

# SAEON Cathedral Peak global change monitoring platform - update on activities

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- Tension
  - Development-sustainability
  - Global change

→ Ons is in die K..

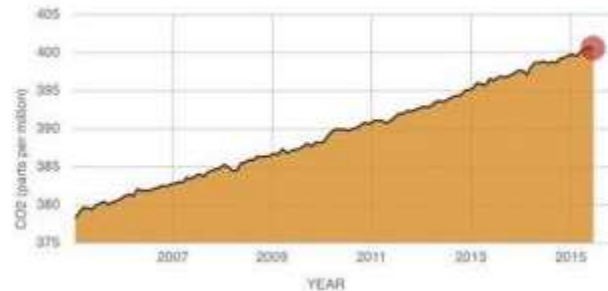
## Advice

- Cross discipline-collaborative
- Science excellence
- Long term data
- Networked approach

# SAEON's Mandate

- Human induced Global Change
- *In situ* long term observation
- ↓ Uncertainty

→ Sustainable development



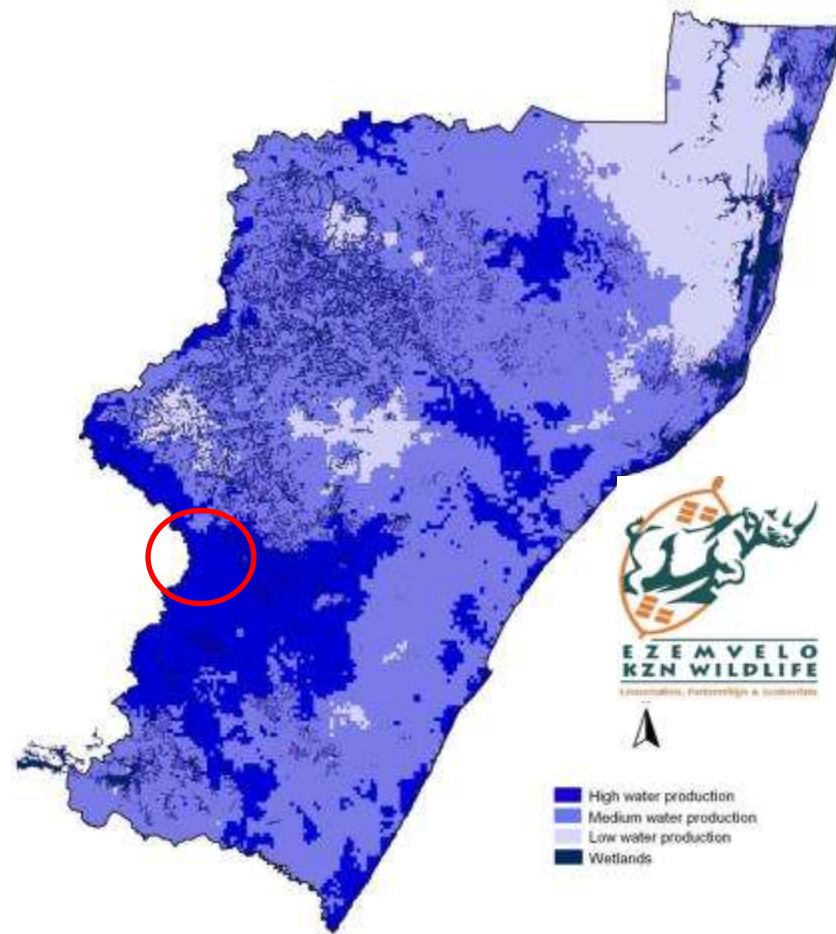


- Approach
  - Progress since 2011
  - Cool science
- **Opportunities & input**

# Why CP?

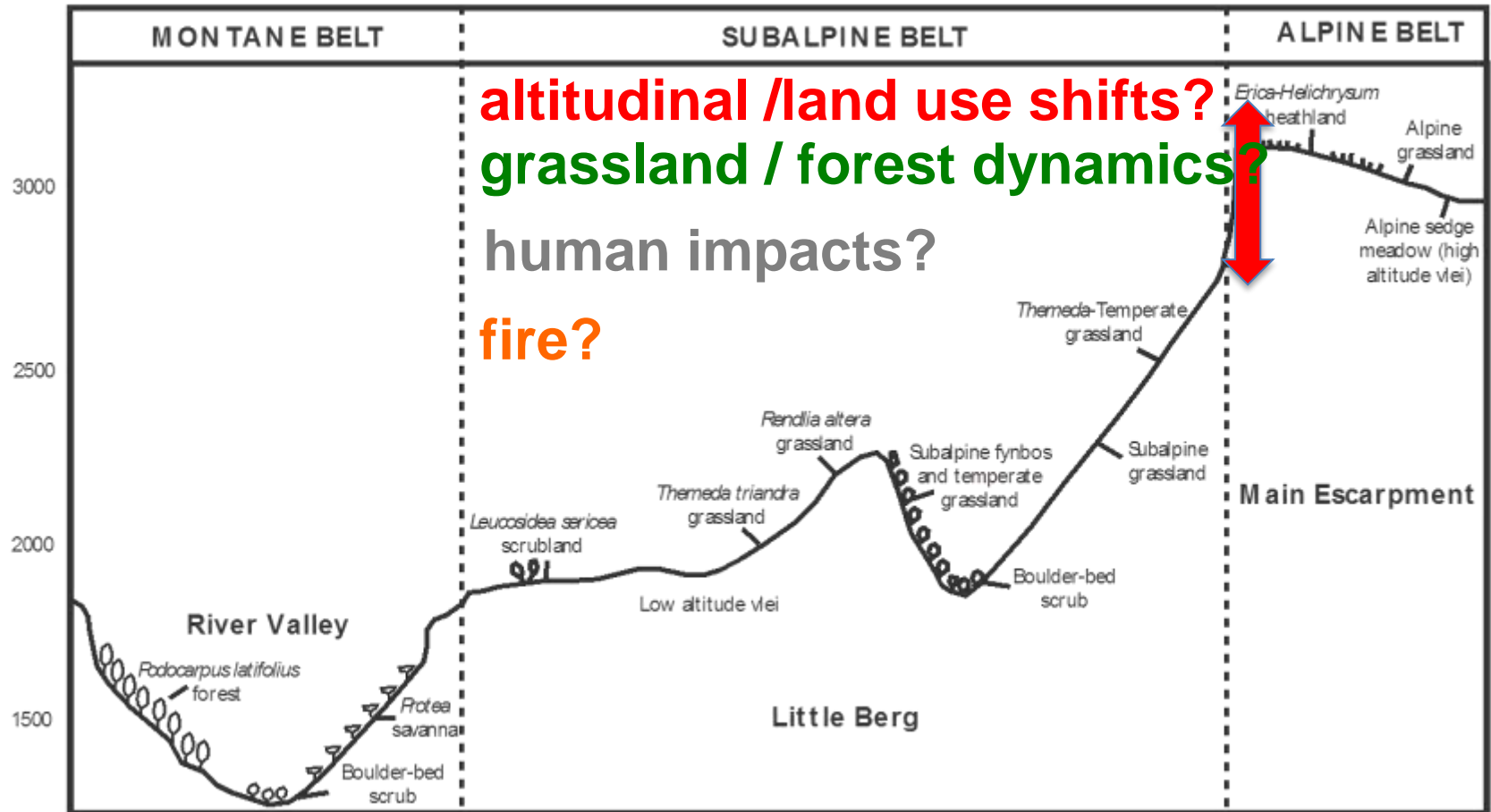


# Water tower



# Why CP?

# Natural Lab



# Why CP?

## Historical data



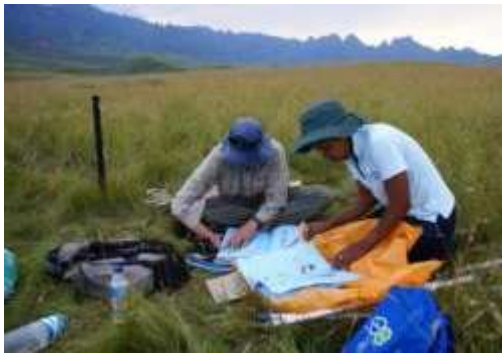
1953

1956

2012

# Observation Approach

- Extending historic *in situ* long term data sets
  - Remote & rare parameter data
  - Integrated Ecosystem Level approach
- Focal site, multiple parameters, across disciplines





# What & Why

- Pattern
  - Parameterise models
- Process research
  - Improve models
- Change detection
  - Scenario trajectories



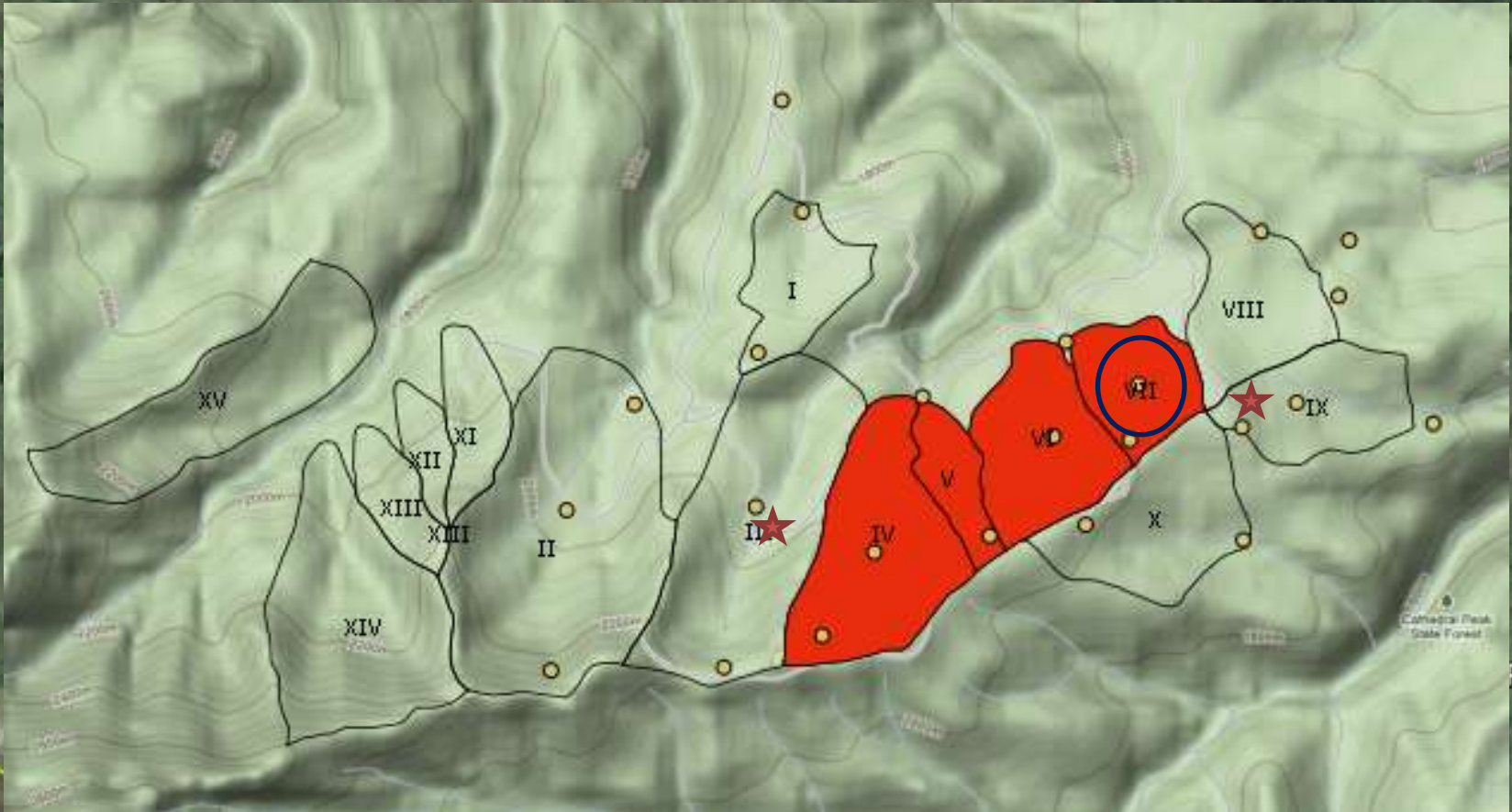
# How

- Globally competitive **research infrastructure** platforms
- Use platform to train and **build capacity**
- Use data outputs to **generate knowledge**



Mfifiyela

Stulwane



Park

# In the begning-2011



# Vital stats

- 40+ instruments (>R2.8mil)
- Monthly water sampling
- Biological monitoring programs

- 35 Projects
- 11 Institutions
- 5 (121) field schools
- 12 students

**>150 platform users**



# Instruments



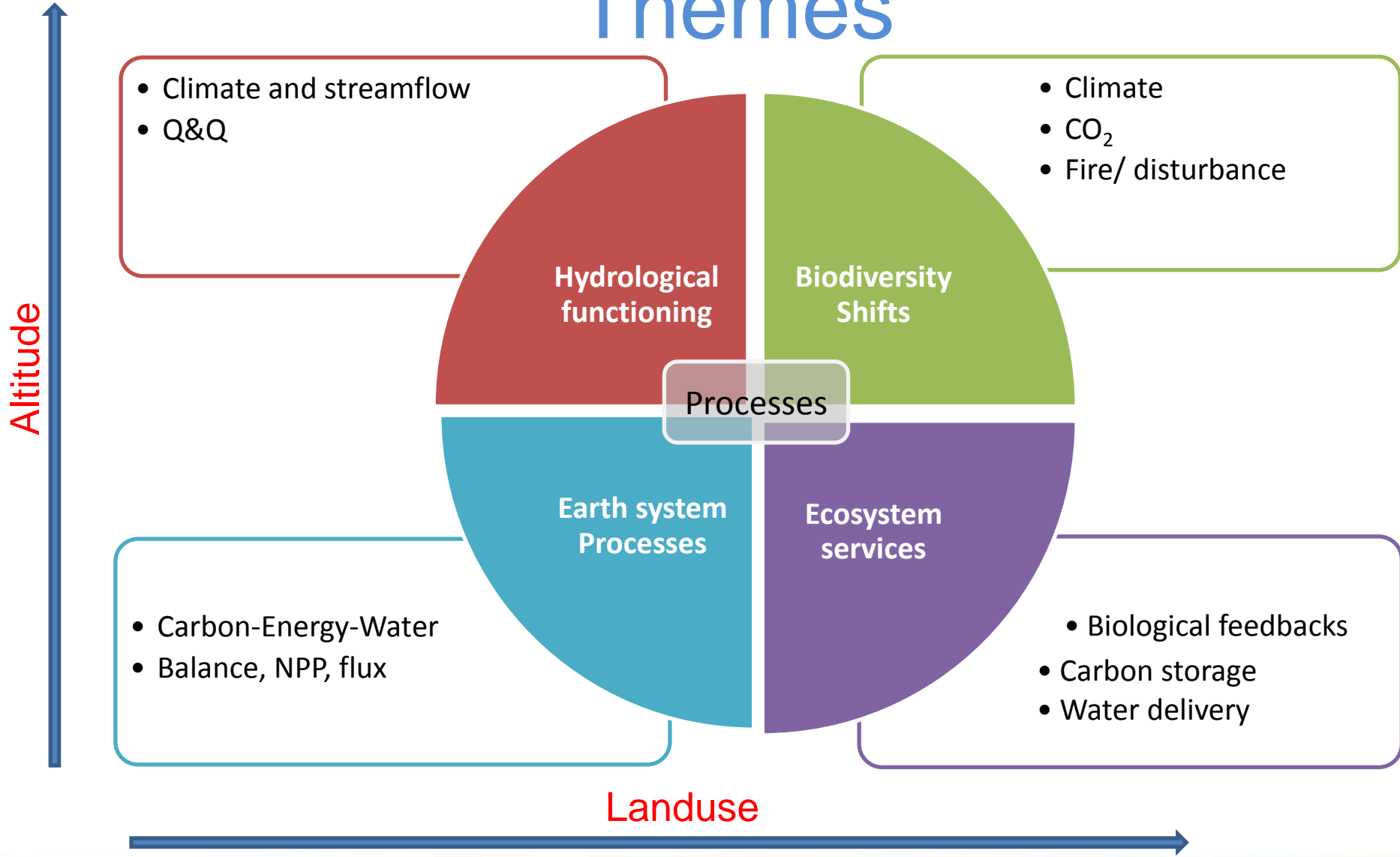
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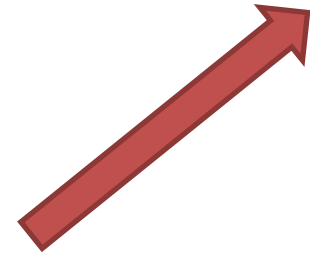
# Themes



# Biodiversity shifts

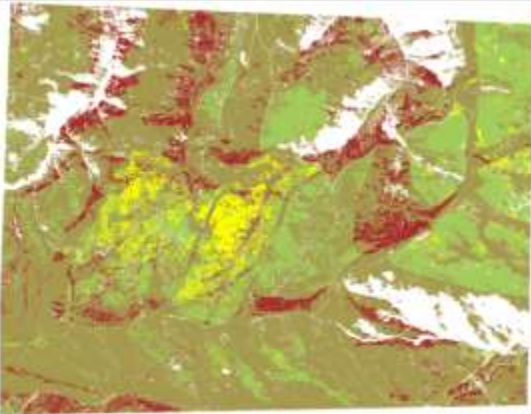
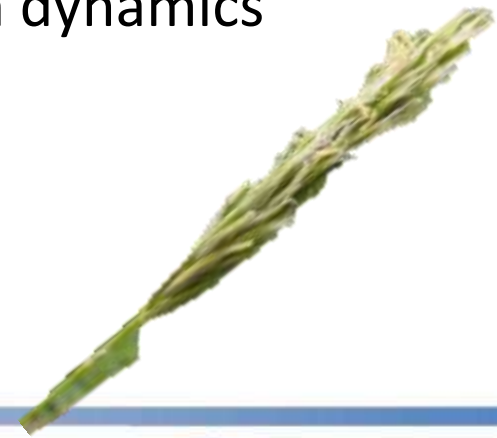
## Invertebrates

- Altitude



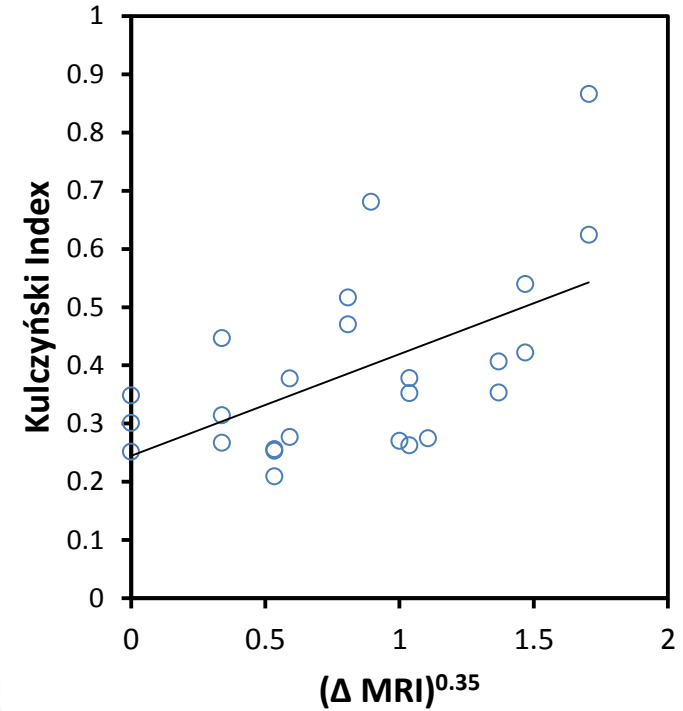
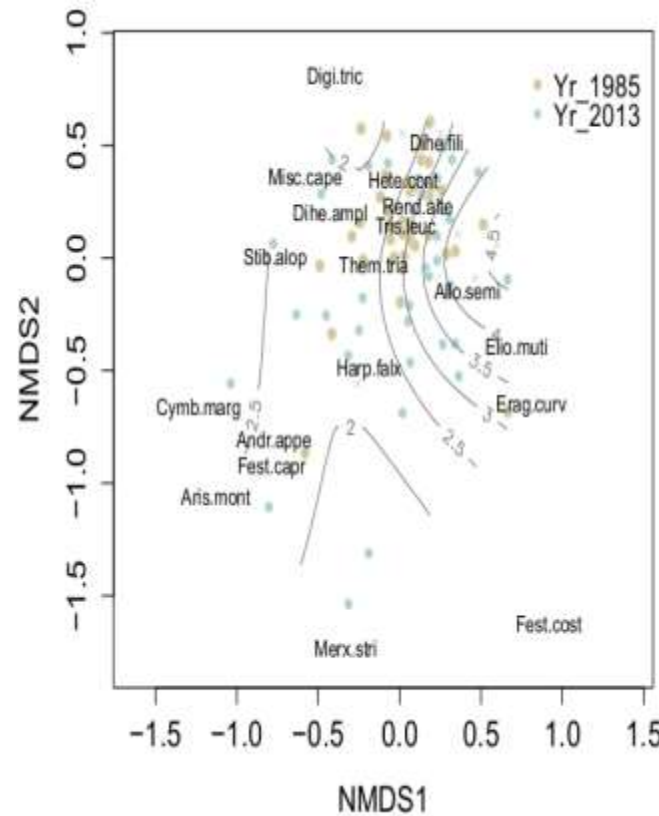
## Vegetation

- Assess relative impacts of local and global drivers on vegetation dynamics over time.





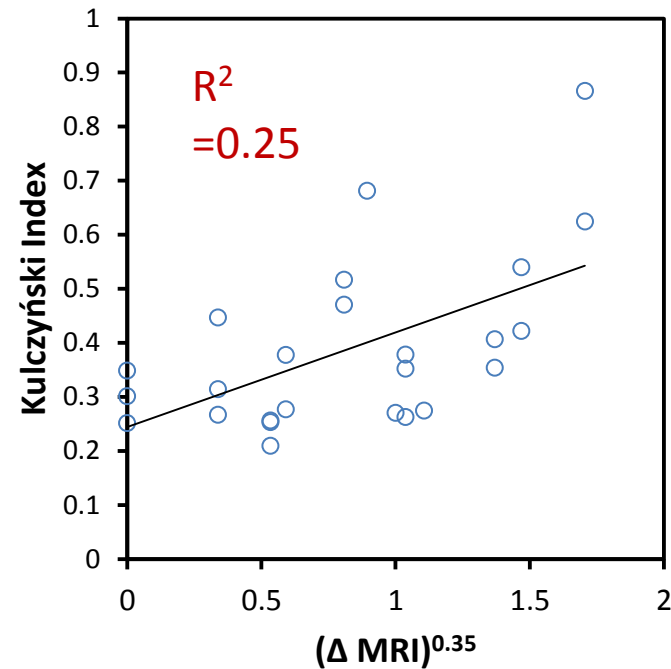
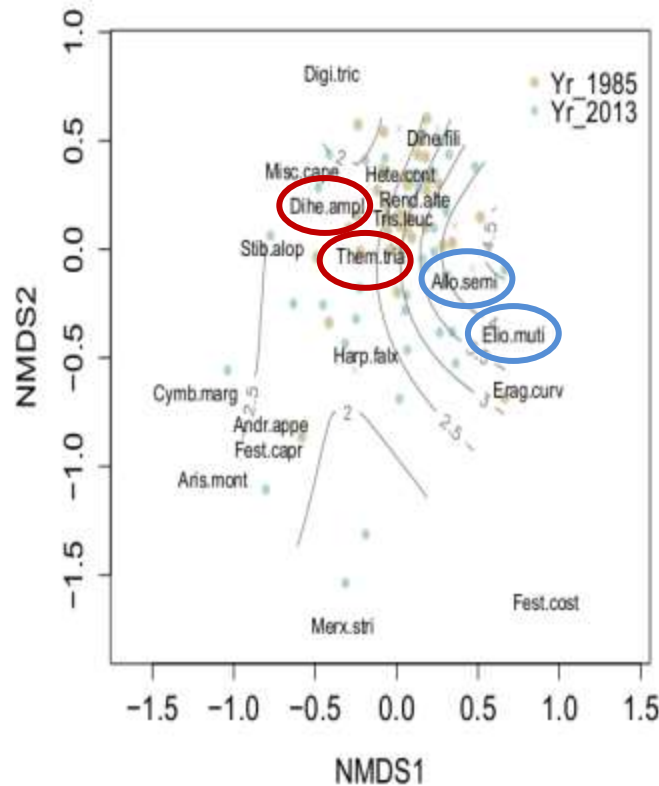
# Assessment of fire as a local driver



$$\text{Composition change} = \beta_1 \cdot \text{Altitude} + \beta_2 \cdot \text{Soil Depth} + \beta_3 \cdot \text{Soil type} + \beta_4 \cdot \text{Aspect} + \beta_5 \cdot \text{Burn Season} + \beta_6 \cdot \Delta \text{ Mean Return Interval}$$

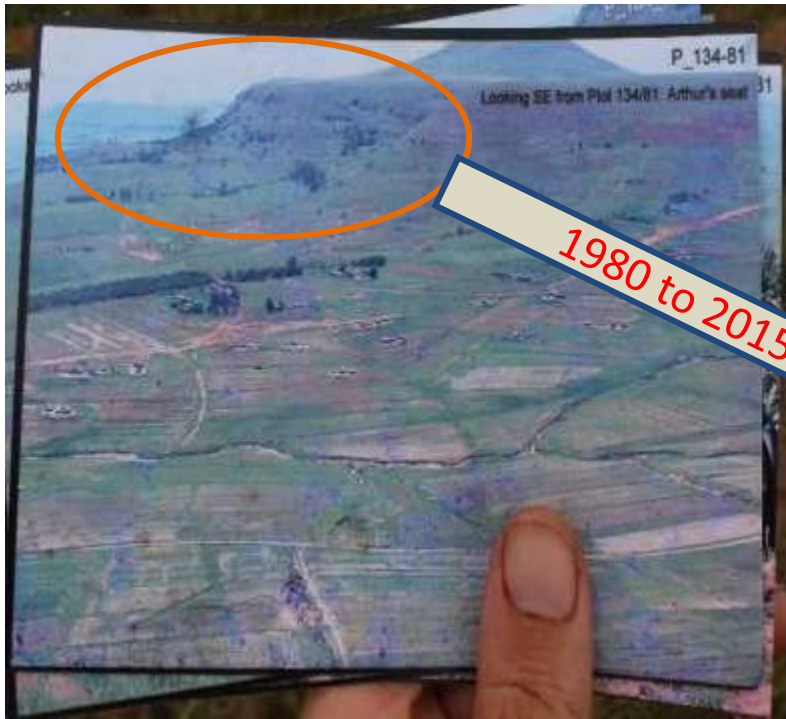
# Results

## NMDS -> Grass composition – \*MRI



$$\text{Composition change} = \beta_1 \cdot \text{Altitude} + \beta_2 \cdot \text{Soil Depth} + \beta_3 \cdot \text{Soil type} + \beta_4 \cdot \text{Aspect} + \beta_5 \cdot \text{Burn Season} + \beta_6 \cdot \Delta \text{ Mean Return Interval}$$

\*\* p<0.01

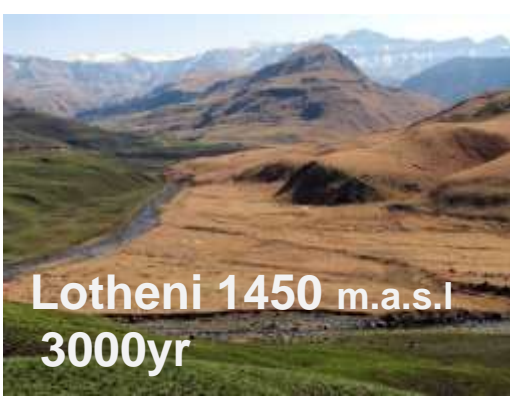


1980 to 2015





# Palaeo-research



Lotheni 1450 m.a.s.l.  
3000yr



Baboon Swamp 1630 m.a.s.l.  
5000-yr



Catchment VI 1890 m.a.s.l.  
15000yr

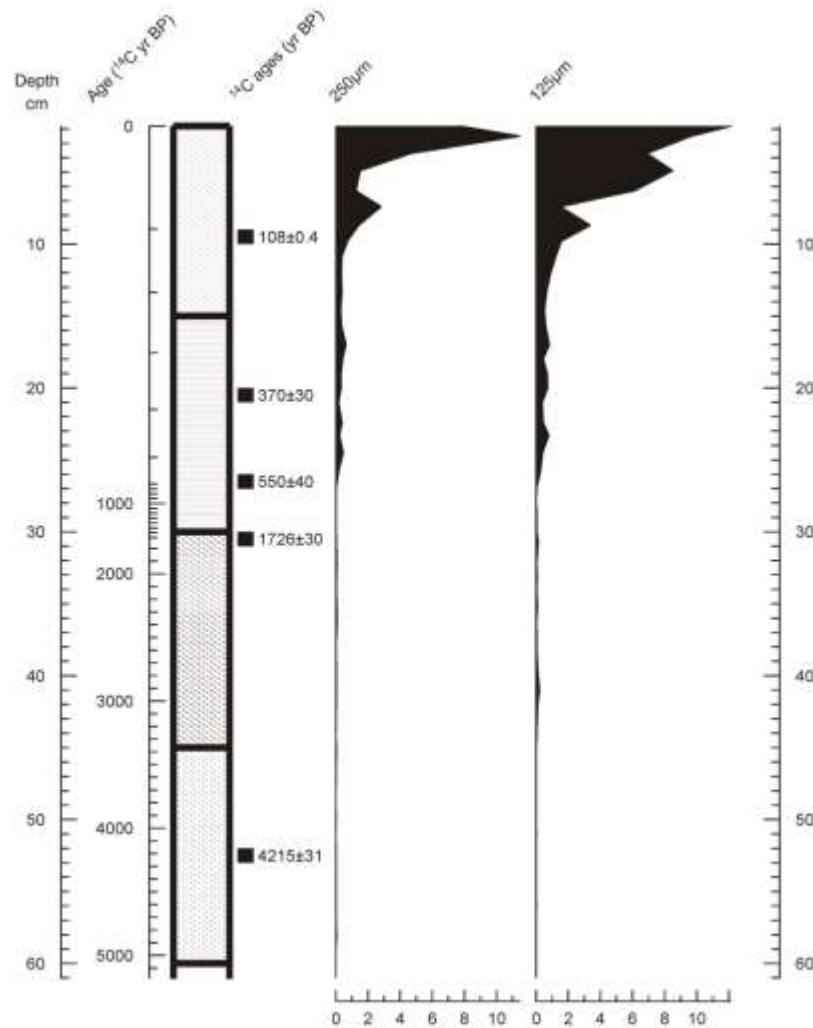
- Understanding species and ecosystem response to climate change
- What is the range of natural variability?
- Palaeo-techniques provide a unique toolkit to address these knowledge gaps

How have fire regimes changed over time?

Were forests previously more widespread?

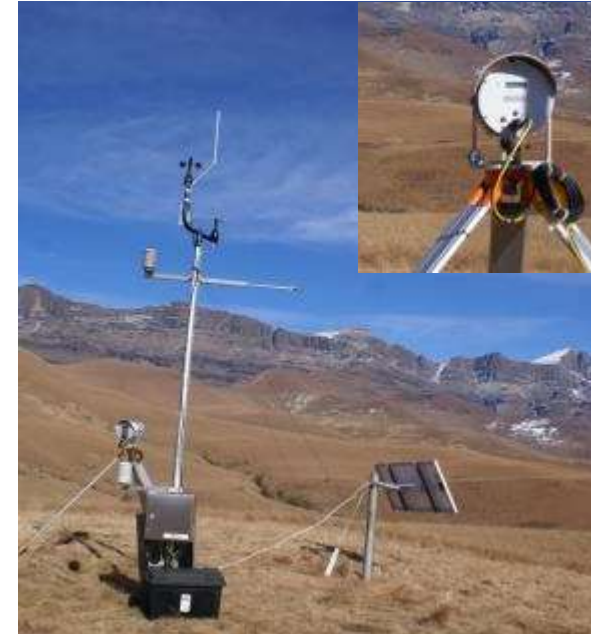


# Baboon Swamp: Charcoal



# Earth system processes

## Carbon- Energy- Water



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EZEMVELO  
KZN WILDLIFE  
Conservation, Partnership & Sustainability



National Research  
Foundation

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# Hydrological Function



- Rainfall-topog. relationships- Feroza
- Change detection- Sibu
- Cross Calibration- Byron
- Fog- Tiffany
- ATM depo –Aobakwe

→ **Infilling**





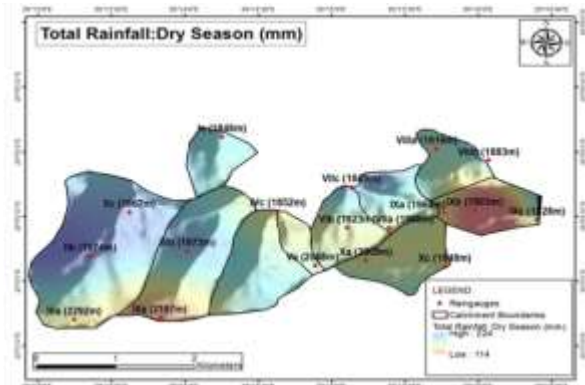
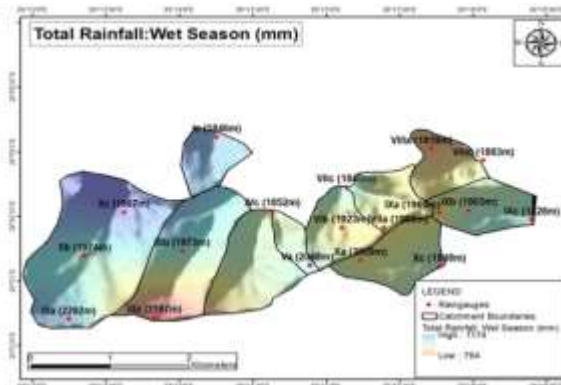
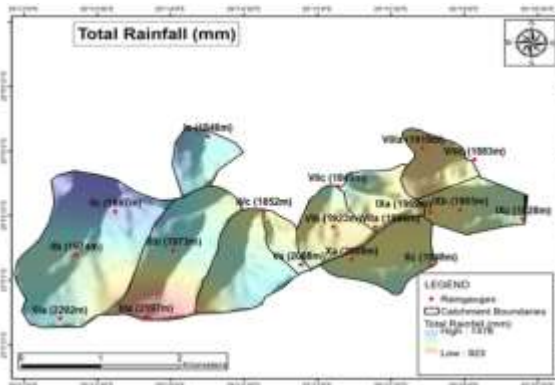
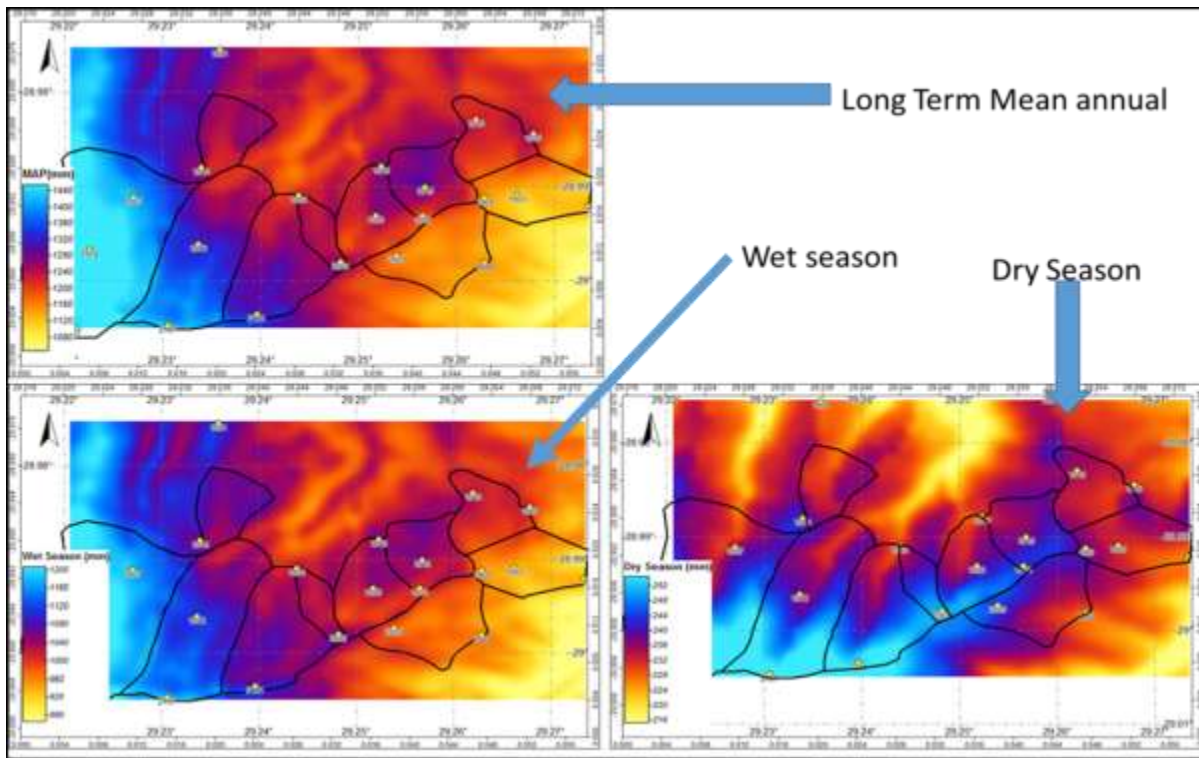
Feroza Morris, UKZN-CWRR  
MSc

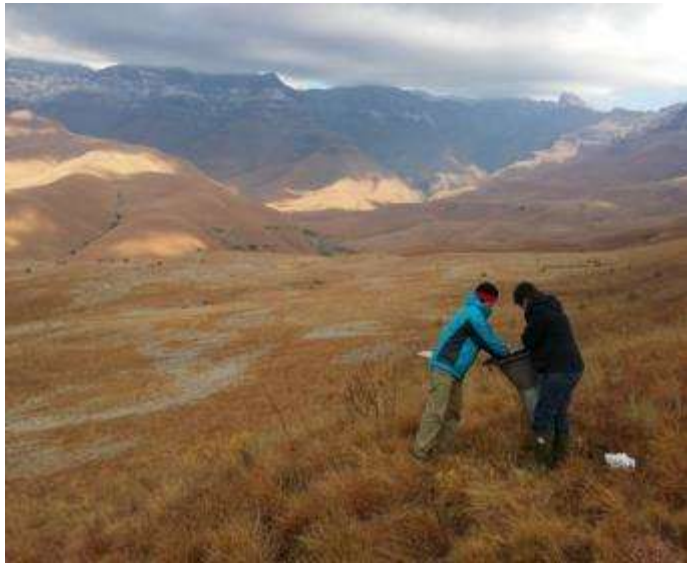
(Regression Kriging)

Historical data analysis

Longitude and Altitude Matter

Current data analysis  
2013/2014

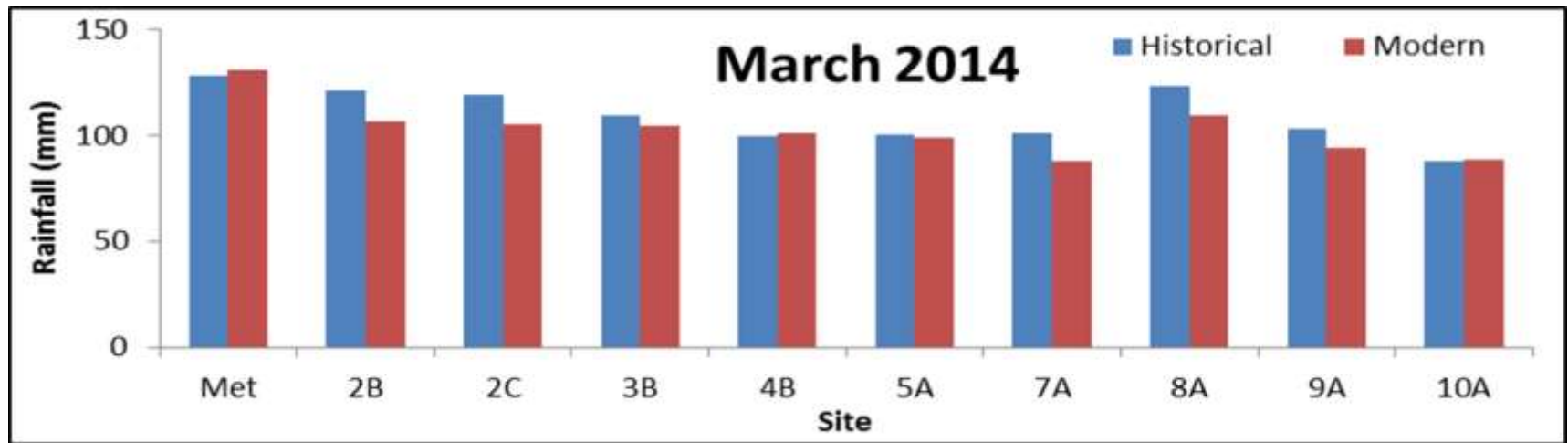




# A cross-calibration study

- Assessing effect of raingauge design, slope and aspect on rainfall measurements

Byron Gray- UKZN-CWRR, MSc



# RAINGAUGES



# Ecosystem services

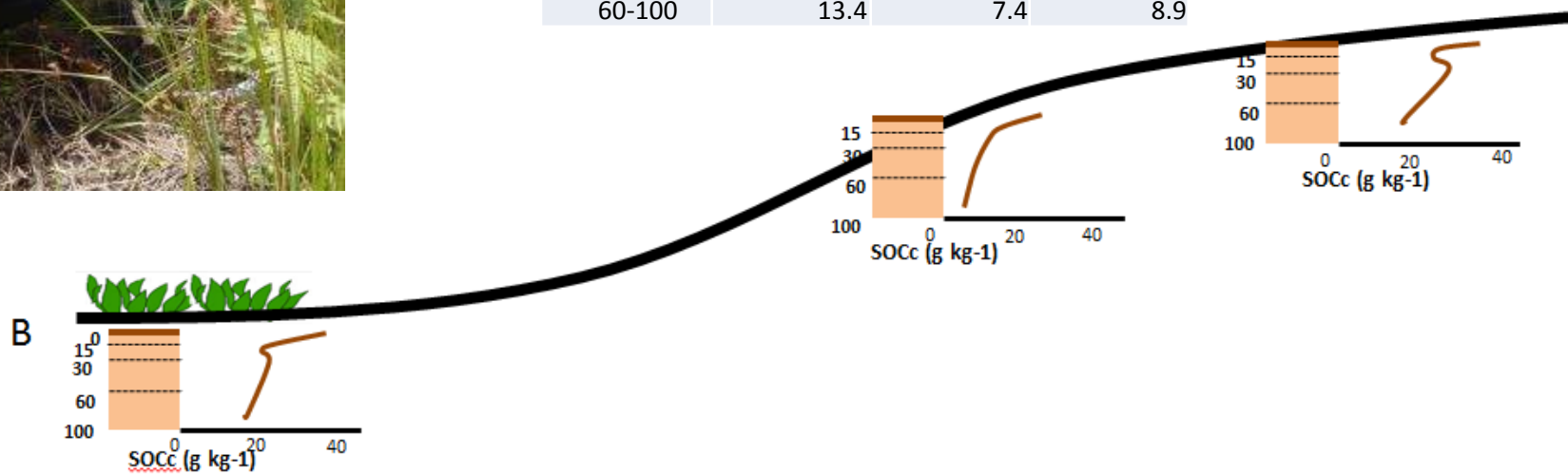
- Carbon
    - Soil Pool (Tain *et al.*, 2015)
  - Water delivery
  - Biological feedbacks
- Current impacts
- $\alpha$  alternative climate-land use trajectories



## Soil organic carbon stocks( kg.m<sup>-2</sup>) in different landscape positions in Catchment 6



SOCs	SOCs		
	Crest	Shoulder	Footslope
0-5	5.1	2.7	1.9
5-15	11.5	4.1	4.5
15-30	17.8	5.0	7.7
30-60	13.4	5.9	9.9
60-100	13.4	7.4	8.9



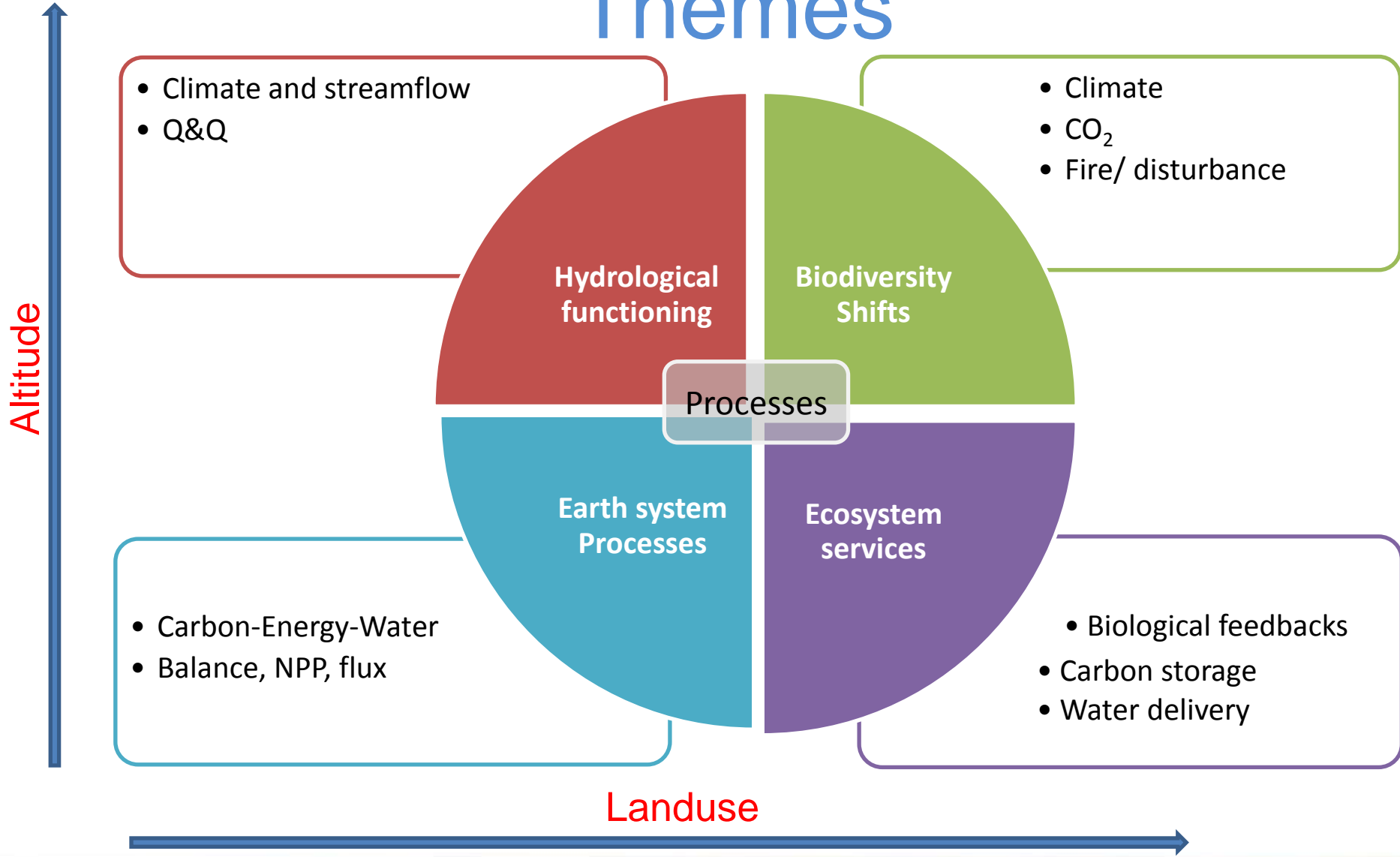
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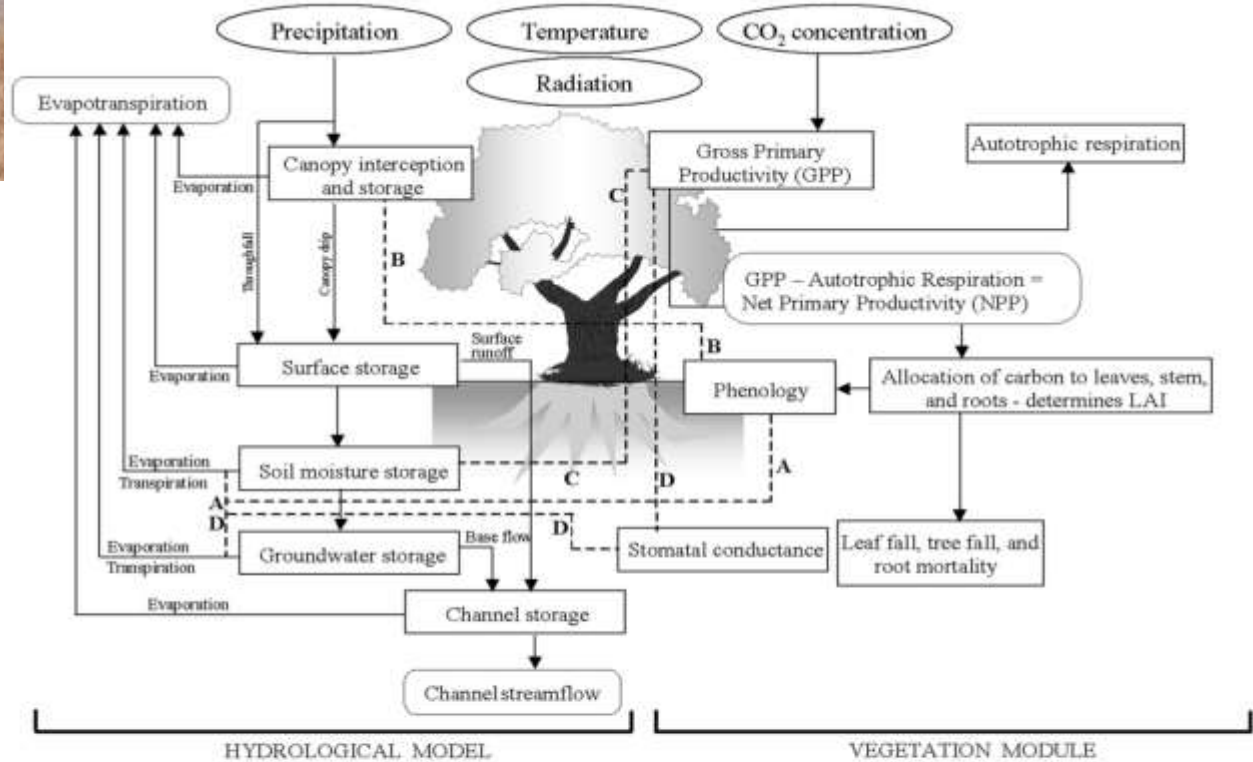


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# Themes



# Process interactions



denotes primary inputs  
denotes processes modeled  
denotes primary outputs  
 Indicates linkage between models.

Dashed lines indicate linkages between the hydrological model and the vegetation module.  
**A** – LAI affects transpiration from soil and groundwater stores.  
**B** – LAI affects canopy interception, storage, and evaporation from canopy leaves.  
**C** – Soil moisture affects photosynthesis.  
**D** – The coupling between photosynthesis and stomatal conductance is used to estimate transpiration.

V. Arora,, *Rev. Geophys.*, 2002 40(2), 1006,, 2002.



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# Acknowledgments

