

4th SADC GROUNDWATER CONFERENCE

10th -12th of November 2021
VIRTUAL CONFERENCE



Groundwater assessment in the transboundary Tuli Karoo Basin

Tinonetsana, P ., Gumindoga, W., Owen, R. & Rwasoka, D



International Association
of Hydrogeologists
the World-wide Groundwater Organisation



GRIPP
GROUNDWATER SOLUTIONS
INITIATIVE FOR
POLICY AND PRACTICE



British
Geological
Survey



Introduction



- ❑ Groundwater is the biggest and most widely distributed store of liquid fresh water available for human use.
- ❑ Quantitative estimates of amount and quality of ground water resources are required in the transboundary Tuli Karoo basin.
- ❑ Little or no reliable and current quantitative information on groundwater resources
- ❑ Relevant in water development policy, water-related development aid, community planning and technical decision making

Objectives

Main objective:

To map groundwater potential zones and model groundwater recharge as well as groundwater flow in Tuli Karoo basin.

Objective 1

To map the spatial variability of groundwater potential in the Tuli Karoo basin.

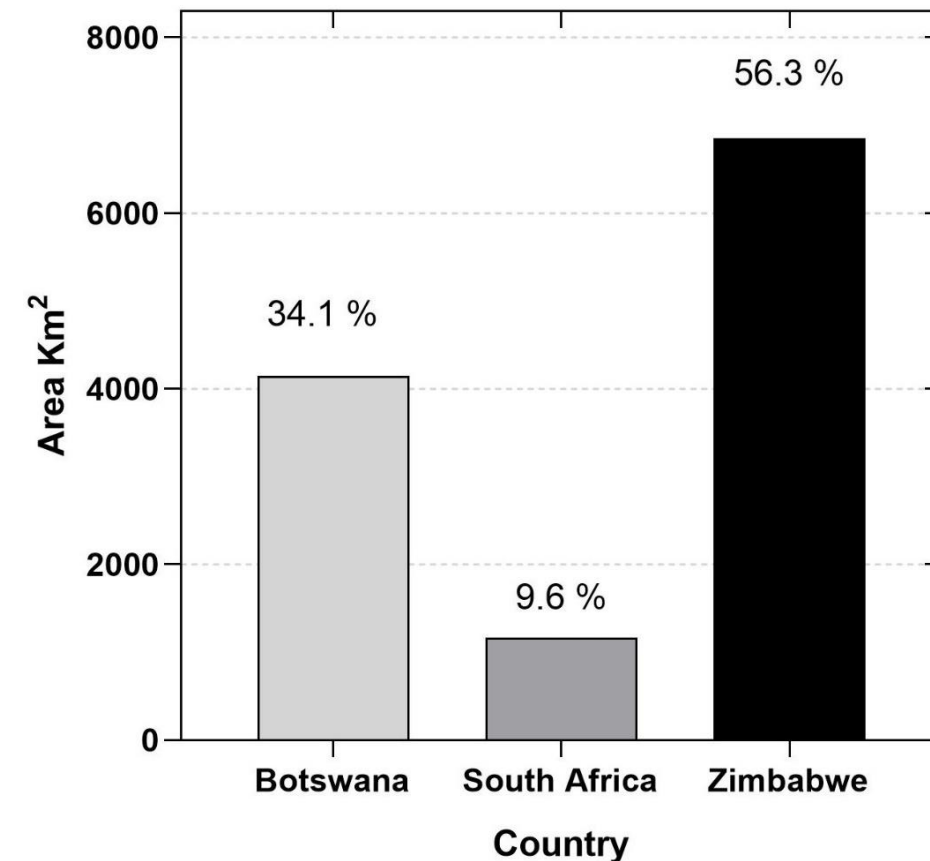
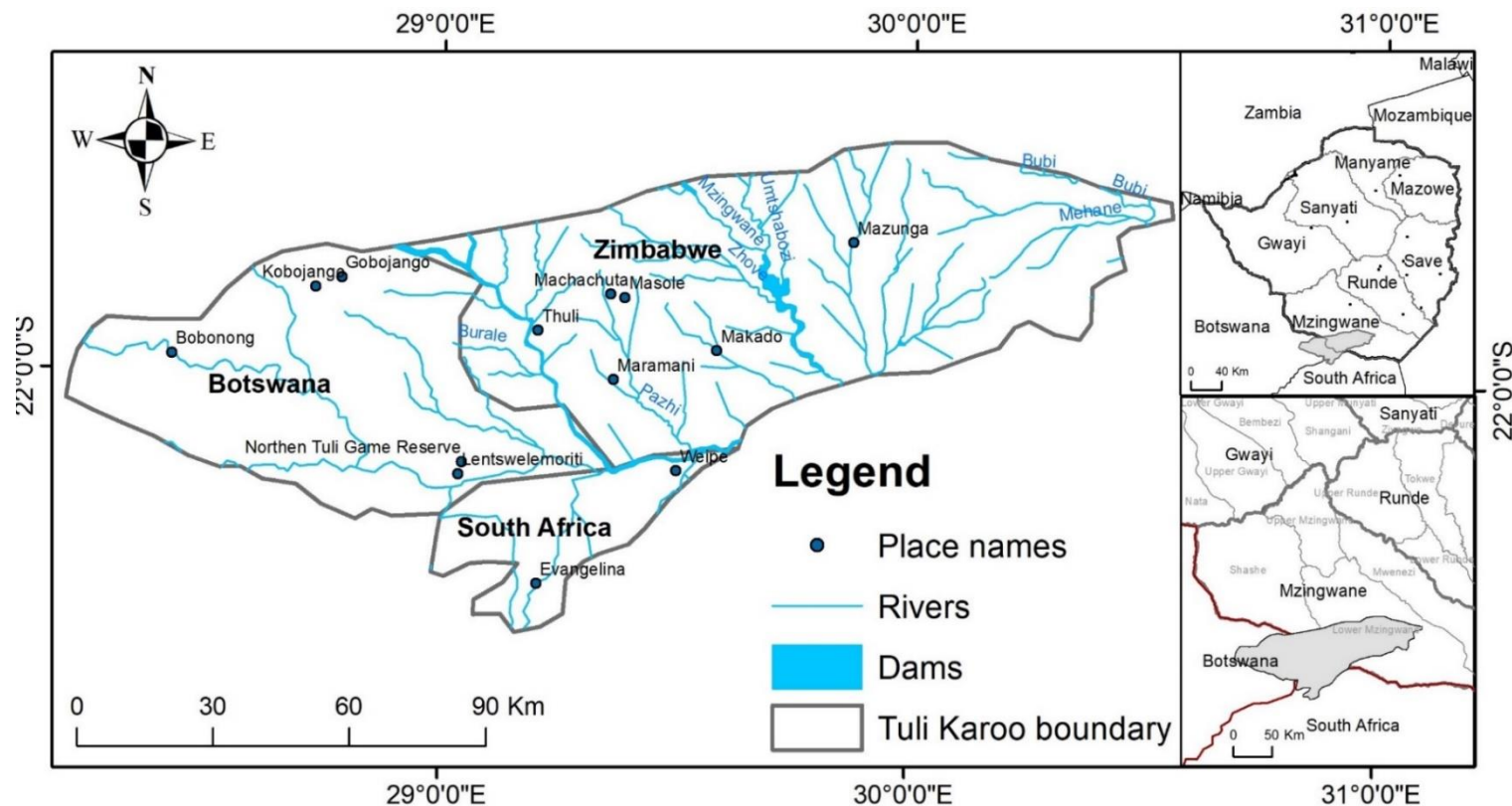
Objective 2

To determine the spatial and temporal distribution of recharge in the Tuli Karoo basin.

Objective 3

To determine the groundwater flow of Tuli Karoo Basin.

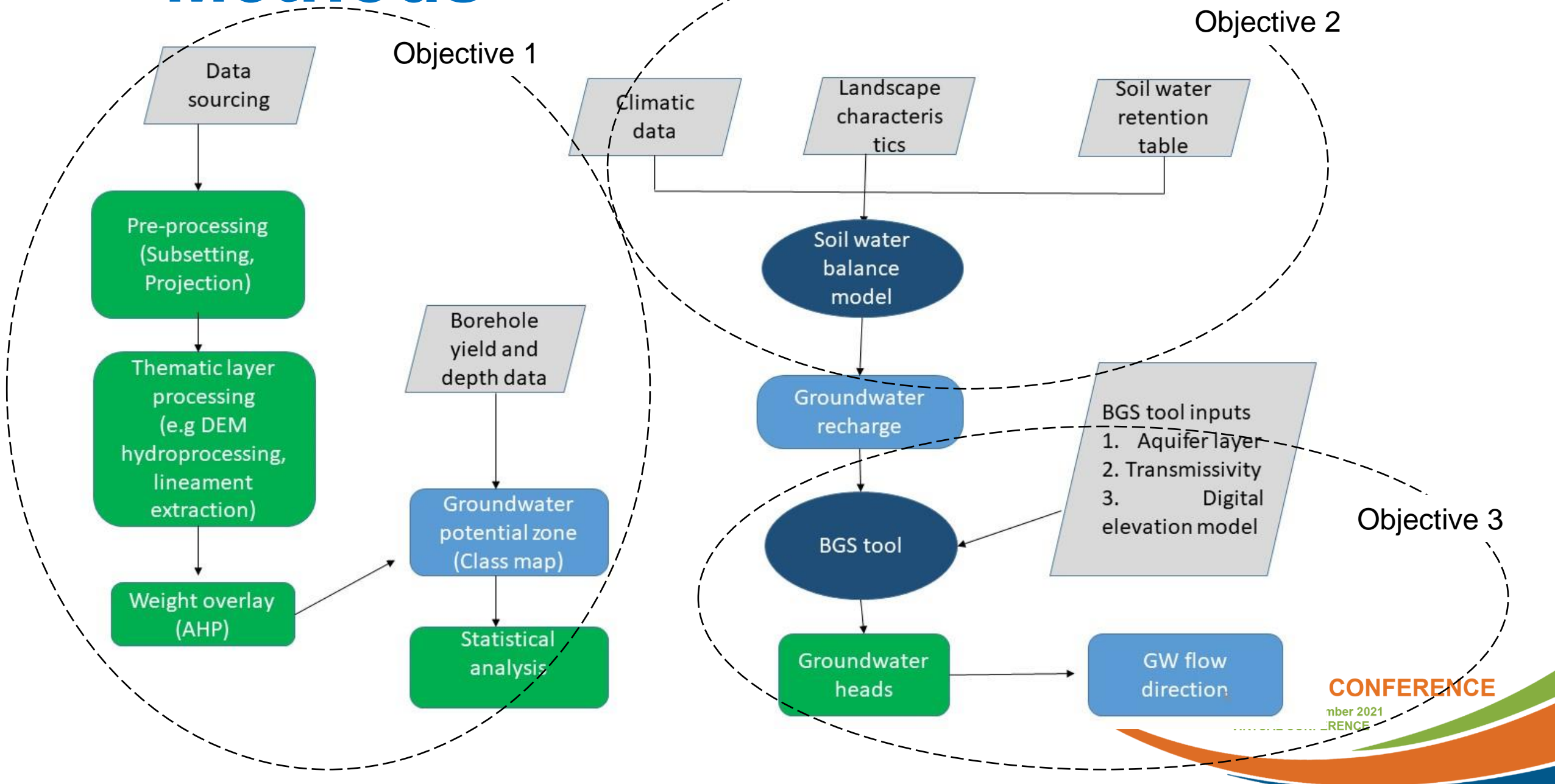
Study area



- ❑ Total area is about **12166 km²**
- ❑ Characterized by shallow water table aquifer systems (Gomo and Vermeulen, 2017)

Materials and methods

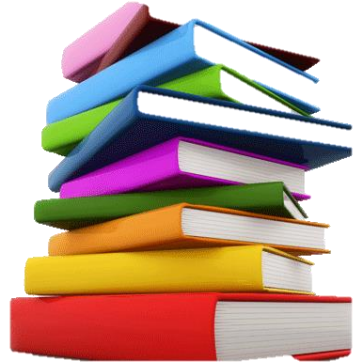
Methods



Data sources



- ☐ STRM Digital elevation model – USGS earth explorer
- ☐ Landsat 8 – USGS earth explorer
- ☐ Precipitation - CHIRPS
- ☐ Processed landcover image - ESA



- ☐ Tuli Karoo boundary
- ☐ Transmissivity

Institutions

- ☐ Borehole locations – ZINWA
- ☐ Borehole yields - ZINWA

Portals

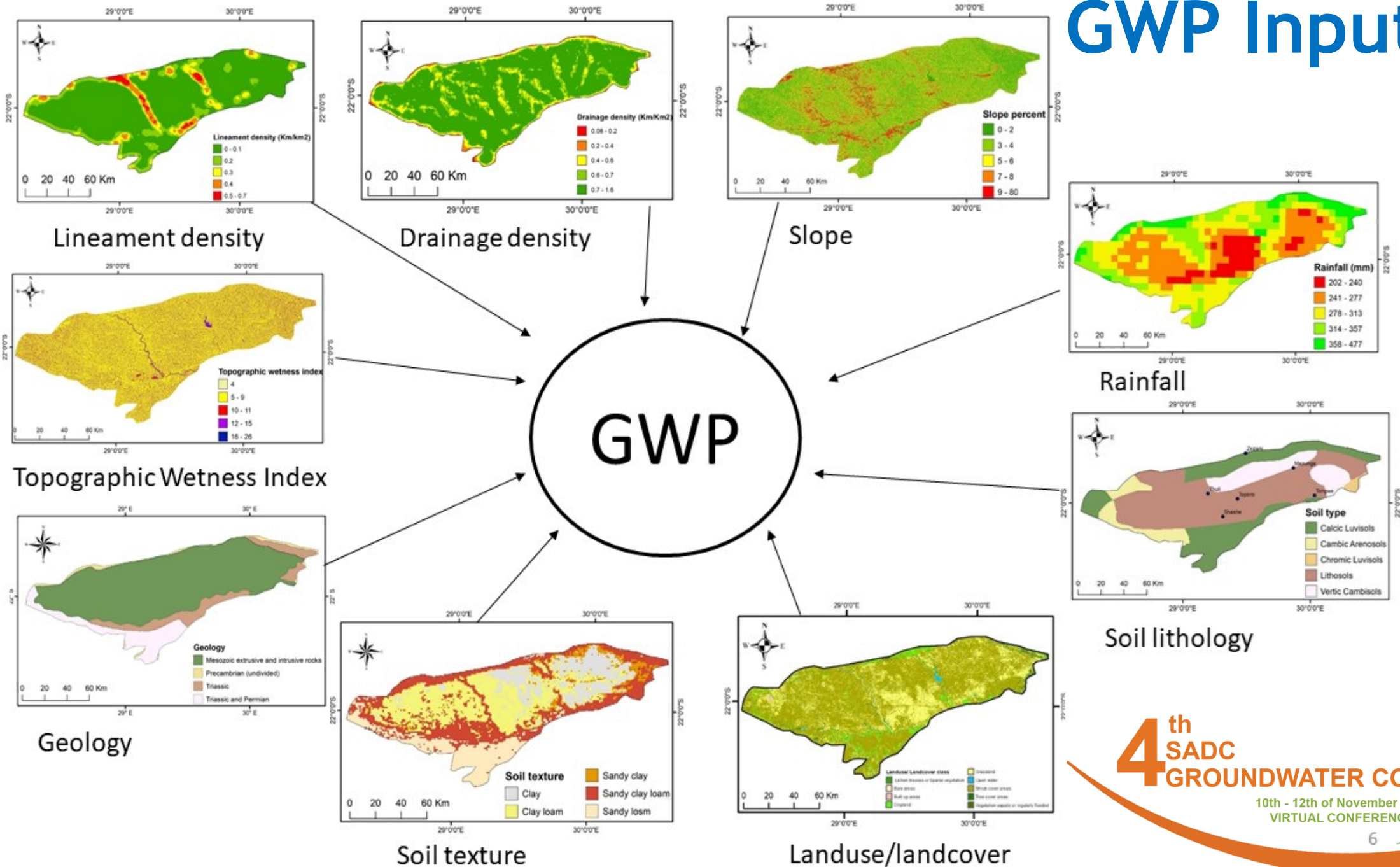
- ☐ Soils – ISRIC
- ☐ Geology – World Geologic Maps
- ☐ Borehole yields and depth – SADC-GIP



- ☐ Ground truthing points

Results and discussion

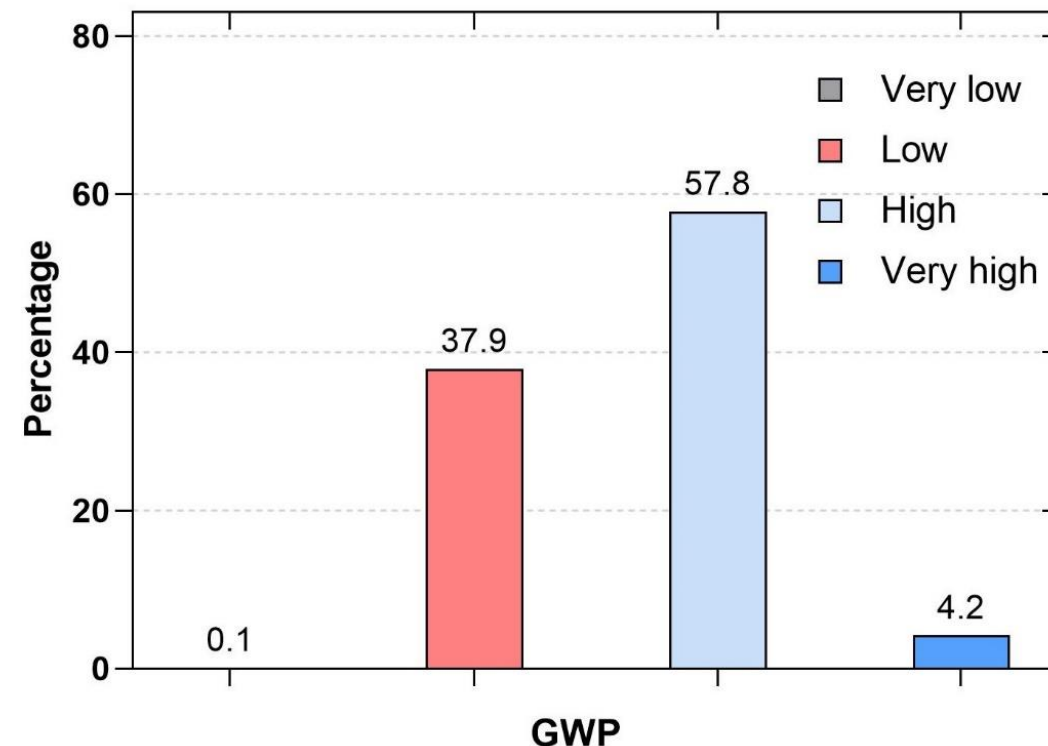
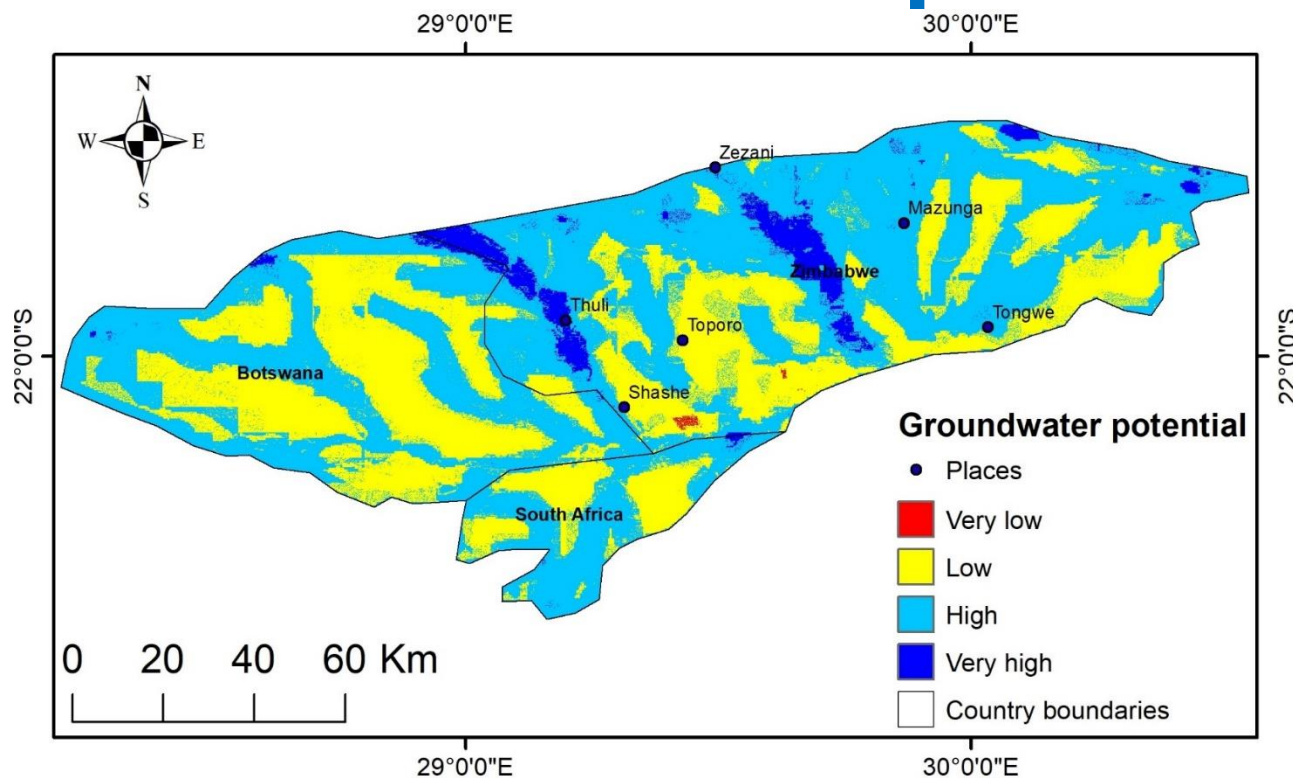
GWP Inputs



**4th SADC
GROUNDWATER CONFERENCE**

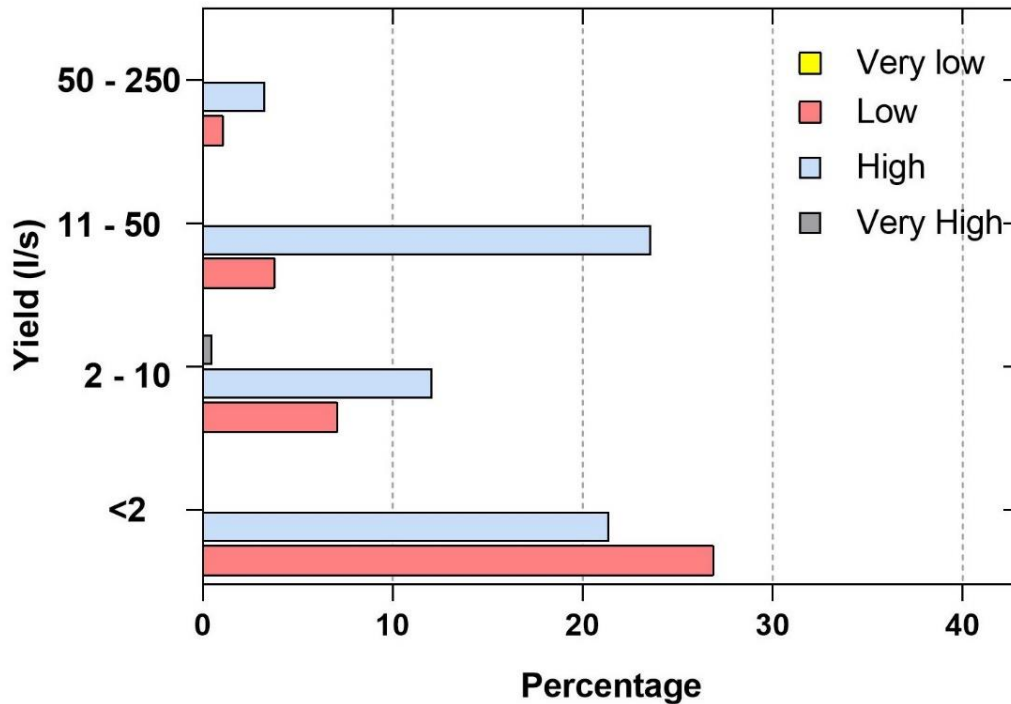
10th - 12th of November 2021
VIRTUAL CONFERENCE

Groundwater potential zones

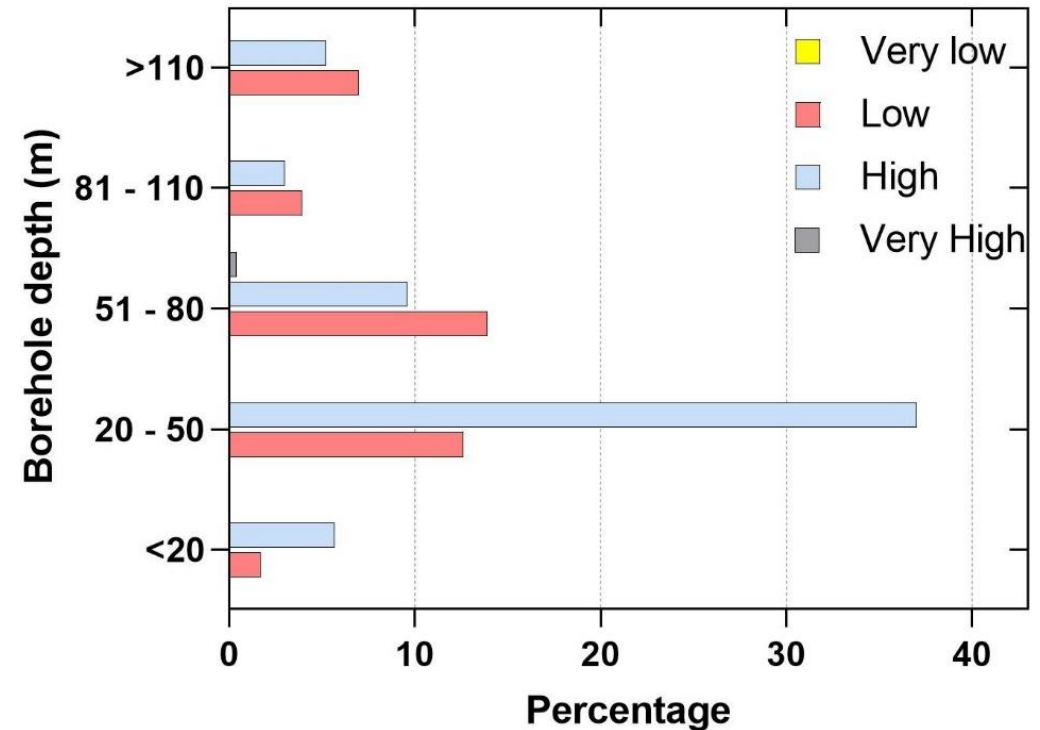


- High groundwater potential is found in areas like Tongwe and Mazunga.
- Some places like Thuli and some parts of Shashe have very high groundwater potential

Validation of GWP map



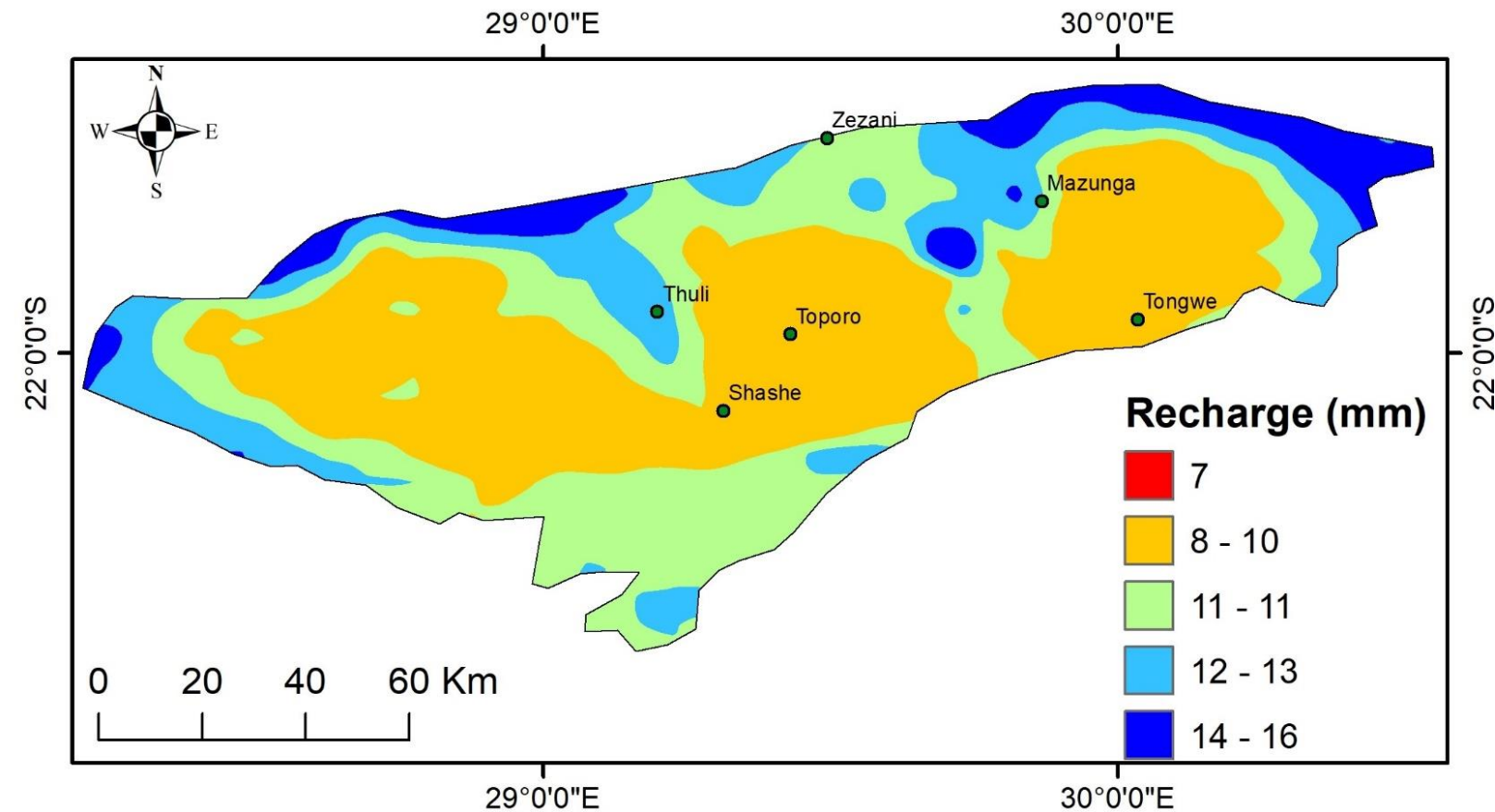
- Percentage for low groundwater potential class decreases as the borehole yield increases



- Statistical test was highly significant (P value <0.0001)
- Map looks to be a reasonable reflection of the situation

1
2

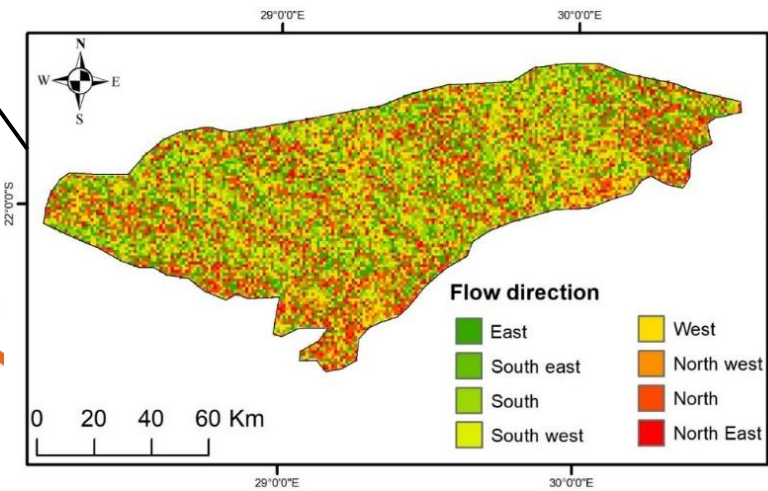
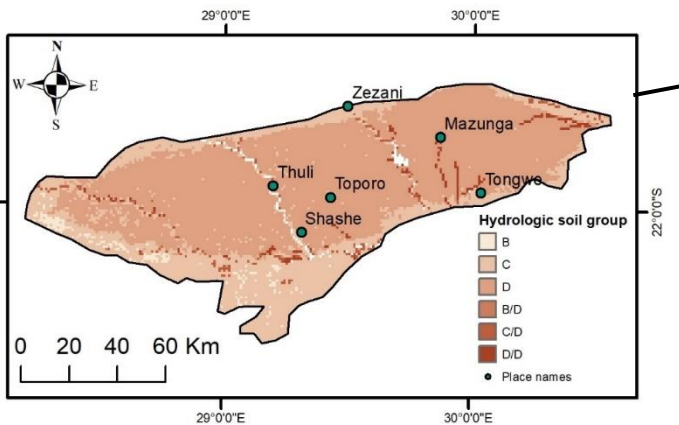
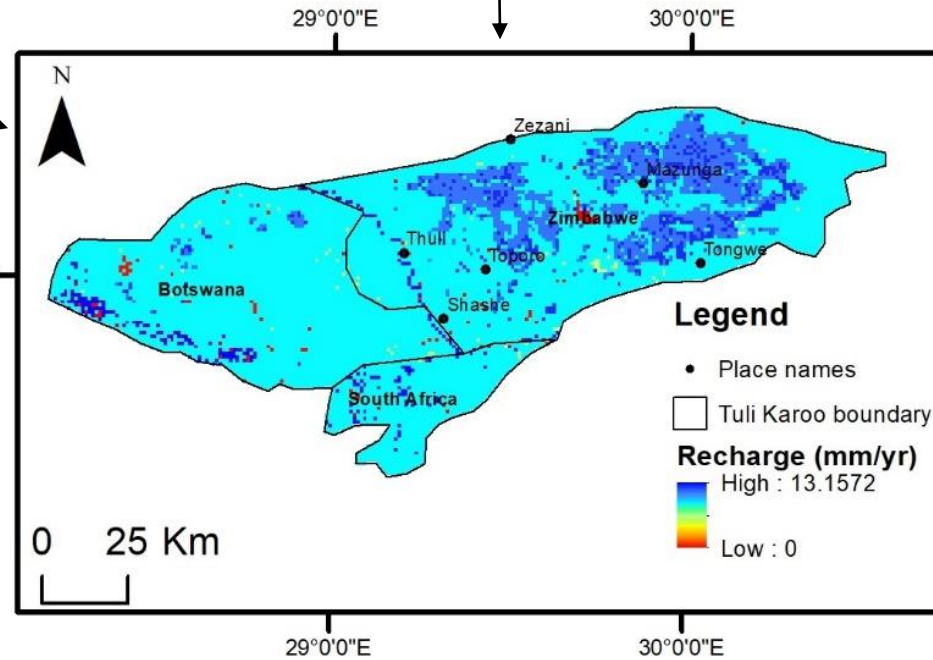
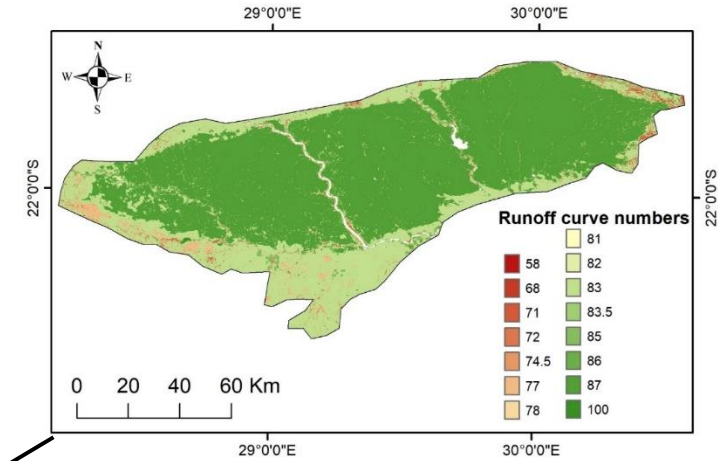
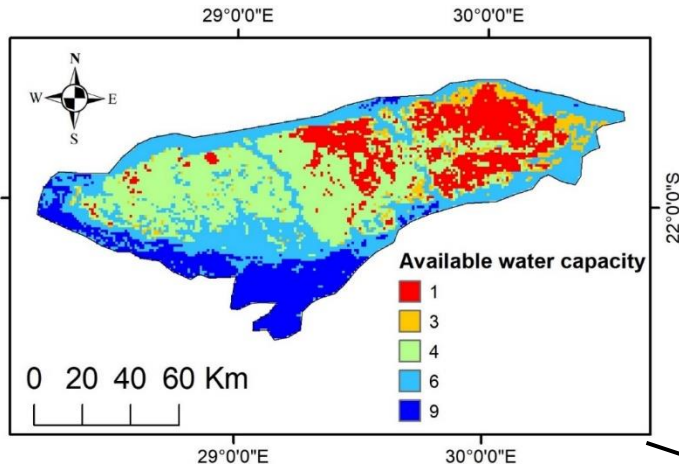
Groundwater recharge using rainfall analysis



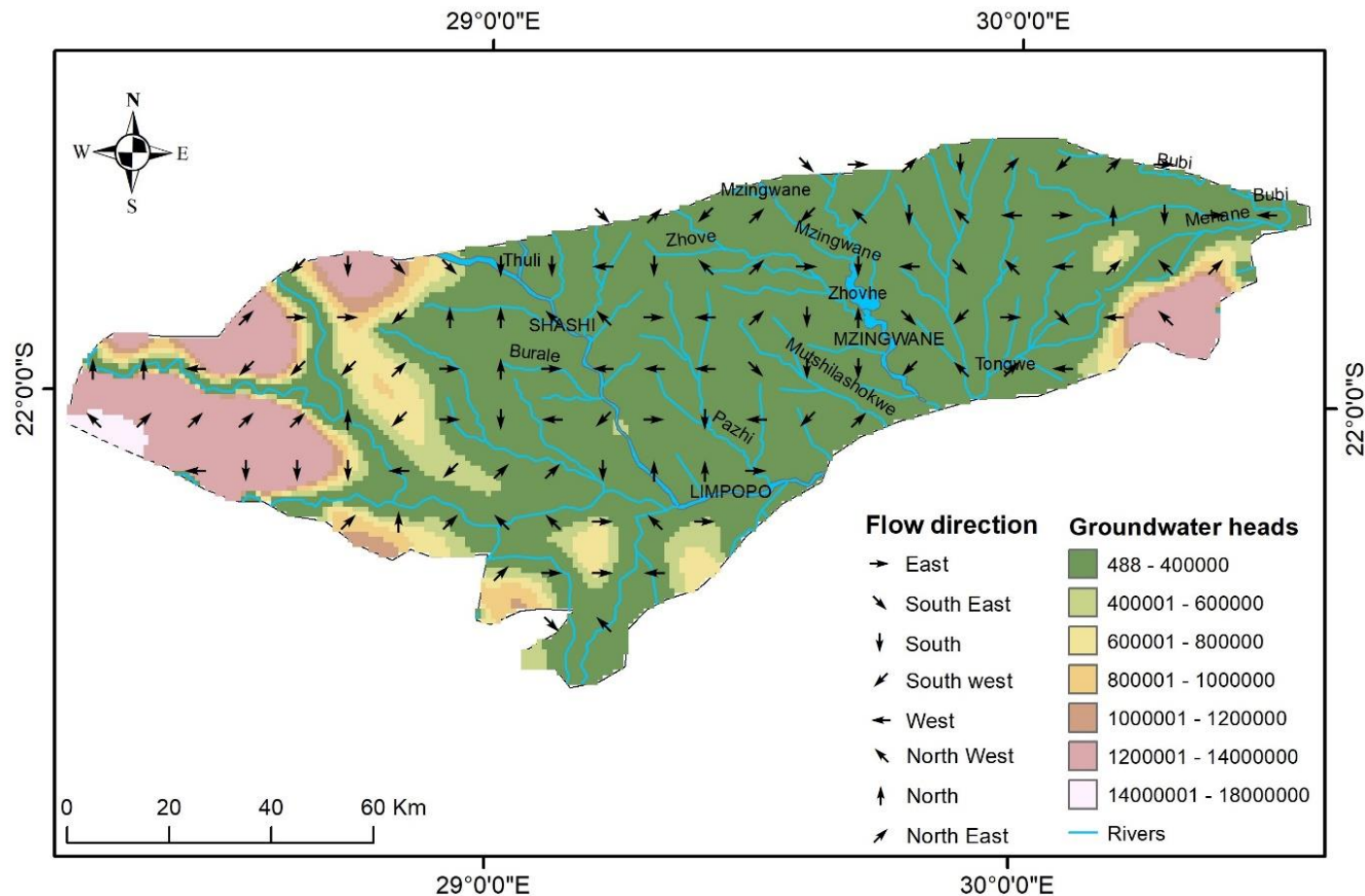
- Groundwater recharge calculated as 3.5% of annual rainfall
- Groundwater recharge is high in the North eastern parts of the basin and low in areas like Shashe.

Estimating recharge using SWB

1. Climatic data
2. Landuse Look-Up table
3. Soil Water retention table



Groundwater flow using BGS



- ❑ Groundwater flows towards rivers
- ❑ In some parts of the basin, groundwater flows from **North West** towards **south east** where there is Limpopo River

Conclusions

1. Tuli Karoo basin has **high** groundwater potential indicated by the dominance of high groundwater potential classes which covers **57.8 %**
2. Tuli Karoo basin has **low** groundwater recharge with a maximum of **13.21** mm per 10 year average.
3. The general groundwater flow in the Tuli Karoo basin is South east

Recommendations

1. Reliable hydrogeological data should be provided to promote better understanding of groundwater as a resource.
2. Further studies should be done in the basin using other groundwater recharge and flow estimation techniques that uses field based data
3. Use of numerical models such as MODFLOW to determine groundwater flow.



Thank you

4th
SADC
GROUNDWATER CONFERENCE

10th - 12th of November 2021
VIRTUAL CONFERENCE