

2026 BURDON LECTURE, KIRSTY UPTON

The Power of a Map: Translating groundwater data to decisions

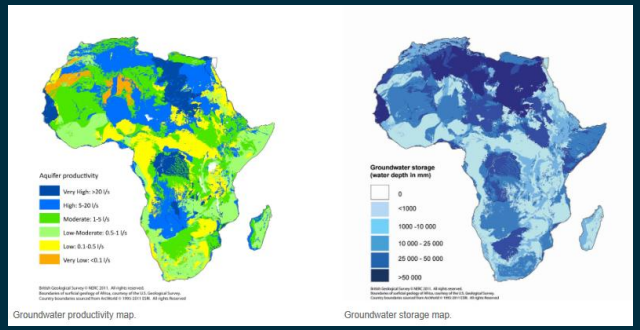
British Geological Survey

IAH Burdon Groundwater Network for International Development

BGID supports the sustainable development and management of groundwater for poverty reduction

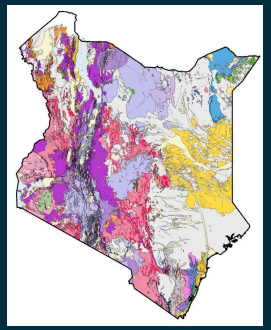
David Burdon worked as a hydrogeologist in >50 countries from 1949-1987, key role in establishing IAH in 1956 and cofounded the Irish Chapter in 1976

The development and use of groundwater maps in Africa

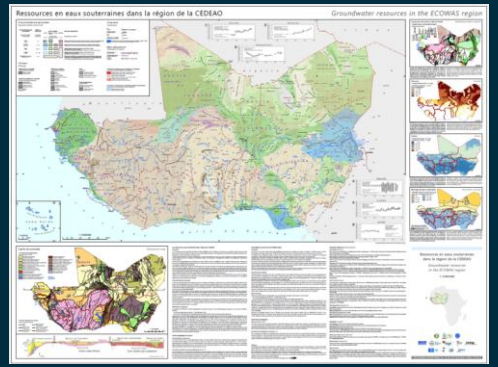


Groundwater productivity map.

Groundwater storage map.







Continental

- Quantitative Maps
- Africa Groundwater Atlas

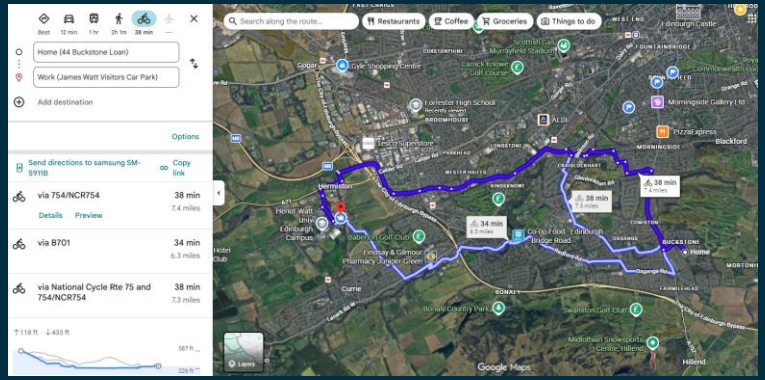
Regional

- ECOWAS & GW Governance

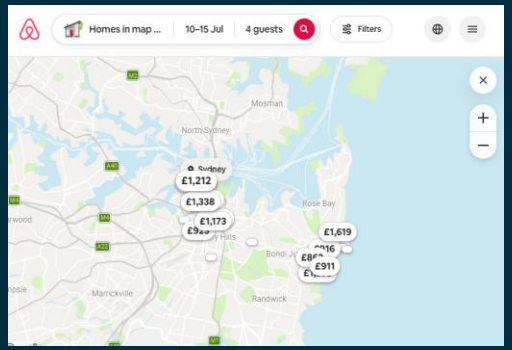
National

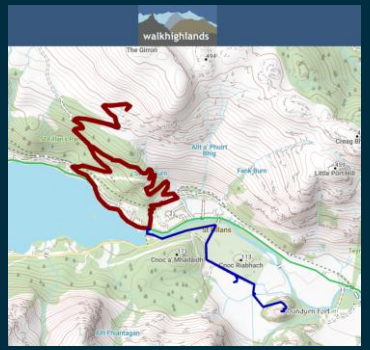
- Kenya GW Decision Support

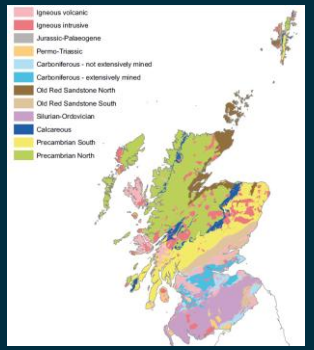
A picture is worth a thousand words

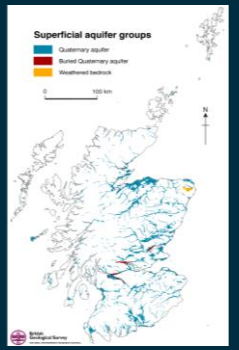




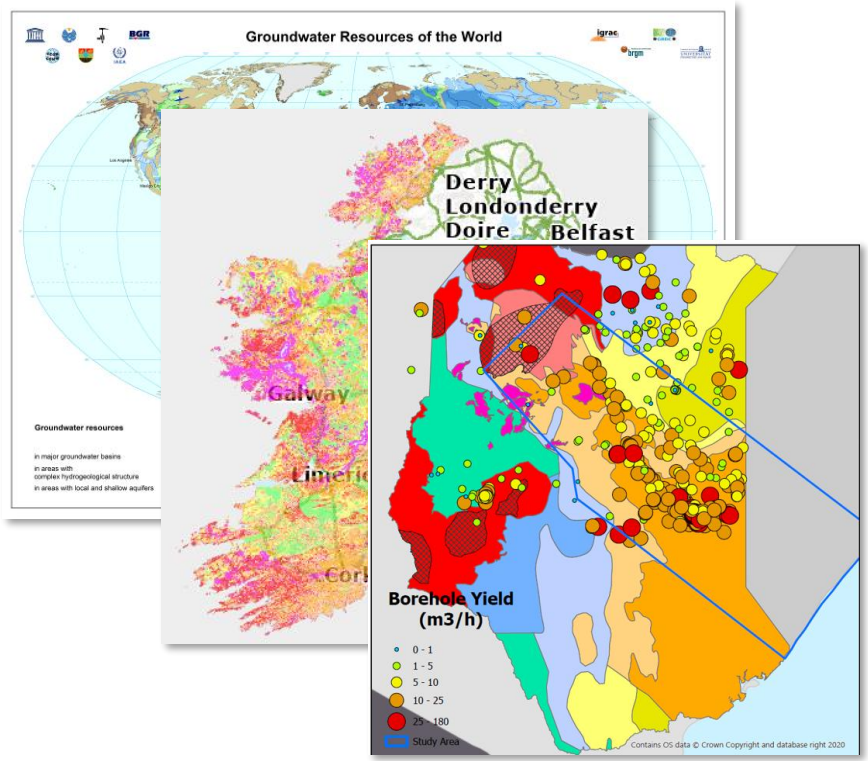








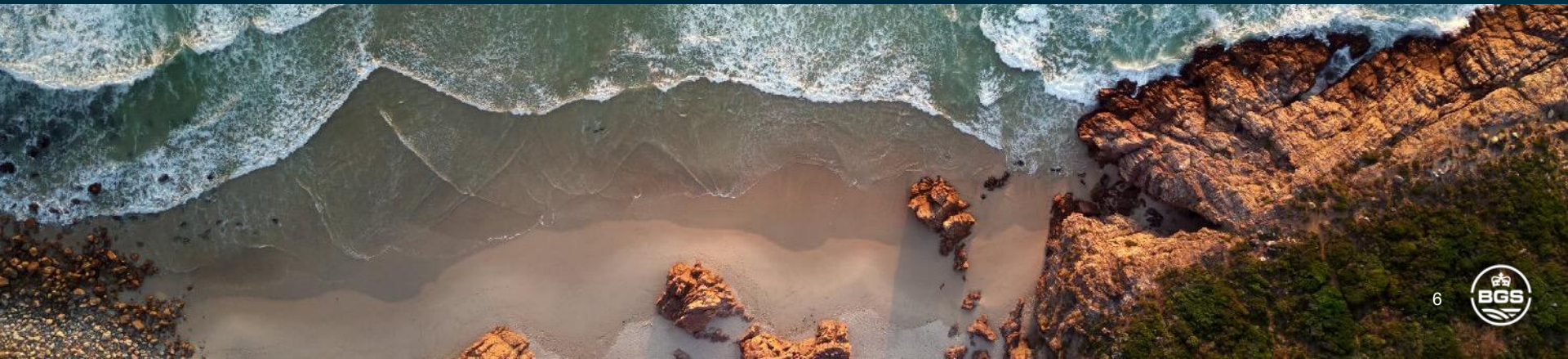
GROUNDWATER MAPPING



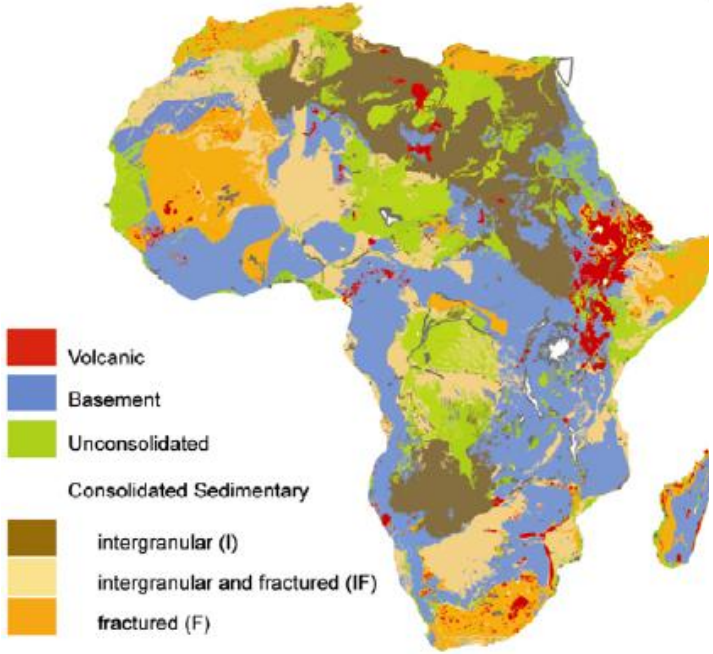
1. Advocacy
2. Planning
3. Regulation
4. Monitoring
5. Implementation

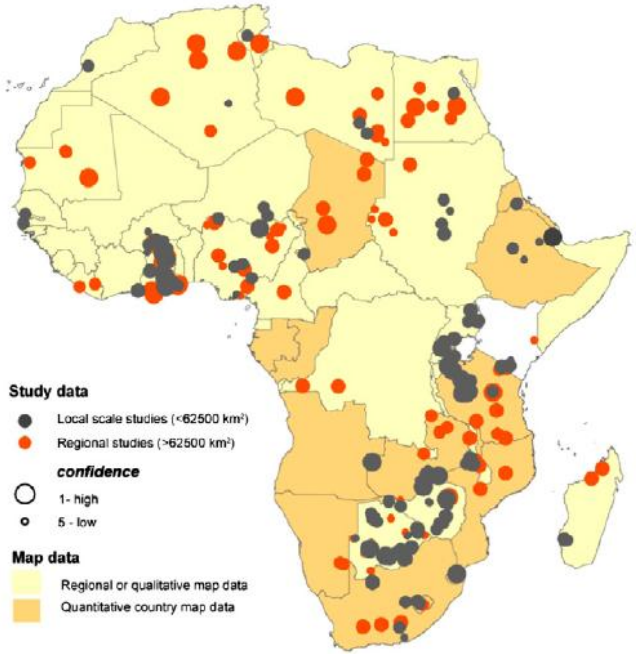
Need to design the map to meet the purpose

Continental Scale Groundwater Mapping in Africa



Quantitative maps of groundwater resources in Africa

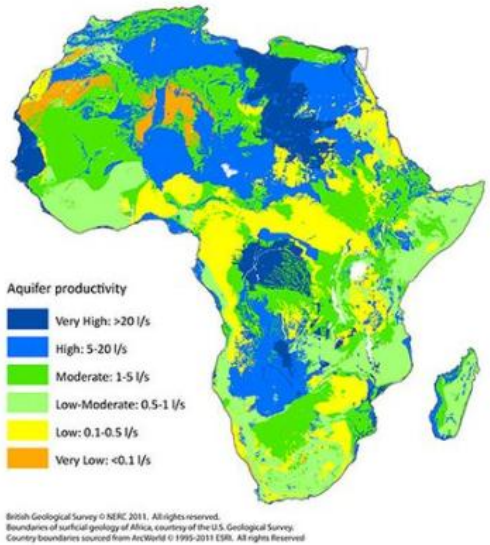




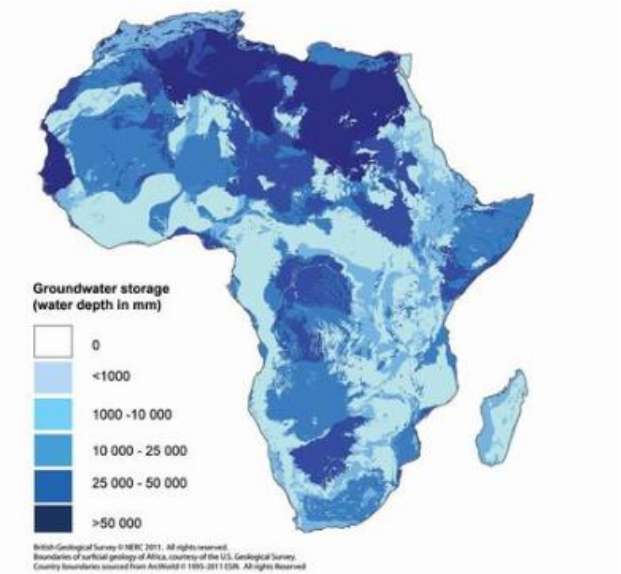
- 1:5 million geology
+
- Existing hydro maps
- Published data
- Grey literature

doi:10.1088/1748-9326/7/2/024009

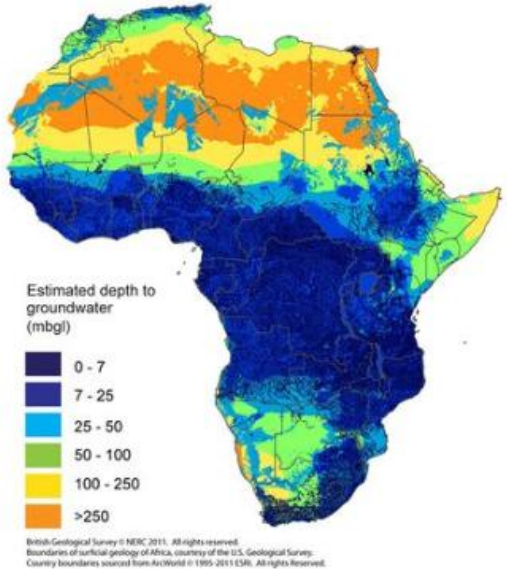
Quantitative maps of groundwater resources in Africa



Aquifer productivity



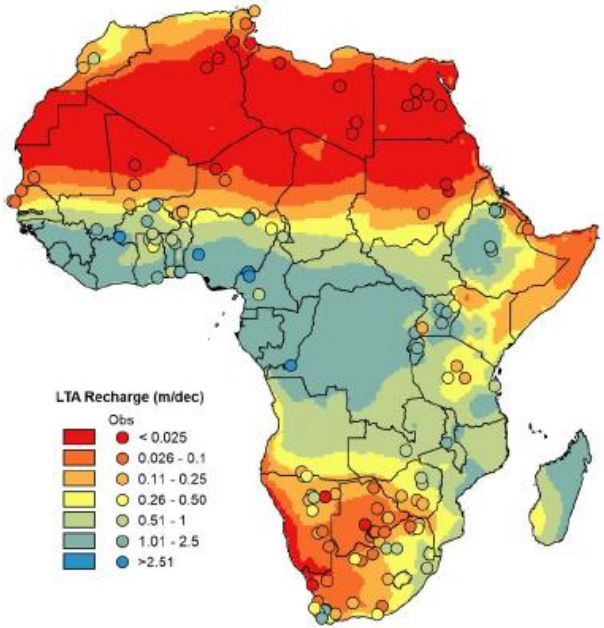
Aquifer storage

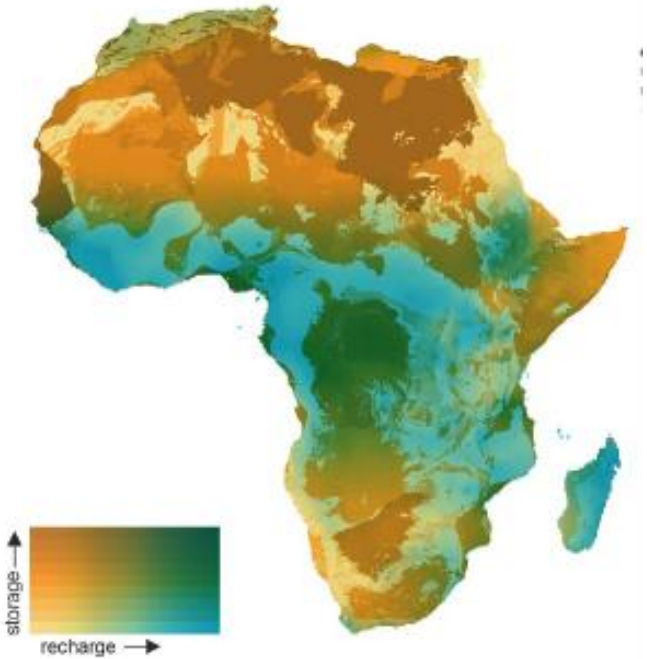


Depth to GW

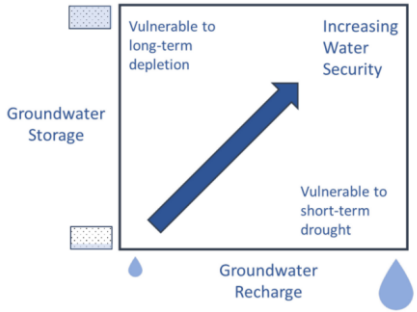
doi:10.1088/1748-9326/7/2/024009

Quantitative maps of groundwater resources in Africa





- LTA Recharge
- GW Storage
- Water security



doi:10.1088/1748-9326/abd661

How have the maps been used?



BBC NEWS

'Huge' water resource exists under Africa

20 April 2012 · 386 Comments

	Quantitative Maps (2012)	Recharge Map (2021)
Downloads	>165,000	>25,000
Academic Citations	587	140
News Citations	18	21
Policy Citations	103	14

UP Gro

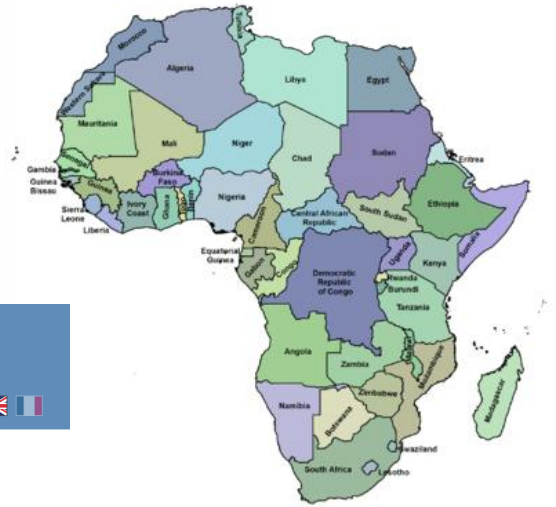
Unlocking the Potential of Groundwater for the poor

BGS

Africa Groundwater Atlas

UP Gro — Unlocking the Potential of Groundwater for the poor

- Improve the availability and accessibility of high-quality information on groundwater in Africa
- Summary of the hydrogeology and groundwater resources of 51 African countries + supporting information
- Developed in partnership with 64 in-country hydrogeologists (IAH)

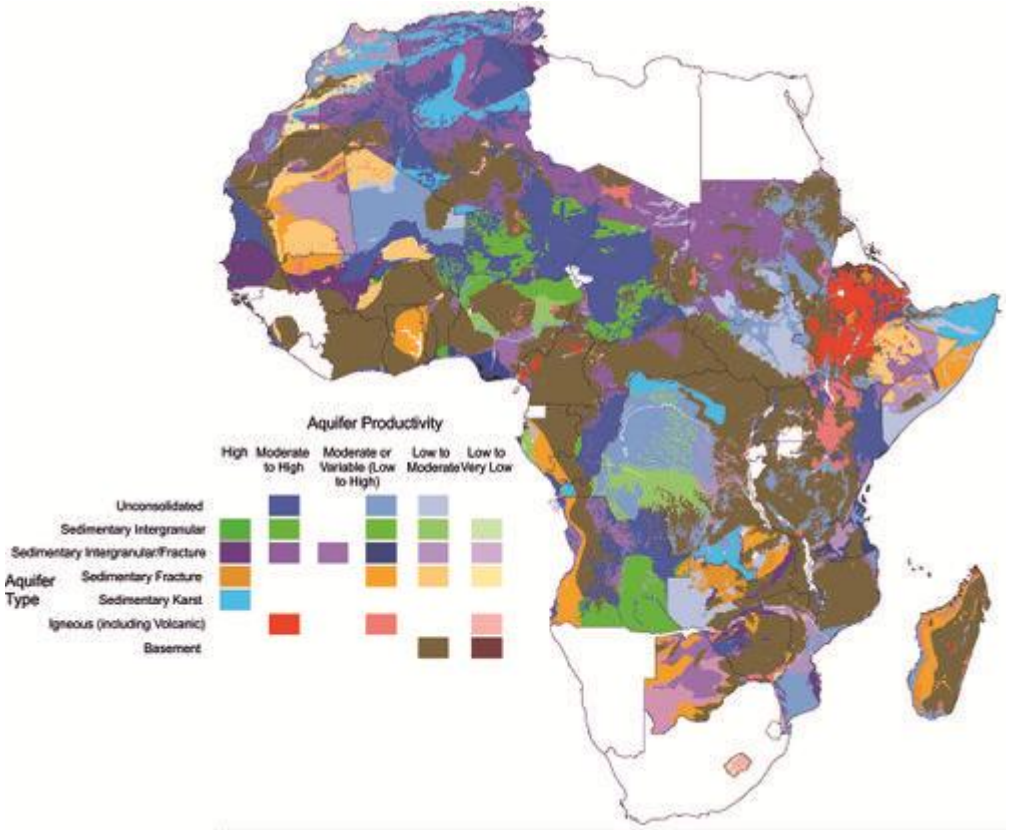


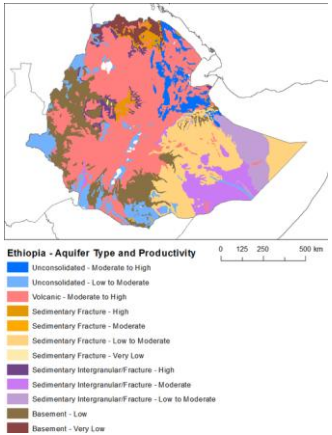


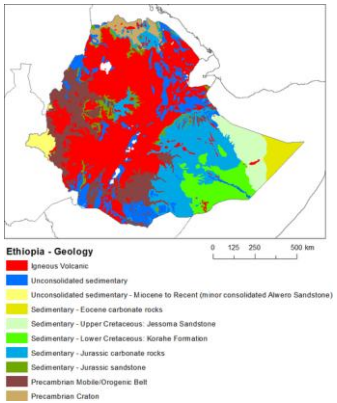
BGS

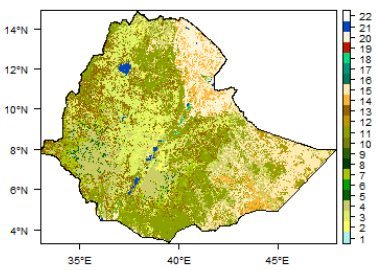
Africa Groundwater Atlas

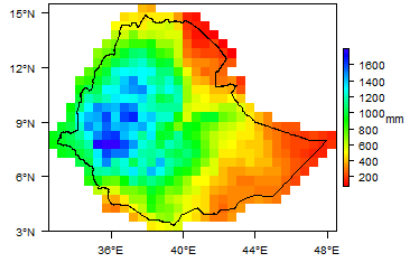
Unlocking the Potential of Groundwater for the poor







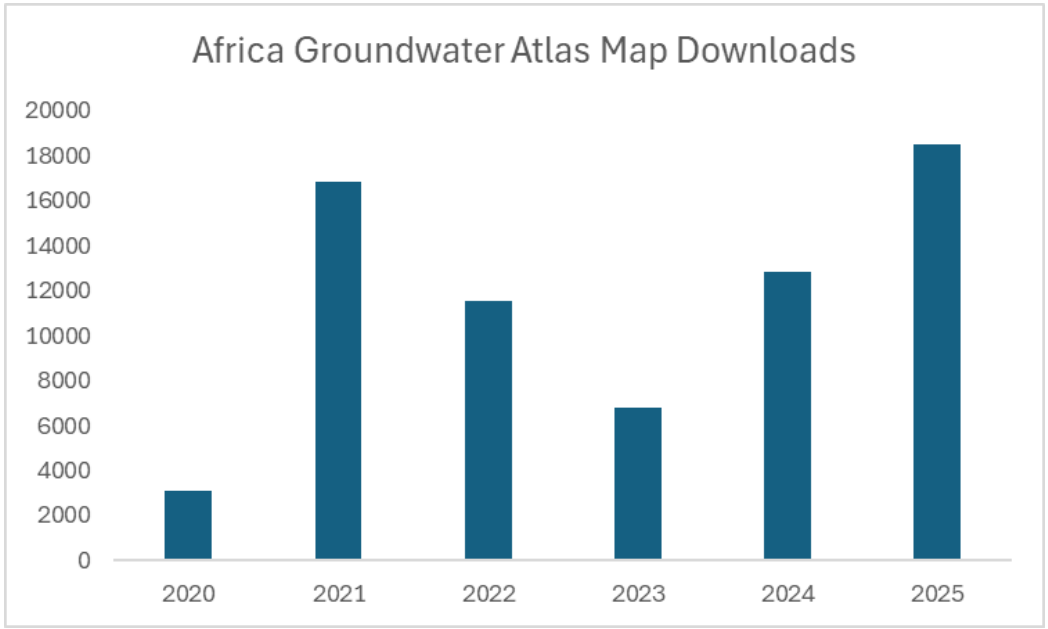


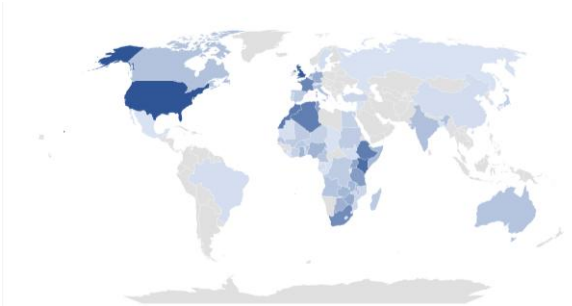


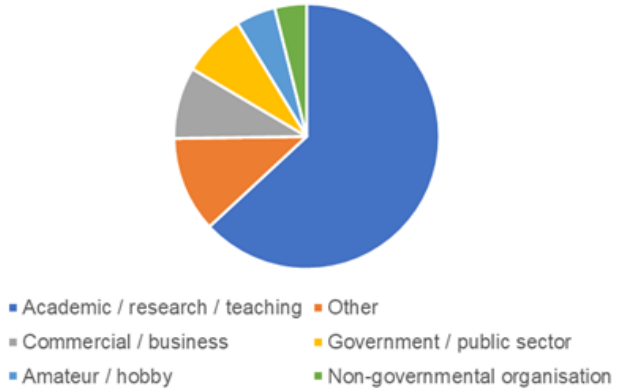
How has the Atlas been used?

Unlocking the Potential of Groundwater for the poor

- ~70,000 downloads since launch in 2019
- Globally by a range of users







Unlocking the Potential of Groundwater for the poor

How has the Atlas been used?

"Identify optimal implementation sites for Photovoltaic Water pumping"

"Research on the potential market size for solar-powered irrigation"

"Enhancement of agriculture sustainability for food security"

"Researching groundwater access, contamination, and droughts in relation to elephant deaths, migration patterns"

"For a Sanitation Project for 4 coastal towns for the Government of Angola"

"We are considering a larger commercial farming operation in Botswana"

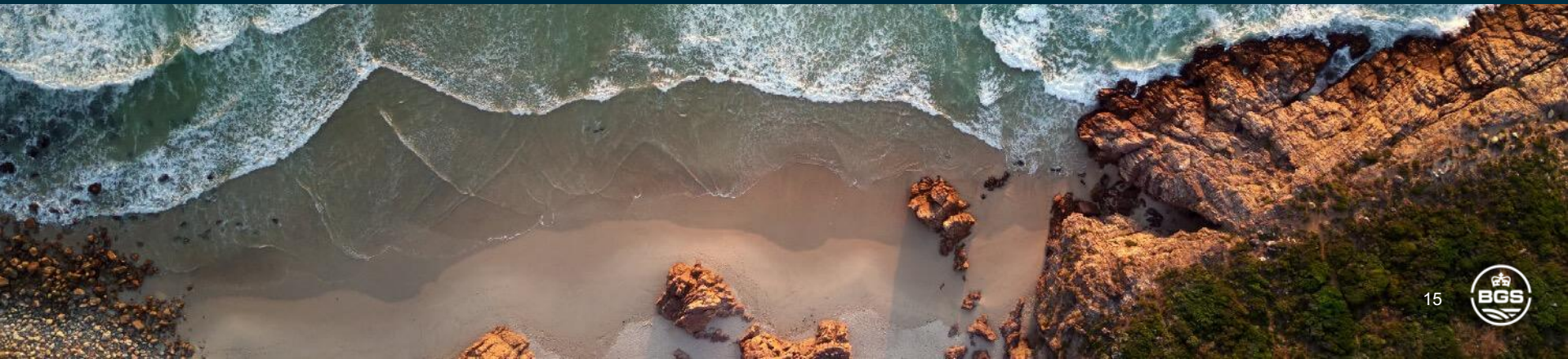
"For water resources master plan in Burkina Faso" *"To implement public health project"*

"To make regulatory decision to enhance water management in Gambia"

"Mapping for railway project"

"To aid policy and intervention during planning in water for agriculture"

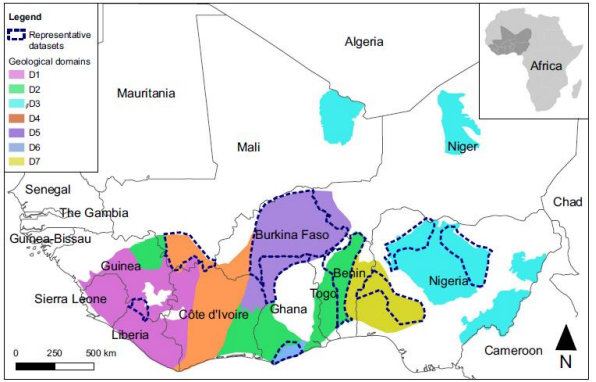
Regional Scale: Focus on the basement & GW governance in West Africa

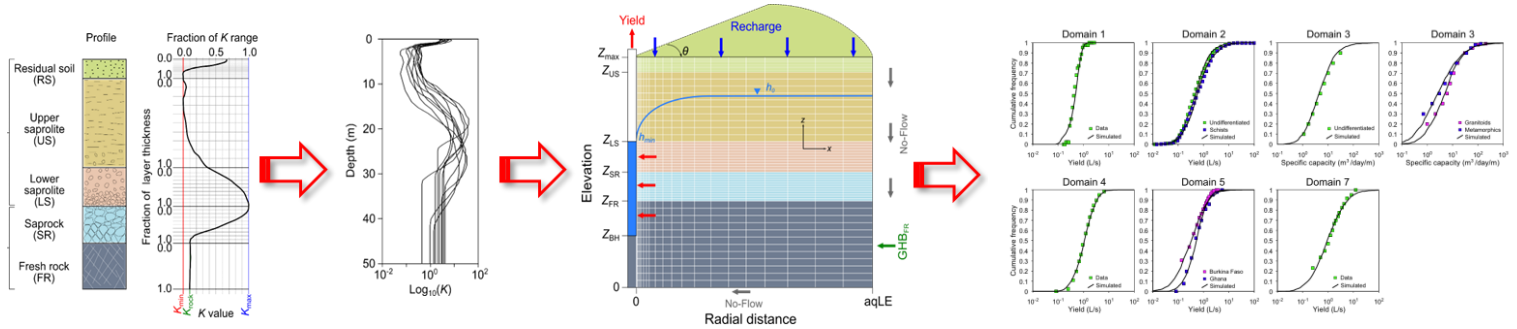


Mapping the basement in West Africa

doi:10.1007/s10040-023-02594-w

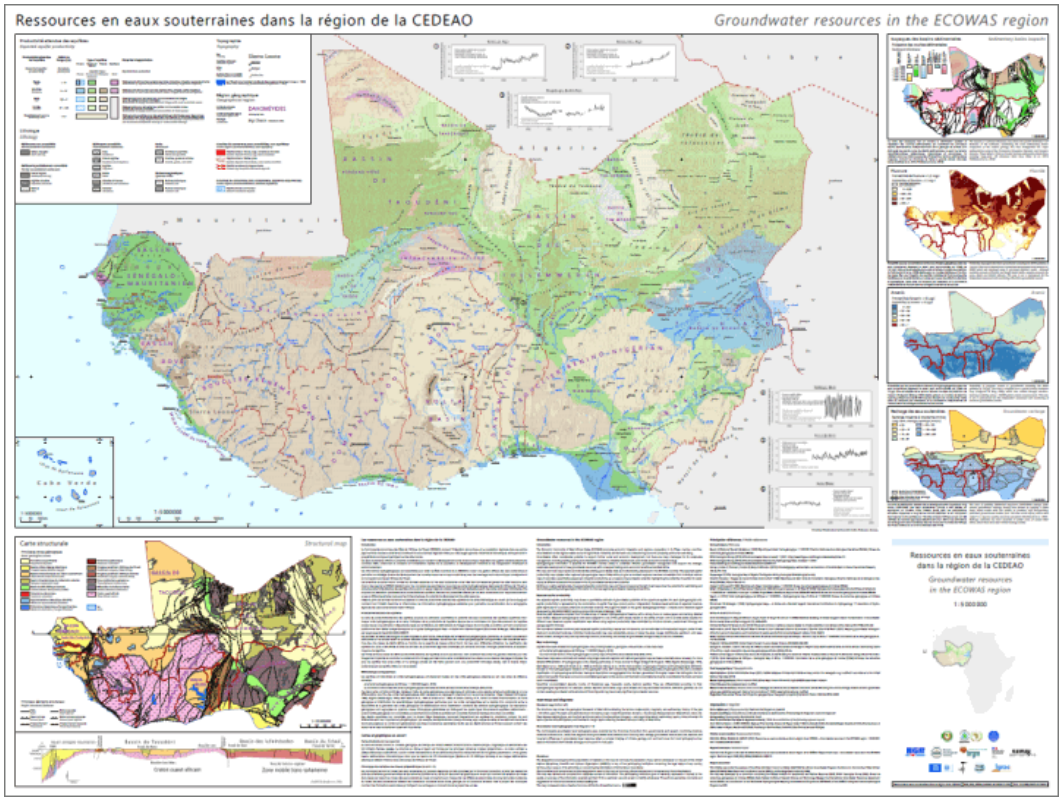
- Defining basement domains based on the nature of weathering and fracturing
- Geological, climatic and landscape controls
- Stochastic parameterisation of typologies (thickness, Kmax, Kmin) in MODFLOW
- Define yield probabilities





- Over all 25% can sustain > 1 L/s and several have >5% of > 5 L/s

Groundwater resources in the ECOWAS region



Used to help develop the new ECOWAS hydrogeology map for West Africa

BGR, BGS, BRGM, EAWAG, UNESCO. 2022 *Ressources en eaux souterraines dans la région de la CEDEAO : Groundwater resources in the ECOWAS region.* 1:5000000. Federal Institute for Geosciences and Natural Resources (BGR).
https://nora.nerc.ac.uk/id/eprint/532446/

A governance tool for West Africa

The development of a tool that enables government agencies to set up a tailored governance system to sustain the socioeconomic benefit of their groundwater resources

Considering:

- **Hydrogeological Conditions**
- Institutional Landscape
- Water Users

ivl Swedish Environmental Research Institute

SIWI

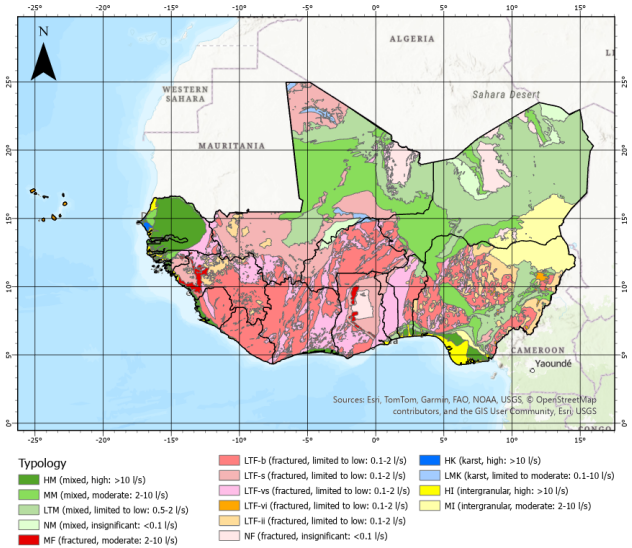
unicef

BGR

BGS

A governance tool for West Africa

1. **Assessment of key risks to groundwater**
2. **Hydrogeological typologies underpin vulnerability assessment**
3. **Risk-based management guidance**



AIM

Limit groundwater depletion/contamination to ensure long-term sustainability and no harm

RISKS & CASCADING IMPACTS

HAZARD CHARACTERISTICS

GROUNDWATER VULNERABILITY

HAZARD

ivl Swedish Environmental Research Institute

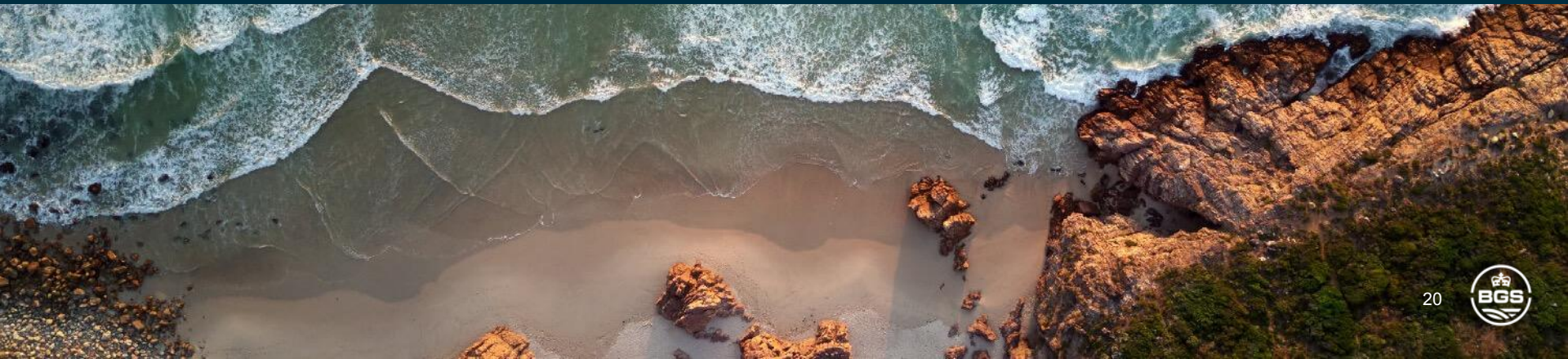
SIWI

unicef

BGR

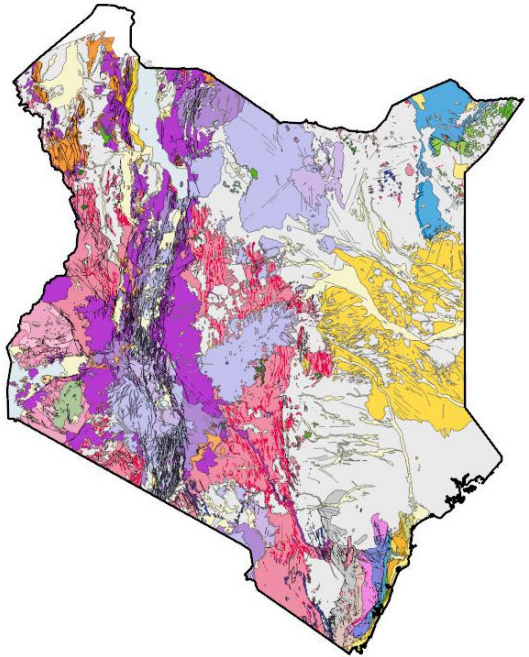
BGS

National Scale: Groundwater decision-support in Kenya



National and sub-national mapping in Kenya

- Domains approach underpinning hydrogeological maps of GW opportunity / risk
- Decision support for the Water Resources Authority and groundwater users



Crystalline Basement Province	Cratonic Basement Domain *Exposed Cratonic Basement Subdomain* *Weathered Cratonic Basement Subdomain* *Cratonic Basement with superficial cover Subdomain*	Sheared and Rifted Basement Domain *Weathered sheared Basement Subdomain* *Exposed Sheared Basement Subdomain* *Sheared Basement with superficial cover Subdomain*
East Africa Rift Province	Central Rift Volcanics Domain Rift Margins Domain Shield Volcanos Domain Central Rift Basins Domain Distal Rift Margins Domain	
Sedimentary Rifts Province	Shallow Karoo Rift Domain Shallow Anza Rift Domain Pliocene sediments Domain Deep Karoo Rift Domain Deep Anza Rift Domain	

Summary & Conclusions

- Maps at different scales for different purposes
- Support different types of decision making
- Geology and groundwater data underpin maps at all scales

British Geological Survey

THANK YOU

Any questions?