



FLOOD ANALYSIS AND IMPACT ASSESSMENT

Cape Town Metropolitan Region



Presentation Outline

- Introduction
- Aim and objectives
- Study area
- Research methods
- Flood spatial extent: a scenario before and after flood occurrence
- Land use land cover (LULC)
- Flood impact on landcover

Introduction

- Floods are the most frequent and prevalent natural disasters
- Often caused by severe weather events linked to climate variability
- Exacerbated by factors such as urban sprawl and land use changes
- Impacts on ecosystems, hydrological processes, demography and economy
- Urban coastal communities = sea level rise and inefficient drainage systems
- Renders them to susceptibility of storm events and tidal conditions

Introduction cont.

- Traditional methods relied on field-based approaches
- Challenge: limited coverage, time-consuming, precision and accuracy
- Additionally, studies have focused on mapping flood extent using hydrodynamic models, as such immediate landcover impact assessment after flood occurrence is still undeveloped
- Availability of earth observation data and development of cloud-based techniques such as Google Earth Engine (GEE) presents opportunities to address these challenges
- Integrated flood mapping and impact assessment help lessen flood risk = preliminary guidance into enhancing resilience and policy decisions

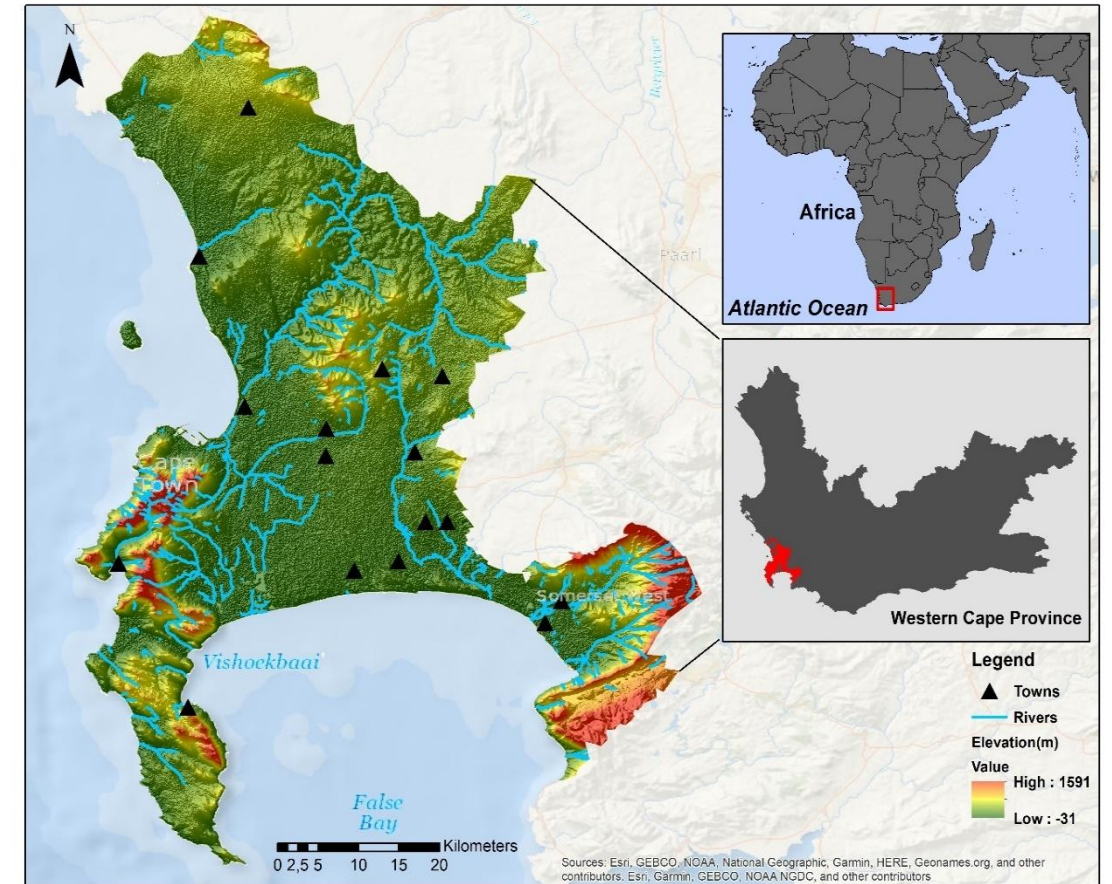
Aim

The presentation seeks to provide a comprehensive analysis and assessment of floods using cloud-based geospatial techniques

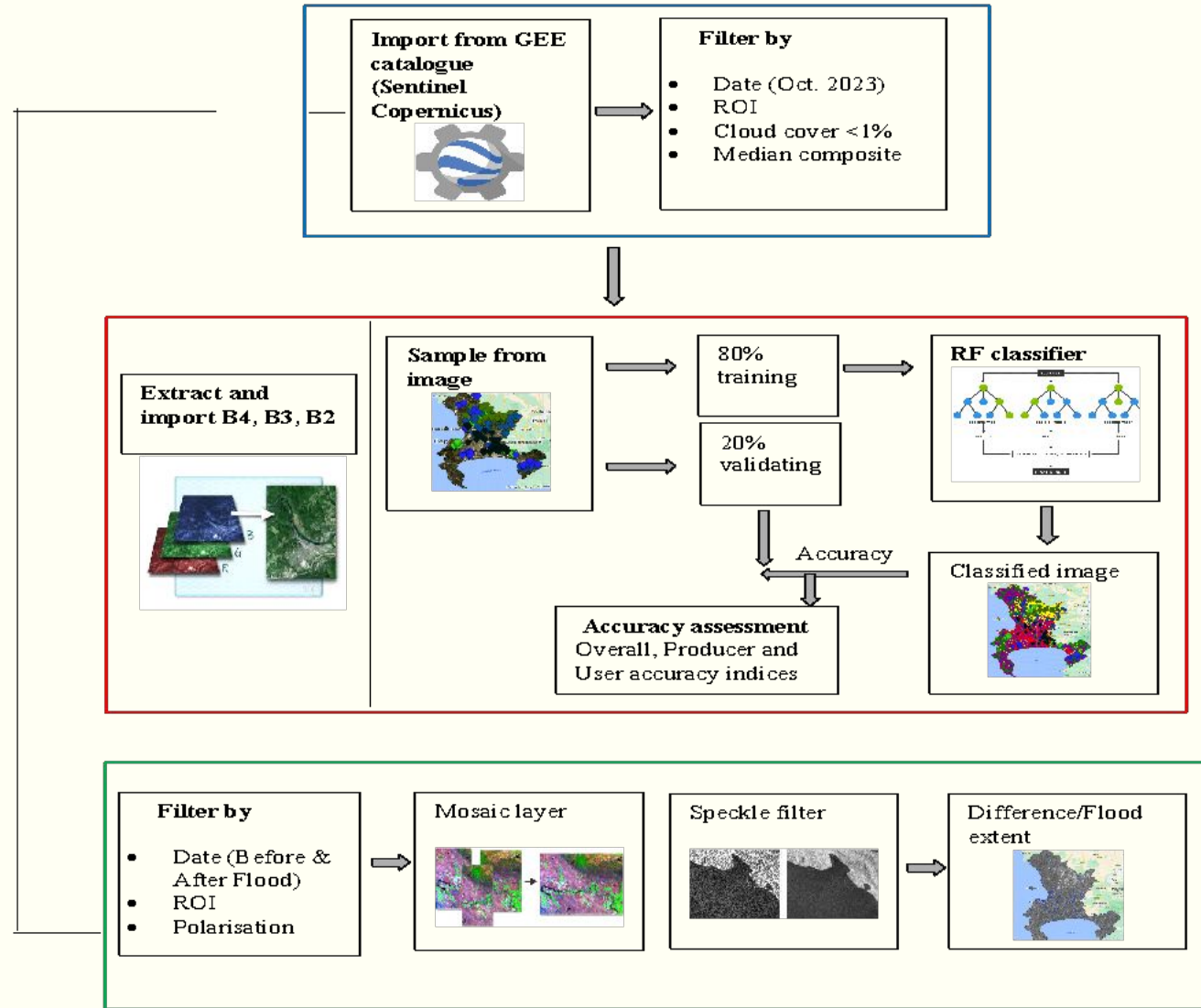


Study area

- South Western part of the Western Cape Province. Approximate area of 2460 km²
- Characterized by different landcover types such as built-up, water bodies, croplands, and vegetated land
- Featured along the Atlantic Ocean
- Mediterranean climate: marked by cold fronts



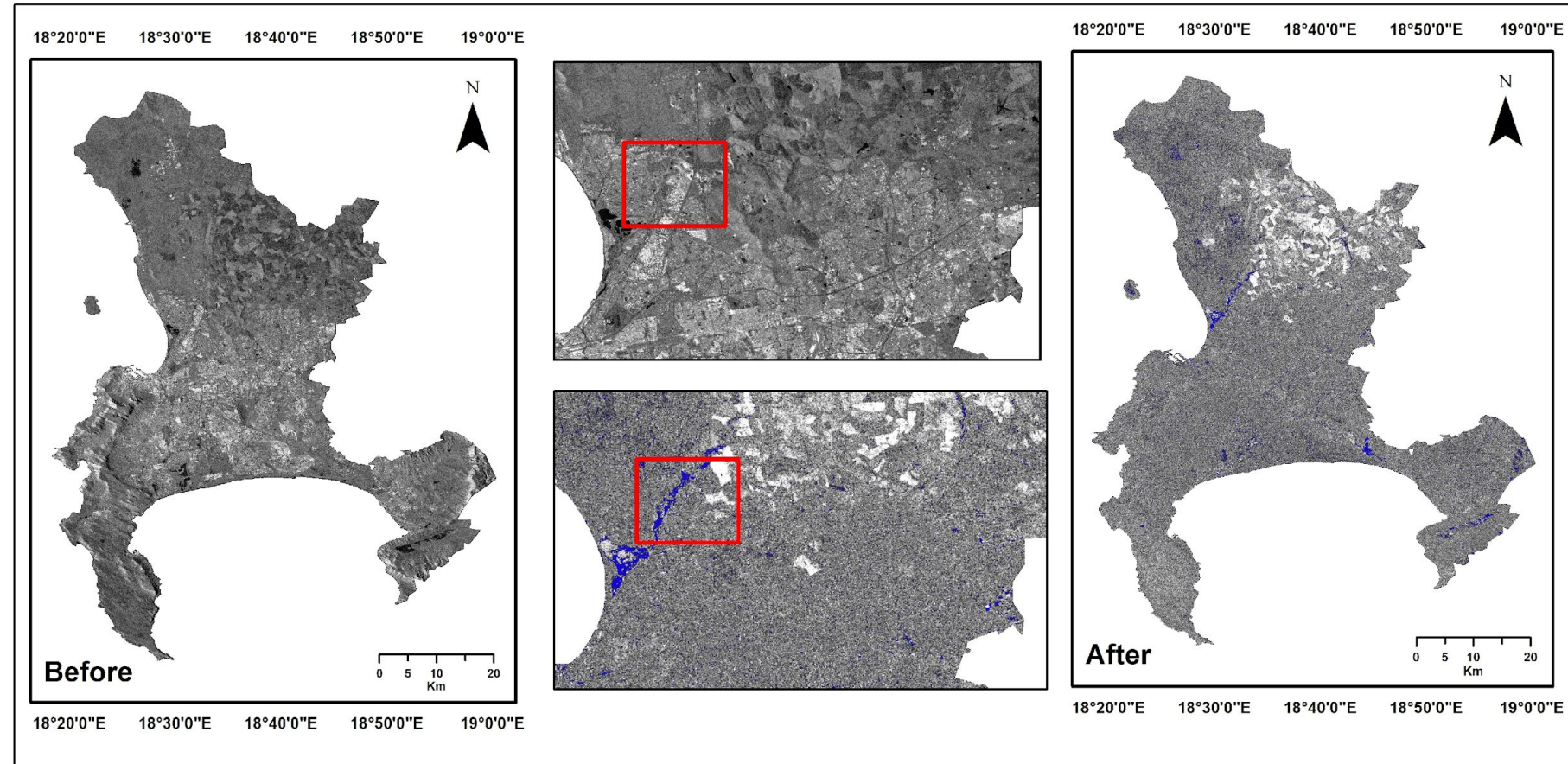
Research methods



Flood spatial extent: A scenario before and after flood

- One of the substantial flood events occurred in September 2023
Resulted in :
 - Fatalities and displacement of residents
 - Road closures and power outages
 - Significant damage to both private and public infrastructure across Western Cape Province
 - Results illustrated significant floods in upper regions (Dieprivier and Rietvlei Dam) and lower regions (Kuils River and Eersterivier)
 - Much of the flood extent could be a result of compound flooding and overtopping of the Rietvlei dam

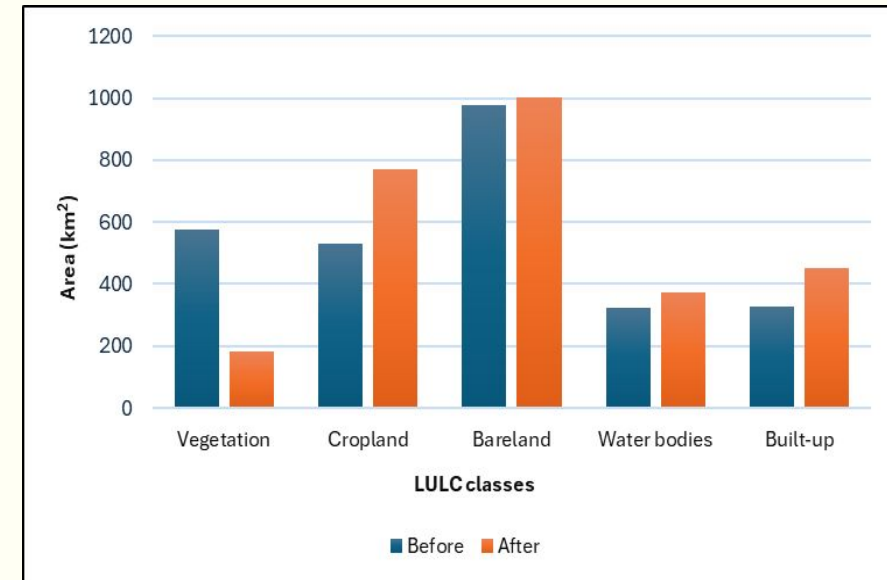
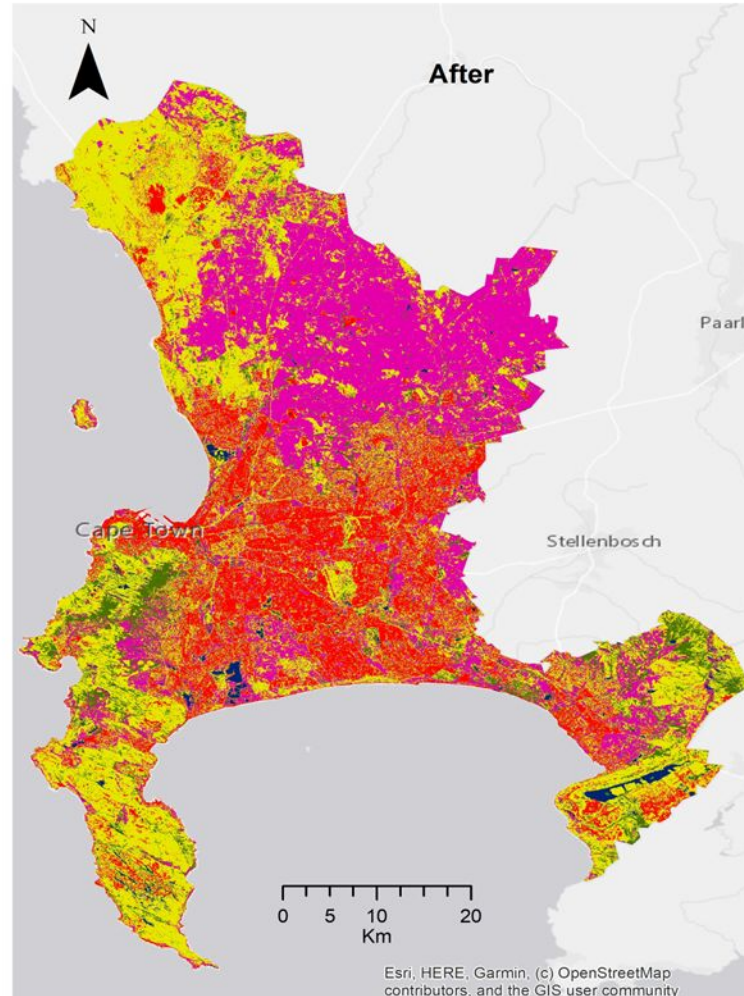
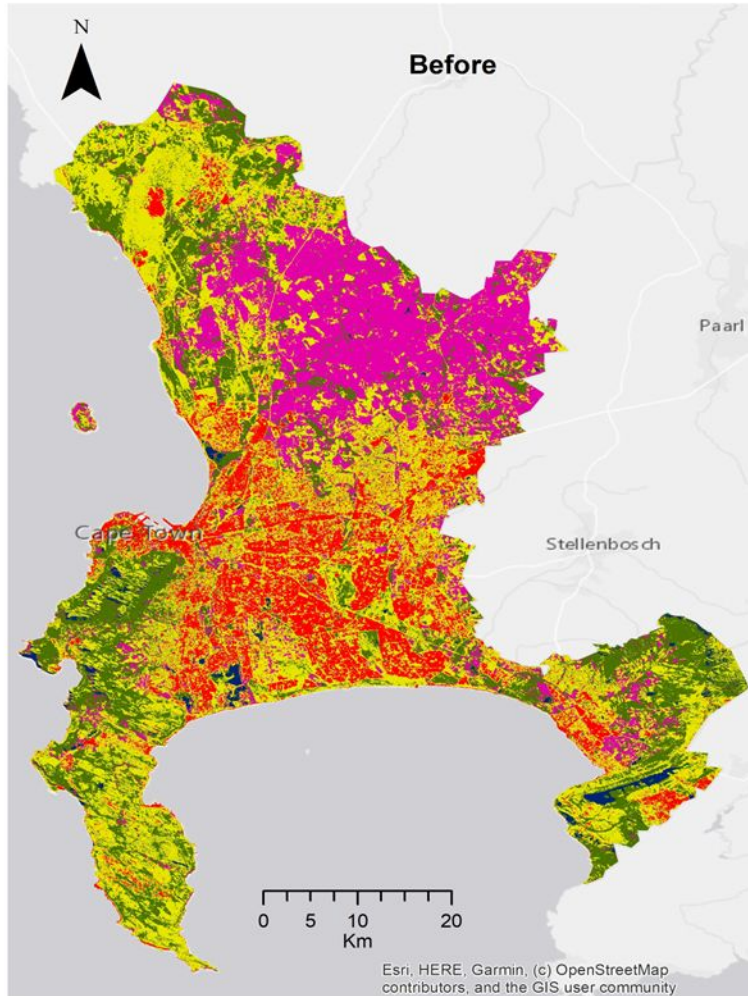
Flood spatial extent: A scenario before and after flood cont..

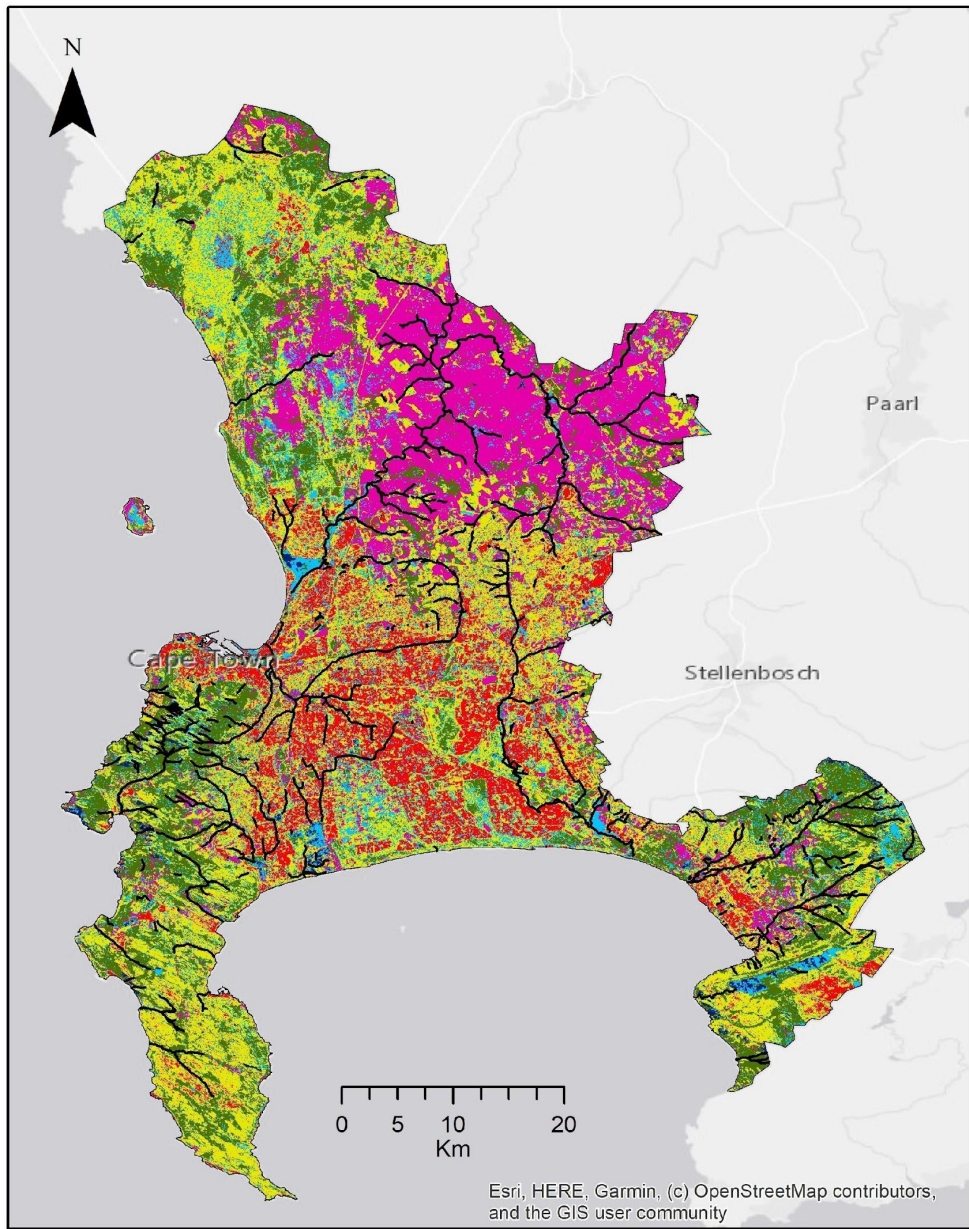


Land use land cover changes and impact

- Water bodies increased = creation of temporary water bodies and the expansion of existing water bodies
- Increase in built-up areas reflects an expansion in infrastructure or residential developments
- Part of the water bodies turned into built-up areas; with the possibility of changing natural draining channels
- While plantation land is also used for settlement development; this resulted in the expansion of open land
- In response to floods, short term or emergency efforts by farmers to restore food supplies resulted in increased cropland at the expense of vegetation and bareland; most of which function as a floodplain
- The significant decrease in vegetation reflects the severity of the floods

Land use land cover changes and impact cont..

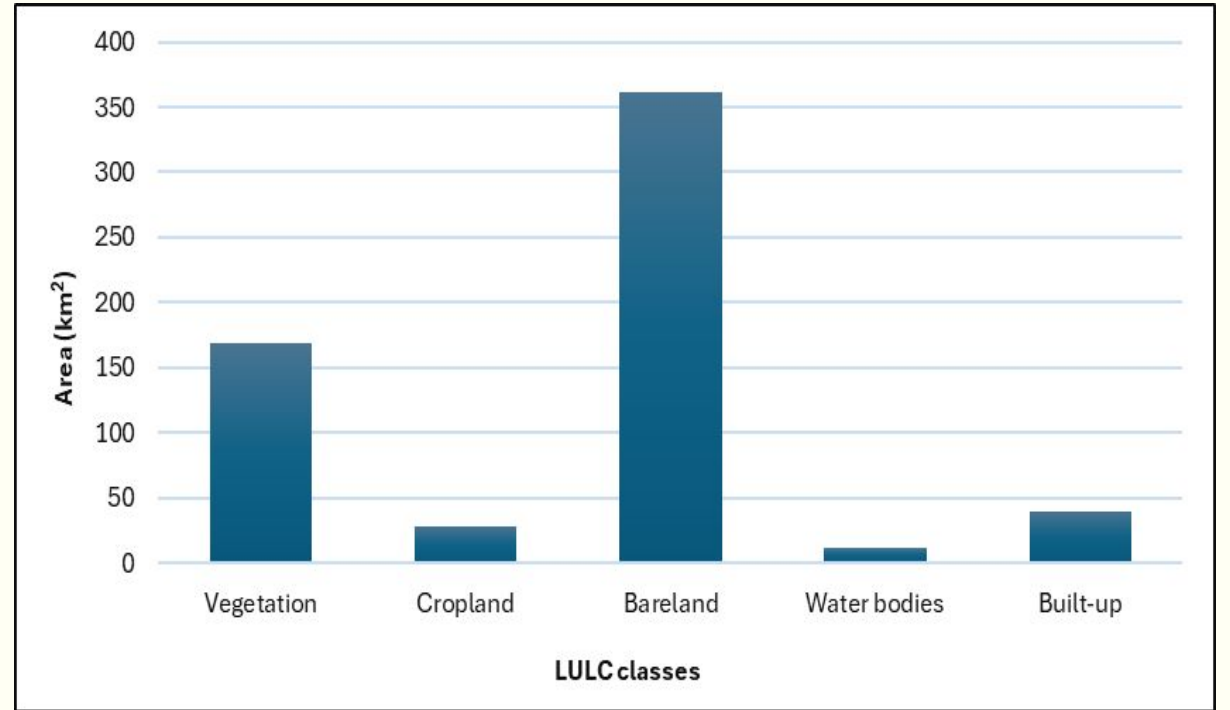




Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

Legend

- Rivers
- Cropland
- Bareland
- Water bodies
- Built-up
- Flooded areas
- Vegetation



Summary

- The availability of near real-time open-source data and the use cloud computing techniques underscored relevance to the study
- Provided immediate results and a faster capacity
- As well as understanding the contextual LULC changes and flood extent
- It was however limited by similarities in spectral reflectance amongst the observed classes = introduced errors in classification process
- The study recommends the analysis in long term recovery of land cover post flood using GEE and machine learning algorithms
- Understanding the full potential of integrating hydrodynamic models, radar and optical data for optimum flood mapping



Thank you