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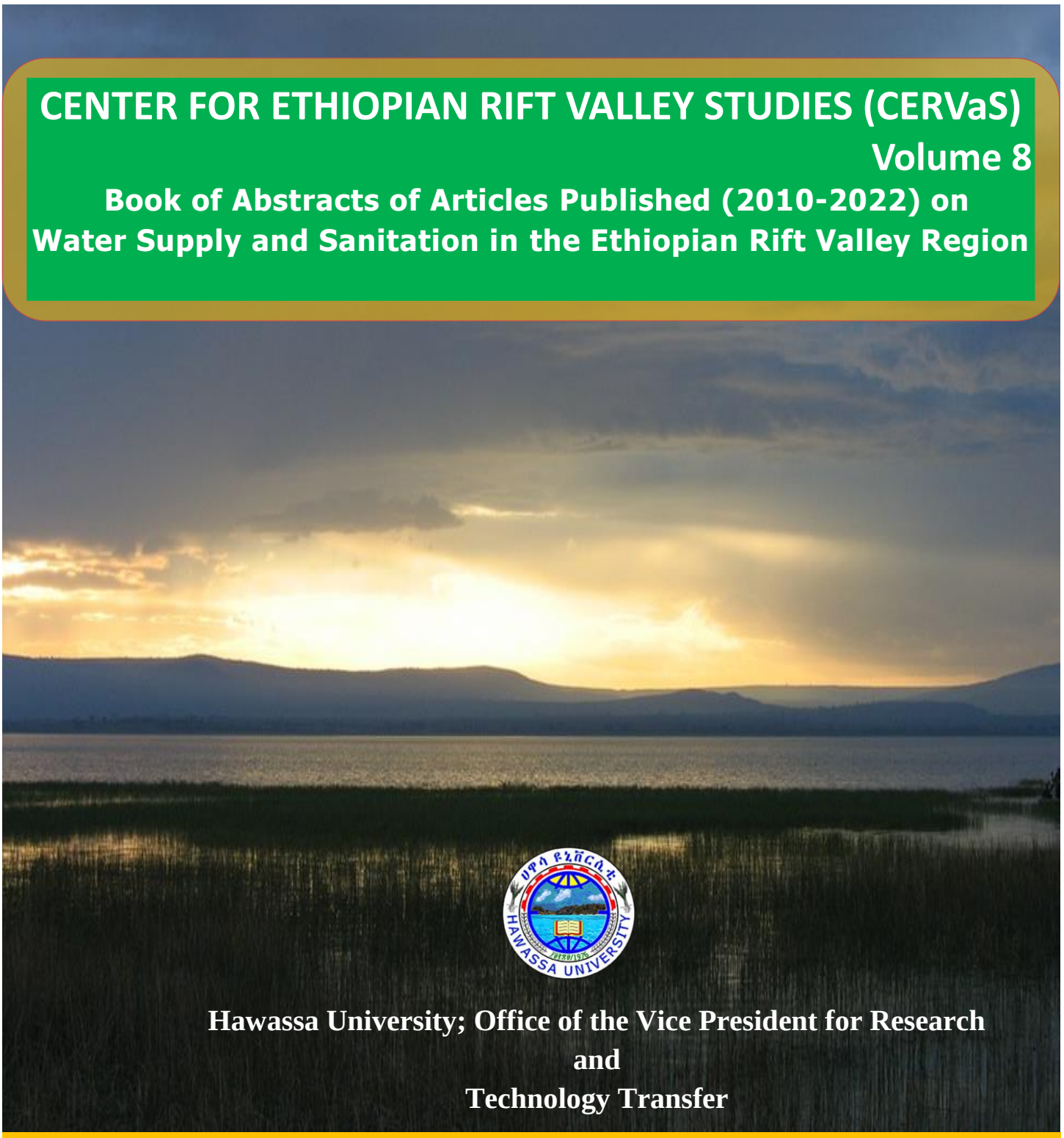

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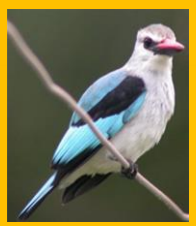

"Joining Hands to Reverse the Alarming Situations"

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The determinants of access to sanitation: The role of human rights and the challenges of measurement

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Abstract:

Ten years after the United Nation's recognition of the human right to water and sanitation (HRtWS), little is understood about how these right impacts access to sanitation. There is limited identification of the mechanisms responsible for improvements in sanitation, including the international and constitutional recognition of rights to sanitation and water. We examine a core reason for the lack of progress in this field: data quality. Examining data availability and quality on measures of access to sanitation, we arrive at three findings: (G. K. Hailu, 2016)(1) where data are widely available, measures are not in line with the Sustainable Development Goal (SDG) targets, revealing little about changes in sanitation access; (2) data concerning safe sanitation are missing in more country-year observations than not; and (3) data are missing in the largest proportions from the poorest states and those most in need of progress on sanitation. Nonetheless, we present two regression analyses to determine what effect rights recognition has on improvements in sanitation access. First, the available data are too limited to analyze progress toward meeting SDGs related to sanitation globally, and especially in regions most urgently needing improvements. Second, utilizing more widely available data, we find that rights seem to have little impact on access. (Schiel et al., 2021)

Keywords: sanitation; water; human rights; sustainable development goals; data quality; data availability

Schiel, R., Wilson, B. M., & Langford, M. (2021). The determinants of access to sanitation: The role of human rights and the challenges of measurement. *Water*, *13*(12), 1676.

Communities coping with risks: Household water choice and environmental health in the Ethiopian Rift Valley

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Abstract

Resource-constrained households are often forced to make complex tradeoffs across multiple environmental health risks. In the Ethiopian Rift Valley, households face tradeoffs between relatively plentiful but fluoride-contaminated groundwater sources and seasonally-variable surface water sources having greater bacteriological risks. We assess factors influencing household water choice in this setting of varied environmental health risks. We analyze behaviors using mixed methods with qualitative and quantitative data that shed light on the relative importance of water quality and other factors, and place this behavior within households' community context. The paper thereby contributes to a wider view of the factors that restrict or promote household balancing of environmental risks. We find that social factors, as measured by survey measures of trust, play a role in household water sourcing behavior and the mitigation of risk. The large seasonal variation in fluoride levels observed in some households' stored drinking water also points to prioritization of convenience (use of surface water sources) during the rainy season, despite these sources' significant microbial risks. Understanding the combined environmental and social factors can better inform policy interventions in household water quality. (Paul et al., 2018)

Keywords:-Environmental health; Water; Fluorosis; Risk; Ethiopia;

Paul, C. J., Jeuland, M. A., Godebo, T. R., & Weinthal, E. (2018). Communities coping with risks: Household water choice and environmental health in the Ethiopian Rift Valley. *Environmental Science & Policy*, *86*, 85-94.

IWRM as a System Approach to Water Security: Evidence from the Awash River Basin of Ethiopia

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Abstract

Integrated Water Resources Management (IWRM) is one of the systems thinking approaches emerged in the 1990s. Since then it has been applied in various countries and contexts. However, the implementation of the IWRM is contested. There are paucity of literature and guidelines as to how the concept can be operationalized. In Ethiopia, there is no evidence that IWRM is successfully instituted. Particularly, IWRM has never been implemented in the Awash River Basin. The study generated data from household and institutional surveys, in-depth interviews, focused group discussions, workshops, and secondary sources. Multiple sources of data were triangulated and thematically summarized. We found that pragmatic water resources management through system approach helps to recognize river basin as a bigger system in which the natural and human systems function. This resolves the problem of fragmentations among among various actors, sectors, interest and priorities. That it facilitates the coordination of various subsystems. The operationalization of IWRM as a system to secure water resources require the establishment and/or strengthening of the interactions of various systems, subsystems, and the elements within the entire basin system. Finally, enabling institutional environments should be considered as a medium of realizing IWRM. (R. Hailu et al., 2018a)

Keywords: Integrated Water Resources Management (IWRM); system thinking; water security; awash basin; Ethiopia

Hailu, R., Tolossa, D., & Alemu, G. (2018). IWRM as a system approach to water security: Evidence from the Awash River Basin of Ethiopia.

Analysis of water balance and hydrodynamics of Lake Beseka, Ethiopia

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Abstract

This study aims to calculate the water balance, interaction with irrigation water inflow, and hydrodynamics of Lake Beseka by a spreadsheetbased model using climatic, hydrological, multi-temporal satellite images, groundwater, and lake chemistry data. The rainfall for the catchment was estimated as 558.4 mm/year, whereas the mean evaporation was computed as 2,214 mm/year by the Penman method. The annual direct rainfall contribution to the lake was found to be 25.84 MCM (million cubic meters) with a runoff inflow in the catchment area of 37.2 MCM. This balance pointed to the mean evaporation of 108.2 MCM/year in the lake indicating that the water inflow was greater than the outflow. A major cause for the rise of the lake level was the drainage of excess irrigation water toward the lake, mainly from the Fentale Irrigation Farm. The average increment of the groundwater level in the area was 12 cm/year from 2010 to 2014. From 1998 to 2014, the electrical conductivity was reduced by 25.6%, and calcium was increased by 96%. The study outlined that appropriate irrigation drainage should be implemented in the catchment to ensure the balance between the rainfall, infiltration, and surface runoff to optimize economic and social welfare in the area. (Gichamo et al., 2022)

Key words: drainage, evaporation, hydrodynamics, Lake Beseka, water balance

Gichamo, Tagesse, et al. "Analysis of water balance and hydrodynamics of Lake Beseka, Ethiopia." Journal of Water and Climate Change 13.5 (2022): 2034-2047.

Assessing the Impact of Existing and Future Water Demand on Economic And Environmental Aspects (Case Study from Rift Valley Lake Basin: Meki-Ziway Sub Basin), Ethiopia

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Abstract
In the development of water resource projects there is an increase and extensive use of water resources, which causes exploitation of the existing systems and ecosystem of the natural environment. The Water Evaluation and Planning (WEAP) model is used to assess water demand by considering the existing development situation and future water resources development with scenarios analysis in the study area (Ziway Meki Sub Basin, Ethiopia).
Three different development scenarios were developed to simulate water use at demand sites. In the simulations, the catchment was divided into 5 main sub-catchments where the supply and demand nodes were spatially located. The competing water sectors were irrigation development, domestic users, soda ash industry and environmental flow requirements. Hydro Meteorological data, net evaporation from Lake Reservoir, and monthly water demand from user sectors were the basic inputs to the model. The results of the reference scenario were validated using observed flows. Accordingly, the simulation result revealed that the total average annual inflow volume into the study area is declining significantly for reference scenarios and water availability is limited in the months of January (17 Mm3) and December (171 Mm3) while in the other months the availability is efficient and all users have 100% coverage. Except Langano irrigation site that have between 33.33% to 86.5% coverage in average during the month of Feb to May (2.57 Mm3) and April in Bulbula 95.2% coverage, others get full coverage. The minimum reliability observed mostly in the ongoing and likely future development scenarios at Bulbula irrigation demand sites which have 92.11% and 66.67% reliability in Langano irrigation demand sites throughout all development scenarios. On the other hand, in Sher-Ethiopia expansion, 51.75% reliability is observed in ongoing and likely future development scenarios and in demand site of Katar irrigation diversion and Meki irrigation from dam 51.75% is observed in likely future development scenarios. (Shumet & Mengistu, 2016)

Keywords: Central rift valley; WEAP model; Water allocation; Demand sites; Demand coverage; Reliability; Scenario analysis

Shumet, A. G., & Mengistu, K. T. (2016). Assessing the impact of existing and future water demand on economic and environmental aspects (Case study from Rift Valley Lake Basin: Meki-Ziway Sub Basin), Ethiopia. Int J Waste Resour, 6(223), 2.

Alleviating Water Scarcity in the Central Rift Valley Lakes through an Inter-Basin Water Transfer, Ethiopia

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Abstract:
Demand for fresh water, as one of the major natural resources, is increasing rapidly with increasing development and environmental degradation. The continued **Abstract**ion of water from Lake Ziway and its main feeder rivers Meki and Katar for irrigation indicates that the water demand may soon exceed the supply. To illustrate disparities in spatial distribution of water resources, the Upper Awash sub-basin, which shares a water-divide with the CRVL sub-basin, has large flow volumes particularly in the rainy season and suffers with seasonal flooding. The rationale behind regaining the water in CRVL relies on this non-uniform spatial distribution of fresh water, calling for a balance between water surplus and deficit regions. For this reason, Inter Basin Water Transfer (IBWT) is suggested as a viable option to augment utilizable water resources of the Upper Awash sub-basin to reduce the significant pressure on the water supply of the rapidly developing urban and irrigation areas in the CRVL sub-basin. A water evaluation and planning (WEAP) model was used to quantify the amount of surplus water in the donor basin, when examining the hydrological dynamics of the basins. Furthermore, optimal flow diversion scenarios were generated by maintaining two baseline scenario constraints. The estimated surplus water in the rainy season is expected to contribute 18 million cubic meters (mcm), 88 mcm and 192 mcm in months June, July and August respectively under average conditions. The optimal amount of diverted water could potentially stabilize the environmental degradation of Lake Ziway and Lake Abijata by compensating for development-driven **Abstract**ion and surface water evaporation respectively. (Berhanu & Bisrat, 2020)

Keywords: Inter Basin Water Transfer, WEAP, Lake Ziway, Upper Awash Sub-Basin, CRVL

Berhanu, Belete, and Ethiopia Bisrat. "Alleviating Water Scarcity in the Central Rift Valley Lakes through an Inter-Basin Water Transfer, Ethiopia." Natural Resources 11.12 (2020): 554.

Assessment of household-level adaptation strategies to water stress in southwestern coastal Bangladesh: a counter-factual analysis

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Abstract

Despite the growing emphasis and global initiatives to ensure safe drinking water and sanitation for all (Sustainable Development Goal 6), households in coastal areas are at risk of growing water stress across the globe. However, little is known about households' adaptation strategies to water stress in coastal areas. This study explores the determinants and impacts of adaptation strategies to household-level water stress (both drinking and non-drinking), considering the behaviors of adopters and non-adopters in the southwestern coastal area of Bangladesh. We applied an endogenous switching regression model by analyzing questionnaire survey datasets (n¼502) to estimate the effect of adopting adaptation strategies on household-level water stress in four saline-prone coastal sub-districts of Bangladesh. Results reveal six commonly-practiced adaptation strategies: reducing vegetable production, reducing livestock production, paying more to access water, increasing time for water collection, preserving water, and using reservoirs to collect water. Determinants such as migration, support from government and non-government agencies, age, gender, literacy, occupation, income, access to tube wells, and distance from drinking water sources play a significant role in adopting adaptation strategies. Results from the endogenous switching regression model denote that adopting all six adaptation strategies appears to significantly reduce household-level water stress. Through counter-factual analysis, results demonstrate that, on average, households that did not adopt adaptation strategies would have encountered less water stress if they had. Therefore, determinants that stimulate adaptation strategies will indirectly reduce household water stress. (Ahsan et al., 2022)

Key words: Adaptation, Bangladesh, Coastal, Counter-factual analysis, Water stress

Ahsan, Md Nasif, et al. "Assessment of household-level adaptation strategies to water stress in southwestern coastal Bangladesh: a counter-factual analysis." Water Policy 24.9 (2022): 1516-1540.

Water resources management in the Central Rift Valley: modelling for the water poor

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Abstract

Achieving a sustainable development is crucial, but is even more important in developing countries, where a wide number of people does not have a safe and secure access to water and relay on the environment to sustain their lives. The Ethiopian Central Rift Valley basin is already a degraded basin from the environmental point of view: ecosystems are endangered due to human activities there developed. Moreover, poverty is widespread all over the basin, with population is mainly living from agriculture on a subsistence economy. In order to achieve sustainable development to increase population incomes without affecting lives of those who are highly dependent on the environment and Integrated Water Resources Management approach shall be applied. First step has been to model the basin water resources, using the Soil and Water Assessment Tool (SWAT), which, after calibration and validation of the model, has given correct results. In order to follow deepening in the IWRM approach, more information on actual and future water demand and specifically water applied to agriculture will be needed. (Pascual Ferrer et al., 2011)

Key words: Integrated Water Resources Management, Water Poor, Modelling, Central Rift Valley

Pascual Ferrer, J., Candela Lledó, L., Pérez Foguet, A., & Kebede, S. (2011). Water resources management in the Central Rift Valley: modelling for the water poor. In International Congress Smallwat11. Wastewater in Small Communities.

Assessment of water resources management in the Ethiopian Central Rift Valley: environmental conservation and poverty reduction

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Abstract

This article assesses the relation between water management, environmental degradation and poverty through a stakeholder analysis focused on the status and management of water resources. It draws from the situation observed in the Ethiopian Central Rift Valley, an endorheic basin south of Addis Ababa where human activities have resulted in the degradation of most freshwater ecosystems and where the vast majority of the population lives in poverty. It proposes a shift in water governance that focuses on improving economic and social welfare and enhancing environmental sustainability. This shift can help overcome some of the problems affecting the Central Rift Valley, namely: (1) the overexploitation of water resources; (2) poor water quality; and (3) the high dependency of the population on water resources to sustain their livelihoods. (Pascual-Ferrer et al., 2014)

Keywords: water resources management, central rift valley, environmental degradation, poverty, stakeholder analysis

Pascual-Ferrer, J., Pérez-Foguet, A., Codony, J., Raventós, E., & Candela, L. (2014). Assessment of water resources management in the Ethiopian Central Rift Valley: environmental conservation and poverty reduction. International Journal of Water Resources Development, 30(3), 572-587.

Rural Water Supply Management and Sustainability: The Case of Adama Area, Ethiopia

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Abstract

Wise utilization of water resources is becoming very important as world faces water crises. The main objective of this study was to investigate the rural water supply systems with case study in Adama area, in central Ethiopia. Both quantitative and qualitative data were collected and analyzed. Four sample water schemes were selected and totally 148 (63 were female) representative households were selected for answering the questionnaires. Key informant interviews and group discussions were also conducted. The study assessed issues such as community participation, water committee empowerment, management and governance of water supply schemes, women participation, and functional status of water supply scheme, sanitation and hygiene issues, external support, and monitoring system of water supply schemes. The findings indicated that the community participation in planning and implementation was very good while monitoring mechanism of operation and management as well as community participation on choice of technology was poor. The water schemes were located at reasonable distances i.e. less than 2 km in most cases and the time taken for round trip to fetch water from source was less than or equal to 30 minutes in most cases, however the queuing time was more than an hour. The water supply was inadequate as only about 15% of beneficiaries could get 20 liters of water per day per capita. The water sources were exposed in many cases to human waste, wild life, livestock and uncontrolled flooding. Sanitary practices in the study area were poor as only about 3.4% had ventilated and improved pit latrine and open pit and/or open field defecation were widely practiced. (Tadesse et al., 2013)

Keywords: Ethiopia; Rural Water Supply; Water Fee; Community Participation; Safe Drinking Water

Tadesse, A., Bosona, T., & Gebresenbet, G. (2013). Rural water supply management and sustainability: the case of Adama Area, Ethiopia.

Household Water Security Index: development and application in the Awash Basin of Ethiopia

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Abstract

Despite water security becomes a complex global challenge; its assessments are spatially and temporally inconsistent. This affected water security monitoring at the local level. Some studies attempted to downscale national, regional or global level indicators to local scale, which have several shortcomings. Therefore, this study came up with a new Household Water Security Index to estimate the state of water security at a local level. The study constructed Household Water Security Index (HWSI) based on water resources availability (R), access (A), utilization (U), capacity (C), and environment (E), and water institution (I) indicators. It also tested the index using a sample district in the Awash Basin of Ethiopia. A cross-sectional firsthand data were collected from randomly selected 400 households. A multivariate technique called Principal Component Analysis (PCA) and bivariate correlation were employed. The result revealed that every household is either chronically or transitionally water unsecured. This was mainly due to poorly organized institutions, as well as lack of both the system and knowledge of water management systems under scarcity and surfeit. In some areas, there are moderate resource constraints. In other areas, the capacity to use water is very low. Yet the institutional performance was consistently weak. We concluded that first; macro-level indicators often obscure the local realities. Thus, the policy-makers and development planners need to prioritize the household's situations accordingly. Second, water resources availability with proper use and capacity plays a pivotal role to achieve household water security. Third, it is important to integrate institutional elements in water security as a mediating process and stewardship of the local needs. Fourth, the HWSI can be replicable at various scales and contexts, which could be considered for further research. Finally, recognizing the local arrangements and building the capacity of water actors are of paramount importance. (R. Hailu et al., 2022)

Keywords: Water security; institution; Awash Basin; Household; Water Security Index; Ethiopia

Hailu, R., Tolossa, D., & Alemu, G. (2022). Household water security index: development and application in the Awash Basin of Ethiopia. International Journal of River Basin Management, 20(2), 185-201.

Fluoride ion and total dissolved solid distribution in Ethiopian Rift valley: The case of Hawassa city aquifer

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Abstract

Study region

The Main Ethiopian Rift valley (MER) region, where millions rely on fluoride contaminated drinking water that is by far higher than the WHO standard resulting skeletal and tooth decay.

Study focus

Pumping test and drilling lithology data of the already drilled and productive 25 wells (25 m–200 m depth) to characterize the aquifer. Particular emphasis is given to the spatial distribution of fluoride ion (F-) and Total dissolved solids (TDS) applying SPSS (Statistical Package for the Social Scientists) statistical tool.

New hydrological insights for the region

The major water bearing formation is of weathered and fractured geologic formation having high porosity and permeability, which resulted in risk of shallow groundwater surface contamination. The concentration of fluoride ion, ranging from 0.65mg/l to 11mg/l is under significance influence by the geochemistry. Higher temperature at the shallow aquifer along with geological process like weathering of rocks and dissolution of CaF_2 promotes the concentrated availability of fluoride ions. The deeper the strata along with igneous formation dominated by pumice, the lower the concentration showing strong inverse correlation with depth for both F- and TDS with R^2 =0.78 and R^2 =0.68 respectively at $\alpha < 0.001$. Either drilling wells beyond such formations (=60m) or blinding the poor quality strata is recommended to minimize the effect of high fluoride and TDS concentration in drinking water for Hawassa city aquifer. (Abdurahman & Zewdie, 2018)

Keywords: Aquifer; Fluoride ion; Geochemistry; Hawassa catchment; Drinking water; Rift valley

Abdurahman, S. G., & Zewdie, M. (2018). Fluoride ion and total dissolved solid distribution in Ethiopian Rift valley: The case of Hawassa city aquifer. *Journal of Hydrology: Regional Studies*, *19*, 240-249.

Drinking water quality in the Ethiopian section of the East African Rift Valley I-data and health aspects

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Abstract

Drinking water samples were collected throughout the Ethiopian part of the Rift Valley, separated into water drawn from deep wells (deeper than 60 m), shallow wells (<60 m deep), hot springs (*T*>36 °C), springs (*T*<32 °C) and rivers. A total of 138 samples were analysed for 70 parameters (Ag, Al, As, B, Ba, Be, Bi, Br, Ca, Cd, Ce, Cl, Co, Cr, Cs, Cu, Dy, Er, Eu, F, Fe, Ga, Gd, Ge, Hf, Hg, Ho, I, In, K, La, Li, Lu, Mg, Mn, Mo, Na, Nb, Nd, Ni, NO_2, NO_3, Pb, Pr, Rb, Sb, Se, Si, Sm, Sn, SO_4, Sr, Ta, Tb, Te, Th, Ti, Tl, Tm, U, V, W, Y, Yb, Zn, Zr, temperature, pH, conductivity and alkalinity) with ion chromatography (anions), spectrometry (ICP-OES and ICP-MS, cations) and parameter-specific (e.g. titration) techniques. In terms of European water directives and WHO guidelines, 86% of all wells yield water that fails to pass the quality standards set for drinking water. The most problematic element is fluoride (F), for which 33% of all samples returned values above 1.5 mg/l and up to 11.6 mg/l. The incidence of dental and skeletal fluorosis is well documented in the Rift Valley. Another problematic element may be uranium (U)—47% of all wells yield water with concentrations above the newly suggested WHO maximum acceptable concentration (MAC) of 2 μg/l. Fortunately, only 7% of the collected samples are above the 10 μg/l EU-MAC for As in drinking water. (Reimann et al., 2003)

Keywords: - Drinking water quality; Ethiopia; East African Rift Valley; Multi element analyses; Fluorosis; Arsenic; Uranium

Reimann, C., Bjorvatn, K., Frengstad, B., Melaku, Z., Tekle-Haimanot, R., & Siewers, U. (2003). Drinking water quality in the Ethiopian section of the East African Rift Valley I—data and health aspects. Science of the Total Environment, 311(1-3), 65-80.

Multivariate Analysis of water Quality and Identification of Potential Pollution Sources of Lake Hawasa, Ethiopia

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Abstract
Multivariate statistics was used to categorize the potential sampling sites of Lake Hawassa and identify potential pollution sources by analyzing water quality parameters. Water quality parameters, such as total dissolved solids (TDS), pH, temperature, conductivity, turbidity, dissolved oxygen (DO), five day biological oxygen demand (BOD5), total hardness as CaCO3, total alkalinity as CaCO3, nitrate, sulfate, orthophosphate, fluoride, K, Mg, Cu, Cd, Cr, Fe, Mn, Pb, and Zn were determined. The results were compared with WHO standards. Principal component analysis (PCA) extracted seven principal components. The first principal component (PC1) accounted for 22.1% of the total variance, and pH, Mn turbidity, specific conductance (SC) and sulfate were strongly loaded on it. Principal component two (PC2) was mainly composed of BOD5, total hardness, temperature, iron, DO, and TDS. This component accounted for 17.3% of the total variance. The third component (PC3), dominated by potassium, TDS, and zinc, explained 12.4% of the total variance. Copper and fluoride were associated in the fourth principal component, accounting for 10.5% of the total variance. In the fifth component, total alkalinity, phosphate, and zinc were the dominant components, which account for 10.2% of the total variance. Nitrate, chromium, and lead were isolated in the sixth component (PC6), accounting for 9.4% of the total variance. The last component was dominated by magnesium, explaining 7.6% of the total variance. Hierarchical cluster analysis (HCA) divided the sampling sites into four clusters. Cluster A include five sampling sites and it was highly loaded with PC4 and PC6, which showed the presence of a high level of pollution from industrial effluents and agricultural runoff. Cluster B and C consisted of three sampling sites and one sampling site, respectively, and they were highly loaded with PC3 and PC6, which indicated the presence of a high level of pollution from domestic wastewaters, land development and urban runoff. Cluster D comprised two sampling sites and was highly loaded with all component loadings except for PC7. It was considered a highly polluted site from multiple sources of pollution. These results obtained from the multivariate analysis can be very useful for the surrounding rural and urban communities for the proper and safe use of the lake. In addition, it can reduce the cost associated with monitoring the lake by reducing the number of sampling sites. (Zigde & Tsegaye, n.d.)

Key words: - Multivariate Statistics, Water Pollution, Water Quality Parameters.

Zigde, M., & Tsegaye, E. Multivariate Analysis of water Quality and Identification of Potential Pollution Sources of Lake Hawasa, Ethiopia.

Optimal Water Allocation Methods and Policy under the Current Development and Climate Change Challenges: A Review on Gidabo Basin of Ethiopia

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Abstract

Ethiopia, with over 1,700 m^3/s per capita water availability is not a water stressed country according to the water stress index (WSI), the spatial and temporal variability of water limits the country's development, management and equitable distribution. Rift Valley Lakes Basin is one of the twelve basins in Ethiopia which covers 53,000 km^2 and consists of 4 sub-basins and 14 watersheds and most of Rift valley lakes exist in this Basin and Gidabo is among these watersheds. There had no well-organized water allocation system in Gidabo Basin. A review was conducted to adopt an allocation plan from existing plan within the country from nearby basins and outside of the country. The water allocation study of the basin will target to provide water allocation for domestic, livestock, environmental flow, coffee wet mills, agro-processing and other industrial water demand in the sub basin and forecasted water demand with sustainable, equitable and rationally manner. As water scarcity has increased globally, water allocation plans and agreements have taken on increasing significance in resolving international, regional and local conflicts over access to water. This review also includes assessment of water conflict, water supply right and sanitation policy and identification of future scenarios for water allocation and adaptation strategies in the Gidabo basin. There were different papers reviewed on each sub topic to attain the aim of the review including domestic demand which is to be calculated with the ratio of population number, biodiversity water demand based on moody method, livestock water demand based on dry matter and their types, industrial water demand which is to be calculated as a function of industrial production data, industrial survey components, and economic development indicators. In addition, decisions related to water resources allocation need to incorporate local hydrologic conditions. This work investigates different water rights principles, and comparison of WEAP and water allocation models. The review suggests the possible application of policies, proclamations, regulations and traditional as well as UN water rights of the societies. (TESFAYE, 2021)

Keywords: Water allocation, Climate change; WEAP; Water demand, Conflict resolution; Legal and institutional framework, IBTs

Tewodros Woldemariam Tesfaye, Sisu Gemechu Biru, Gemedo Tunebo Gelgalu[3] Desalegn Ersado Laelago, Mihret Danato Ulsido, Tewodros Assefa, Petros Yohanne, Alene Mitiku (2021). Optimal Water Allocation Methods and Policy under the Current Development and Climate Change Challenges: A Review on Gidabo Basin of Ethiopia. *Ethiopian Journal of Engineering and Technology*, *1*(1), 57-75.

Anthropogenic nitrate contamination of water resources in Ethiopia: an overview

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Abstract

Nitrate is one of the water contaminants that mainly results from anthropogenic activities. The major causes of nitrate contamination of water resources are anthropogenic activities such as animal or human waste, septic or sewage systems, fertilizer application, concentrated animal farming, industrial waste, and landfill leachates. These man-made activities are the primary sources of nitrate contamination in water resources. Nitrate contamination of water is a global issue that has been increasing over time. According to previous research, exposure to nitrate in water above the World Health Organization (WHO) guideline limit (50 mg of NO3/L) has been found to induce major health effects such as methemoglobinemia in humans, with the severity depending on the amount consumed. This problem has become a major threat to humans and the environment. Thus, this article presented an overview of nitrate contamination of water resources in Ethiopia, emphasizing anthropogenic activities to indicate the current nitrate water contamination status for the necessary remedial actions. (Wakejo et al., 2022)

Key words: anthropogenic activities, contamination, Ethiopia, health impacts, nitrate, water resources

Wakejo, Wondimu Kebede, et al. "Anthropogenic nitrate contamination of water resources in Ethiopia: an overview." Water Supply (2022).

Water criteria evaluation for drinking and irrigation purposes: a case study in one of the largest rivers of Sundarbans World Heritage region

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Abstract

Pasur River is one of the largest rivers in the World Heritage Sundarbans mangrove forest region of the south-western part of Bangladesh. Due to lack of alternative sources, more than 1 million inhabitants living in the Pasur river basin area rely heavily on the river water for domestic, irrigation, and industrial purposes without proper and reliable information on the water qualities and contamination types. The study aimed at evaluating the suitability and sustainability for irrigation and consumption practices, and suitable hydro geochemical techniques and quality of Pasur river water of Sundarbon region of Bangladesh were investigated. Water samples were collected from six locations during pre-monsoon and post-monsoon seasons and assessed for suitability for drinking and irrigation application. The water quality index (WQI) was calculated to evaluate the suitability for drinking. WQI indicates that the river water samples during both the seasons are safe for drinking in the good category. Sodium percentage (Na%), sodium adsorption ratio (SAR), magnesium hazard (MH), residual sodium carbonate (RSC) were investigated to assess the feasibility for agricultural applications. Most of the indices, such as SAR, Na%, and RSC results recommend that the river water is safe for irrigation. A suggestion is made that MH in river water should be controlled for the use of water in irrigation. United States Salinity Laboratory (USSL) diagram and Wilcox diagram analysis also identified that river water as a usable category for irrigation purposes is feasible during both seasons. (Hasan et al., 2022)

Key words: hydro chemical characteristics, Sundarbans region, USSL diagram, water quality index, Wilcox classification

Hasan, Md Mahabub, et al. "Water criteria evaluation for drinking and irrigation purposes: a case study in one of the largest rivers of Sundarbans World Heritage region." Water Supply 22.6 (2022): 5800-5817

Urban surface water quality and the potential of phytoremediation to improve water quality in peri-urban and urban areas in sub-Saharan Africa – a review.

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ABSTRACT

In 2017, 400 million people in sub-Saharan Africa (SSA) were still using unimproved drinking water sources, 80 million of whom relied on untreated surface water. Urban areas are vastly expanding all over the continent and many larger cities in SSA struggle to provide safely managed drinking water. Phytoremediation implemented in constructed wetlands (CWs) is a low-cost and sustainable alternative to highly costly and energy-consuming wastewater treatment plants. In addition, CWs offer the potential to be integrated into farming and aqua-culture systems and can therefore improve food quality and production. The most prominent pollutants in urban SSA surface waters and the pollutant removal efficiencies for microbial and chemical contaminations of different plant species were identified from the literature and the accumulation rates for Pb, Cr, and Cd were compared with each other. A strong focus was given to studies conducted in SSA or other (sub)tropical regions. This review identified a range of potential phytoremediators to treat contaminated surface water and highlights the need for further in situ studies in SSA. Plant species such as Lemna minor, Ipomoea aquatica, Spirodela polyrhiza and Brachiaria mutica show a high potential to phytoremediate the heavy metals Pb, Cr and Cd from surface water. (Schnabel et al., 2022)

Key words: constructed wetlands, heavy metals, phytoremediation, sub-Saharan Africa, water quality

Schnabel, Bastian, et al. "Urban surface water quality and the potential of phytoremediation to improve water quality in peri-urban and urban areas in Sub-Saharan Africa–a review." Water Supply (2022).

Communities coping with risks: Household water choice and environmental health in the Ethiopian Rift Valley

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Abstract

Resource-constrained households are often forced to make complex tradeoffs across multiple environmental health risks. In the Ethiopian Rift Valley, households face tradeoffs between relatively plentiful but fluoride-contaminated groundwater sources and seasonally-variable surface water sources having greater bacteriological risks. We assess factors influencing household water choice in this setting of varied environmental health risks. We analyze behaviors using mixed methods with qualitative and quantitative data that shed light on the relative importance of water quality and other factors, and place this behavior within households' community context. The paper thereby contributes to a wider view of the factors that restrict or promote household balancing of environmental risks. We find that social factors, as measured by survey measures of trust, play a role in household water sourcing behavior and the mitigation of risk. The large seasonal variation in fluoride levels observed in some households' stored drinking water also points to prioritization of convenience (use of surface water sources) during the rainy season, despite these sources' significant microbial risks. Understanding the combined environmental and social factors can better inform policy interventions in household water quality.(Paul et al., 2018)

Keywords: Environmental health; Water; Fluorosis; Risk; Ethiopia

Paul, Christopher J., et al. "Communities coping with risks: Household water choice and environmental health in the Ethiopian Rift Valley." Environmental Science & Policy 86 (2018): 85-94.

Hydrochemical interfaces using water quality index in ascertaining integrity of river Ikpoba, South-South Nigeria

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Abstract
Investigation on the quality of river water resources, management and hydro-chemical interfaces is vital for monitoring and ascertaining of surface-water contaminants sources. River Ikpoba samples were gotten from various sampling points at a distance of 10 m apart along the stretch of the river during the dry season (November 2020) and wet or rainy season (July 2021). These samples physicochemical parameters were scrutinized using and the outcome was used to compute coefficient of variability, water quality index (WQI), multivariate test as well as descriptive and L-moment statistics. The result displays that WQI of 56.2% sampling locations is categorize as excellent water in both seasons. Besides, the WQI values gotten during the scrutiny displayed deterioration changes in water quality from up-stream location to down-stream location, which in turn, signifies that river water is of poor standard or quality. Beyond, the periodic values of WQI suggest that throughout wet season, the river water is more badly influenced than during dry season. Similarly, analyses using thrice variable probability distribution model, explicitly; generalized pareto distribution (GPA); generalized extreme value distribution (GEV), as well as generalized logistics distribution (GLO) with the idea of ascertaining the appropriate fit probability/ likelihood distribution model, predicted (forecasted) rainfall quartile magnitude (Qt) created on the GLO model vary between 83.55 mm at two years (2yrs) return period to 133.68 mm at 100 years return period. Equally, r2 which is the coefficient of determination for the experimental vs. predicted (forecasted) rainfall created on the appropriate fit model was witnessed to be 0.9999.(Igibah & Ihimekpen, 2022)

Keywords: Water level rise; Ikpoba River; Interfaces; Nigeria; Probability

Igibah, Ehizemhen Christopher, and Ngozi Isioma Ihimekpen. "Hydrochemical interfaces using water quality index in ascertaining integrity of river Ikpoba, South-South Nigeria." Materials Today: Proceedings 65 (2022): 3519-3530.

Water institutions in the Awash basin of Ethiopia: the discrepancies between rhetoric and realities

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Abstract
This paper strived to describe the features of water institutions in the Awash basin from a historical perspective based on reviews of water laws, policies, and administrative documents, as well as interviews with water actors using snowball techniques. The result revealed that institutions had rapidly been changing but not coherently built. The most centralized duties and powers of institutions, coupled with financial and technical limitations created difficulty in enforcing the laws. The policy was comprehensive and inculcated the principles of Integrated Water Resource Management. Yet, it did not properly cascade down to the lower level as it was fundamentally top-down. Several stakeholders were not involved in the policy-making process. Water institutions were overwhelmingly more rhetoric than action oriented. Customary water institutions were undermined. Therefore, critical steps need to be taken towards enforcing formal water institution, recognizing the role of customary practices, and involving the key stakeholders, and building the capacity of actors to minimize water insecurity in the basin. (R. Hailu et al., 2018b)

Keywords: Awash basin; administration; Ethiopia; institution; laws; policy; water insecurity

Hailu, Reta, Degefa Tolossa, and Getnet Alemu. "Water institutions in the Awash basin of Ethiopia: the discrepancies between rhetoric and realities." International journal of river basin management 16.1 (2018): 107-121.

Application of a spreadsheet hydrological model for computing the long-term water balance of Lake Awassa, Ethiopia

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Abstract

The water balance of the closed freshwater Lake Awassa was estimated using a spreadsheet hydrological model based on long-term monthly hydro meteorological data. The model uses monthly evaporation, river discharge and precipitation data as input. The net groundwater flux is obtained from model simulation as a residual of other water balance components. The result revealed that evaporation, precipitation, and runoff constitute 131, 106 and 83 × 106 m3 of the annual water balance of the lake, respectively. The annual net groundwater outflow from the lake to adjacent basins is 58 × 106 m3. The simulated and recorded lake levels fit well for much of the simulation period (1981–1999). However, for recent years, the simulated and recorded levels do not fit well. This may be explained in terms of the combined effects of land-use change and neotectonism, which have affected the long-term average water balance. With detailed long-term hydrogeological and meteorological data, investigation of the subsurface hydrodynamics and including the effect of land-use change and tectonism on surface water and groundwater fluxes, the water balance model can be used efficiently for water management practice. The result of this study is expected to play a positive role in future sustainable use of water resources in the catchment. (Ayenew & Gebreegziabher, 2006)

Keywords: Awassa; Ethiopian Rift; Lake Hydrology; modeling; water balance; water management

Ayenew, Tenalem, and Yemane Gebreegziabher. "Application of a spreadsheet hydrological model for computing the long-term water balance of Lake Awassa, Ethiopia." Hydrological sciences journal 51.3 (2006): 418-431.

Global Fluoride Occurrence, Available Technologies for Fluoride Removal, and Electrolytic Defluoridation: A Review

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Abstract

This review article is aimed at providing precise information on the global scenario of the intensity and severity of excess fluoride in drinking water and the efforts made by various investigators in the field of fluoride removal from drinking water. The fluoride levels in foodstuffs and edible items are also presented with a view to help effective fluorosis mitigation in fluoride-affected areas. The critical assessment of various available technologies for the removal of fluoride reveals that, among various available technologies, electrolytic defluoridation appears to be a promising alternative for the treatment and will go a long way toward providing safe drinking water in the fluoride-affected areas of developing countries like India. It provides a technically simple, cost-effective, and reliable system for supplying fluoride free drinking water. Thus, electrolytic defluoridation is a step in upgrading access to safe drinking water and reconsidering the way forward in light of the millennium development goals. (Mumtaz et al., 2015)

Key words: defluoridation of water; electrolytic defluoridation; fluoride; occurrence in water and foodstuffs

Mumtaz, Neha, Govind Pandey, and Pawan Kumar Labhasetwar. "Global fluoride occurrence, available technologies for fluoride removal, and electrolytic defluoridation: a review." Critical Reviews in Environmental Science and Technology 45.21 (2015): 2357-2389.

Threats and Opportunities to Major Rift Valley Lakes Wetlands of Ethiopia

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Abstract
Rapid declines threaten the persistence of many rift valley lake wastelands. Few populations recover rapidly, most exhibit little or no change in abundance up to recent years after a collapse. Reductions in fishing pressure, although clearly necessary for population recovery, are often insufficient. Persistence and recovery are also influenced by life history, habitat alteration, changes to species assemblages, genetic responses to exploitation, and reductions in population growth attributable to the wetland effect. Unprecedented reductions in abundance and surprisingly low rates of recovery draw attention to scientists' limited understanding of how fish behavior, habitat, ecology, and evolution affect population growth at low abundance. Failure to prevent population collapses and to take the conservation biology of marine resources seriously will ensure that many severely depleted rift valley species remain wetlands, ecological and numerical shadows in the ecosystems that they once dominated. (Gebretsadik & Mereke, 2017)

Keywords: Rift valley lake; Conservation biology; Lake wetlands; Threats and opportunities; Ethiopia

Gebretsadik, Teklu, and Kassahun Mereke. "Threats and opportunities to major rift valley lakes wetlands of Ethiopia." Agric. Res. Technol 9 (2017): 1-6.

Evaluating water quality of Awash River using water quality index

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Abstract

Awash River has been impaired by various types of pollution owing to waste released from different socio-economic activities in its basin. This research was aimed at evaluating its quality status with respect to drinking and irrigation water uses. Based on accessibility and land use severity, 17 sample sites were chosen along the river and sampling was done twice in each of the dry and wet seasons. Thereafter, both onsite and offsite water quality analyses were undertaken following standard procedures. Canadian Council of Ministers of Environment Water Quality Index (CCME WQI) was applied to compute the water quality indices. Accordingly, the drinking and irrigation water quality indices of the upper basin were found to be 34.79 and 46.39 respectively, which were in the poor and marginal categories of the Canadian water quality ranking. Meanwhile, the respective indices for the middle/lower basin, which were 32.25 and 62.78, lie in the poor and fair ranges of the ranking. Although the difference in the dataset used for the two cases and natural purification in the course of the river might contribute to the difference in WQI, it is generally conceivable that the water quality of the river is below the good rank. Establishment of wastewater treatment plants and storm water quality management at hotspot areas are recommended to improve the quality. (Amare et al., 2017)

Key words: Awash River basin, Canadian Council of Ministers of Environment Water Quality Index (CCME WQI), drinking and irrigation water uses, Ethiopia, water pollution.

Amare, Shiberu Keraga, Kiflie Zebene, and Nigussie Engida Agizew. "Evaluating water quality of Awash River using water quality index." International Journal of Water Resources and Environmental Engineering 9.11 (2017): 243-253.

Water and sanitation service levels in urban informal settlements: a case study of Portee-Rokupa in Freetown, Sierra Leone

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Abstract

Evidence-based data are fundamental in enhancing the delivery of sustainable and resilient water and sanitation services in informal settlements of urban cities in low- and middle-income countries (LMICs). This paper describes the water and sanitation service situation of an urban informal settlement of Freetown, Sierra Leone's capital city. Data were collected from 385 households through a cross-sectional design. More than 80% of the respondents use sachet water as the main drinking source and 59% use protected wells for non-drinking needs. One-third (32%) of the respondents use unimproved sanitation services. Lined pit latrines are the most used facilities (39%), followed by hanging toilets (14.3%). Sanitation facilities mostly shared (69.6%) with a poor hygiene level and the risk of using them at night are reported as main threats. These findings point to the need for greater priority for investments and improvements for safely managed water and sanitation services. (Tumwebaze et al., 2022)

Key words: drinking and domestic water, informal settlement, sanitation, Sierra Leone, urban

Tumwebaze, I. K., Hrdličková, Z., Labor, A., Turay, A., Macarthy, J. M., Chmutina, K., ... & Howard, G. (2022). Water and sanitation service levels in urban informal settlements: a case study of Portee-Rokupa in Freetown, Sierra Leone. Journal of Water, Sanitation and Hygiene for Development, 12(8), 612-621.

Hydrogeochemical controls and human health risk assessment of groundwater fluoride and boron in the semi-arid North East region of Ghana

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Abstract

In this study, eighty-eight (88) samples were collected from active boreholes in the North East region of Ghana and analyzed for concentrations of the hydrogeochemical parameters. This helped in understanding the hydrogeochemistry, spatial distribution, origin of groundwater F− and B and the level to which the underlying geology influences the F− and B. Human health risks of F− and B were also assessed based on the model of the US Environmental Protection Agency. Groundwater is alkaline in this area and the dominant hydrochemical facies is Na-HCO3 facies, which is a reflection of the predominant carbonate lithology of the Oti/Pendjari Group in the region. The study reveals that the F− concentrations range from 0.05 to 13.29 mg/L with an average value of 3.26 mg/L, suggesting that majority of the boreholes have F− concentrations higher than the acceptable limit (1.5 mg/L) of WHO. The B concentrations also vary from 0.03 to 5.13 mg/L with an average of 1.52 mg/L in excess of the guideline value of 0.5 mg/L. The groundwater F− and B threats, respectively affect about 70% and 82% of boreholes in the region particularly around the northeastern, southeastern, central, and western parts. F− and B are mainly coming from geogenic sources and are controlled by hydrogeochemical factors such as semi-arid climatic conditions of the region, alkaline nature of the water, water-rock interaction, intense weathering, ion exchange, mineral dissolution and precipitation. The human health risk assessment reveals that non-carcinogenic risk for F− and B is higher in children than the adult population. About 89% of children in the study area are exposed to initial symptoms of dental and skeletal fluorosis and have higher chances of cardio-protection since no health threat is currently reported for high B in drinking water. We recommend immediate action towards mitigating the high groundwater F− to safeguard the health and livelihood of the people. (Zango et al., 2019)

Keywords: Hydrogeochemistry; Groundwater; Fluoride; Boron; Risk assessment; Northeastern Ghana

Zango, Musah Saeed, et al. "Hydrogeochemical controls and human health risk assessment of groundwater fluoride and boron in the semi-arid North East region of Ghana." Journal of Geochemical Exploration 207 (2019): 106363.

Quality of Water from Rift Valley Lakes of Ethiopia for Livestock Drinking

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Abstract:

Water from five rift valley lakes (Awassa, Beseka, Chamo, Langano and Shala) of Ethiopia was sampled at the inlets, sites influenced by human activity and livestock drinking sites. Quality of water was evaluated based on physicochemical and microbiological properties, while suitability of the water for livestock drinking was evaluated by comparing the results with maximum levels which are safe if present in livestock drinking water. There was no difference in water quality parameters ($P>0.05$) among sampling sites but it varied among the lakes ($P<0.01$). Comparison of the measured parameters with guidelines shows that levels of magnesium, calcium, nitrate, nitrite and zinc in water of all lakes, temperature, alkalinity, salinity, potassium, chloride and bicarbonate in more than 80% of the samples (except Lake Shala) and pH and sodium in 60% of the samples were below the maximum permissible levels in livestock drinking water. Nevertheless, levels of iron, cadmium and total coliform count in all the samples, and chromium, copper and manganese in 93% of the samples were beyond the safe limits. Although consumption of water with relatively high concentrations of chemicals for short term may not affect animal performance, the high concentrations of toxic elements need due attention, since human health could be affected through residues in animal products. Based on this result, the lakes except Shala, can be considered safe drinking water sources for livestock. However, to make a concrete conclusion, it is necessary to undertake detail analysis of the lake water at different seasons including other quality parameters that are not included in the present study and to evaluate long term effects of drinking the water on different species, breeds and classes of livestock. (Yirga et al., 2019)

Keywords: Livestock drinking water, Microbiological properties, Physicochemical properties, Rift valley lakes, Water quality

Yirga, Hirut, et al. "Quality of water from rift valley lakes of Ethiopia for livestock drinking." East African Journal of Veterinary and Animal Sciences 3.1 (2019): 9-16.

Water Supply And Sanitation In Zimbabwe's Resettlement Areas: A Case Study Approach

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Abstract:
Access to clean and safe water and adequate sanitation facilities is a basic human right, yet this remains a huge challenge in many developing countries of the world. The study sought to assess access to safe water and sanitation in a resettlement area in Zimbabwe. Both qualitative and quantitative research methods were used to collect primary data. The study revealed a precarious, and unacceptable, situation regarding access to safe water and adequate sanitation in the study area. 74% of study respondents lacked access to safe water, while 57.3% had no toilet facility at their homesteads. The results of the study highlight the general poor state of service provision in the country's resettlement areas, largely due to a poorly planned and politicized resettlement programme; in addition to highlighting the drastic demise of water and sanitation infrastructure in the country following economic decline and political isolation since the turn of the century, as most of the country's water and sanitation initiative's funding partners left the country. The need for properly planned and depoliticized resettlement areas, adequately served with essential social services such as water and sanitation infrastructure, cannot be overemphasized. Zimbabwe should also desist from overdepending on donor funding for its water and sanitation initiative, and set aside specific budgetary allocation from treasury. Only then can the country have a viable and sustainable water and sanitation provision programme, with donor funding only playing a supportive role. Hence, the collapse of the water and sanitation sector following the withdrawal of funding by donors and other partners should be treated as an important eye-opener. (Chigonda & Chazireni, 2018)

Keywords: water supply, sanitation, resettlement areas, land reform, water-borne diseases, Zimbabwe

Chigonda, Tanyaradzwa, and Evans Chazireni. "Water supply and Sanitation in Zimbabwe's Resettlement areas: A case study approach." European Journal of Social Sciences Studies (2018).

Identifying determinants of sustainable water management at the household level through rainwater harvesting systems in Nepal

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Abstract

The urban water supply systems around the world are highly stressed at present due to growing water demand caused by rapid population growth and unplanned urbanization. The growing environmental awareness and water supply restrictions have made rainwater harvesting systems (RWHS) a priority as well as a necessity in many countries. To improve urban water security, the practice of an RWHS is increasingly being adopted in the cities and towns of developing countries. This study aims at identifying the factors affecting the adoption of rainwater harvesting for household uses in the Kathmandu valley (KV) of Nepal. The results were drawn from a survey of 405 respondents who reside in the KV. To explain the determinants of adaptation, structural equation modeling (SEM) was used. Results show that independence for water access and system sophistication are significant for the adaptation of RWHS and relative advantage plays a moderating role that has partial mediation among dependent and independent variables with a significant relationship. Thus, variables like independence for water access, system sophistication, relative advantage and sustainable use should be highlighted for a sustainable supply of water. For this, we recommend effective policy interventions at the local and national level for the adoption of RWHS and its advantages in terms of safeguarding water in the long run at the present changing climate scenario. (Thapa et al., 2022)

Key words: Kathmandu valley, rainwater harvesting system, structural equation modeling, sustainability, urban water management

Thapa, Anusha, et al. "Identifying determinants of sustainable water management at the household level through rainwater harvesting systems in Nepal." Water Policy 24.10 (2022): 1676-1691.

Health impacts of water and sanitation insecurity in the Global North: a scoping literature review for U.S. colonias on the Mexico border

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Abstract

U.S. border colonias are peri-urban settlements along the U.S.–Mexico border. Residents often face substandard housing, inadequate septic and sewer systems, and unsafe or inadequate household water. As of 2015, an estimated 30% of over 5 million U.S. colonia residents lacked access to clean drinking water, suggesting health complications. This scoping review identifies a very limited existing set of research on water and sanitation insecurity in U.S.–Mexico border colonias, and suggests value in additional focused research in this specific context to address health challenges. Preliminary health data indicates that due to water insecurity, colonia residents are more likely to contract gastrointestinal diseases, be exposed to carcinogenic compounds from contaminated water, and experience psychosocial distress. These widespread health issues in colonias are exacerbated by historical and ongoing socioenvironmental injustices in the U.S.–Mexico border region and their relation to the poor health outcomes. (Zheng et al., 2022)

Key words: colonias, health, mental health, sanitation, scoping review, water insecurity

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