# Collating data for freshwater biodiversity planning in South Africa
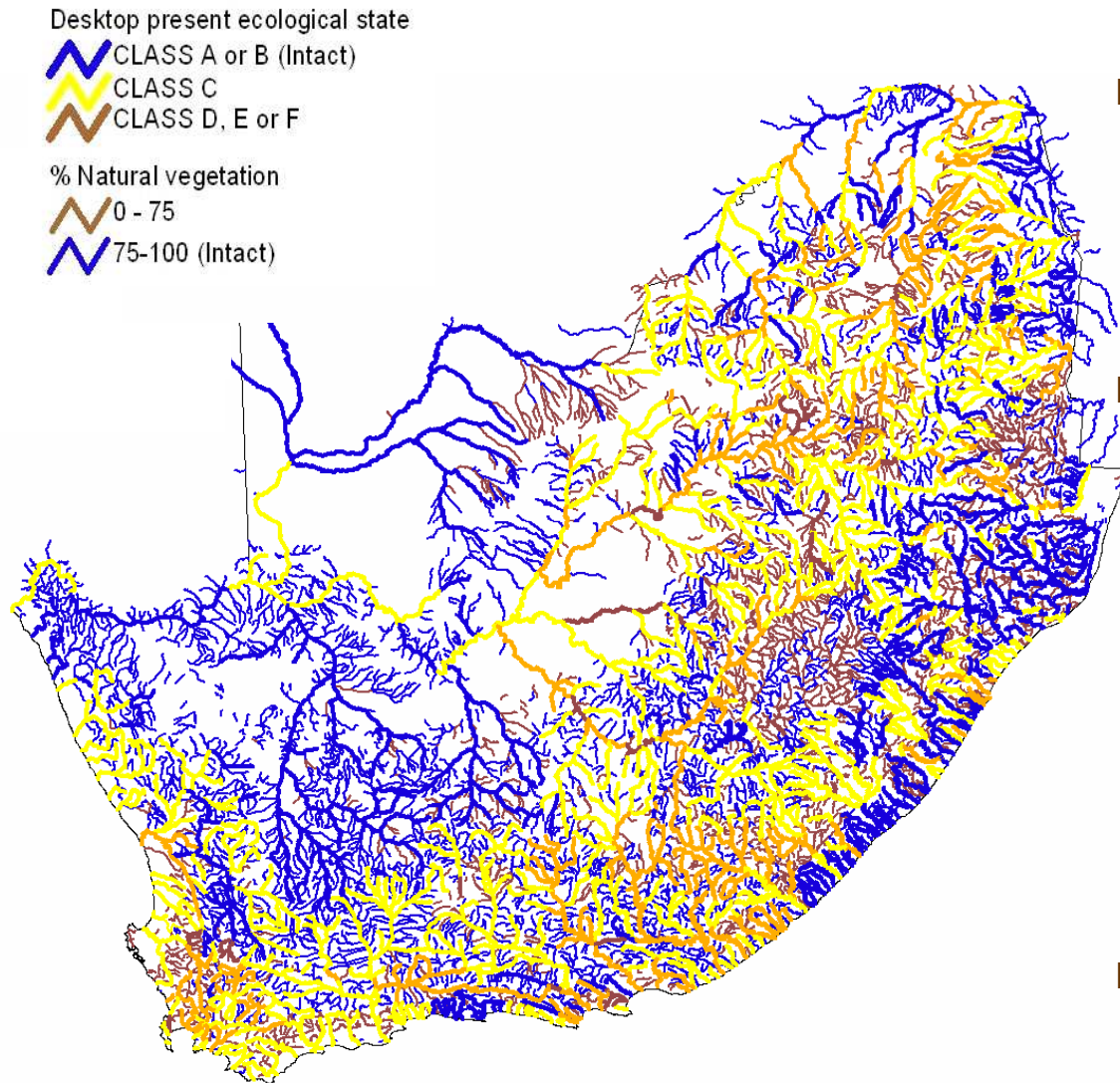
CHANTEL PETERSEN, JEANNE L. NEL, LINDIE SMITH-ADAO, ASHTON MAHERRY, HEIDI VAN DEVENTER, LARA VAN NIEKERK, MAO AMIS, SMISO BHENGU, DEVLYN HARDWICK, SHERWYN MACK, NAMHLA MBONA, ERNST SWARTZ, NOKUTHULA WISTEBAAR

# Introduction

- National Freshwater Ecosystem Priority Areas (NFEPA) Project started in 2008

- NFEPA is supported by SANBI, CSIR, DWAF, WRC and WWF South Africa, SANParks, SAIAB) and DEAT.

- The aims of NFEPA are:
  - To identify a national network of freshwater ecosystem priority areas, using spatial modeling and expert review, which will include rivers, wetlands and estuaries.
  - To develop an institutional basis for implementing the freshwater ecosystem priority areas through engaging with key stakeholders and through pilot projects

- Focus will be on the input data layers and methods used in collation thereof
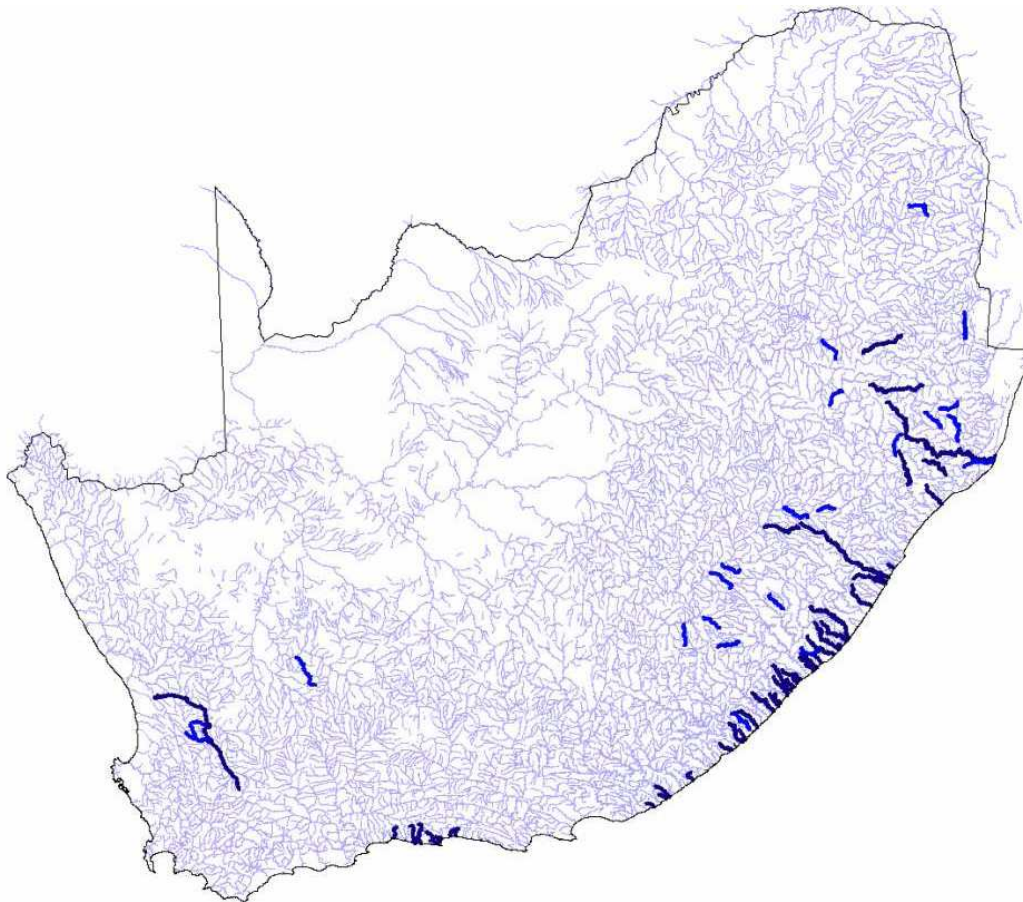
# Rivers



Desktop present ecological state
- CLASS A or B (Intact)
- CLASS C
- CLASS D, E or F

% Natural vegetation
- 0 - 75
- 75-100 (Intact)

- DWAF's Present Ecological State (PES) (1999)

- 6 categories e.g. A category = natural, while D/E category = seriously to critically modified

- Updated Ecological Reserve Determination data, sub-national Present Ecological State (PES) assessments, EcoStatus data and River Health were used to update the river layer

- The 1:500 000 river layer was updated with information obtained from expert workshops
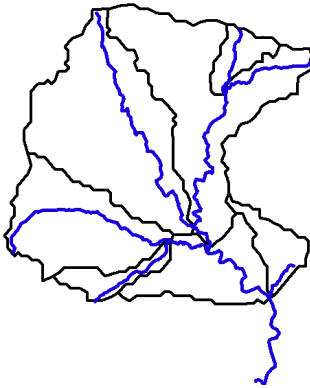
# Free-flowing rivers

**—— Inland river reaches of 50-100km**

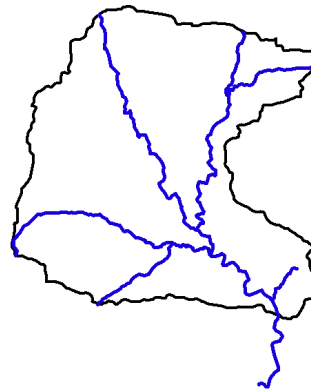**—— Short coastal river reaches or reaches >= 100km**



- Free-flowing rivers were identified as:
  - Permanent or seasonally flowing
  - Intact (AB rivers)
  - No instream dam throughout its length
  - Length ≥ 50 km for inland rivers, with no size threshold for coastal rivers

- This layer was also assessed and finalised during expert workshops
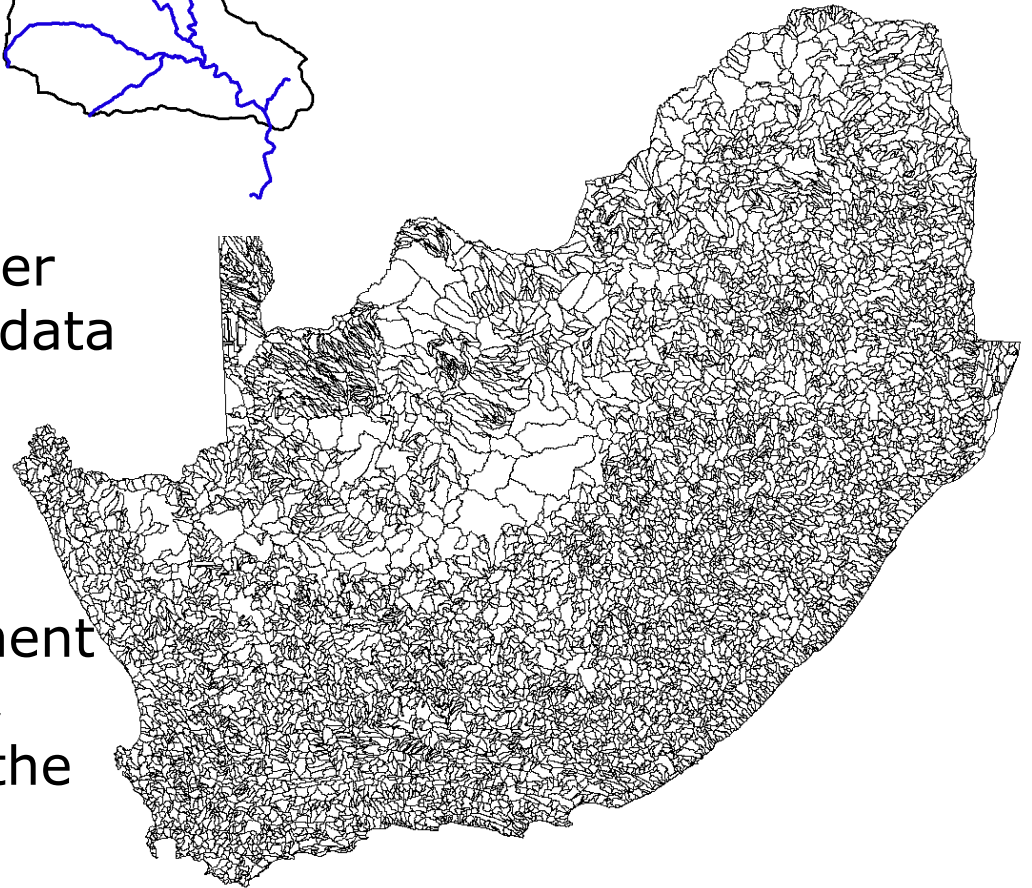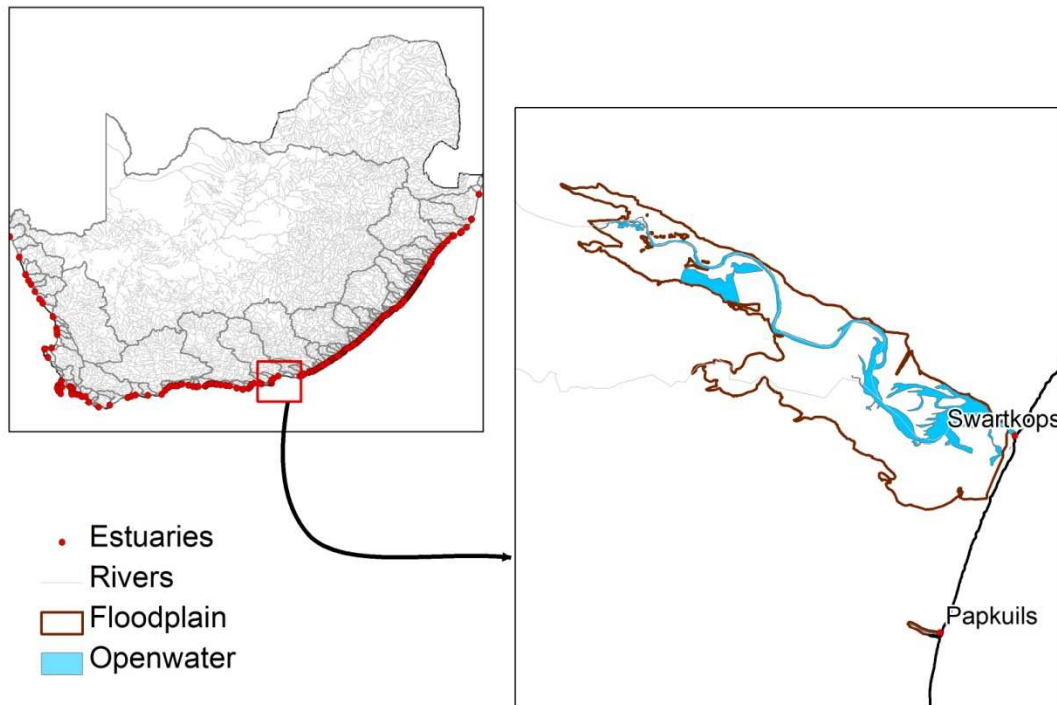
# Sub-quaternary catchments

**Sub-quaternaries**          **Quaternaries**

□ Based on updated Rivers layer
□ Used 50 m Digital Elevation data
□ 15 954 of them
   Average size ~17,000 ha
□ ~2000 quaternaries
   Average size ~65,000 ha
□ Each sub-quaternary catchment
   was assigned a unique code,
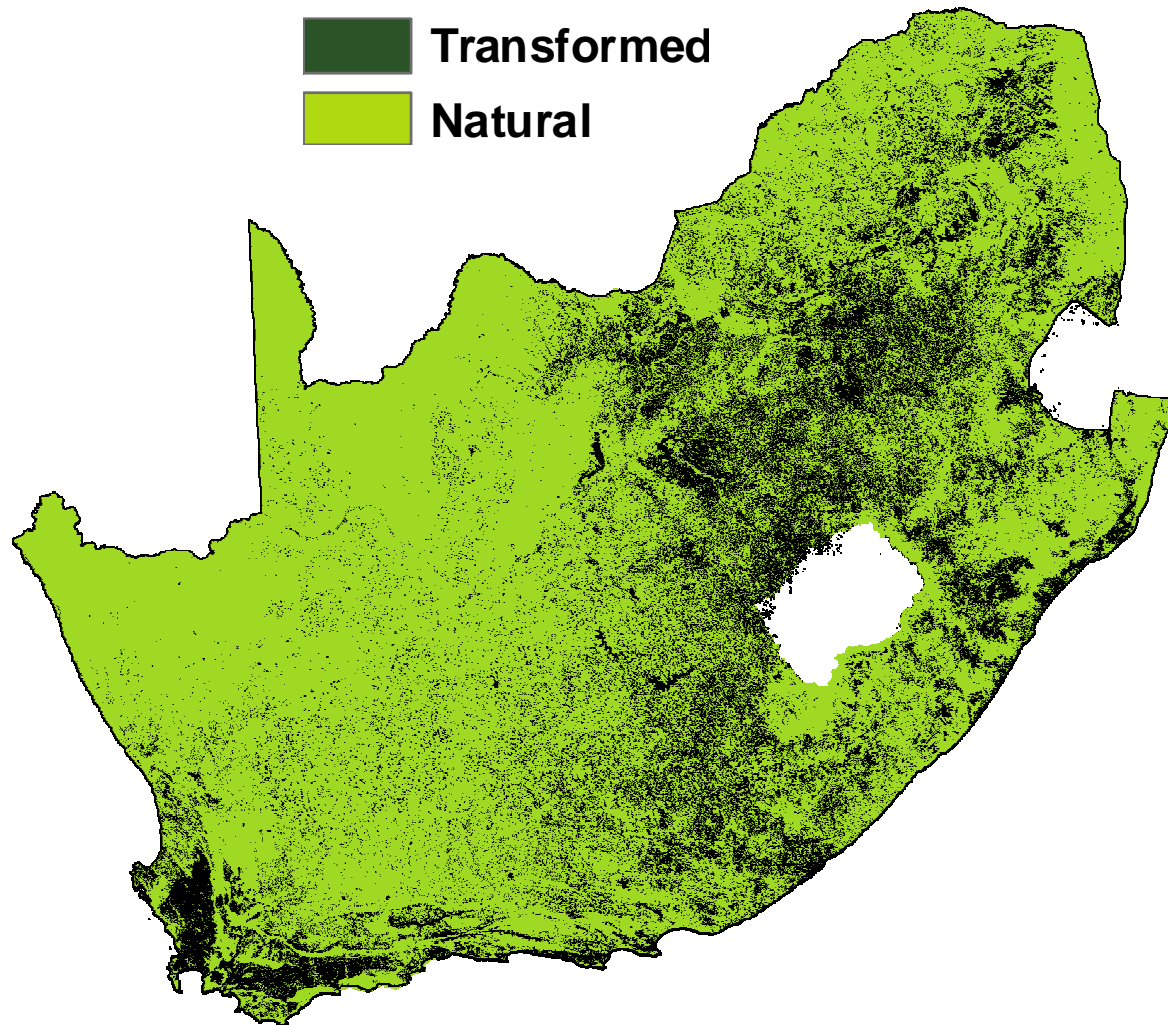   based on the reach-code in the
   DWAF 1:500 000 river layer

# Estuary Delineation



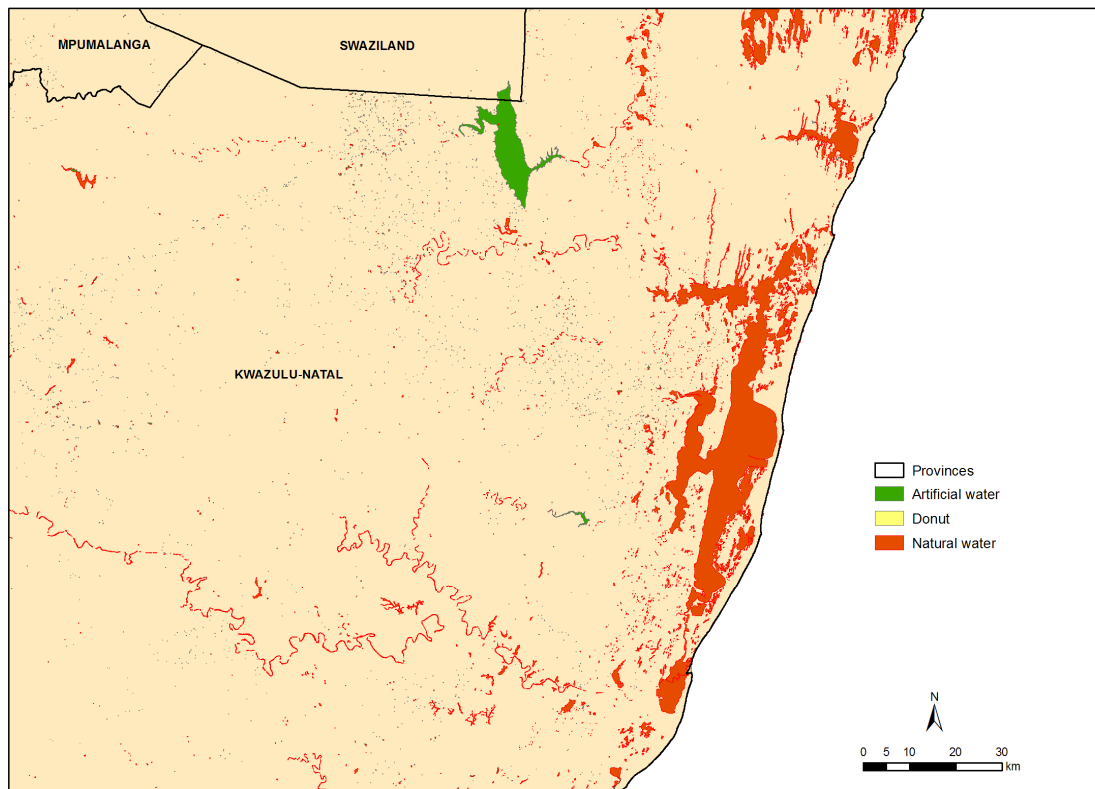- Estuaries
- Rivers
- Floodplain
- Openwater

Swartkops

Papkuils

- 300 estuaries along the SA coast were mapped using Google Earth and Spot 5 (2008) imagery

- Open water and floodplain areas were delineated for each estuary

- The 5 m contour obtained from CDSM data was used to determine the upper estuarine boundaries and estuarine floodplain/area

# Mosaic land cover and transformed water bodies
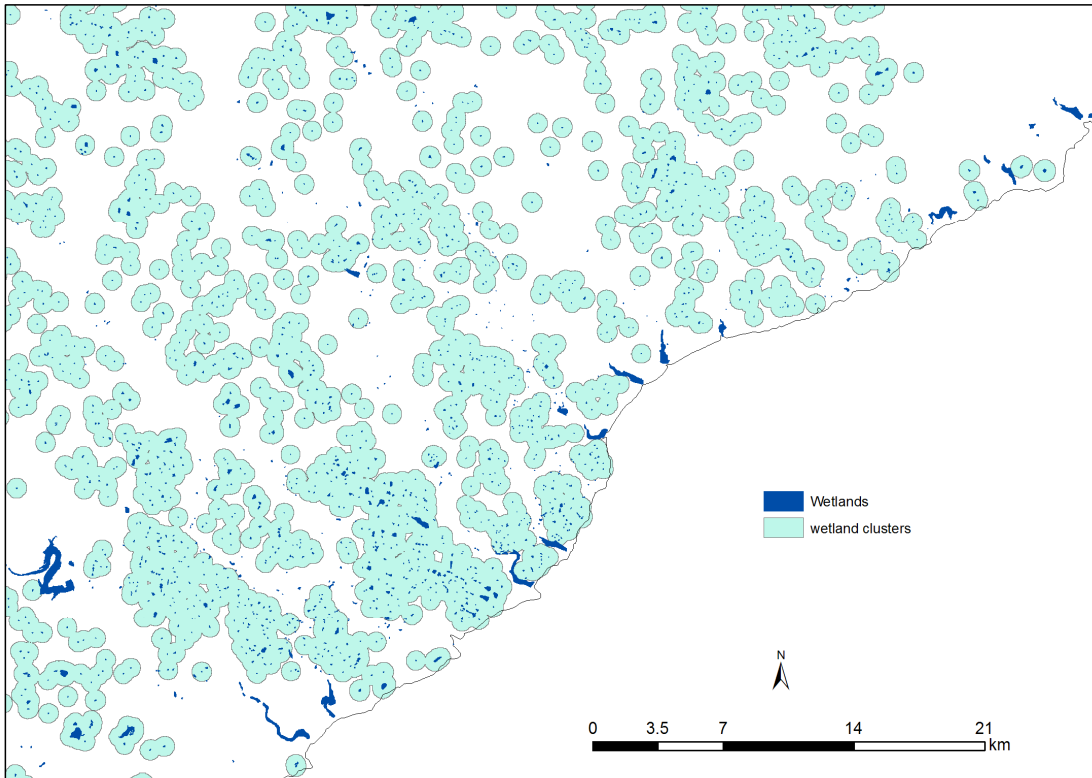


Transformed
Natural

- 30 m Mosaic land cover
- CDSM transformed water features were combined with the 30 m mosaiced land cover
- An Erosion layer was produced by extracting
  - Gullies
  - Dongas
  - Sheet erosion
- These were used in tributary condition modelling
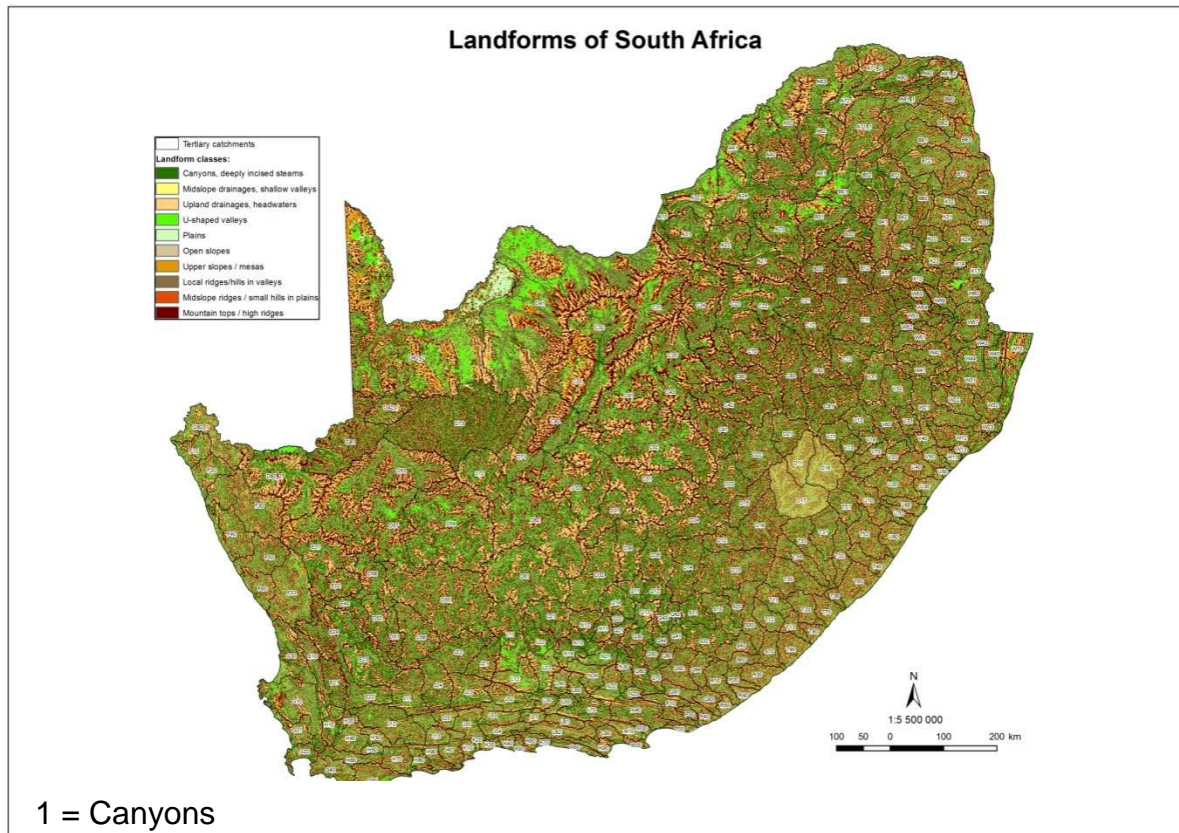
# Wetland Map III



- SANBI's Wetland Map II was used as the base layer and updated
- In National Wetland Map III, the wetland and natural waterbody layers were combined together with the artificial waterbodies
- Polygons have been described as either "natural" or "artificial" waterbodies

# Significant Wetland Clusters



- Wetland Map III was used selecting all polygons which were of a distance > 50 m from 1:500 000 rivers
- These were then buffered by 500 m
- Converted to a raster grid and vectorised in order to dissolve wetland clusters with unique identifiers
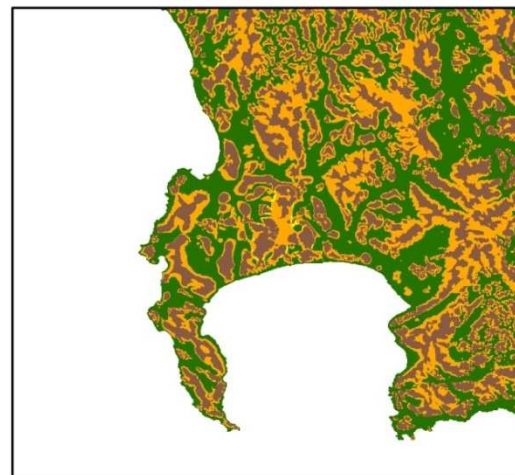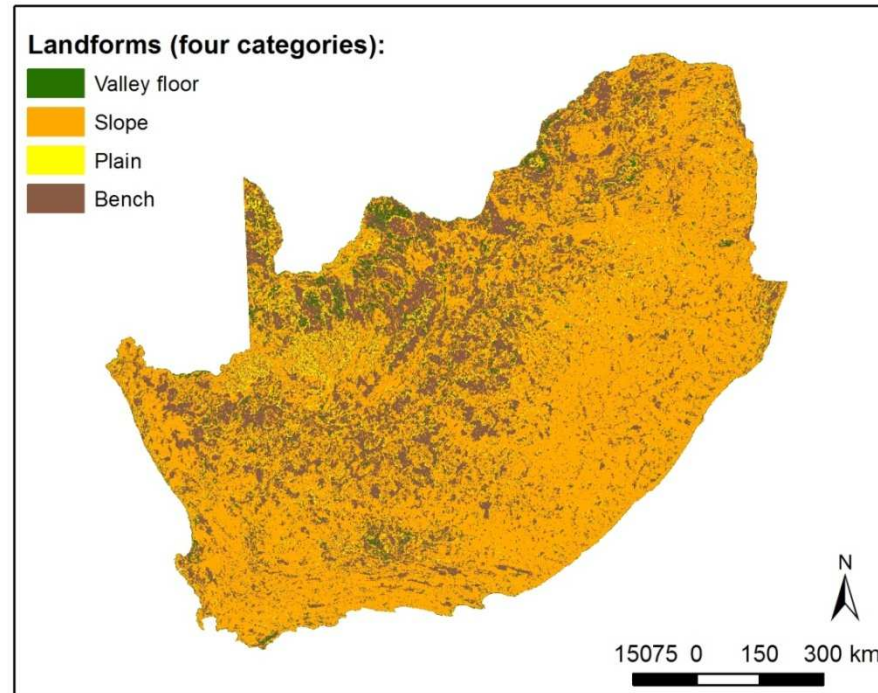- During the expert review workshop wetland clusters of significance were identified at a sub-quaternary level

# Landforms of South Africa



**Landforms of South Africa**

Tertiary catchments

Landform classes:
- Canyons, deeply incised steams
- Midslope drainages, shallow valleys
- Upland drainages, headwaters
- U-shaped valleys
- Plains
- Open slopes
- Upper slopes / mesas
- Local ridges/hills in valleys
- Midslope ridges / small hills in plains
- Mountain tops / high ridges

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1:5 500 000

100  50  0      100      200 km

1 = Canyons
2 = Midslope drainages, shallow valleys
3 = Upland drainages, headwaters
4 = U-shaped valleys
5 = Plains
6 = Open slopes
7 = Upper slopes / mesas
8 = Local ridges / hills in valleys
9 = Midslope ridges / small hills in plains
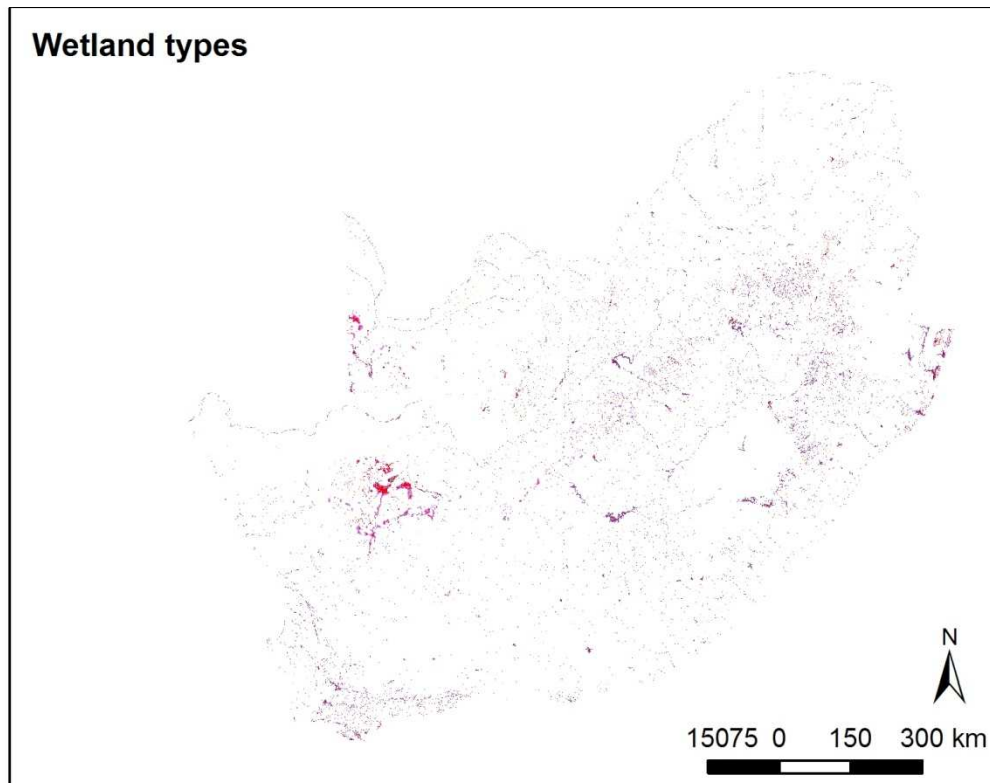10 = Mountain tops / high ridges

- This was derived using the 50 m DEM and the Topography Tools-Landform tool
- Landforms with default 10 classes were calculated
- This was reclassified to 4 classes to identify the position of wetlands in the landscape on Level 3 according to the National Wetland Classification System
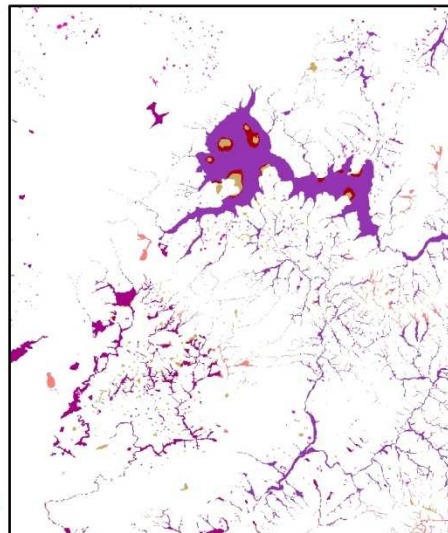
# Landforms – 4 categories



Landforms (four categories):
- Valley floor
- Slope
- Plain
- Bench

# Wetland Typing

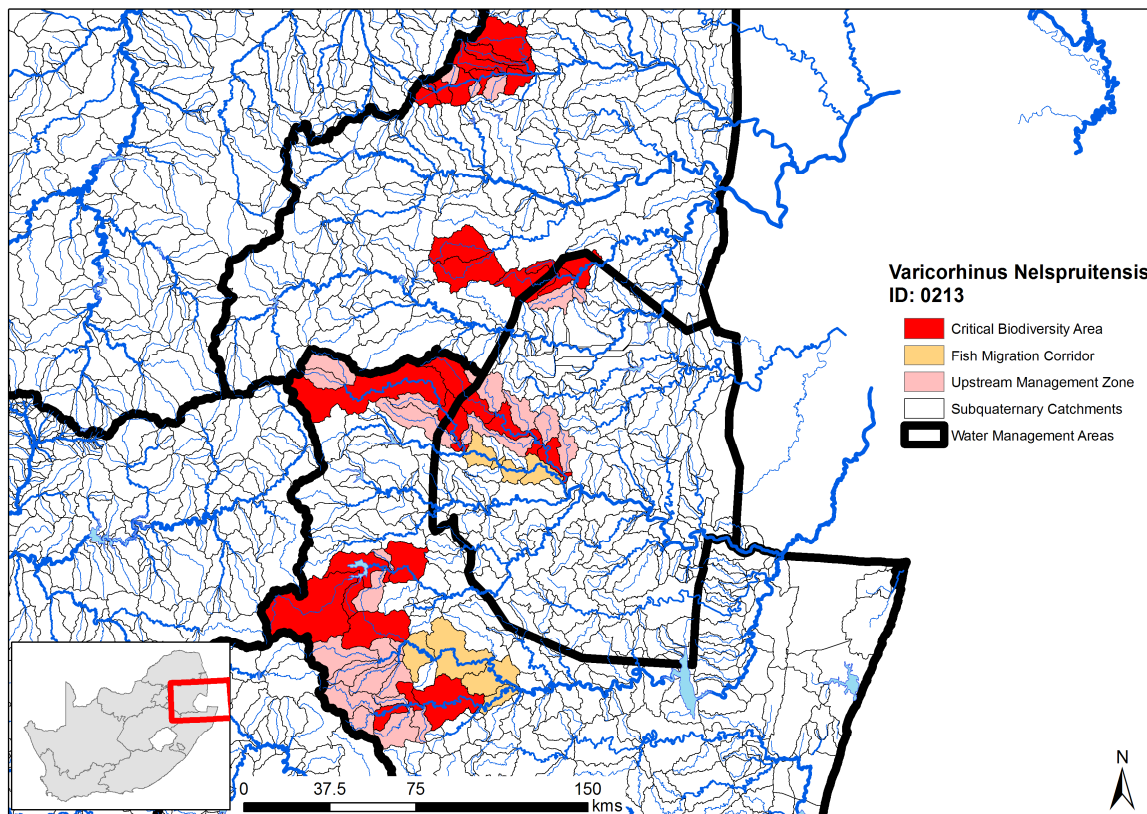**Wetland types**



15075  0    150   300 km

**Wetland types (Level 4A):**
- Bench: Depression
- Bench: Flat
- Plain: Depression
- Plain: Flat
- Plain: Floodplain wetland
- Plain: Unchannelled valley-bottom wetland
- Slope: Depression
- Slope: Seep
- Slope: Valleyhead seep
- Valley floor: Channelled valley-bottom wetland
- Valley floor: Depression
- Valley floor: Floodplain wetland
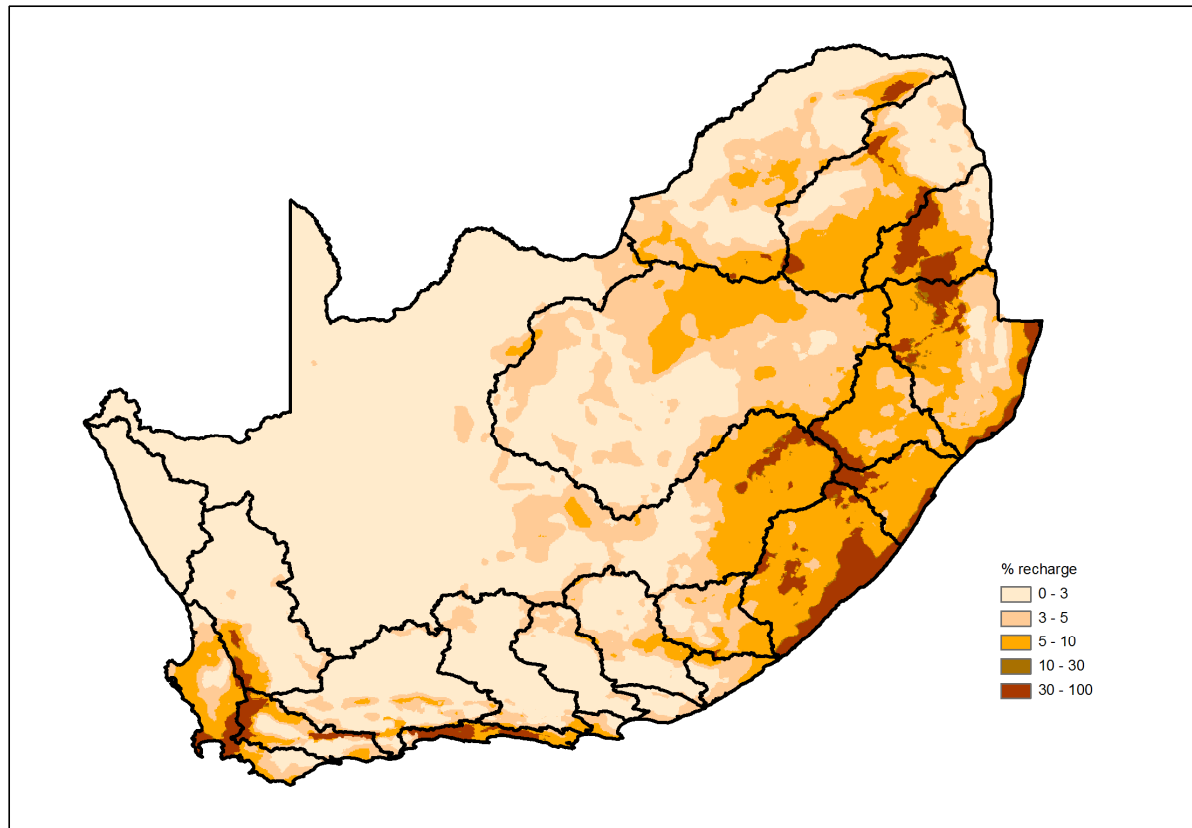- Valley floor: Unchannelled valley-bottom wetland

❑ Wetlands were classified using a number of ancillary data sets such as landforms, lowland rivers, pans, 1:50 000 river lines and estuaries

# Fish Sanctuaries



**Varicorhinus Nelspruitensis**
**ID: 0213**

- Critical Biodiversity Area
- Fish Migration Corridor
- Upstream Management Zone
- Subquaternary Catchments
- Water Management Areas
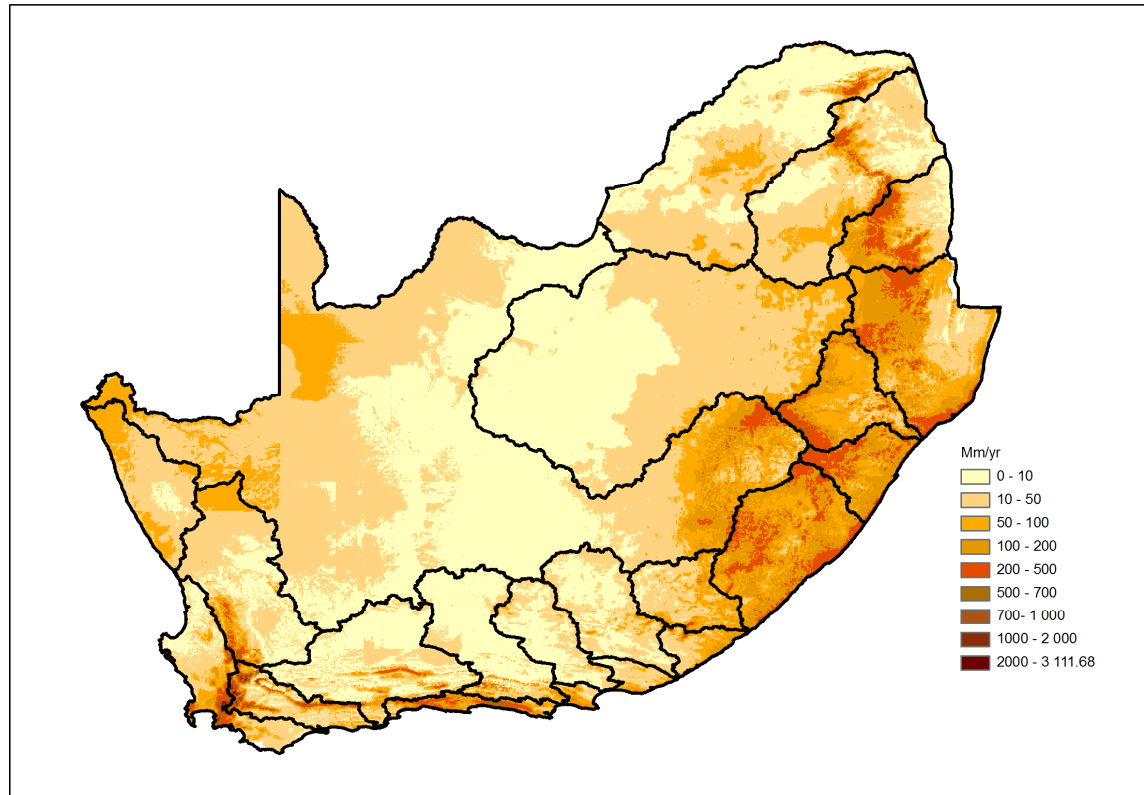
0    37.5    75    150
kms

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- Sub-quaternary catchments acting as Fish Corridors between significant fish sanctuaries were selected and significant upstream management zones
- Mapping based on expert review workshops for IUCN status:
  - Vulnerable
  - Endangered
  - Critically Endangered
- Mapping delineated:
  - Critical Biodiversity Area
  - Fish Migration Corridor
  - Upstream Management Zones
  - Relocation Zones
  - Rehabilitation Zones

# High groundwater recharge areas



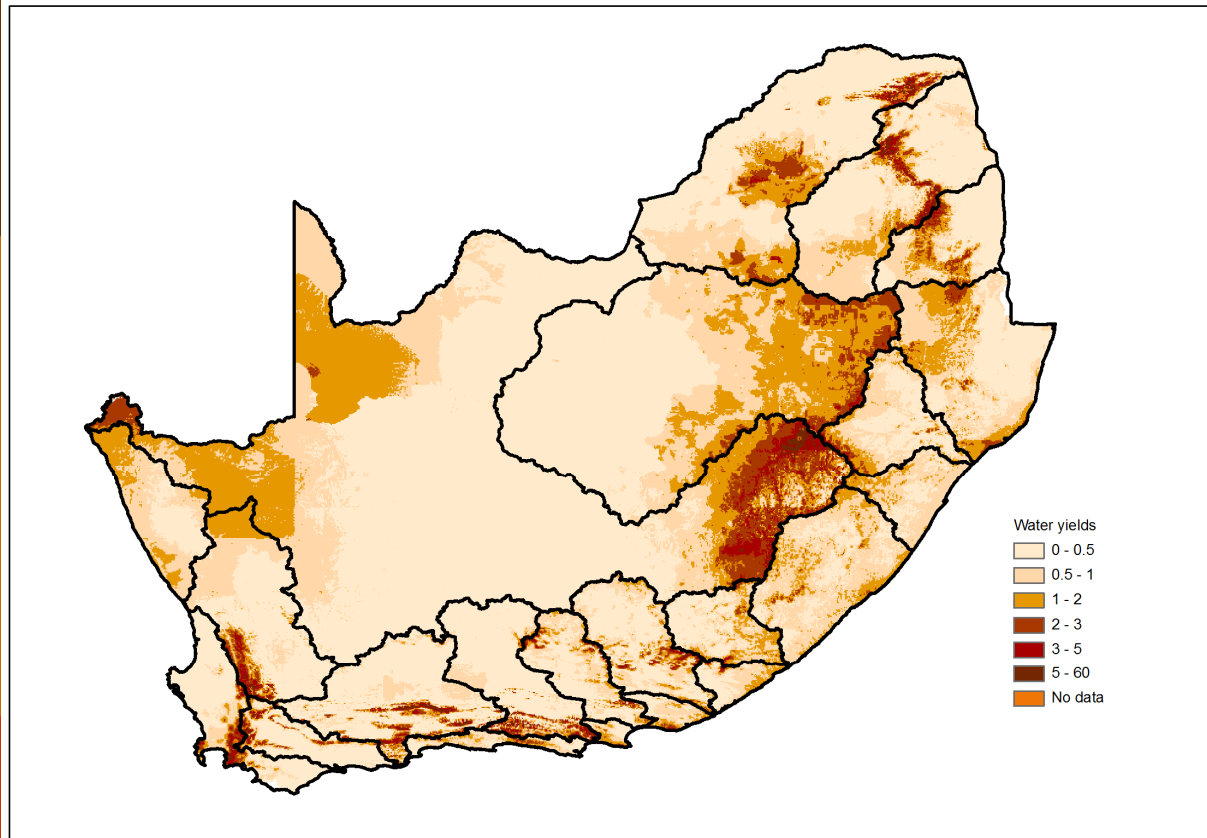**% recharge**
- 0 - 3
- 3 - 5
- 5 - 10
- 10 - 30
- 30 - 100

- Used data from Groundwater Resource Assessment II, DWAF 2005

- Data used that expresses groundwater as a % of total rainfall as compared to using absolute numbers (mm/year)

- The recharge "hotspot" areas were guided by groundwater experts

- Areas above 3-5 % can be considered high recharge areas

# Mean Annual Runoff



Mm/yr
- 0 - 10
- 10 - 50
- 50 - 100
- 100 - 200
- 200 - 500
- 500 - 700
- 700- 1 000
- 1000 - 2 000
- 2000 - 3 111.68

□ This layer was developed using the ACRU Mean Annual Precipitation 1x1 minute grid and the DWAF WR90 relationships of estimating runoff from rainfall

# High water yield areas



Water yields
- 0 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3
- 3 - 5
- 5 - 60
- No data

- Mean Annual Runoff per 1x1' grid cell is divided by the average Mean Annual Runoff for its associated primary catchment
- Where the value is over 1 the runoff for that grid cell is above average MAR in the primary, 2 = double average etc
- This could also be done per WMA or per secondary catchment

# Where to from here

□ Data layers will be incorporated into a series of maps showing the freshwater ecosystem areas identified

□ Data dissemination through for example SANBI's BGIS website

□ Developing a network of relationships among key natural resource implementing agencies and capacity building to understand and use the series of maps developed

□ Supporting documentation: Catchment Managers Manual for implementing NFEPAs and an Atlas will be developed

□ End product to feed into the NBA 2010

**BiodiversityGIS**

(http://bgis.sanbi.org)