Hydrogeological Mapping for Climate Resilient WASH in Ethiopia – LOT 1

21 March 2022

Risk Mitigation; Dr. Arjen de Vries, Vince Uhl, Dr. Seifu Kebede

BDA/ICB/GW01/2021

ውሃና ኢነርጂ ሚኒስቴር
MINISTRY OF WATER AND ENERGY

ACACIA WATER

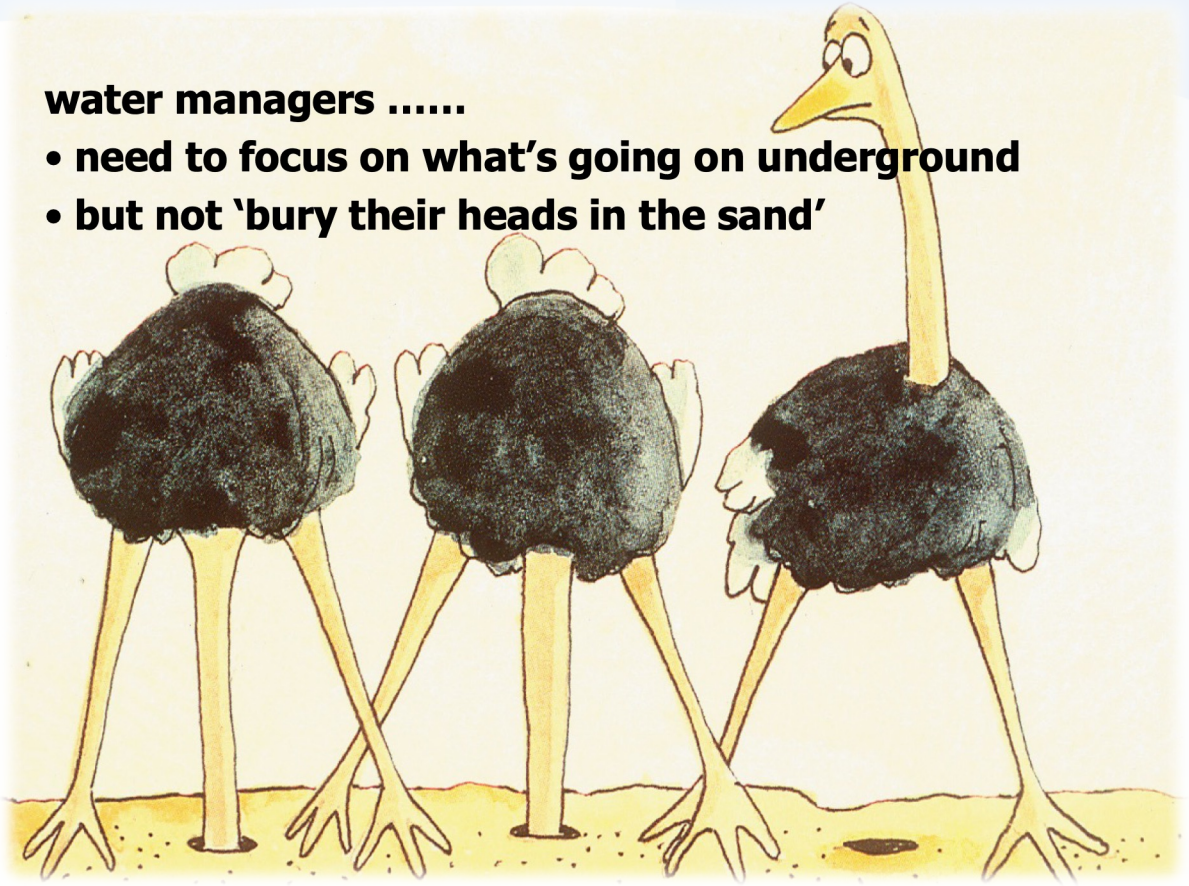
aquacon ENGINEERING PLC

UHL

Foreign, Commonwealth & Development Office

Groundwater in Ethiopia

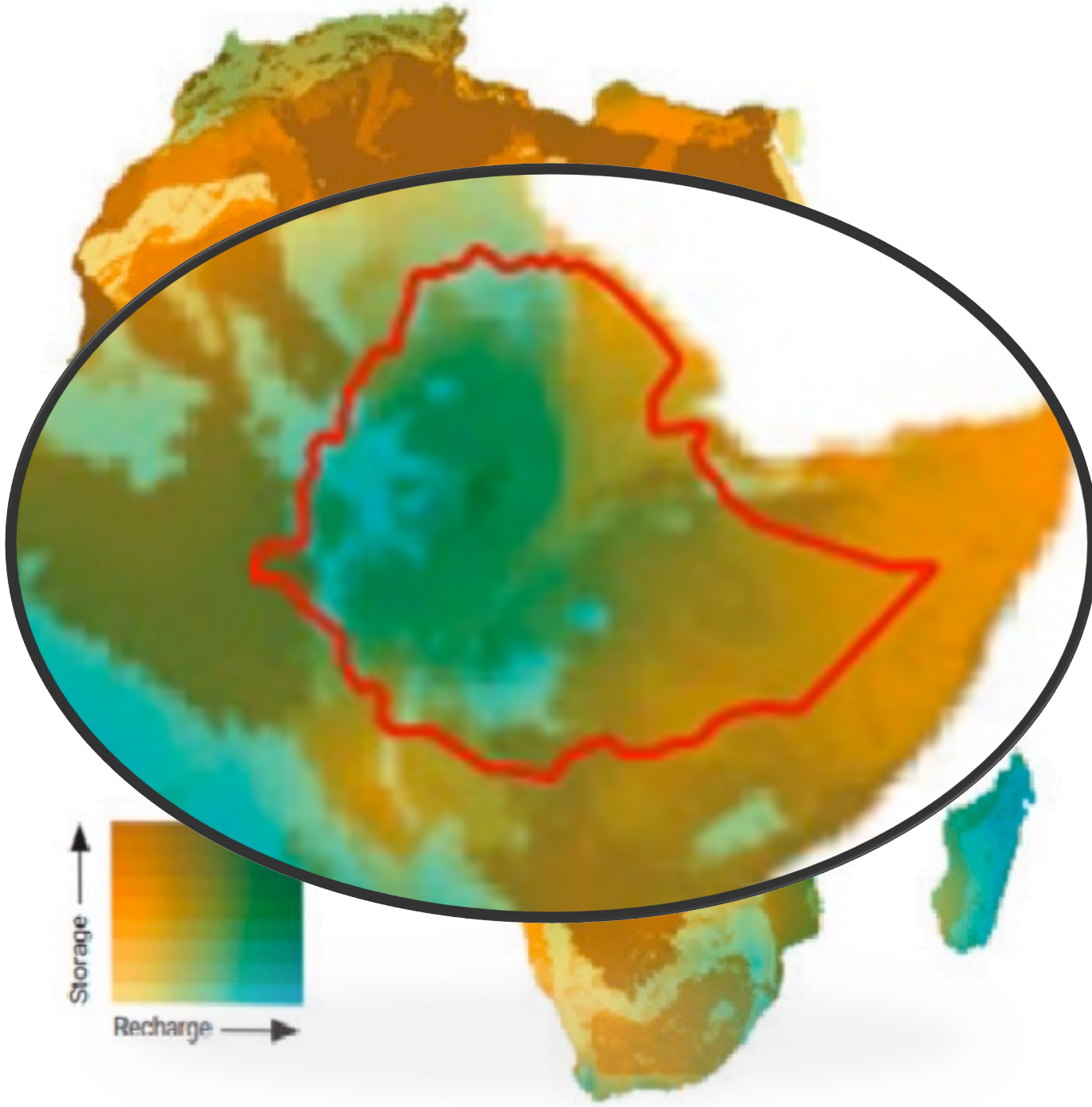
- Groundwater plays a crucial role in water availability (>70%)
- Key to absorb climate shocks
- Every reason to appreciate groundwater and exploit it wisely
- It is the great unknown for many water managers and users;



"out of sight, out of mind", an "an infinite source"

Resilience to drought

- High groundwater storage buffers against short-term changes in rainfall
- high average long-term groundwater recharge enable an aquifer to recover rapidly after drought



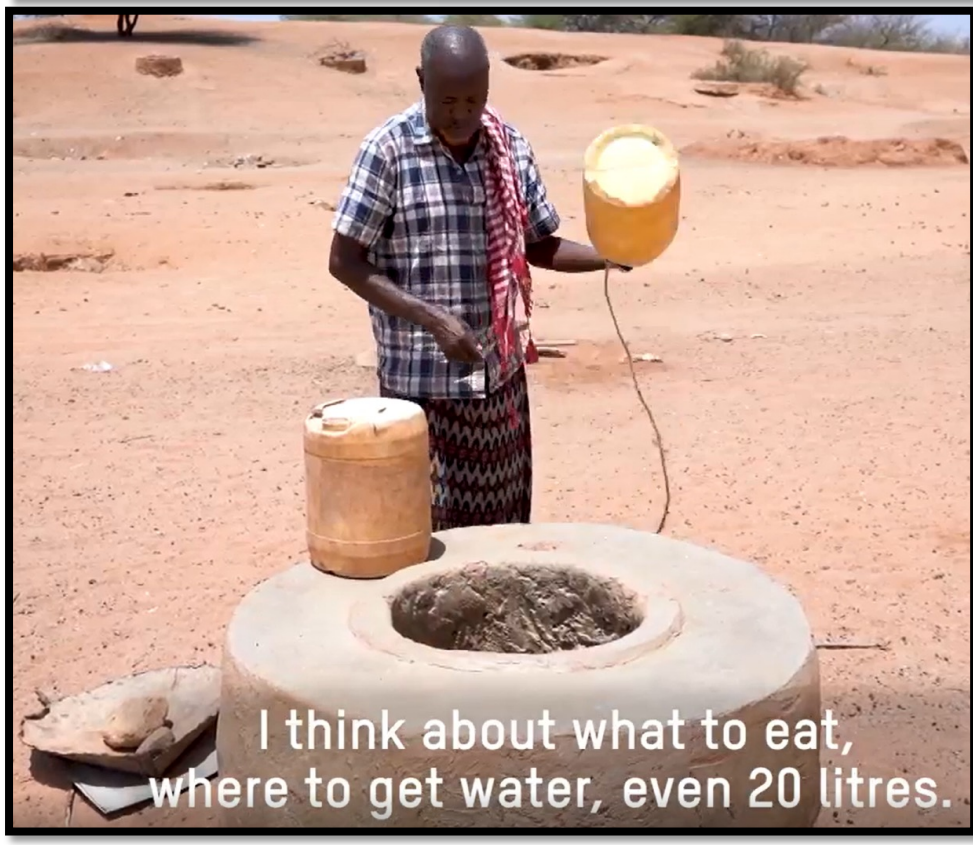
MacDonald et al. (2021)

Resilience to drought

- Natural resilience of aquifer systems to CC varies considerably and is controlled primarily by geology, vegetation, topography and climate

Depending on use and location, but:

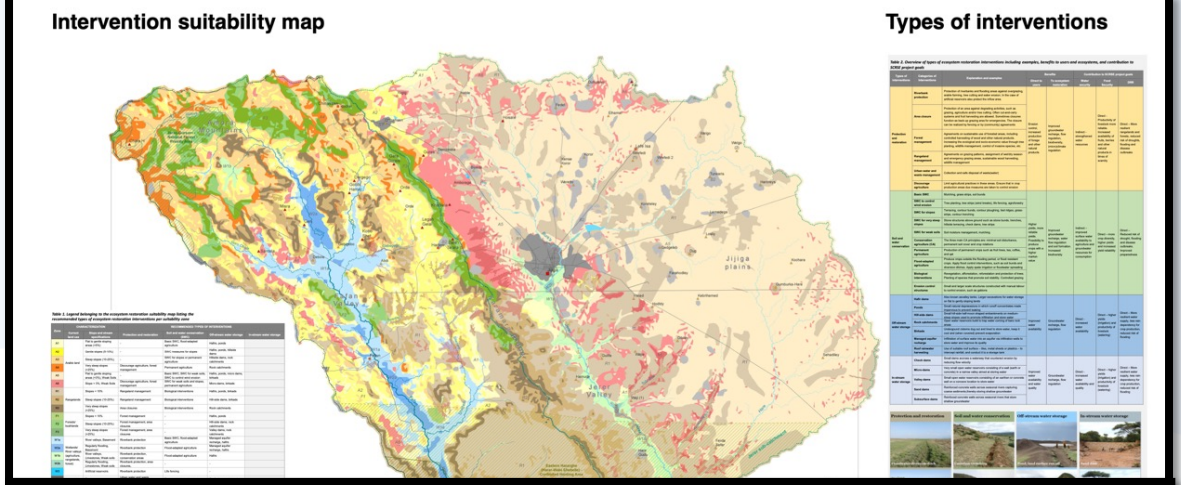
- Deep GW : ~resilient
- Shallow GW: rainfall vs recharge

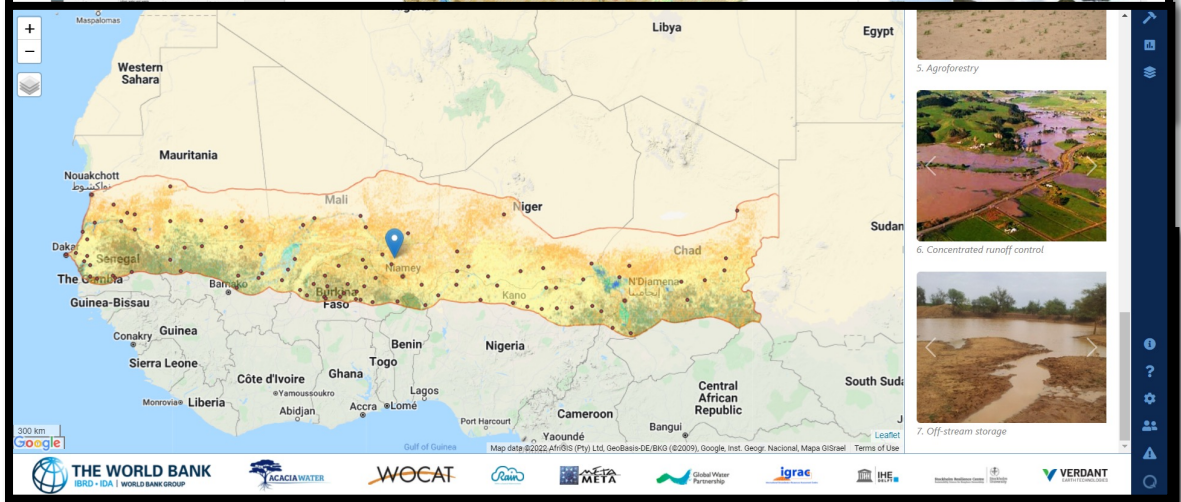


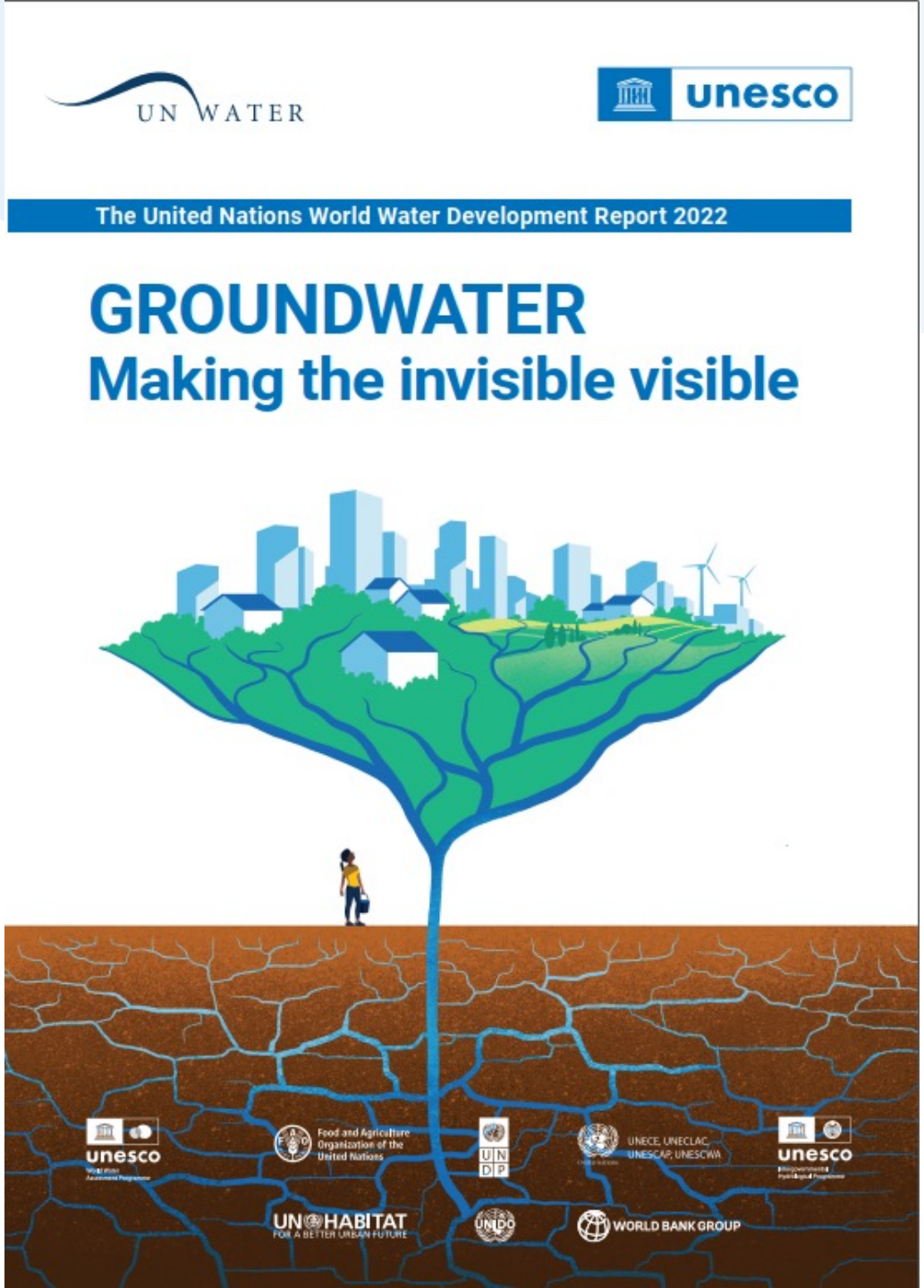
Rainwater harvesting mapping

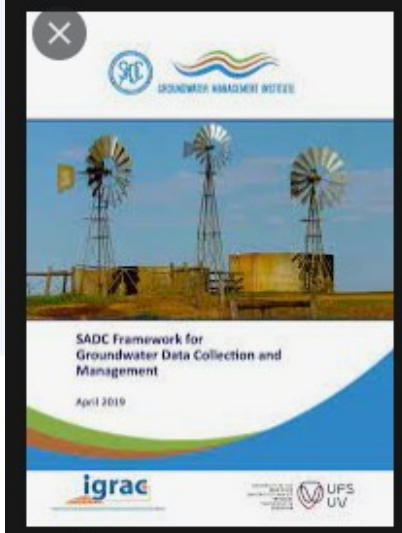
Aim: Improved recharge of shallow groundwater recharge through feasibility mapping of concrete measures

- Reduced recharge due to land degradation
- Shallow groundwater is the key sustainable water source and crucial for resilience
- Need for mapping interventions to improve recharge and availability

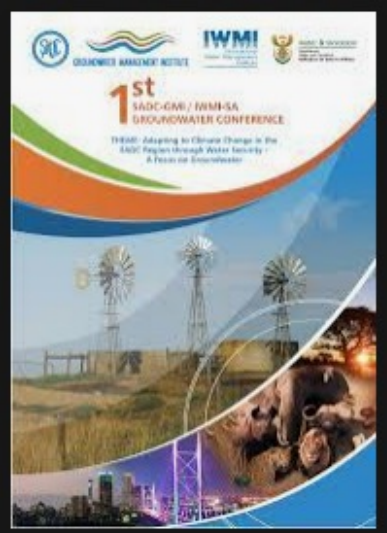




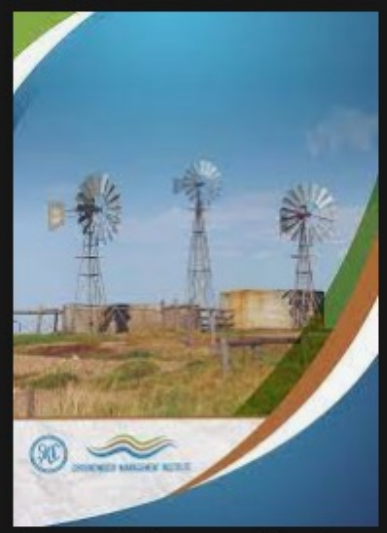




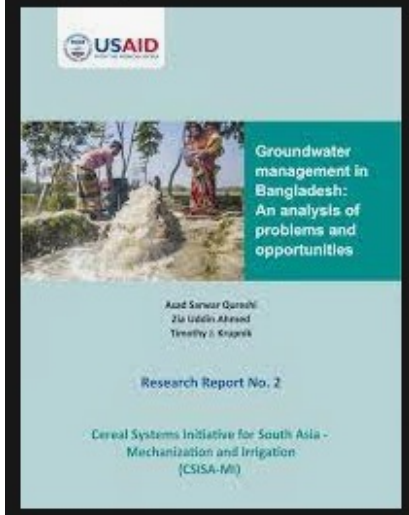
Untitled
un-igrac.org



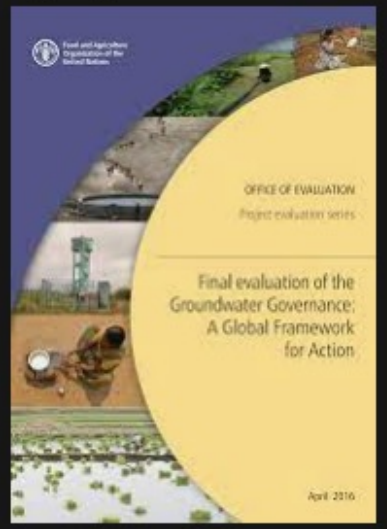
Southern Africa | International Groundw...
un-igrac.org



Policy, Legal and Institutional Developm...
sadc-gmi.org

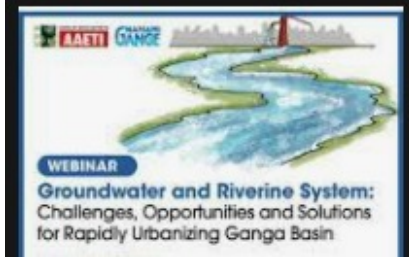


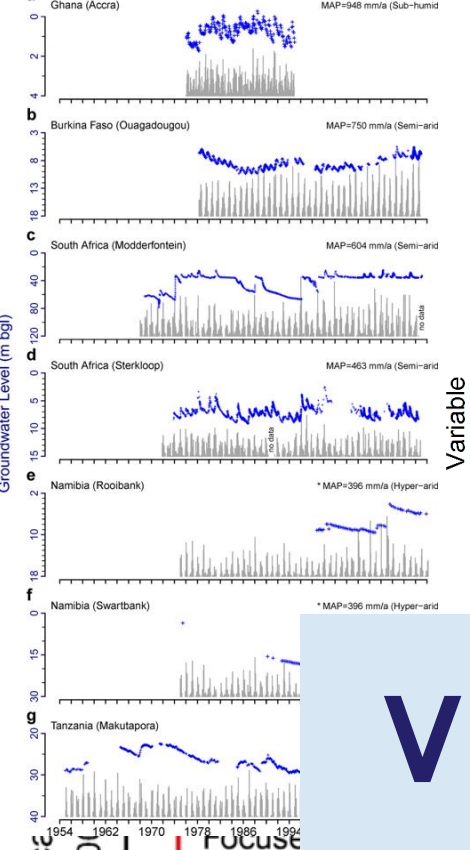
PDF) Groundwater management in Ban...
researchgate.net



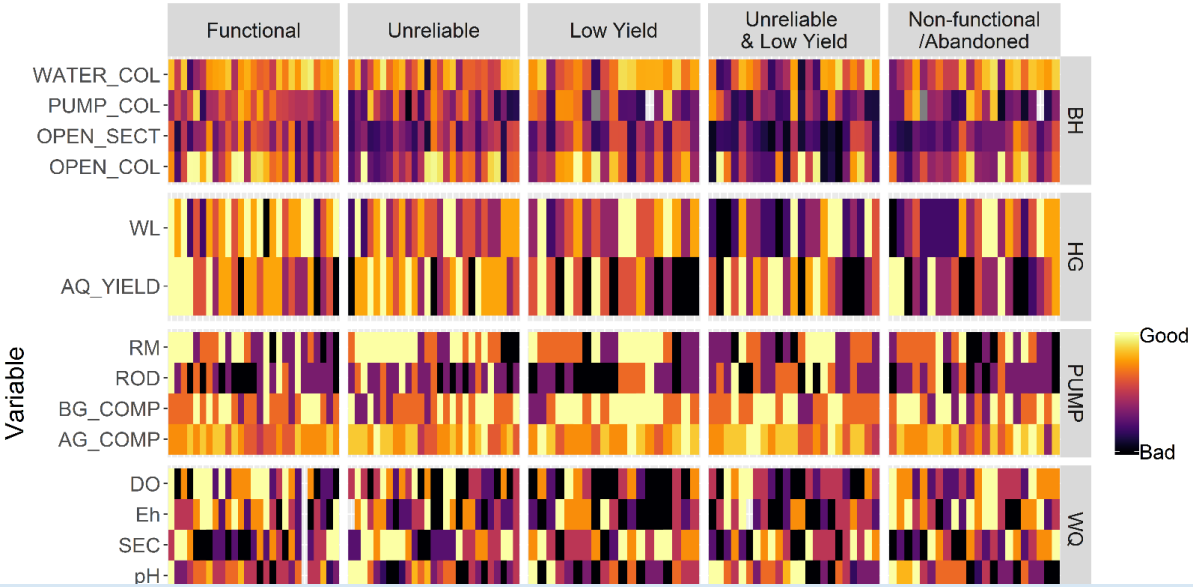
Final evaluation of the Groundwater Gov...
fao.org

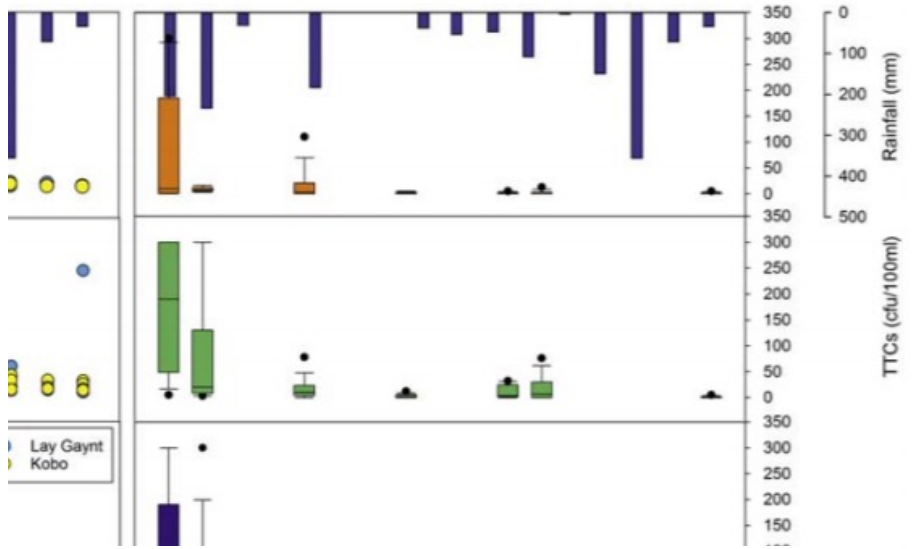
Abstracts
ag-groundwater.org



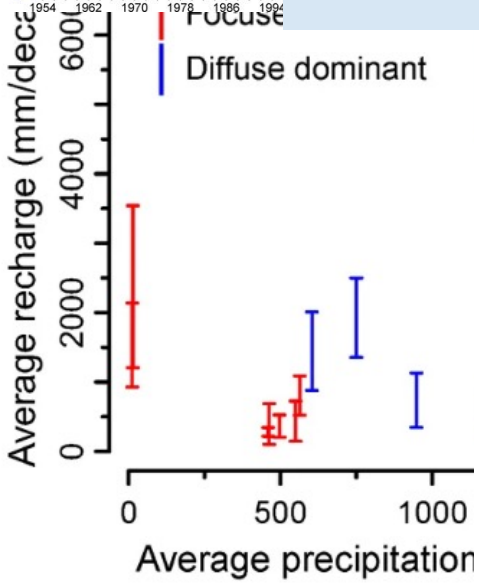


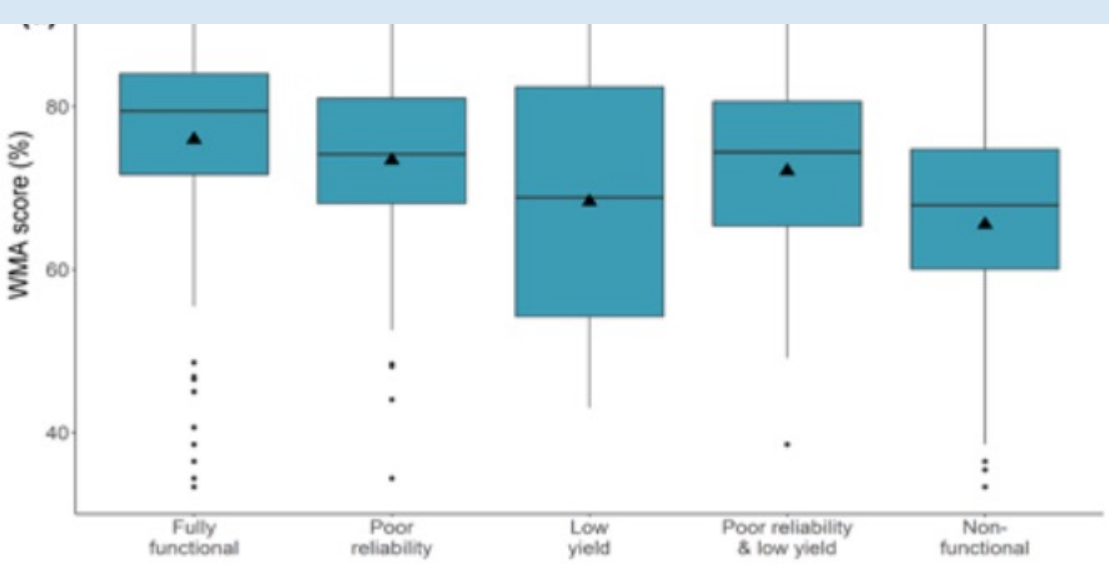
Ethiopia, Malawi and Uganda, functionality

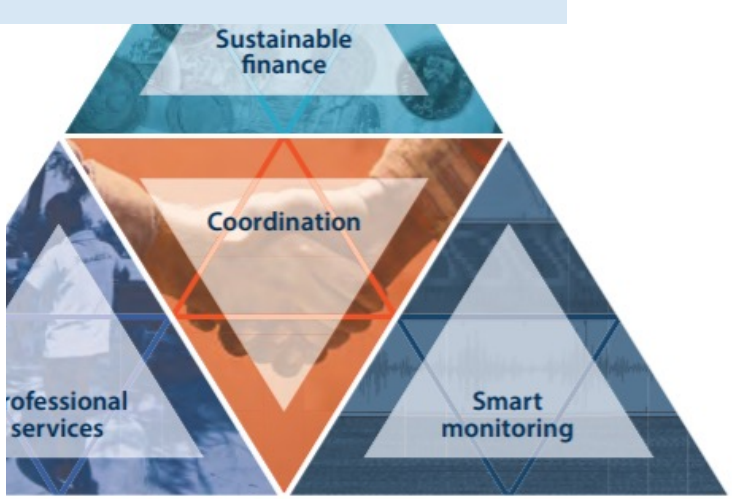




Very relevant scientific outputs





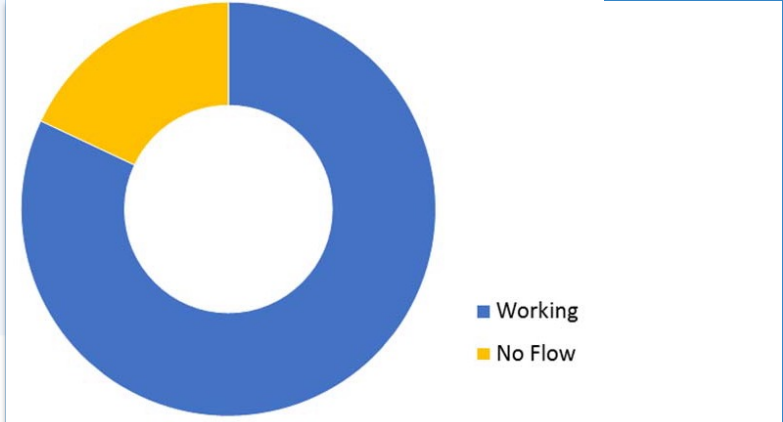


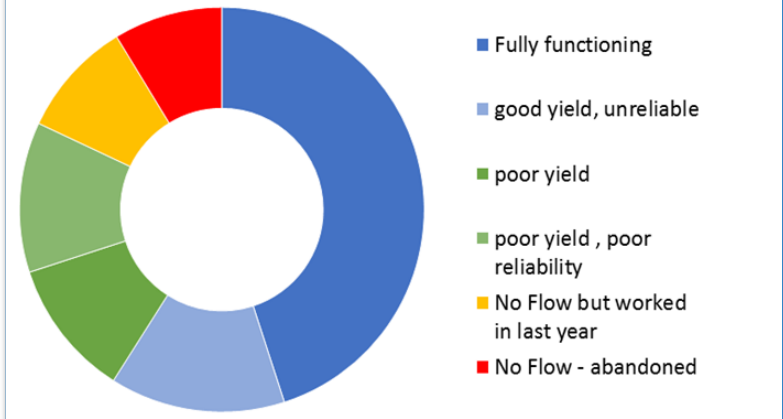
The FundiFix model has four connected dimensions:

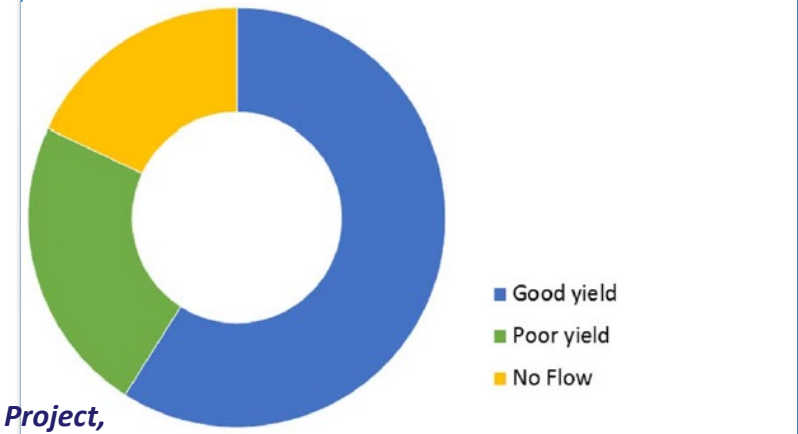
Some observations

- Low success rates; dry wells and shortages
- Poor sustainability
- Conflicts and reduced resilience
- Depletion of fossil reserves
- Overview of resources is lacking
- Poor capacity
- Poor maintenance; technical failures
- No guidelines/protocols

➔ **Not rocket science issues**





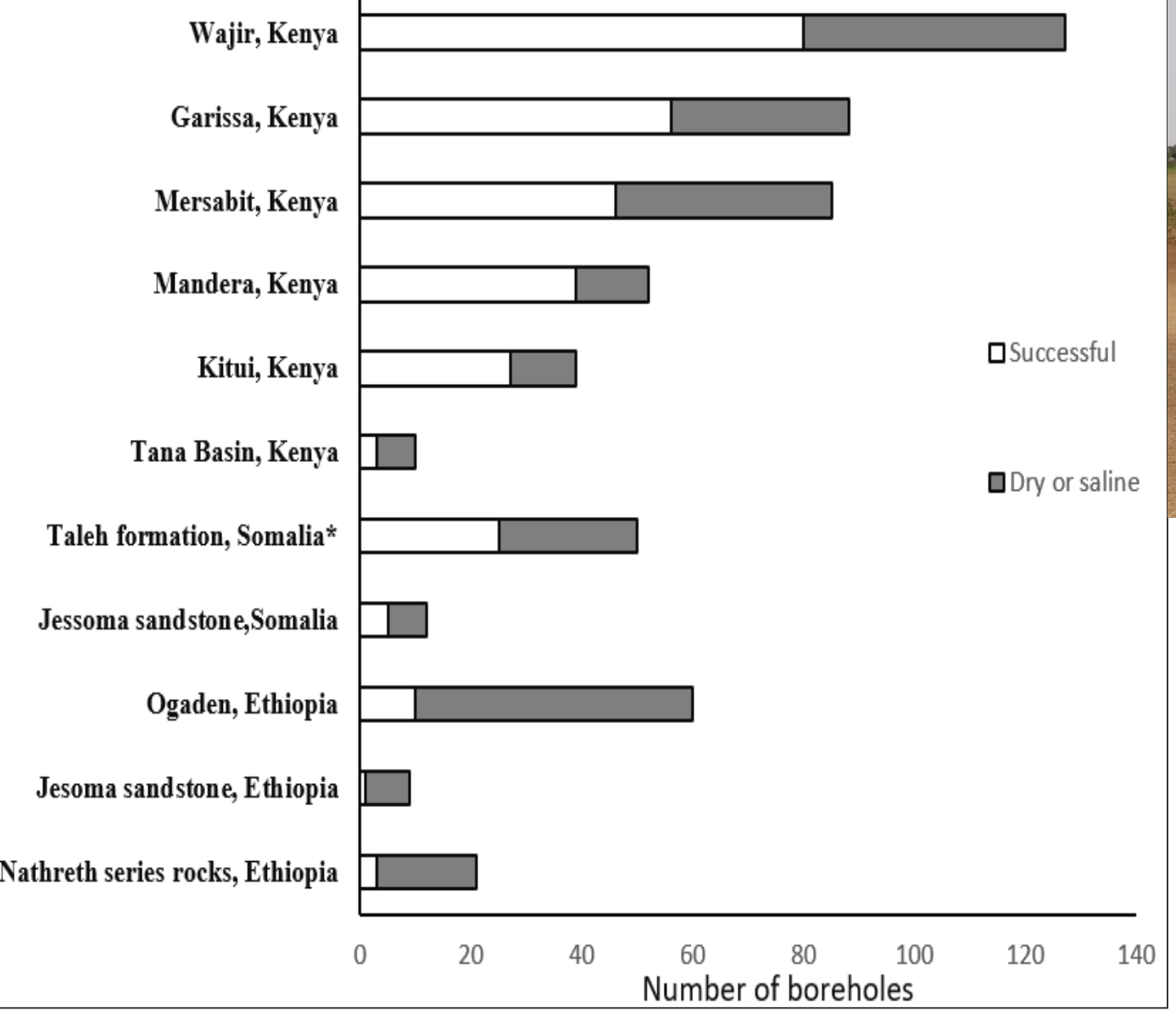


Hidden Crisis Project, 2017 [BGS, ODI, AAU 2017

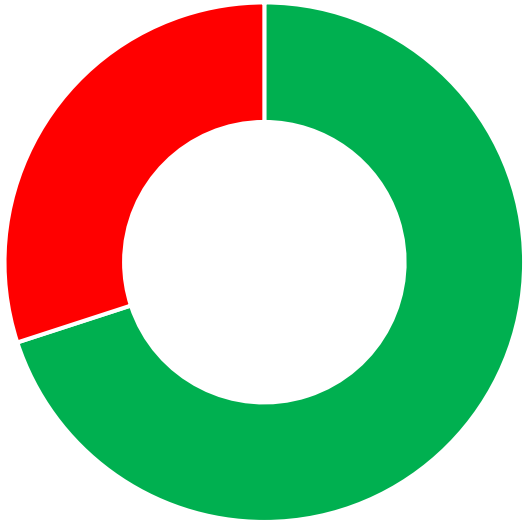


Failing infrastructure





Kebede and Teferi 2020 in Global Groundwater



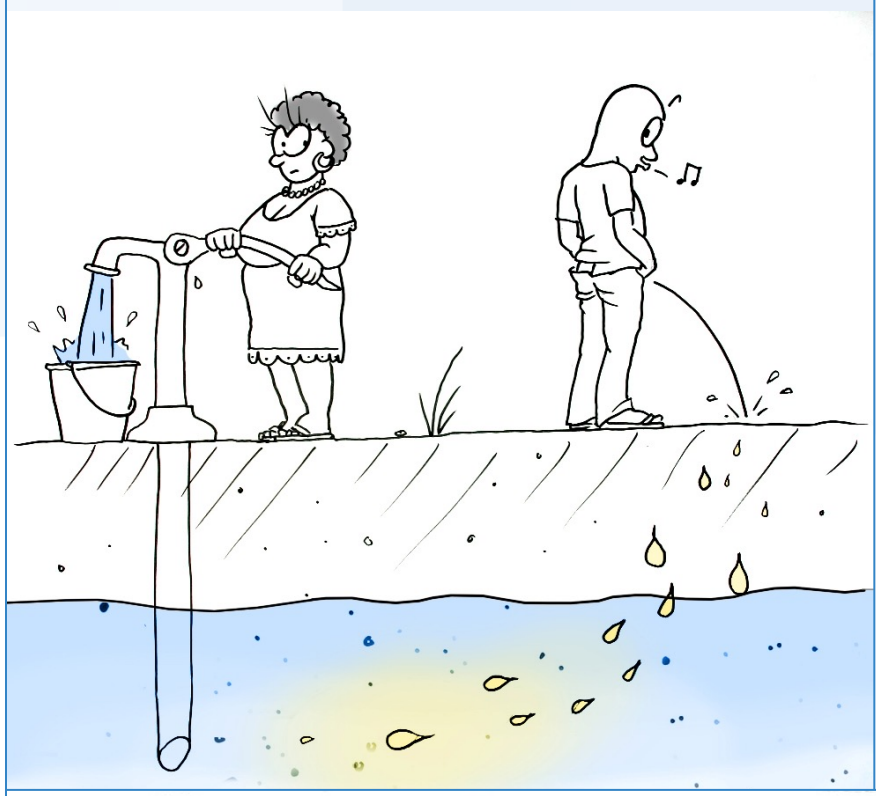
Drilling success rate in easy hydrogeology environments

Drilling success rate in difficult hydrogeology environments

Geophysics matters!

Some Ethiopian facts

- < 50% of boreholes functioning reliably
- 25% contaminated with pathogens *(MacDonald et al., 2019)*.
- > 40% of boreholes in the Ethiopia Rift valley Fluoride concentrations > WHO standard *(Tekle-Haimanot et al., 2006)*.
- 20% of water wells > WHO standard for bacteriological quality *(Lapworth et al., 2020)*

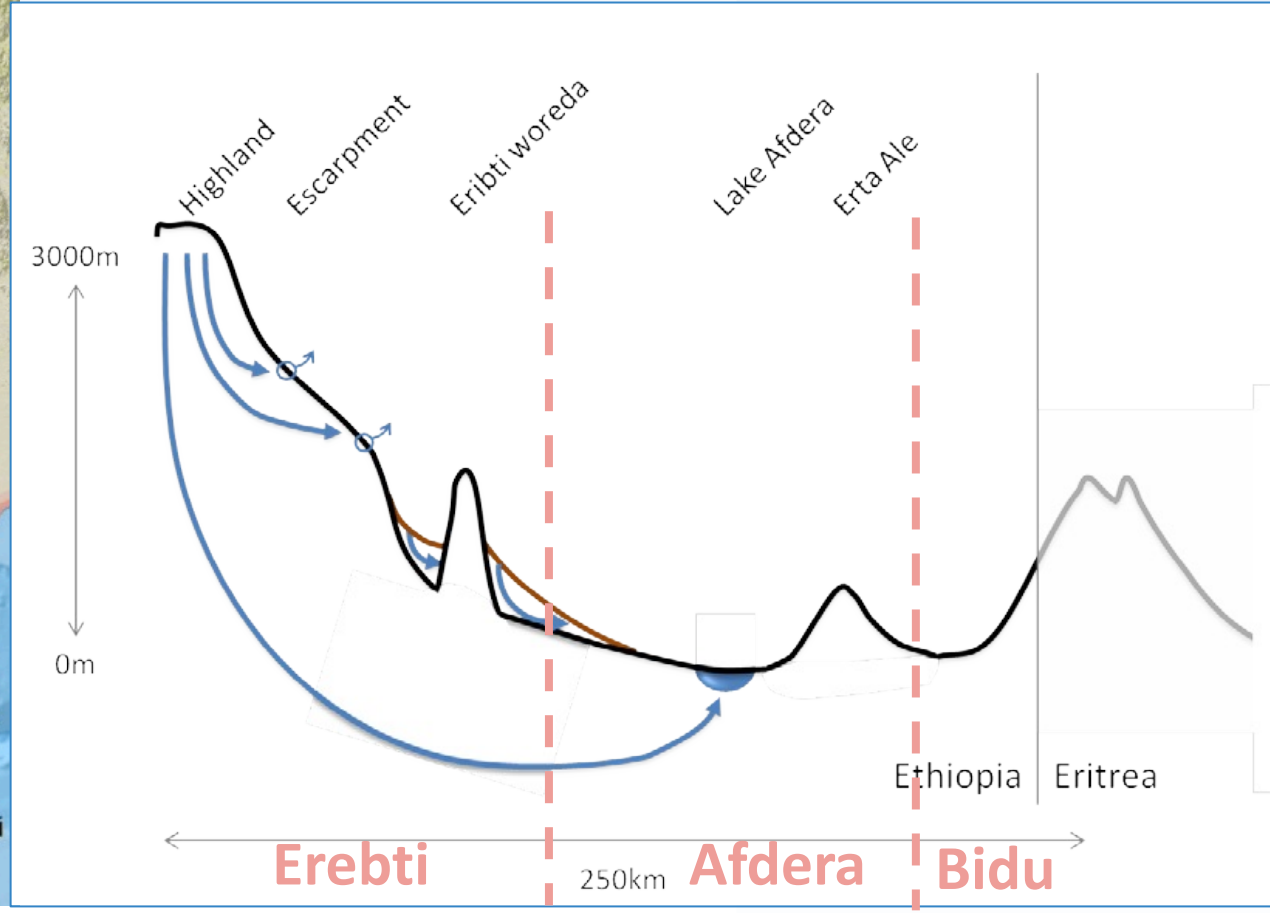


Field observations

- Water bureau not always overseeing
- Poor contracts with contractors
- Very poor supervision
- Lack of capacity with IP
- Over dimensioning
- Poorly executed pumping tests
- Financial incentive

Why

- **Disconnect** between research community and practitioners ➔many issues are not **rocket science** but are not tackled
- WASH sector focusses on short term **outputs** ➔ Water resources assessments seen as **afterthought** ➔ impacts sustainability
- IWRM as **guiding principle** often not applied; ➔upstream vs downstream impacts not considered
- **Limited** capacity government and implementing partners ➔ **poor** contracts ➔ impacts sustainability and yield
- Physical vs administrative boundaries ➔ impacts **effective and sustainable** management plans



- Deep groundwater system vs shallow groundwater system
- Groundwater management should include both
- Scale of management should be at deep groundwater scale

priorities

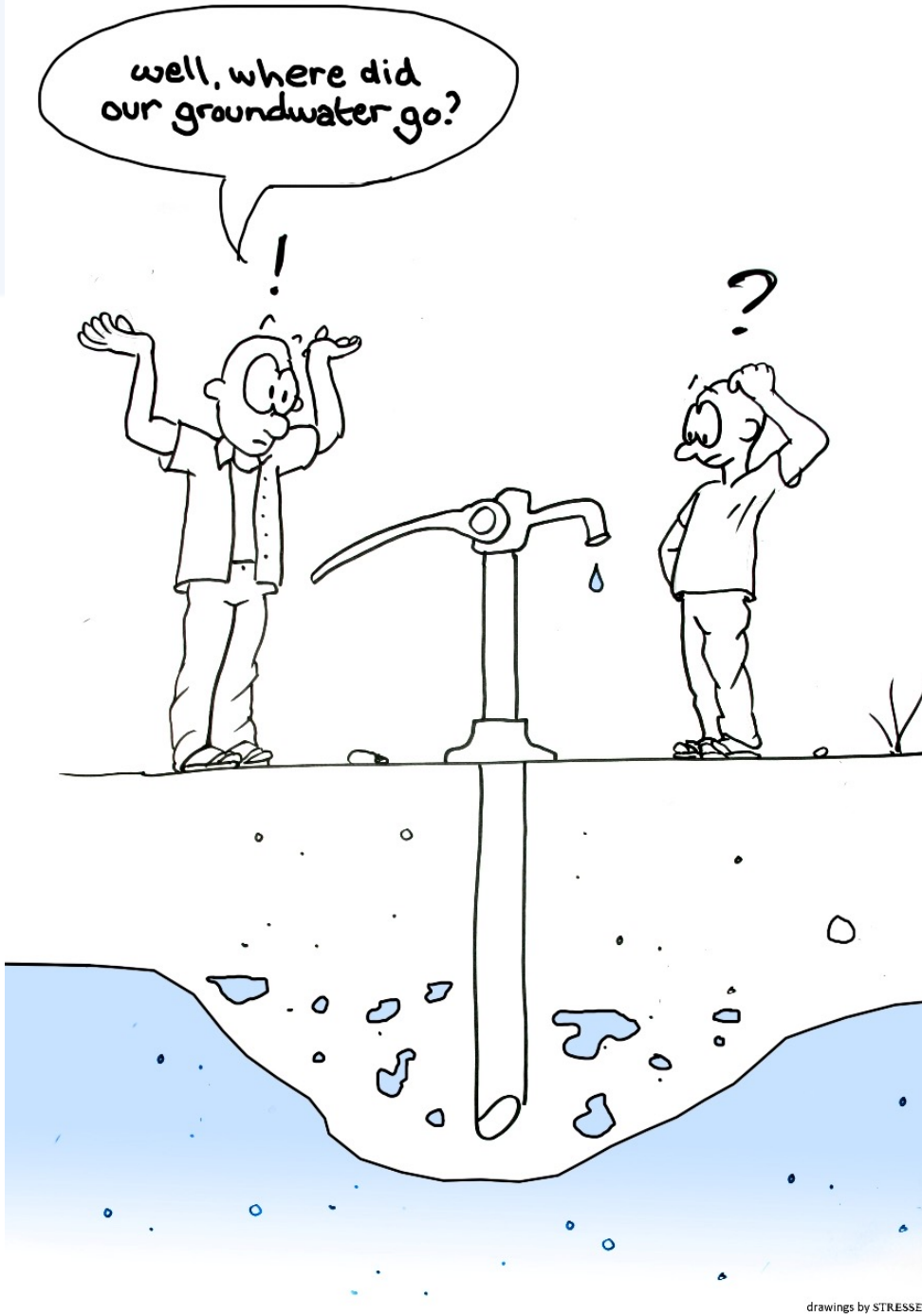
- Protecting and monitoring strategic aquifers
- Skilled Hydrogeological potential Mapping
- Explore local possibilities for site specific design
- Monitoring and asset management of successful boreholes
- Guidelines and protocols for GW development
- Groundwater database
- Capacity building of governmental agencies

➔ **Risk mitigation strategy**

Risk Mitigation Strategy

focus on the steps and processes required to evaluate and mitigate risks to borehole functionality

- **Step 1** develop a ranking matrix and an analysis/probability of current risk levels for each woreda.
- **Step 2** development of risk mitigation strategies for various levels/probabilities of risk that relate to:
    1. resource potential;
    2. water quality;
    3. borehole or source functionality.



Thanks for your attention

March 21th 2022

van Hogendorpplein 4, 2805 BM Gouda, the Netherlands

telephone: +31 (0)182 - 686 424

info@acaciawater.com | www.acaciawater.com