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GROUNDWATER FOCUS ON AFRICA

The critical role of groundwater as a catalyst for socioeconomic development cannot be overemphasized. This overview synthesizes current relevant information regarding groundwater for socio-economic transformation in Africa. Although at the scale of the continent, Africa has vast groundwater resources, many still lack access to adequate and safe water for basic human needs: at least 400 million people in Sub-Saharan Africa do not have access to even basic water services. Therefore, the overwhelming priority for most countries is to improve access, first to basic water services and eventually to safely managed household supplies. Climate change is increasing the frequency of floods and droughts, leading to recurrent surface water scarcity and threatening the progress made so far in the provision of water and sanitation services. Rapid increases in water demand due to population growth, urbanization, climate change and environmental degradation adds to the pressure and increases the need for an expansion in climate-resilient water services. Hence, groundwater development offers great potential for Africa to meet increasing demands for resilient water, but these resources need to developed inclusively and be managed sustainably, for the benefits to be realised for all in Africa.

Groundwater facts and figures for Africa

The total groundwater storage in Africa is estimated to be approximately 650,000 km^3, with about 2% of it being renewed every decade. Not all this groundwater storage is available for abstraction, and the distribution is highly variable, but even in low storage areas groundwater offers a resource many times that of surface water

Some African countries have significant renewable groundwater resources (e.g. Gabon, Central African Republic, Republic of Congo, Liberia Equatorial Guinea) as indicated by recharge per capita (Figure1).

FIGURE 1. Long-term average annual groundwater recharge per capita (1970–2019).

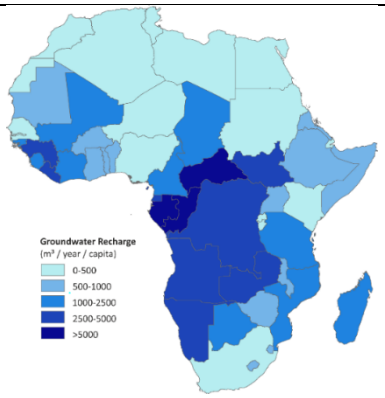

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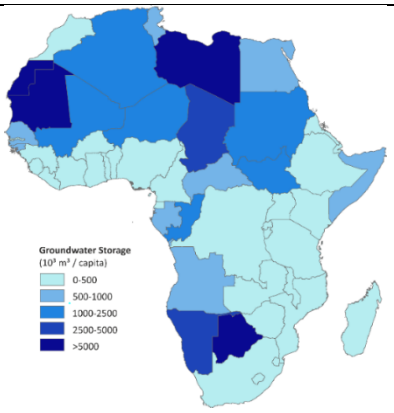
FIGURE 2. Groundwater storage per capita.



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The same figure also points to countries with vast dryland areas where renewable groundwater resources could be further exploited to overcome water scarcity and food insecurity (e.g. Mali and Mauritania). Many areas with low renewable groundwater resources, however, have significant non-renewable, often fresh groundwater (Figure 2). For example, parts of Algeria, Libya, Niger, Botswana and Namibia, while vulnerable to long-term depletion, could use these resources in the short-to medium term for strategic or emergency supplies. Regions with both high groundwater recharge and storage have the highest potential for groundwater development, while countries with low recharge and low storage have the lowest overall potential, although small-scale development is still of critical importance for smaller communities.

FIGURE 3. Long-term average annual groundwater abstraction per capita (1958–2015).

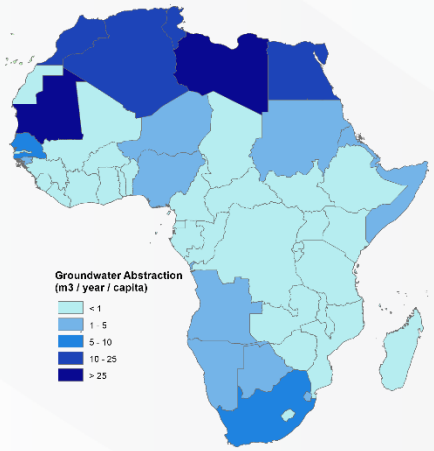

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Figure 3 shows countries with intensive use of groundwater relative to their population. This mostly reflects high use for irrigated agriculture and the risk of potential long-term depletion, especially in those countries with relatively little storage and few renewable sources of groundwater (e.g. Libya, Egypt, Algeria, Tunisia, Morocco, Mauritania, South Africa).

Generally there is more knowledge on extent and characteristics of aquifers in Africa than about their quantitative and qualitative state. Data and information groundwater base is dispersed across local and international institutions, private sector and other archives. Collaboration is needed in capturing, validating and in some cases continuous updating of these data and information at all scales to provide more reliable information on the potential risks for groundwater development.

African development imperatives and the role of groundwater

Groundwater for Climate Resilience

One of the most significant impacts of climate change affecting Africa is an increase in the frequency and intensity of extreme water-related weather events, such as droughts and floods. Impacts of extreme events are much larger in low-income countries. Managing water resources is key to climate resilience and climate change adaptation.

Groundwater will be increasingly relied on in a changing climate with more extreme weather. During droughts, groundwater provides a resilient source of water for both urban and rural areas. Therefore, better drought management is required, including explicitly accounting for groundwater as part of long-term sustainable and adaptive planning.

During floods, groundwater can provide emergency relief if flood-proof groundwater access infrastructures are in place. Aquifers may further alleviate flooding impacts by retaining excess runoff as part of dedicated improved managed storage strategies.

Groundwater for WASH, Urbanization and Economic Growth

It is estimated that only 30% of the population of Sub-Saharan Africa have access to safely managed drinking water services, with 35% of the population lacking access to even basic services. In addition, only 21% of the population have access to safely managed sanitation services. The situation is worse in rural communities where 8 out of 10 people have no access to safe water and sanitation. The COVID-19 pandemic underscored the fundamental importance of hygiene, clean water and improved sanitation.

Several hundred million people living in rural parts of Africa depend on groundwater for drinking. The majority obtain groundwater from decentralized communal water points, most commonly boreholes equipped with handpumps or motorized pumps, hand-dug wells and protected and unprotected springs. Maintenance of pumps and sustainability of supply through abstraction wells is far below satisfactory. Yet, groundwater provides a relatively inexpensive, off-grid, distributed source of water for dispersed rural communities throughout Africa. Groundwater-based supply from shallow sources is often the only viable and cost-effective water source for such communities with even the least productive aquifers capable of supporting water supplies for domestic and small-scale agricultural use.

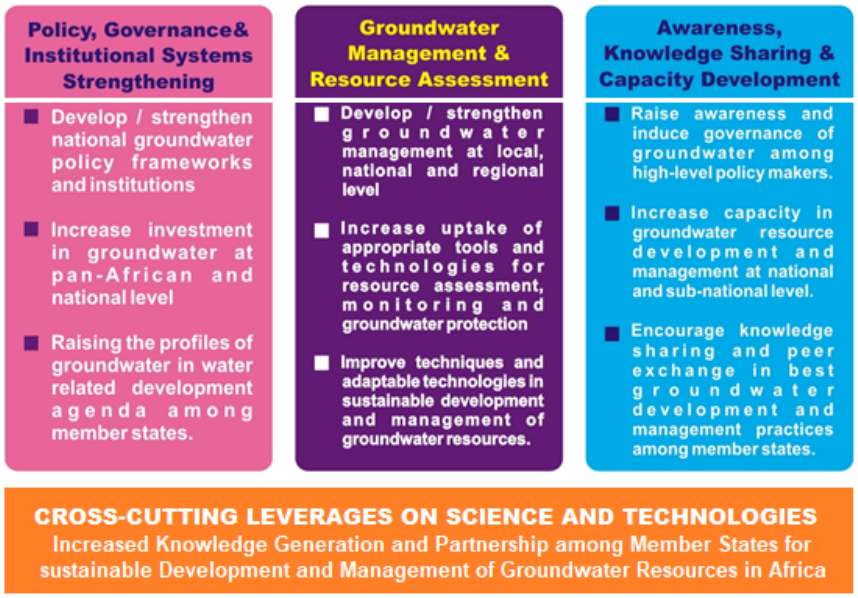
Africa's population in urban areas is increasing rapidly, projected to reach almost 50% in 2035. African cities face low huge infrastructure and service gaps, including crucial water supply. As a result, the proportion of the urban and peri-urban population served by utility-provided water is decreasing, leading to the rapid expansion of groundwater self-supply. Poor urban dwellers rely on unprotected springs, shallow wells, rivers and other sources often vulnerable to contamination, affected by on-site sanitation and poor waste management. There is a clear need to integrate groundwater and sanitation management to enhance safe water supply and protect critical water resources. The inclusion of groundwater within urban water suppliers in conjunction with surface water is an imperative for many regions in Africa in coming decades.

AMCOW's Pan-African Groundwater Program (APAGroP)

The African Ministers Council on Water (AMCOW) is an intergovernmental institution of the African Union with a mission to provide political leadership, policy direction and advocacy in the provision, use and management of water resources for sustainable social and economic development and maintenance of African ecosystems. In recognition of the strategic importance of groundwater in Africa, AMCOW launched a Pan-African Groundwater Program (APAGroP) in October 2019, having the following vision:

> *"Through improved policy and practice, groundwater is used sustainably and equitably, increasing water and food security and resilience supporting improved lives and livelihoods in Africa."*

APAGroP works across three main thematic pillars, as depicted below.



Main APAGroP goals and outcomes are:

1) Increased awareness and political commitment to groundwater, with better representation of groundwater in water policies and major water-focused programs at various levels across the continent.
2) Continental cooperation, knowledge sharing and collective action between Member States and partners to establish a pan-African community of best practice on groundwater.
3) Efficient linkages between the research community, practitioners and policymakers to promote evidence-based decision making on groundwater-related issues.
4) Strengthened institutional and individual capacity to improve groundwater use, management and governance.

Agricultural Transformation supported by Groundwater

Agriculture is still a primary sector of Africa's economy, employing more than half the labour force and accounting for about 15% of GDP in SSA. Food productivity is low due to the factors such as limited perennial water sources for irrigation, land degradation, extensive farming practices and increasing intensity and frequency of extreme climate events. Agriculture provides income and food security especially for marginalized groups including women, the poor, minorities and indigenous people. Crop performance is based predominately on rainfed agriculture and is highly sensitive to temperature and precipitation variations. In the drought-prone countries, the prevalence of undernourishment has increased over the last years and millions of people are estimated to be severely food insecure.

Value-addition techniques accessing sustainable water resources along with efficient and clean energy sources are reported to reduce poverty two to four times faster than growth in any other sector. Countries that have increased investments in agriculture including irrigation and fertilizer use, have already seen a reduction in hunger and poverty and an increase in productivity.

Groundwater provides a perennial and widely available water source to support climate-smart agriculture in SSA, which can be developed on an incremental cost-effective basis. While shallow groundwater availability is reliant on replenishment from regular rainfall and more vulnerable to longer drought, deeper groundwater is more resilient. The development of groundwater resources for food production in fragile regions may reduce migration and displacement. Groundwater can contribute to food security in mostly rainfed, often dryland, areas, but also in subhumid areas with increasingly shifting rainy seasons and in already irrigated areas with potential for expansion.

Environment, Groundwater and Nature-based Solution

Africa is home to a vast diversity and abundance of the world's biological and natural resources. However, many ecosystems and the services they provide are under severe threat by human pressure. Africa's freshwater ecosystems and their biodiversity are especially threatened. These negative impacts are exacerbated by the effects of climate change. The harmful effects of degradation of ecosystem services are being borne disproportionately by the poor and are contributing to growing inequities and disparities among societies.

Investment in services (water and sanitation, natural resource management, health, finance and safety) and infrastructure (transport and accommodation) could provide the foundation for communities to take part in economic opportunities including nature-based tourism.

The ecosystem services naturally provided by groundwater need to be tailored and managed to support water security and resilience, often in conjunction with engineered infrastructure. Examples are managed aquifer recharge (MAR) and in-situ water quality management using treated wastewater. These integrated solutions hold great potential for enhancing water security while also tackling increasing issues of water and ecosystem contamination across the continent.

Transboundary Aquifers for Regional Integration and Stability

Africa is a continent shaped by regional natural and social diversities and complementarities, which provide a need and a potential for closer cooperation and integration. This holds for many fields including economy, education, labour and commodity market, and certainly shared water resources. International cooperation on shared water resources is increasingly acknowledged as a critical aspect of development goals, as exemplified by SDG 6.5.2.

Africa has more than 70 transboundary aquifers (TBAs) which cover about 40% of the continent equivalent. About 33% of the African population lives on TBAs often is arid and semi-arid regions. TBAs are attracting international attention as population growth and climate change increase demand for freshwater.

The importance of identifying, mapping, and assessing valuable and productive transboundary groundwater resources increases, in particular because of higher rainfall uncertainty, full allocation of surface water resources, and increasing ecosystem degradation related to transboundary river systems.

Around a dozen TBAs in Africa have been subjected to more detailed characterization so far, hence a development potential of TBAs in Africa asks for increased engagement. Existing work on TBAs in Africa provides an important basis for water diplomacy and international relations that increase regional integration. However, only seven TBAs are currently subject to specific bilateral or multilateral agreements on joint research, monitoring, consultation or governance. No TBA cooperation agreement has so far been consolidated in a joint dedicated institutional body. Not without reason, cooperation on TBAs is listed as one of the priority actions in the APAGroP programme.

Groundwater protection and sustainability asks for a due attention

While groundwater holds significant development potential in Africa, it is paramount to weigh and assess the benefits (of use) and risks (of pollution) and make the necessary trade-offs.

The **nature** of groundwater resources (distribution, availability, quality, etc.) can be challenging for groundwater development. Africa possesses large groundwater resources, but they are not evenly distributed across the continent nor according to local needs. A large part of Africa is underlain by rocks with limited storage and/or permeability. On the other hand, the large sedimentary aquifers in the Northern Africa receive little, often negligible recharge.

One of the main challenges is groundwater **quality**. Most of the groundwater storage is either fresh or brackish in nature. However, a considerable number of aquifers in arid and semi-arid areas as well as in coastal plains are impacted by geogenic contaminants such as salinity in coastal areas and fluoride in the East African Rift.

Saltwater intrusion induced by overexploitation of coastal aquifers has led to salinity increase in a number of countries. Other anthropogenic groundwater quality deterioration is also on the rise, caused by factors such as mining activities, poor irrigation practices and urbanization (bacteriological

contamination). Groundwater quality problems such as salinisation and bacteriological contamination may be exacerbated by climate change.

The main **governance** challenge is to overcome inertia in the institutional setup. Up until the last decade, groundwater has received little attention from policy-makers. For instance, while Southeast Asian countries tapped their groundwater resources to transform agricultural activity in the 1970s and 80s, there was no such effort in Africa. Africa has also missed many other landmark global groundwater development trends. Globally, many countries started building groundwater databases and developing hydrogeological maps in the 1980s, but these are still rare in Africa. Regular **monitoring** of groundwater levels or quality, the first step to groundwater management, is restricted to only a few countries. Very few countries have groundwater licensing systems.

There are few universities that teach groundwater as a subject, and few professional bodies for hydrogeologists or drillers. Consequently, hydrogeological studies and drilling are often carried out by insufficiently qualified personnel, having inappropriately sited boreholes that are poorly constructed as a serious consequence.

Financing continues to be a critical issue for developing groundwater resources in Africa. The further development of groundwater in Sub-Saharan Africa is not currently limited by a lack of groundwater, but rather by a lack of investment.

Key Messages and Call to Actions

Based on the critical role groundwater plays and will continue to play in achieving multiple continental and global development goals as highlighted above, there is the need for strong commitment of political decision makers and strong partnerships with key stakeholders and actors including the private sector. Such synergy is needed for prioritizing investments in groundwater development, use, protection and management.

Furthermore, to achieve Africa Water Vision 2025 of increasing water security, resilience, and better lives and livelihoods and to safeguard benefits for socioeconomic transformation of Africa and for generations to come, there is the need for call to actions to:

- Recognize the critical role of groundwater in supporting resilience and socioeconomic transformation in pursuit of Agenda 2063.
- Take action to increase investments that build capacity and strengthen the enabling environment to realize the full potential of groundwater in line with national development priorities.
- Enhance national and regional cooperation around groundwater and transboundary aquifers within a broader goal of international water cooperation and regional integration for peace and political stability.
- Engage with APAGroP and related AMCOW's groundwater initiatives as key mechanisms for supporting Member States toward equitable and sustainable use of groundwater for achieving multiple development goals, recognizing the need for diverse context-specific pathways.