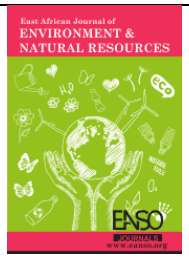

East African Journal of Environment and Natural Resources
eajenr.eanso.org
Volume 7, Issue 1, 2024
Print ISSN: 2707-4234 | Online ISSN: 2707-4242
Title DOI: https://doi.org/10.37284/2707-4242

EAST AFRICAN NATURE & SCIENCE ORGANIZATION

Original Article

Water Governance in Tanzania – A Synthesis of Legal and Institutional Frameworks for Groundwater Management in the Upper Great Ruaha River Catchment

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Article DOI: https://doi.org/10.37284/eajenr.7.1.1836

Date Published: *23 March 2024*

Keywords: *Water, Groundwater, Institutional Arrangements, Regulations, and Sustainability.*

ABSTRACT

The importance of groundwater resources in buffering the effects of climate change on water scarcity and security is highly acknowledged worldwide. However, groundwater development and use can only be sustainable with a more robust policy and institutional arrangements related to water governance. The purpose of this study was to analyse the legal framework of water resource development and management in order to contribute in identifying policy constraints to sustainable groundwater resource development and management in Tanzania. The paper used information from literature reviews and data collected through qualitative methods using a case study of Usangu Plains in the Upper Great Ruaha River Catchment in Tanzania. The findings reveal that water governance institutional frameworks are well structured to provide guidelines on how water as a basic human resource can be utilised and properly managed, but most importantly, these institutional arrangements place disproportionate emphasis on groundwater. Attaining sustainable groundwater development and use requires new disclosures and narratives in water policy and law, integrating both surface and groundwater resources. The weaknesses identified in groundwater governance need to be taken on Board once, the existing water institutional frameworks open to perfection for sustainable utilisation of groundwater resources.

APA CITATION

Mosha, D. B. (2024). Water Governance in Tanzania – A Synthesis of Legal and Institutional Frameworks for Groundwater Management in the Upper Great Ruaha River Catchment. *East African Journal of Environment and Natural Resources*, *7*(1), 112-123. https://doi.org/10.37284/eajenr.7.1.1836.

CHICAGO CITATION

Mosha, Devotha Baltazary. 2024. "Water Governance in Tanzania – A Synthesis of Legal and Institutional Frameworks for Groundwater Management in the Upper Great Ruaha River Catchment". *East African Journal of Environment and Natural Resources* 7 (1), 112-123. https://doi.org/10.37284/eajenr.7.1.1836.

HARVARD CITATION

Mosha, D. B. (2024) "Water Governance in Tanzania – A Synthesis of Legal and Institutional Frameworks for Groundwater Management in the Upper Great Ruaha River Catchment", *East African Journal of Environment and Natural Resources*, 7 (1), pp. 112-123. doi: 10.37284/eajenr.7.1.1836.

IEEE CITATION

D. B., Mosha. "Water Governance in Tanzania – A Synthesis of Legal and Institutional Frameworks for Groundwater Management in the Upper Great Ruaha River Catchment", *EAJENR*, vol. 7, no. 1, pp. 112-123, Mar. 2024. doi: 10.37284/eajenr.7.1.1836.

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Article DOI: https://doi.org/10.37284/eajenr.7.1.1836

MLA CITATION

Mosha, Devotha Baltazary. "Habitats Heterogeneity Affects Bee Species Assemblage in an Urban Green Space: A Case Study of Nairobi Museum Botanic Garden, Kenya". *East African Journal of Environment and Natural Resources*, Vol. 7, no. 1, Mar 2024, pp. 112-123, doi:10.37284/eajenr.7.1.1836.

INTRODUCTION

Groundwater is abundant globally and is an important resource for social and economic development in both developed and developing countries. Its importance is demonstrated by its potential to supply more than 50 percent of total municipal water withdrawals, 43% of global irrigation water use, and 40% of total industrial withdrawals while sustaining important ecosystem functions (Siebert et al., 2010). Regional-wise, groundwater provides about 70% of drinking water in the European Union, 80% of water supply in Sub-Saharan Africa (SSA), and 60% of agricultural irrigation water in India (Foster et al., 2012). Globally, groundwater is increasingly utilised in meeting demands on water supply due to insufficient surface water flows resulting due the impact of climate change (Kisakal and Mato, 2018). Climate change and variability causing extreme droughts (e.g., El-Nino events) and unreliable rainfall patterns have negative impacts on river flows and lake levels leading to water deficit in most regions. Water deficits normally jeopardise economic development activities, including agricultural productivity, water quality, sanitation, and human well-being.

In Tanzania, groundwater supplies more than 25% of water used for domestic purposes (Imogen Bellwood-Howard et al., 2022). It is a holistic water source in arid and semi-arid regions in Tanzania, particularly in Dodoma, Dar es Salaam, Shinyanga, Simiyu, Arusha, Mara, Southern Kilimanjaro, and Usangu Plains (Brüssow et al., 2019). In these regions, groundwater forms the foundation for social and economic development because climate change has profound impacts in all stages of the hydrological cycle (precipitation, evaporation, runoff, and river flows (Pavelic et al., 2012). Therefore, groundwater is used for domestic water supply and to a lesser extent for irrigation (Mosha et al., 2022). Several studies have shown that groundwater development and management have not been seen as an important component of the water sector in Tanzania and, subsequently, has not been exploited as heavily as surface water (Gudaga et al., 2018; Imogen Bellwood-Howard et al., 2022). The majority of the groundwater sources remain undeveloped in rural and peri-urban areas, and a good proportion of the population uses water from crudely developed sources, for instance, dug wells, circumstances which threaten human health due to pollution. This uncertainty in groundwater shallow wells presents a risk to the sustainability of groundwater for human consumption and economic development. Evidence shows that in the recent decades (2010 - 2030), due to the availability of electric energy, geological information and knowledge, and accessibility to high drilling and pump technologies have brought about a silent groundwater revolution in Tanzania, especially in urban and rural settings (Gudaga et al., 2018; Komakech & de Bont, 2018). Likewise, commercialisation of electrical, diesel, and solar pumps inevitably accelerates the intensification of groundwater abstraction in rural settings, and threatens quality, quantity as well as aquifer degradation. As such development, the capability of existing water governance is likely to be unfit with this evolution of groundwater extraction.

According to Sappa et al. (2015), water governance is the range of political, social, economic, and administrative systems that are in place to influence the use of water and its management. Governance is essential and, in most cases, is considered by many development practitioners as a very important aspect of sustainable, equitable and social inclusion through the allocation and regulation of water use (Wijnen et al., 2012). Essentially, governance is all about who gets what water, when and how, and who has the right to water and related services. In addition, governance involves the art of coordinating administrative actions and decision-making between and among different jurisdictional

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Article DOI: https://doi.org/10.37284/eajenr.7.1.1836

levels—one of which may be the local community (Brüssow et al., 2019). According to Chilton and Smidt (2014), a good groundwater environment is one where governance processes equitably reflect the voices and interests of different stakeholders and where broadly supported courses of action can be implemented effectively and equitably manner. For this paper, governance refers to the operation of rules, regulations, instruments, and organisations that can align stakeholder behaviour and actual outcomes with policy objectives and subsequently play a role in realising water adequacy, equitable access, inclusivity, and sustainable use.

While a number of research has been conducted regarding water resources management and use worldwide, Africa and Tanzania in particular (See, for example, Pietersen *et al.*, 2012; Chakava et al., 2014; UN WWDR, 2015; Brüssow et al., 2019; Gudaga et al., 2018; Mosha *et al.*, 2022), very little is known on narratives and discourses of existing water policy and laws on groundwater resource. Besides, a study by Komakech and Bont (2018, pp. 624) pointed out that little research has been done on the "governance of groundwater in the Africa continent…" Tanzania is different from some African countries; groundwater governance still is under the broader national water policy of 2002 and Water Resource Act No., 11 of 2009. My concern was to explore the extent to which existing water policy and law and any related regulations describe how groundwater should or will be managed to sustainable and equitable use. In trying to narrow this research gap, the paper uses information or data from key informants – groundwater users and literature reviews. A case study highlights the practical side of how the laws and regulations are operationalised and perceived by groundwater users in the UGRRC, Tanzania and its associated challenges. Findings from this study, therefore, intended to raise governance of groundwater at the top of the agenda for policy makers and other practitioners to safeguard this important common pool resource. More detailed in the below methodological and other sections.

METHODOLOGY

Study Area

This paper builds on past research works and research project outputs of the authors in the field of unlocking the potential of groundwater resources in Sub-Saharan Africa (Gro-Future in SSA). The Gro-Future project was conducted by the authors from 2013 to 2018 at the UGRRC. The Upper Great Ruaha River Catchment (UGRRC) is situated in the upper reaches of the Rufiji River Basin (RRB). The basin lies within a semi-arid belt from North to South through the central portion of Tanzania. The UGRRC covers an area of 85,554 km^2, which is equivalent to 46.5% of the total drainage of the RRB. The area also comprises the catchment area of the Great Ruaha River and its main tributaries, such as the Little Ruaha River (Mwakalila, 2011). The Usangu Plains is on the lowland side of the UGRRC within the Mbarali district. It covers an area of 21,500 km^2 and forms the headwaters of the Great Ruaha River (Rufiji Basin Water Office (RBWO) 2010). The area receives a unimodal rainfall pattern normally from mid-November to April. The average annual rainfall is 1,500 mm in the upper catchment and 600 mm in the plains. The Usangu basin has potential for paddy production, hydropower generation and national parks, hence contributing greatly to the national economy and to about 1.2 million people who are living in the UDRRC (Mwakalila, 2011).

Research Methods

The methods used in this paper include a review of water governance reports not limited to the national water policy of 2002, Water Resource Management Act No. 11 of 2009, the 2013 guidelines on the requirements for groundwater exploitation and development, the thesis, and GroFuture project publications. The paper also draws qualitative information that was collected during an interview with key informants and focus group discussions (FGD) under the Gro-Future project. Fifteen key informants were interviewed. The key informants were three Village Executive Officers (VEOs), three chairpersons from each

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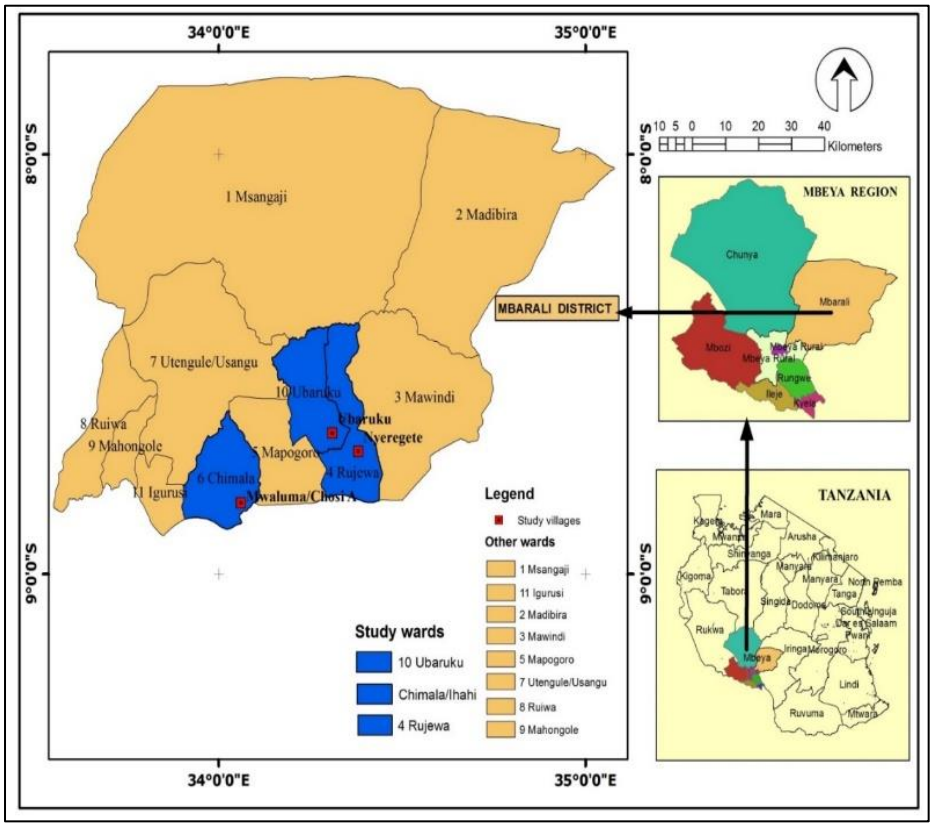
village, three water managers (officials from the Rufiji Water Basin Board), one secretary of a Community Water Supply Organization (COWSO) famous known as Ubaruku Mpakani (UBAMPA); one District natural resources manager and 4 traditional elders from the study villages.

In addition, three FGDs were conducted, one in each village with a maximum of 35 participants. The FGD participants and key informants were purposively selected as these were people who were knowledgeable and experienced with the topic under discussion. Gender issues such as sex, age, and experience of respondents were among the aspects that were considered in their selection. The discussion and interview with FGD participants, as well as key informants, were guided by checklists of items. FGDs captured information on groundwater allocation, availability, access, usage, and management.

The study found that the selected participants were quite well-informed and normally were the ones who managed all information related to groundwater facilities in their village. They were able to clarify issues related to institutional and structural arrangements on groundwater governance. The primary information was drawn from communities of the Usangu Plains, involving three villages, namely Nyeregete, Ubaruku, and Mwaluma (Figure 1). The villages were purposively selected based on the degree of dependence on groundwater resources, availability, accessibility, public use, and presence of collective actions on water management. Information from policy and stakeholder analysis workshops is also integrated in this paper.

Figure 1: Map of Mbarali district showing study villages



Data Analysis

The qualitative data were analysed using the content analysis approach. This involves clustering information recorded during the discussion into smaller meaningful units based on the objectives and themes of the research. The information was clustered based on the frequency of responses and then summarised in narratives.

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Article DOI: https://doi.org/10.37284/eajenr.7.1.1836

RESULTS AND DISCUSSION

Uses of Groundwater in the Upper Great Ruaha River Catchment

Groundwater is a major source of water in the UGRRC and the most viable alternative supplement to surface water. Findings in *Table 1* show that 96% of groundwater is used for domestic purposes, 47% for livestock, 62% for brickmaking, and 33% for irrigation in backyard gardens.

During FGDs, participants showed that almost all villagers (100%) access and use groundwater during the dry season. Groundwater sources are from both deep wells (boreholes) and shallow wells. A deep well is one constructed by either cable tools or rotary-drilling machines (van der Wal, 2010). Most of the deep wells were more than 60 meters deep, and the space around the casing is sealed with grouting material of neat cement to prevent contamination by dirty surface water. Drilled shallow wells comprise a pipe drilled into soft ground, such as gravel or thick sand and a perforated pipe is attached at the end of the pipe to allow water to seep into the well (van der Wal, 2010). Besides, their construction is done in such a way that locally available materials can be put into use. It was reported that *"…The dependency on groundwater decreases in the wet season because of the use of harvested rainwater and runoff from ephemeral streams…"* narrated one of the respondents from Ubaruku village.

Table 1: Extend of households using groundwater in Usangu Plans (N= 45)

Groundwater uses	Frequency	Percentage*
Domestic	43	96
Livestock	21	47
Brickmaking	28	62
Irrigation	14	33

** Percentage, not necessarily add to 100 due to multiple respondents*

The findings reveal that the minimal water requirement per person varies within the study villages, ranging from 30 to 50 litres per day in Ubaruku village and between 25 and 40 litres per day in Nyeregete and Mwalima villages. The amount of water consumption per household depends on the household size, age, and household members. For example, families with a high number of children under-five years consumed more water than families with no or few under-five children. Although groundwater is also used in irrigated agriculture to a low extent, it is mainly used to irrigate paddy seedlings raised in nurseries, particularly in November and December each year, and backyard gardens where horticultural crops, including vegetables, onions, tomatoes, and fruit trees, are grown. One of the most interesting cases in the Usangu Plains was the Mont Fort Secondary School, which was operated and owned by a Roman Catholic Church. Since 1998, the school used groundwater to irrigate horticultural crops.

National Water Policy, Water Laws, and Institutional Landscape in Tanzania

The National Water Policy (2002) and Water Resource Management Act No. 11 (2009) are the principal institutional frameworks for Tanzania's water sector. They provide a comprehensive framework that emphasises equitable access, appropriate exploitation, and sustainable development, control, and management of both surface and groundwater resources for the benefit of the present and future generations. In order to realise this goal of sustainable development, management, and use of water resources, the National Water Policy sets four long-term policy objectives, which are to (i) preserve, conserve and protect available water resources and allocate them in sustainable, rational, and economic ways; (ii) supply good quality water in sufficient quantities to meet the various water needs, including poverty alleviation while ensuring safe wastewater disposal and environmental

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protection; (iii) establish efficient and effective institutions to achieve systematic development and management of the water sector; and (iv) develop a sound and sustainable system for effective water resources management, water supply, and sanitation development (URT, 2002).

The water policy implementation strategies emphasised the need to (i) determine the quantity, quality, and location before one can advocate the use of groundwater in all nine river basins; (ii) develop sustainable operational, maintenance, and management criteria for groundwater use; (iii) explore and monitor groundwater resources and prepare comprehensive guidelines for groundwater development in the basin. From the literature reviewed, neither the promotion nor the rule and regulation of groundwater use have received much attention. Groundwater managers and users in Usangu Plains and the UGRRC reported that little effort had been put forward on the management of invisible water sources (that is, groundwater). Komakech and de Bont (2018) also noted that policy implementation strategies are focusing more on surface water and less on groundwater. This means that groundwater is typically undervalued as it is often weakly governed, underfunded, and underrepresented in water policy discourse.

The current water law (WRMA No. 11 (2009) defines regulations on how the country's water resources should be accessed or made available, controlled, and regulated while ensuring the achievement of the three goals: social equity, economic efficiency, and environmental sustainability (van Koppen et al., 2016). The law and groundwater licensing regulation of 2013 provide guidelines to ensure that groundwater is recognised, used, and protected as an integral part of the country's natural resources. A number of the groundwater-related guidelines stipulated in the documents are as follows:

- Groundwater is a public asset, and trusteeship is vested in the state.
- Groundwater is an integral part of the water resource and must be managed based on the principles of IWRM.
- Groundwater will be managed on the basis of aquifer boundaries and in conjunction with the river basin.
- Vulnerable recharge areas and potential groundwater sources, and areas with poor water quality will be identified, delineated, and declared as protected areas.
- The status of surface and groundwater resources in terms of quantity and quality and their uses will be defined regularly on the basis of a river basin and in conjunction with aquifer boundaries and
- The information is made easily accessible to users, stakeholders, and decision-makers.

Generally, the WRM Act (2009) emphasises that any person being the legal owner or occupier of any land may construct a shallow hand-dug well (provided that the source did not exceed 22.7 m^3 per day) and use that water for domestic purposes without Groundwater Permit (URT, 2009). However, the Act specified that "…a person who wants to construct a deep well or borehole in groundwater-controlled area or any other area" needs a groundwater permit (URT, 2009, p. 387). Though the guideline clearly articulates to requirements for groundwater abstraction, landowners assert their rights to develop and abstract water beneath their land, and this is a general practice in the study sites. The section below highlights institutional fragmentations and their implications on groundwater governance, a case study of the UGRRC, particularly the experience of Usangu Plains communities.

Institutions versus Practices: Institutional Fragmentations

The current water policy of 2002 and Act No. 11 of 2009 define water as a public asset or property and clearly emphasise that before groundwater is abstracted, the users should obtain approval—a "water permit" from the state. The procedure for license applications is supposed to apply to all

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categories of people, e.g., the rich, poor, marginalised, and disadvantaged groups, including elders, women, and disabled people. As described in the above section, the regulations allow people to drill shallow and use water for domestic purposes freely, while all other groundwater abstractions, e.g., a deep borehole, need a water permit. In the Usangu Plains, drilling of boreholes is done by a company following formal procedures such as environmental impact assessment and quality, and quantity tests (Komekech & de Bont, 2018). However, some of the groundwater abstractors and users deliberately take advantage of the freeness attached to using a shallow well. It was reported even the better-off water users, businesspeople, and organisations (such as schools, churches, and mosques) had no water permits. Even the investors who owned land within the catchment take the same advantage of abstracting groundwater, claiming that the right to groundwater abstraction is entrenched on land property rights. This means that despite the fact that water regulations and guidelines vest ownership and regulatory powers in the state, decisions on how much water to abstract in the basin were in practice, left to landowners. This reinforces the perception that groundwater is a private good.

On the other side, the study found that even those who are aware of the regulations pertaining to groundwater management are not willing to pay the water fee; their opinions are much embedded in the old mentalities of either that water is a gift from God, or that entitlement to it is attached to land ownership. FGD participants blame the Government of Tanzania for not putting more effort into surface water. They reported that development planning, fund allocation, and staffing are often prejudiced to surface water. The 2013 groundwater licensing regulations describe the entitlement of groundwater resources and that their development, exploitation, and management are governed by rules (Mosha et al., 2022). In this regard, all groundwater wells must be officially recognised and registered by the Government authority as well as areas to be drilled should be notified as 'sensitive' where notice of intention to drill is the requirement (URT, 2013). Unfortunately, local water users have little awareness of the requirement of groundwater abstraction and development, and the government officers responsible for managing this important resource take for granted that users are aware. Little or lack at all on how groundwater should be controlled and managed is consistent with what was observed in the Iringa District Council (Mosha et al., 2022); that is, irrigators abstract irrigation water without having a water permit from the Rufiji River Basin Office. The situation that causes overexploitation, competition, and conflict over water. Based on this awareness creation to groundwater users is essential to change their mindset and attitude towards sustainable utilisation and management of water resources.

Organisational Setup and Fragmentation

The government of Tanzania has transferred responsibilities for supervision and management of water resources from the central government to the basin, catchment, sub-catchment, and local communities. In 1989, the Minister of Water gazetted nine river basins and subsequently the establishment of the River Basin Offices (RBO) and its associated Boards. The Basin Water Board is the paramount institution responsible for the development and management of water resources. It is responsible for the coordination and control of all water resources in each basin. Each basin has a Board and an Office stationed at its headquarters. In our case, the Rufiji River Basin is one among the nine basins established in 1990, and the Rufiji River Basin Office (RRBO) and its Board were established in 1993.

The Board has the mandate to coordinate technical aspects of Regional and District transboundary issues in the basin, approve issues revoke water use and discharge permits, and integrate district plans into water resource management plans (Ministry of Water, 2014). In most cases, however, the basins tend to be most efficient and effective when they focus on clear tasks and immediate needs rather than on long-term objectives. As many water scholars argue, a clear

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definition of long-term objectives depends on political priorities and financial processes (Van Koppen et al., 2016). The trend shows that ministers, executive directors, and leaders stay for a short period in their management posts.

Leadership reforms in the water sector have always preceded or occurred during political changes. The reforms happened as a combination of sudden and gradual change. For example, ministers and water technical officers do not stay for long periods to provide such kinds of support (see van Koppen et al., 2016). No single minister was responsible for the water sector to achieve long-term objectives. At the local level, there are water user associations established with the purpose of controlling the allocation and distribution of water from a common pool resource. However, during the FGDs, participants argued that the water user association focuses on surface water only. This means that the procedures diverge widely from popular perception and from actual practice either due to a lack of awareness or to laxity of official water resource managers of the basin water board. Van Kopen et al. (2016) argue that centralisation does not take local stakeholders' knowledge and interests into account; rather, it imposes a top-down approach that often benefits the vested interests of the rich and powerful while undermining the poor and the powerless.

Groundwater Management Challenges in the UGRRB, Tanzania

Rules Enforcement Problems

Breaching existing rules and bylaws due to laxity and nepotism among village leaders is one of the challenges. The reluctance to implementation of laid down procedures implied a lack of accountability among responsible organisations and officials. Taking evidence from South Africa with the trend in politics, leaders at province, district, and community levels appeared to lack political will and commitment to groundwater resource management (Foster *et al.*, 2012). It was also learned that the process of acquiring a water permit takes a long time, either due to inadequate human and financial resources or the carelessness of some staff. *"…there is a severe shortage of technical capacity and financial resource…"* narrated DWE in Mbarali District Council. Arguing the evolution of groundwater use in Tanzania does not match its management utilisation procedures, consequently leading to a set of unachievable expectations. A vivid example is that the water sector had high expectations that the water supply and management section would be financially self-sufficient through a collection of water fees or taxes and self-income generation projects. Yet, this overarching goal bounced, and hence, often, there is concern about low revenue collection from water tax payments (Van Koppen et al., 2016).

Licensing and Procedural Problems

In Tanzania, regulations or requirements for the abstraction of groundwater, control, and management through the use of water permits has met some problems due to operational difficulties, especially in obtaining applicants' necessary information. In the past, water rights which have now changed to water permits, were issued centrally at the Ministry's headquarters. However, due to long bureaucratic procedures, it was impossible to get it on time, and this was therefore transferred to the headquarters of respective basins. This is still a problem because the RRB has about 173,000 $km^{2,}$ which creates difficulties for interested people or parties to travel all the way to its headquarters, which is based in Iringa town. Participants of FGD claimed, *"...processing of water permit could take up to 9 months and needs a lot of money since the location of the office is about 250 kilometres from our residence".* Lack of data on the resource, including quality and yield capacity, provides an additional burden on the water administration staff for timely processing and issuing of water permits (Pietersen *et al.*, 2012).

As mentioned earlier, the licensing process can take up to 9 months or more to complete. Local water users often regard it as bureaucratic and a tedious piece of work rather than a powerful tool for ensuring sustainability. The majority of local

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water users in Nyeregete village did not perceive any advantage of seeking a water permit. They claimed that by having licenses, you will be required to pay water fees and comply with conditions in the license in order to continue using the resource, while their fellow water users continue to enjoy the resource freely. This negative attitude toward groundwater resources has continued to spread to the younger generation; with time, it will be difficult to institutionalise the water permit.

Staff and Administrative Problems

As far as URBC is concerned, the Rufiji River Water Basin Office needs more staff and capacity building because it has inadequate staff to deal with both surface and groundwater resources. Human resources are inadequate, including professional expertise, which is missing at most management levels (RBWO, 2010). For example, the basin administration stayed for a long period without recruiting a hydrogeologist or groundwater engineer responsible for technical aspects. For example, from an observation point of view the number of groundwater staff in the Rufiji River Basin office (geologists, drilling and groundwater inspectors, superintendents, and groundwater assistants, including community development officers) working in the basin is about 20 staff.

Each district office, in most cases, has only one water resources expert (District Water Engineer). As a result, the RBWO has "very limited capacity to monitor and control illegal abstraction and to evaluate and judge each application on its own merits, check on-site or enforce the licensing process. Possibly, this makes them have a bias toward surface water. According to Movik et al. (2016), these problems are exacerbated by the perception that the process of license granting can only be allocated through the formal authorisation of licenses (already a highly bureaucratic and complex administrative process). Interviews with a series of experts from government, academia, and social organisations in the basin also highlighted that the problem is linked to a poor level of centralisation of the water administration in the country. There is limited structural integration between decentralised government bodies (Regional water office, Local government offices, and River Basin Offices), causing limitations in the exchange of staff as well as cooperation between and across sectors very difficult. This led to difficulties for staff from the Rufiji Basin Water Office in processing licenses and monitoring groundwater use and management.

Regulating the Construction of Boreholes

Under the Water Act, groundwater abstraction rights in the borehole may only be acquired through a permit. Part VII Section (a) 44 stipulates that it is an offence to construct a borehole without a permit. Following this, it was expected that water managers at the basin level would be in a position to regulate the abstraction and use of groundwater. The challenge of this system, however, is that it is dependent on landowners coming forward with information regarding their intention to abstract groundwater. Since boreholes are located within the boundaries of private property, there is a good chance that the basin officers and local authorities may not know that a borehole has been drilled. The water basin's ability to enforce these rules through its own inspection, monitoring efforts, and collaboration with the district council in providing information, therefore, becomes critically impossible.

Inadequate Information for Groundwater Management

Stakeholder consultations identified that information beyond basic hydrogeology is either less available or lacking. According to evidence (Kashaigili 2010; Wawa, 2020), there is limited information and knowledge of aquifer characteristics and exploitation, which certainly undermines the capacity to manage groundwater resources in Tanzania. Information is needed not only on aquifer characteristics but also on uses and users in order to understand the behaviour and trends of groundwater flows (EWURA, 2016). In Tanzania, the only aquifer that is adequately delineated for management is the Makutupora

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Article DOI: https://doi.org/10.37284/eajenr.7.1.1836

aquifer in the Dodoma region. Scholars argue that this situation is due to high costs of collection prevalent capacity and skills gaps, and lack of commitment and resources. These findings confirm Kisaka & Mato's (2012) argument that poor data or inadequate availability of water-related data and inappropriate water information systems are major constraints in many water river basins in Africa. In general, it is argued that it is essential to keep in mind that without this information, the ability of managers to regulate pumping, polluting activities and inappropriate land uses is severely restricted, and thus it hampers management efforts (Danert & Furey, 2012). We strongly argue that once information is collected, it has to be available to water managers and to all stakeholders through an open information policy.

CONCLUSION AND RECOMMENDATIONS

Tanzania National Water Policy of 2002 and Water Resource Management Act No. 11 (2009) are key overriding institutional frameworks that guide the planning, development, and management of both surface and groundwater resources. The policy describes the vision, missions, and strategies that aim to control and regulate the development and management of water resources in inequitable, efficient, and sustainable ways for the current and future generations. The law recognises the economic value of groundwater and, therefore, imposes a number of regulations to guide and control its abstraction and use. Additionally, there are the 2013 groundwater licensing regulations, which describe entitlement of groundwater resources and that their development, exploitation, and management are governed by rules. In general, the rules in use emphasise that the groundwater resource needs good protection and management to avoid overexploitation and degradation of aquifer systems in Tanzania's water river basins.

Although there are rules and regulations itemised in water institutional frameworks, they are undoubted because they are deemed to be biased toward surface water and practically become difficult to use. For example, the water law clearly states that ownership of both surface and groundwater is vested in the state and that the owner must acquire a license to use groundwater. Regardless of this, misunderstanding arises among groundwater users that, leading to difficulties in putting it into practice because of failure to adhere to or accept the rules and some other constraints, such as "…. social views of groundwater (ownership) lag behind the formal policy of public resource, and are tied more on closely to land ownership…" Consequently, groundwater resource development happens largely in the private arena without effective authority control. The situation is constantly compromised by an unlawful abstraction, which threatens its availability in the long run. The difficulties in practising the regulations are also facilitated by inadequate human and financial resources, weak enforcement mechanisms, and partly by bias to political commitments. Apparently, good governance arrangements need to be matched with implementation capacity, mainly in terms of financial and human resources.

Intriguingly, fundamental groundwater management challenges are related to bias toward surface water, fragmented and lack of awareness of institutional aspects and setup, weak enforcement mechanisms, and inadequate financial and human resources. Inadequate availability of groundwater data/information also hampers efforts toward sustainable management and use of groundwater. Attaining good groundwater governance first requires new disclosures and narratives of water policy and law integrating well both surface and water resources regulations without placing disproportionate emphasis on surface water management only. Tanzania has formal water governance arrangements in the forms of institutional and organisational frameworks when open to improvements, detailed specific regulations, and guidelines for groundwater management.

In addition, actions are needed to create awareness of the existing groundwater regulations and enforcement mechanisms regarding requirements

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Article DOI: https://doi.org/10.37284/eajenr.7.1.1836

for compliance with the water laws. The actions would need to target individuals' groundwater users and public and private sector organs operating under the water institutional framework. In principle, political will, commitment, and accountability are required to put groundwater regulations into practice for sound management.

ACKNOWLEDGMENTS

I would like to thank, in particular, Rufiji River Basin Officers, villagers from the three villages Ubaruku, Nyeregete, and Matebete, and other stakeholders in the basin for their active participation, generous insights, and feedback. The author is grateful to Prof. Andrew Tarimo for his editing and perfecting of this paper during early manuscripts developed.

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