# Enhanced Terrestrial and Freshwater Ecological Observation Infrastructure

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science & technology

Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

What research infrastructure do South African ecologists need to remain at the forefront of their field?

# What is it?

**Partnering organisations**
Weather service, hydrology, agriculture etc

**Coordinating office**
System management
Data management
Technical Support
Training
Outreach, communication

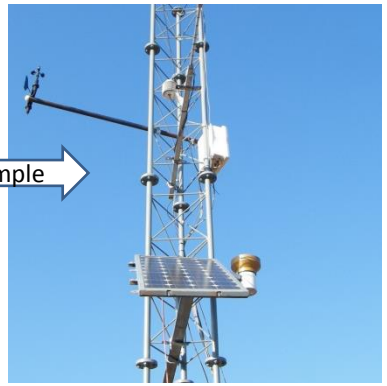
**Users and contributors**
Researchers, graduate students, citizens

Also direct site-level interactions

- **Biome node 1**
  Highly-instrumented
  Reference site
  Site team
- **Biome node 2**
  Eg karoo
- **Biome node 3**
  Eg fynbos
- **Biome node 4**
  Eg grassland
- **Biome node 5**
  Eg Agricultural
- **Biome node 6**
  Eg Urban or mining

~20 lightly instrumented sites per biome, includes experiments and aquatic

example



example

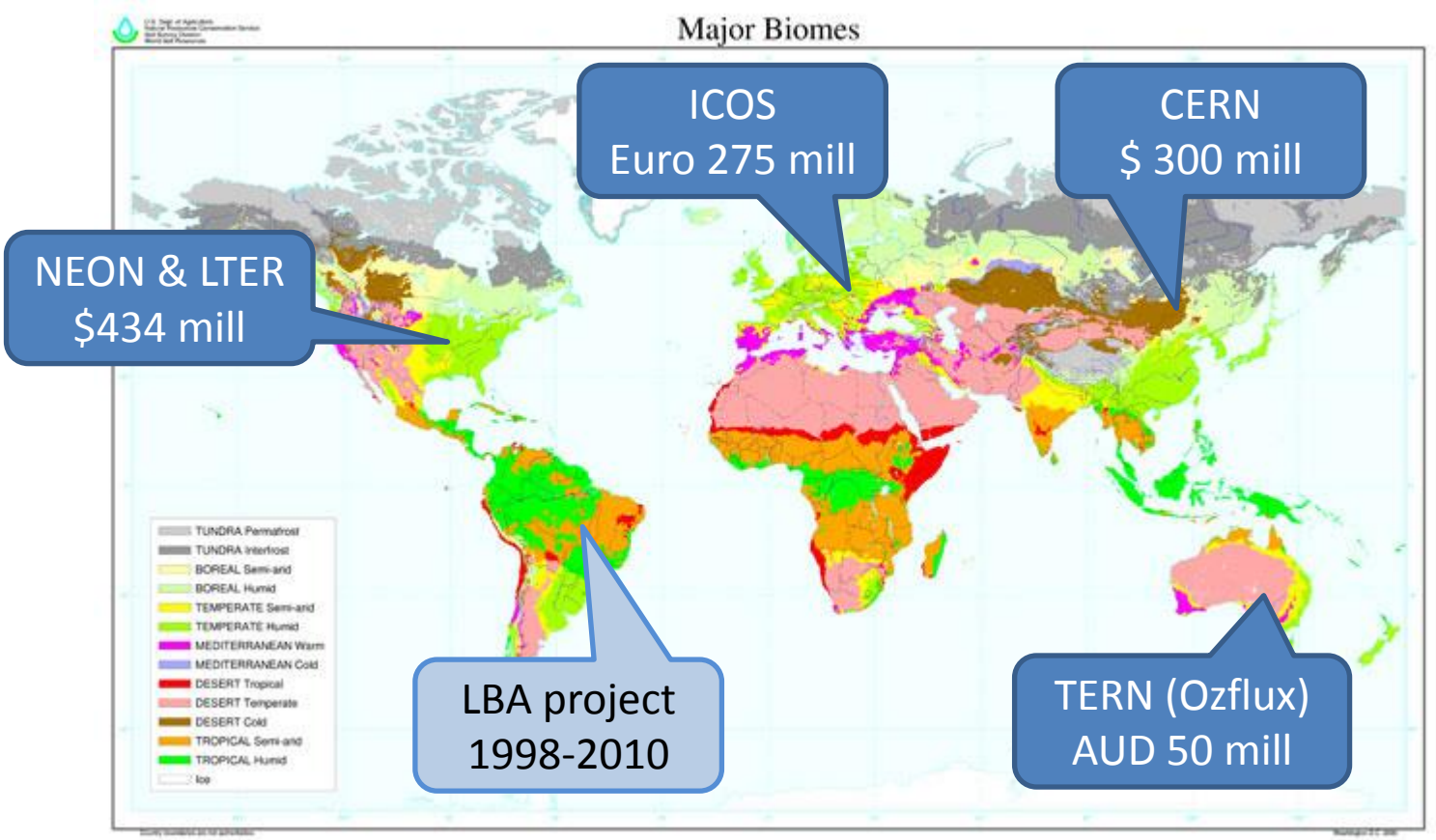
Hundreds of sample locations per biome, some monitored by the network, others by partner organisations. Includes surveys of people living in and using the ecosystems

# What can it do?

- Measure exchange of $CO_2$, $H_20$ , nutrients and energy between atmosphere and land, and between land and water, 24 hours a day, 365 days/y in order to
  - Understand the controls on key ecosystem processes
  - Gain a predictive understanding of global climate change
- Record changes in structure, composition, function, disturbance and use of ecosystems, especially over long periods and landscape scales
- It is a *research infrastructure* rather than a monitoring network, but can contribute to measurements required by national and international law, calibration and validation of remote sensing, testing of models

# Similar infrastructure around the world

## most have started up in the past 5 years



# Comparative advantages

To remain at the cutting edge of ecological research, South African scientists need access to infrastructure comparable to those elsewhere. But we can't compete on expense, so we must compete on innovation:

- Include an experimental component, eg long-term fire trials, experimental catchments
- Integrate land, water and people
- Focus on understudied but important ecosystems

We may join an international consortium as a strategy

# Strategic Importance

- 7% of SA economy rests on natural resources, and almost the whole economy depends on water
- Mega-biodiversity and research history make South Africa leaders in ecological research
  - Key destination for international researchers
- Global and regional change (climate, land use, population, economy) occurs at decadal timescales and multiple-km space scales. To understand them we must study the processes at commensurate scales.

# Local and Global Impact

- **Advance South African ecosystem science** into the ‘big data’ era: large scales, complex issues
  - Expose next generation to methods and concepts
- Provide **local and national policymakers** with guidance, early-warning and predictions relating to natural resources and environment
- Bring **tropical and arid ecosystems** to the same state of knowledge as temperate ecosystems

# Maturity

- Ecosystem-scale science originated~ 1960s
- Recent innovations in instrumentation and computation are opening up exiting new areas
- There is growing consensus worldwide on what needs to be measured and how, and the instrument suppliers are well-established

# Potential for success

- The instrumentation is challenging, but within South African capability
  - Have operated similar systems for a decade
- National policy mandates greater sharing and integration of data collected with public funds
  - The interoperability issues are soluble
  - The inter-agency issues are the key challenge
- The under-studied nature of African ecosystems makes the region a destination of choice for researchers and donors

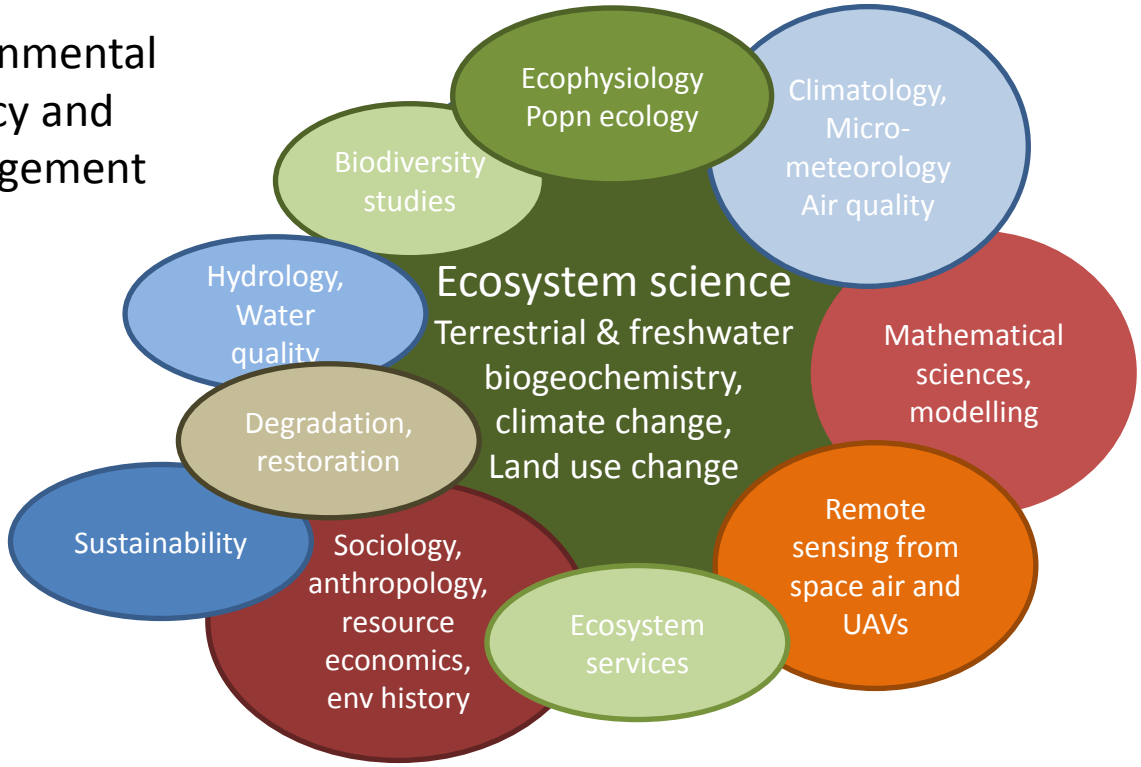
# Policy and Policymakers

- Global change - atmosphere, climate and land use – is a key challenge of our time
  - Need to develop a predictive understanding relevant to our unique environment
  - Informs international, national, provincial and local policies
- Natural resources – water, land, grazing, fuel, biodiversity, air quality…
  - What are the limits to sustainable use?

# Scope and range of science

## Broadly, Environmental Sciences and Global Change

Environmental Policy and Management




Big data informatics computation

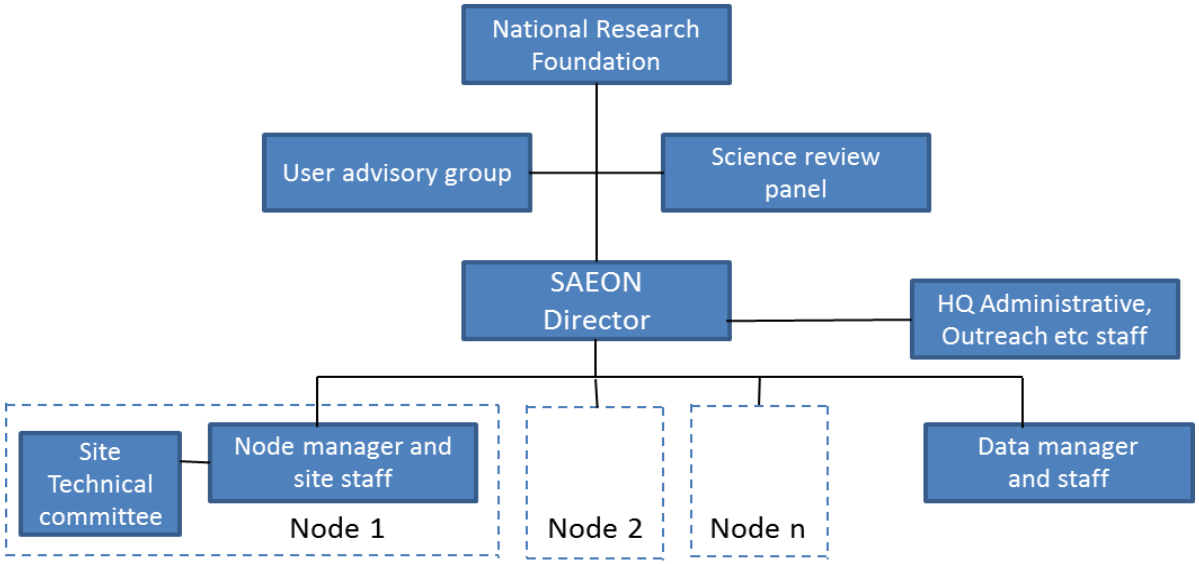
## Innovation and technology transfer

**First time in Africa**

**Solutions for a Green Economy**

**Power and efficiency from integrative synergies**

# Governance and management



# Finances

| | | Per node | Network of nodes | HQ | Total |
|---|---|---|---|---|---|
| **Capital Expediture (once in 10 years)** | | | | | |
| | Sensors, loggers and site-based equipment | 2596528 | 15579170 | 5193057 | 20772226 |
| | Data and communication infrastructure | 15000 | 90000 | 130000 | 220000 |
| | Supporting infrastructure: buildings, roads | 100000 | 600000 | | 600000 |
| | Vehicles | 400000 | 2400000 | 400000 | 2800000 |
| | | | | | **24392226** |
| **Operating Expenses (per year)** | | | | | |
| | Consumables | 10000 | 60000 | 20000 | 80000 |
| | Transport and travel | 160000 | 960000 | 100000 | 1060000 |
| | Stakeholder outreach meetings | 30000 | 180000 | 100000 | 280000 |
| | Governance meetings | 25000 | 150000 | 150000 | 300000 |
| | Maintenance | 261153 | 1566917 | 20000 | 1586917 |
| | Upgrades | 52231 | 313383 | 20000 | 333383 |
| | Data purchases: imagery and in situ | 42000 | 252000 | 500000 | 752000 |
| | Broadband | 7200 | 43200 | 24000 | 67200 |
| | Office rental | 120000 | 720000 | 480000 | 1200000 |
| | Insurance | 155576 | 933458 | 6500 | 939958 |
| | | | | | **6599459** |
| **Facility-related Human Resources (per year)** | | | | | |
| | Managers | 700000 | 4200000 | 1900000 | 6100000 |
| | Facility scientists/professionals | 500000 | 3000000 | 1300000 | 4300000 |
| | Administrative | 250000 | 1500000 | 500000 | 2000000 |
| | Technicians | 1500000 | 9000000 | 2100000 | 11100000 |
| | | | | | 23500000 |
| **Annual operating total** | | | | | 30099459 |
| **Total for 10 year operation, CAPEX plus operating** | | | | | **421127021** |

NEON, ICOS R9.3-10.9 million/site/y
This proposal R7 mill/site/y

# Summary

3 Compelling reasons to do this

- **reduced uncertainty** about the consequences of a world changing both as a result of global atmospheric and climate changes, and local land- and water-use changes;
- leverage South African **comparative advantage** based on ecological diversity to enhance and transform its world-class ecological research status;
- impetus to **integrate** and revolutionize existing currently underperforming and fragmented investments in environmental observation and prediction.

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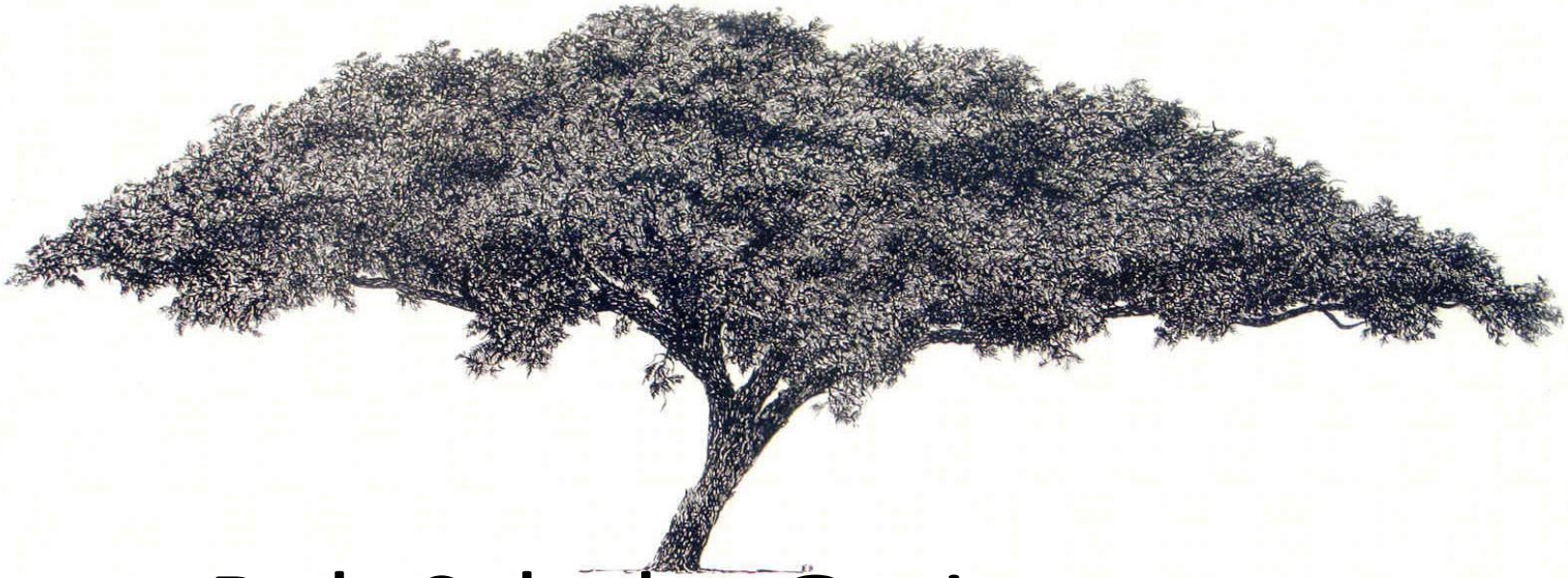

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