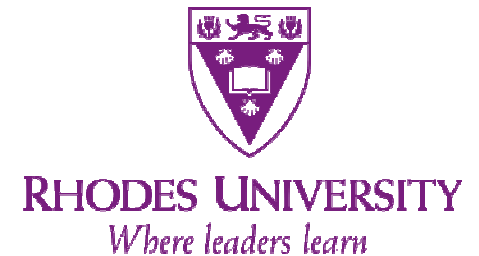


# Gully erosion susceptibility modelling for avoided degradation planning



***Jay le Roux & Bennie van der Waal***



An aerial photograph of a desert landscape. A winding river flows through the center of the image, surrounded by arid, brownish terrain. A winding road is visible on the right side of the image. The overall scene is a vast, open landscape with some small structures and vegetation scattered throughout.

# Layout

**1. Introduction**

**2. Methodology**

**3. Results and discussion**

**4. Conclusion**

# Introduction: Tsitsa River Catchment

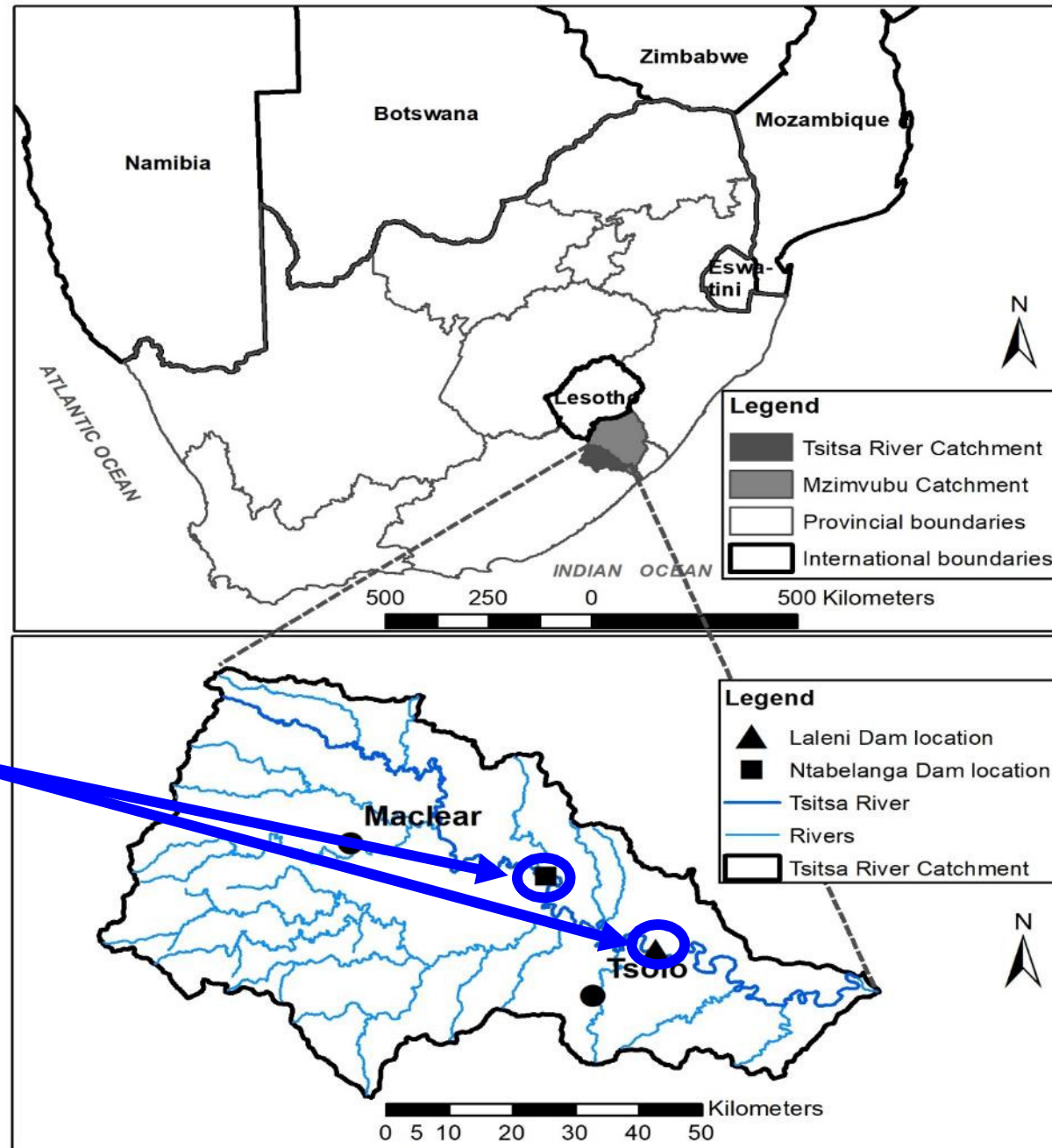
- Water resource development is planned on the Tsitsa River in South Africa (SA)
  - Project include building of:
    - irrigation dam (storage capacity of 490 million m<sup>3</sup>)
    - hydropower dam (storage capacity of 232 million m<sup>3</sup>)
  - **Only large river network in SA without a dam**
  - Opportunity to accelerate social and economic upliftment within the catchment, one of the poorest and least developed regions of SA



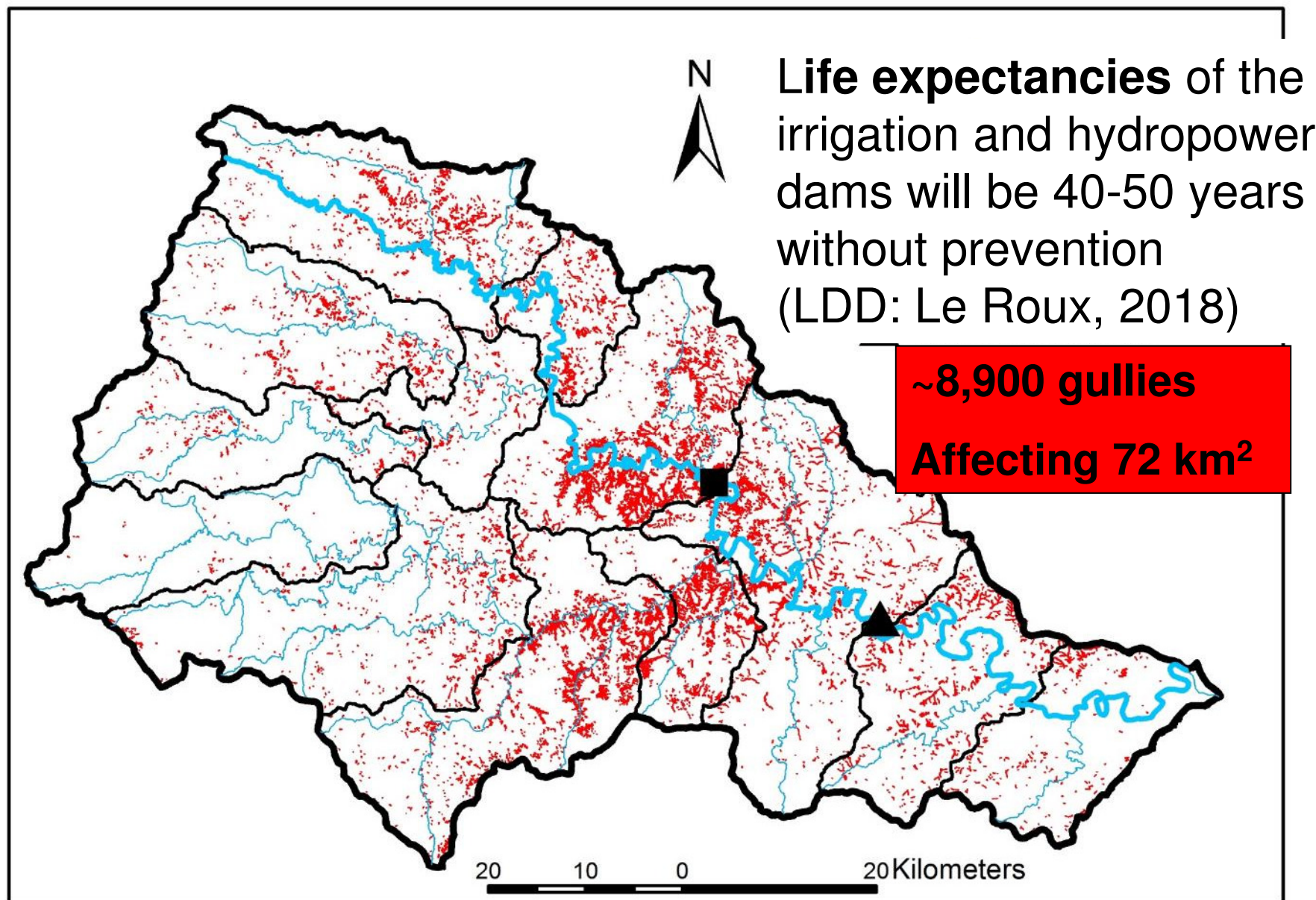


# Introduction: Tsitsa River Catchment

Dam locations



# Introduction: Tsitsa River Catchment





# Introduction: Tsitsa River Catchment



Badlands like these are irreparable



# Introduction: Tsitsa River Catchment



Check Youtube video:  
Tsolo gully exploration

Gully networks  
can be more than  
10 m deep, over  
100 m wide and  
several km long

Arguably largest gully  
in the world a.k.a.  
**“The Mother”**

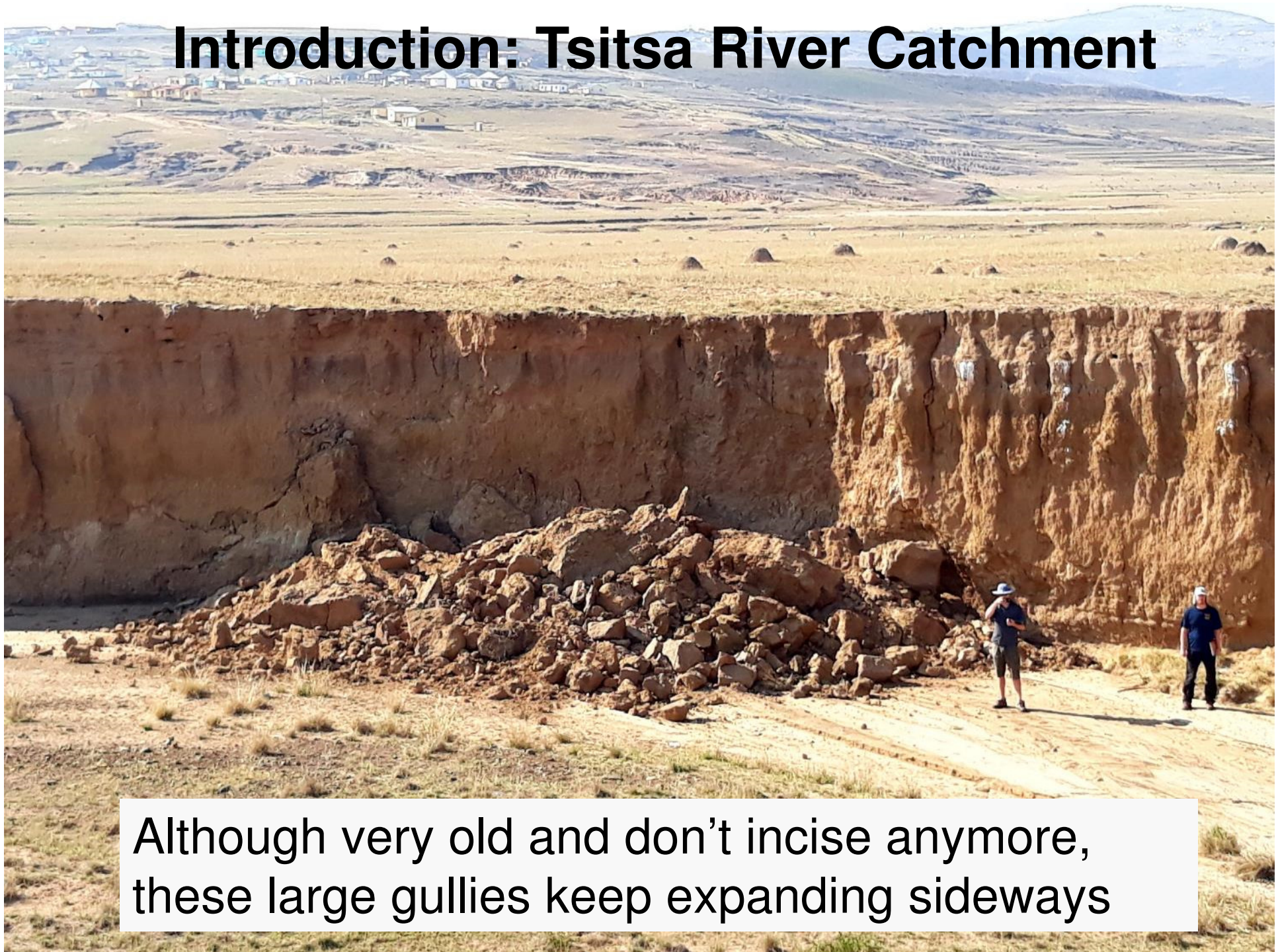
**Photo by David Hedding and video by Rhett Calvert**

<https://www.youtube.com/watch?v=nF9izujoGG0>

**RC** videography



# Introduction: Tsitsa River Catchment



Although very old and don't incise anymore, these large gullies keep expanding sideways



# Introduction: Tsitsa River Catchment

Soils are extremely erodible  
due to **dispersive and duplex nature** of soils  
(classified as Planosols by the FAO)

Non-dispersive (stable topsoil)

Dispersive clay (unstable subsoil)





# Introduction: Tsitsa River Catchment

Dispersible duplex soils are derived from **purple mudstones**

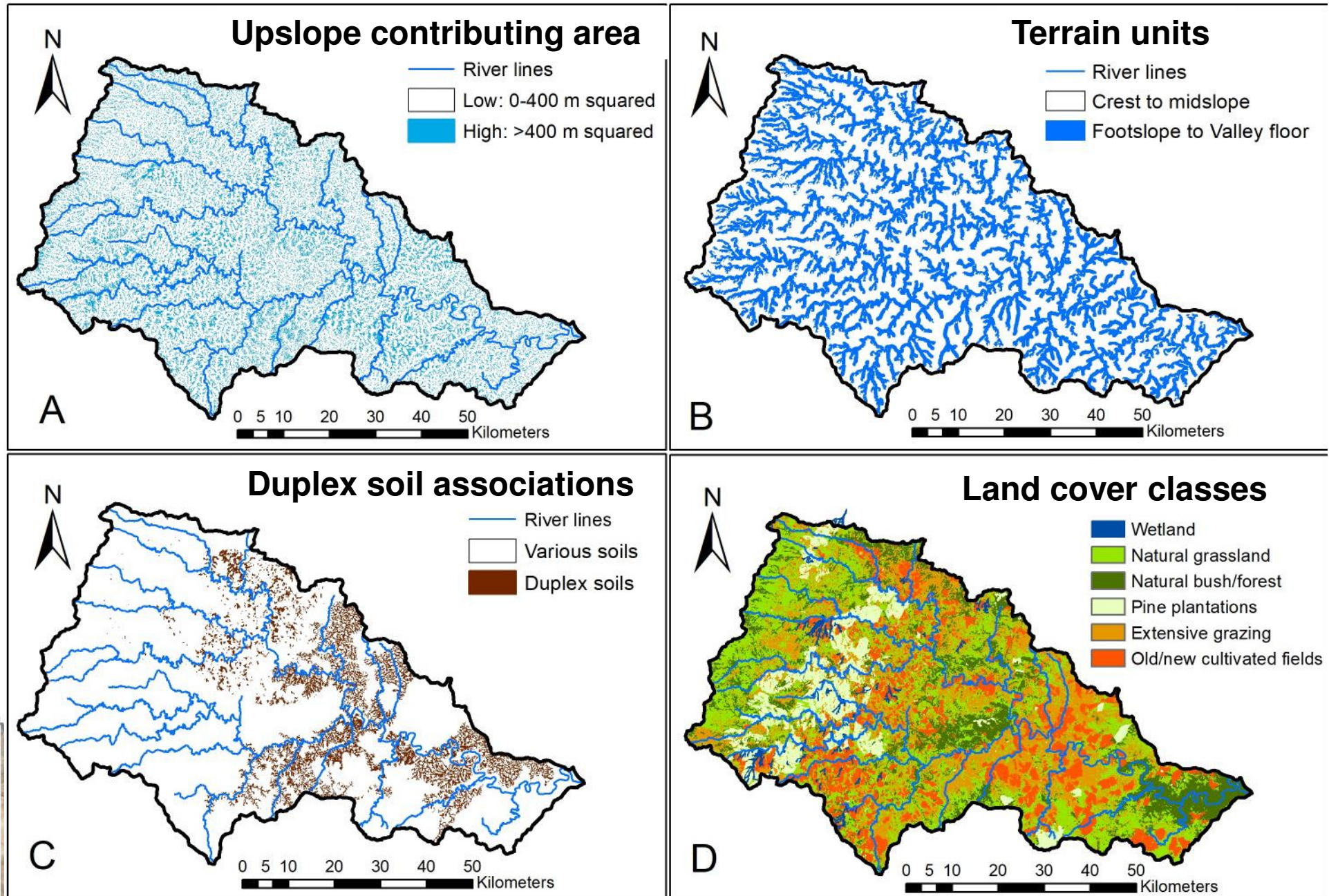


# Introduction: Tsitsa River Catchment

- Not feasible to rehabilitate large gully networks
- More practical to formulate preventative measures and to target areas with short term advantages and large impacts at low cost
- **Aim: The aim of the study is to map vegetated and/or gully-free areas susceptible to gully development**
- Gully-free/susceptible areas were identified by mapping areas that have same DEM-derived topographical variables and parent material-soils interactions than gullied areas including...



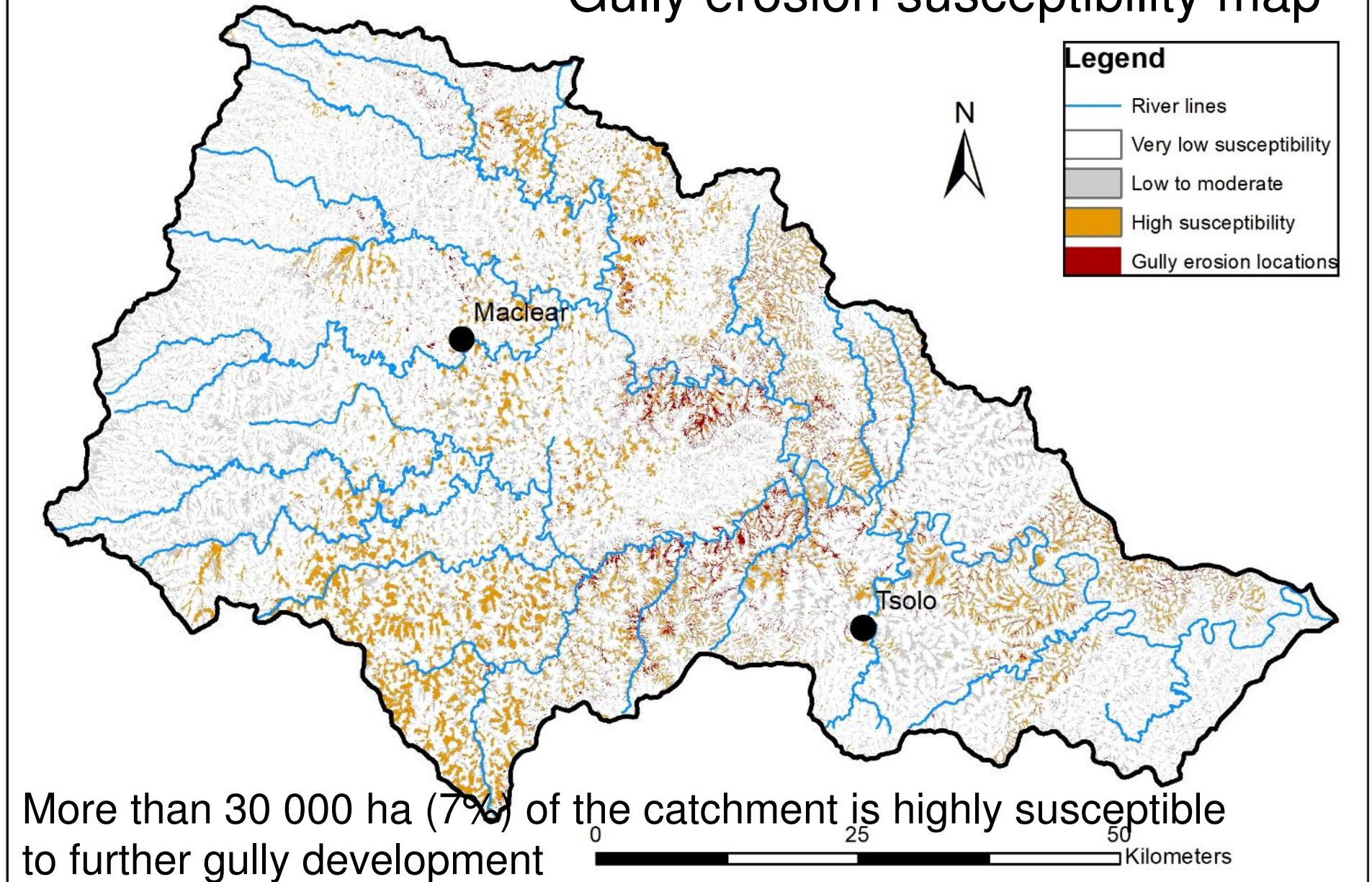
# Methodology





# Results and discussion

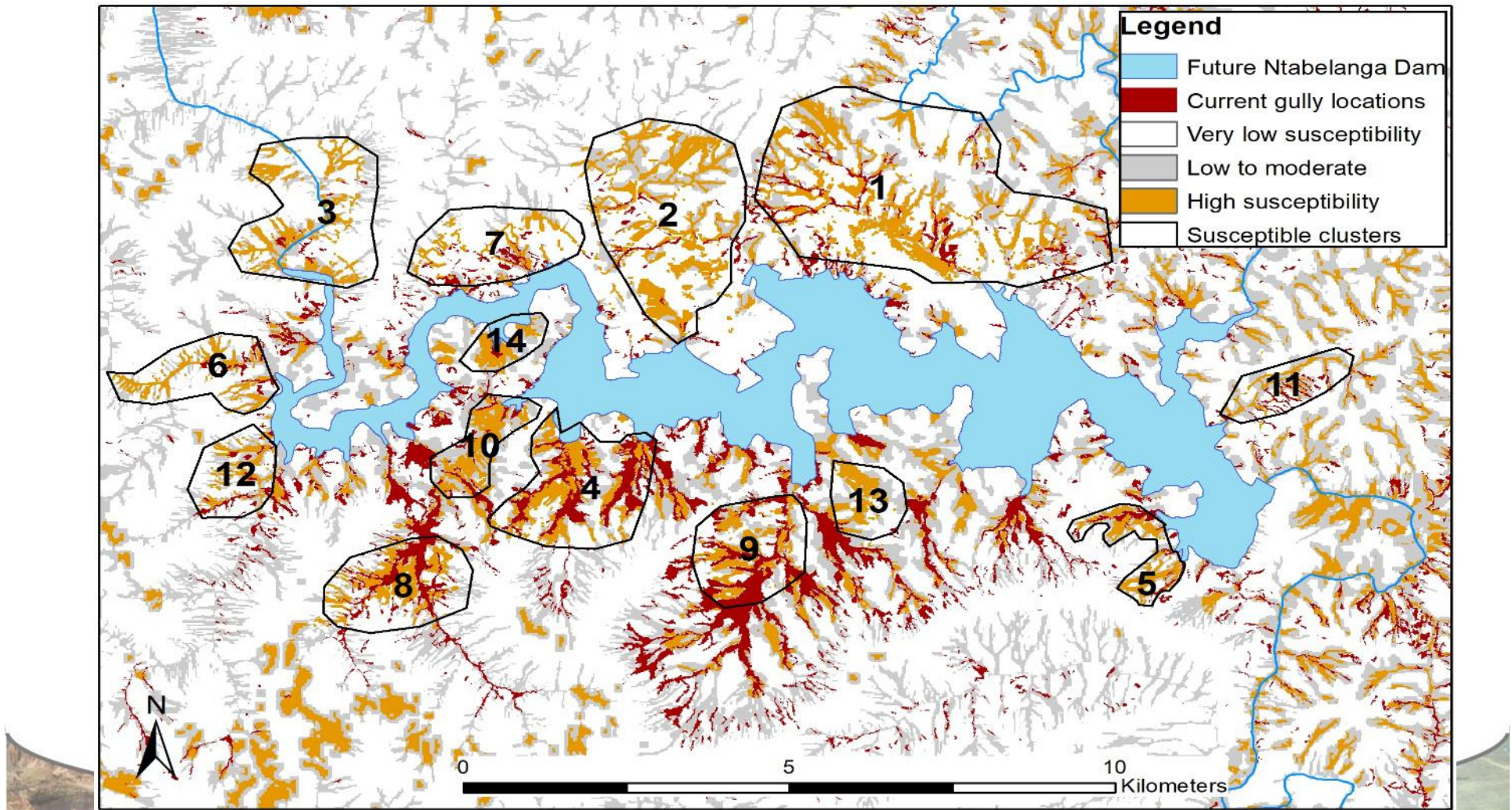
## Gully erosion susceptibility map





# Results and discussion

Areas susceptible to gully erosion near future dam

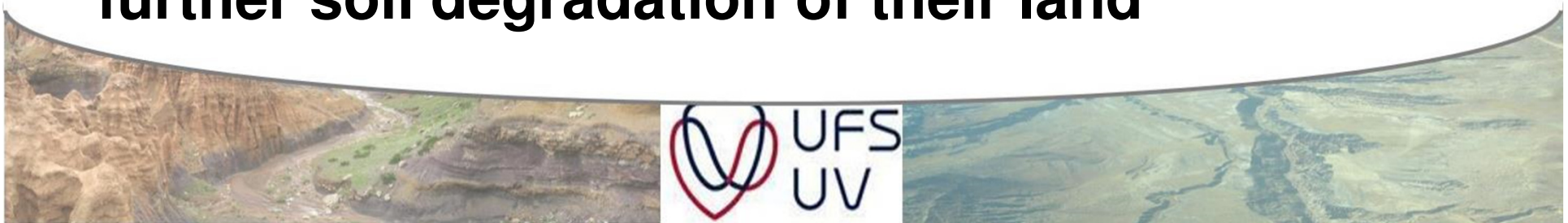


Imperative to prevent further erosion of these areas that are connected with the to river and future dam



# Conclusion and recommendations

- Prevention and rehabilitation of susceptible areas need to be prioritized according to NB criteria:
  - Sediment connectivity and sediment delivery potential, and
  - Socio-ecological criteria (identified by communities)
- If not protected, susceptible areas will contribute **additional sediment** loads to the river network
- Soil erosion prevention will not only reduce the **sediment yield** and increase **dam life expectancy**
- Also benefit the local communities by preventing further soil degradation of their land



# Thank you



Photo: Japie Buckle