

# Yellow River Basin Management under Pressure. The Present State, Restoration and Protection: Lessons from a Special Issue

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Ecological protection and high-quality development in the basin of the Yellow River, known as China's "Mother River" and "the cradle of Chinese civilization", have been receiving increasing attention because of the important role they play in China's economic and social development, and its cultural heritage. Under ongoing climate change and intense human activities, the Yellow River basin is facing crucial challenges, e.g., flooding, water security, water resource shortage, water pollution, and ecological environment degradation, which seriously affects the sustainable development of the regional economy and society. Meanwhile, significant differences in key characteristics across the upper, middle, and lower reaches call for joint management efforts, including integrated management, water conservancy, and ecological environment restoration. This Special Issue focusses on the current state, challenges, and suggestions relating to Yellow River basin management and sustainable development under pressure, aiming to help improve ecological protection and achieve high-quality development. The following topics, including the management, restoration and protection of the Yellow River basin, and harmonious regulation of the human–water relationship were systematically studied. The main themes are listed as follows:

- (1) Current state and characteristics of Yellow River basin management;
- (2) Influence of the changing environment on the characteristics of the Yellow River;
- (3) Harmonious regulation of the human–water relationship;
- (4) Integrated management under a changing environment.

This Special Issue aims to exhibit scientific research on the themes mentioned above.

This Special Issue includes sixteen original contributions focused on Yellow River basin management under pressure. Considering the unique regional characteristics of the Yellow River in China, the contributions mainly result from research conducted by universities and R & D institutions in China.

The sixteen articles in this Special Issue can be divided into four categories: category A: "The characteristics of Yellow River basin management"; category B: "Influence of the changing environment on the characteristics of the Yellow River"; category C: "Harmonious regulation of the human–water relationship"; category D: "Integrated management under a changing environment". References [1–6] belong to category A; References [7–10] belong to category B; References [11–13] belong to category C; References [14–16] belong to category D.

In category A "The characteristics of Yellow River basin management", Junjie Xu et al. [1] systematically studied the trends of hydrological elements in the Weihe River basin (1970–2019) by using the M–K analysis method. Seldom significant changes in the potential evapotranspiration and precipitation were observed in the Weihe River basin among



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1970–2019. In the study by Guosheng Duan et al. [2], the transportation of cohesive bank-collapsed materials in a sharply curved channel was simulated, while the quantities of the collapsed materials that transformed into suspended and bed loads were comprehensively analyzed. Based on the transverse distribution formula of the river section, and the water and sediment factors, Linjuan Xu et al. [3] investigated the asymmetry of the cross-sectional shape as well as the water and sediment factors, along with the transverse distribution in the wandering reaches of the lower Yellow River. Xiaoxia Tong et al. [4] studied the characteristics and causes of changing groundwater quality in the boundary line between the middle and lower Yellow River (right bank), and the relationship between the hydrochemical evolution of river water and groundwater. Mingcan Gao et al. [5] studied the spatial and temporal evolution and the human–land relationship at early historic sites in the middle reaches of the Yellow River in the Sanhe Region, by using the GIS technology. Jiandong Li et al. [6] analyzed the aggregation characteristics of early settlements in the Zhengzhou ancient Yellow River distributary area based on the data of distributaries, lakes and swamps, and early settlements of the ancient Yellow River.

For the category B “Influence of the changing environment on the characteristics of Yellow River”, the article of Yadi Run et al. [7] analyzed the dynamics of land and water resources and the utilization of cultivated land of the Yellow River beach area by using Landsat and Sentinel-2A/B images, and data from the Third National Land Survey. Zhizhuo Zhang et al. [8] measured the dynamics of water use level (by using SBM-DEA Model) compared with economic and social developments of the Yellow River basin, and the spatial and temporal evolution of composite water use indices in nine provinces of the Yellow River basin from 2012 to 2018. The article by Jialu Li et al. [9] analyzed the occurrence and ecological risk assessment of heavy metals in the Wuliangsuhai Lake, Yellow River basin, and the heavy metals in sediment interstitial water, surface sediments, and sediment cores. Shuangyan Jin et al. [10] analyzed the return period of “7.20” rainstorm in the Xiaohua section of the Yellow River in 2021, based on the maximum rainfall data of different periods and the “7.20” rainstorm data of the section from Xiaolangdi to Huayuankou of the Yellow River in 2021.

In the category C “Harmonious regulation of the human–water relationship”, Jiawei Li et al. [11] studied the regulation of the harmonious relationship between water, energy, and food of the nine provinces along the Yellow River basin by using the WEF harmony framework. The article by Wenge Zhang et al. [12] studied the water allocation rights of coordinated development on water–ecology–energy–food, which has built a water allocation rights model with the goals of fairness, efficiency, and coordinated development. Zuotang Yin et al. [13] studied the multi-scale spatiotemporal characteristics of soil erosion and its influencing factors in the Yellow River basin, by using the revised universal soil loss equation (RUSLE) and optimal parameters-based geographical detector (OPGD).

For the category D “Integrated management under a changing environment”, the article by Xinjian Guan et al. [14] focused on the water allocation rights of irrigation water users in irrigation districts of the Yellow River basin, establishing a double-level water allocation rights model of national canals–farmer households in irrigation districts by using the Gini coefficient method. Fang Wan et al. [15] investigated the ecological water demand and ecological water supply in the Wuliangsuhai Lake (the largest shore lake in the upper reaches of the Yellow River), and proposed potential ways to meet the requirements for ecological water demand. The article of Yifei Zhang et al. [16] investigated the environmental regulation, local government competition, and high-quality development of 78 prefecture-level cities in the Yellow River basin by using panel data.

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## References

1. Xu, J.; Gao, X.; Yang, Z.; Xu, T. Trend and Attribution Analysis of Runoff Changes in the Weihe River Basin in the Last 50 Years. *Water* **2022**, *14*, 47. [[CrossRef](#)]
2. Duan, G.; Liu, H.; Shao, D.; Yang, W.; Li, Z.; Wang, C.; Chang, S.; Ding, Y. Numerical Simulation of the Transportation of Cohesive Bank-Collapsed Materials in a Sharply Curved Channel. *Water* **2022**, *14*, 1147. [[CrossRef](#)]
3. Xu, L.; Jiang, E.; Zhao, L.; Li, J.; Zhao, W.; Zhang, M. Research on the Asymmetry of Cross-Sectional Shape and Water and Sediment Distribution in Wandering Channel. *Water* **2022**, *14*, 1214. [[CrossRef](#)]
4. Tong, X.; Tang, H.; Gan, R.; Li, Z.; He, X.; Gu, S. Characteristics and Causes of Changing Groundwater Quality in the Boundary Line of the Middle and Lower Yellow River (Right Bank). *Water* **2022**, *14*, 1846. [[CrossRef](#)]
5. Gao, M.; Lyu, H.; Yang, X.; Liu, Z. Spatial and Temporal Evolution and Human–Land Relationship at Early Historic Sites in the Middle Reaches of the Yellow River in the Sanhe Region Based on GIS Technology. *Water* **2022**, *14*, 2666. [[CrossRef](#)]
6. Li, J.; Song, Y.; Zhang, W.; Zhu, J. Analysis of the Aggregation Characteristics of Early Settlements in the Zhengzhou Ancient Yellow River Distributary Area. *Water* **2022**, *14*, 2961. [[CrossRef](#)]
7. Run, Y.; Li, M.; Qin, Y.; Shi, Z.; Li, Q.; Cui, Y. Dynamics of Land and Water Resources and Utilization of Cultivated Land in the Yellow River Beach Area of China. *Water* **2022**, *14*, 305. [[CrossRef](#)]
8. Zhang, Z.; Zuo, Q.; Jiang, L.; Ma, J.; Zhao, W.; Cao, H. Dynamic Measurement of Water Use Level Based on SBM-DEA Model and Its Matching Characteristics with Economic and Social Development: A Case Study of the Yellow River Basin, China. *Water* **2022**, *14*, 399. [[CrossRef](#)]
9. Li, J.; Zuo, Q.; Feng, F.; Jia, H. Occurrence and Ecological Risk Assessment of Heavy Metals from Wuliangshai Lake, Yellow River Basin, China. *Water* **2022**, *14*, 1264. [[CrossRef](#)]
10. Jin, S.; Guo, S.; Huo, W. Analysis on the Return Period of “7.20” Rainstorm in the Xiaohua Section of the Yellow River in 2021. *Water* **2022**, *14*, 2444. [[CrossRef](#)]
11. Li, J.; Ma, J.; Yu, L.; Zuo, Q. Analysis and Regulation of the Harmonious Relationship among Water, Energy, and Food in Nine Provinces along the Yellow River. *Water* **2022**, *14*, 1042. [[CrossRef](#)]
12. Zhang, W.; He, Y.; Yin, H. Research on Water Rights Allocation of Coordinated Development on Water–Ecology–Energy–Food. *Water* **2022**, *14*, 2140. [[CrossRef](#)]
13. Yin, Z.; Chang, J.; Huang, Y. Multiscale Spatiotemporal Characteristics of Soil Erosion and Its Influencing Factors in the Yellow River Basin. *Water* **2022**, *14*, 2658. [[CrossRef](#)]
14. Guan, X.; Wang, B.; Zhang, W.; Du, Q. Study on Water Rights Allocation of Irrigation Water Users in Irrigation Districts of the Yellow River Basin. *Water* **2021**, *13*, 3538. [[CrossRef](#)]
15. Wan, F.; Zhang, F.; Zheng, X.; Xiao, L. Study on Ecological Water Demand and Ecological Water Supplement in Wuliangshai Lake. *Water* **2022**, *14*, 1262. [[CrossRef](#)]
16. Zhang, Y.; Wang, Y.; Jiang, Y. Environmental Regulation, Local Government Competition, and High-Quality Development—Based on Panel Data of 78 Prefecture-Level Cities in the Yellow River Basin of China. *Water* **2022**, *14*, 2672. [[CrossRef](#)]