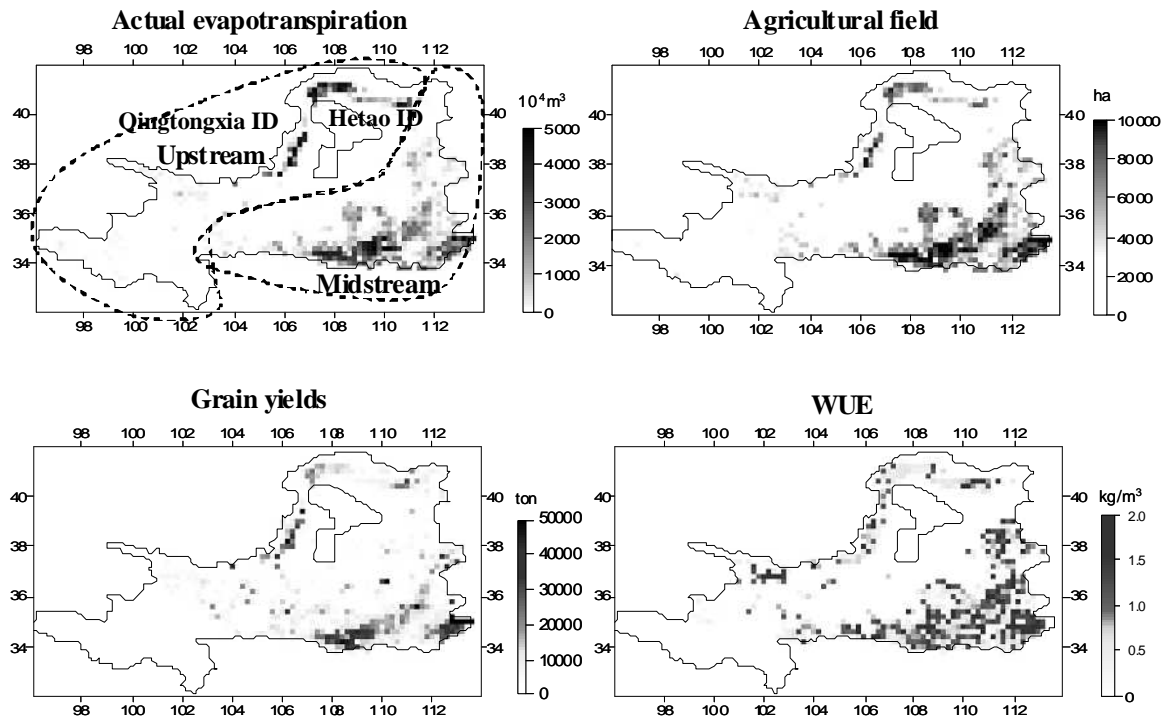


Fig. 3 Agricultural water use efficiency of 2000 in the Yellow River basin: The figure is created by Onishi.

more efficient. Of particular note, it is being suggested that the agricultural sector should sell its water-drawing permits to the industrial sector, because not enough water resources are currently being allocated to meet new demand from industrial uses. We therefore examined the current situation and issues for water rights trading in the Yellow River basin. Our findings are as follows: (1) Emissions trading is not actually being conducted under free market conditions, as the government is involved in the negotiation of transactions. (2) As a result, water rights trading are strongly nuanced in favor of economic compensation for vested interests. (3) The costs of water conservation measures should normally be the basis for the valuation of water rights, but because the methods to calculate those costs are not adequately established, their actual use is less than what is stipulated by legislation. Water rights trading can contribute to water conservation in the agricultural sector, and at the same time can increase production in the industrial sector without resorting to additional water withdrawals from other rivers. Thus, water rights trading can contribute to more efficient use of water resources. However, if water rights are not priced at the appropriate level, greater disparities are likely to arise between regions. It is therefore important to examine the socio-economic impacts of changes in water resources distribution, and to establish methods to calculate water rights pricing.

4. Conclusion

We studied on the relationship between economic development and water demand structure in the Yellow River basin. By summarizing above sub-studies, our research objective was to contribute to discussions about water resource management of the Yellow River basin.

References

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