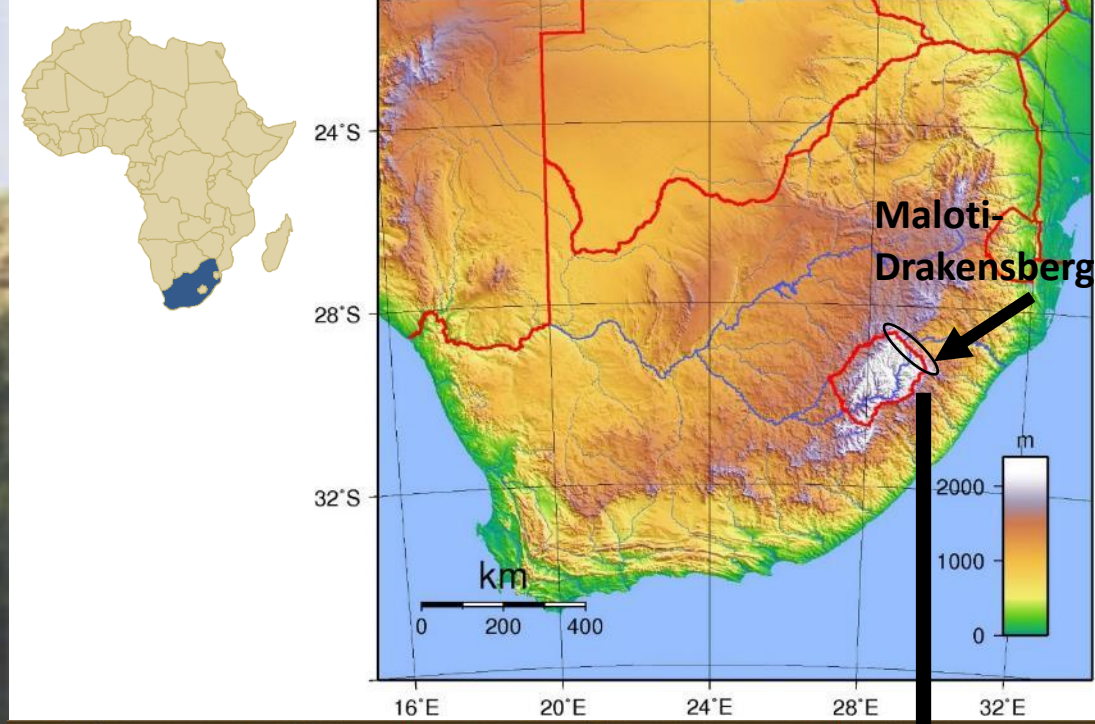
Re-Establishing the Cathedral Peak Research Catchments, South Africa as a Long Term Observation Platform

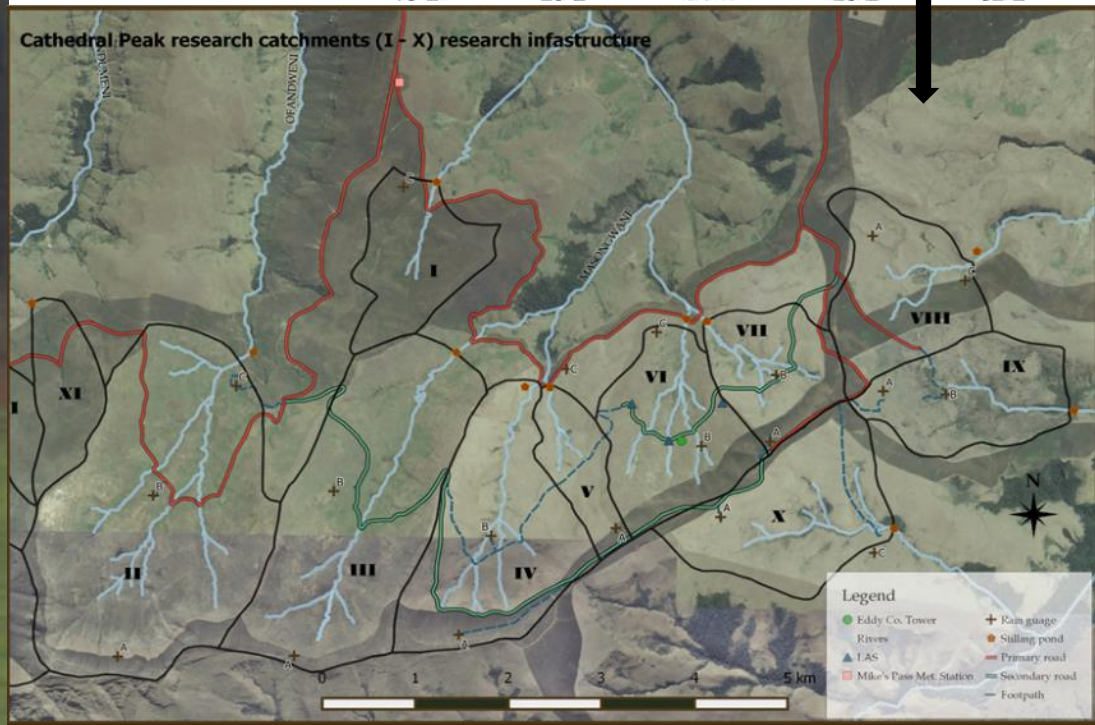
Michele Toucher, Susan Janse Van Rensburg, Byron Gray, Kent Lawrence and Siphiwe Mfeka

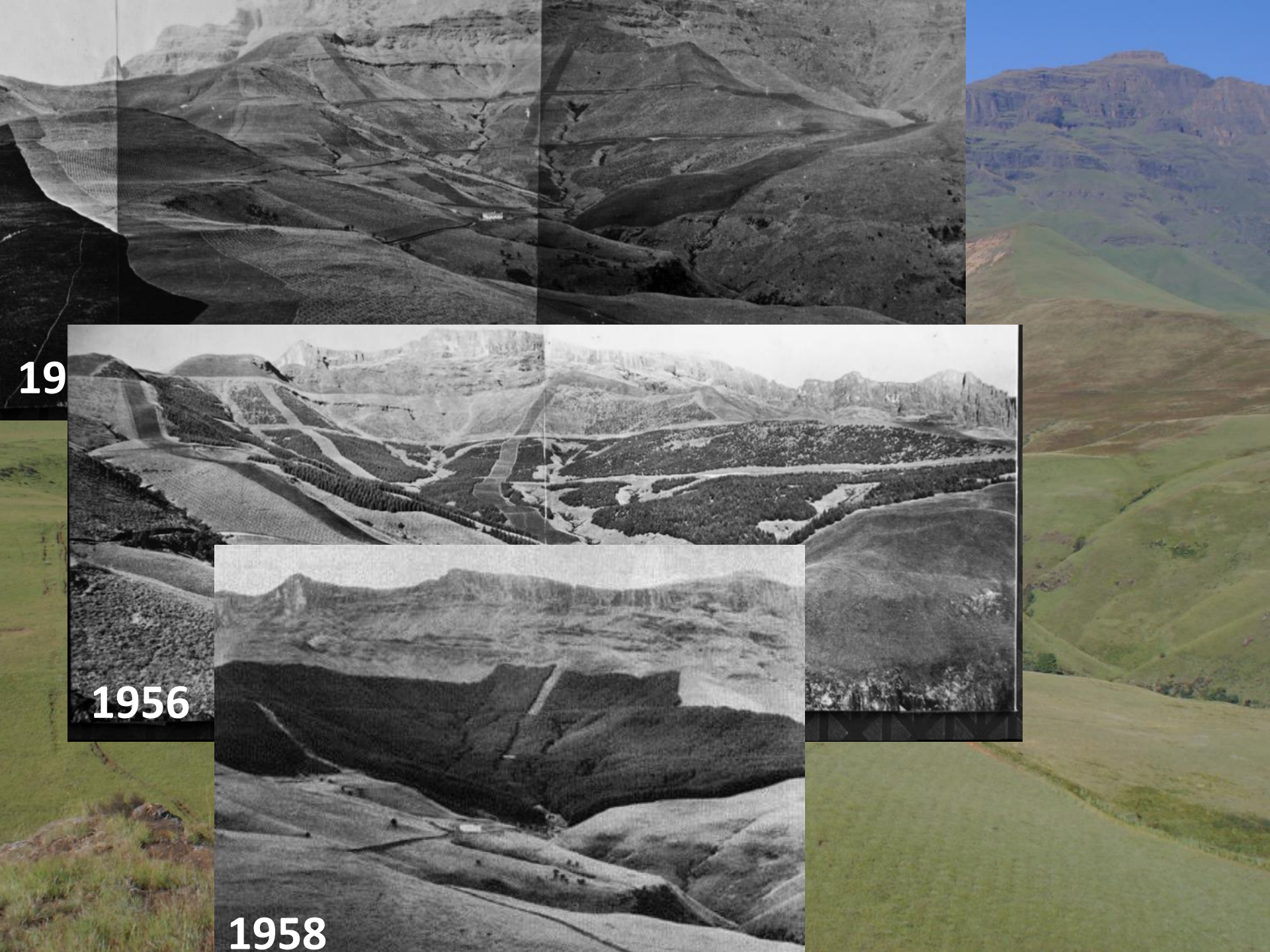
NRF National Research Foundation
SAEON South African Environmental Observation Network
UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI
CWRR

CATHEDRAL PEAK CATCHMENTS (est. 1945)

- 1850 - SA forestry enthusiasts promoted idea that tree planting would increase amount of rain in dry areas
- By 1880's – starting to question
- 1900's –become entrenched that forests stopped erosion & conserved water
- 1923 - Drought Investigation Commission – agreed with views
- 1935 – British Empire Forestry conference (Durban, South Africa)
  - Public & scientific criticism of forestry
  - Gathered support for research programme and establishment of Jonkershoek and Cathedral Peak research catchments

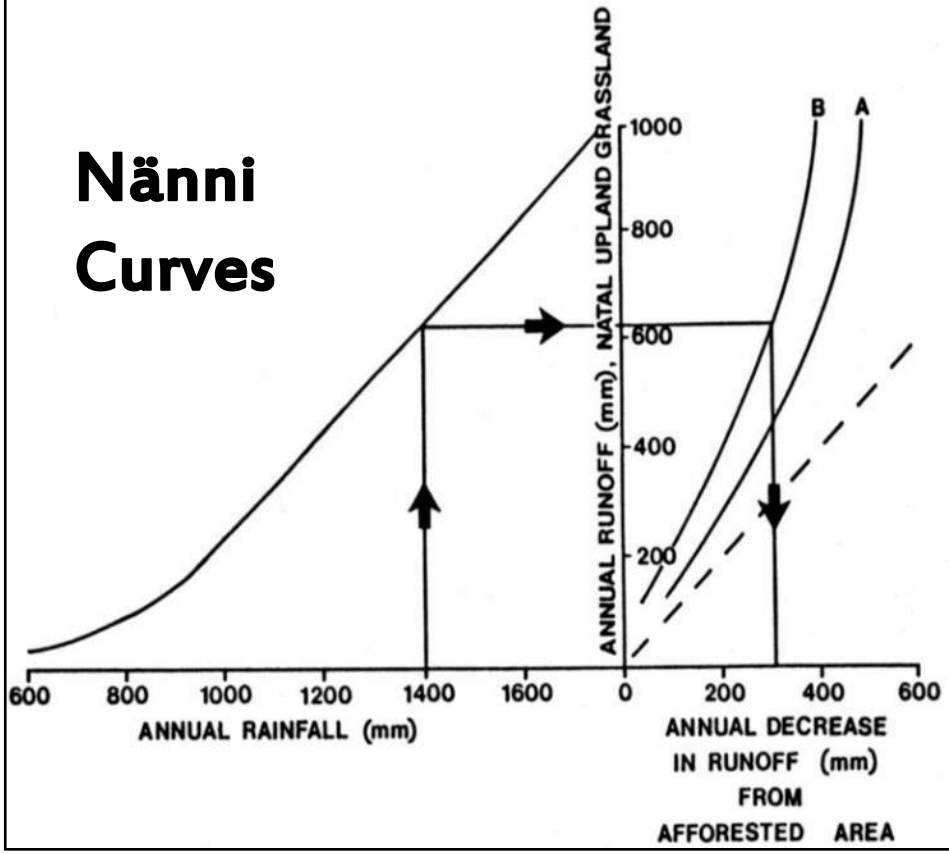





19
1956
1958

Impact of research in Cathedral Peak catchments

- Clear policy lessons for afforestation.
  - Forestry restricted to regions with higher rainfall.
  - Sites for afforestation should be chosen and managed with care.

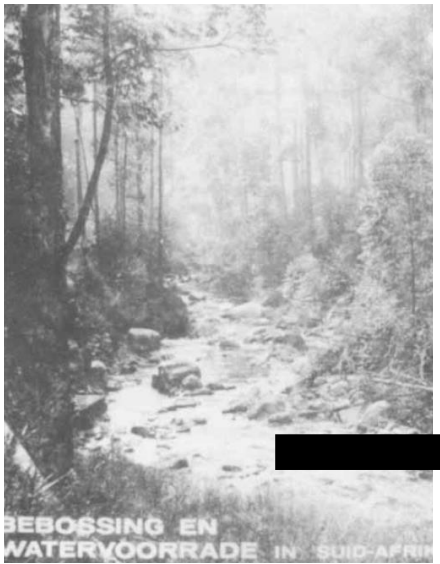


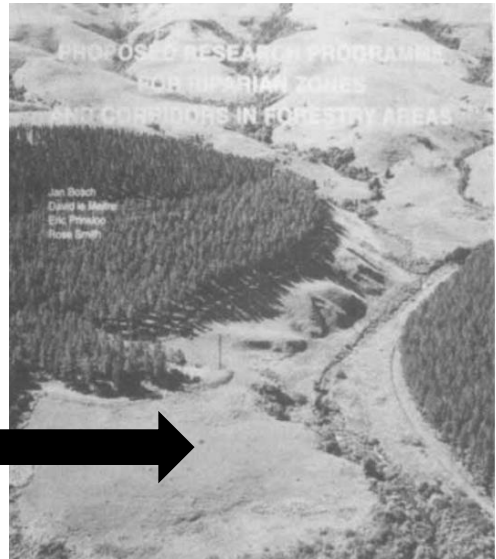
Policy Uptake

Afforestation Permit System 1968

↓

National Water Act 1998





MORE RECENTLY

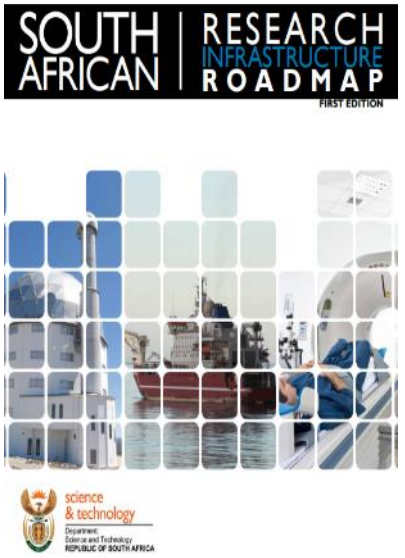
Recognition of the value of long term observation and monitoring by national Government.

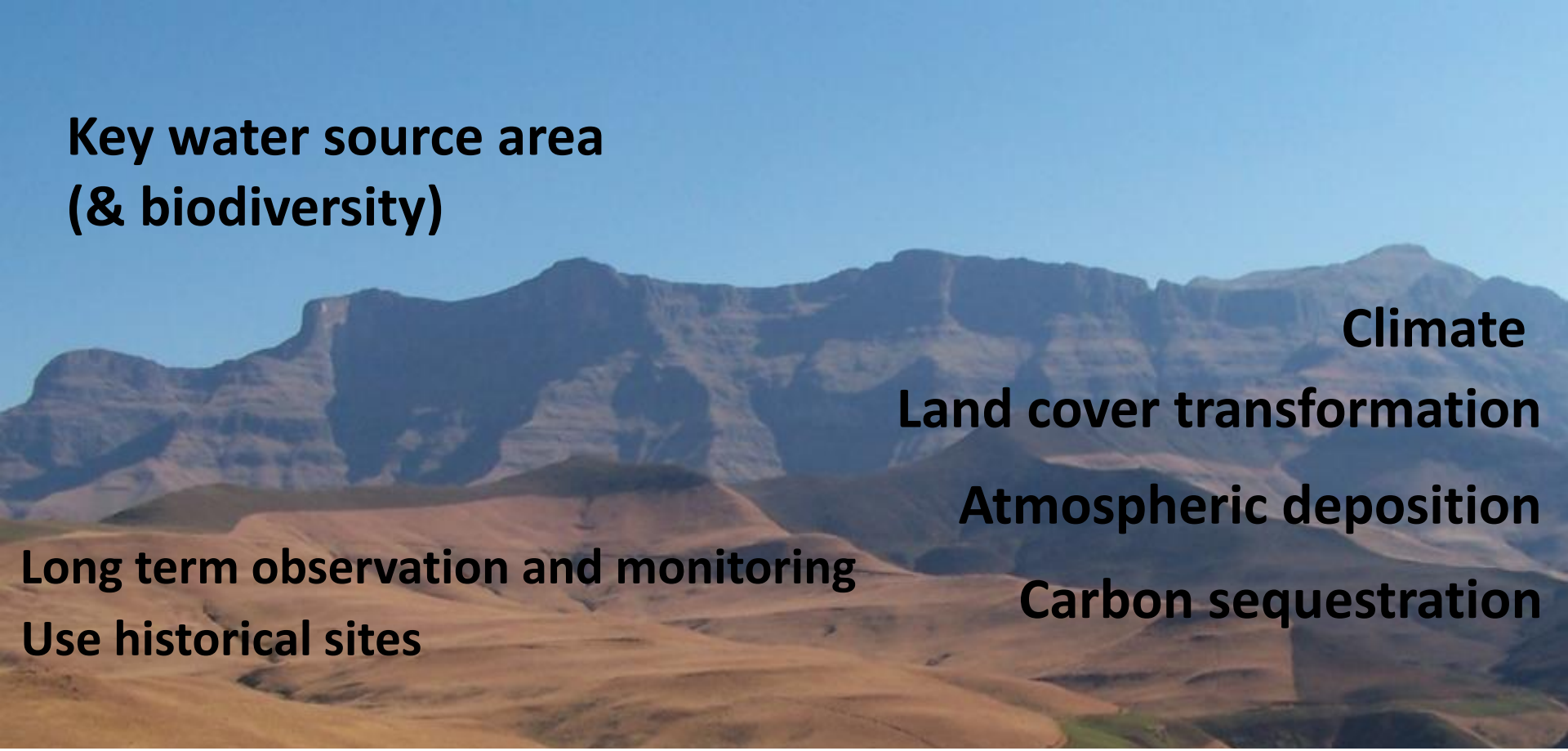
DST Global Change Grand Challenge (Research plan 2008 – 2018)

Understanding a changing planet	Reducing the human footprint	Adapting the way we live	Innovation for sustainability
1. Observation, monitoring and adaptive management 2. Dynamics of the oceans around southern Africa 3. Dynamics of the complex internal earth systems 4. Linking the land, air and sea 5. Improving model predictions at different scales	1. Waste minimisation methods and technologies 2. Conserving biodiversity and ecosystem services, e.g. clean drinking water 3. Institutional integration to manage ecosystems and ecosystem services	1. Preparing for rapid change and extreme events 2. Planning for sustainable urban development in a South African context 3. Water security for South Africa 4. Food and fibre security for South Africa	1. Dynamics of transition at different scales - mechanisms of innovation and learning 2. Resilience and capability 3. Options for greening the developmental state

Significant government investment into expanding research infrastructure

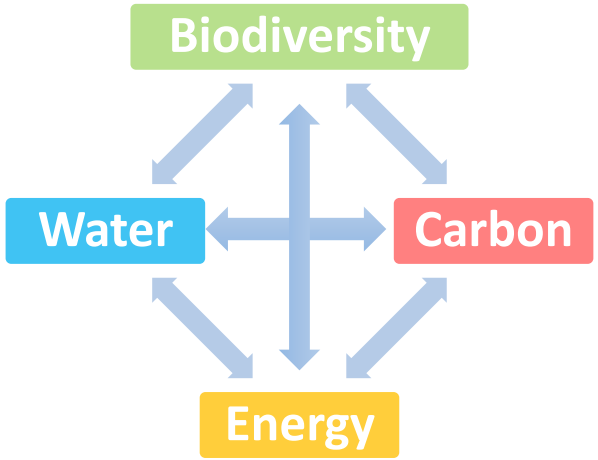
Projected investment of R95.5 Million over the next five years





Designed to

- **Understanding interactions and feedbacks in an integrated manner.**
- **Allow for comparisons with historical data.**



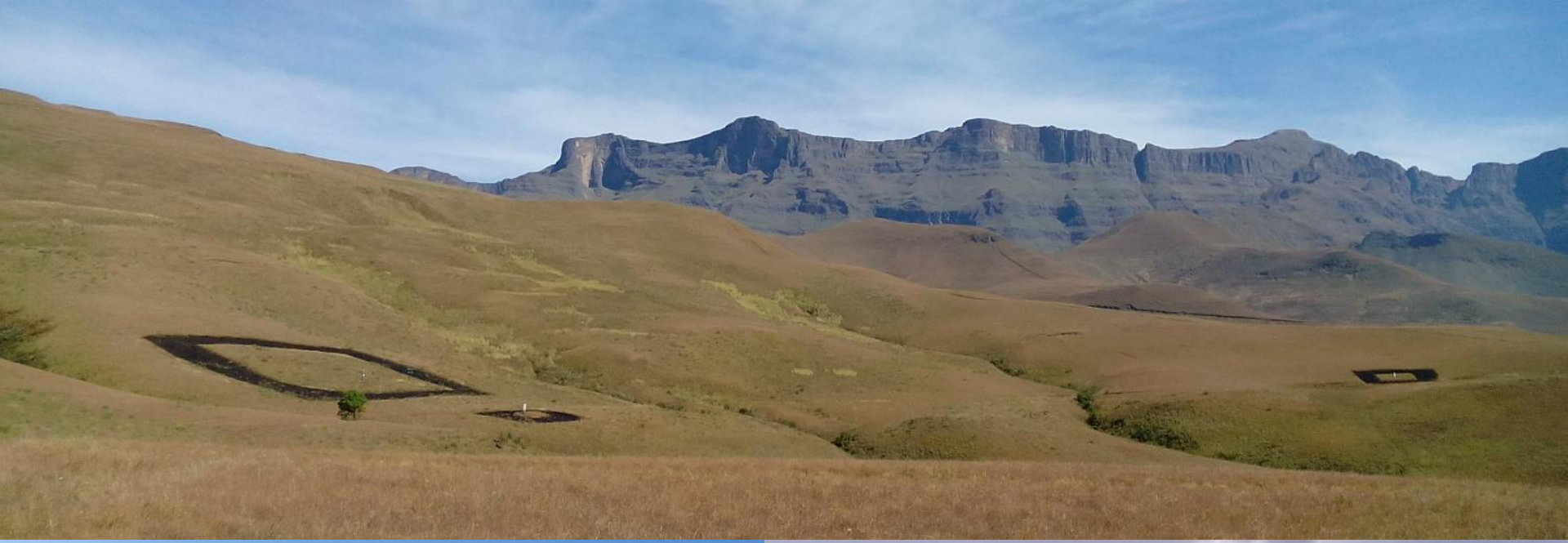
Catchment state in 2011

Catchment state in 2013

To understand the interactions and feedbacks, the catchments have been densely instrumented. Within an approximately 8 km^2 area:

- 3 meteorological station (and a high altitude station outside this area)
- 36 Raingauges
- 6 Streamflow gauges
- Water quality:
  - 3 ISCO water sampler
  - 2 Spectral probes
- Evaporation (incl. radiation & albedo):
  - 1 Eddy Covariance flux tower (includes CO_2)
  - 2 Surface renewal systems
- Warming chambers
- Fire disturbance records
- Repeat vegetation surveys plots
- Monthly Leaf Area Index

- Soil Water
  - Cosmic Ray Probe
  - 3 pits of TDR soil water probes to 1.6 m
  - Monthly Diviner readings at 18 points through catchment
- Soil respiration:
  - LiCor-8100 Soil Respiration System
  - Monthly manual gas extraction collars



LIVING LABORATORY

EZEMVELO KZN WILDLIFE

access
Applied Centre for Climate & Earth Systems Science

SASSCAL
Southern African Science Service Centre for Climate Change and Adaptive Land Management

NRF National Research Foundation | SAEON South African Environmental Observation Network

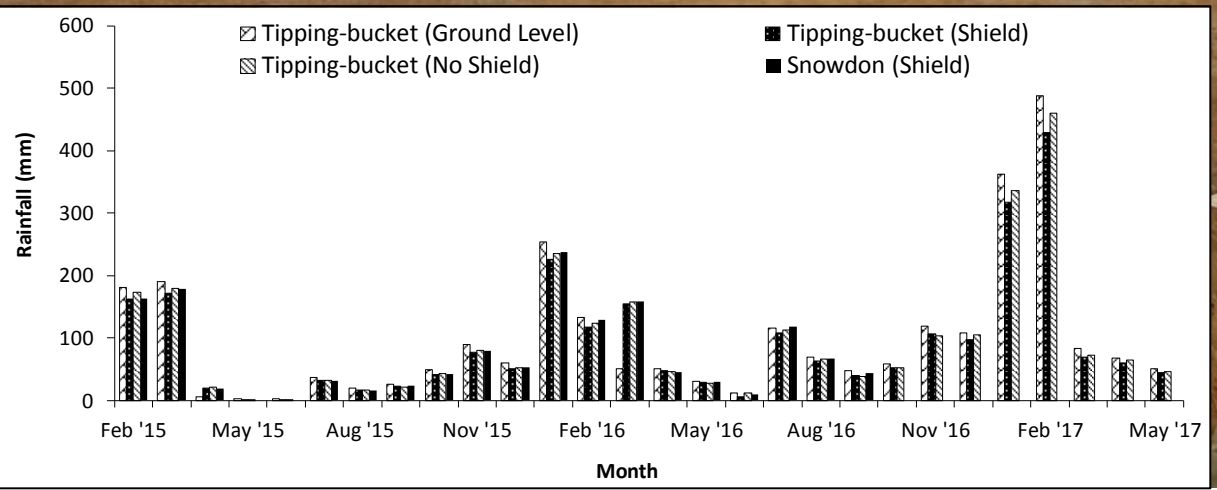
WATER RESEARCH COMMISSION

science & technology
Department: Science and Technology
REPUBLIC OF SOUTH AFRICA

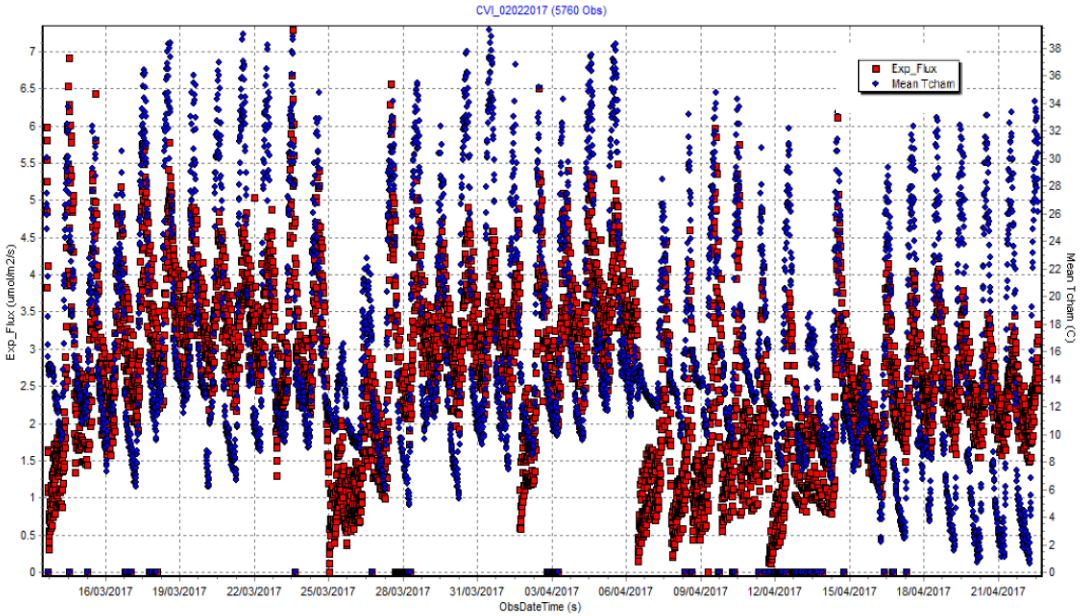
environmental affairs
Department: Environmental Affairs
REPUBLIC OF SOUTH AFRICA

Challenges

..—Gauge erected perpendicular to slope of ground. (Note
experimental compound gauge in background.)

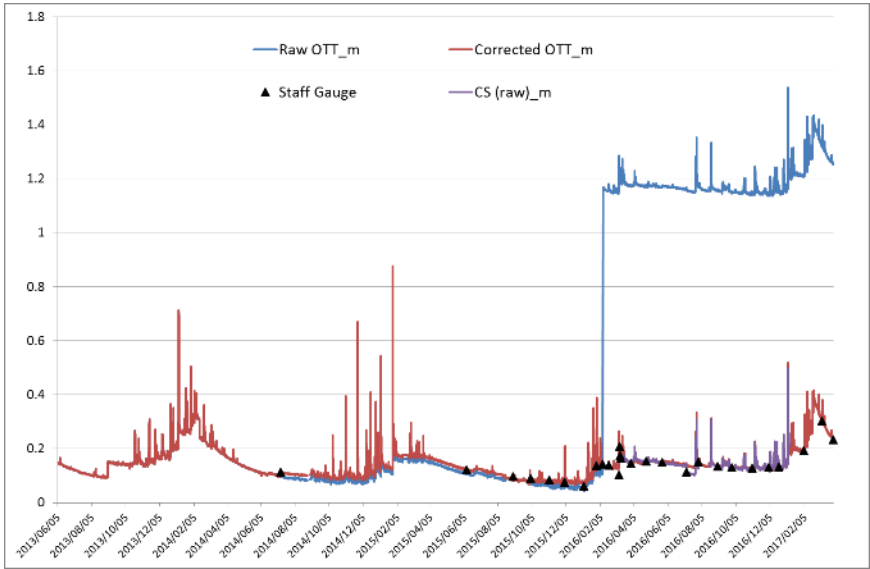

Tipping-bucket (Ground Level)
Tipping-bucket (Shield)
Tipping-bucket (No Shield)
Snowdon (Shield)
Rainfall (mm)
600
500
400
300
200
100
0
Feb '15
May '15
Aug '15
Nov '15
Feb '16
May '16
Aug '16
Nov '16
Feb '17
May '17
Month

Data management



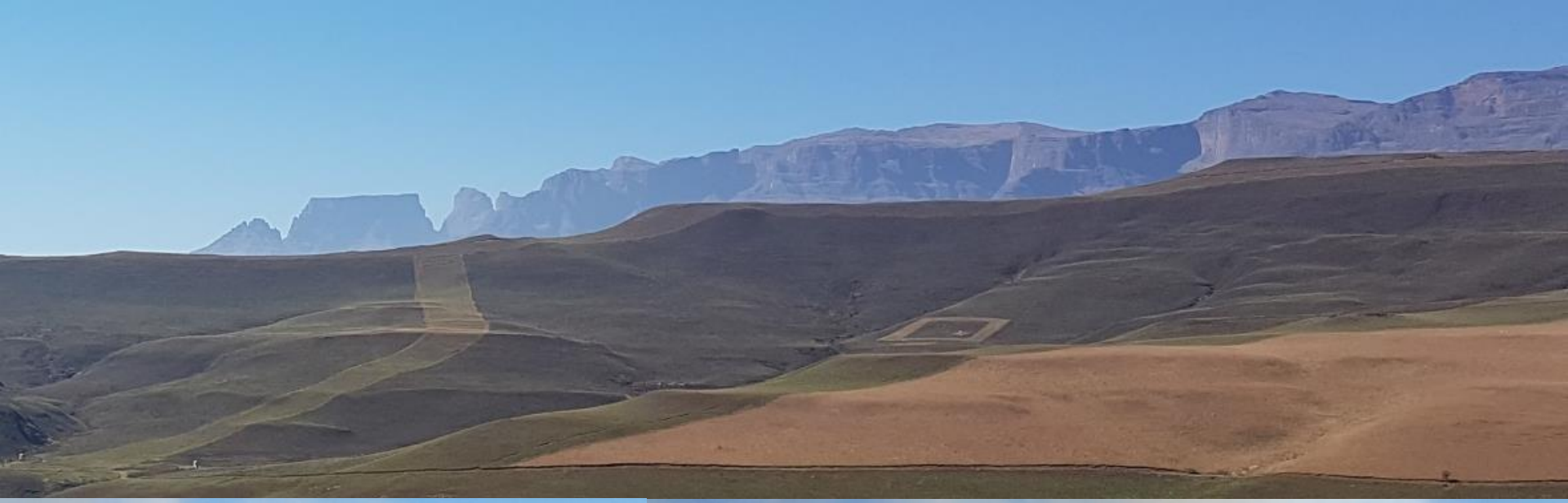
Quantity

- Monitoring started before database development
- Variety of data types
- Internet connectivity



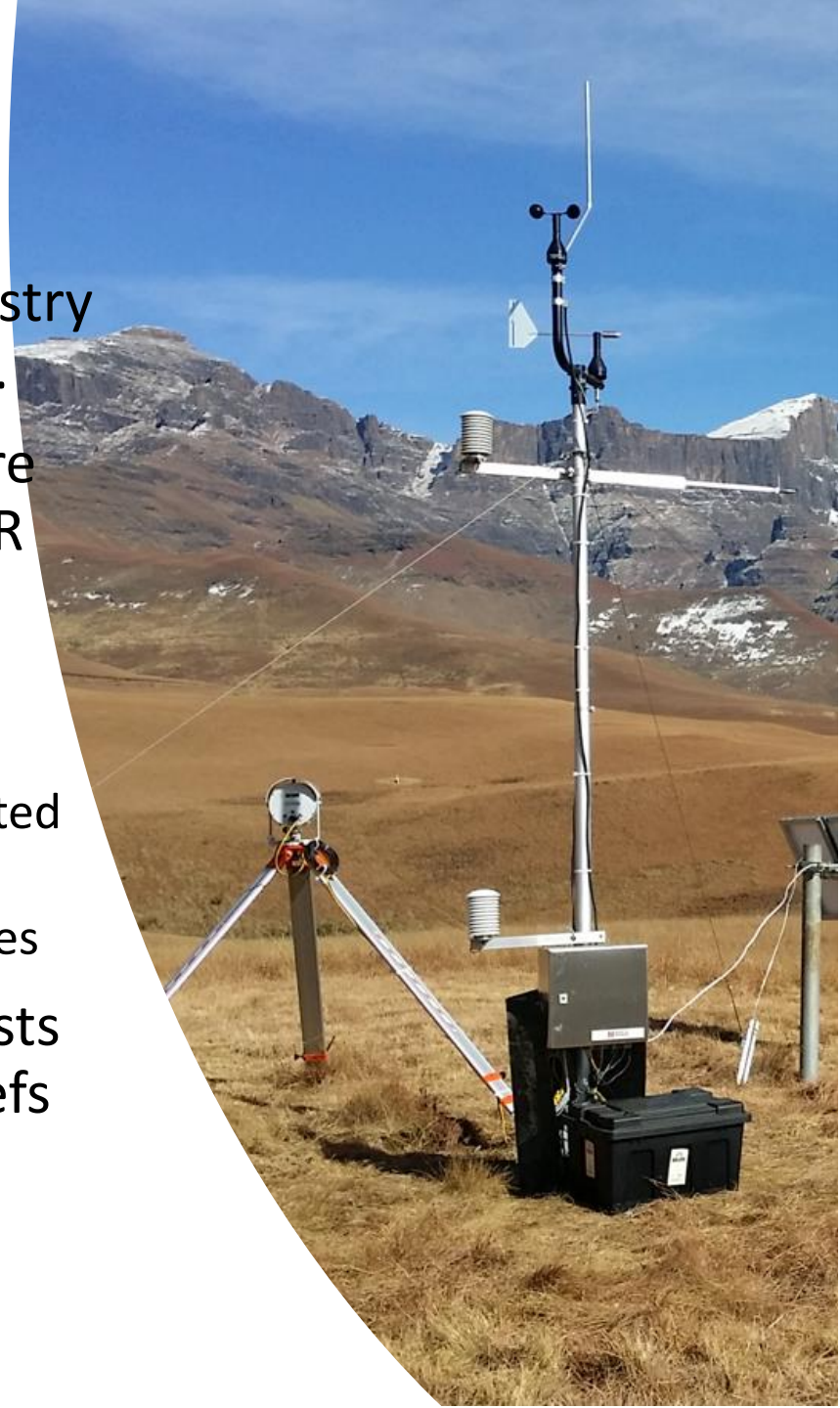
Quality

- Standard operating procedures
  - In-field protocols
  - Quality controls and checks
  - Metadata
- International standards



Conclusions

- The influence and benefit of the forestry influences catchments persists today.
- Consider lessons from those to ensure same influence and benefit from LTER sites:
  - Long history of trust in research
  - Thoroughness and patience
  - Research was strategic – planned, directed and relevant
  - Research undertaken by the state entities
- Relationship between funder, scientists and industry – better than policy briefs



ACKNOWLEDGEMENTS

WATER RESEARCH COMMISSION

science & technology
Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

NRF
National Research Foundation

SASSCAL
Southern African Science Service Centre for Climate Change and Adaptive Land Management

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

EZEMVELO KZN WILDLIFE
Conservation, Partnerships & Ecotourism

access
Applied Centre for Climate & Earth Systems Science

LINKS

Mike's Pass AWS – http://lognet.saeon.ac.za:8088/Mikes_Pass/index.html
Vulture's Retreat AWS – http://lognet.saeon.ac.za:8088/HiAlt/index.html
Cathedral Peak CRP – http://cosmos.hwr.Arizona.edu/Probes/StationDat/093/index.php
SAEON website – http://www.saeon.ac.za/
CWRR - http://cwrr.ukzn.ac.za/homepage