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RECEIVED 20 September 2023

ACCEPTED 01 November 2023

PUBLISHED 07 November 2023

## CITATION

Wan Z, Wan R, Ahmad S and Eyvaz M  
(2023), Editorial: Sustainable  
development on water resources  
management, policy and governance in a  
changing world.  
*Front. Environ. Sci.* 11:1297585.  
doi: 10.3389/fenvs.2023.1297585

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# Editorial: Sustainable development on water resources management, policy and governance in a changing world

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## KEYWORDS

sustainable development, water resources management, water resources policy, water resources governance, sustainability

## Editorial on the Research Topic

**Sustainable development on water resources management, policy and governance in a changing world**

Water resource management holds a significant role in upholding human wellbeing, agricultural productivity, and the delicate equilibrium of ecosystems. The escalating challenges posed by climate change have led to frequent discussions about the water-energy-food nexus, which underscores the interplay between these elements and their impact on the climate. Consequently, water resource management has emerged as a crucial focal point for endeavors in sustainable development. The complexity of water management and policy formulation has amplified, particularly in economically developing nations, including those with lower to middle-income levels. Beyond the repercussions of climate fluctuations, several factors such as imbalances in power dynamics, restricted access to water resources, and socio-cultural and socio-economic disparities are further complicating the prospects for reaching sustainable water governance across various regions worldwide. Simultaneously, ecological harm and degradation in diverse global locales exert an influence on policies and the sustainable administration of water resources. In the face of the ongoing shifts in our global landscape, the availability and quality of water resources confront grave perils.

In this context, we are honored to introduce this Research Topic of our esteemed environmental journal, a Research Topic of scholarly articles. In this Research Topic consisting of six original research papers, two brief research reports, and one data report, we delve into the intricate web of issues surrounding water resources management, focusing on the policies and governance structures underpinning sustainable development. The importance of each of the following studies cannot be overstated, as they contribute significantly to our understanding of the complexities inherent in water resource management:

The first article on this Research Topic empirically shows a significant positive correlation between the advancement of marine science and technology and the overall sustainability of marine economies. The analysis ventures into the growth models of key

marine economic zones, including the “Circum-Bohai Sea Economic Zone,” “Yangtze River Delta Economic Zone,” and “Pearl River Delta Economic Zone.” The study employs a threshold panel model to dissect the influences of five critical factors: opening to international markets, government investment, financial development, human capital, and technology investment. Consequently, it becomes evident that a plethora of external influences converge, sometimes synergistically and at other times restrictively, to shape the overarching impact of innovation in the marine sector (Wu et al.).

Wang et al. venture into the realm of waterfront tourism sustainability in the West Strait of China. This exploration introduces an innovative framework for evaluating the sustainability of waterfront ecotourism. Developed through two rounds of expert consultation, this framework quantifies the significance of various indicators, offering valuable insights for stakeholders in the field. The weighted indicators encompass Waterfront Tourism Design, Ecotourism Experience, Aquatic Ecological Knowledge Sharing, Pro-Water Culture, Pro-Water Identity, Aesthetic Value of Water Landscape, Pro-Water City Brand, Infrastructure Construction, Regional Economic Development, Folkway Support, and Government Policy Support. Empirical data collected from five core cities in the West Strait region illuminate the critical impact of certain indicators, with Pro-Water Culture emerging as the most influential, followed by Aquatic Ecological Knowledge Sharing. In contrast, Pro-Water City Brand and Folkway Support exhibit negligible effects on waterfront ecotourism. This comprehensive evaluation framework paves the way for informed decision-making in the realm of ecotourism sustainability. In another research, Xu et al. embark on a journey to visualize the spatial distribution of water-polluting enterprises in Zhejiang Province, China. It scrutinizes the effectiveness of environmental regulations and underscores the prevalence of water pollution enterprises in regions characterized by lower environmental standards and weaker enforcement. The study employs advanced spatial analysis techniques to reveal that water pollution enterprises tend to cluster, needing more rigorous environmental oversight. These findings underscore the importance of optimizing industrial structures and enhancing surveillance of suburban water pollution enterprises to curtail their environmental impact.

In the follow-up study, the intricacies of collaborative watershed management within the Chehelchay region of Golestan province, Iran are endeavored to be unraveled (Rezaei-Moghaddam and Fatemi). It investigates the organizations involved in managing the watershed, dissecting the types and intensity of communication and interaction between these entities. This network analysis underscores the pivotal role of identifying key actors with substantial social power in the context of local natural resource management. By harnessing the capabilities and resources of these organizations and individuals, the runtime and cost of implementing natural resource projects can be significantly reduced. The study underscores the crucial role of social power and comprehensive participatory management as essential tools for fostering trust among local natural resource users. Moreover, it emphasizes the necessity of transitioning from traditional governmental management paradigms to more inclusive

governance structures to ensure the sustainable management of natural resources and watersheds.

Our fifth contribution casts a discerning eye on groundwater quality within Jieshou City, uncovering potential health hazards stemming from abnormal ion concentrations. Through meticulous analysis of hydrogeological conditions, water chemistry, and ion sources, the study offers critical insights into the composition and characteristics of groundwater in the region. The results elucidate that the groundwater in Jieshou City is characterized as marginally alkaline water, dominated by Na<sup>+</sup> cations and HCO<sub>3</sub><sup>-</sup> anions. Furthermore, the study reveals that Na<sup>+</sup> and F<sup>-</sup> ions exceed the standard for Class-III water quality, with their concentrations positively correlated with monitoring depth. The primary sources of abnormal ions are traced back to fluorine-containing rocks, emphasizing the profound influence of local geological settings, hydrochemical factors, and human activities on groundwater composition by (Su et al.).

Ishaque et al. grapples with the formidable challenge of Pakistan's impending water crisis. The study accentuates the dire consequences of climate change, manifesting in recurring droughts and floods. It posits that inadequate water reservoirs, wasteful agricultural practices, minimal wastewater recycling, and water contamination pose severe health risks and substantial national security threats. The research unequivocally asserts that unless Pakistan addresses its burgeoning water crisis promptly, it has the potential to become the most pressing national security concern. To avert this catastrophe, the article advocates for integrated smart technology solutions, efficient water governance, and sustainable water management strategies. In another study on Pakistan, Majeed et al. takes us to the heart of disaster vulnerability by scrutinizing flash flood susceptibility in the district of Jhelum, Punjab, Pakistan. Employing geospatial models and sophisticated methodologies, this research endeavors to assess and understand the factors contributing to the region's vulnerability. The study meticulously considers eight influential flood-causing parameters, including the Digital Elevation Model, slope, distance from the river, drainage density, land use/land cover, geology, soil resistivity, and rainfall deviation. These parameters are carefully weighted using the Analytical Hierarchy Process (AHP) and Frequency Ratio (FR) methods, enabling a nuanced evaluation of flood susceptibility. This detailed spatial analysis is vital for disaster management authorities, infrastructure planners, and policymakers, providing them with crucial insights to better prepare for and mitigate the impacts of future floods.

Liu et al. employs a synergistic approach, combining the System Dynamics (SD) model and the Technique for Order Preference by Similarity to an Ideal Solution (TOPSIS) method, to unravel the dynamic water resources carrying capacity (WRCC) of the Hangbu River basin. This novel method yields intriguing results, indicating that the WRCC of each scenario initially declines before experiencing a resurgence. Notably, the scenario that prioritizes water resources diverges from conventional WRCC studies and underscores the significance of the research method, as well as the specific development focus and level of the study area. The article concludes with prescient recommendations, emphasizing the importance of enhancing irrigation water use efficiency and adopting a forward-thinking approach to regional development.

The final contribution casts a spotlight on the profound impacts of typhoons on agriculture in Taiwan, a coastal region susceptible to extreme weather conditions. This study assesses agricultural losses and emphasizes the role of flood control infrastructure in safeguarding agricultural activities. The research employs Data Envelopment Analysis (DEA) and geographical mapping to unveil spatial disparities in agricultural losses caused by typhoons. Notably, the study highlights how flood control infrastructure has been instrumental in reducing agricultural damage in certain areas (Wei et al.).

As we reflect upon these nine remarkable contributions, a resounding theme emerges—the critical importance of water resources in the context of sustainable development. Whether it be the nexus between marine science and economic prosperity, the evaluation of ecotourism sustainability, collaborative watershed management, groundwater quality, or the looming water crisis, each article underscores the urgency of addressing water-related challenges. Furthermore, our examination of water pollution enterprises, water resources carrying capacity, flash flood susceptibility, and typhoon effects on agriculture all emphasize the intricate interplay between environmental factors, policy decisions, and governance structures. These studies collectively offer guidance and a road map for navigating the complex terrain of sustainable water resource management in an ever-changing world.

The research highlighted in this Research Topic provides valuable insights, not only for scholars and researchers but also for policymakers, practitioners, and the broader community. In closing, we express our heartfelt gratitude to the authors, reviewers, and all those who contributed to this Research Topic. We hope that

the reader will find a useful reference on the sustainable management of water resources in this Research Topic.

## Author contributions

ZW: Writing—original draft, Writing—review and editing. RW: Writing—original draft, Writing—review and editing. SA: Writing—original draft, Writing—review and editing. ME: Writing—original draft, Writing—review and editing.

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The author(s) declared that they were an editorial board member of *Frontiers*, at the time of submission. This had no impact on the peer review process and the final decision.

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