Ecosystem Accounting in South Africa: Initial Work

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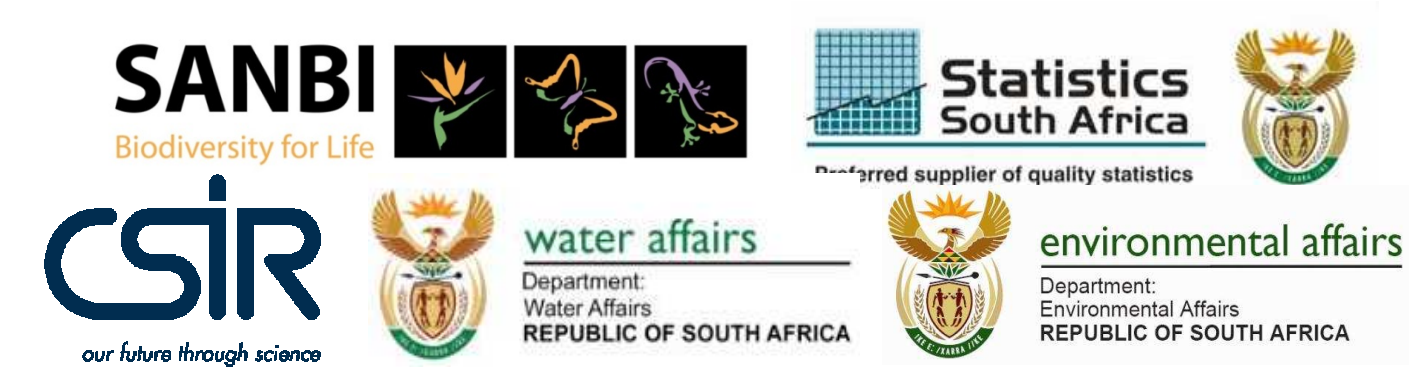
South African National Biodiversity Institute

UNSD EGM on Experimental Ecosystem Accounting

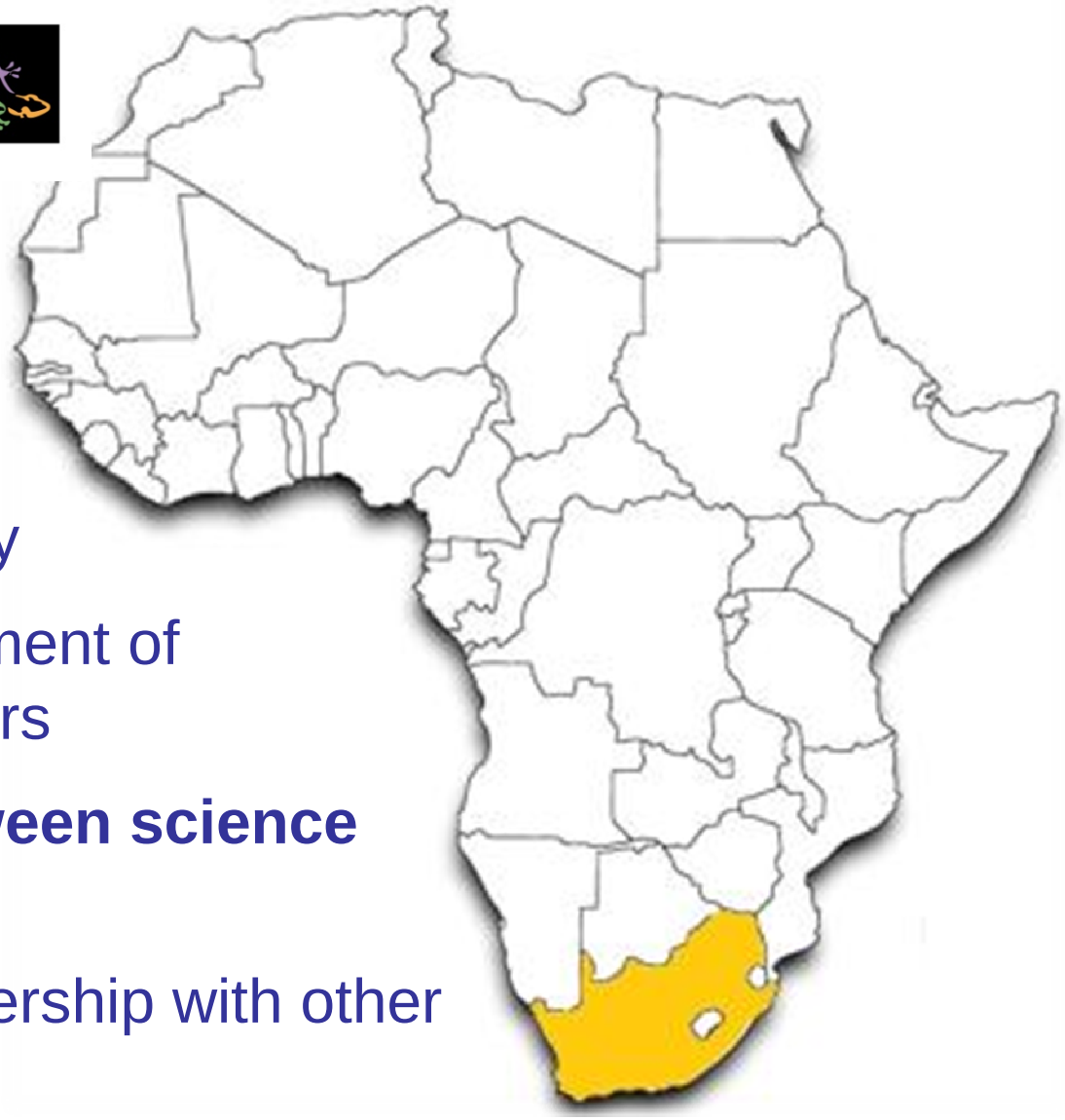
18 November 2013



South African National Biodiversity Institute

SANBI
Biodiversity for Life

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA



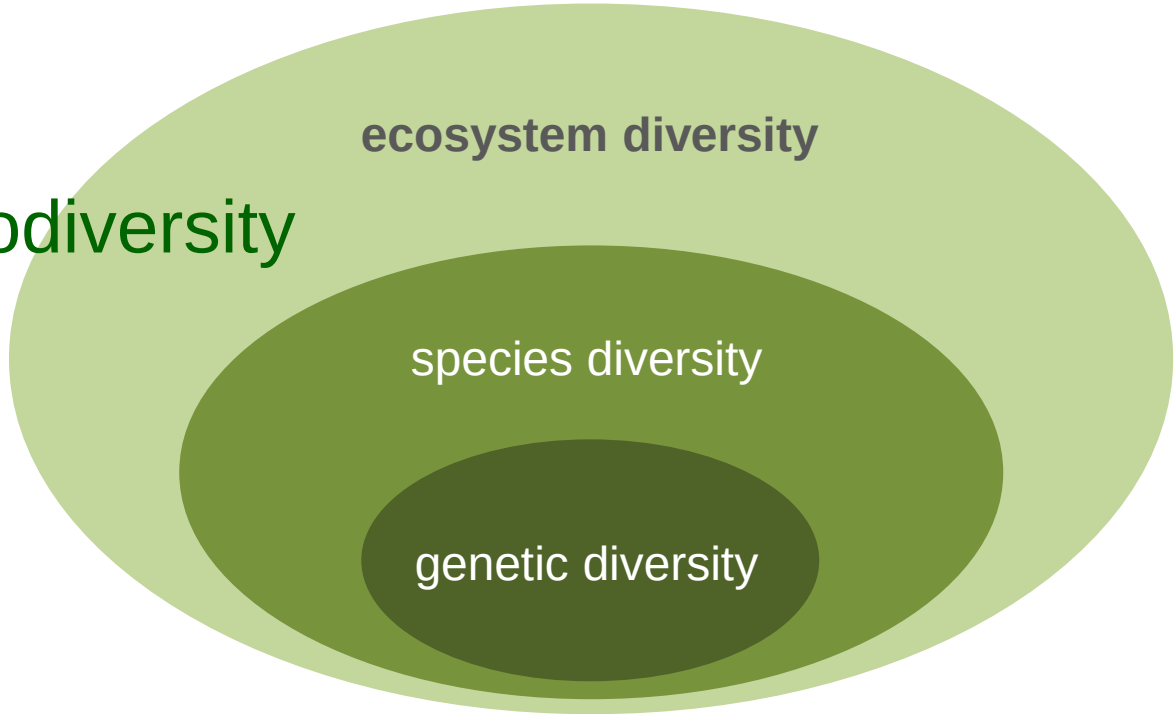
- Government agency
- Falls under Department of Environmental Affairs
- **Bridging role between science and policy**
- Often work in partnership with other organisations

Biodiversity ≠ species

In a mega-diverse country,

our focus is often at the ecosystem level

Components of biodiversity



Overview

- Starting point
  - National Biodiversity Assessment
- Approach to ecosystem classification
- Measuring and mapping ecological condition
  - Focus on rivers
- River ecosystem accounts
  - Why start with rivers
  - Next steps

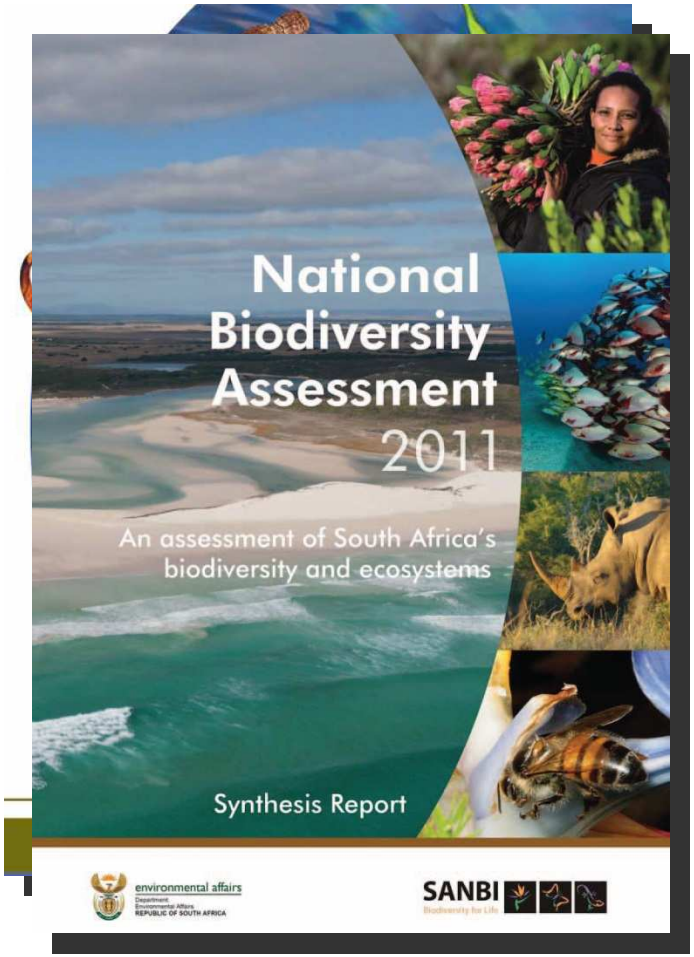
Two national assessments of biodiversity in SA

- Strong focus on ecosystems
- Every 5 to 7 years
- Part of SANBI's mandate to monitor and report on the state of biodiversity

National Spatial Biodiversity Assessment 2004

→ 1st asmt of ecosystems across terrestrial, river, estuarine & marine environments

NBA 2011: Added wetlands & invasives, more focus on indigenous species & climate change

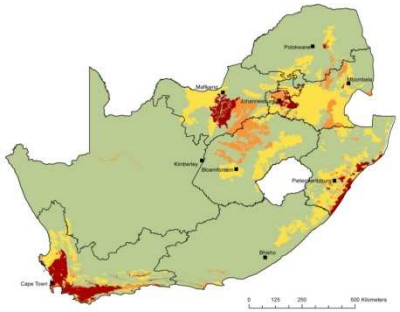


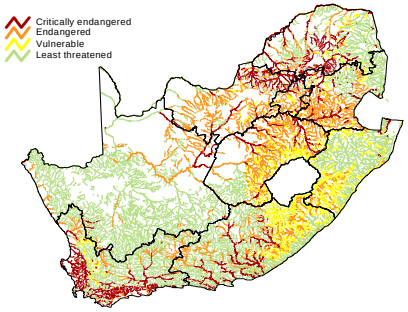
NBA 2011: More than 200 scientists & practitioners from over 30 organisations contributed, 3 year process

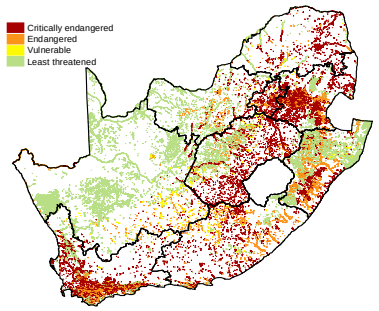
and many more…

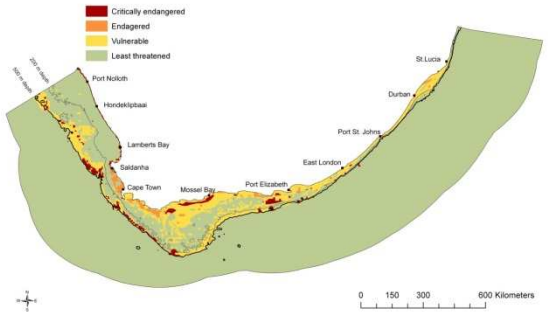
National ecosystem indicators

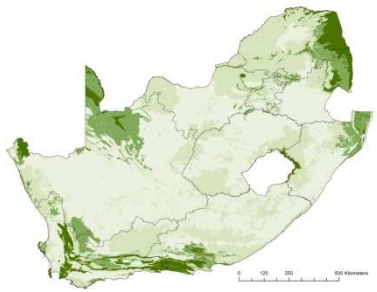
- How threatened are our ecosystems?
- How well protected are our ecosystems?

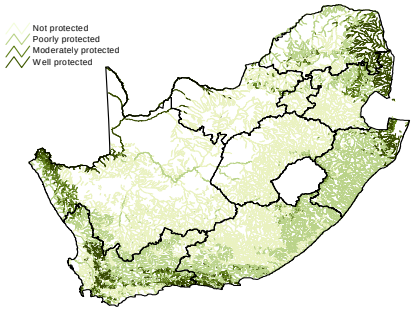


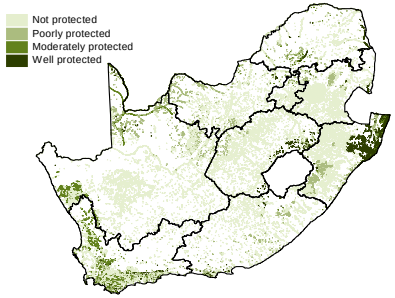


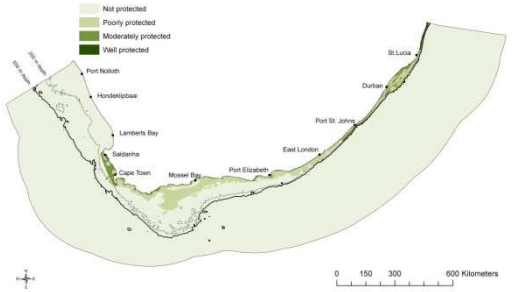




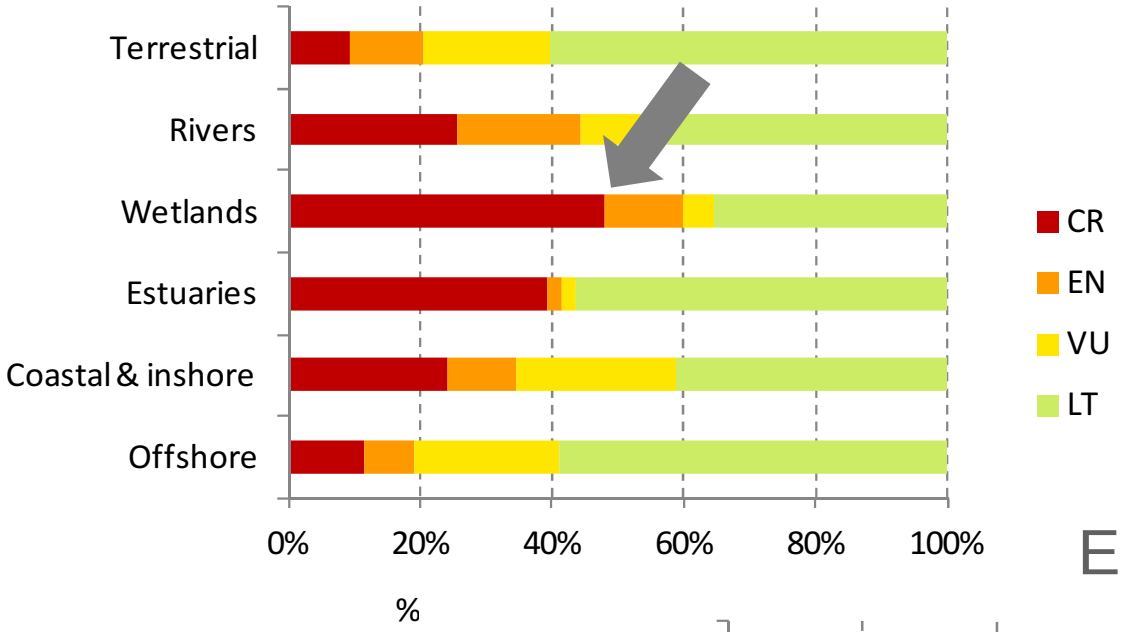






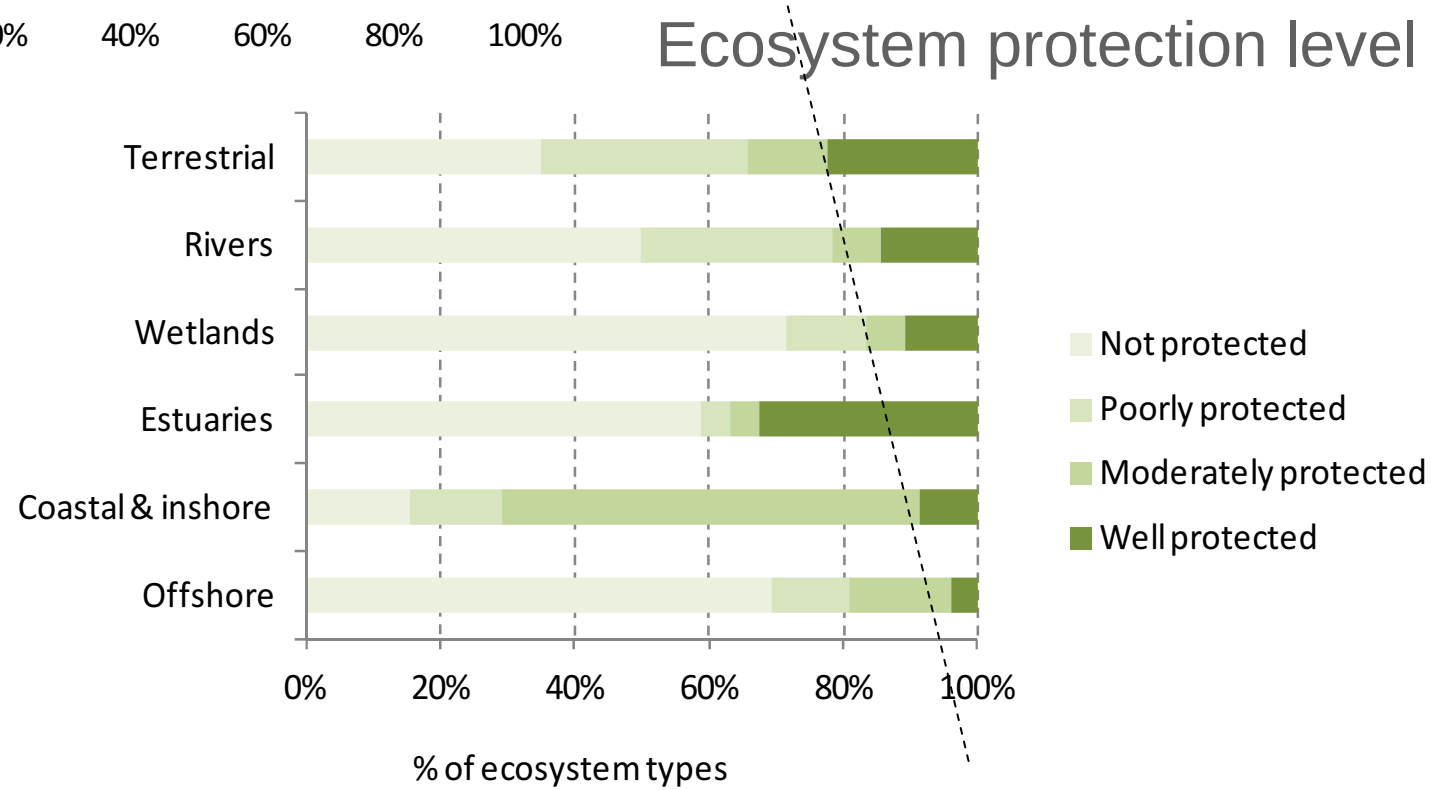


Ecosystem threat status



Powerful indicators that can be simply displayed

Ecosystem protection level



National ecosystem indicators

- Direct links to various policy & legislative tools
- BUT… don’t lend themselves to national accounting
- However, the underlying concepts do, especially:
  - Ecosystem types
  - Ecological condition

Ecosystem types – mapping and classifying ecosystems

- Grouping habitats or natural features into categories with similar characteristics, properties, or functions

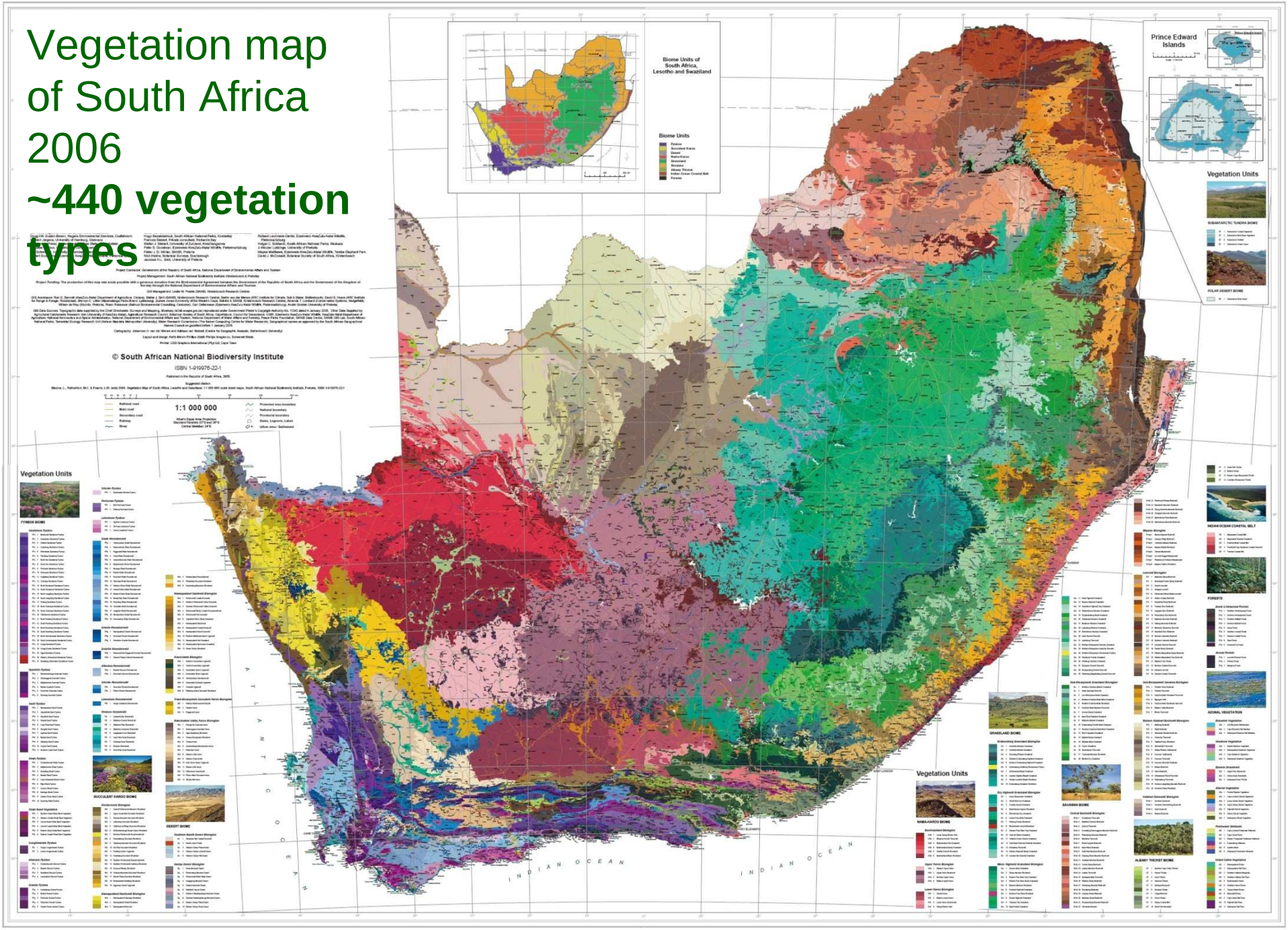
- A way of simplifying the complexity of biodiversity
- Provides a nationally consistent basis for concepts and terminology to be communicated
- Provides a coarse-filter surrogate for biodiversity pattern (species)
- Groups ecologically similar ecosystems so that “rules” can be set up for ecological models

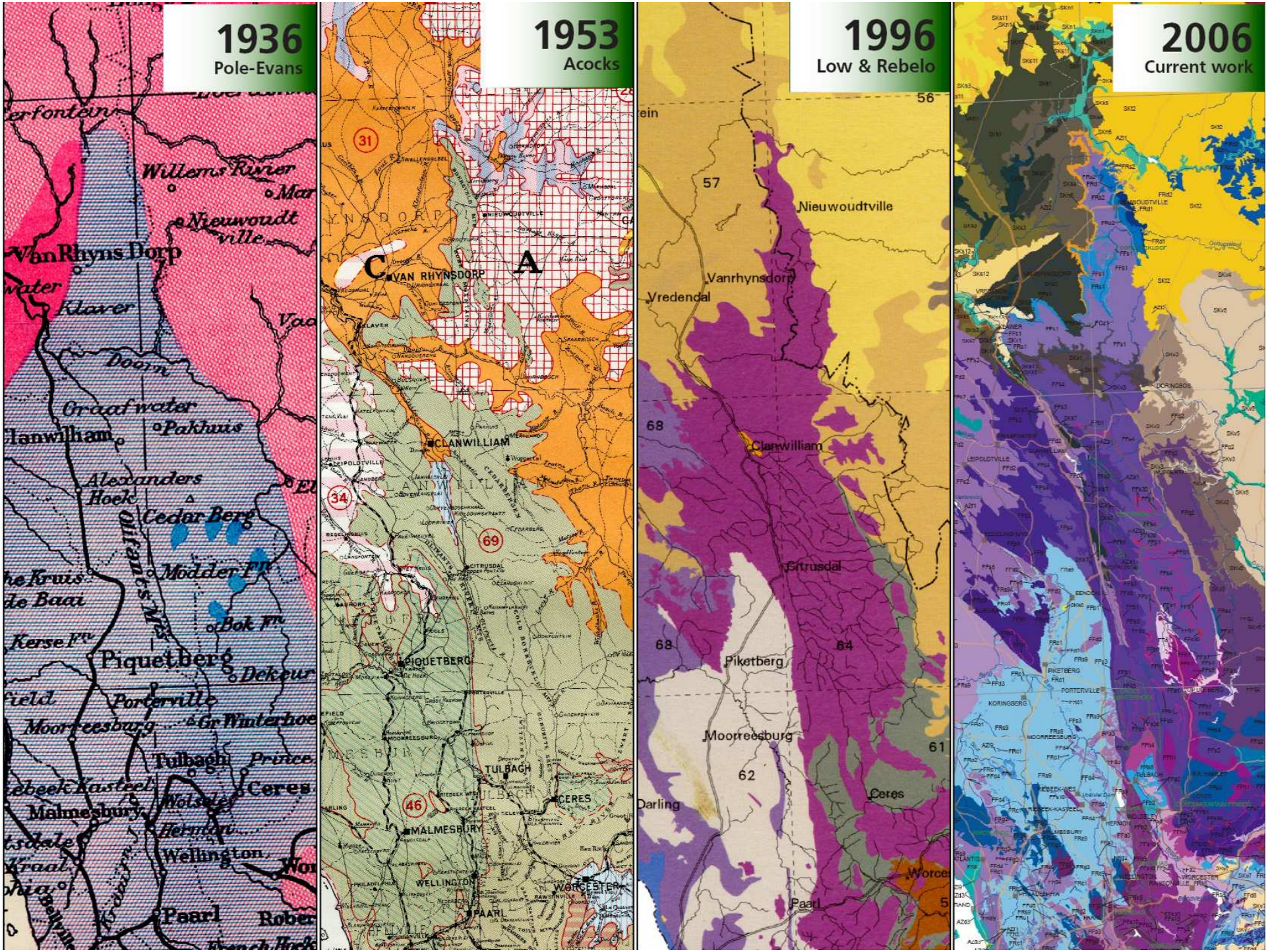
National Ecosystem Classification System (NECS)

- Long history in terrestrial environment → vegetation mapping, going back to 1930s
- More recent progress in aquatic environments, especially in last 10 years

Vegetation map of South Africa 2006

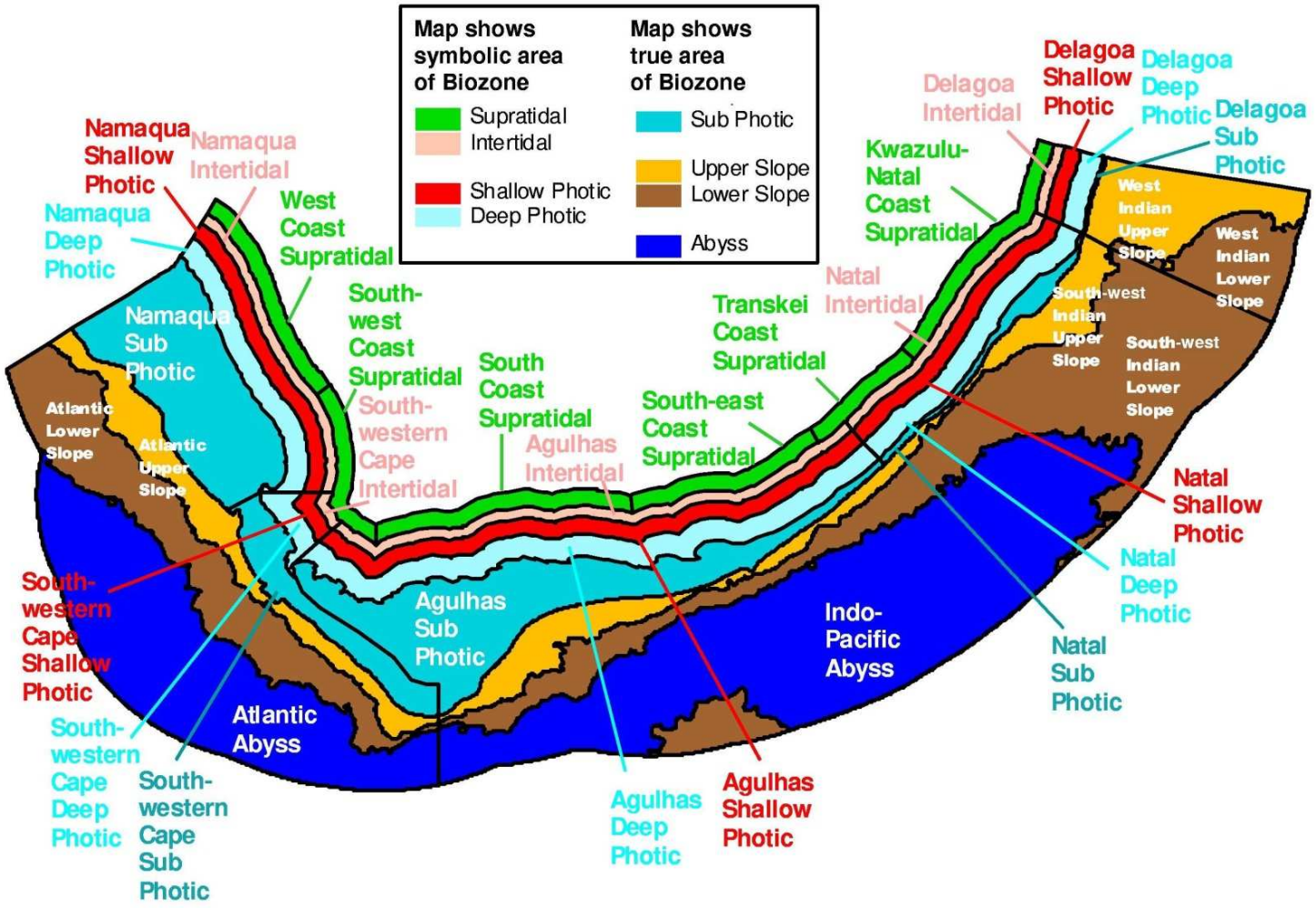
~440 vegetation types



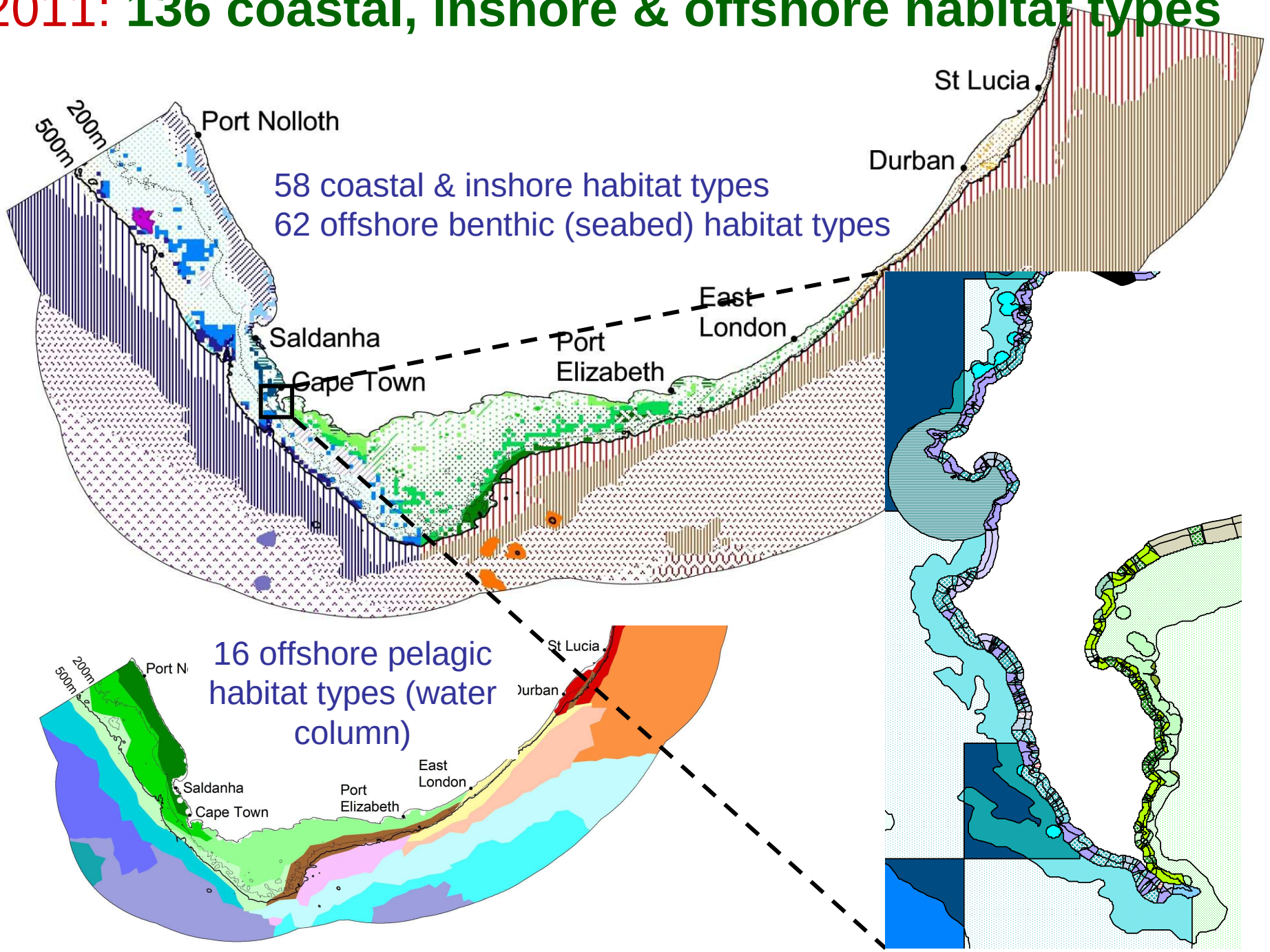

1936
Pole-Evans
1953
Acocks
1996
Low & Rebelo
2006
Current work
Willems River
Nieuwoudtville
Van Rhyns Dorp
Klaver
Doorn
Graafwater
Lanwilham
Pakhuis
Alexanders Hoek
Cedar Berg
Modder Fn
Bok Fn
Piquetberg
Porterville
Moorreesburg
Tulbagh
Ceres
Malmesbury
Wellington
Paarl
VAN RHYNSDORP
CLANWILLIAM
PIQUETBERG
TULBAGH
CERES
MALMESBURY
WELLINGTON
PAARL
WORCESTER
Vanrhynsdorp
Vredendal
Clanwilliam
Citrusdal
Piketberg
Moorreesburg
Ceres
Darling
Paarl

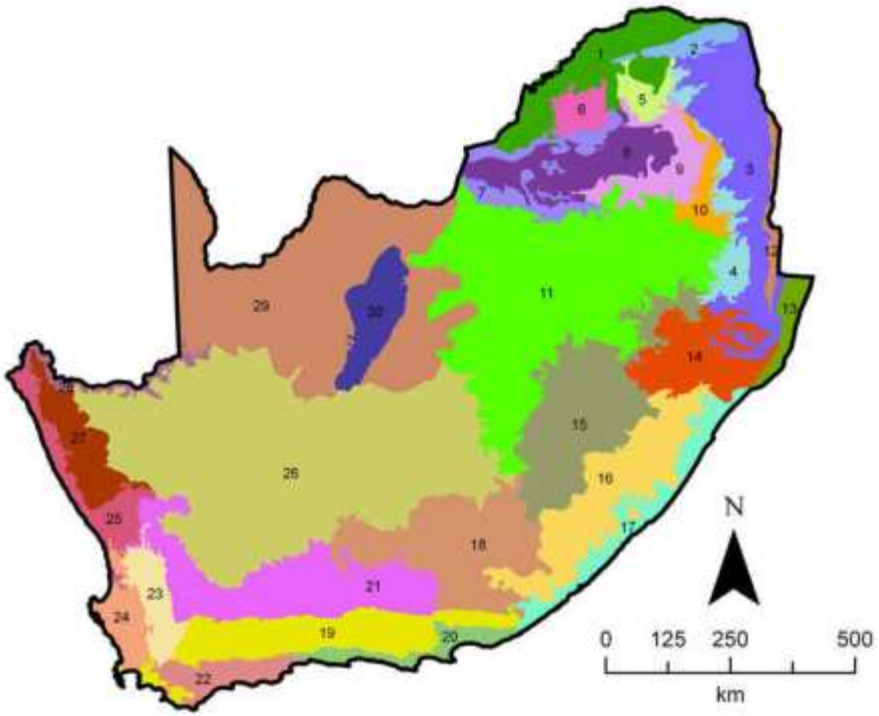
Marine ecosystem types

- From 34 biozones in NSBA 2004…



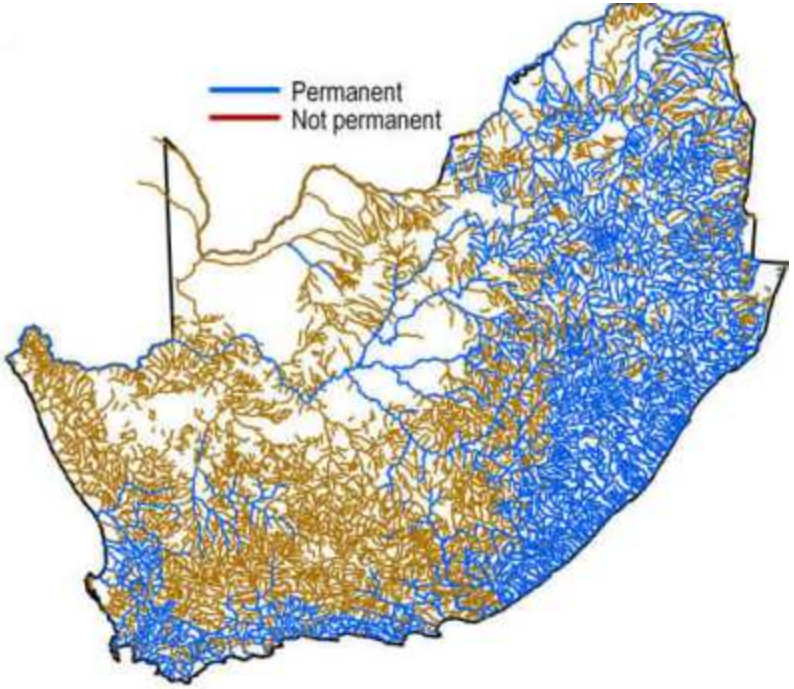
2011: **136 coastal, inshore & offshore habitat types**

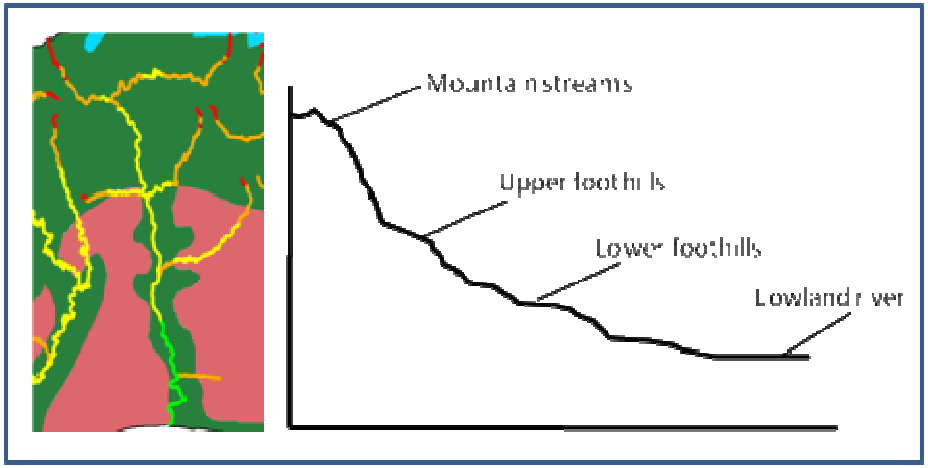




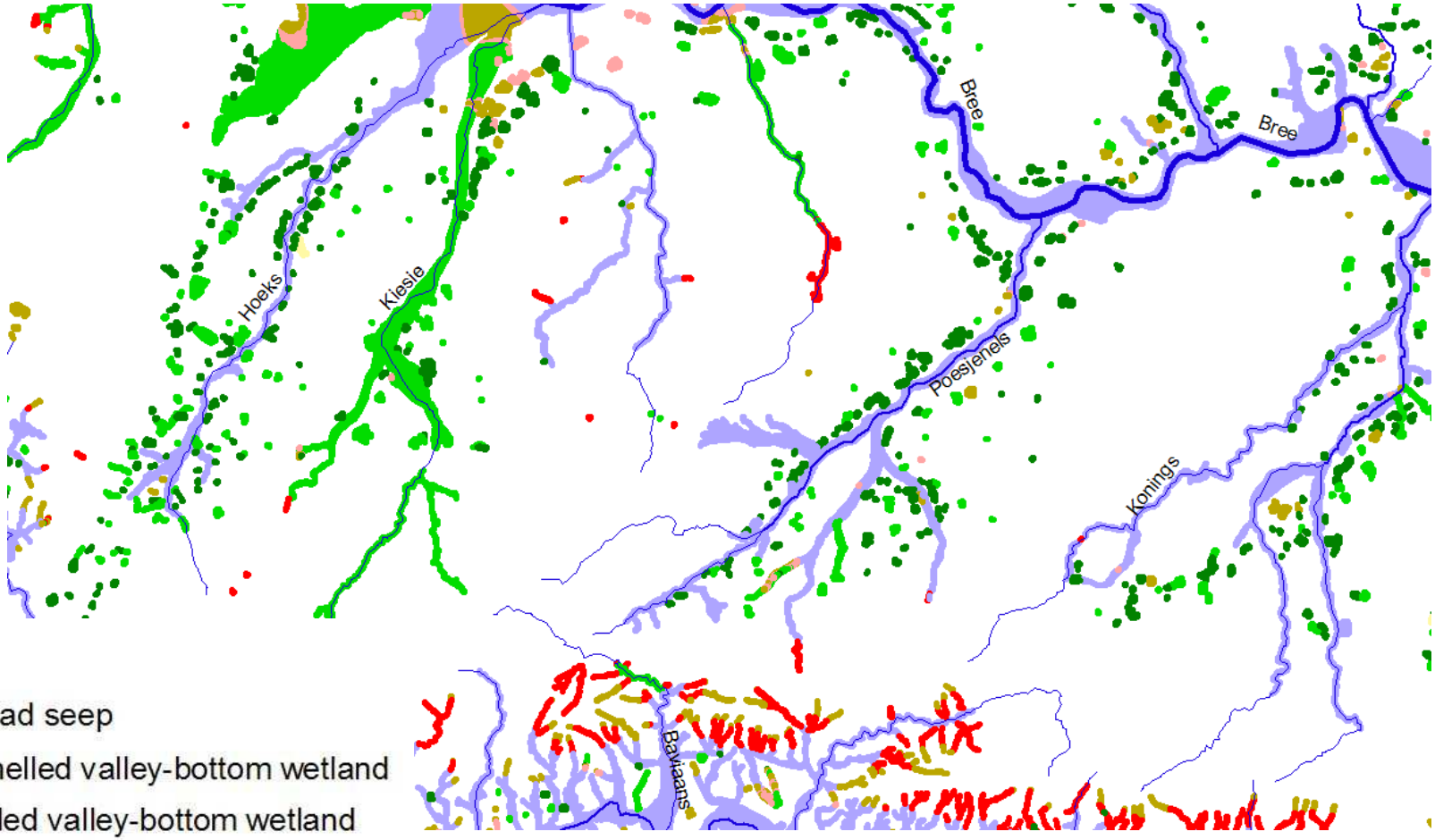
223 river ecosystem types

- 31 Level 1 ecoregions
- 2 flow regime categories
- 4 longitudinal zones





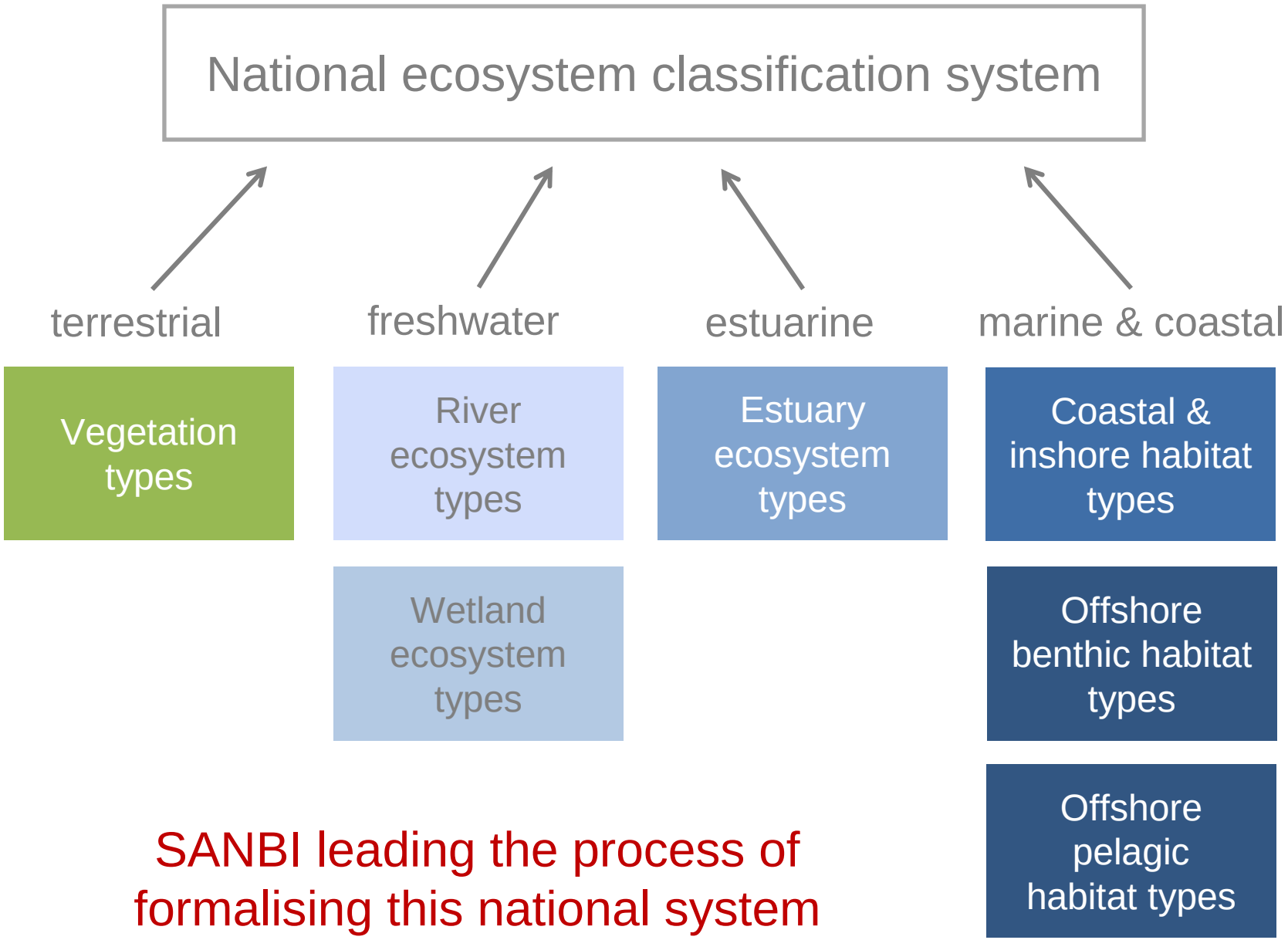
Approx 300 000 wetlands (difficult to map at national scale!) → 792 wetland ecosystem types



- Seep
- Valleyhead seep
- Unchannelled valley-bottom wetland
- Channelled valley-bottom wetland
- Floodplain wetland
- Depression
- Flat

- 7 hydro-geomorphic classes (landscape setting)
- 133 wetland veg groups

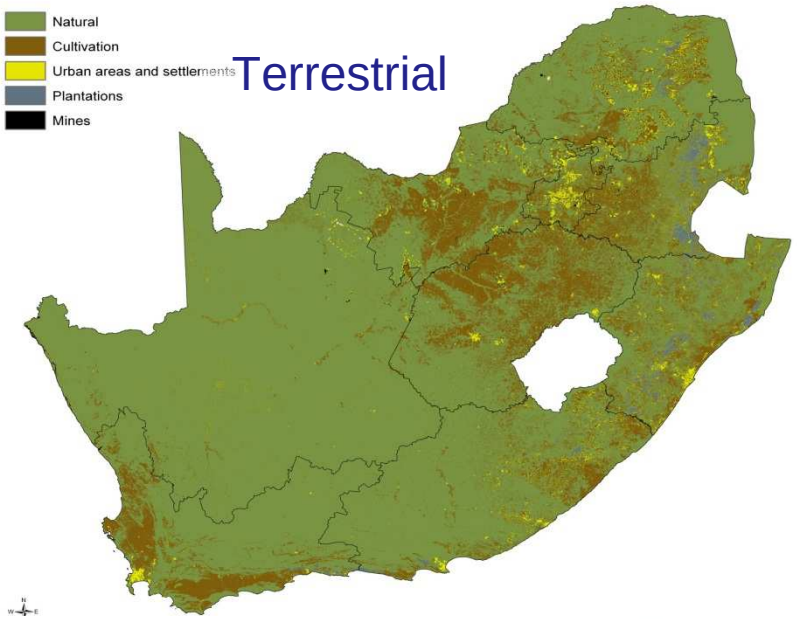
- **NB:** Mapping and classification of ecosystem types is based on pre-colonial /pre-industrial extent of ecosystems – doesn't depend on current land cover / land use / resource use
- Uses various biophysical data layers, ideally combined with ground-truthing of ecosystem types
  - e.g. geology, soil types, rainfall, temperature, altitude, flow variability, longitudinal zones, hydro-geomorphology, biogeography, substrate, depth, wave exposure

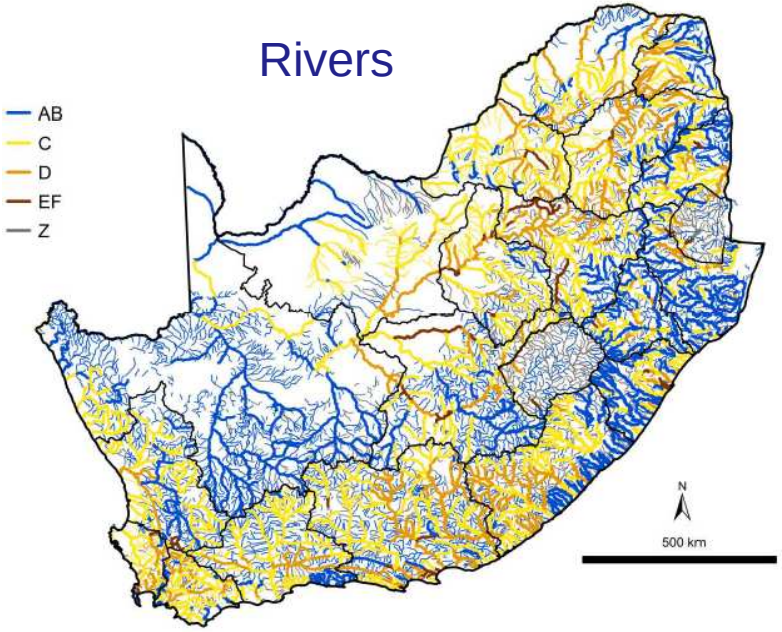

National ecosystem classification system
terrestrial
freshwater
estuarine
marine & coastal
Vegetation types
River ecosystem types
Wetland ecosystem types
Estuary ecosystem types
Coastal & inshore habitat types
Offshore benthic habitat types
Offshore pelagic habitat types
SANBI leading the process of formalising this national system

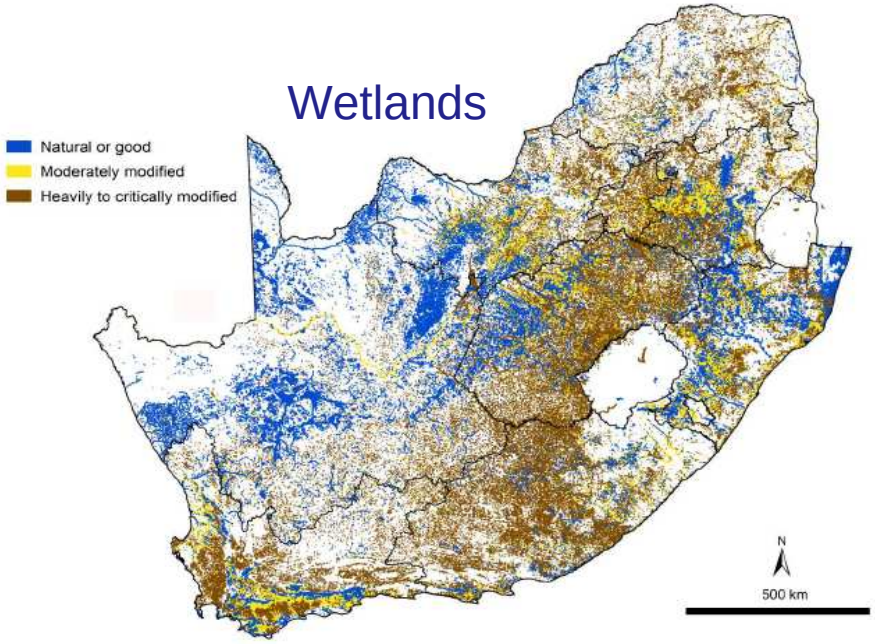
Ecological condition

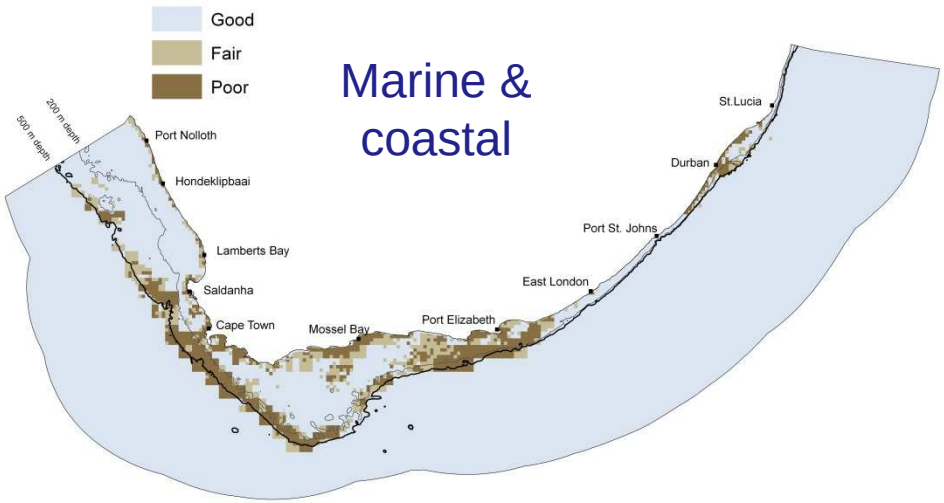
- At the simplest level: good/fair/poor
  - Good → natural/near-natural
  - Fair → moderately modified
  - Poor → severely or irreversibly modified
- Can be applied across terrestrial and aquatic environments
- This is where land cover comes in
- Can combine data and expert input

Maps of ecological condition









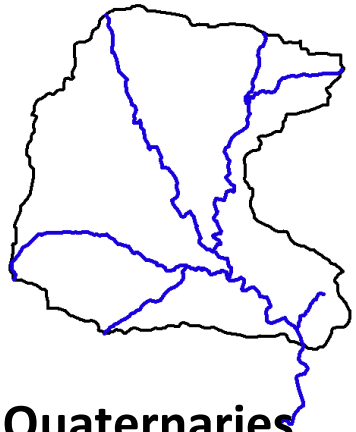
More detail for rivers: Dept of Water Affairs system of ecological condition categories

Ecol condition	Description
A	Unmodified, **natural**
B	**Largely natural**, with few modifications. A small change in natural habitats & biota may have taken place but the ecosystems functions are essentially unchanged
C	**Moderately modified**. A loss and change of natural habitat & biota have occurred but the basic ecosystem functions are still predominantly unchanged
D	**Largely modified**. A large loss of natural habitat, biota & basic ecosystems functions has occurred
E	**Seriously modified**. The loss of natural habitat, biota & basic ecosystems functions is extensive
F	**Extremely modified**. Modifications have reached a critical level & the system has been modified completely with an almost complete loss of natural habitat & biota. Worst instances: the basic ecosystem functions have been destroyed & the changes are irreversible

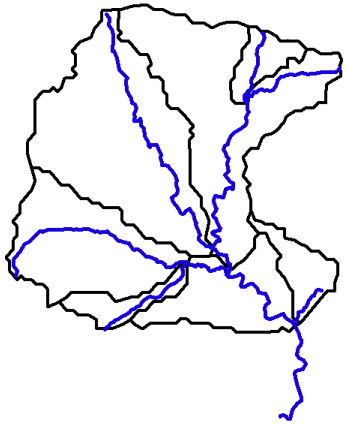
Based on 6 attributes / drivers of condition

- Attributes:
  - Flow (e.g. quantity, timing, velocity)
  - Inundation (dams, weirs, other obstructions in the channel)
  - Water quality
  - Stream bed condition
  - Introduced instream biota
  - Riparian or stream bank condition
- For each attribute:
  - Extent of modification from natural is assessed
  - Based on data and expert input, with a confidence rating

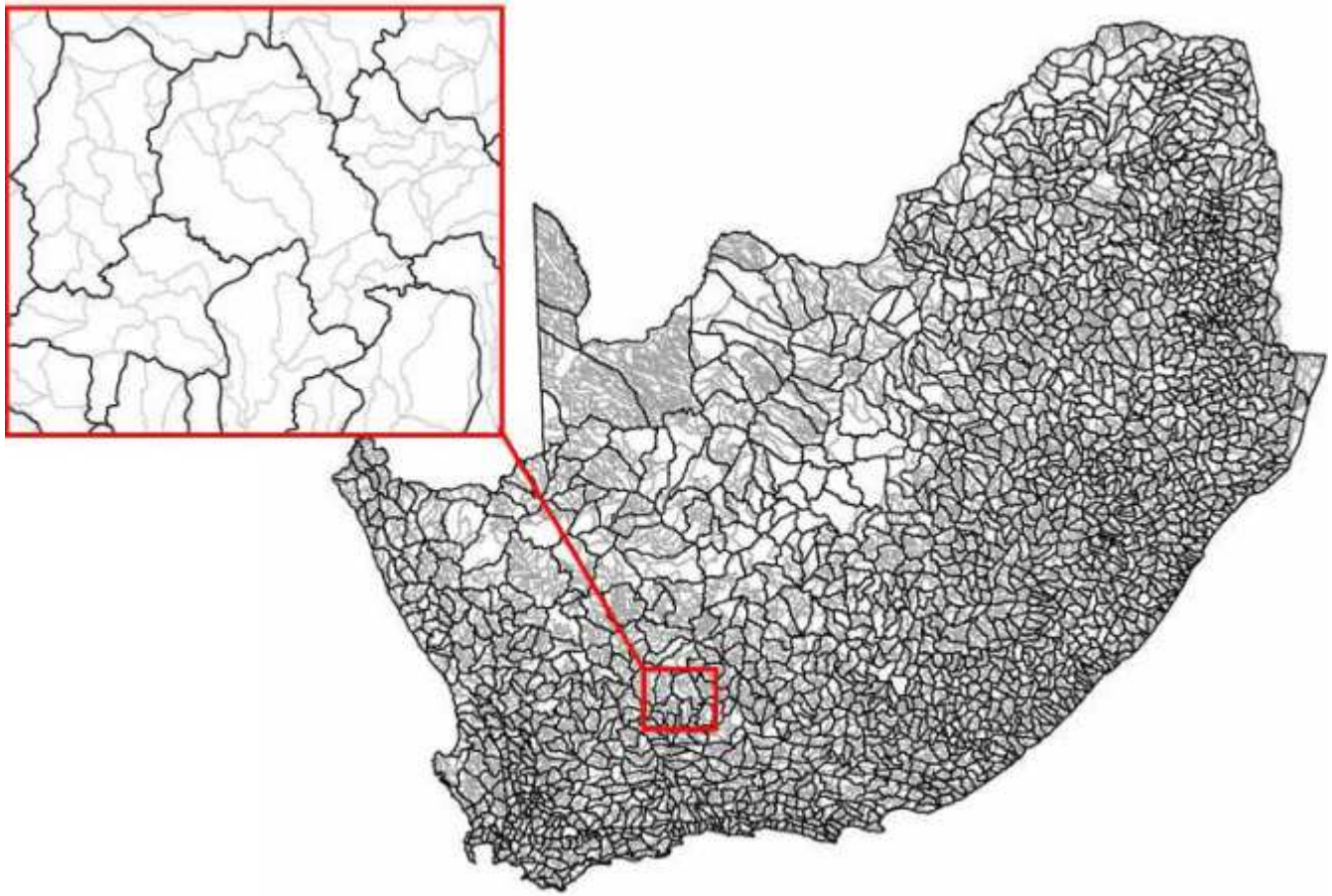
Spatial scale: sub-quaternary catchments



- **Quaternaries**
  Average size ~650 km^2

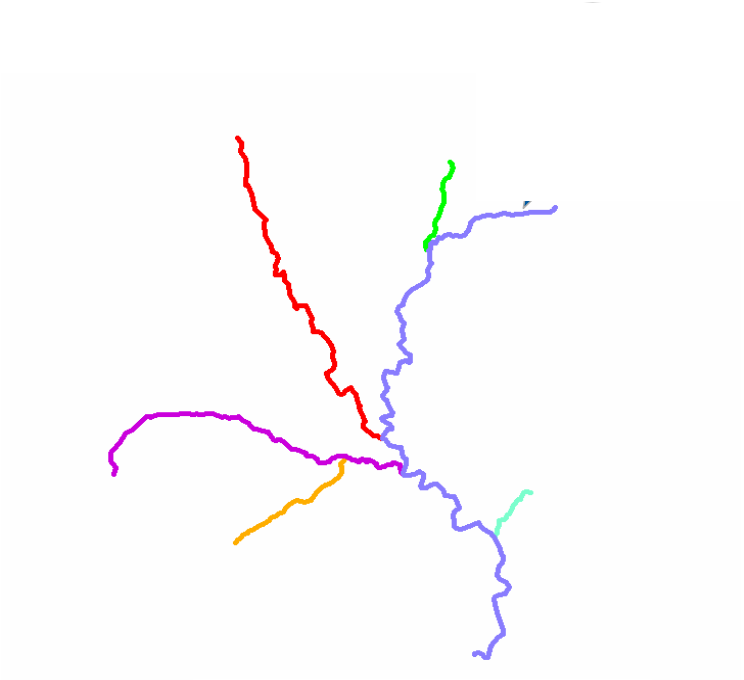


- **Sub-quaternaries** 8547
  Average size ~170 km^2

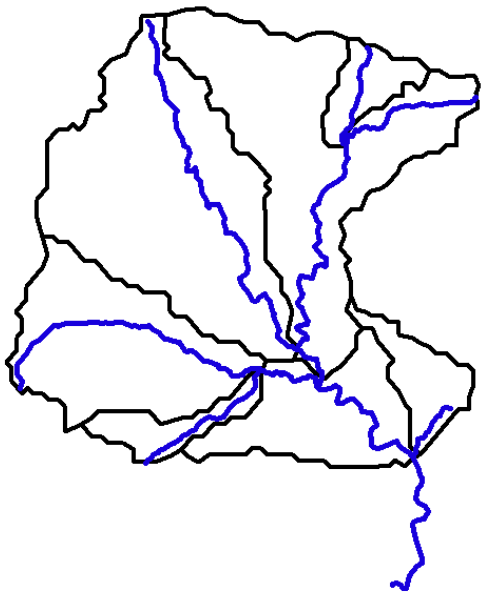


→ Results can be aggregated to a range of scales/units e.g. municipalities, provinces, water management areas

OR river reaches (within sub-quaternary catchments)



River network topology



Sub-quaternaries

National river ecosystem accounts

- Freshwater ecosystems are the most threatened ecosystems in SA – water scarce country
- River ecosystem assets support a range of provisioning, regulating and cultural services
- Dept of Water Affairs has just completed a national revision of ecological condition data for rivers
- Hope to be able to draw links with national water accounts, as well as recent census data on e.g. access to water
- Physical accounts rather than monetary

Application of key EEA concepts

- Basic spatial unit: sub-quaternary catchments
- Ecosystem unit: river ecosystem types
- Ecosystem accounting unit: municipalities, water management areas, or any other set of administrative units

Next steps

- StatsSA & CSIR currently working with data from Department of Water Affairs
- Work session early 2014 to explore initial results
- Discussion document during 2014