Water Practice & Technology

IWA PUBLISHING

Water Practice & Technology Vol 18 No 10, 2207 doi: 10.2166/wpt.2023.163

Editorial: water and environmental solutions for adaptation to global change pressures in developing countries

The Sustainable Development Goals are a global call for action to end poverty, protect the earth's environment and climate, and ensure that people everywhere can enjoy peace and prosperity. Goals 6, 7, 11, and 13 focus on increasing access to clean water and sanitation, providing sustainable and affordable energy, mitigating the effects of climate change, and making cities sustainable.

In an era of unprecedented global change, the challenges faced by developing countries when it comes to adapting to environmental pressures are becoming more complex and urgent. One of the most crucial issues is the sustainable management of water resources and the environment. As climate change, population growth, and urbanization exert mounting pressures, innovative analyses, approaches, and solutions must be implemented to ensure the resilience and adaptability of developing nations while accelerating progress towards achieving the aforementioned goals.

This special issue delves into the pressing need for water and environmental solutions that address the unique challenges experienced by developing countries and is a contribution from mainly from participants of the IDRC funded project titled Building Capacity in Water Engineering for Addressing Sustainable Development Goals in East Africa (CAWESDEA) project and other Water and Environmental Practitioners. The objective of the CAWESDEA project was to strengthen the capacity of engineers in East Africa by enhancing their competency and employability to effectively meet the societal and developmental needs, focusing on gender parity in the profession. For this reason, 13 articles were selected to be published after unbiased and rigorous peer reviews. These contributions show a variety of innovative water and environmental approaches, analyses, models, and solutions that are tailored to the adaptation to global change pressures as well as the unique challenges that often exist in developing countries. We hope that this issue sparks interest from various people in supporting and implementing these solutions, such that no community is left behind in the face of global change.

Phulpagar & Ganesh (2023) investigated the prioritization of groundwater masses and identified the factors influencing groundwater depletion trends by applying two innovative approaches in Ajmer Division, India. The first approach, which focuses on prioritizing groundwater masses, was implemented by analysing seasonal groundwater table trends, while the second approach focused on identifying the factors influencing the downward trend in groundwater by analysing trends in climatic parameters, minimum temperature, and precipitation. The study demonstrated that the application of trend analysis is essential for proper groundwater resource management.

It is necessary to adopt an innovative method of man-made aquifer replenishment as explained by Ousrhire & Ghafiri (2022). A structure of the existing literature on man-made aquifer recharge, highlighting the most recent stages and aspects that have been covered while identifying the open issues, knowledge gaps, areas for improvement, and research trends in this field, has been presented here. Ousrhire & Ghafiri (2022) provide a broad perspective on the artificial aquifer recharge (AAR) as a solution to curb flooding and reduce water scarcity. Consequently, the study provides a benchmark for their implementation depending on the geographical characteristics. These results provide a basis for future works to facilitate the better comprehension of AAR.

To study the impact of climate change on a drainage network using the hybrid approach – a combination of the past performance approach used for ranking general circulation models and the envelope approach based on future climate projections. Sharma & Ganesh (2022) focused on the effect of climate change on Surat City's stormwater drainage and identified Nash-sutcliffe efficiency (NSE) as the principal factor for ranking General circulation models (GCMs). The study revealed the possibility of severe future events increasing the likely occurrence of floods. The results provide groundwork for future climatic and hydrological studies on the study area.

Lusweti *et al.* (2022) studied the impacts of oil exploration on surface water quality highlighting the variations in the composition of oil-produced water and recommending site-specific tests to ascertain the composition. The study opens up extensive possible areas for future research such as the need to investigate the health precautions resulting from exposure to oil-related contaminants and the development of policy dialogues in water quality management. The study identified the need for the detailed analysis of heavy metals in water and/or sediments and an understanding of the hydro-chemical facies of surface water at oil drilling sites for effective policy formulation.

Tusingwiire *et al*. (2023) assessed the combined impacts of climate change and land use on mini-hydropower generation in the Kyambura watershed using the soil and water assessment tool (SWAT). The results highlighted an increase in urban land use, barren land, and water by 11.89, 25.78, and 0.49%, respectively, with a vegetation area reduction of 38.17% by the year 2050. An increase of over 10% is anticipated in average annual hydropower generated by the year 2050. The total annual rainfall and temperatures were predicted to increase by 7% and 0.5 °C by the year 2050. The study highlighted the need for formulating governing policies to regulate and preserve the watersheds and ensure the reliability of power production.

Using historical data, Auma *et al.* (2023) developed two logistic regression models, binomial and multinomial, and evaluated them according to their prediction accuracy, receiver operator traits, and area under the curve. The findings indicated that the binomial regression model performed better than the multinomial model, and it was concluded that the models may be used to alter data collection procedures to more accurately identify probable water pipes that need repair or replacement.

To encourage quick corrective steps, Marwa *et al.* (2022) focused on evaluating the operational state of water pumps and building a suitable application for early defect detection. As such, they assessed the operational workings of pumps and developed a web and mobile-based Android application that primarily identified pump failures for use in rural projects. The developed pump diagnosis tool provides a rapid insight into the working state of the pump and the necessary measures to address the diagnosed problem, all in advance to reduce equipment downtime, a principal factor in water supply breakdowns.

Ombasa *et al.* (2022) combined the methods of the Remote Sensing-Geographical Information System (RS-GIS) and the Analytical Hierarchy Process (AHP) to identify the groundwater potential zones and thematic layers of rainfall, slope, lithology, soil type, land use, drainage density, and lineament density in Baringo County, Kenya. While most of the high-yield boreholes with acceptable fluoride concentrations were located in good groundwater potential zones, the low-yield boreholes with high fluoride concentrations were discovered in poor groundwater potential zones. This study concluded that remote sensing, GIS, and AHP are crucial monitoring and evaluation tools for areas with prospective groundwater resources.

Omondi *et al.* (2023) amalgamated remote sensing and empirical multivariate regression modelling to estimate water quality parameters. The study highlighted Total Suspended Solids (TSS) as best modelled using both exponential and polynomial regression with a mean R^2 value of 0.809, while turbidity and chlorophyll-a (chl-a) were best modelled using polynomial regression models. The chl-a had an R^2 value of 0.803, while turbidity had an R^2 value of greater than 75%. Therefore, water quality parameters (WQPs) enable real-time access to the spatial–temporal view of water quality from satellites with precise accuracy.

As a result of their poor performance due to a lack of technical knowledge, Osome *et al.* (2023) suggested improvements to the hydraulic pumps to improve their performance efficiencies. Using locally accessible materials, improved hydraulic ram pumps were designed and assembled boasting an optimal efficiency of 54% with an optimal delivery flow rate of 13 L/min. The findings showed that the manufactured pump exhibited improved efficiency when compared to the current hydraulic ram pumping systems, and the goal is to make the designed pump competitive on the market.

Robert *et al.* (2023) analysed the quality of water of the Kadambrayar River, which flows through an urbanized and industrialized Indian city. A collection of 16 water quality parameters was investigated across eight sampling points as per IS 10500:2012 IS 2296:1992 and WHO ICMR safety standards. The analysis of Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), and coliforms proved non-compliance with the standard limits. Arsenic and chromium concentrations were 7 and 50 times higher than the national standard limits, respectively, highlighting the significant levels of pollution in the river. The study provides a better understanding of the pollution and its sources in the river and what remedial measures can be framed for improving water quality for sustainable development.

Mavaringana *et al.* (2023) employed the HBV model to determine how a River Basin's flood inundation extent is impacted by climate change and to estimate future changes in hydroclimatic factors. From the CORDEX project, 10 regional climate models' climate ensembles were chosen. The HBV model was used to generate streamflow for the period 2022–2099 using historical rainfall, temperature, and downscaled climate data. The study is crucial for decision-making on flood risk hazard mapping early warning systems for sustainable development

Mureithi *et al.* (2022) investigated the suitability of satellite data to estimate run-off time series for the Nzoia River Basin, taking into account the estimates of two models, such as the NAM model in Mike 11 and Goddard Earth Observing System model version 5 (GEOS-5) satellite data from the NASA. The calibrated GEOS-5 data outperformed the uncalibrated data with R^2 values of 0.96 and 0.6 for daily values. The performance at calibration and validation were 0.9 and 0.8, respectively. Thus, adequately calibrated satellite data provide desirable estimates for sparsely gauged basin discharges.

In conclusion, the repercussions of inactivity during these global change pressures in developing countries might be disastrous for both the afflicted areas and the global community, and thus the time to act is now. We can create the conditions for a future that is more resilient, just, and sustainable by supporting these creative and comprehensive solutions.

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