

Photo: Björn Guterstan

# Yellow River Shows Signs of Life

## – The Future of Northern China As Region of Extreme Water Scarcity

The water predicament of the Yellow River, including Hai and Huai, its two water-starved neighbouring basins, has problems on a massive scale. It also has degrees of freedom which are limited in several senses: rural development has to be secured to avoid unwanted urban migration, irrigation water has to be secured to raise the income level of the rural population and avoid social conflicts, and food self-sufficiency on an improved nutritional level has to be secured for the rising population. At the same time, large scale sedimentation has to be avoided, otherwise flood risks to the densely populated neighbouring plains will be exacerbated.

“No China without the Yellow River,” says the Chinese Minister of Water Resources, Mr. Wang Shucheng, meaning that the North China Plateau was the result of Yellow River sedimentation. Minister Wang, who will speak during this year’s Stockholm Water Symposium, personifies the important shift in

Chinese water polices from project-based to resource-oriented water management.

### Water-rich country with water-poor areas

China is the third largest country in the world, with only Russia and Canada being larger. It has 21% of the world population and will be increasing by 200 million people over the next half century. Most of the huge country is unproductive deserts and inaccessible mountains, and most of the population live in the eastern parts, where the climate is mostly temperate and subtropical, controlled by monsoon winds, and with moist winds blowing in from the southeast in the summertime and cold dry winds from the northwest during the winter.

Overall, China is a water-rich country when seen in relation to the overall population and its per-capita water availability of some 2,200 m<sup>3</sup> per person per year (m<sup>3</sup>/p yr). This constitutes a water-crowding level of 450 people per flow unit of 1 million cubic meter per year (p/flow unit). The population continues to grow, however, so that by 2030 the per-capita availability will have declined to some 1,700 m<sup>3</sup>/p yr (600 p/flow unit) – a level where a multitude of countries tend to start relying partly on a water-deficiency driven food import (virtual water). There are, however, huge regional differences in terms of water crowding in China (see table and map).

The most water stressed regions are the Hai-Luan basin, hosting the cities of Beijing and Tientsin, and the Huai basin south of the Yellow River. Also, the Yellow River is in the chronic scarcity interval with 1400 p/flow unit. The use-to-availability ratio in these three rivers is already quite high, between 50-98.

### Implications of severe water-stress in Northern China

In China, the most arable land is in the north, where agriculture depends on irrigation. With most of the grain production coming from irrigated agriculture, water plays a major role for food security and poverty alleviation. Agriculture is the dominant sector and is thus responsible for 80% of the water demand. To support the growing population, irrigation will have to expand by some 50% by 2030. In spite of this, average water withdrawals are in most basins at or below 500 m<sup>3</sup>/p yr – only 20% of the withdrawal levels compared to the USA and Central Asia, for example!

A dramatic water crisis is looming in the grain producing regions in the north. In the Hai River basin, farmers depend on shallow groundwater, and the water table has been dropping steadily for almost 30 years. Natural streamflow has almost completely ceased in response to high consumptive use, land begins to subside and salt water intrudes into freshwater aquifers. Upstream/downstream allocation problems in the Yellow River are serious. Excessive upstream withdrawals have caused the river to dry up more and more for part of the year, culminating in 1997 with 7 months when downstream people could walk across the river bed. The flow interruption, explained by urban growth, expanding industrial use, and new irrigation projects in a number of upstream provinces, left users in the two downstream provinces Shandong and Henan without surface water sources, forcing them to switch to groundwater.

### Mastering the nexus of streamflow depletion, massive silting and flood risk

The four key problems in the Yellow River basin are closely interconnected: floods, sedimentation, streamflow depletion and



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pollution. The floods are particularly difficult to master since the river bed has over time been raised over the surrounding landscape and is now 6-10 meters higher. The flood threat is closely linked to the problem of a spectacular sediment flow colouring the river yellow. Ensuring the stability of the dikes along the lower river is a key security issue because of the high population density in the surrounding landscapes. The 100-year flood, even with the existing reservoirs operating, is an almost incredible 16,000 m<sup>3</sup>/second. In winter time, ice jams add to the flood risk problem.

Streamflow depletion adds to the problem: when water flow declines, sediments deposit in the main channel. Securing the river bed from rising is a matter of large scale soil conservation in the Loess plateau in the middle part of the river, silt retention in a well functioning system of reservoirs, and flood season silt flushing along the lower part of the river.

### Complex water management challenge

Water resources management has been key to sustaining China for 5,000 years and is key to the new challenges when moving into an open, market-oriented society. Last year the National People's Congress approved a new water law. The water law is the foundation for a holistic approach to manage water for the demands of agriculture, cities, industry and nature. The new policy even puts ecosystem functions as a priority. Integrated water resources management (IWRM) is the prescribed way to secure water for all sectors in China. The challenge ahead is how to implement new policy through rules and regulations.

The present population of 1.3 billion is sustained with domestic grain, and by 2030 some 1.6 billion are to be supplied without increased water withdrawal. This progress will be achieved through improved water use efficiency from the present 0.45 to a future 0.55. According to the Chinese Ministry of Water Resources, the future increase in water demand will happen in the urban areas as people move to the cities looking for employment in the growing industries. Today, some 400 million live in urban areas. In the next three decades this may increase to 800 million. Social and economic reasons are behind this change and will give the remaining farmers a better economic situation, while urban economic growth will sustain about half the population in the future.

The many problems of the Yellow River (drying up, siltation, floods, destroyed

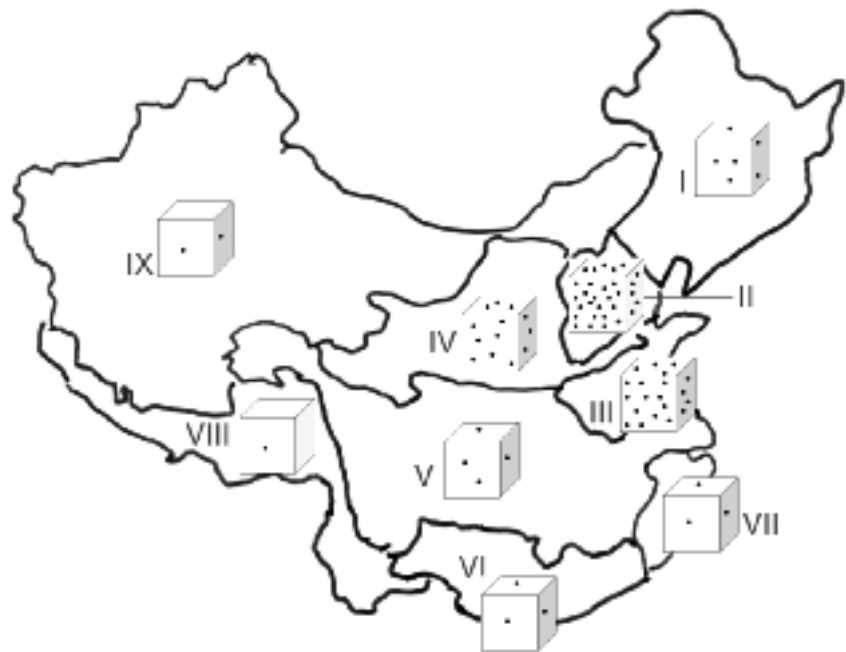
ecosystems and poor water quality) have to be addressed and managed in order to be solved. The newly empowered river basin commission recently restricted access to water in upstream provinces to increase the downstream flow. Pricing, and wise use of a set of reservoirs, contributed to the effort. Measures have also been taken to return cultivated land to recover forest and grassland. Water demanding crops like rice have been replaced by dry tolerant wheat. At the same time it is now reported that the Yellow River has again reached the sea throughout the year during the last three years.

In order to meet increasing demands of water in the dry north of China, the south to north transfer of water from the Yangtze River is being realised. The 50-year project,

which will include three main transfers, was officially started in December 2002 with the eastern transfer from Jiangsu province to Shandong and neighbouring provinces.

The question is if China will be able to move from a present very critical water situation to a re-established sustainable relation to its water resources. The holistic approach of IWRM involving all stakeholders in that process is the best guarantee for success. The policies of today with modernised water governance give hope that China will succeed and that the Yellow River will remain.

This article was co-written by Professor Malin Falkenmark of SIWI and Mr. Björn Guterstam of the Global Water Partnership.



Regional differences in terms of water crowding (population pressure on available water resources, expressed as people per flow unit of one million cubic meters of annual recharge). Increasing water crowding means an increasing dispute proneness and an increasing number of people polluting each flow unit of water. Each cube shows one flow unit, each dot equals 100 persons. Basins: I) rivers in Northern China, II) Hai river, III) Huai river, IV) Yellow river, V) Yangtze river, VI) rivers in South China, VII) rivers in Southeastern China, VIII) inland river.

TABLE. Water scarcity in China

Basin	Per capita availability m <sup>3</sup> /p yr	Water crowding p/mill m <sup>3</sup> /yr	Similar to	Use to availability ratio percent
Hai Luan	330	3030	Israel	98
Yellow	770	1300	Egypt	54
Huai	500	2000	Tunisia, Algeria	57
Yangtze	2400	420	Spain, UK	17
Total China	2200	450		