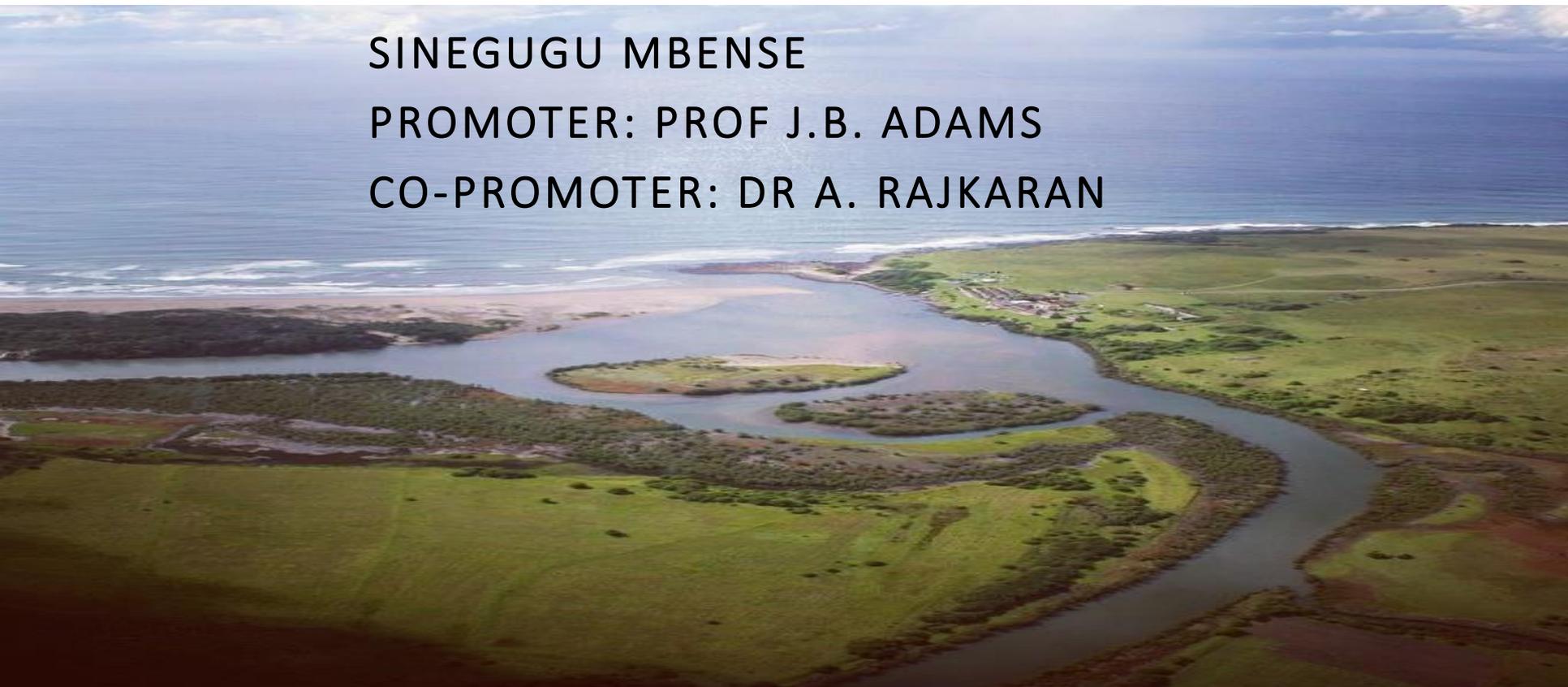


Ecosystem services of coastal habitats and responses to climate change

SINEGUGU MBENSE

PROMOTER: PROF J.B. ADAMS

CO-PROMOTER: DR A. RAJKARAN



Coastal Ecosystem Services



Source: <http://nca2014.globalchange.gov/report/regions/coasts>

Ecosystem services

Coastal protection

- 20% wave energy reduction per 100m (Das, 2013)

Nursery function

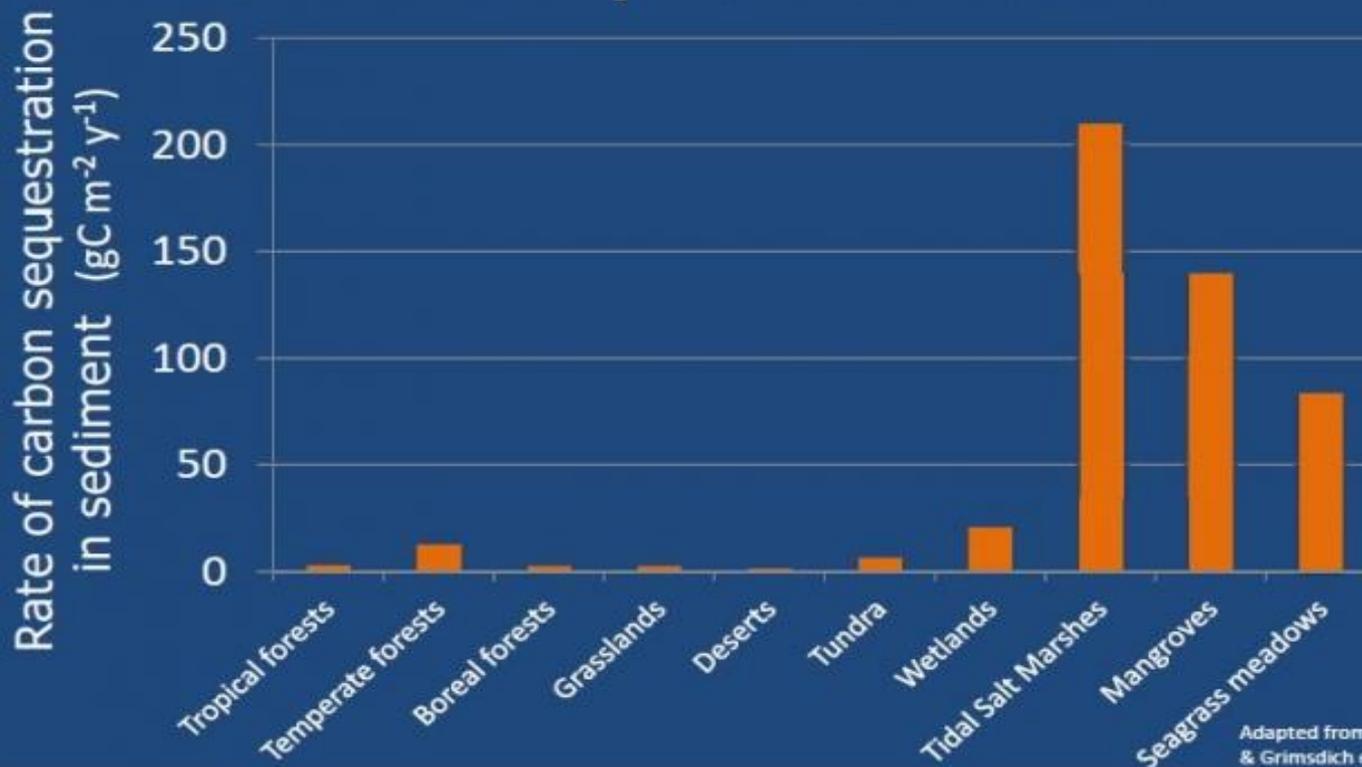
- commercially and ecologically important fish species (Seitz et al., 2014)

Carbon sequestration

- coastal habitats cover less than 2% of global area
- extensive carbon sinks (Macreadie et al., 2014)



Coastal ecosystems have high carbon sequestration rates



Adapted from Laffoley
& Grimsdich eds. 2009

Blue carbon markets

Emissions trading

Reducing Emissions from Deforestation and Forest degradation (REDD+)

Clean Development Mechanism (CDM) (Wylie et al.,2016)



Source: Mark Huxham, Wylie et al.,2016

Rationale and motivation

Coastal habitats threatened (Van Niekerk et al., 2015)

Carbon Tax Bill implemented in South Africa

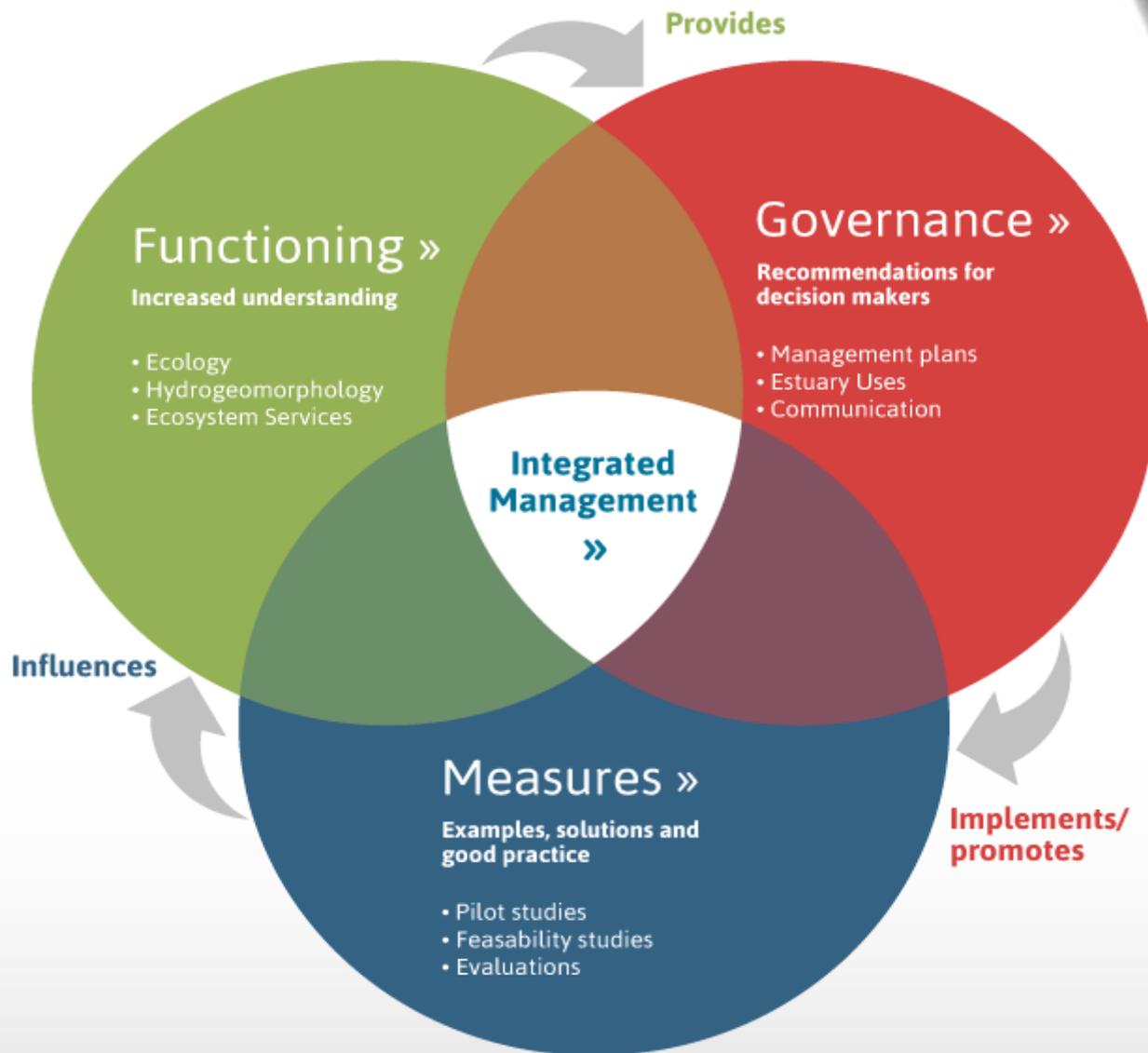
- Reduce greenhouse gas emissions by 34% by 2020 and 42% by 2025

Integrated Coastal Management Act

National Biodiversity Monitoring Framework,

- National Biodiversity Assessment (2018)
- Estuary management plans





Climate and coastal change

Climate - related drivers of coastal change

Ocean processes

- ❖ Speed and positions of Agulhas and Benguela currents affects circulation and impacts coastal habitats

Precipitation/ runoff

- ❖ Precipitation ↑ = heavier runoff from inland areas
- ❖ Precipitation ↓ = ↑ droughts and reduced freshwater inflows

Van Niekerk et al. (unpublished)

Climate and coastal change

Temperature and regime shifts

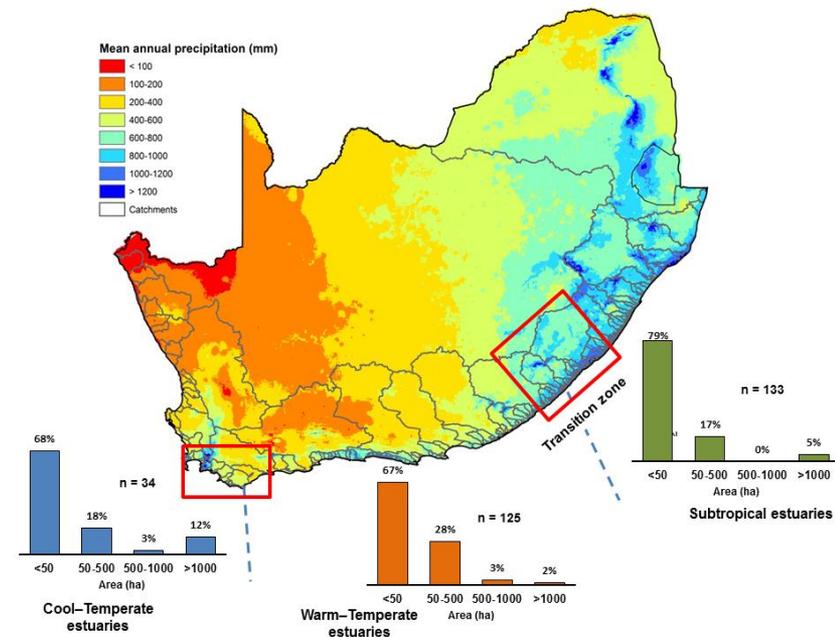
- ❖ South Africa projected 3 to 4° C temperature increase

Increase in frequency and intensity of sea storms

- ❖ 10% increase in wave climate (wind speed and stress)
- ❖ 80% increase in wave power (Theron, 2007)

Sea level rise

- ❖ Estimated sea level rise of around 0.5 to 1m by 2100



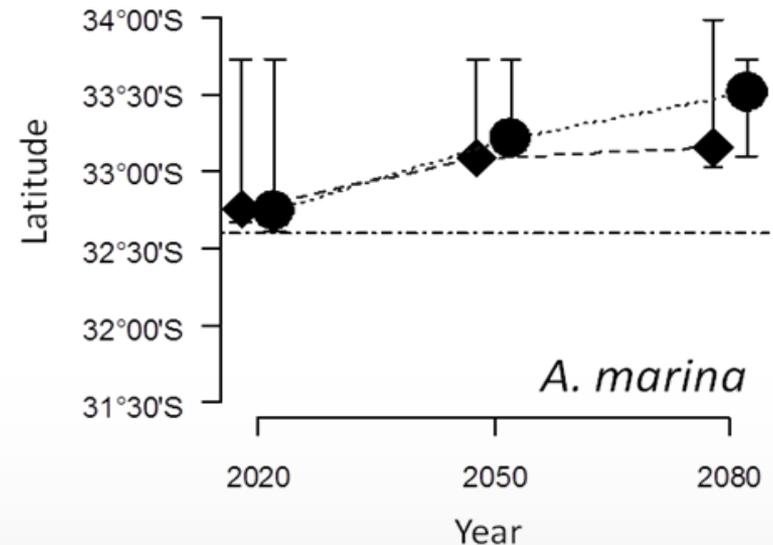
Van Niekerk et al. (unpublished)

Sea level rise, increase temperature and carbon dioxide

- Mangrove encroachment on salt marshes in some South African estuaries.
- Increase in suitable sites beyond latitudinal limits



Hoppe-Speer et al., 2015



Quisthoudt et al., 2013

Overall aims

1. To determine the extent of blue carbon coastal habitats in South Africa and estimate blue carbon storage and quantify associated ecosystem services
2. To quantify the loss of blue carbon coastal habitats and associated ecosystem services
3. To predict the response of blue carbon ecosystems to climate change in the form of sea-level rise and increased global temperatures

Methods

- 1. Quantification of ecosystem services**
 - Habitat area
 - Google Earth and aerial photography
- 2. Blue carbon quantification**
 - IPCC methods
 - Tier 1 and 2 Assessments (Howard et al.,2014)
- 3. Loss of habitats and associated ecosystem services**
 - GIS mapping
 - *Abundance*
 $\% \text{ similarity} = 100 \times \frac{\text{present area cover}}{\text{reference area cover}}$
- 4. Predict responses of coastal habitats, ecosystem services to climate change**
 - Modelling (e.g. bioclimatic envelop models, SLAMM)



Expected outputs

- Preliminary database on blue carbon habitats and detailed mapping, including changes over time and assessment of ecosystem services lost
- Produce a low confidence blue carbon inventory/ database for coastal habitats in South Africa
- Climate change responses and detailed modelling for mangroves
- WRC report
- Provide input to the National Biodiversity Assessment of 2018

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