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Editorial

Land and Water Resources for Food and Agriculture

Fan Zhang [1,*] and Mo Li [2]

[1] Jixian National Forest Ecosystem Observation and Research Station, National Ecosystem Research Network of China (CNERN), School of Soil and Water Conservation, Beijing Forestry University, Beijing 100083, China
[2] School of Water Conservancy & Civil Engineering, Northeast Agricultural University, Harbin 150030, China; limo0828@neau.edu.cn
* Correspondence: zhang_fan@bjfu.edu.cn

1. Introduction

As the population continues to increase, the demand for food has never been greater, placing immense pressure on the sustainable management of land and water resources. With increasing desertification, deforestation, and the pollution of freshwater sources, the challenges to maintaining arable land and clean water are more complex than ever. These challenges are exacerbated by the interplay between agricultural practices, water usage, and environmental conservation, which requires innovative, multifaceted solutions to ensure food security and ecological balance. With this in mind, we presented the Special Issue entitled "Land and Water Resources for Food and Agriculture", a compilation of cutting-edge research that delves into these pivotal areas.

This issue brings together a diverse array of studies that offer novel insights and approaches to optimize the use of land and water resources in agricultural contexts. The topic garnered a significant response from the scientific community, reflecting the urgency and relevance of the topics addressed. It is our hope that this Special Issue will serve as a catalyst for further exploration and action in pursuit of sustainable agricultural practices.

2. Overview of the Special Issue

The collected studies focused on optimizing agricultural water resources, assessing sustainable land use, exploring agricultural technologies for environmental benefits, and understanding the interplay between hydrological conditions and human activities.

2.1. Agricultural Water Resource Optimization and Management

With the aim of improving water use efficiency in agricultural production, some studies successfully applied inventive approaches to optimize and manage agricultural water resources.

Zhang et al. [1] introduced a cloud-based framework tailored for arid agriculture, adeptly managing uncertainties inherent in this context. Through the integration of subjective market conditions and the stochastic modeling of meteorological variables, the study offered a nuanced understanding of irrigation water allocation under unpredictable conditions. This framework provided decision-makers with a robust tool for optimizing irrigation practices, crucial for mitigating water scarcity in arid regions.

A Bayesian AI approach to evapotranspiration estimation was proposed by Ribeiro et al. [2]. This approach represented a pivotal innovation in addressing data limitations in agricultural water management. By leveraging Bayesian regression and networks, the study offered a flexible and data-driven solution for estimating missing climatological variables, essential for irrigation planning and decision support systems. This approach not only improved the accuracy of evapotranspiration estimates but also enhanced the resilience of agricultural systems to changing environmental conditions.

The study by Wang et al. [3] explored a strategy to improve the Sacramento Soil Moisture Accounting (SAC-SMA) model's simulation performance by using soil properties

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from the Harmonized World Soil Database (HWSD). The researchers used HWSD soil properties to estimate soil moisture characteristics and identified Soil Conservation Service (SCS) runoff curve numbers (CNs) based on land cover types. The major parameters of the SAC-SMA model were then derived and adjusted using the Free Search algorithm for better calibration.

The optimization–evaluation framework presented by Zhou et al. [4] offered a holistic approach to managing agricultural resources within the water–energy–food nexus. By coupling optimization techniques with entropy-weighted TOPSIS evaluation modules, the study provided a pathway towards balanced resource management, considering water and energy efficiency alongside economic and ecological considerations. Its successful application in the Jinxi irrigation district demonstrated its potential to enhance the sustainability of agricultural systems.

2.2. Sustainable Utilization and Evaluation of Agricultural Land

To promote the sustainable utilization of agricultural land, several studies explored sustainable practices in land use and agriculture amidst various environmental and socio-economic challenges.

Chen et al. [5] kickstarted the narrative by framing the discussion around the intricate interplay between water, land, energy, and food in the context of sustainable land use. Their study in Quzhou County, China, served as a testament to the ongoing efforts and positive trends in sustainable land management, despite hurdles such as water scarcity.

Building upon this foundation, Hu et al. [6] probed the realm of practical solutions, focusing on zeolite's potential to address excess nitrogen and phosphorus in paddy fields where straw is returned to the soil. Their findings highlighted a promising method to mitigate water quality deterioration, thus aligning with the overarching goal of sustainable land management.

Meanwhile, Chen et al. [7] explored the synergy between agricultural productivity and environmental stewardship. Through their investigation into the effects of straw return and nitrogen fertilizer reduction on rice plants, they unveiled a pathway towards eco-friendly agricultural practices that enhance water productivity and yield, while also promoting efficient resource utilization.

In parallel, Prochazka et al. [8] pivoted towards the economic dimensions of sustainable land use, shedding light on the factors influencing the value of agricultural land. By analyzing long-term relationships and short-term fluctuations in farmland prices, their research aimed to inform policymakers on strategies to stabilize the agricultural land market, thereby fostering an environment conducive to sustainable land management practices.

Zou et al. [9] broadened the scope by examining the multifunctional aspects of cropland resources in rapidly urbanizing regions, using Guangzhou as a case study. Their comprehensive analysis underscored the need for a cognitive framework that integrates production, ecological, and living functions of cropland, offering valuable insights into sustainable land management practices tailored to urbanizing landscapes.

2.3. Agricultural Technology and Environmental Impact

Sustainable agricultural practices and land management were focused on in some studies, weaving together technological innovations, policy analyses, and ecological considerations.

Shi et al. [10] investigated the potential of magnetized water to mitigate emitter clogging in drip fertigation systems. These systems play a pivotal role in optimizing water and fertilizer usage in agriculture. Through rigorous field experiments spanning two planting seasons, they evaluated how magnetized water impacts clogging and system performance. Their findings underscored the efficacy of magnetized water treatment in reducing clogging, enhancing water flow, and enhancing overall system efficiency. This environmentally friendly approach holds promise for revolutionizing drip irrigation management.

In parallel, Wang et al. [11] undertook a comprehensive analysis of China's Basic Farmland Protection System (BFPS). Recognizing its critical role in ensuring national food security and sustainable socio-economic development amidst limited per capita farmland, they scrutinized its evolution, current challenges, and future prospects. Their study proposed strategic enhancements for the BFPS, emphasizing the necessity of integrating ecological civilization principles into territorial spatial planning. Such integration is pivotal for safeguarding China's agricultural landscape and advancing towards sustainable development goals.

2.4. The Relationship between Hydrological Conditions and Human Activities

Some studies looked into the intricate dynamics of hydrological systems, each shedding light on different facets of the complex interplay between human activities, climate change, and water resource management.

Zhang et al. [12] employed advanced modeling techniques to dissect the dynamic response of runoff in the Lancang River, China, to human-induced changes and climate variations. By integrating hierarchical structure hydrological modeling with vector autoregressive modeling, their research dissected the relative impacts of anthropogenic activities and climate shifts on runoff dynamics. Their findings not only deepened our understanding of runoff response but also furnished valuable insights into the nuanced influences of meteorological variables on hydrological processes, paving the way for more accurate and stable runoff simulations.

Yang et al. [13] focused on the Yongding River Basin, specifically examining the Xiangshuipu section, to unravel the evolution of hydrological conditions and their driving forces. Employing a combination of the Indicators of Hydrologic Alteration (IHAs), the Range of Variability Approach (RVA), and the WetSpa model, their study identified key hydrological indicators and quantified the contributions of climate change, reservoir storage, and irrigation practices to hydrological alterations. By elucidating periods of hydrological variability and discerning the impacts of various factors, their research offered crucial insights for effective water resource utilization and ecological management within the basin.

3. Conclusions

As we reflect on the content of this Special Issue, it is clear that the path forward requires continued research, investment in new technologies, and the implementation of effective policies that support the sustainable use of land and water resources. The findings and discussions presented in these pages serve as a call to action for the scientific community, policymakers, and practitioners to work together towards a more sustainable and food-secure future.

We hope that this collection of research will inspire further exploration, dialogue, and action in the pursuit of innovative solutions for the sustainable management of land and water resources in agriculture.

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