

Measuring the responses of coastal habitats to sea level rise

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South African Environmental
Observation Network



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Global Change Research

- monitoring & understanding **anthropogenic & natural** change
- impacts of change on **coastal & marine systems** as well as the **human communities** dependent on them

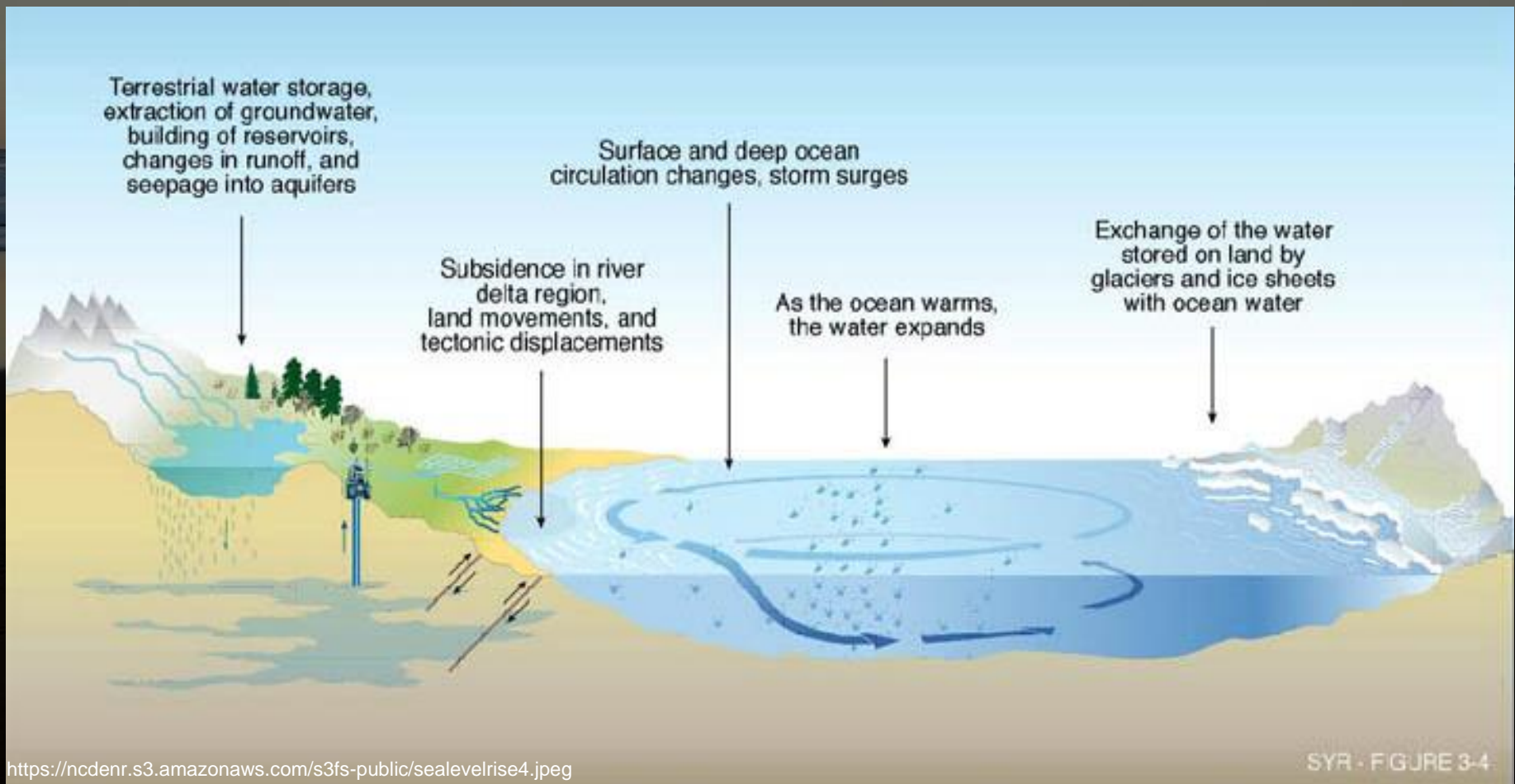


Global Change Research

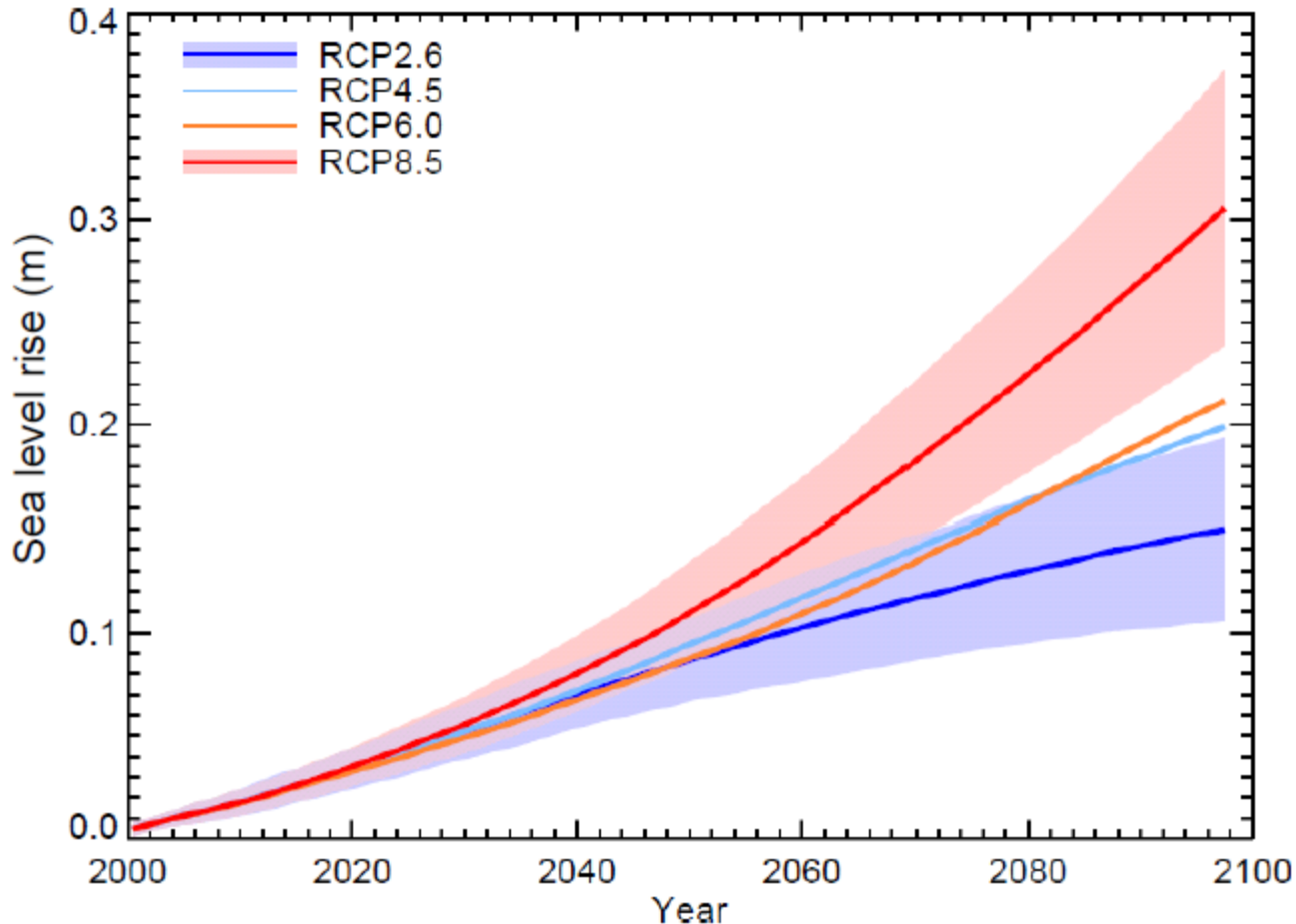
- monitoring climate change through **physical and biological processes**, its drivers and implications
- understanding **risks and vulnerabilities** due to environmental change

Sea Level Rise

- IPCC 5th Assessment Report (2014)



Sea Level Rise



RCP2.6

– stringent mitigation scenario

RCP4.5 & RCP6.0

– intermediate scenarios

RCP8.5

– very high GHG emissions

Sea Level Rise

- major threat to human communities & coastal habitats



Coastal habitat vulnerability

- changes in inundation duration & frequency
: death of vegetation, species shifts & reduced productivity
- high **regional variability** in SLR rates
: tidal range & geomorphic setting
- influenced by management regimes

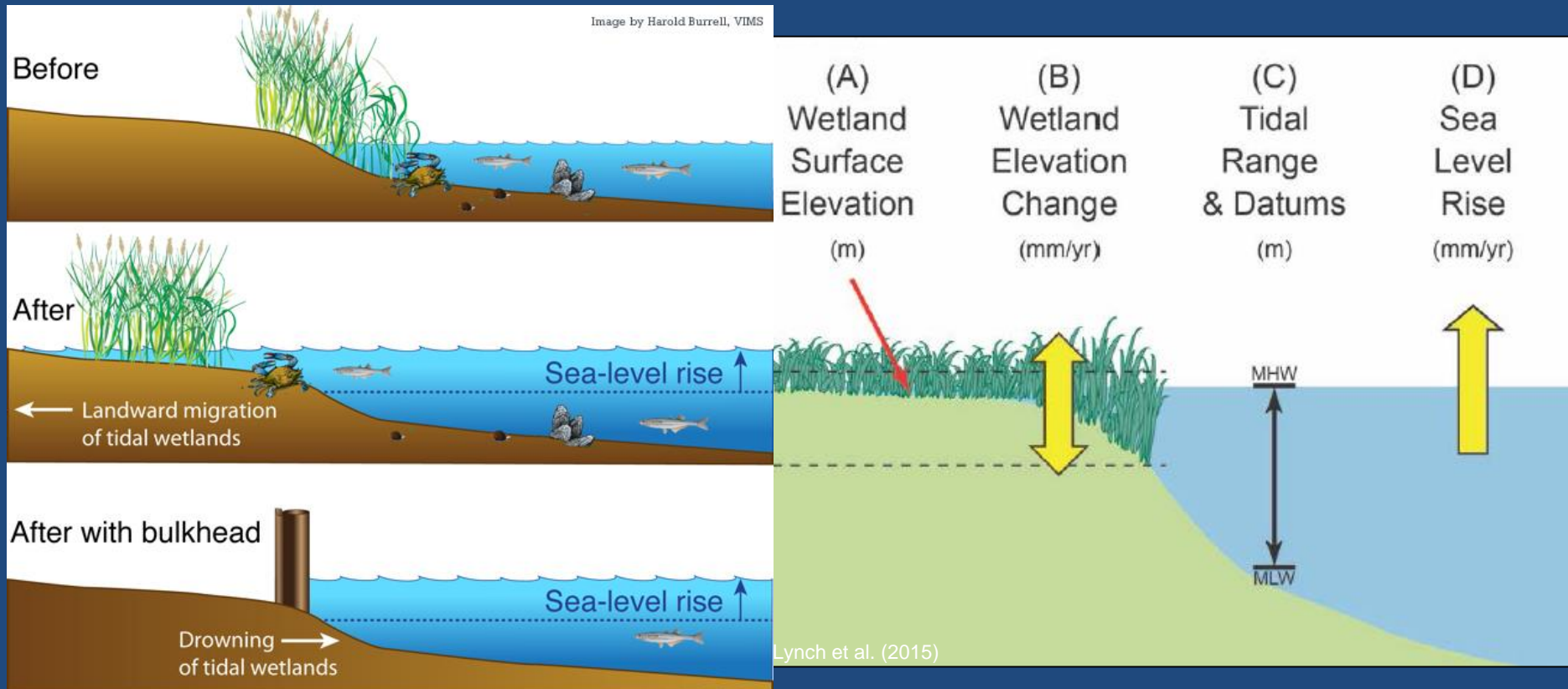
Coastal habitat responses

- resilience to fluctuations in sea level:
 - 1) modification of the environment
 - **surface elevation change processes**
 - 2) **migration inland over successive generations**

Coastal habitat responses

SURFACE ELEVATION CHANGE

LANDWARD MIGRATION



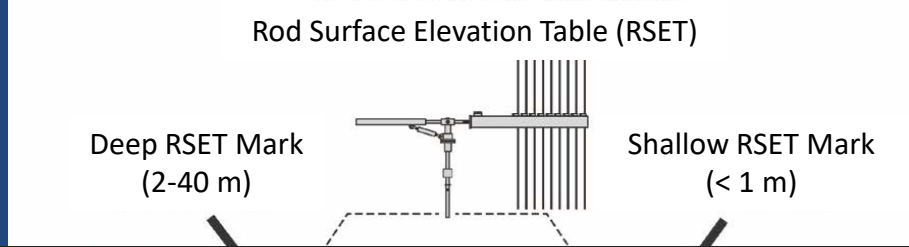
South African coastal habitats

- mangroves & salt marshes are confined to sheltered estuarine areas
- mangroves reach southern continental limit on SA east coast
 - : currently expanding further south with increased SST

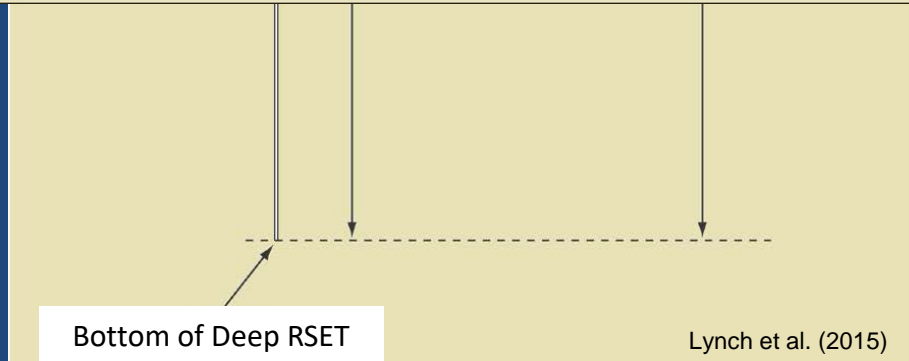
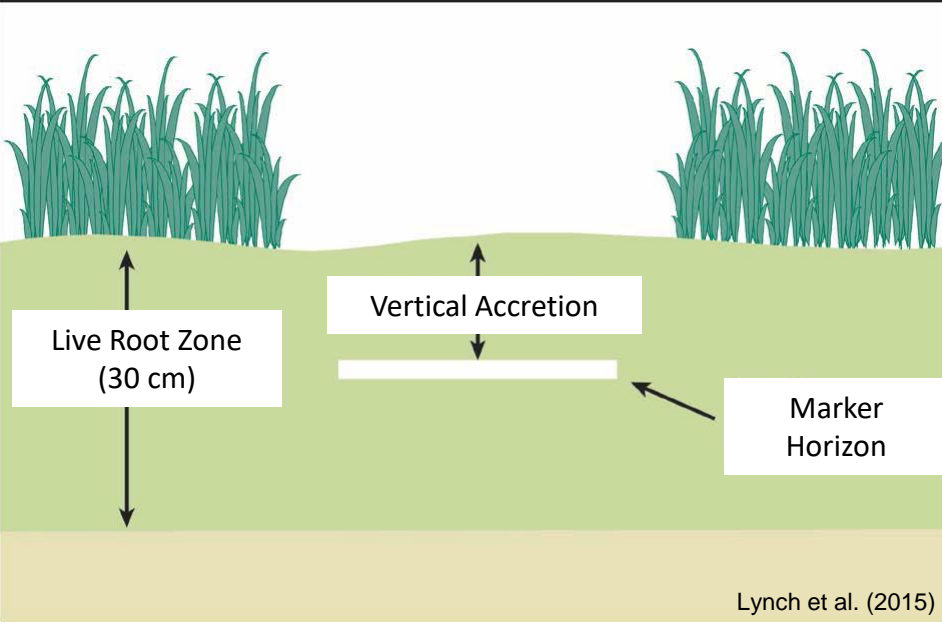
Why measure responses?

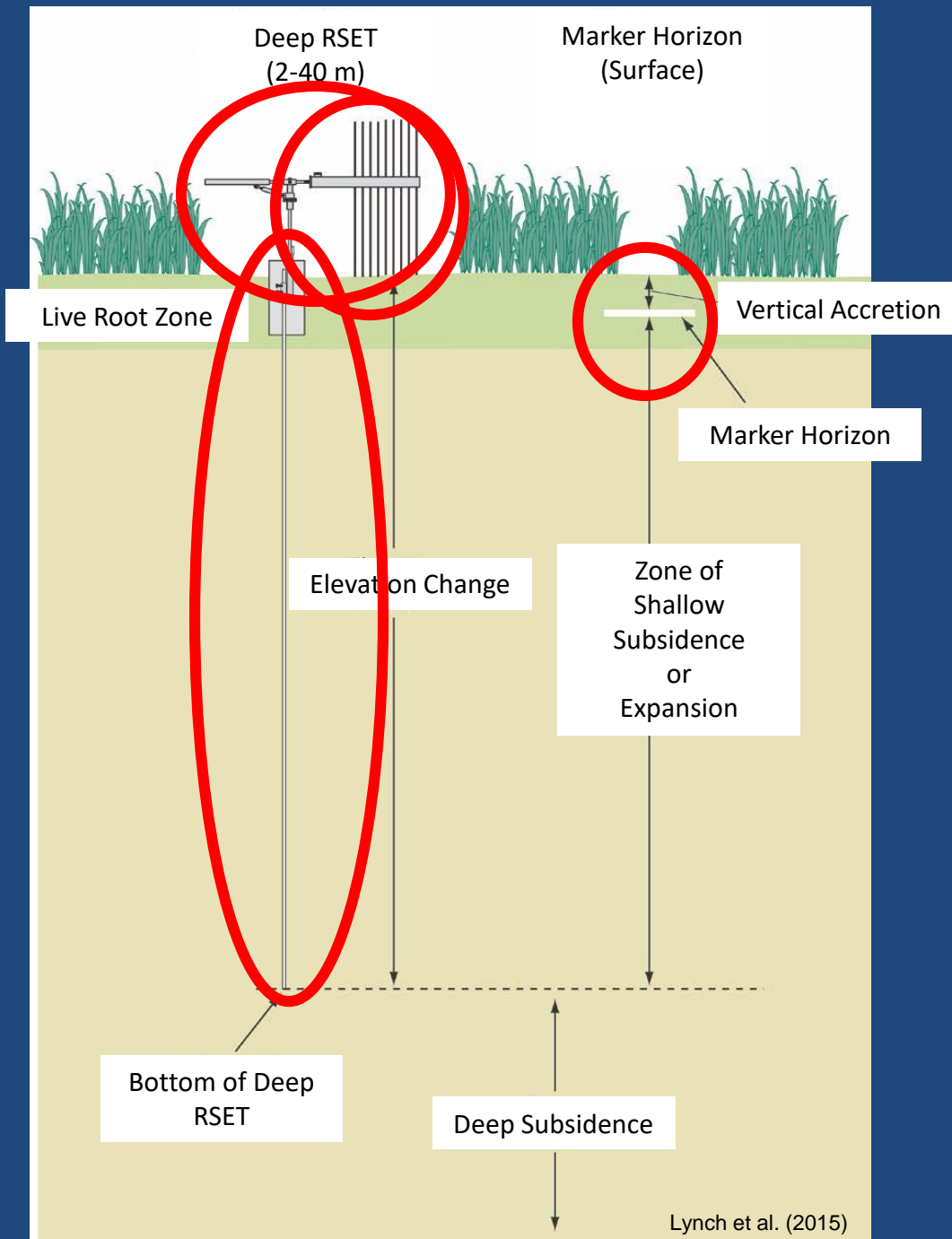
- estimates of SLR for SA indicate rates up to **2.74 mm/yr** on east coast
- mangroves & salt marshes are **ecologically & economically valuable** environments
: many ecosystem goods & services
- **threatened** directly & indirectly by pressures from catchment to coast

How to measure responses



Globally standardized method using Rod Surface Elevation Table (RSET) & Marker Horizon (MH)





changes in the heights of the pins RSET instrument over time reflect transported to field on vertical dynamics established on the surface and is started with each sampling interval together used to measure surface accretion and subsidence from pins on the arm

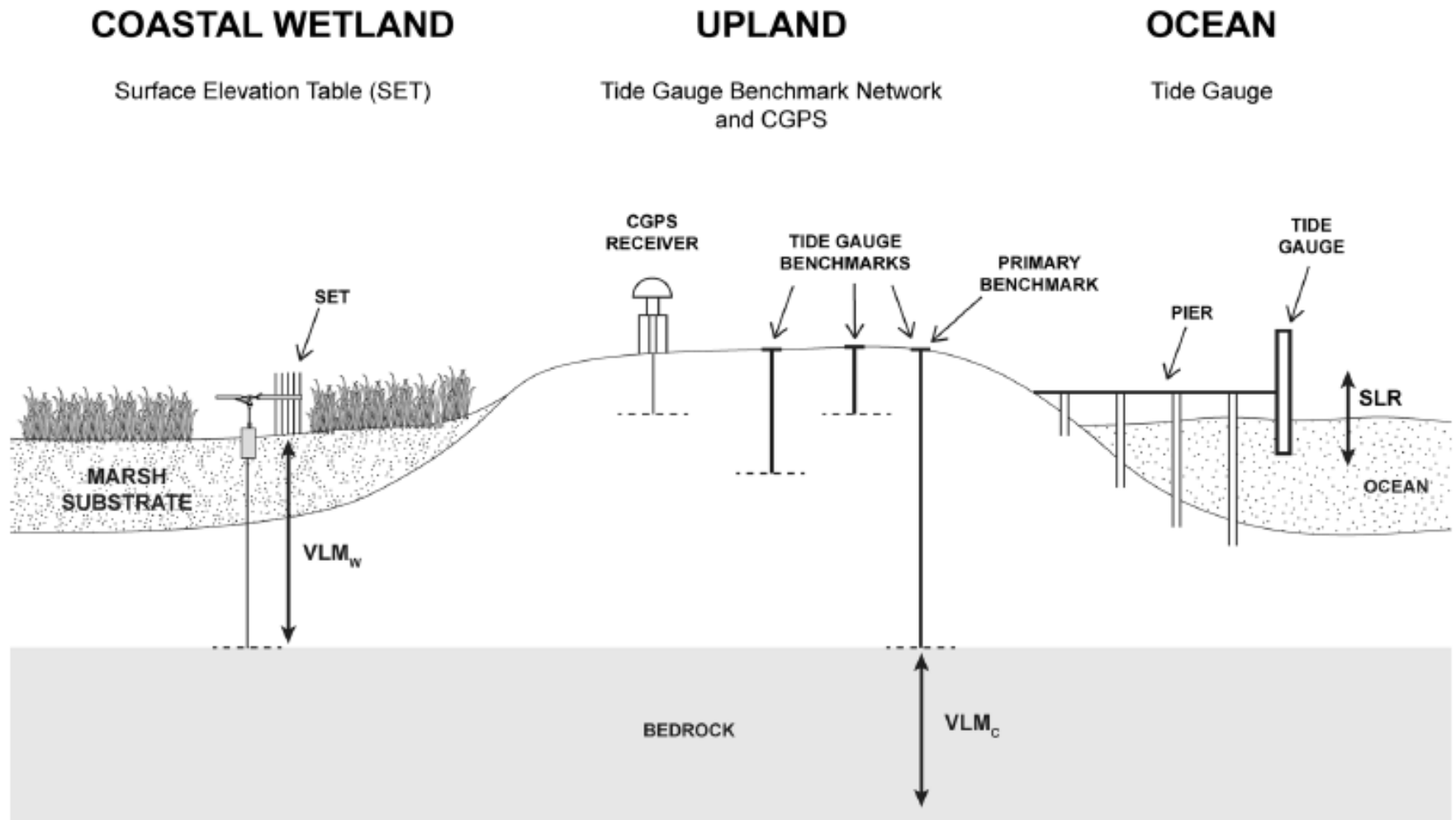


Fig 1 Conceptual diagram showing the relationship among measures of vertical land motion as recorded by the tide gauge benchmark network at a coastal upland area (VLM_c) and the rod surface elevation table (RSET)

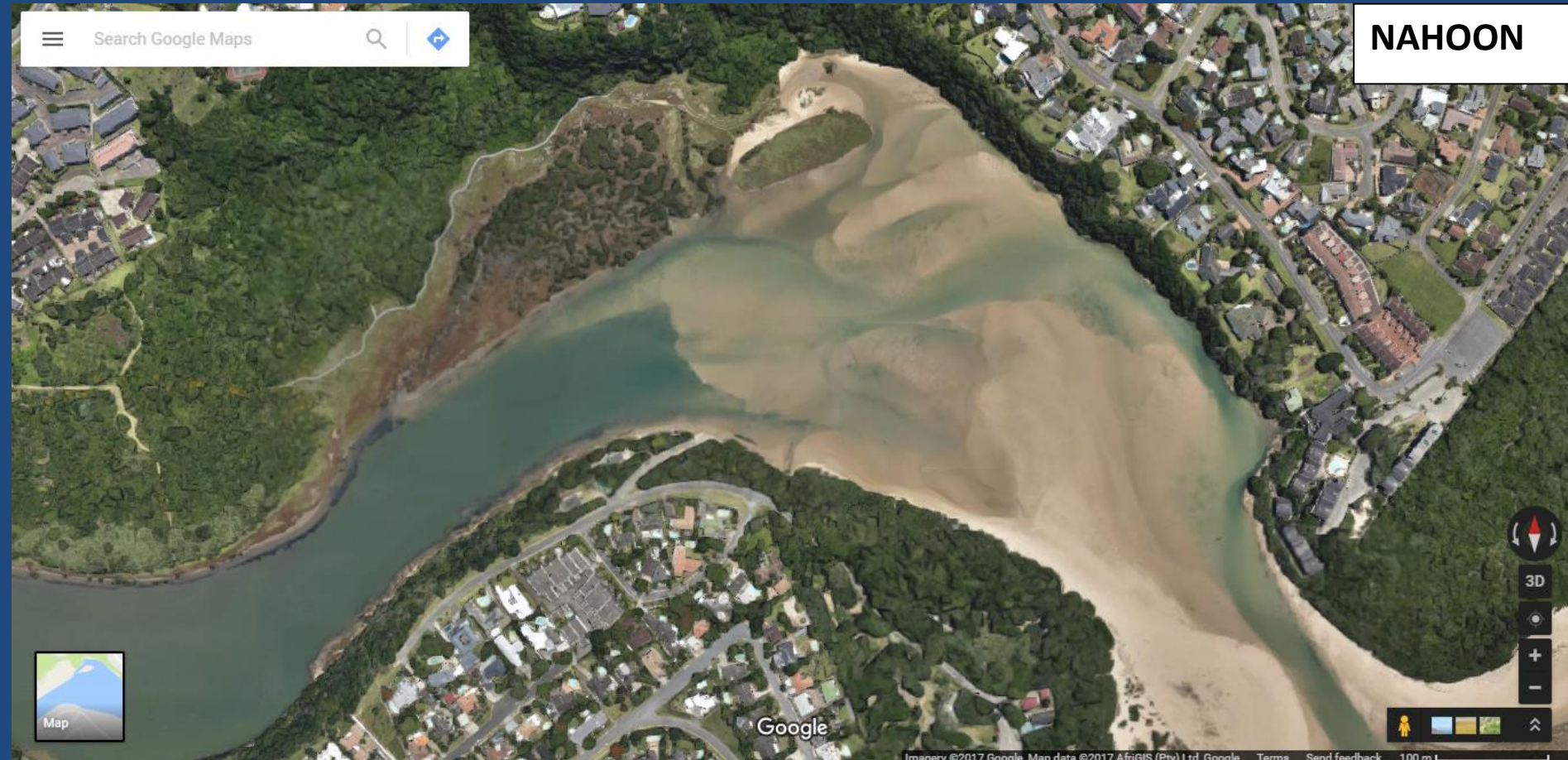
method in a coastal wetland (VLM_w). The double-headed arrows for VLM_w and VLM_c indicate that vertical motion can be up or down, depending on the local setting and conditions

SA study sites

- aim to set up a monitoring program for estimating long term surface elevation trends in mangrove habitats
- site selection is dependent on logistical and accessibility constraints
 - practicality of accessing areas to set up stations
 - preventing loss or damage of the stations
 - ability to repeatedly access the stations for a long period of time into the future

SA study sites

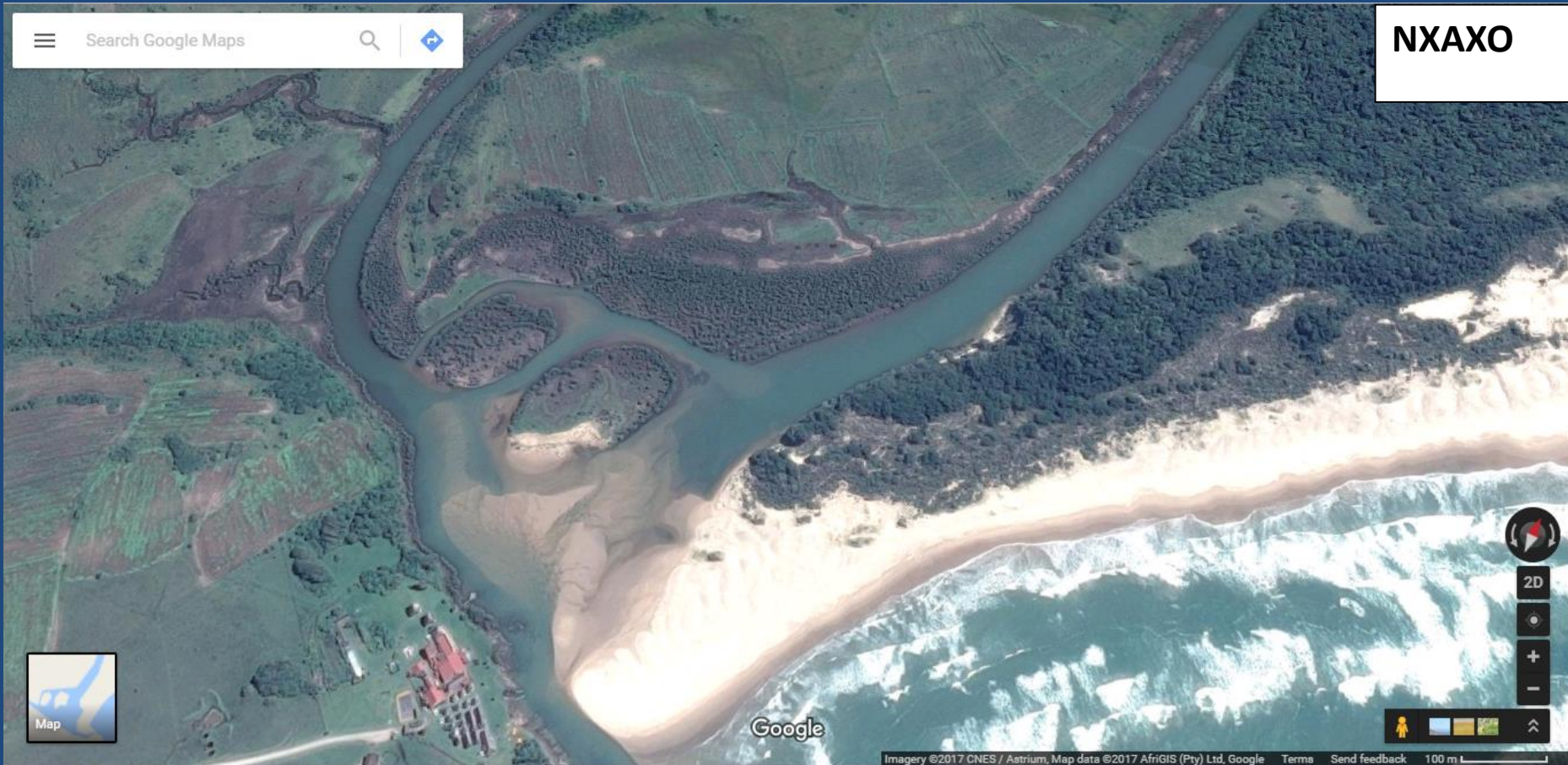
NAHOON



32°59'10"S; 27°57'08"E

**Eastern Cape
Warm temperate region**

SA study sites

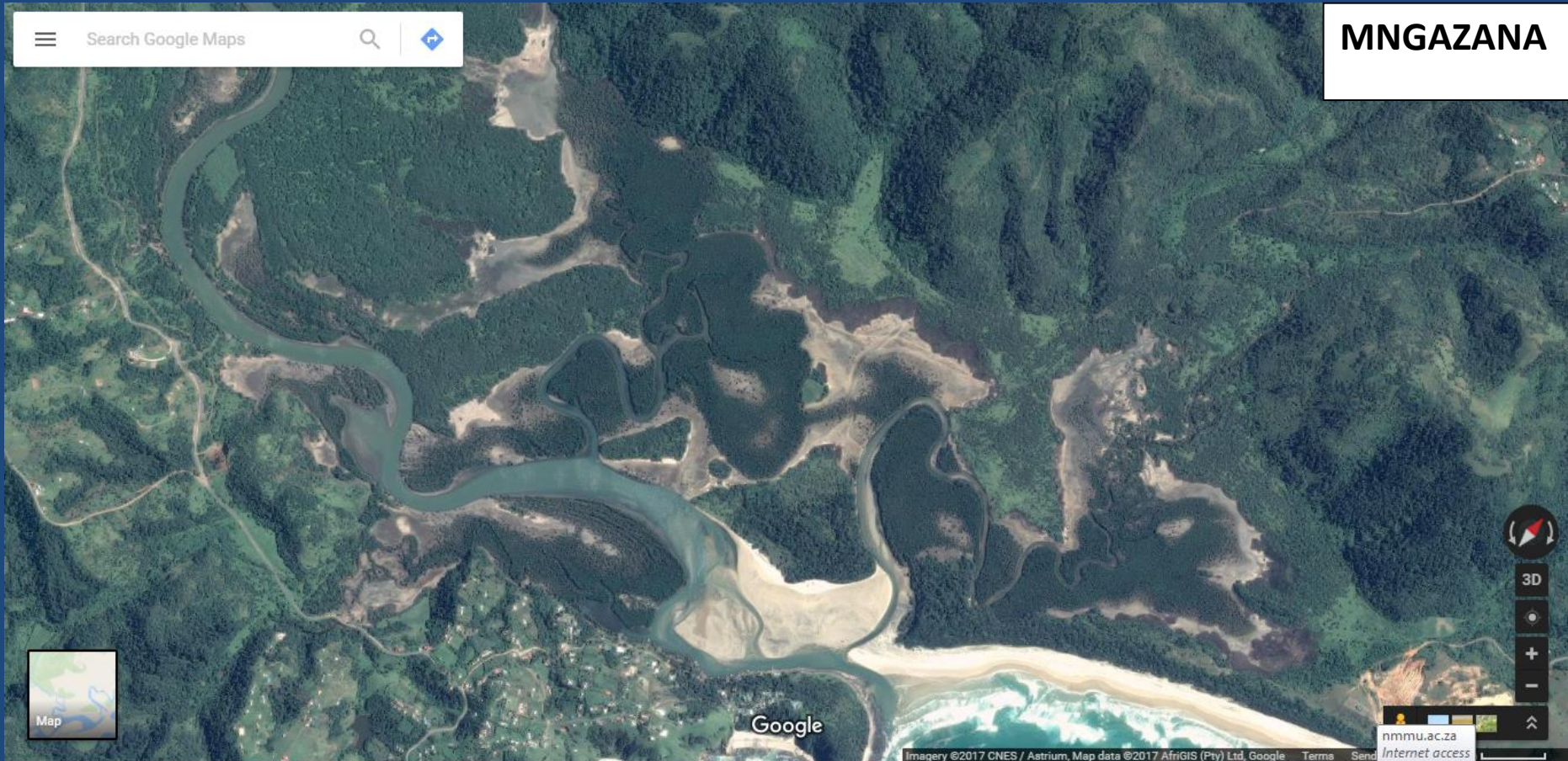


NXAXO

$32^{\circ}35'05''\text{S}$; $28^{\circ}31'32''\text{E}$

Eastern Cape
Warm temperate region

SA study sites

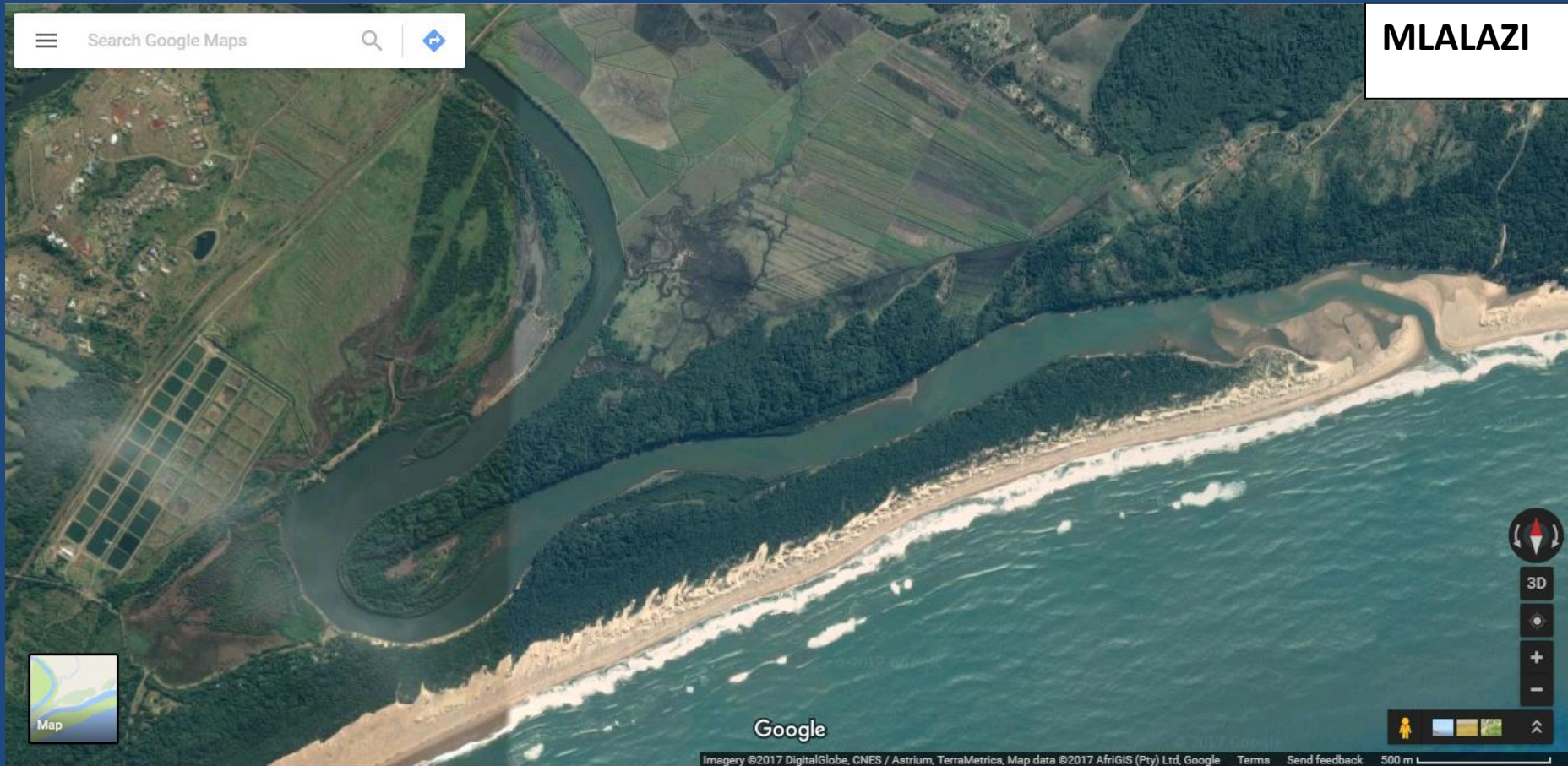


MNGAZANA

31°41'29"S; 29°25'24"E

**Eastern Cape
Subtropical region**

SA study sites



28°56'42"S; 31°48'58"E

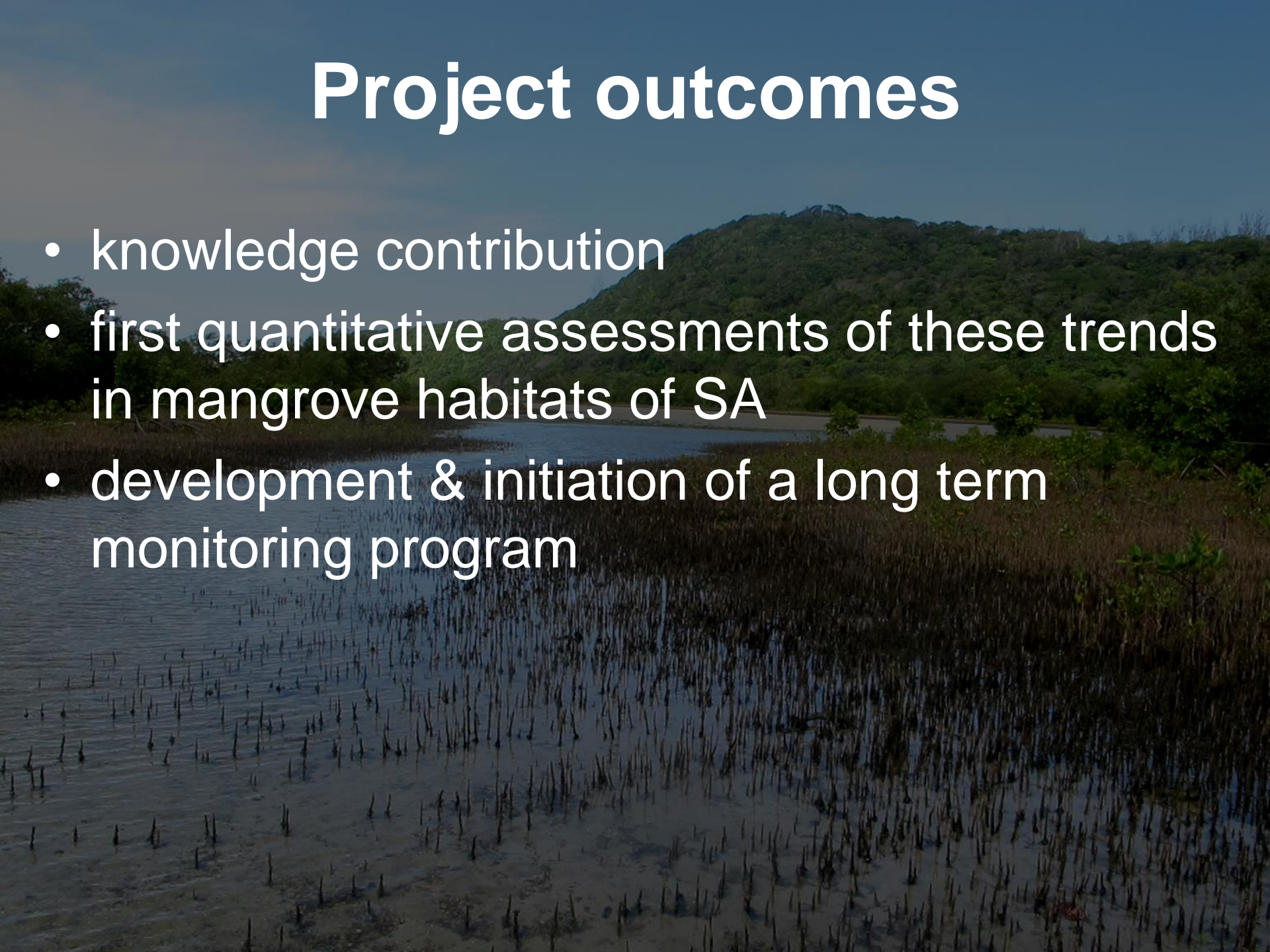
**KwaZulu-Natal
Subtropical region**

Project details

- this research falls under the **WRC Climate Change Lighthouse:**
Water-linked Ecosystems
Ecosystems and global change
Ecosystems and climate change
- this research is part of the WRC-funded project **“Climate change and South Africa’s blue carbon ecosystems”**

Project outcomes

- knowledge contribution
- first quantitative assessments of these trends in mangrove habitats of SA
- development & initiation of a long term monitoring program



Acknowledgements



Any interested collaborators are formally invited to
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References

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- IPCC (2014) Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri RK, Meyer LA (eds.)]. IPCC, Geneva, Switzerland, 151 pp.
- Lynch JC, Hensel P, Cahoon DR (2015) The surface elevation table and marker horizon technique: A protocol for monitoring wetland elevation dynamics. *Natural Resource Report NPS/NCBN/NRR—2015/1078*. National Park Service, Fort Collins, Colorado.