

# GESI Water and Livelihoods Assessment Report – focus on data

Component Two - D2.7



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## **Executive Summary**

The GESI and Groundwater Assessment in Africa report, developed for G4DR Component Two, addresses the critical need for improved data on groundwater management through the lens of Gender Equality and Social Inclusion (GESI). Groundwater is Africa's largest and most reliable freshwater resource, yet it remains under-monitored and inadequately integrated into planning processes. This data scarcity limits efforts to design inclusive, equitable, and sustainable water governance systems, particularly affecting marginalized populations such as women, youth, and rural communities.

Current groundwater abstraction in Africa represents just 2.4% of its renewable resources, with significant regional disparities. In sub-Saharan Africa, shallow aquifers serve rural populations, 50-75% of whom depend on groundwater for drinking water. However, the lack of systematic data on groundwater quantity, quality, and usage prevents effective planning, risking overexploitation or contamination. These knowledge gaps disproportionately impact women and girls, who are often responsible for household water collection. Gender and social disparities are reinforced by exclusion from groundwater governance processes. While men typically dominate decision-making, women and youth remain underrepresented. Meaningful inclusion requires transformative approaches that address social norms and structural barriers. Without disaggregated data on water access, usage patterns, and governance participation, it is impossible to design policies ensuring equitable access to groundwater resources.

Climate change adds urgency to the need for better data. Projections suggest that by 2050, up to 921 million people in sub-Saharan Africa could face water stress from climate-related impacts. Groundwater could be a lifeline under these conditions, but only if investments are based on solid data and inclusive analysis. Projects like Groundwater for aDvancing Resilience (G4DR) aim to bridge this gap by improving groundwater data systems, establishing inclusive monitoring networks, and integrating GESI-sensitive indicators into planning and evaluation frameworks.

This document assesses the types of data available to understand GESI issues in groundwater management across Africa. It includes a comparative matrix highlighting the advantages and disadvantages of qualitative versus quantitative data within the GESI framework. Using eight

significant themes, the report discusses gaps, opportunities, and red flags in data availability for GESI and groundwater management in Africa.

Integrating GESI into groundwater management ensures that all individuals, regardless of gender, age, socioeconomic status, disability, or other social identities, have equitable access to groundwater resources, participate meaningfully in decision-making processes, and benefit fairly from groundwater-related services and opportunities. This approach is foundational to achieving Sustainable Development Goals (SDGs) and ensuring resilient economic growth. The report concludes that prioritizing GESI leads to more effective and inclusive groundwater management strategies. By addressing the unique challenges faced by different social groups, we can ensure more equitable and sustainable access to groundwater resources.

Given the diverse nature of the data available, it is crucial to consider the context in which the data was developed when using and integrating it. Blending qualitative and quantitative data can overcome the weaknesses of each and reveal deeper social patterns. For instance, sequential designs can use survey data to identify gaps and then conduct interviews in underserved regions or use focus group findings to shape indicators for broader household surveys. Embedded designs can incorporate qualitative questions within large-scale surveys or use vignettes to elicit normative beliefs. Triangulation can combine and compare both types of data to validate findings. By employing these methods, we can gain a more comprehensive understanding of gender exclusion patterns and improve water governance, ultimately leading to more inclusive and effective groundwater management.

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# 1. Introduction

There is a pressing need for better data across Africa on groundwater management, especially when viewed through the lens of gender equality and social inclusion (GESI). Despite groundwater representing the continent's largest and most reliable freshwater resource (Pazola et al, 2024; MacDonald et al, 2012), it remains under-monitored, under-managed, and inadequately integrated into planning processes. This data scarcity severely limits efforts to design inclusive, equitable, and sustainable water governance systems that respond to the realities faced by marginalized populations—particularly women, youth, and rural communities.

Current groundwater abstraction in Africa represents just 2.4% of its renewable groundwater resources (FAO, 2019), with major disparities between regions. In sub-Saharan Africa, most groundwater use comes from shallow, vulnerable aquifers serving rural populations, 50–75% of whom depend on groundwater for drinking water (Carter & Parker 2009, Goulden et al. 2009). However, the lack of systematic data on groundwater quantity, quality, and usage prevents effective planning, risking overexploitation or contamination—particularly in drought-prone or conflict-sensitive areas. These knowledge gaps are especially harmful to women and girls, who are often responsible for household water collection and are disproportionately affected by inadequate access to safe water services. For example, fewer than one in three women in sub-Saharan Africa currently have access to safely managed drinking water (UNESCO, 2025).

Gender and social disparities are further reinforced by exclusion from groundwater governance processes. While men typically dominate institutional decision-making, women and youth remain underrepresented (Nigussie et al, 2018). Simply meeting participation quotas is not enough; meaningful inclusion requires transformative approaches that address the social norms and structural barriers limiting engagement. Without disaggregated data on water access, usage patterns, and governance participation, it is impossible to design and implement policies that ensure equitable access to groundwater resources.

Climate change adds another layer of urgency. Projections suggest that by 2050, up to 921 million people in sub-Saharan Africa could face water stress from climate-related impacts (Cisneros et al, 2021). Groundwater has the potential to be a lifeline under these conditions, but only if investments are based on solid data and inclusive analysis.<sup>1</sup> Projects like G4DR, aim to bridge this gap by

improving groundwater data systems, establishing inclusive monitoring networks, and integrating GESI-sensitive indicators into planning and evaluation frameworks.

In light of the discussion, the purpose of this document is to provide an assessment of the types of data available that aid in understanding GESI issues in groundwater management across Africa. Given the complexity of the problems and solutions required to address these issues from a GESI perspective, we acknowledge that various types of data are essential in resolving these challenges. Both qualitative and quantitative data can assist in this endeavour. This document includes a comparative matrix that highlights the advantages and disadvantages of qualitative versus quantitative data within the framework of GESI and groundwater management, helping to determine which data to use in different contexts. Using eight themes significant to GESI and groundwater management, we discuss the gaps, opportunities, and red flags in terms of data availability for GESI and groundwater management in Africa.

## **1.1. GESI and Groundwater Management**

GESI in groundwater management refers to the deliberate and systematic integration of gender and social considerations into the planning, development, and governance of groundwater resources. This approach ensures that all individuals—regardless of gender, age, socioeconomic status, disability, or other social identities have equitable access to groundwater resources, participate meaningfully in decision-making processes, and benefit fairly from groundwater-related services and opportunities.

Groundwater has a critical social value that cannot and should not be gauged by volumetric use alone. As the World Bank (2023) notes, groundwater underpins water and food security, serving to reduce poverty and boost resilient economic growth. It is foundational to achieving SDG 6 (clean water and sanitation) and contributes directly to SDGs 1 (poverty eradication), 2 (zero hunger), 5 (gender equality), 11 (sustainable cities), 13 (climate action), and 15 (life on land). Despite this, groundwater remains a common-pool resource for many communities, open-access, undervalued, and vulnerable to mismanagement and overexploitation.

Despite increasing recognition of the importance of gender equity in water resource management, much of the existing focus has been placed on GESI in surface water systems, with comparatively less attention to gendered dynamics in groundwater governance, where exclusion can be even

more entrenched (Aladuwaka and Momsen, 2010; WGF & IWMI, 2021). The distinction between surface water and groundwater is gendered. Surface water (rivers, lakes, ponds) is publicly accessible, often within walking distance, and has historically been considered part of the domestic responsibilities of women and girls (UN Women and UNICEF, 2021). Groundwater (wells, boreholes, aquifers) often requires technology (e.g., pumps, drilling equipment), land access/ownership, financial capital, and institutional governance (e.g., water user associations) (Van Koppen, 2002). These factors push groundwater into the "productive domain", often controlled by men or elites—whereas surface water remains in the "reproductive domain", considered women's responsibility (Zwarteveen, 2009; Cleaver and Hamada, 2010).

Women often are also confronted by social norms restricting their access to groundwater. For example:

- Land ownership and tenure norms: In many African societies, land is passed through male lineage, and women rarely own or inherit it. Since groundwater infrastructure is tied to land rights (e.g., who can drill a well), women often lack legal or social permission to access or manage groundwater sources (Doss et al, 2018; FAO, 2011).
- Control of Technology and Infrastructure: Technologies like mechanized boreholes and pumps are expensive and male dominated. Technical knowledge and training are often channelled toward men due to gender stereotypes (e.g., "engineering is for men") (Van Koppen, 2002; Manfre and Nordehn, 2013; Colvin, 2021).
- Exclusion from Decision-Making Bodies: Water User Associations (WUAs), groundwater committees, and local governance bodies are often led by men. Women may not be invited to meetings or may be socially discouraged from speaking or leading in mixed-gender settings (Cleaver and Hamada, 2010; Zwarteveen and Meinzen-Dick, 2001).
- Gendered Division of Labor: Women's roles are largely defined around domestic water collection and caregiving, not resource management or infrastructure planning. Groundwater is framed as part of agriculture or enterprise—activities traditionally associated with men, which gives them institutional priority (Meinzen-Dick and Zwarteveen, 1998; Van Koppen, 2009)
- Norms Around Mobility and Safety: In conservative or rural settings, women may be restricted from traveling far, working with male technicians, or participating in mixed-gender

trainings—limiting their ability to engage in groundwater access projects (Sultana, 2009; WFG and IWMI, 2021).

- **Cultural Beliefs About “Underground Water”:** In some contexts, groundwater may carry spiritual, ritual, or symbolic meanings, and decision-making about its extraction is reserved for elders or men, not women (Colvin, 2021; MacDonald, et al, 2019).

The exclusion of women from decisions about groundwater sources creates a gendered paradox. Women are the primary water collectors for their households—yet excluded from decisions about the very water sources (groundwater) that could improve their efficiency, dignity, and safety. When women are empowered to participate in groundwater governance—through land rights, leadership training, or quotas in user associations—water projects tend to be more sustainable, more equitable, and better maintained (IWMI, 2018, World Bank, 2024).

Integrating GESI addresses unique challenges faced by different social groups. Prioritizing GESI leads to more effective and inclusive groundwater management strategies, for example:

- **Equitable Access and Use:** In many African communities, women and girls are primarily responsible for water collection and management. However, they often face barriers to accessing clean and safe groundwater due to social norms, limited rights, and infrastructural challenges. Addressing these disparities is crucial for ensuring equitable access to water resources.
- **Inclusive Decision-Making:** Women, youth, and marginalized groups are frequently underrepresented in water governance structures. Their exclusion can lead to policies and practices that do not reflect the needs and priorities of all community members. Inclusive participation enhances the relevance and effectiveness of groundwater management strategies.
- **Resilience to Climate Change:** Climate-induced water scarcity disproportionately affects vulnerable populations. Integrating GESI considerations into groundwater management enhances community resilience by ensuring that adaptation strategies are inclusive and address the specific vulnerabilities of different social groups.
- **Health and Sanitation:** Access to clean groundwater is essential for public health. Women and girls, in particular, face health risks related to inadequate water quality and lack of sanitation facilities. GESI-focused approaches help in designing interventions that address these specific health challenges.

GESI issues are central to sustainable and equitable groundwater governance. In sub-Saharan Africa, women and girls are responsible for fetching water in about 80% of households without on-premises water (Worldbank, 2024), spending on average 40 billion hours per year collecting water (FP Analytics, 2024). This leaves them with fewer opportunities for education, income-generation, and civic engagement. By incorporating gender considerations in groundwater projects—like installing local boreholes or shared taps—GESI-driven governance directly reduces these burdens, allowing women to regain time for farming, education, or community leadership.

## **2. Nature and availability of data in the context of GESI and Groundwater management.**

Various types of data are essential in addressing and resolving the complex challenges that arise from integrating GESI with groundwater management. To better understand which data is effective in different contexts, we have created a comparative matrix that highlights the advantages and disadvantages of qualitative versus quantitative data within the framework of GESI and groundwater management.

*Table 1. Matrix: Comparing Qualitative and Quantitative Data in GESI and Groundwater Management*

<b>Criteria</b>	<b>Qualitative Data</b>	<b>Quantitative Data</b>
<b>Nature of data</b>	Descriptive, narrative, context-rich	Numerical, measurable, analysed through statistics
<b>Advantages</b>	Captures lived experiences, values, power dynamics, and social norms	Enables pattern recognition across large populations

	<p>Useful for exploring <i>how</i> and <i>why</i> inequalities exist</p> <p>Reveals barriers faced by marginalized groups (e.g., women, youth)</p> <p>Enables participatory and feminist research approaches</p>	<p>Facilitates comparative and trend analysis (e.g., water access by gender)</p> <p>Useful for baseline data and impact evaluation</p> <p>Perceived as more “objective” by policymakers, thus viewed as more legitimate in comparison to data that is more subjective</p>
<b>Disadvantages</b>	<p>Context-specific and harder to generalize</p> <p>Data collection and analysis are time-consuming</p> <p>Often not recognized as “rigorous” by certain technical or policy communities</p>	<p>May miss underlying reasons behind disparities</p> <p>Difficult to capture intersectionality and power relations</p> <p>Can mask marginal voices by averaging across groups</p> <p>Limited by what is predefined and measured</p>
<b>Best Use Cases</b>	<p>Understanding community dynamics, social exclusion, and gendered water roles</p> <p>Evaluating the influence of cultural and traditional norms</p> <p>Informing gender-transformative approaches and policy advocacy</p>	<p>Establishing GESI baselines (e.g., % of women in decision-making roles)</p> <p>Monitoring progress toward SDGs</p> <p>Identifying disparities in groundwater access/use between groups</p>

<b>Data Collection Methods</b>	Focus group discussions, interviews, storytelling, ethnography, participatory mapping	Surveys, censuses, administrative records, structured indicators
<b>GESI Relevance</b>	Deepens understanding of gendered vulnerabilities, social norms, and inclusion barriers	Enables disaggregation (by sex, age, disability, etc.) to track equity in access and benefits
<b>Challenges in Groundwater Context</b>	<p>Social norms around water use often underreported</p> <p>May require trust-building in communities</p> <p>Difficult to scale findings</p>	<p>Lack of consistent sex- and age-disaggregated data</p> <p>Sectoral groundwater data (e.g., agriculture/domestic use) rarely disaggregated by gender</p> <p>Data often unavailable and not inaccurate, especially at different levels</p>

### **3. Data related to GESI and Groundwater management**

To get a better understanding of what data is available in the context of GESI and groundwater management, we have identified eight themes. These themes are demographic and socioeconomic data; groundwater access and use; governance and decision making; climate change and environmental impacts; health and sanitation; economic opportunities and livelihoods; cultural and social norms; and conflict and security. In the section that follows we provide a description of each of these themes as well as some key insight regarding data for each of these themes. Note later we provide a matrix detailing available data sources—both quantitative and qualitative—pertinent to GESI in groundwater management across Africa. The matrix is organised

by the thematic areas, specifying the data type, geographic scope, and depth of GESI-related information

### 3.1. Demographic and socioeconomic data

This theme is well-supported by robust quantitative datasets at the pan-African level, particularly from the Africa Gender Data Portal. These datasets provide gender- and age-disaggregated information on population demographics, education, employment, household structure, and land access. However, qualitative insights remain limited, especially regarding how intersectional identities (e.g., disability, ethnicity) shape access to resources. Regional disparities also exist in data comprehensiveness.

This type of data can be useful for addressing several questions related to groundwater governance and management:

- Who has access to land suitable for groundwater development, and how does this differ by gender, age, and region
  - Leveraging data on land ownership and tenure disaggregated by gender and geography.
- How does women's level of education correlate with household access to improved water sources (including groundwater)?
  - Cross-analysing education data with household water access and use.
- What is the relationship between employment status (especially in agriculture) and access to groundwater for productive use across genders?
  - Using employment sector data linked to groundwater use in irrigation or livestock.
- How does household composition (e.g., female-headed households, youth-headed households) affect groundwater access and decision-making power?
  - Drawing on household structure data disaggregated by age and sex.
- Which regions or social groups (e.g., by ethnicity or disability status) are most excluded from groundwater infrastructure and services?
  - Identifying gaps or exclusions using disaggregated data, while noting limitations in qualitative depth.

Key insights with regards to of the gaps, opportunities, and red flags concerning demographic and socioeconomic data:

GAPS	OPPORTUNITIES	RED FLAGS
<ul style="list-style-type: none"><li>• Limited availability of sex-disaggregated data, particularly concerning non-binary and marginalized groups.</li><li>• Inconsistent data collection practices across countries, leading to challenges in comparative analysis.</li><li>• Insufficient integration of intersectional factors such as disability, ethnicity, and socioeconomic status in existing datasets</li></ul>	<ul style="list-style-type: none"><li>• Strengthening national statistical systems to routinely collect and publish gender-disaggregated data.</li><li>• Leveraging digital technologies for real-time data collection and analysis.</li><li>• Collaborating with international organizations to standardize data collection methodologies.</li></ul>	<ul style="list-style-type: none"><li>• Be cautious of data that may not capture informal or subsistence activities predominantly undertaken by women.</li><li>• Recognize potential underreporting due to cultural sensitivities or stigma associated with certain demographics.</li></ul>

### 3.2. Groundwater access and use

Quantitative data on water access patterns (e.g., travel time, water source types) is available, but does not always reflect the nuanced roles gender and age play in daily water use and management. Qualitative case studies provide critical insights into gendered labour burdens, sectoral groundwater use, and affordability challenges. These studies highlight the need for more integrated monitoring systems that capture social roles and economic dynamics around groundwater.

This type of data can be useful for addressing several questions related to groundwater governance and management:

- How does travel time to groundwater sources differ by gender and age, and what are the implications for time poverty?
  - Quantitative data on access combined with qualitative insights on daily routines and unpaid care work.

- What gendered labour burdens are associated with groundwater collection and household water management?
  - Drawn from qualitative case studies exploring domestic responsibilities and physical demands.
- How do affordability and willingness to pay for groundwater services differ between male- and female-headed households?
  - Combining economic data with gender-disaggregated household analysis.
- In what ways do men and women use groundwater differently across sectors (e.g., domestic, agriculture, small-scale enterprise)?
  - Sectoral use patterns tied to gender roles and economic activities.
- How do age and gender influence decision-making power over groundwater use and technology adoption at the household or community level?
  - Qualitative studies can uncover who controls groundwater-related decisions and why.

Key insights with regards to of the gaps, opportunities, and red flags concerning groundwater access and use:

GAPS	OPPORTUNITIES	RED FLAGS
<ul style="list-style-type: none"> <li>• Scarcity of data on the specific roles of women and youth in groundwater collection and management.</li> <li>• Limited information on the time and physical burdens associated with water collection, disaggregated by gender and age.</li> <li>• Inadequate data on the affordability and pricing of groundwater services and their differential impacts.</li> </ul>	<ul style="list-style-type: none"> <li>• Conducting participatory research to understand community-specific water usage patterns.</li> <li>• Implementing time-use surveys to quantify the labor involved in water collection.</li> <li>• Developing gender-sensitive indicators for water access and usage.</li> </ul>	<ul style="list-style-type: none"> <li>• Ensure that data collection methods are culturally appropriate and sensitive to local norms.</li> <li>• Avoid assumptions about uniformity in water usage practices across different communities.</li> </ul>

### 3.3. Governance and decision-making

Data in this area is largely qualitative, derived from policy reviews and case studies that show women and youth are underrepresented in water governance structures. There is evidence of legal and policy frameworks increasingly integrating gender concerns, yet implementation remains inconsistent. The interaction between statutory and customary water rights is particularly complex, often limiting formal participation by women and marginalized youth.

This type of data can be useful for addressing several questions related to groundwater governance and management:

- To what extent are women and youth represented in groundwater governance structures (e.g., water user associations, local councils)?
  - Informed by case studies highlighting participation gaps and leadership dynamics.
- How do statutory and customary water rights interact to shape (or limit) women's and marginalized youth's access to groundwater decision-making spaces?

- Drawing from legal analyses and ethnographic case work on overlapping governance systems.
- What barriers prevent the effective implementation of gender-sensitive groundwater policies at local or national levels?
  - Based on policy reviews and documented implementation challenges.
- How do social norms and power dynamics influence whose voices are heard in groundwater-related decisions?
  - Explored through qualitative accounts of community engagement and negotiation.
- What strategies or interventions have been effective in improving gender and youth inclusion in groundwater governance?
  - Highlighted in case studies of participatory reforms or capacity-building initiatives.

Key insights with regards to of the gaps, opportunities, and red flags concerning governance and decision making:

GAPS	OPPORTUNITIES	RED FLAGS
<ul style="list-style-type: none"> <li>• Underrepresentation of women and youth in water governance structures and decision-making bodies.</li> <li>• Lack of comprehensive data on the effectiveness of gender-sensitive policies in water governance.</li> <li>• Insufficient understanding of the interplay between customary and statutory water rights from a gender perspective.</li> </ul>	<ul style="list-style-type: none"> <li>• Promoting inclusive governance models that actively involve women and youth.</li> <li>• Conducting policy analyses to assess the gender responsiveness of existing water laws and regulations..</li> <li>• Facilitating capacity-building programs to empower marginalized groups in water governance.</li> </ul>	<ul style="list-style-type: none"> <li>• Be aware of tokenistic inclusion that does not translate into actual decision-making power.</li> <li>• Recognize the potential resistance from traditional power structures to inclusive governance reforms.</li> </ul>

### 3.4. Climate change and environmental impacts

Qualitative data is the primary source of insight here, capturing how water scarcity disproportionately affects women and youth and how communities are responding. Reports from UNESCO and others illustrate how women and youth lead or participate in climate adaptation initiatives. However, there is a notable lack of gender-disaggregated quantitative indicators specifically linking groundwater resilience to climate vulnerability. Notably however, some progress has been made, for example a global assessment of gender inequality in water security by Kakinuma\* and Wada (2024).

This type of data can be useful for addressing several questions related to groundwater governance and management:

- How do climate-induced groundwater shortages affect women's and youth's livelihoods and daily responsibilities differently than men's?
  - Explored through community-level case studies on drought impacts and gender roles.
- What roles do women and youth play in local groundwater-related climate adaptation strategies (e.g., water harvesting, drought planning)?
  - Informed by reports documenting inclusive adaptation efforts (e.g., UNESCO case studies).
- What coping mechanisms are used by women and youth when groundwater becomes less reliable due to environmental stress?
  - Qualitative interviews and participatory research often capture these adaptation behaviours.
- How do gender norms influence who accesses groundwater during periods of environmental stress or scarcity ?
  - Case studies highlight gendered resource allocation under stress conditions.
- What barriers prevent women and youth from participating fully in groundwater resilience planning and decision-making ?
  - Derived from qualitative analysis of participation gaps in climate response programs.

Key insights with regards to of the gaps, opportunities, and red flags concerning climate change and environmental impacts:

GAPS	OPPORTUNITIES	RED FLAGS
<ul style="list-style-type: none"><li>• Limited data on the specific vulnerabilities of women and youth to climate-induced water scarcity.</li><li>• Scarcity of information on gender-specific adaptation strategies and resilience-building initiatives.</li><li>• Inadequate integration of indigenous knowledge systems in climate adaptation planning.</li></ul>	<ul style="list-style-type: none"><li>• Engaging women and youth in the co-creation of climate adaptation strategies.</li><li>• Documenting and scaling successful community-led resilience initiatives.</li><li>• Incorporating traditional ecological knowledge into formal climate adaptation frameworks.</li></ul>	<ul style="list-style-type: none"><li>• Avoid generalizations that portray women solely as vulnerable or as agents of change without context.</li><li>• Ensure that adaptation strategies are context-specific and culturally sensitive.</li></ul>

### 3.5. Health and sanitation

This theme benefits from both quantitative data (e.g., access to sanitation, disease prevalence) and qualitative reports focusing on gender-specific health outcomes. In terms of qualitative data, gridded data<sup>1</sup> on access to WASH is available, offering a valuable opportunity to integrate this with demographic data for a comprehensive quantitative analysis. Moreover, the two types of data often work in concert to provide a holistic picture of the issue. Adolescent girls and women face unique challenges, including limited access to menstrual hygiene facilities, often exacerbated by poor groundwater quality. UNICEF's work is a major contributor to this body of knowledge.

This type of data can be useful for addressing several questions related to groundwater governance and management:

- How does the quality of groundwater affect health outcomes differently for women, men, and children—especially in relation to waterborne diseases?
  - Quantitative data on disease prevalence can be disaggregated by gender and age.

<sup>1</sup> <https://ghdx.healthdata.org/record/ihme-data/lmic-wash-access-geospatial-estimates-2000-2017>

- What are the specific health and hygiene challenges faced by adolescent girls due to lack of clean groundwater and inadequate sanitation facilities?
  - Informed by UNICEF and qualitative studies on menstrual hygiene management (MHM).
- How does limited access to safe groundwater impact maternal health and caregiving responsibilities in water-scarce areas?
  - Explored through intersectional analysis of household health burdens.
- What infrastructure or behavioural barriers prevent equitable access to groundwater for hygiene, especially among people with disabilities or in female-headed households?
  - Combines physical access data with qualitative insights into social constraints.
- How do cultural norms shape who can access groundwater for sanitation purposes and when, particularly in communal or shared facilities?
  - Captured through qualitative assessments of social practices and taboos.

Key insights with regards to of the gaps, opportunities, and red flags concerning health and sanitation:

GAPS	OPPORTUNITIES	RED FLAGS
<ul style="list-style-type: none"> <li>• Insufficient data on the health impacts of groundwater quality, particularly on women and children.</li> <li>• Lack of comprehensive information on access to sanitation and hygiene facilities, including menstrual hygiene management.</li> <li>• Limited understanding of the gendered impacts of waterborne diseases.</li> </ul>	<ul style="list-style-type: none"> <li>• Integrating health surveillance systems with water quality monitoring.</li> <li>• Implementing gender-sensitive WASH (Water, Sanitation, and Hygiene) programs.</li> <li>• Conducting targeted health education campaigns addressing the specific needs of women and girls.</li> <li>• Gridded data on access to WASH is available, presenting an opportunity to integrate this with demographic data for a comprehensive quantitative analysis:</li> </ul>	<ul style="list-style-type: none"> <li>• Be cautious of data collection methods that may not capture the experiences of marginalized groups.</li> <li>• Ensure that interventions do not inadvertently reinforce existing gender inequalities.</li> </ul>

### 3.6. Economic opportunities and livelihoods

Available data is largely qualitative, with case studies highlighting how women and youth engage in groundwater-dependent livelihoods such as agriculture and crafts. Barriers include lack of access to credit, land, and technology. While programs targeting economic empowerment exist, consistent and disaggregated data to assess their reach and effectiveness are scarce.

This type of data can be useful for addressing several questions related to groundwater governance and management:

- How do women and youth utilize groundwater for income-generating activities such as small-scale agriculture, crafts, or food processing?
  - Answered through case studies documenting groundwater-based livelihoods.
- What barriers (e.g., credit, land ownership, technology) limit women's and youth's ability to benefit economically from groundwater resources?
  - Drawn from qualitative insights on structural and financial constraints.
- How do gender norms influence control over groundwater infrastructure and its use in productive activities?
  - Explored through sociocultural analyses of access and decision-making.
- What has been the impact of economic empowerment programs targeting women and youth in groundwater-reliant sectors?
  - Based on qualitative program evaluations, though lacking consistent disaggregated metrics.
- How does unequal access to groundwater affect household income security and resilience for women-led or youth-headed households?
  - Highlighted in livelihood-focused case studies, especially in rural settings.

Key insights with regards to of the gaps, opportunities, and red flags concerning economic opportunities and livelihoods:

GAPS	OPPORTUNITIES	RED FLAGS
<ul style="list-style-type: none"> <li>• Limited data on the participation of women and youth in groundwater-dependent livelihoods.</li> <li>• Scarcity of information on barriers to entrepreneurship in the water sector for marginalized groups.</li> <li>• Inadequate understanding of access to financial services for water-related businesses.</li> </ul>	<ul style="list-style-type: none"> <li>• Conducting market analyses to identify opportunities for inclusive economic participation.</li> <li>• Developing targeted financial products and services to support women and youth entrepreneurs.</li> <li>• Implementing vocational training programs focused on groundwater management.</li> </ul>	<ul style="list-style-type: none"> <li>• Avoid one-size-fits-all approaches; tailor interventions to specific community contexts.</li> <li>• Be mindful of cultural norms that may influence economic participation.</li> </ul>

### 3.7. Cultural and social norms

Most data here is qualitative and context-specific, emphasizing how traditional gender roles and social perceptions shape groundwater use and governance. Barriers to participation for women and youth are linked to deeply entrenched norms, and intersectional challenges (e.g., linked to class or disability) are underreported. This thematic area is crucial for understanding resistance to GESI-oriented reforms.

This type of data can be useful for addressing several questions related to groundwater governance and management:

- How do traditional gender roles shape who collects, manages, and makes decisions about groundwater in households and communities?
  - Explored through ethnographic studies and participatory research on water responsibilities.
- What cultural beliefs or social stigmas prevent women and youth from participating in groundwater governance or accessing groundwater technology?
  - Informed by interviews and case studies on norm-driven exclusion.
- How do social hierarchies—such as class, caste, or disability status—intersect with gender to influence groundwater access and use?

- Intersectional analyses reveal multi-layered barriers often absent in quantitative data.
- What types of resistance exist to gender-inclusive reforms in groundwater policy or practice, and what drives them?
  - Case studies reveal how deeply held beliefs can obstruct institutional change.
- How are community perceptions of “appropriate” roles for women and youth evolving in relation to groundwater use and leadership?
  - Captured through longitudinal or comparative qualitative research.

Key insights with regards to of the gaps, opportunities, and red flags concerning social norms:

GAPS	OPPORTUNITIES	RED FLAGS
<ul style="list-style-type: none"> <li>• Insufficient data on how cultural and social norms influence access to and control over groundwater resources.</li> <li>• Limited understanding of intersectionality in the context of water resource management.</li> <li>• Scarcity of studies examining the impact of traditional gender roles on water governance.</li> </ul>	<ul style="list-style-type: none"> <li>• Conducting ethnographic research to explore the influence of cultural norms on water management.</li> <li>• Engaging community leaders in dialogues to challenge and transform restrictive norms.</li> <li>• Incorporating gender and social analyses into water resource planning and policy development.</li> </ul>	<ul style="list-style-type: none"> <li>• Ensure that interventions are respectful of cultural contexts and avoid imposing external values.</li> <li>• Recognize the diversity of cultural practices and avoid homogenizing communities.</li> </ul>

### 3.8. Conflict and security

Qualitative studies document how groundwater scarcity and contamination contribute to local conflicts, disproportionately affecting women and youth who rely on water for both domestic and livelihood purposes. Data on displacement due to groundwater issues is limited, and more research is needed on how women and youth contribute to or lead water conflict resolution efforts.

This type of data can be useful for addressing several questions related to groundwater governance and management:

- How does groundwater scarcity or contamination trigger or exacerbate conflicts at the community level, particularly affecting women and youth?
  - Explored through case studies on water stress and local disputes.
- In what ways are women and youth disproportionately impacted by groundwater-related conflicts and insecurity?
  - Qualitative data reveal impacts on domestic responsibilities, livelihoods, and personal safety.
- What coping strategies do women and youth use when groundwater-related conflict disrupts access to safe water?
  - Captured through community narratives and participatory assessments.
- How involved are women and youth in resolving groundwater-related disputes, and what barriers limit their participation in peacebuilding or water diplomacy?
  - Highlighted in conflict resolution case studies with a GESI lens.
- How does displacement or migration caused by groundwater scarcity affect gender roles, responsibilities, and vulnerability?
  - Emerging area requiring further data but partially addressed in humanitarian reports.

Key insights with regards to of the gaps, opportunities, and red flags concerning conflict and security:

GAPS	OPPORTUNITIES	RED FLAGS
<ul style="list-style-type: none"> <li>• Limited data on the gendered dimensions of water-related conflicts.</li> <li>• Scarcity of information on the roles of women and youth in conflict resolution over water resources.</li> <li>• Inadequate understanding of the impacts of displacement due to groundwater issues on different demographics.</li> </ul>	<ul style="list-style-type: none"> <li>• Conducting conflict analyses that incorporate gender perspectives.</li> <li>• Promoting inclusive peacebuilding initiatives that involve women and youth.</li> <li>• Developing early warning systems that consider the needs and roles of all community members.</li> </ul>	<ul style="list-style-type: none"> <li>• Be cautious of oversimplifying complex conflict dynamics.</li> <li>• Ensure that interventions do not exacerbate existing tensions or inequalities.</li> </ul>

## 4. Examples of available data and sources

To gain a comprehensive understanding of GESI issues in groundwater across Africa, several pan-African data sources and initiatives offer valuable insights. Below, we present key resources, each labelled as either "foundational" or "GESI." Foundational resources are those that, while not specifically designed to provide GESI data, offer essential contextual information that can influence or mitigate negative circumstances or reduced opportunities.

### Africa Groundwater Atlas & Literature Archive (British Geological Survey)

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This comprehensive resource offers country-specific information on geology, hydrogeology, groundwater use, and management for 51 African countries. It includes a searchable database of nearly 7,000 references, encompassing scientific articles, reports, and maps. While not exclusively focused on GESI, it provides foundational data that can be instrumental in GESI analyses.

- [BritishGeologicalSurvey+1african groundwateratlas.org+1](#)
- [Africa Groundwater Atlas](#)

### Cooperation in International Waters in Africa (CIWA) – GESI Framework

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CIWA has developed a GESI Framework to guide the integration of gender and social inclusion considerations in transboundary water projects. Their approach emphasises collecting disaggregated data and incorporating gender perspectives in project design and implementation.

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- [World Bank Blogs+4CIWA program+4CIWA program+4](#)
  - [CIWA program](#)

### Groundwater for Africa's Resilience and Socioeconomic Transformation (AMCOW)

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This initiative by the African Ministers' Council on Water (AMCOW) underscores the strategic role of groundwater in achieving development goals, including climate resilience and water security. While the focus is broad, it highlights the importance of inclusive groundwater management practices.

- [amcow.ams3.cdn.digitaloceanspaces.com](http://amcow.ams3.cdn.digitaloceanspaces.com)

### Groundwater Mapping for Africa

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This platform provides interactive maps and data on groundwater resources across Africa, developed using open-source tools. The maps can support analyses related to access and equity in groundwater distribution.

- [groundwaterinfo.africa+1British Geological Survey+1](http://groundwaterinfo.africa+1British Geological Survey+1)

### UNESCO IHP-WINS: Groundwater Storage Dataset

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UNESCO's International Hydrological Programme offers a dataset detailing groundwater storage across Africa at a 5 km resolution. This data can be pivotal in assessing regional disparities in groundwater availability, which may intersect with GESI concerns.

- [ihp-wins.unesco.org](http://ihp-wins.unesco.org)

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- [UNESCO Groundwater Storage Dataset](#)

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### Afrobarometer



Afrobarometer conducts public attitude surveys across Africa on various topics, including water access and governance. While not specific to groundwater, the data can provide context on public perceptions and experiences related to water services, which may inform GESI analyses.

- <https://www.afrobarometer.org/>

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### SADC Groundwater Management Institute (SADC-GMI)



SADC-GMI supports sustainable groundwater management across Southern Africa. Their publications include data on groundwater resources, management practices, and policy frameworks. The institute has developed a GESI Strategy and Implementation Plan, highlighting the importance of integrating GESI considerations into groundwater management

- [sadc-gmi.org+1KAZA-GROW+1](https://sadc-gmi.org+1KAZA-GROW+1)
- [sadc-gmi.org](https://sadc-gmi.org)

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### Africa Gender Data Portal



A comprehensive repository offering gender-disaggregated data across Africa, covering socio-economic indicators, employment, education, health, and more. While not specific to groundwater, the portal provides contextual data that can inform analyses of gender disparities in water access and management.

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- [africagenderdata.org](http://africagenderdata.org)

### **UN Women – Africa Gender Data Repository**

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This repository collates regional and global gender data resources, including data sources, research reports, and case studies. The repository offers insights into gender dynamics that can be correlated with groundwater access and management issues.

- [africa.unwomen.org](http://africa.unwomen.org)

## 4.1. Data Matrix

Below is a matrix detailing available data sources—both quantitative and qualitative—pertinent to GESI in groundwater management across Africa. The matrix is organised by thematic areas, specifying the data type, geographic scope, and depth of GESI-related information. Note the goal of this matrix is not to serve as an exhaustive source of information and databases, but rather to provide examples of what is available.

### 1. Demographic and Socioeconomic Data

Indicator	Data Type	Geographic Scope	Depth of GESI Information	Source
Gender-disaggregated population data (men, women, non-binary, youth)	Quantitative	Global	1000+ Indicators in the gender data portal for every economy in the last 5 years, last 10 years, or since 1960.	<a href="#">World Bank Gender Data Portal</a>
	Quantitative	Pan-African	Comprehensive data on gender and age demographics	<a href="#">Africa Gender Data Portal</a>
	Quantitative	Global	A global dataset of 7 billion individuals with socio-economic characteristics	<a href="#">GLOPOP-S - Harvard Dataverse</a>

			<ul style="list-style-type: none"> <li>~1800 Global Data Lab Regions; 545 in Africa</li> </ul>	
Age distribution (youth: 15–35 years)	Quantitative	Global	1000+ Indicators in the gender data portal for every economy in the last 5 years, last 10 years, or since 1960.	<a href="#">World Bank Gender Data Portal</a>
	Quantitative	Pan-African	Detailed age-specific data, including youth demographics	<a href="#">Africa Gender Data Portal</a>
	Quantitative	Global	<p>A global dataset of 7 billion individuals with socio-economic characteristics</p> <ul style="list-style-type: none"> <li>8 age categories -(not by gender); including 15-24 &amp; 25-34</li> </ul>	<a href="#">GLOPOP-S - Harvard Dataverse</a>
Education levels (disaggregated by gender and age)	Quantitative	Global	1000+ Indicators in the gender data portal for every economy in the last 5 years, last 10 years, or since 1960.	<a href="#">World Bank Gender Data Portal</a>
	Quantitative	Pan-African	Data on education attainment by gender and age	<a href="#">Africa Gender Data Portal</a>
	Quantitative	Global	A global dataset of 7 billion individuals with socio-economic characteristics	<a href="#">GLOPOP-S - Harvard Dataverse</a>

Employment and income levels (by gender and age)	Quantitative	Global	1000+ Indicators in the gender data portal for every economy in the last 5 years, last 10 years, or since 1960.	<a href="#">World Bank Gender Data Portal</a>
	Quantitative	Pan-African	Employment statistics and income levels disaggregated by gender and age	<a href="#">Africa Gender Data Portal</a>
	Quantitative	Global	A global dataset of 7 billion individuals with socio-economic characteristics	<a href="#">GLOPOP-S - Harvard Dataverse</a>
	Quantitative	Global to sub-national	Includes data on 1,800 subregions across 166 economies	<a href="#">Global Subnational Atlas of Poverty</a>
Household structure (female-headed, male-headed, child-headed households)	Quantitative	Global	1000+ Indicators in the gender data portal for every economy in the last 5 years, last 10 years, or since 1960.	<a href="#">World Bank Gender Data Portal</a>
	Quantitative	Pan-African	Information on household composition by headship and gender	<a href="#">Africa Gender Data Portal</a>
Land ownership and access to resources	Quantitative	Pan-African	Data on land ownership and resource access by gender and age	<a href="#">Africa Gender Data Portal</a>

(gender- and youth-disaggregated)				
	Quantitative	Global	1000+ Indicators in the gender data portal for every economy in the last 5 years, last 10 years, or since 1960.	<a href="#">World Bank Gender Data Portal</a>
Barriers to employment for women and girls	Qualitative	Sub-Saharan Africa	Analysis of challenges faced by women and girls in accessing employment opportunities	<a href="#">Youth Unemployment and Gender Inequality in Africa</a>

## 2. Groundwater Access and Use

Indicator	Data Type	Geographic Scope	Depth of GESI Information	Source
Gendered roles in water collection and management	Qualitative	Sub-Saharan Africa	Insights into the division of labour and responsibilities in water collection and management by gender	<a href="#">Gender and Water Access in South Africa</a>
Distance to groundwater sources (time spent by men, women, and youth)	Quantitative	Pan-African	Data on time and distance travelled to access water sources, disaggregated by gender and age	<a href="#">UNICEF WASH Data</a>
		Pan African	WASH DATA; percentage of population and number of population with access	<a href="#">Mapping geographical inequalities in access to drinking water and sanitation facilities in low-income and middle-income countries, 2000–17 - ScienceDirect</a>
Household reliance on groundwater vs. other water sources	Quantitative	Pan-African	Statistics on household water sources and reliance on groundwater	<a href="#">UNICEF WASH Data</a>

Sectoral groundwater use (agriculture, domestic, industry) by gender and youth	Qualitative	Sub-Saharan Africa	Case studies on groundwater use across sectors, highlighting gender and youth participation	<a href="#">IWMI Groundwater in Africa</a>
Water pricing and affordability (impact on women and youth)	Qualitative	Sub-Saharan Africa	Analyses of water pricing structures and their socioeconomic impacts on women and youth	<a href="#">Gender and Water Policies in Africa</a>

### 3. Governance and Decision-Making

Indicator	Data Type	Geographic Scope	Depth of GESI Information	Source
Representation of women and youth in water user associations and governance structures	Quantitative	Eastern Africa	Statistics on participation rates of women and youth in water governance bodies	<a href="#">UNESCO Gender Perspectives</a>

Legal and policy frameworks on groundwater access (gender-sensitive policies)	Qualitative	Pan-African	Review of existing policies and their incorporation of gender considerations	<a href="#">Gender and Water Policies in Africa</a>
Participation in decision-making (women's and youth involvement in groundwater management committees)	Qualitative	Sub-Saharan Africa	Case studies highlighting the involvement of women and youth in decision-making processes	<a href="#">How Important is Gender in Transboundary Groundwater Governance?</a>
Customary vs. statutory water rights (gender and youth perspectives)	Qualitative	Sub-Saharan Africa	Analyses of the interplay between customary practices and statutory laws affecting water rights for women and youth	<a href="#">Gender and Water Policies in Africa</a>
Role of indigenous knowledge in groundwater management (gender and youth lens)	Qualitative	Sub-Saharan Africa	Documentation of indigenous practices and the roles of women and youth in traditional water management	<a href="#">African Voices from the UNESCO Groundwater Youth Network</a>

#### 4. Climate Change and Environmental Impacts

Indicator	Data Type	Geographic Scope	Depth of GESI Information	Source
Gender- and youth-specific vulnerabilities to water scarcity	Qualitative	Sub-Saharan Africa	Studies on how climate-induced water scarcity disproportionately affects women and youth	<a href="#">UNESCO Water, Gender and Climate</a>
Adaptation strategies (community-led initiatives by women and youth)	Qualitative	Sub-Saharan Africa	Documentation of grassroots adaptation efforts led by women and youth	<a href="#">UNESCO Water, Gender and Climate</a>
Resilience-building programs (gender- and youth-inclusive)	Qualitative	Sub-Saharan Africa	Evaluations of programs aimed at building resilience among vulnerable groups	<a href="#">UNESCO Water, Gender and Climate</a>

## 5. Health and Sanitation

Indicator	Data Type	Geographic Scope	Depth of GESI Information	Source
Groundwater quality and its impact on public health	Quantitative	Pan-African	Data on water quality and associated health outcomes, disaggregated by gender and age	<a href="#">UNICEF WASH Data</a>

(disaggregated by gender and age)				
Waterborne diseases and their gendered impacts	Qualitative	Sub-Saharan Africa	Studies on the prevalence of waterborne diseases and their specific impacts on women and girls	<a href="#">UNICEF Adolescent Girls' Access to WASH</a>
	Quantitative	Global	Low- and Middle-Income Country Drinking Water and Sanitation Facilities Access Geospatial Estimates 2000-2017	<a href="#">HME/GHDx</a>
Access to sanitation and hygiene (particularly for women and girls)	Quantitative	Pan-African	Statistics on access to sanitation facilities, with a focus on gender disparities	<a href="#">UNICEF WASH Data</a>
Availability of menstrual hygiene facilities (reliance on groundwater sources)	Qualitative	Sub-Saharan Africa	Reports on the availability and adequacy of menstrual hygiene facilities and their dependence on water sources	<a href="#">UNICEF Adolescent Girls' Access to WASH</a>

## 6. Economic Opportunities and Livelihoods

Indicator	Data Type	Geographic Scope	Depth of GESI Information	Source
Groundwater-dependent livelihoods (agriculture, fishing, crafts, etc.) by gender and youth	Qualitative	Sub-Saharan Africa	Case studies on livelihoods reliant on groundwater, highlighting gender and youth participation	[IWMI Groundwater in Africa] <a href="https://www.iwmi.org/blogs/">https://www.iwmi.org/blogs/</a>

## 5. Conclusion

In conclusion, this GESI and Groundwater assessment for Component 2 has provided valuable insights into the current state of groundwater resources and the socio-economic factors influencing their use. The findings underscore the importance of incorporating gender equality and social inclusion into groundwater management practices. Considering the information presented in this report, in the context of groundwater and GESI, it is evident that there is a scarcity of comprehensive, disaggregated quantitative datasets and this can present real challenges. However, there are promising ways to address these gaps by scaling qualitative data and integrating it with quantitative methods. Generalizing qualitative data is difficult due to its context-specific nature. However, several strategies can scale or systematize qualitative insights. For instance, thematic synthesis or meta-ethnography combines findings from multiple case studies to identify recurring themes, social patterns, and power dynamics. An example of this is a synthesis of over 50 groundwater governance case studies across sub-Saharan Africa, which could reveal regionally recurring gender exclusion patterns in water user associations (Villholth et al, 2013). Additionally, standardized qualitative tools like Most Significant Change (MSC) and Participatory Rural Appraisal (PRA) can be replicated across sites using a common protocol. UNESCO's WWAP has developed a gender-sensitive water monitoring toolkit that uses standardized qualitative surveys, which have been used in Africa and Asia (UNESCO WWAP, 2019). Furthermore, digital qualitative methods at scale, such as SMS-based surveys, chatbots, and interactive voice responses (IVRs), now allow the collection of open-text or semi-structured feedback from thousands of users, even in remote areas (Raftree and Bachan, 2013). For example, UNICEF's U-Report (UNICEF, 2023) gathers real-time feedback from youth, including questions on water, sanitation, and gender.

Blending qualitative and quantitative data can overcome the weaknesses of each and reveal deeper social patterns. Some common models include sequential designs, where one method informs the other. For instance, using survey data to identify gaps (Quant → Qual) and then conducting interviews in underserved regions, or using focus group findings to shape indicators for broader household surveys (Qual → Quant). An example of this is IFPRI's Land Tenure Survey

in Malawi (Place and Otsuka, 2001), which used qualitative village histories to explain anomalies in women's reported land ownership. Another model is embedded designs, which incorporate qualitative questions within large-scale surveys or use vignettes to elicit normative beliefs. The LSMS+ (Doss et al, 2020) is an example, integrating intra-household decision-making questions into national panel surveys, revealing how land ownership data diverges from actual control, particularly among women. Lastly, triangulation combines and compares both types of data to validate findings. For example, quantitative data might show low female participation in water committees, while qualitative interviews explain this is due to social stigma and time poverty (Van Koppen, 2002).

In conclusion, by addressing the unique needs and challenges faced by various social groups, we can ensure more equitable and sustainable access to groundwater resources. Lastly, given the diverse nature of the data available and its sources, it is crucial to consider the context in which the data was developed when using and integrating it. Blending qualitative and quantitative data can overcome the weaknesses of each and reveal deeper social patterns. For instance, sequential designs can use survey data to identify gaps and then conduct interviews in underserved regions or use focus group findings to shape indicators for broader household surveys. Embedded designs can incorporate qualitative questions within large-scale surveys or use vignettes to elicit normative beliefs. Triangulation can combine and compare both types of data to validate findings. By employing these methods, we can gain a more comprehensive understanding of gender exclusion patterns and improve water governance, ultimately leading to more inclusive and effective groundwater management.

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