WATER CONVENTION

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on Droughts in Transboundary Basins
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Challenges related to droughts and aquifers and way forward

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BACKGROUND

- The SADC region is prone to recurring droughts
- The region has undergone severe droughts during the 2015/2016 and 2016/2017 summer rainfall seasons
- In the past, droughts were driven by natural climate variability, but with anthropogenic influences, the characteristics of droughts are changing to include a type of drought that has a rapid onset and short duration
- The droughts in SADC cause problems such as crop failure, food shortages, famine and epidemics
- When groundwater systems are affected by drought, first groundwater recharge and later groundwater levels and groundwater discharge decrease
- Such droughts are called groundwater droughts and generally occur on a time scale of months to years

SADC Member States. Source: SADC, 2019

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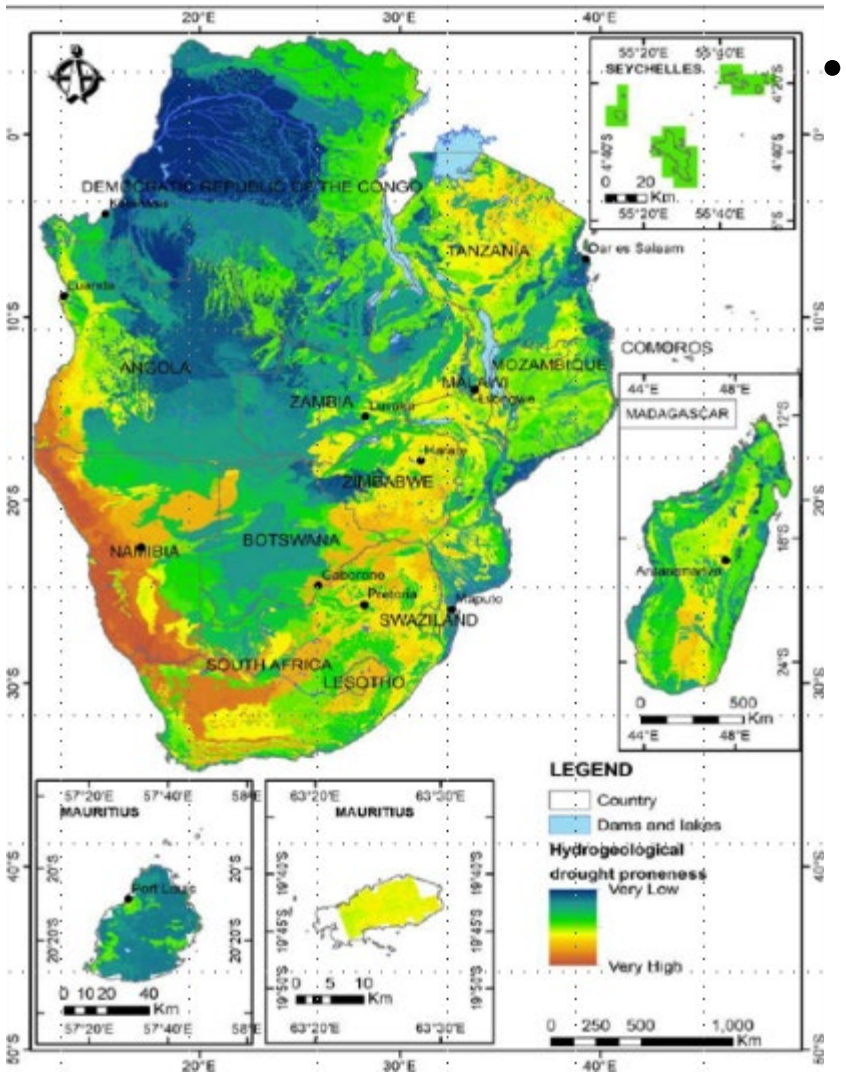
DROUGHT IMPACTS ON GROUNDWATER

- Inadequate monitoring systems for modelling and validation make it difficult to attribute the following observed changes to climatic changes:
  - groundwater level,
  - storage,
  - discharge, and
  - quality



- Projected impacts of drought on groundwater
  - Groundwater recharge changes
  - Groundwater quantity changes (storage changes)
  - Changes in discharge and groundwater-surface water interaction patterns
  - Groundwater quality degradation
  - Groundwater-dependent ecosystems (GDEs) changes

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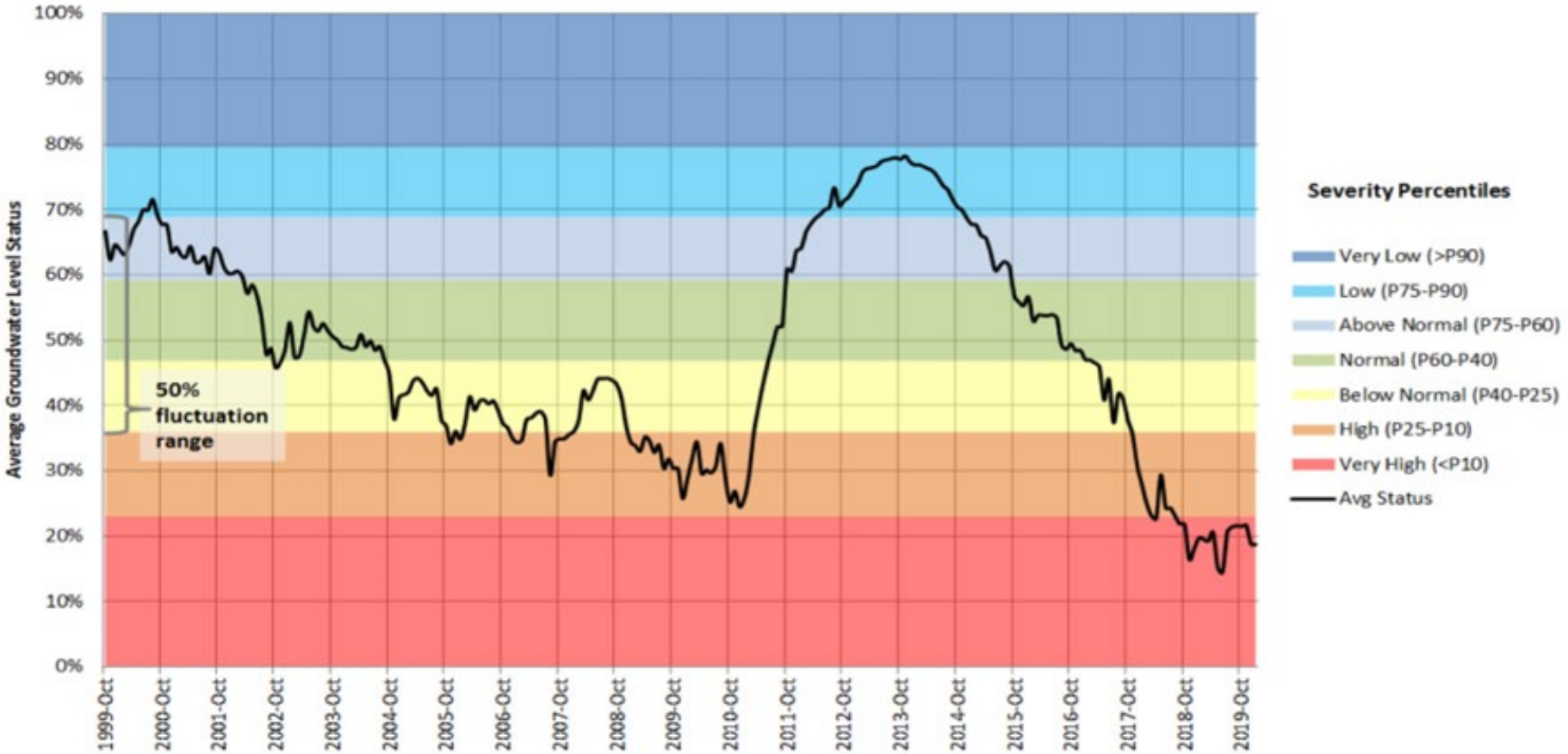
EXAMPLE OF GROUNDWATER LEVEL DECLINE



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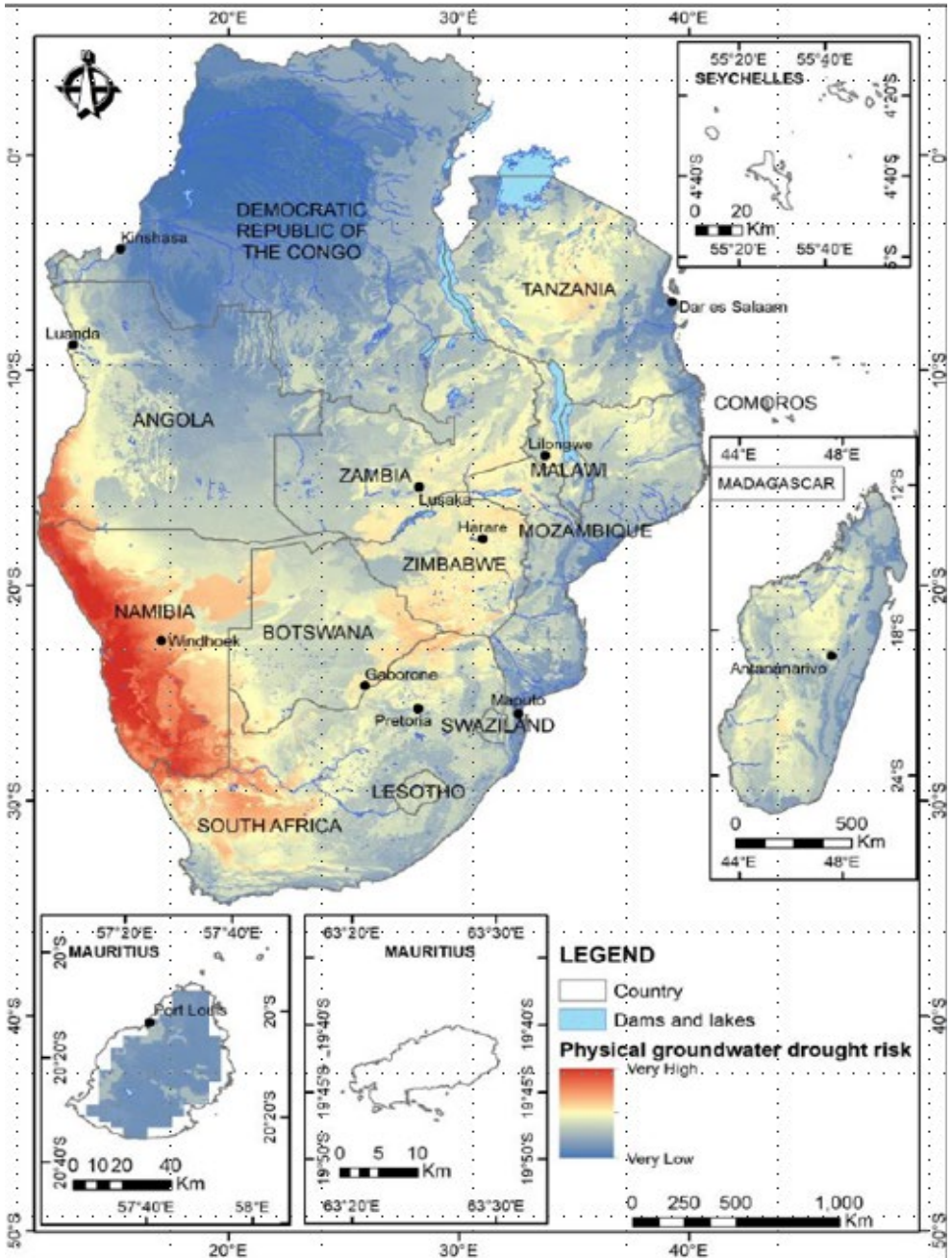
GROUNDWATER QUALITY CHANGES

- The effects of drought on groundwater quality require careful monitoring of not only general chemistry but also pollutants of emerging concern
- Sea-water intrusion of coastal aquifers triggered by increased pumping driven by drought
- Mobilisation of naturally occurring salts in the soil negatively affecting groundwater quality

GROUNDWATER DROUGHT RISK MAPPING AND MANAGEMENT SYSTEM (GRIMMS)

- In 2011, the first SADC groundwater drought risk (GDR) map was developed using the GRiMMS algorithm (Villholth et al., 2013)
- The approach employed a composite mapping analysis technique to overlay and mathematically combine several vital characteristics in groundwater drought risk assessment
- However, this did not include an assessment of the variations in groundwater volumes
- SADC-GMI updated and enhanced the SADC GDR map through the use of new, improved datasets, as well as a component that focuses on capturing groundwater storage drought



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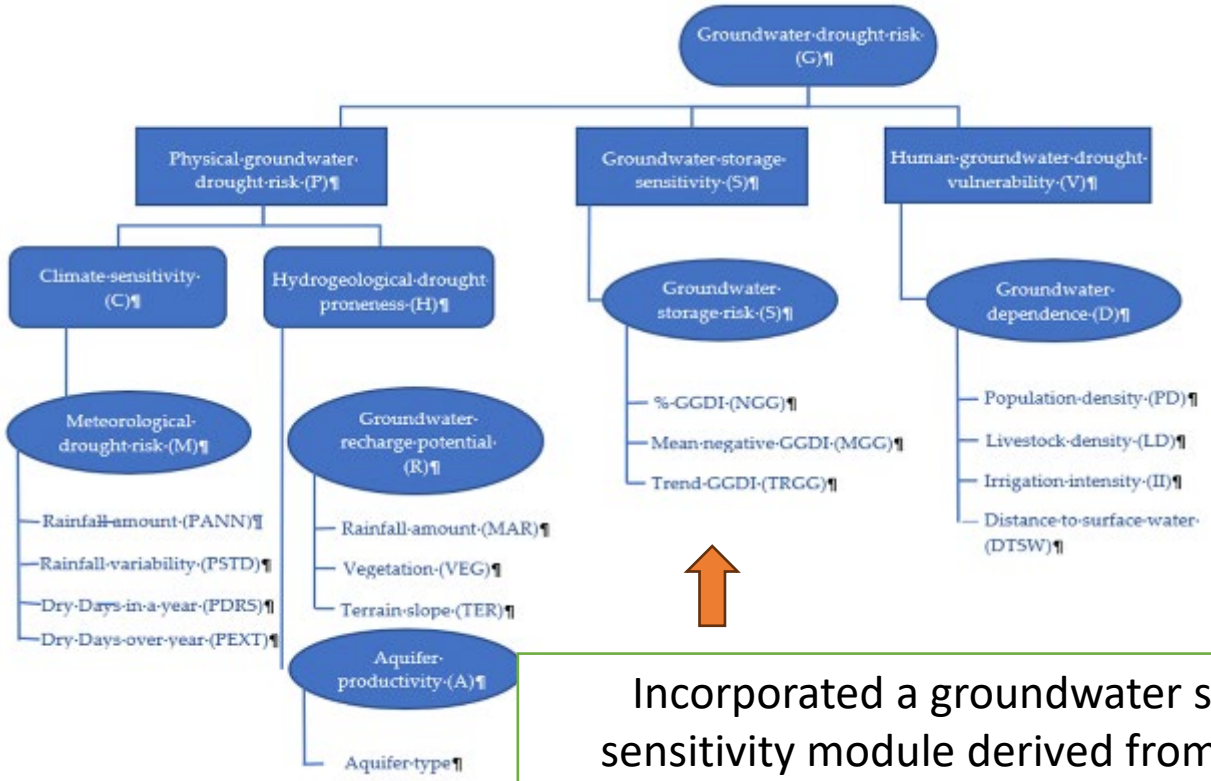
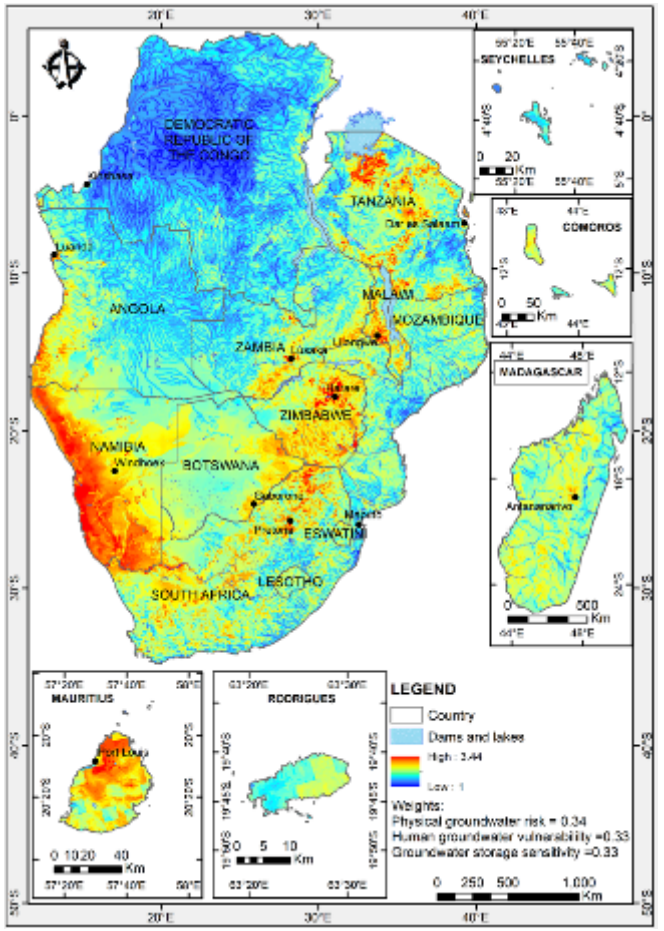
THE UPDATED GRIMMS ALGORITHM



Incorporated a groundwater storage sensitivity module derived from Gravity Recovery and Climate Experiment (GRACE) satellite datasets.

Revised GDR map



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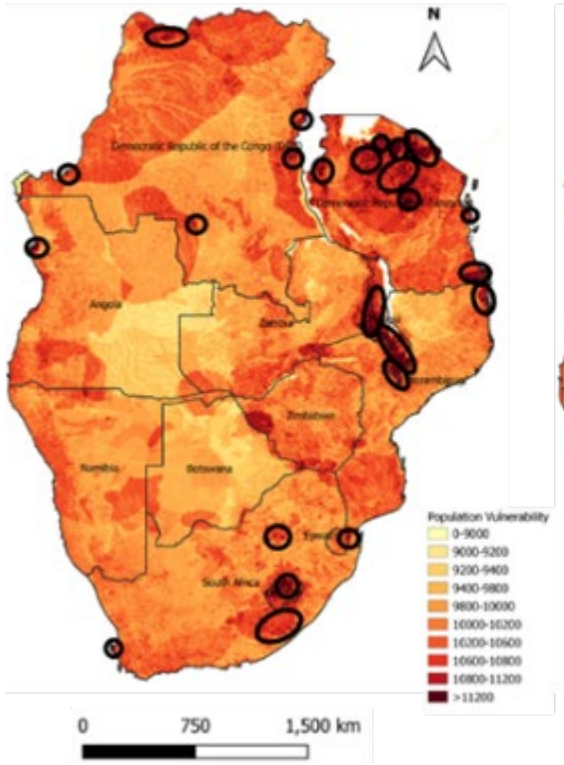
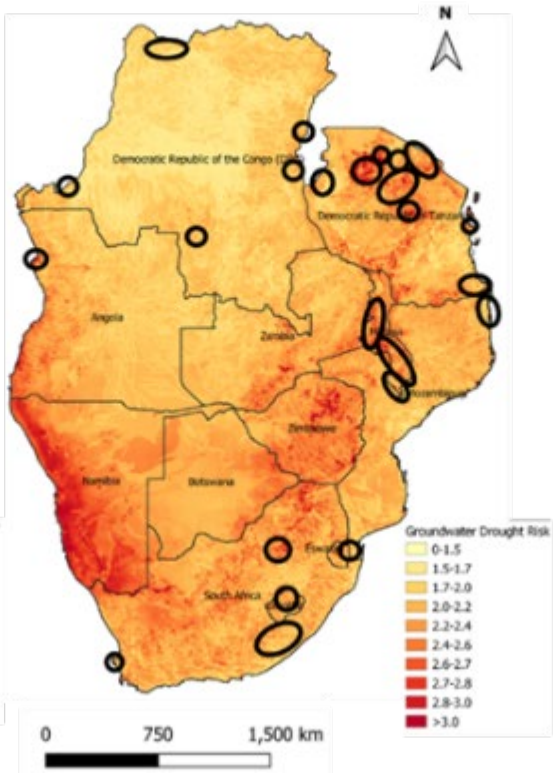
STEP FURTHER - ASSESSMENT OF REGIONAL WATER SUPPLY HOTSPOTS AND INTERVENTIONS

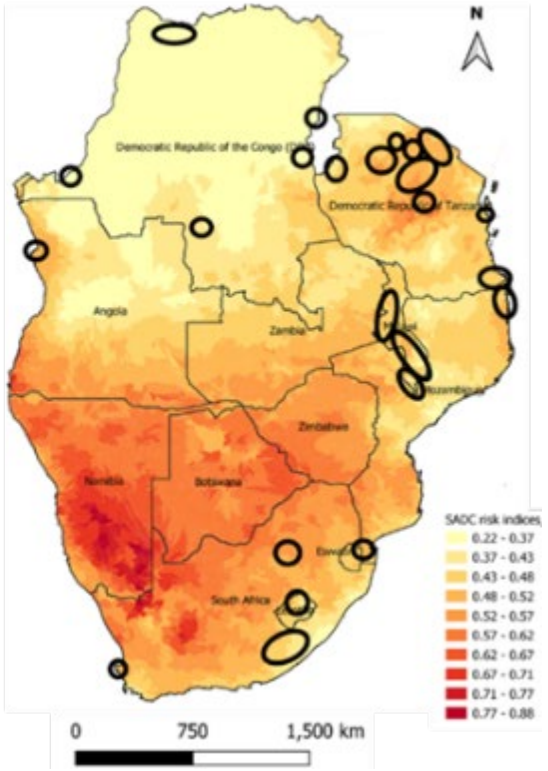
Population Vulnerability Map



Groundwater Drought Risk Map



Surface Water Risk Map



- Combined population vulnerability, GDR and surface water risk
- The result of the final calibrated overlay indicated hotspot areas for further investigation
- Identified water infrastructure supply interventions in hotspot areas

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CHALLENGES RELATED TO DROUGHTS AND TRANSBOUNDARY AQUIFERS

- Lack of established transboundary collaboration and cooperation mechanisms and plans to govern, monitor and manage the sustainable utilisation of TBAs in a coordinated manner

- Limited technical knowledge and understanding of the baseline status of transboundary groundwater resources and future climate scenarios to inform policy development and investment decision-making at the national and regional levels

- National institutions with mandates to manage groundwater have limited financial, technical and human resource capacity

- Currently, groundwater monitoring in the region is variable, with some countries monitoring boreholes while others lack monitoring altogether:
  - This creates unbalanced monitoring data for a transboundary aquifer, where two or three countries may be extracting groundwater from the same source, which is detrimental to decision-making for sustainable groundwater management and use, particularly for climate change adaptation

- Limited understanding of the impacts of groundwater over-abstraction and catchment degradation on the diversification and improvement of community livelihoods in the face of the changing climate:
  - This, in turn, limits access to climate-resilient measures and infrastructure for the sustainable use of groundwater resources by farmers and agribusinesses to adapt to a changing climate

CONCLUSION

- The need for continuous groundwater monitoring systems in light of climate change and anticipated droughts is critical
- The hypothesis that groundwater can become a buffer during drought requires rigorous testing under local hydrogeological conditions
- This is particularly true considering the expected extended drought periods that may result in an overall reduction in groundwater storage
- Monitoring also becomes critical due to the anticipated groundwater vulnerability and drought risk

Thank you

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