Discerned Access: Underutilized groundwater potential for improving livelihood in Ngara District, Tanzania

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INTRODUCTION

• Groundwater is an essential resource for a large share of the global population and economies, particularly in developing countries where water is becoming scarce.

• It is a vital drinking water source and the primary water supply source in rural and urban populations. It provides potable water to about two billion people and 42% of irrigation water, contributing to about 40% of world food production.

• However, groundwater sources are less exploited due to differentiated water sources, inadequate knowledge, poor technology, socioeconomic development and increased incidences of pollution.

• Thus recommended that Land use planners take the necessary steps to guarantee groundwater resources and their recharge mechanism are sustained and well protected (Nkosi et al., 2021).
INTRODUCTION

• However, limited information on groundwater sources, recharge, stability and sustainability under the changing environments were noted.
• How the interdependence and interaction between climate change, irrigation, vegetation and river discharges affect the groundwater recharge process must be clarified.
• This study is devoted to groundwater sources that are less exploited and have very little governance information in the literature on the Kagera river Sub-basin (specifically in Ngara District).
• This paper contributes to knowledge for understanding the groundwater resources' potential and utilization challenges for decision-making.
2. Methodology

Study area

- Ngara district is one of the eight Kagera Region districts, located between longitude 30° 15’E and latitude 2° 10’ and 3° 0’S

- Ngara District is a strategic point that borders Rwanda and Burundi to the West and North West.

- The district falls in a series of dissected plateaus at different altitude levels, with hills and valleys resulting from subsequent erosion and dissection.
Study area

- The district has major rivers; the Kagera, which marks the north-western border with Burundi and Rwanda, and the Ruvubu River, which flows around the southern border and crosses the district to join the Kagera River.
- There are Perennial and seasonal rivers and springs marked by the numerous valley bottoms across the district.
- The main land use types of Ngara district are uplands agriculture, wetland agriculture (mainly subsistence), silviculture, game reserve and livestock.
- The main natural vegetation types in the district include riverine forest, wooded grassland, bushed grassland, grasslands and the poorer drained parts of the minor valleys.
2. Methodology

Used the mixed approach that includes qualitative and quantitative data collected through:

- Key informant interviews
- Household questionnaire,
- Focus group discussions,
- Direct Field observations.
- Literature review that reviewed the government reports, journal papers, books, published articles, policies and regulations.
Data organization and analysis

• The study assessed groundwater differentiated access and challenges to knowledge, infrastructure development, capacity and technology that determines the water source.

• SPSS 20 and Microsoft excel software used to analyze quantitative data.

• The thematic, content and trend analysis were used for qualitative data.

• The qualitative and quantitative analysis produced informative information presented in disruptive tables, graphs and charts to indicate essential variables and their significations.

• Data presented in graphs, Figures, Tables and descriptive statements.
RESULTS AND DISCUSSION

Water sources and Groundwater utilization

• The results indicate most smallholder farmers and households rely on surface water springs, streams/ rivers and shallow wells for their domestic and productive purposes.

• Most smallholder farmers' households access groundwater through constructed shallow wells because it is based on using cheap and simple technologies that require little financial capital.

• The differentiated access to knowledge, infrastructure development, capacity and technology determines the water source.
Main water sources used in the area

<table>
<thead>
<tr>
<th>Water sources</th>
<th>Sources Wet Season</th>
<th>Sources Dry Season</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tap water</td>
<td>33</td>
<td>28</td>
<td>66</td>
</tr>
<tr>
<td>River</td>
<td>31</td>
<td>34</td>
<td>53</td>
</tr>
<tr>
<td>Dug well</td>
<td>15</td>
<td>16</td>
<td>47</td>
</tr>
<tr>
<td>pond</td>
<td>1</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>Spring</td>
<td>22</td>
<td>22</td>
<td>62</td>
</tr>
<tr>
<td>Rain water</td>
<td>5</td>
<td>1</td>
<td>90</td>
</tr>
</tbody>
</table>

Percentage

Water sources:
- Tap water
- River
- Dug well
- pond
- Spring
- Rain water
Groundwater resources use and management

• Low technology, lack of knowledge and enforcing capacity, exacerbated by different priorities among government actors, and groundwater exploitation, are limited to improving groundwater access for different uses.

• Constraints by lack of resources to enable adaptation to changes

• The challenges include the water table decline and siltation (from floods) that increases the cost of deepening and enlarging wells, financial capital, technology and governance for sustainability.
Factor affecting groundwater resources utilization and management

- Policy, Legal and institution framework: 14%
- Climate variability (Drought & Floods): 47%
- Anthropogenic activities: 24%
- Environmental Knowledge: 15%
Challenges in groundwater utilization

• The challenges resulting from human activities, especially income generation, multiple uses opportunities, management technologies and industry.
• Evolving socio-economic context and stakeholders with conflicting interests lead to a highly complex decision problem.
• Activities conducted upstream, within water sources (agricultural and deforestation for different use, including energy.
• Climate change impact on water resources availability (drought and floods)
Challenges for utilization of groundwater sources

- Weak enforcement: 14.9
- Lack of resources: 14.4
- Lack of important information: 22.8
- Lack of knowledge: 45.2
- Poor monitoring and management: 22.8
- Destructive practices: 8.8
Option for groundwater development

• Capacity building for groundwater resource use and management rests an urgent need at both individual and the institutional level
• More investment in groundwater assessment and infrastructure relative to its potential
• Growing awareness at decision-making levels about the importance of groundwater needs to be adequately reflected in policies and practices.
• Investment in groundwater to address climate change, pollution and ineffective maintenance and reduce challenges.
• Availability of information
Conclusions and recommendations

• Understanding water sources and a sound management system of livelihood and the environment reduce risk and improve resource management and community livelihood.

• Despite the low level of groundwater utilization, it provides a potential source for irrigation and water resilience under the changing environment and increasing water demands.

• Social relations, including material, cultural, and political-economic, including access to financial capital and technology, can constrain or enable access to groundwater.
Conclusions and recommendations

• There is a need to enhance groundwater's role in water access, ecosystem sustainability, livelihoods, climate change response and addressing Sustainable Development Goals.

• The study recommends understanding the processes and improving groundwater access and quality and how they are being reinforced through policy and regulations.