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Editorial

Introduction to the Special Issue "Socio-Hydrology: The New Paradigm in Resilient Water Management"

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Water is life! Ancient human communities were established in close proximity of natural water systems, i.e., streams and rivers, lakes, springs and oceans, where water was readily available for human consumption. Science and technology, environmental and social values related to water source development and use have evolved over generations. In modern times, the 18th century Industrial Revolution can be considered as a benchmark for human intervention in natural systems. Energy production and use, in the form of fossil fuels (i.e., coal and petroleum), enabled water transport from source to distant consumers and caused the emergence of high-density population (urban) centers, accelerated industrial activity, and modernized the agricultural and food production systems. It is important to note that the environmental and social values of the 18th century were dictated by the 18th century state-of-knowledge and values and did not foresee the unintended consequences of accelerated human intervention on natural systems and environment degradation throughout the 20th century, and even up until today in some parts of the world.

On a positive note, the 20th century witnessed significant modernization in the arena of water resources development and water infrastructure. The technological accomplishments of the 20th century include building dams and reservoirs, using powered pumps to extract deep groundwater and surface water resources, construction of centralized water treatment plants and water delivery pumps and pipelines to transport clean drinking water to homes and public and commercial buildings, and installing sewer and stormwater pipes to move wastewater and stormwater runoff away from population centers. However, the technologies and water management strategies that were implemented in the 20th century did not fully integrate environmental impact assessments and social and anthropogenic factors in the planning and design of sustainable water management systems [1].

During the third decade of the 21st century, human societies across the world are being challenged with significant water-related problems such as ecosystem degradation, groundwater depletion, natural and anthropogenic drought and floods, water borne health issues, and deforestation. These problems are exacerbated by climate change, a phenomenon that is largely accelerated due to human intervention in natural systems since the Industrial Revolution. The impacts of climate change demonstrate how the overall benefit of economic development during the past two centuries can be negated by neglecting the influence of anthropogenic factors in the planning and design of water management systems. The impact of climate change on water resources includes, but is not limited to, increases in regional and average global temperatures, resulting in changes in precipitation patterns and intensity; the severity and length of droughts; sea level rise and its associated consequences (e.g., the flooding of coastal cities and the encroachment of saline waters

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into freshwater aquifers); and increased acidity of the oceans acidity and its consequences, resulting in a potentially significant impact on marine ecosystems, as well as the health of coral reefs, shellfish and fisheries [2].

Furthermore, due to the accelerated interconnectedness of the global economy, the adverse impact on global hydrologic conditions in recent decades has become a critical factor that impedes the sustainable management of water resources across the world. There is a significant need to better understand the interaction of hydrological systems, such as climate variability and anthropogenic factors, that contribute to the dynamics and resilience of coupled human–water systems and effective risk management in the arena of water resources management. Consequently, there is significant demand for a paradigm shift toward seeking resilient solutions for complex water management problems.

The emerging field of socio-hydrology intends to address these complex water management issues. Socio-hydrology is an interdisciplinary field that integrates the natural and social sciences and aims to study the long-term dynamics of bidirectional feedback in coupled human–water systems [3–5]. The science of coupled human–water systems is based on the interconnectedness of global biophysical and social processes and aims to examine tradeoffs and synergies in order to provide scientific feedback for defining resilient solutions that resolve complex water management problems. The feedback approach in socio-hydrologic studies further advances the concept of Integrated Water Resources Management (IWRM), a practice that promotes the coordinated development and management of water, land and related resources in order to maximize economic and social benefits.

This Special Issue on socio-hydrology was planned to compile interdisciplinary scientific endeavors and innovations on coupled human–water systems research development, education, and applications. Articles were sought to explore and discuss the following topics and research case studies within the context of socio-hydrology: (1) methods applied in socio-hydrology research and education; (2) socio-hydrologic studies across interdisciplinary boundaries; (3) analysis of the spatial dimension of socio-hydrologic factors; (4) resilience assessment and risk management in coupled human–water systems; (5) socio-hydrologic modeling techniques and applications; and (6) other topics relevant to socio-hydrology.

This Special Issue is by no means a comprehensive coverage of the socio-hydrology issues but attempts to open a window to observe and understand emerging topics of socio-hydrology through various applications and case studies. The articles published in this Special Issue represent diverse and broad aspects of water management in the context of socio-hydrology systems around the globe. The topics discussed include hydrologic and economic implications of irrigation efficiency policy; the role of public trust, risk perceptions and social salience in selecting drinking water sources; landslide susceptibility to anthropogenic influences, which can cause profound social and economic impacts; the assessment of the influence of anthropogenic factors on watershed scale water quality; the assessment of the societal readiness and resilience against water-related crises such as floods, dam failure, drinking water disruption and excessive precipitation; the application of the common pool resource principle to foster groundwater resilience and avoid water source exploitation; social barriers and the hiatus from the successful implementation of green stormwater infrastructure; the application of a socio-hydrology model in agrarian communities focused on knowledge sharing among scientists, local knowledge-holders and students; and a case study of the impact of regional climate change on coastal tourism.

The articles and ideas presented in this Special Issue can be significant reference sources for interdisciplinary water science programs and an excellent guide for experts involved with the futuristic planning and management of water resources.

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