

# DYNAMICS OF MANGROVES ALONG THE SOUTH AFRICAN COASTLINE

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**Nelson Mandela  
Metropolitan  
University**

*for tomorrow*

**AREA & DISTRIBUTION, CASE STUDIES FUTURE CHANGES**



*Avicennia marina* (Forrsk.) Vierh.

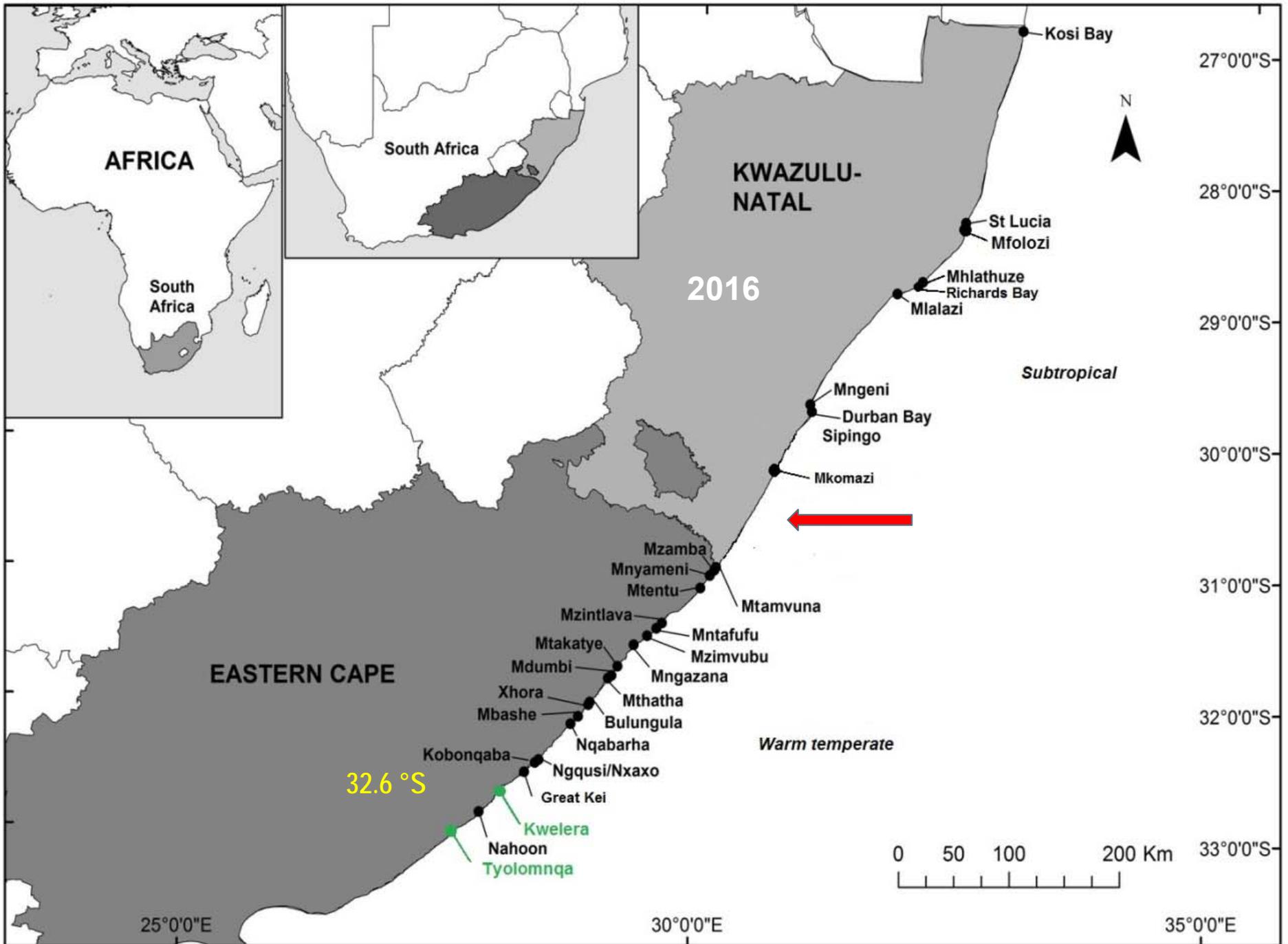
- 31 estuaries
- ~ 2000 ha (0.05 % of Africa)
- Biodiversity conservation
- National Biodiversity Assessment (2018)
- Red data listing (2016)



*Rhizophora mucronata* (L.)



*Bruguiera gymnorrhiza* (L.) Lam.



# Decrease in mangrove area

ESTUARY	SPECIES	AREA (ha)	
		earliest – recent	
St Lucia	Bg, Am	305 – 209.5	Freshwater diversion Mouth closure, drought
Richards Bay	Rm, Bg, Am	267 – 130	Harbour development
Durban Bay	Rm, Bg & Am	438 – 15	
Mngazana	Rm, Bg & Am	145 – 118	Harvesting, browsing, trampling
Mthatha	Rm, Bg & Am	42- 31	

# Increase in mangrove area

ESTUARY	SPECIES	AREA (ha)	
		2012	2016
Kosi Bay	Rm, Bg, Am, Ct, Xg, Lr	60.7	70.1
Mhlathuze	Rm, Bg, Am	652	840
Mgeni	Rm, Bg & Am	20.3	31.7

↑ 118 ha

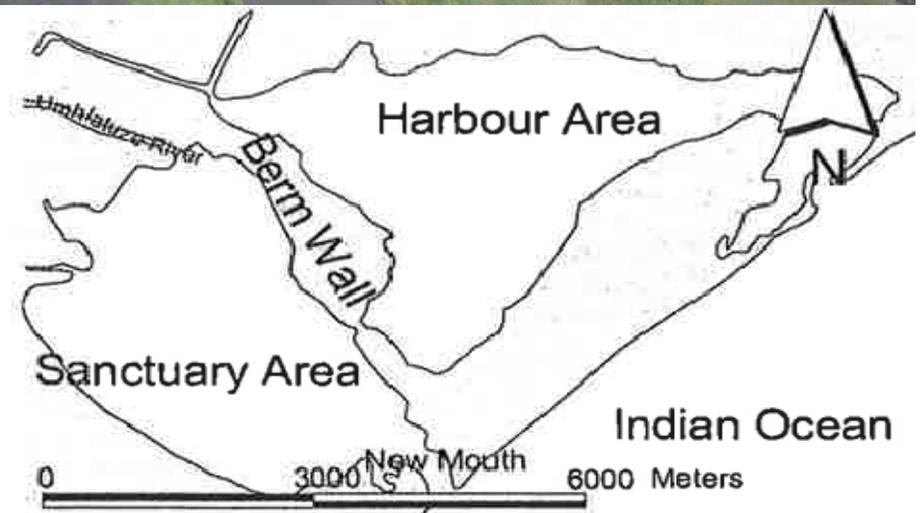
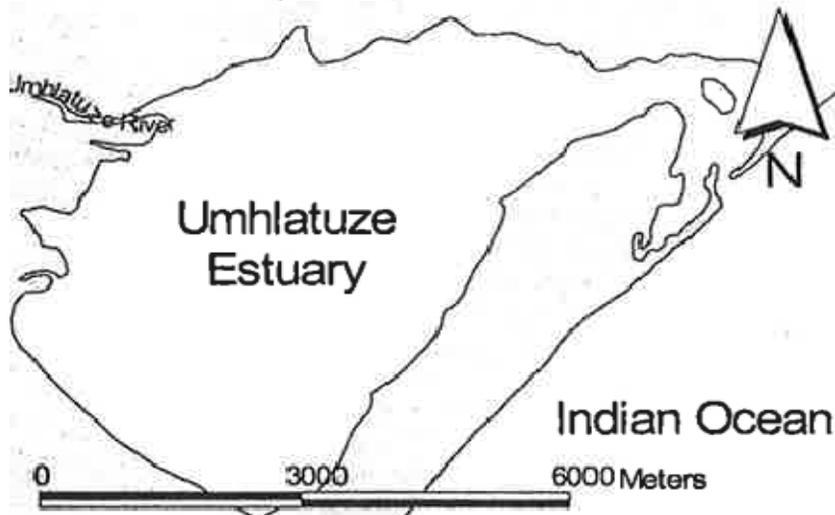
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# MHLATHUZE

- 1975 – 100 ha
- 1998 – 652 ha
- 2016 – 840 ha
- Harbour development
- Artificial mouth

Bedin T. 2001. The progression of a mangrove forest over a newly formed delta in the Umhlatuze Estuary, South Africa. *South African Journal of Botany* 67: 433-438.

Photo: F Mackay



# Loss - estuary

	Ward & Steinke 1982 (ha)	Pressures
Mhlanga, Little Manzimtoti, Msimbazi, Mgababa, Ngane, Kongweni, Bilanhlolo, Mhlangankulu, Khandandlovu	< 0.5	Road bridge, railway bridges, infilling, mouth closure (6 months),
Lovu	2	sugarcane, siltation,
Mahlongwa	1	modified freshwater inflow



Rajkaran, A. Adams, J.B. and Taylor, R. 2009. Historic and recent state (2006) of mangroves in small estuaries from Mlalazi to Mtamvuna in Kwazulu-Natal, South Africa. *Southern Forests* 71(4): 287-296.

# Natural dynamic changes

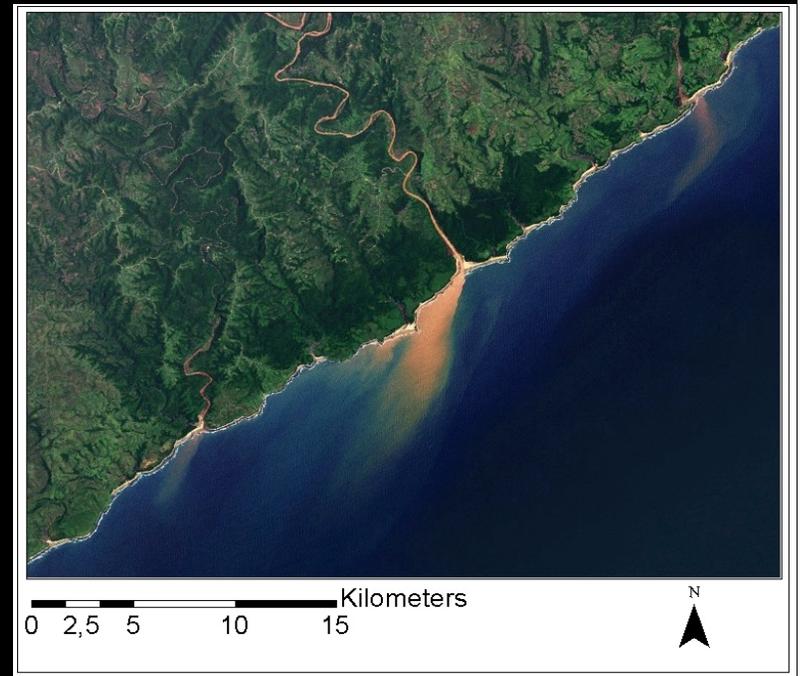
<b>MANGROVE COVER (ha)</b>	<b>1988 Steinke and Ward</b>	<b>1999 Colloty</b>	<b>2012 Hoppe-Speer</b>
Mnyameni	3	0 (floods)	5
Mzimvubu	1	0 (floods)	0.03
Bulungula	3.5	0 (mouth closure)	0.01
Kobonqaba	6	3.5 (mouth closure)	0.05

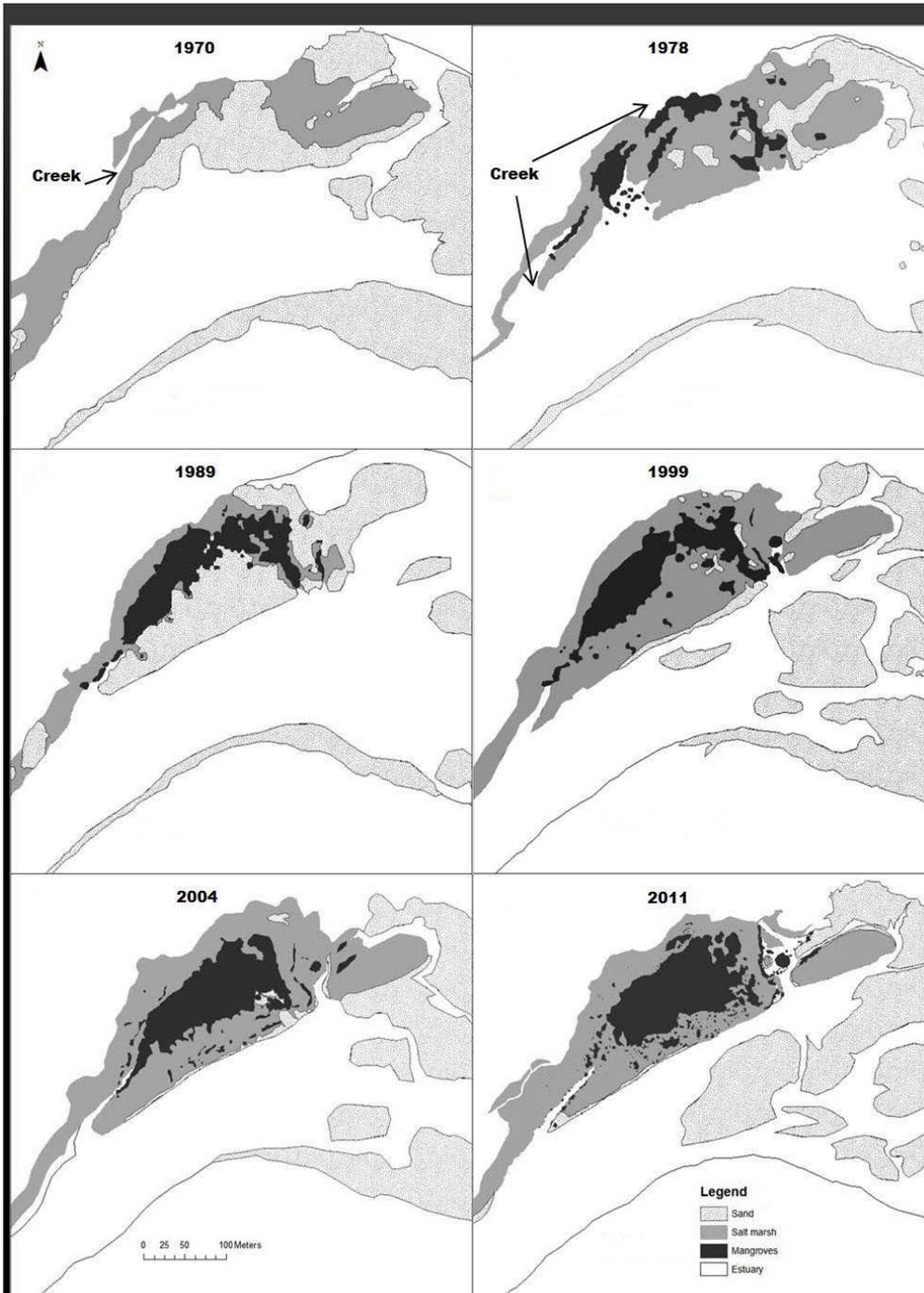
Adams, JB, BM Colloty and GC Bate. 2004. The distribution and state of mangroves along the coast of Transkei, Eastern Cape Province, South Africa. *Wetlands Ecology and Management* 12: 531-541.

Hoppe-Speer SCL, JB Adams and D Bailey. 2015. Present state of mangrove forests along the Eastern Cape coast, South Africa. *Wetlands Ecology and Management* 23:371-383.

# DYNAMIC NATURE OF SOUTH AFRICA'S ESTUARIES

- MAR variable fluctuating between droughts and floods
- Spatial location reset by floods
- Little permanent habitat structure
- Planning challenge
- **Future fate ?**





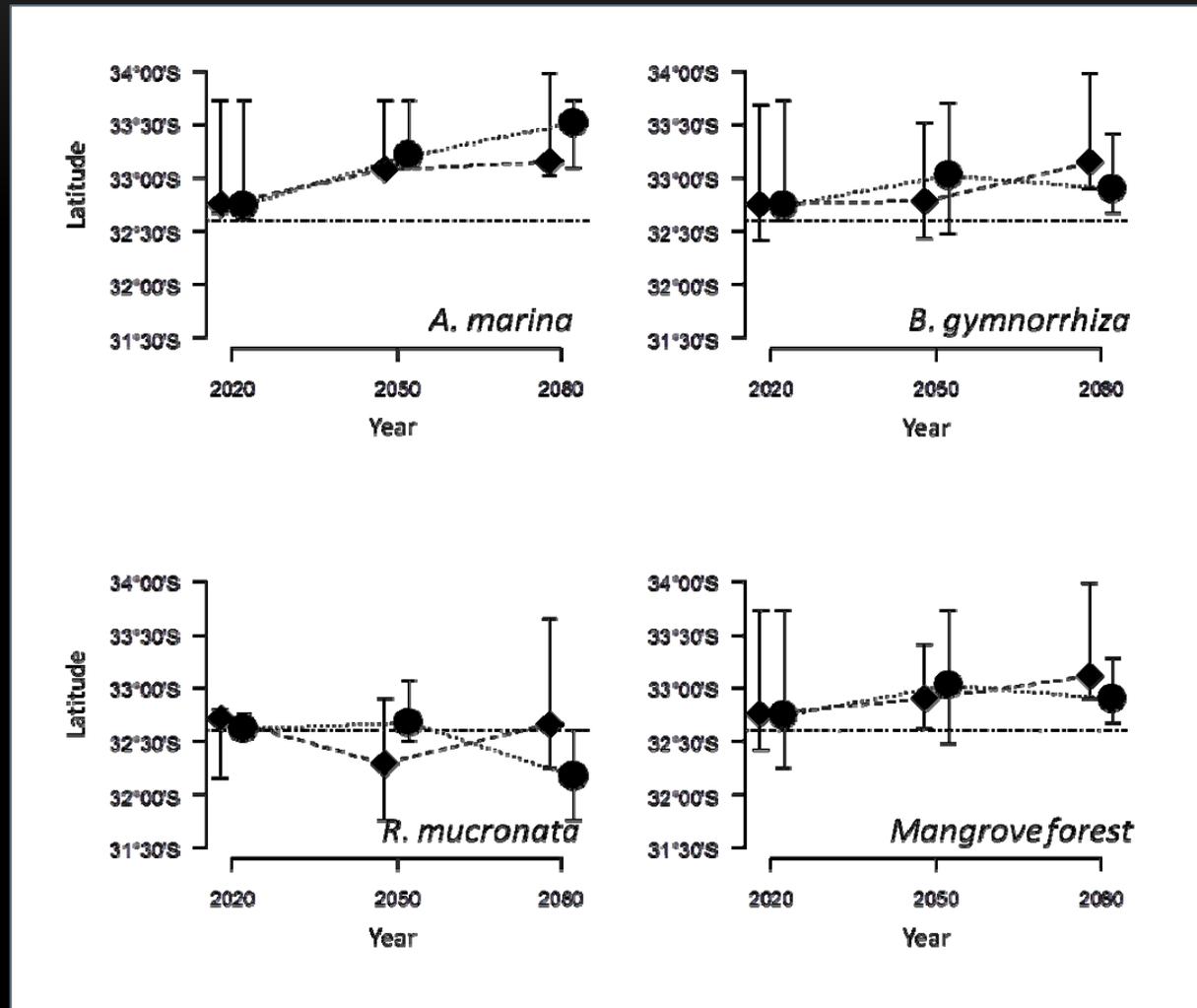
## INCREASE TEMPERATURE INCREASE EXPANSION

- Expansion of planted mangrove forest at Nahoon Estuary ( $32^{\circ}59'S$ ;  $27^{\circ}56'E$ ) possibility of further natural expansion.
- **0.06 ha per annum**



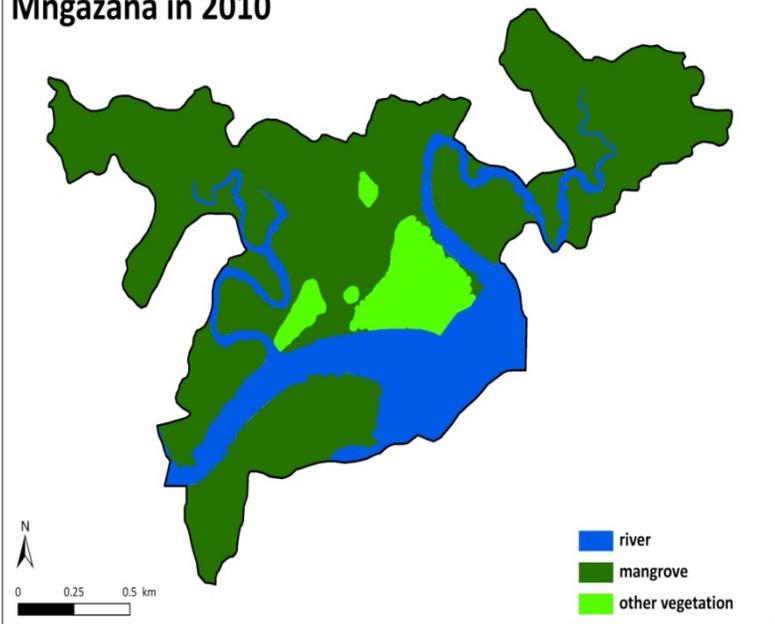
Hoppe-Speer, SCL, JB Adams and A. Rajkaran. 2015. Mangrove expansion and population structure at a planted site, East London, South Africa. *Southern Forests: a Journal of Forest Science* 77: 131-139

## Global warming - suitable sites for *A. marina* & *B. gymnorhiza* beyond their current limits

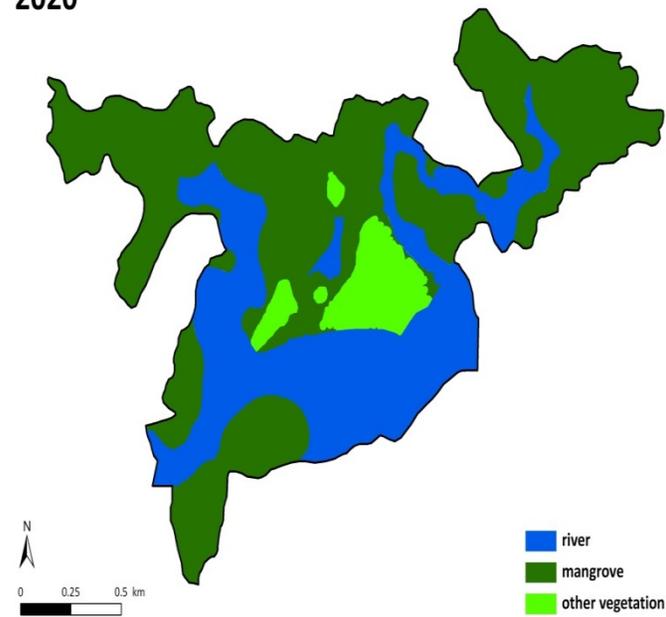


Quisthoudt, K, CF Randin, J B Adams, A Rajkaran, F Dahdouh-Guebas and N Koedam. 2013. Disentangling the effects of global climate and regional land-use change on the current and future distribution of mangroves in South Africa. *Biodiversity and Conservation* 22: 1369-1390.

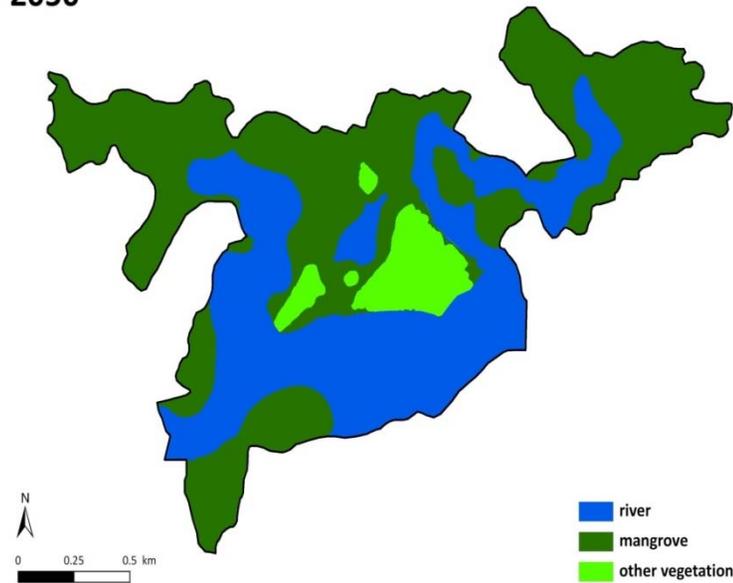
Mngazana in 2010



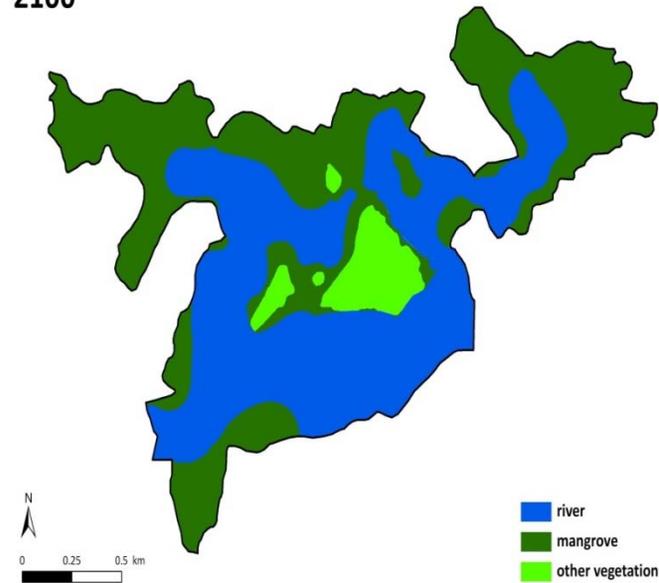
2020



2050



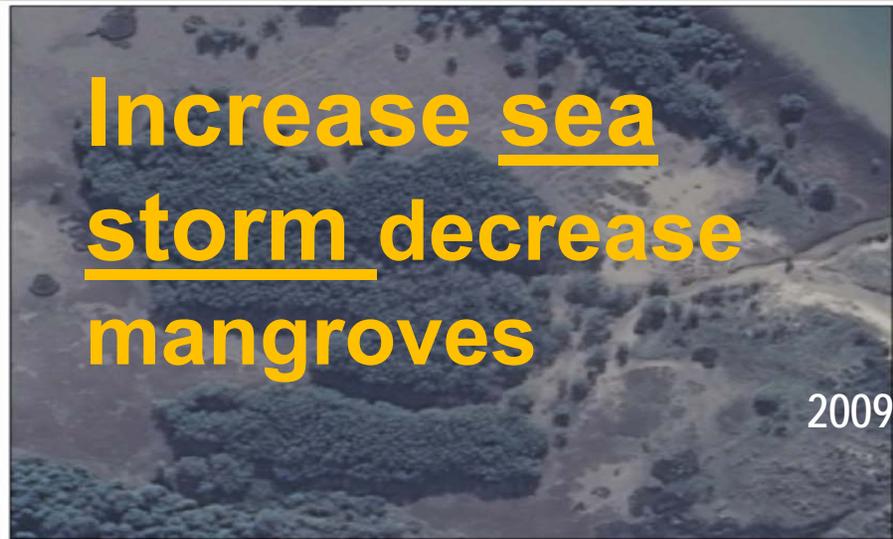
2100



**INCREASE  
SEA LEVEL  
INCREASE**

Initial  
increase  
thereafter  
loss of 0.32  
ha yr<sup>-1</sup>

Elevation  
limitation of the  
adjacent non  
mangrove  
areas.



**Increase sea  
storm decrease  
mangroves**

2009

0 12,5 25 50 75 100 Meters



Rescaled aerial photograph 2009  
Source: Department of Rural Development and Land Reform



**Marine sediment deposition**

2010

0 12,5 25 50 75 100 Meters



Rescaled aerial photograph 2010  
Source: Google Earth



2012

0 12,5 25 50 75 100 Meters



Rescaled aerial photograph 2012  
Source: Google Earth



**Verle, K. 2013 .Characteristics of the Mbashe Catchment and Estuary, South Africa: Towards an assessment of catchment land use impact. MSc study.**



March 2011

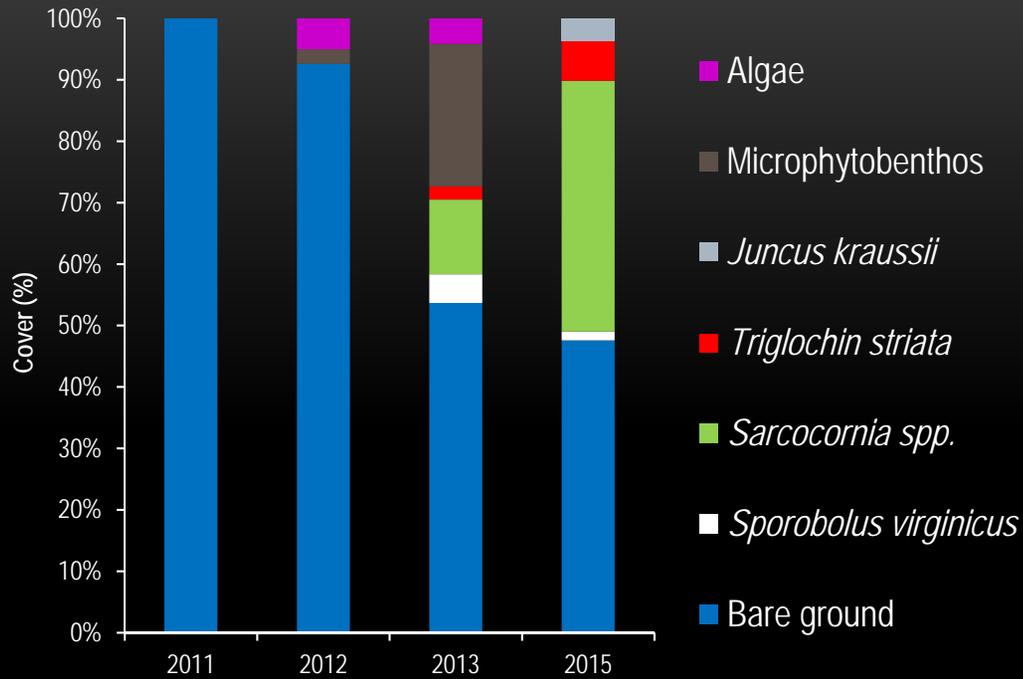
**Water level increase – Kobonqaba Estuary**



Mouth closure – July 2010

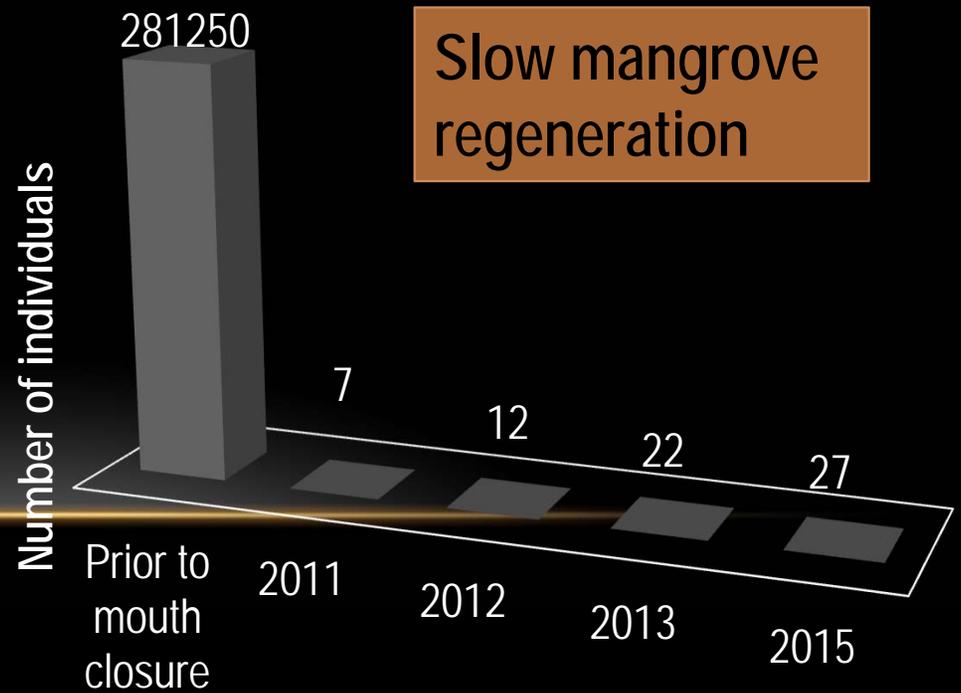


Recovery – July 2015



Salt marsh colonization

Mbense, S, A Rajkaran, U Bolosha and JB Adams. Rapid colonization of degraded mangrove habitat by succulent salt marsh. *South African Journal of Botany* in press.



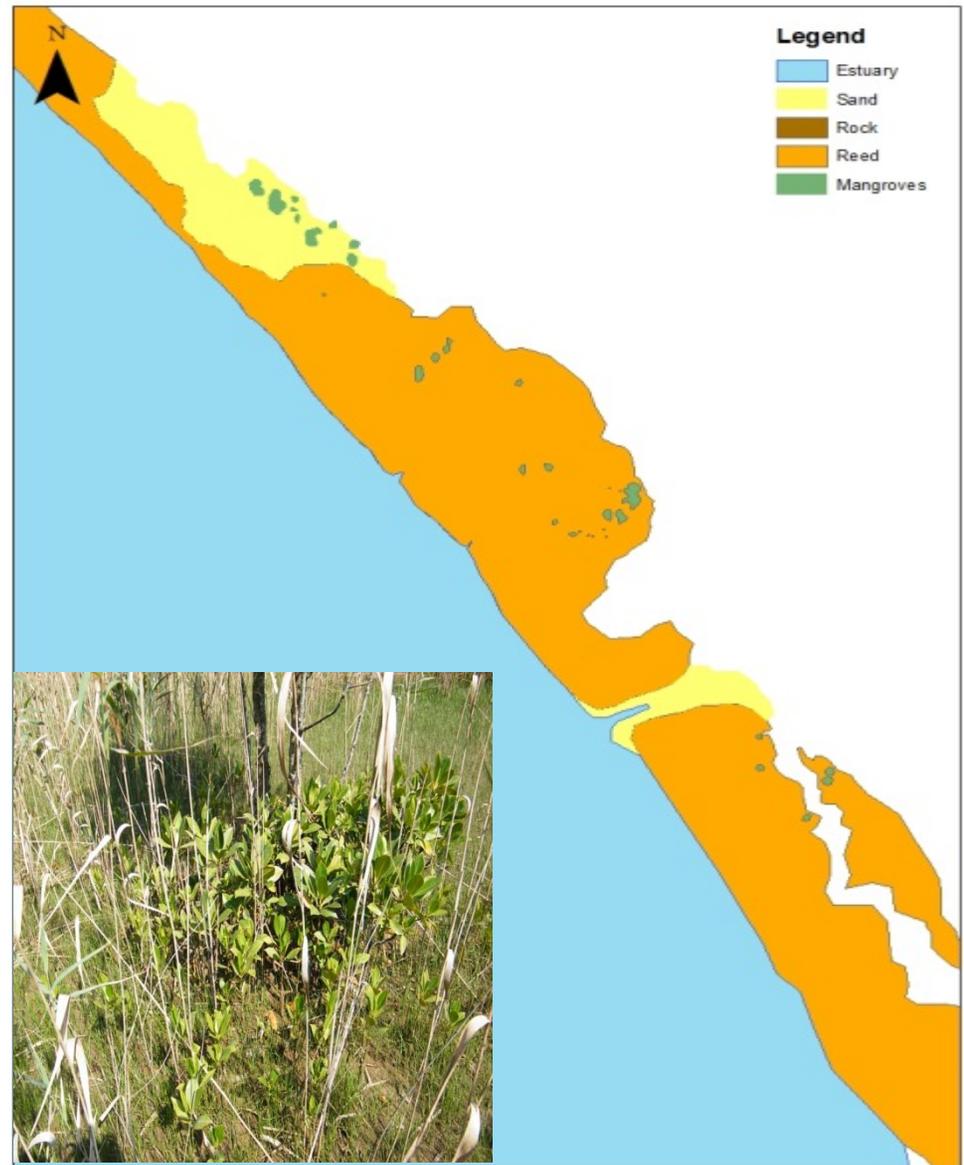
Slow mangrove regeneration

# SEA STORMS - RECRUITMENT

- Population structure in other small east coast estuaries indicates historical single successful recruitment events and persistence linked to initial flooding and connectivity with the sea.



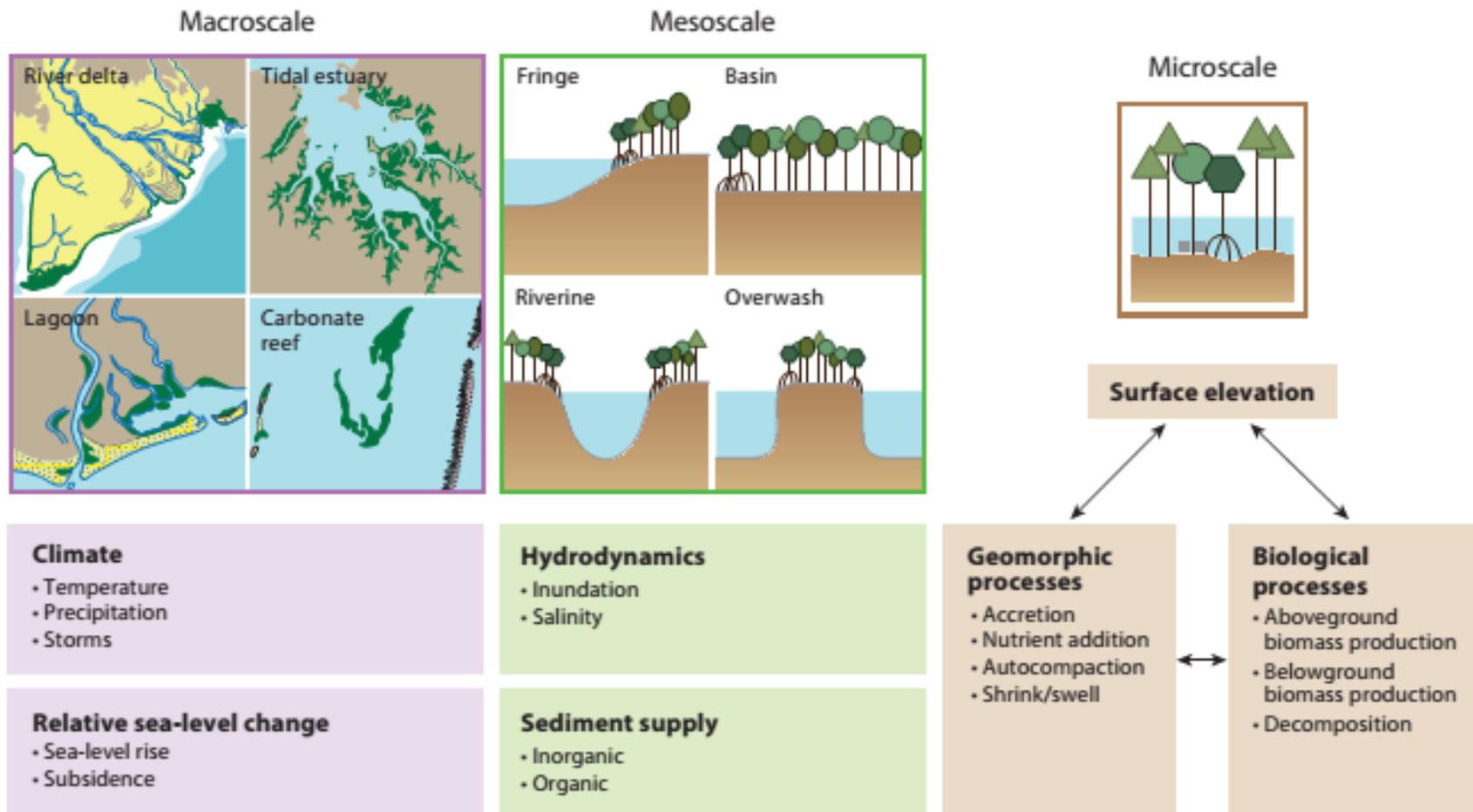
# Mzimvubu



Pulsed recruitment – 18.6 yr highest tide?

# SUMMARY MANGROVE RESPONSES

- ↑ TEMPERATURE & CO<sub>2</sub> – expansion
  - ↑ SEA LEVEL RISE – increase in mangroves if available habitat & TOCEs
  - ↓ ↑ SEA STORMS – erosion and sediment deposition, propagule recruitment
  - ↓ MOUTH CLOSURE drought / freshwater abstraction – inundation & die back
  - ↓ INCREASE INTENSITY OF RAINFALL EVENTS - erosion and loss of mangroves after flooding
  - ↑ increase marine connectivity and intertidal conditions temporarily open/closed estuaries
-

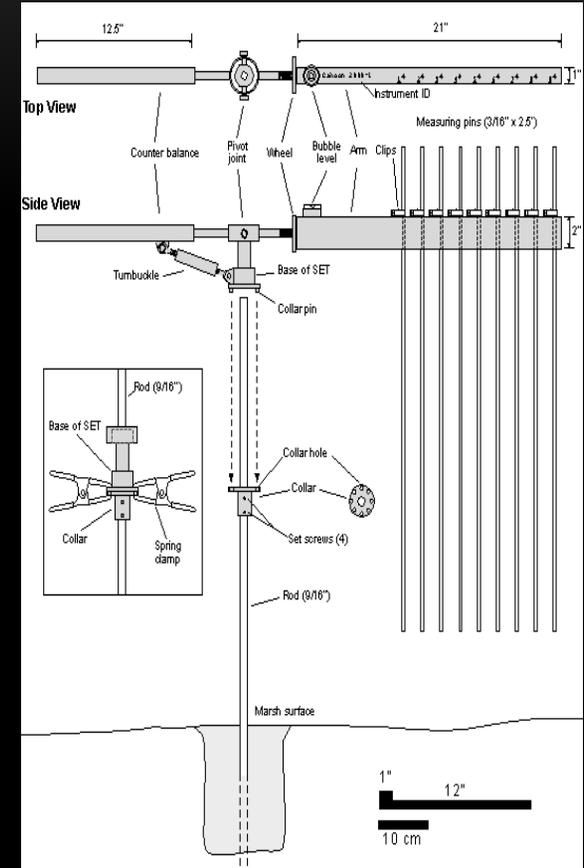


**Figure 3**

A scale-based framework within which to view mangrove systems, comprising macroscale regional boundary conditions (climate and relative sea-level change, which includes both subsidence and sea-level rise); mesoscale processes, in which hydrodynamics and sediment supply are important influences on mangrove systems; and microscale at-a-site interactions within a mangrove stand, including surface and subsurface processes.

**C.D. Woodroffe, K. Rogers, K.L. McKee, C.E. Lovelock, I.A. Mendelssohn, and N. Saintilan. 2016. Mangrove sedimentation and response to relative sea-level rise. Annual Review of Marine Science 8: 243-246.**

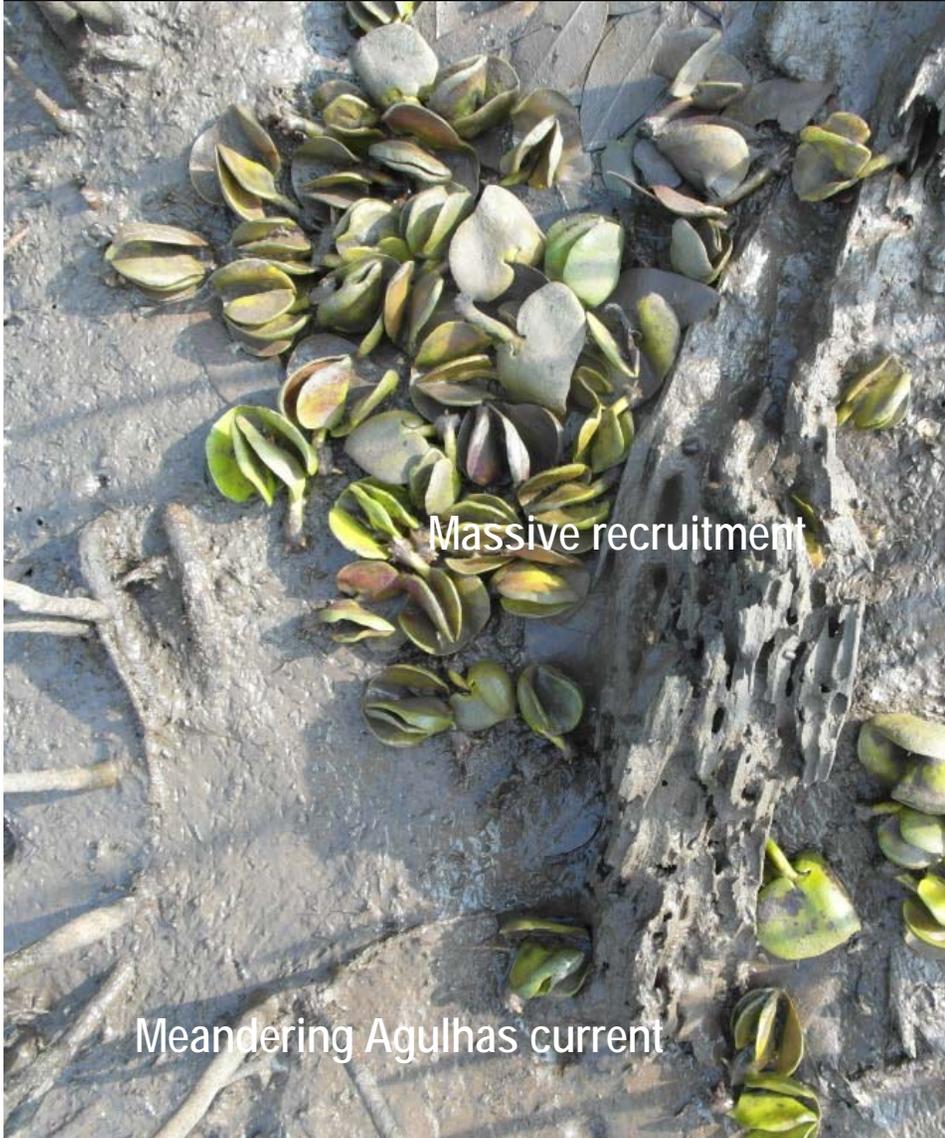
# RSET (ROD SURFACE ELEVATION TABLE)



## RSET – SALT MARSHES – 3 ESTUARIES

Bornman, TG, J. Schmidt, JB. Adams, AN Mfikili, RE Farre and AJ Smit. Relative sea-level rise and the potential for subsidence of the Swartkops Estuary intertidal salt marshes, South Africa.

**Climate change - systems will become less stable influence propagule dispersal, seedling establishment and survival**



# Thank-you

*National Research Foundation*

