



Climate change vulnerability assessment in mangrove & coral reef ecosystems in Tanzania

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PROJECT OBJECTIVES

1. to develop a **generalizable methodology for vulnerability assessment** in mangrove and associated coral reef ecosystems
2. to identify **patterns of CC vulnerability & resilience** in relevant ecosystems in project area
3. to identify and design **appropriate adaptation strategies** and activities
4. to **build capacity in-country** to promote effective vulnerability assessment and adaptation.

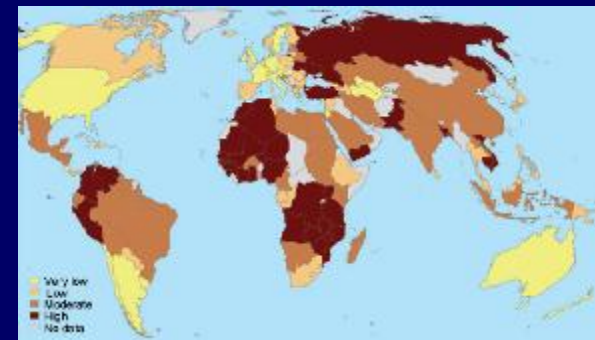
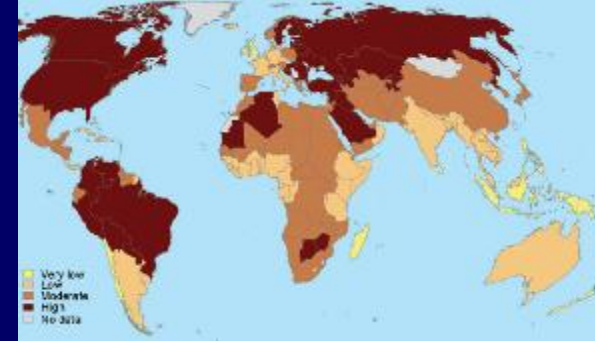
Identifying patterns of vulnerability

Vulnerability and resilience are a function of:

Exposure

Sensitivity

Adaptive capacity



Identifying adaptation activities

Vulnerability and resilience
are a function of:

Exposure

Sensitivity

Adaptive capacity



adaptation
activities may:

reduce exposure/
preserve resilience

and / or

reduce sensitivity/
preserve resilience

and / or

enhance adaptive
capacity

Climatic & not-climatic impacts on mangroves

Changes in precipitation upstream affecting hydrology, salinity & sedimentation

Rise in air Temp + CO₂

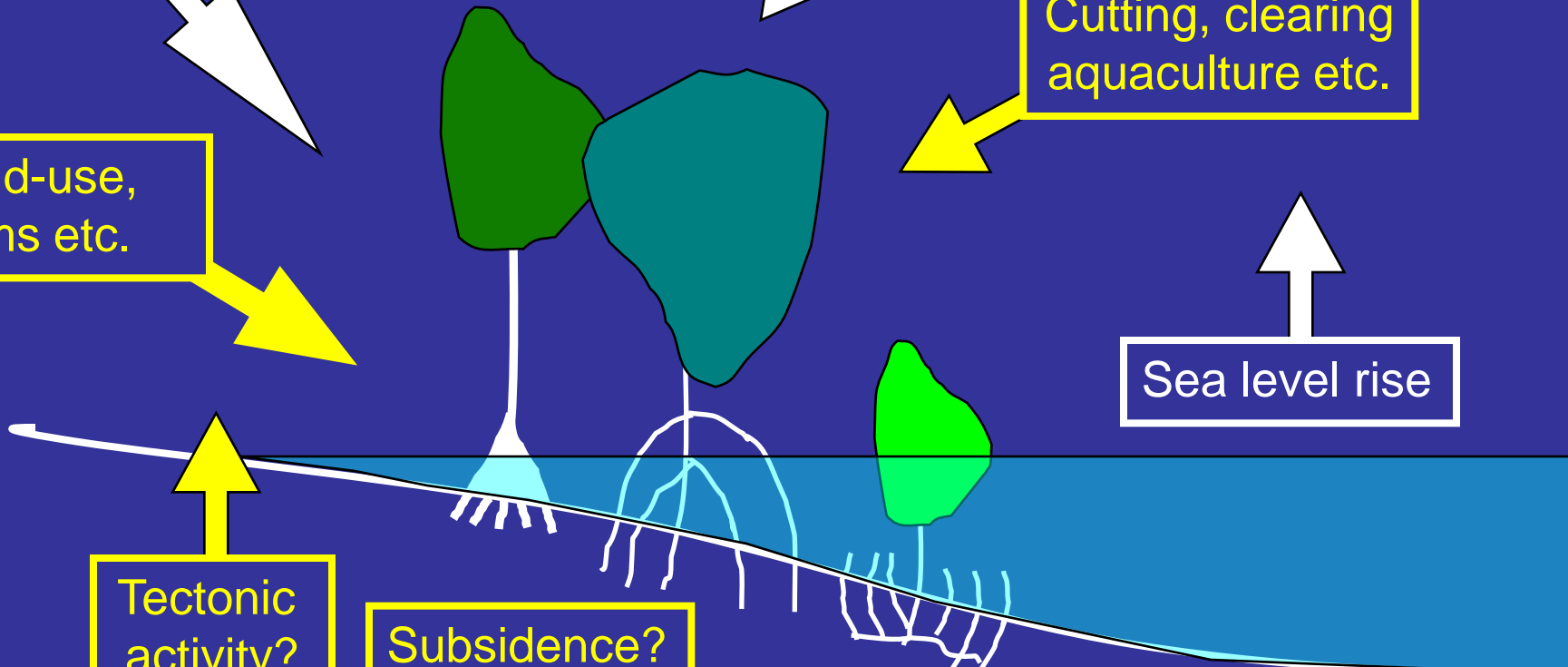
Cutting, clearing aquaculture etc.

Land-use, dams etc.

Sea level rise

Tectonic activity?

Subsidence?



Methodological approach - Tanzania

3. Remote-sensing change detection, 1989-2009

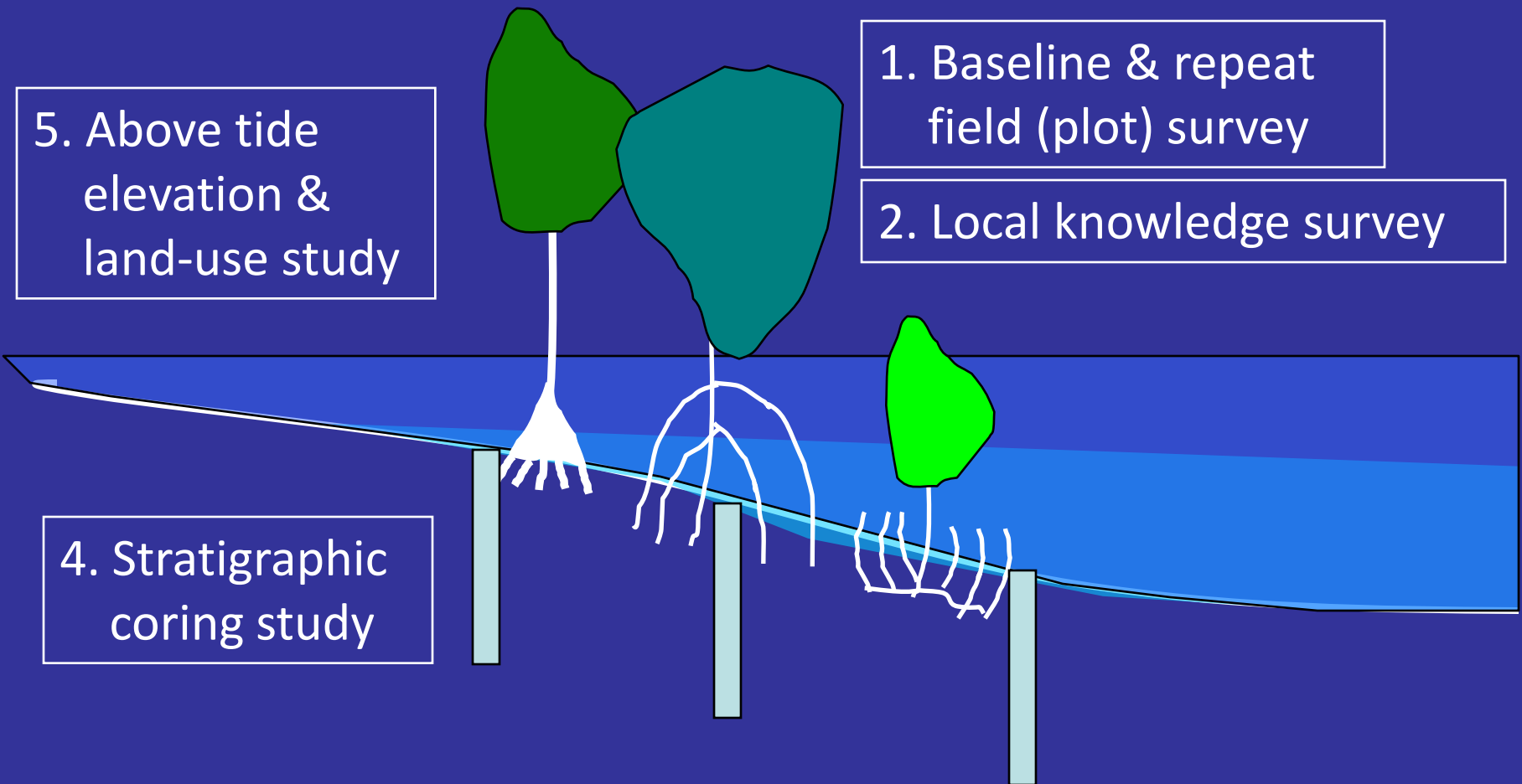


5. Above tide elevation & land-use study

1. Baseline & repeat field (plot) survey

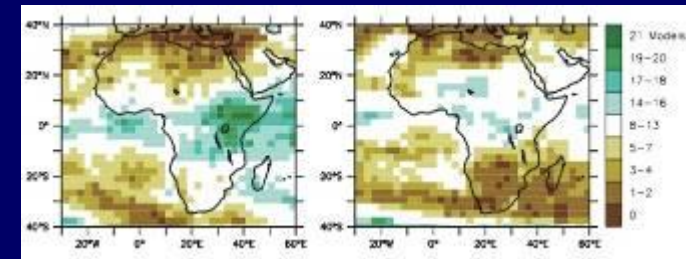
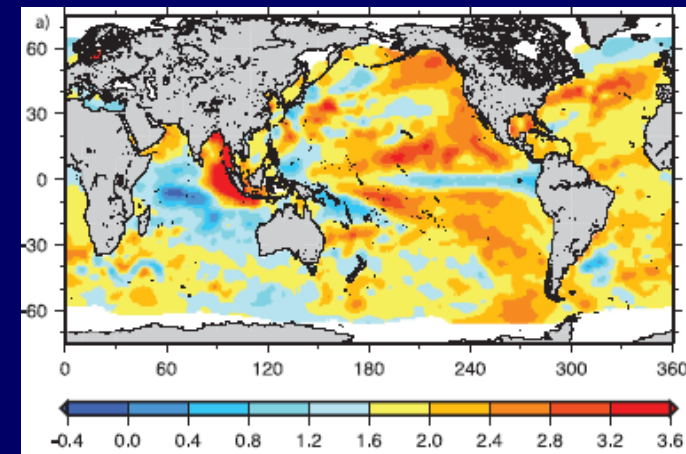
2. Local knowledge survey

4. Stratigraphic coring study



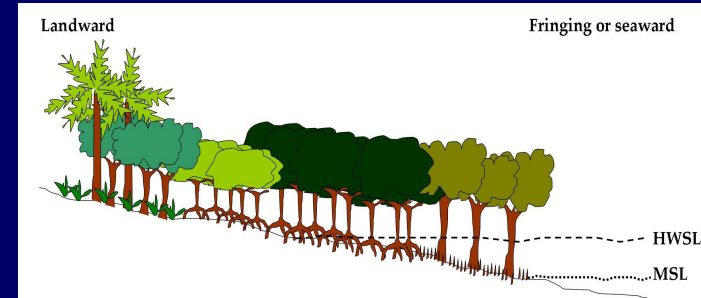
LESSONS

1. There is no formula for conducting vulnerability assessments
2. reliable trend data for key climate parameters is often not available
3. downscale projections can provide useful backdrop but are ambiguous, theoretical and data dependent
4. no single study conclusively characterises CC vulnerability as vectors of change are multiple
5. need to triangulate results from different studies

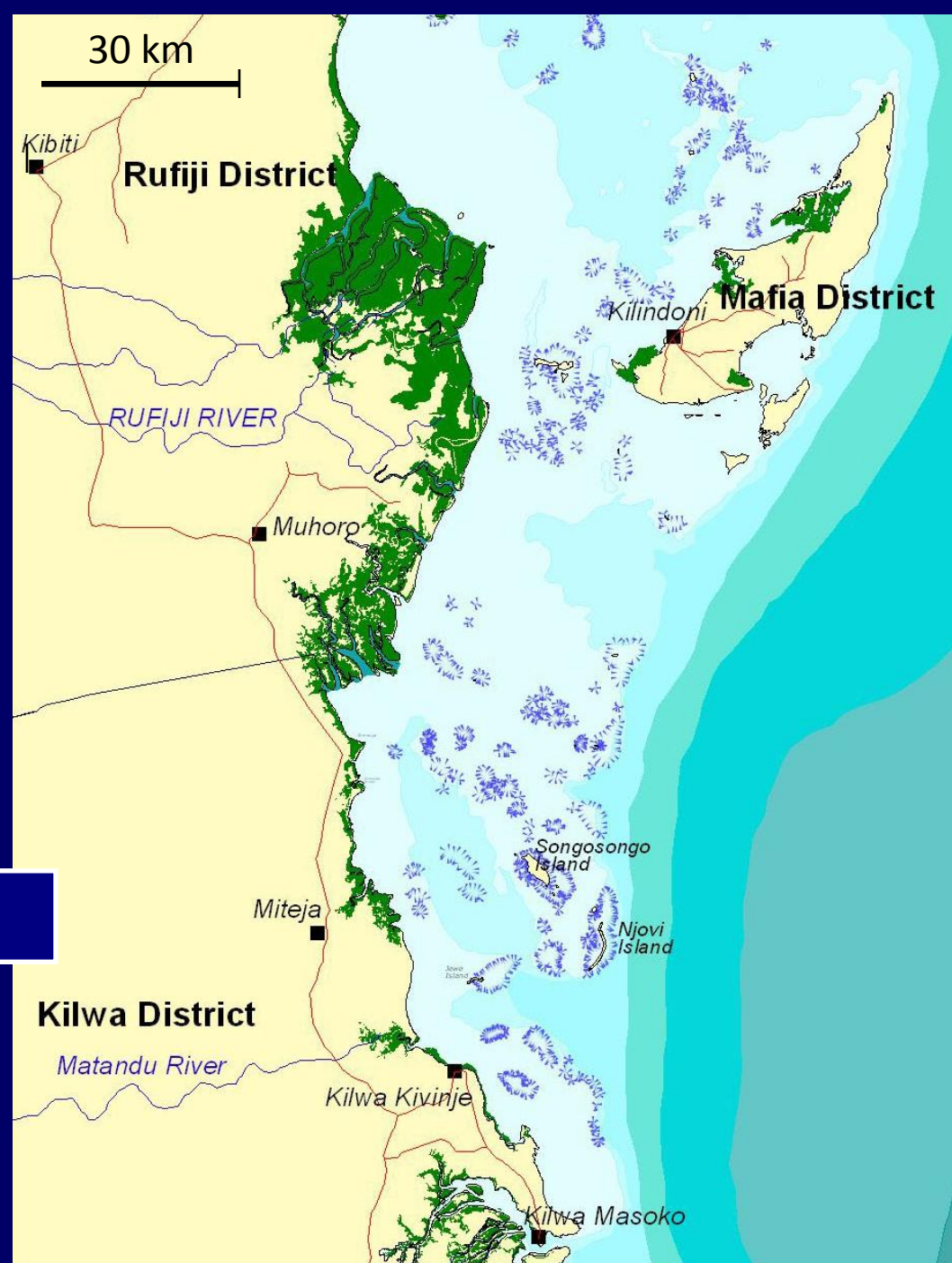


LESSONS cont'd

5. changes in vegetation over time can provide a proxy indicator of climate trends and impacts
6. but need to be interpreted with care
7. community-based assessments are necessary but not sufficient
8. quantifying severity of impact is important ... time-scales of CC impacts & livelihood concerns may not be reconciled



Tanzania project site



Rufiji-Mafia-Kilwa Seascape

Mangrove area = ~ 73,500 ha

Delta population = ~ 27,000



0 100 200 Kilometers

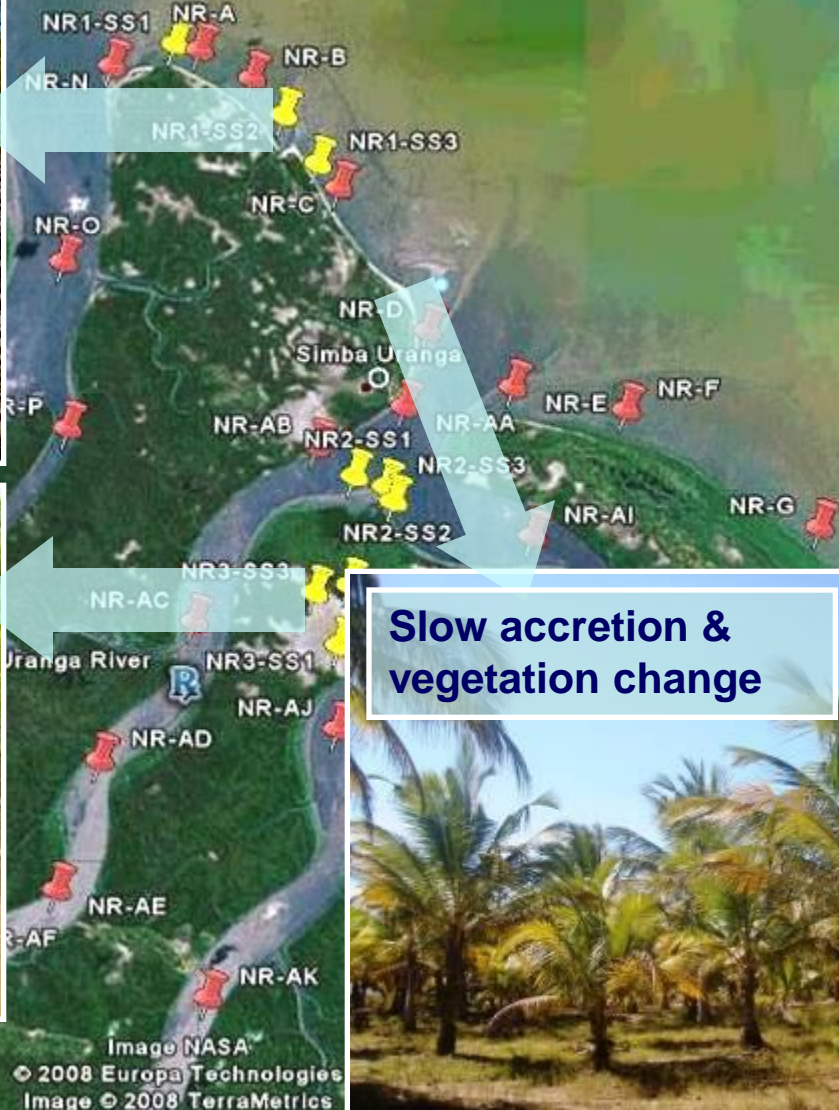


North Rufiji Delta mangrove survey sites

Loss of 25m of mangrove in 2 yrs



Slow colonisation by Avicennia

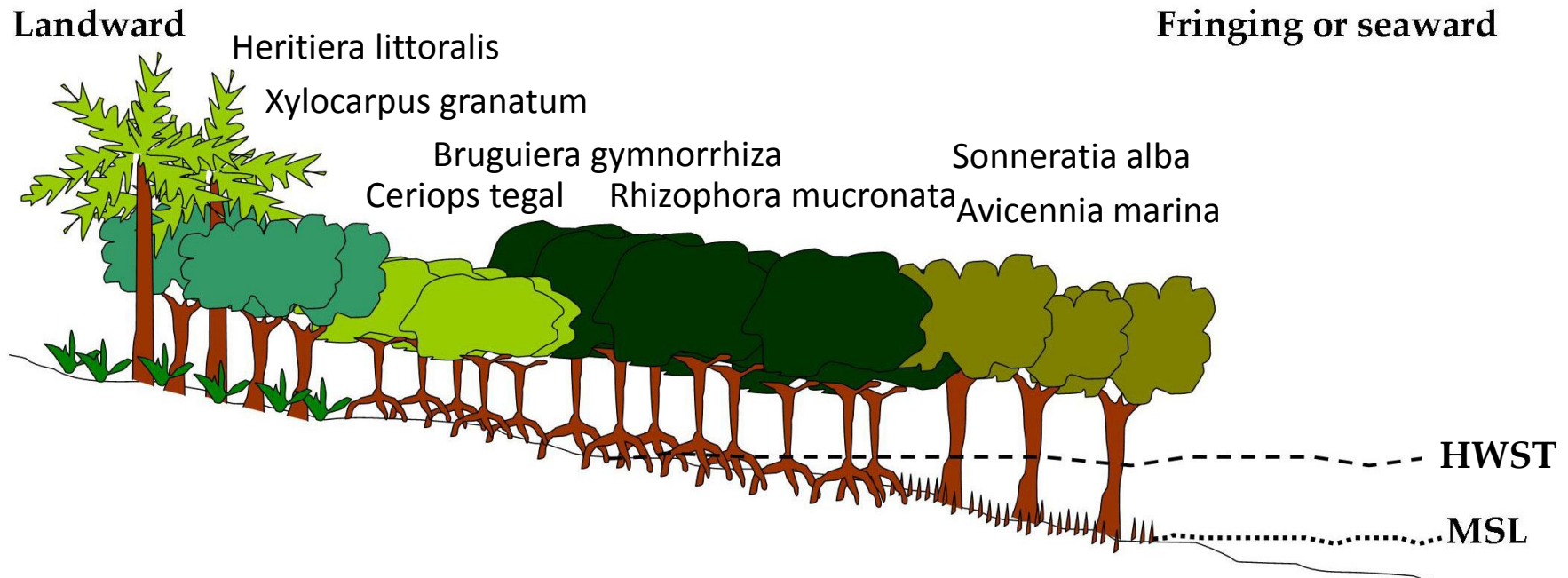


Slow accretion & vegetation change

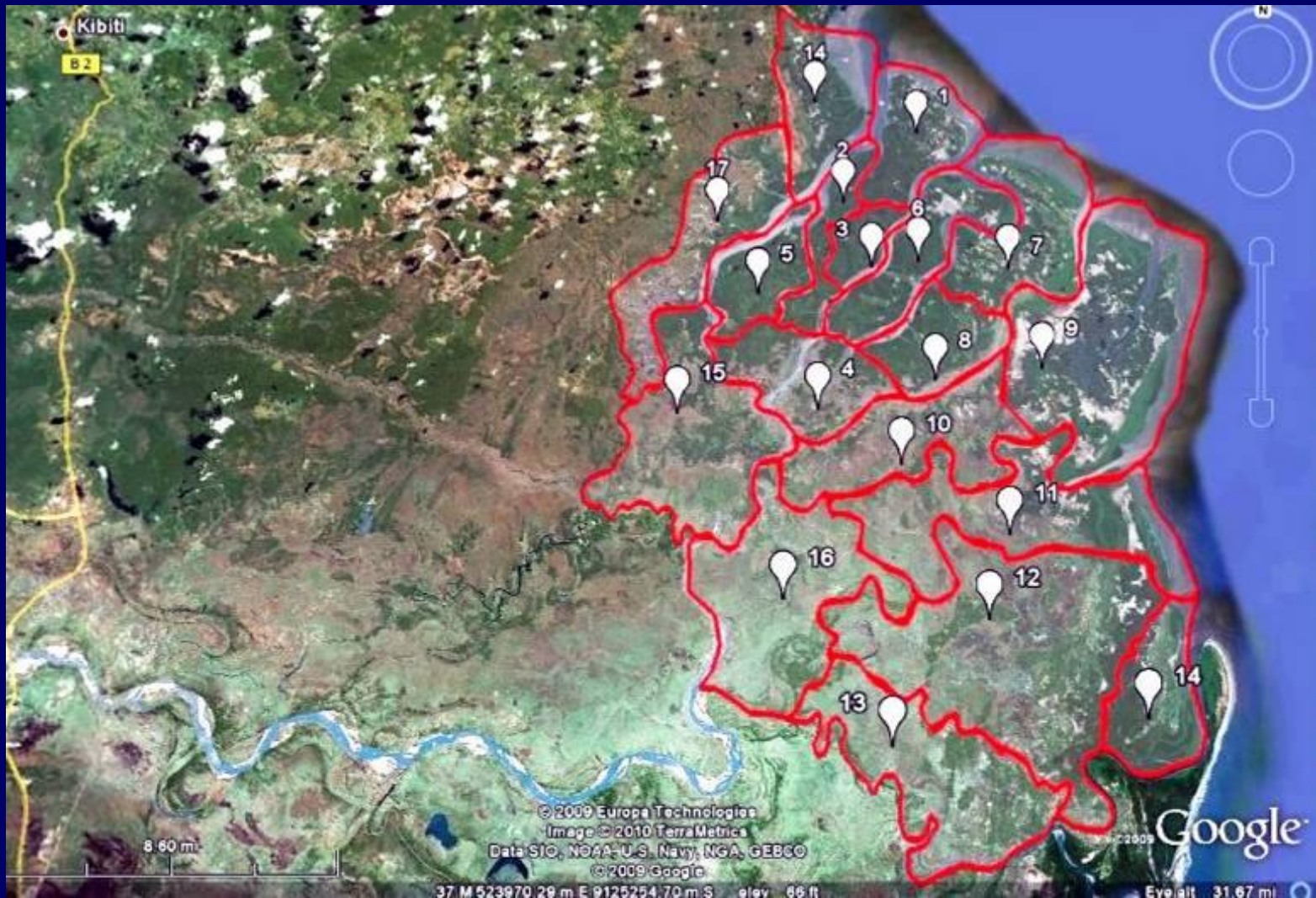


Mangrove zonation in Rufiji Delta

Nine mangrove species present Tanzania (Kathiresan and Rajendran, 2005 and Wang *et al.*, 2003), show distinct zonation (Taylor *et al.*, 2003) with respect to tide levels.

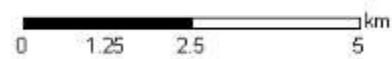
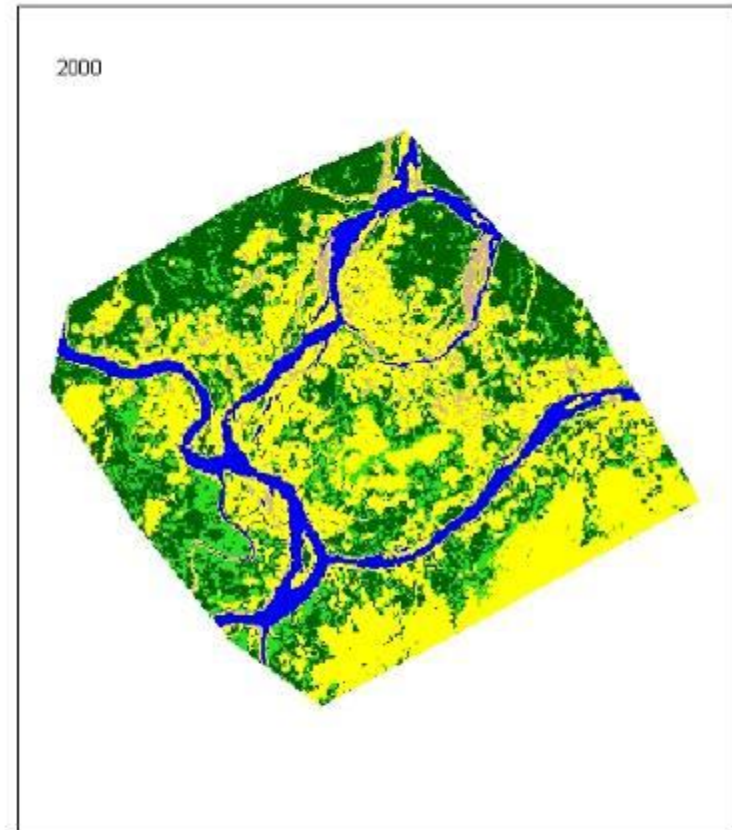
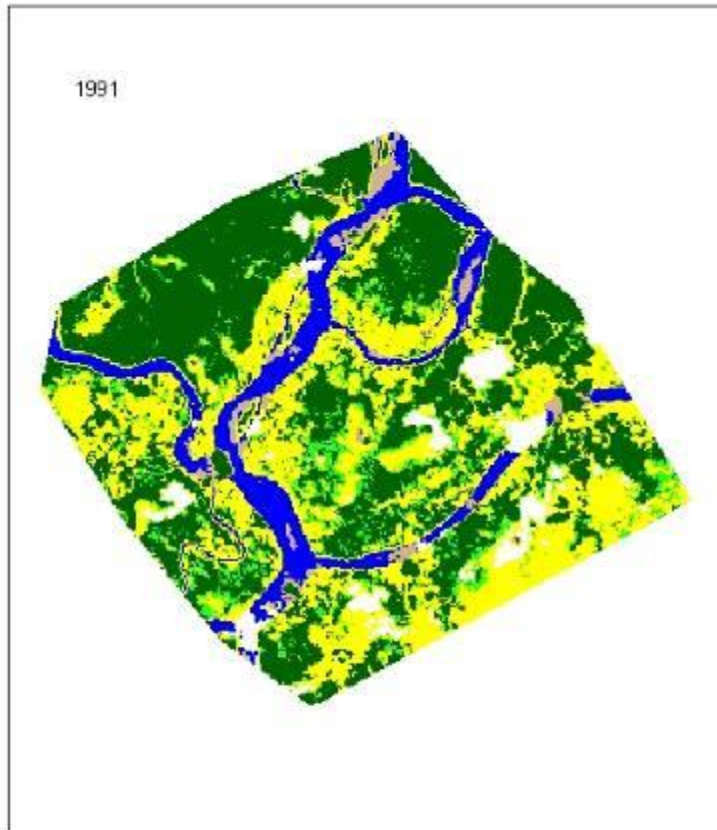


Unit blocks for remote sensing analysis - Tanzania

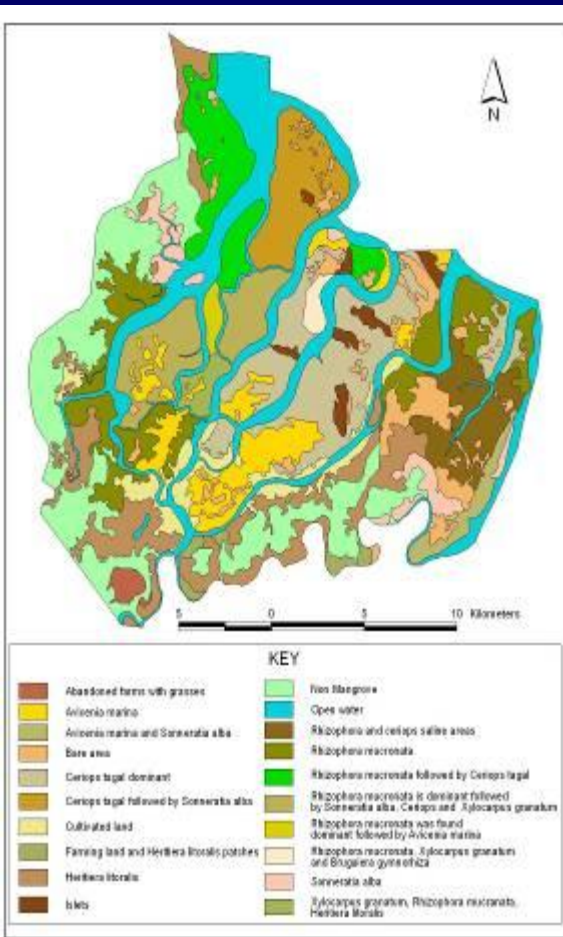


Vegetation change, Mawanda, Rufiji

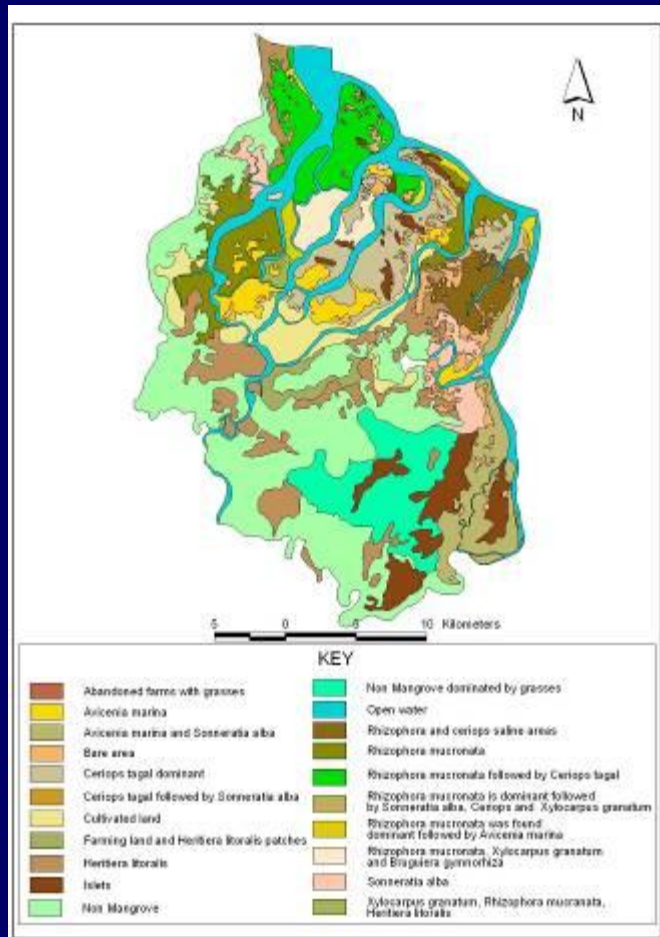
Landsat May 1991 and June 2000



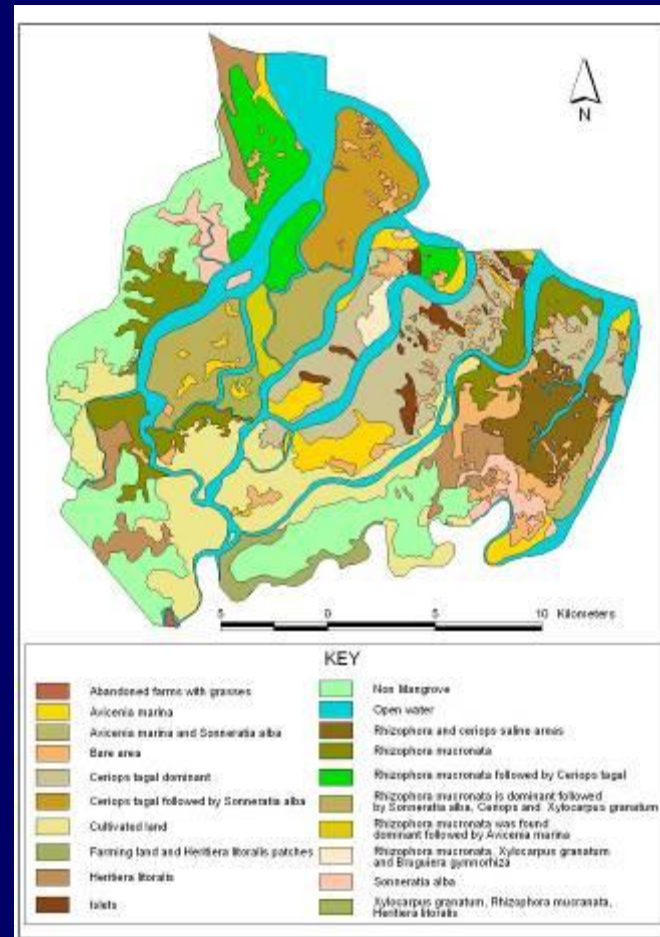
1989 Landsat



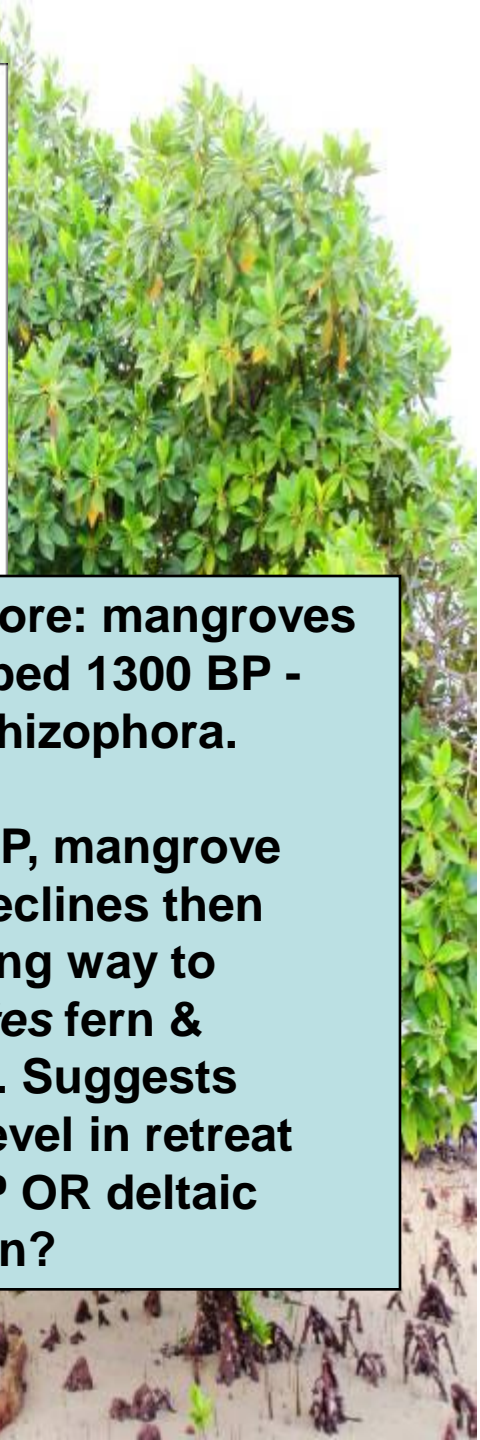
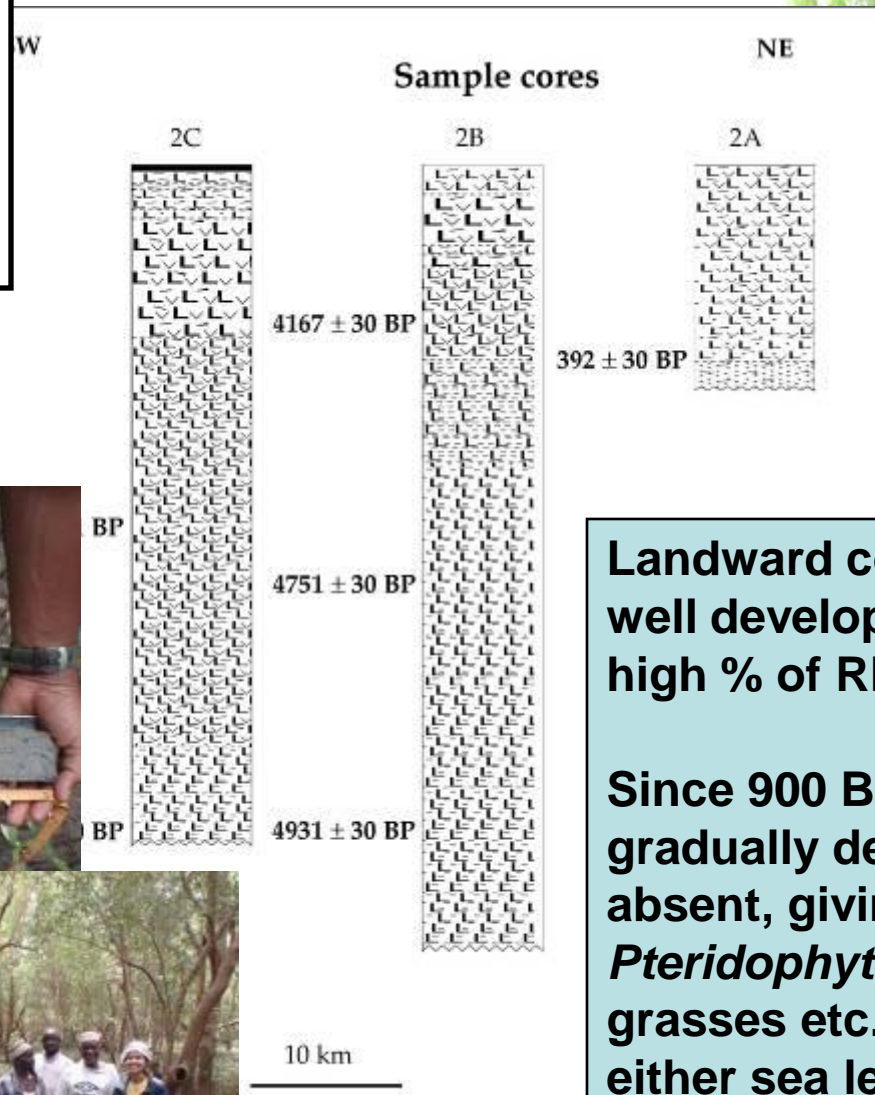
2000 Landsat



2010 WorldView-1



**Rufiji Delta
relative sea-level
reconstruction
Punn, 2010
York University, UK**



Landward core: mangroves well developed 1300 BP - high % of Rhizophora.

Since 900 BP, mangrove gradually declines then absent, giving way to *Pteridophytes* fern & grasses etc. Suggests either sea level in retreat after 900 BP OR deltaic progradation?



Community knowledge & perceptions

- Major shift of outflow patterns from south delta to north delta during 1960s and again 1978
- Major die-off of Heritiera during el Nino rains, 1998



- Getting hotter
- Humidity decreasing.
- Rainfall decreasing and more irregular
- Aware of sites of erosion and accretion but not of trends in sea levels



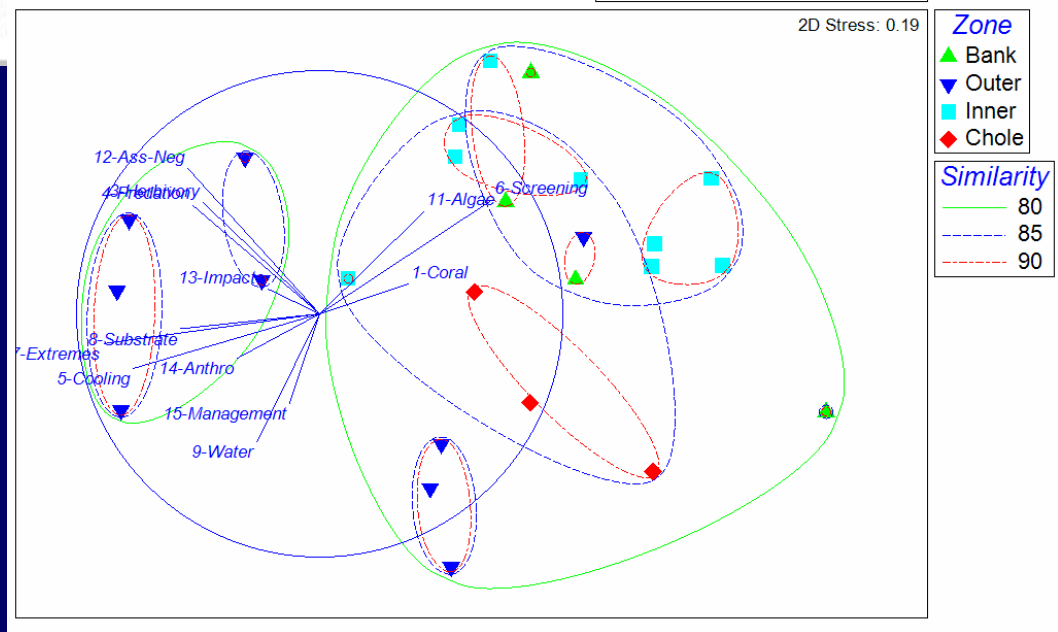
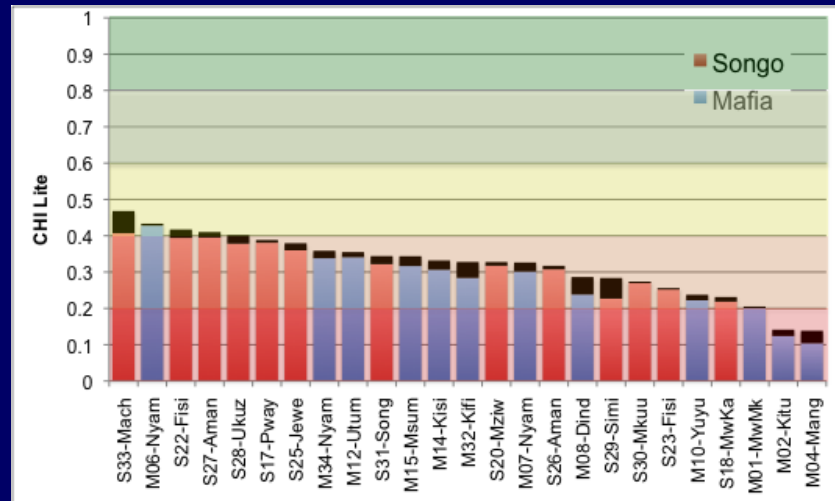
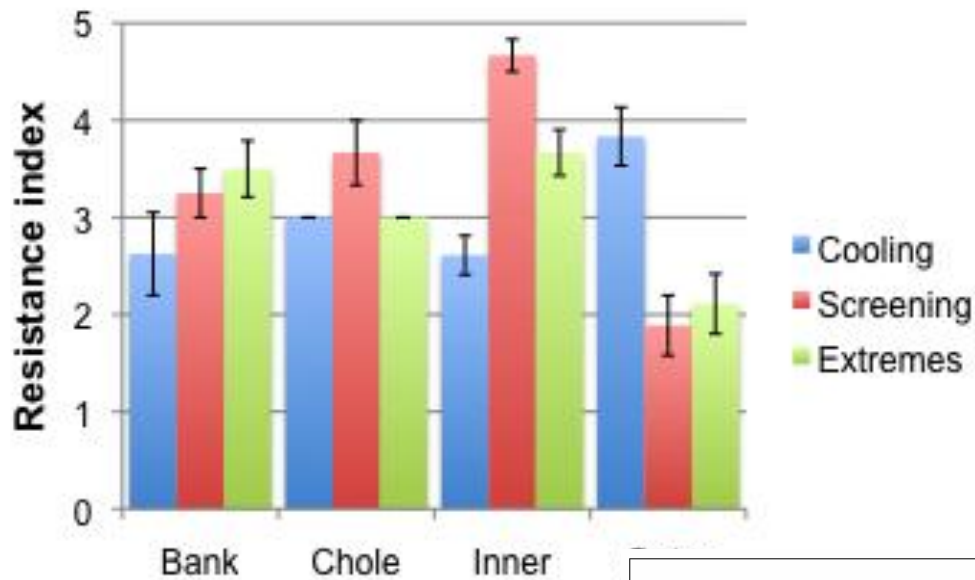
Coral reef resilience survey

Repeat surveys 2007 & 2009
27 sites in 2007
25 sites in 2005
17 sites repeat sites
34 sites total

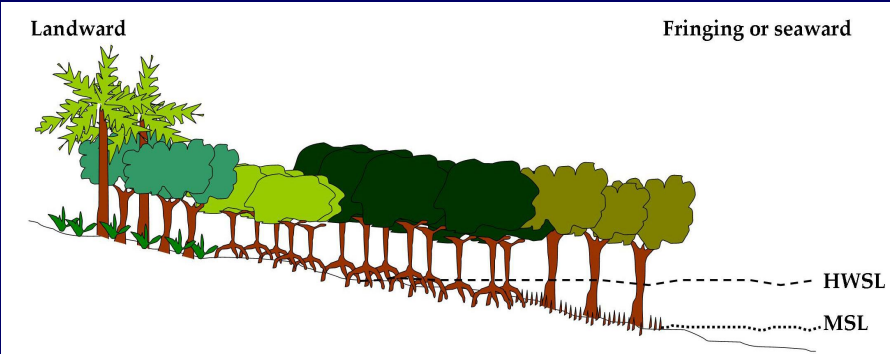
- ## Coral reef CC resilience indicators
1. Benthic cover – coral, algae, rubble
 2. Physical factors
 - topographic complexity
 - cooling & flushing
 - temperature
 - shading & screening
 - acclimatization
 3. Coral community - colony size, mortality, disease
 4. Coral associates – fish community, bio-eroders
 5. Direct anthropogenic pressures
 - water quality
 - fishing pressure
 - management capacity



Coral reef resilience analysis

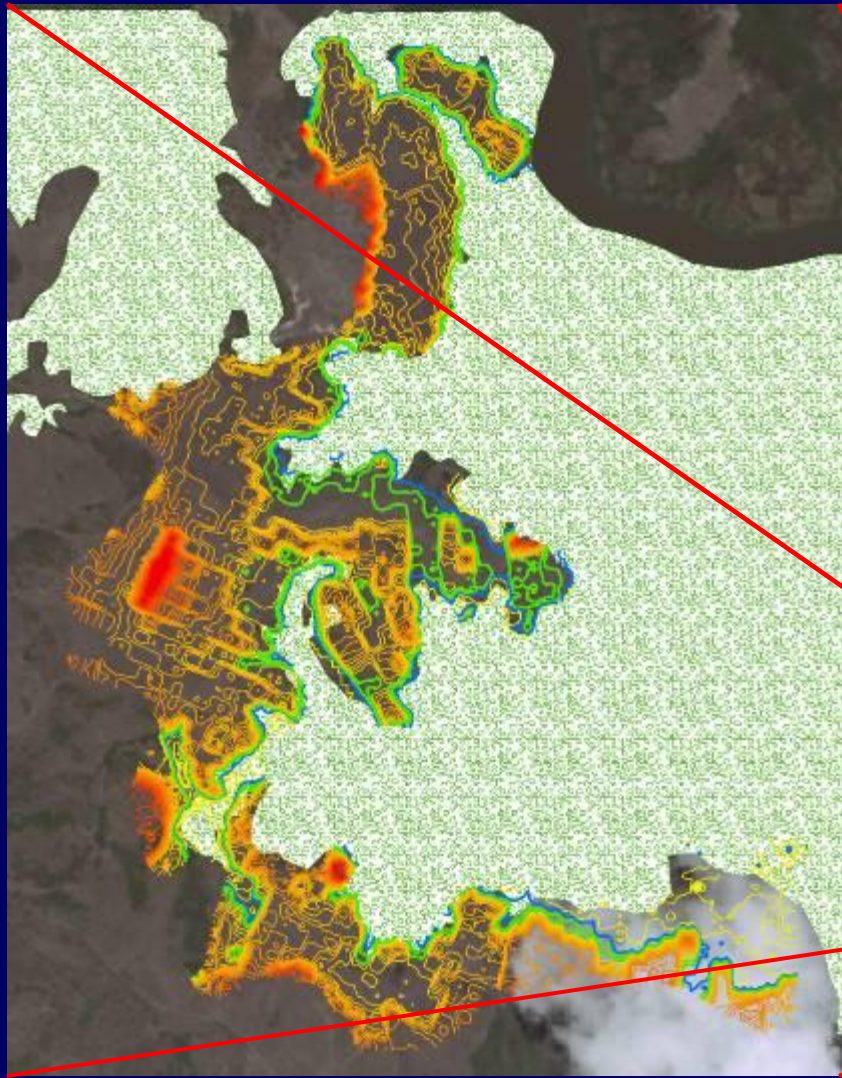


Landward colonisation & land-use in Rufiji

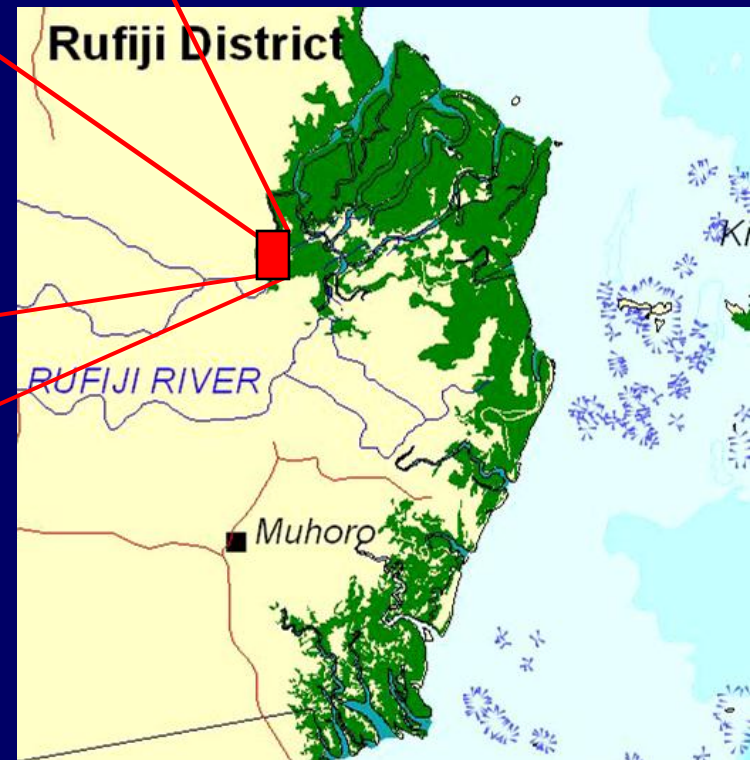


A map of the Rufiji District in Tanzania. The Rufiji River is shown in blue, flowing through a green-shaded area. The text 'Rufiji District' is at the top, and 'RUFJI RIVER' is written in blue letters across the river. The map shows the coastline and some internal boundaries.





Elevation survey, Rufiji



Adaptation response



73 ha degraded areas replanted

Implications for future land-use planning in high tide margins

