# Managing Coastal Wetland Retreat for Carbon Sequestration Benefits in the Hunter River

International Blue Carbon Scientific Working Group,
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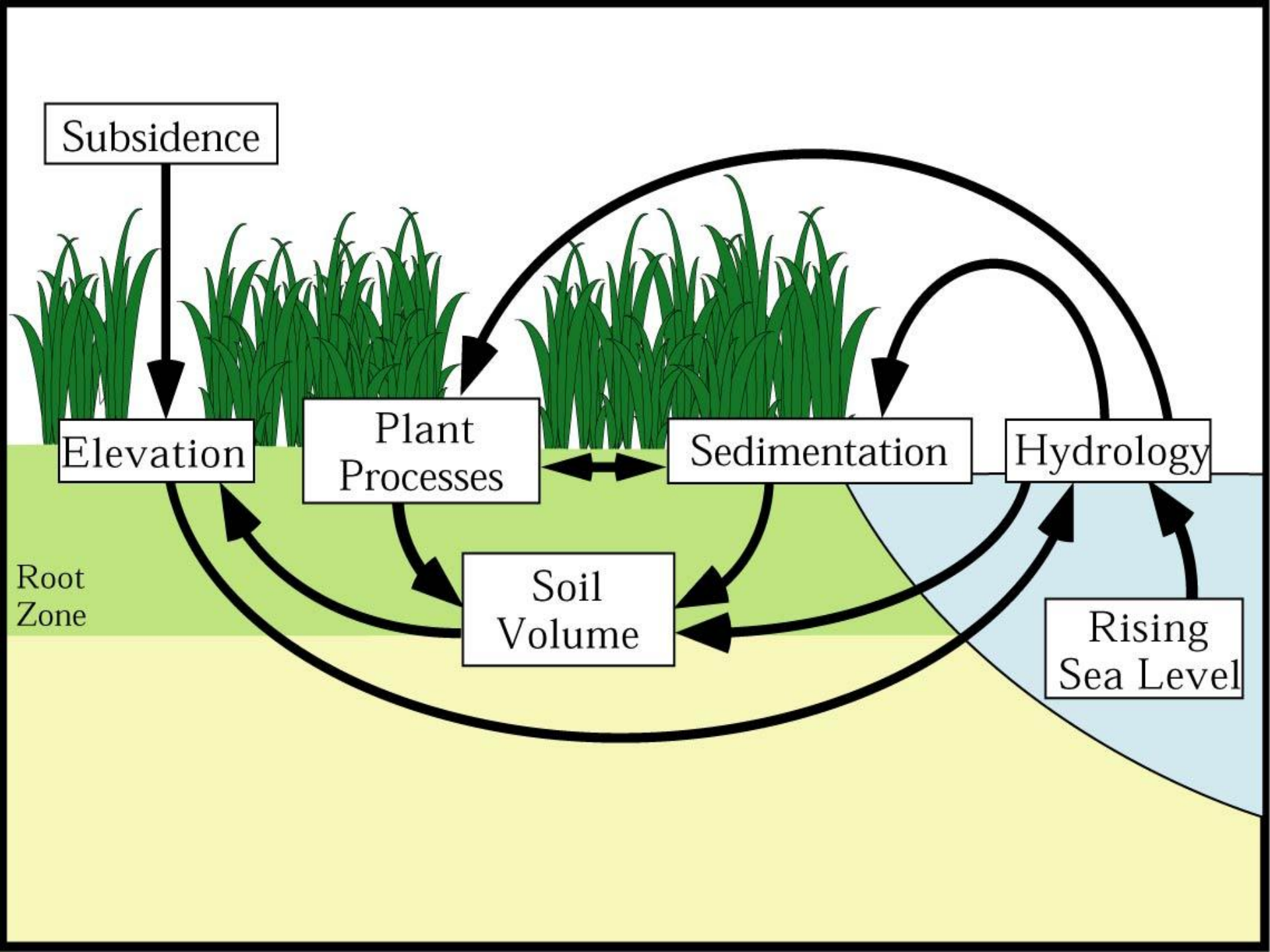
# Outline

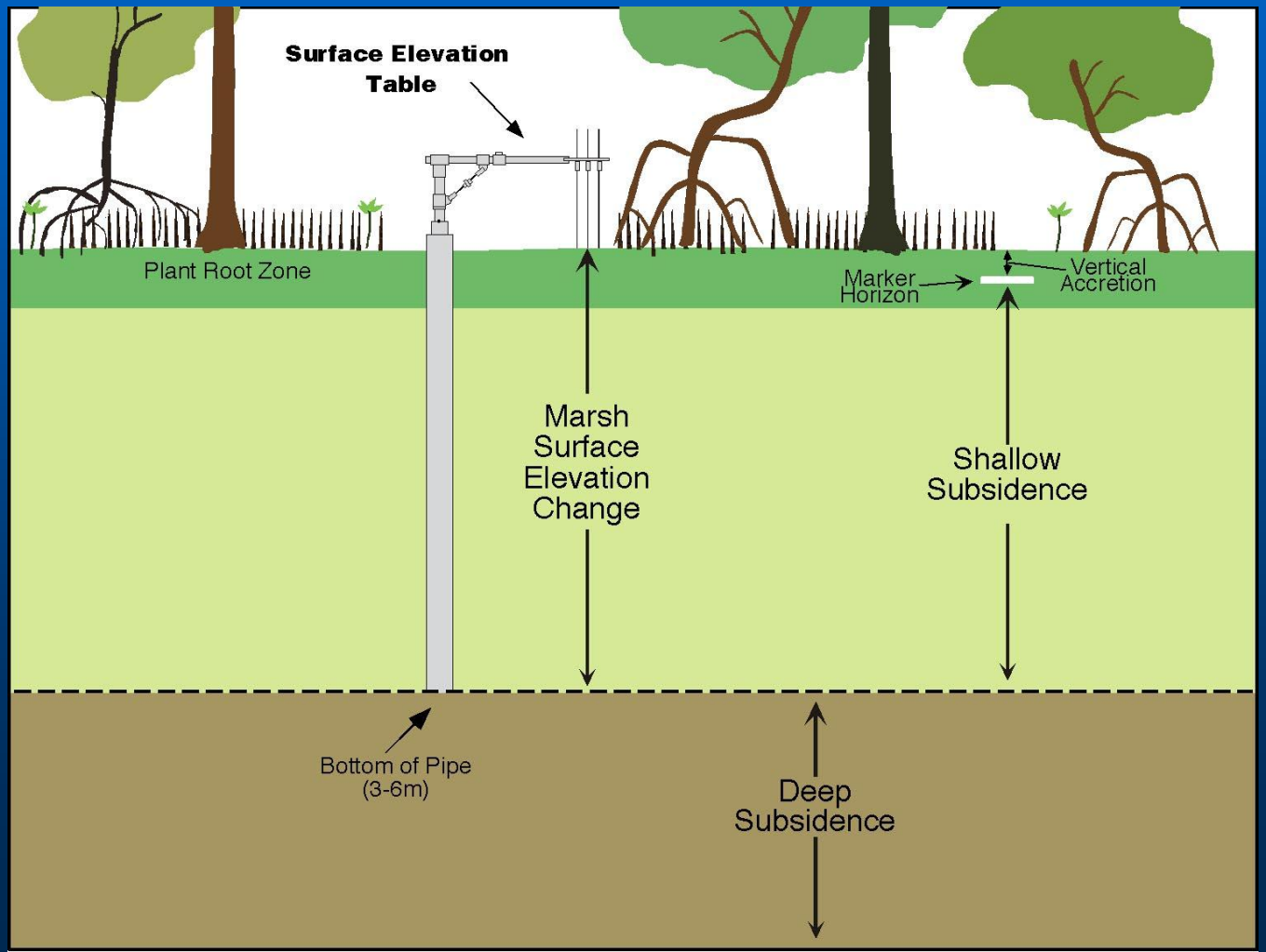
- We mapped mangrove and saltmarsh
- We used a LiDar-derived DEM to determine elevation ranges
- We used Surface Elevation Tables to determine drivers of accretion rate
- We developed a model of elevation change to 2100 responding to changes in accretion and sea-level
- We applied this model to project mangrove and saltmarsh extent for two IPCC scenarios
- We determined the effect of management interventions on mangrove and saltmarsh extent, and carbon sequestration


Subsidence
Elevation
Plant Processes
Sedimentation
Hydrology
Root Zone
Soil Volume
Rising Sea Level

# Measuring accretion

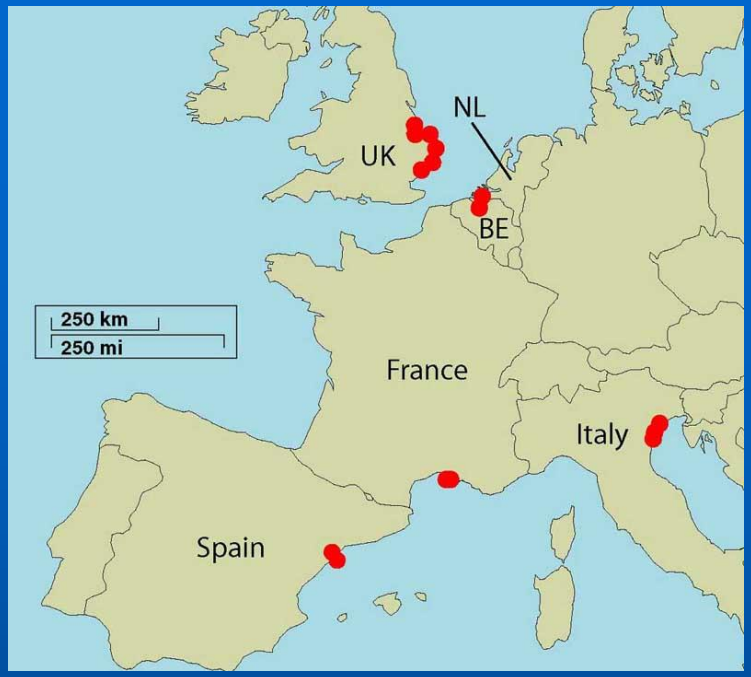
- Marsh responses to sea-level rise can be measured using the Surface Elevation Table/Marker Horizon technique
- Also useful in estimating carbon accumulation
- This benchmark measures changes in the elevation of the marsh surface, and the rate of sediment accumulation
- Over 100 have been installed from SE Qld to Victoria

# Surface Elevation Analysis



# SET

# Vertical Accretion


NL
UK
BE
250 km
250 mi
France
Italy
Spain


400 km
400 miles


500 Km
500 Mi.
Micronesia
Australia
New Zealand

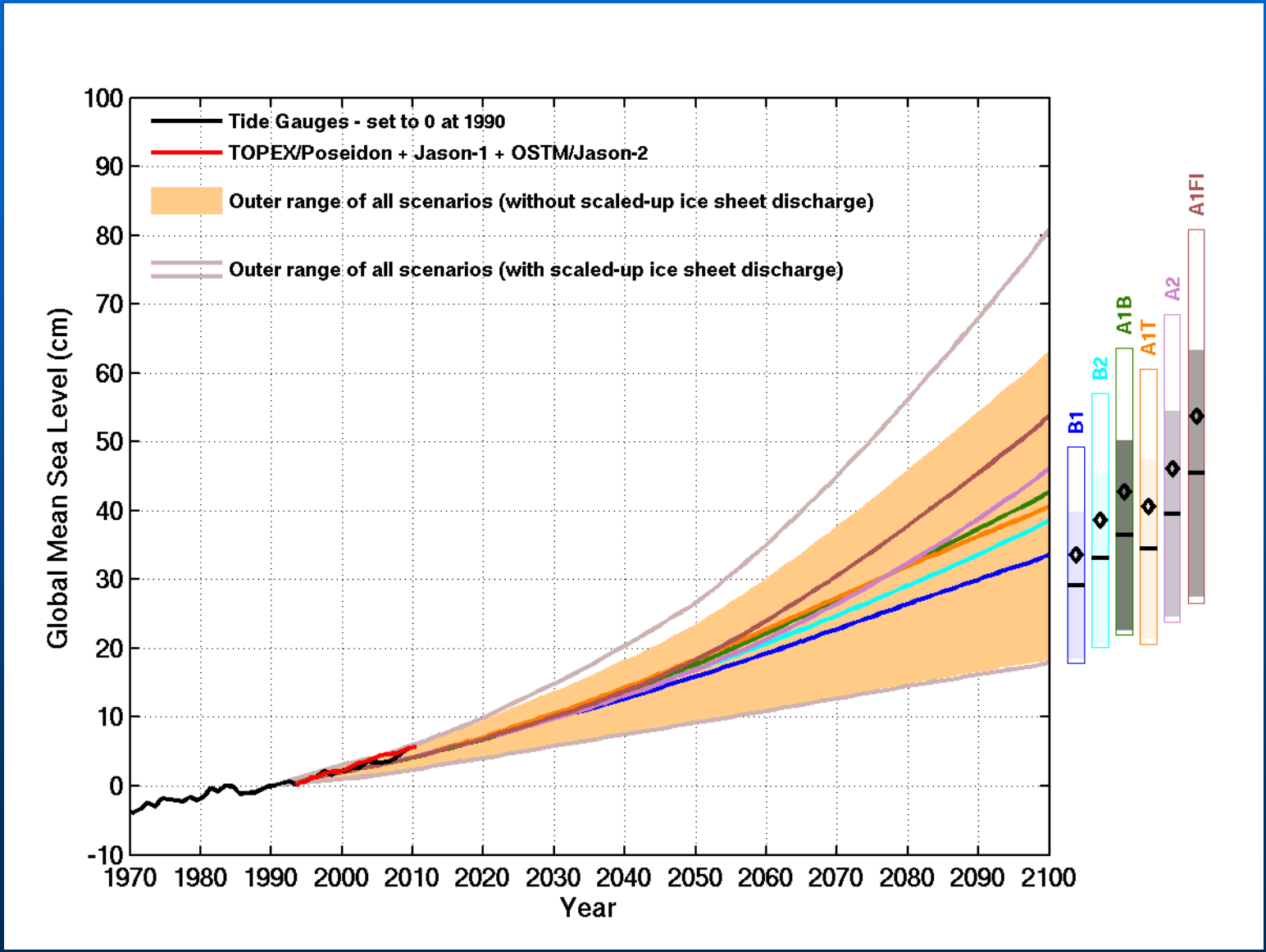

U.S.A.
Gulf of Mexico
North Atlantic Ocean
200 Km
200 Mi.
THE BAHAMAS
CUBA
HAITI
DOM. REP.
JAMAICA
MEXICO
BELIZE
GUATEMALA
HONDURAS
EL SALVADOR
NICARAGUA
Caribbean Sea
COSTA RICA
PANAMA
COLOMBIA
VENEZUELA
North Pacific Ocean

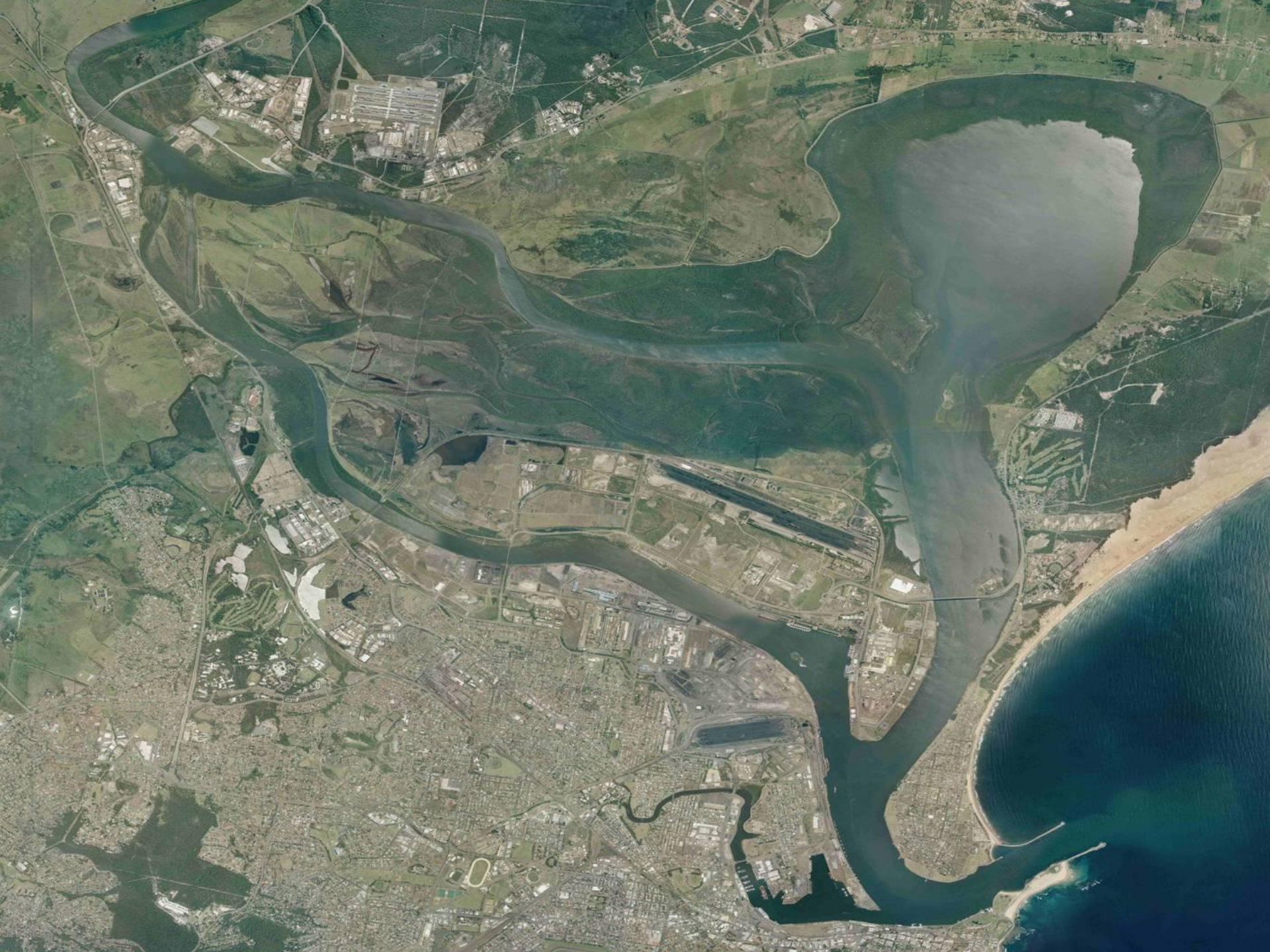
# Modelling Sea-level Rise impacts

- Models have been developed linking rates of sea-level rise to marsh surface elevation changes at the landscape scale (Kerrylee Rogers, University of Wollongong)
- These models show that the management of structures is critical to the survival of important weltands

# Predicted Sea-Level Rise to 2100

(IPCC, AR4)



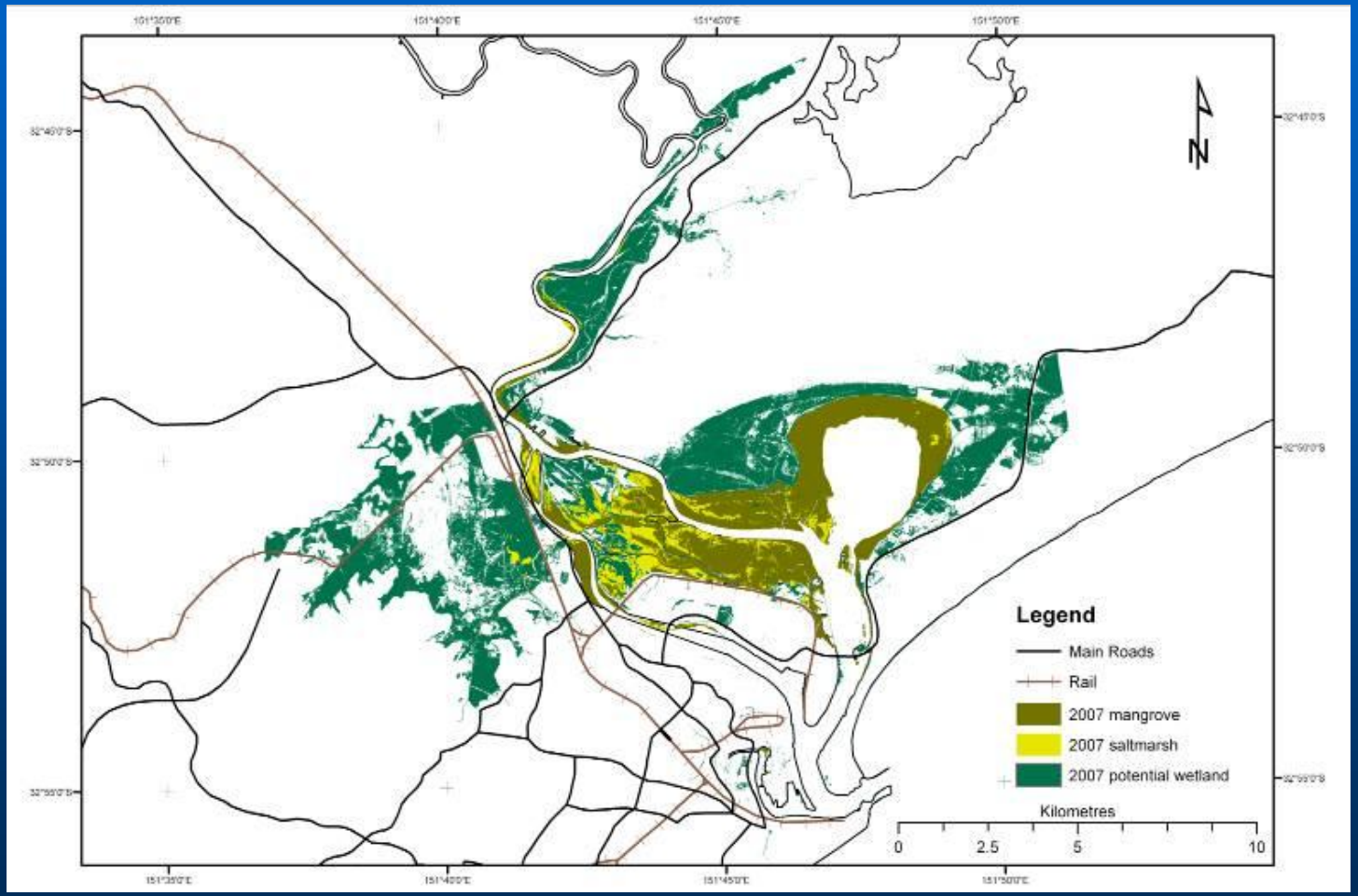


# Carbon measures-

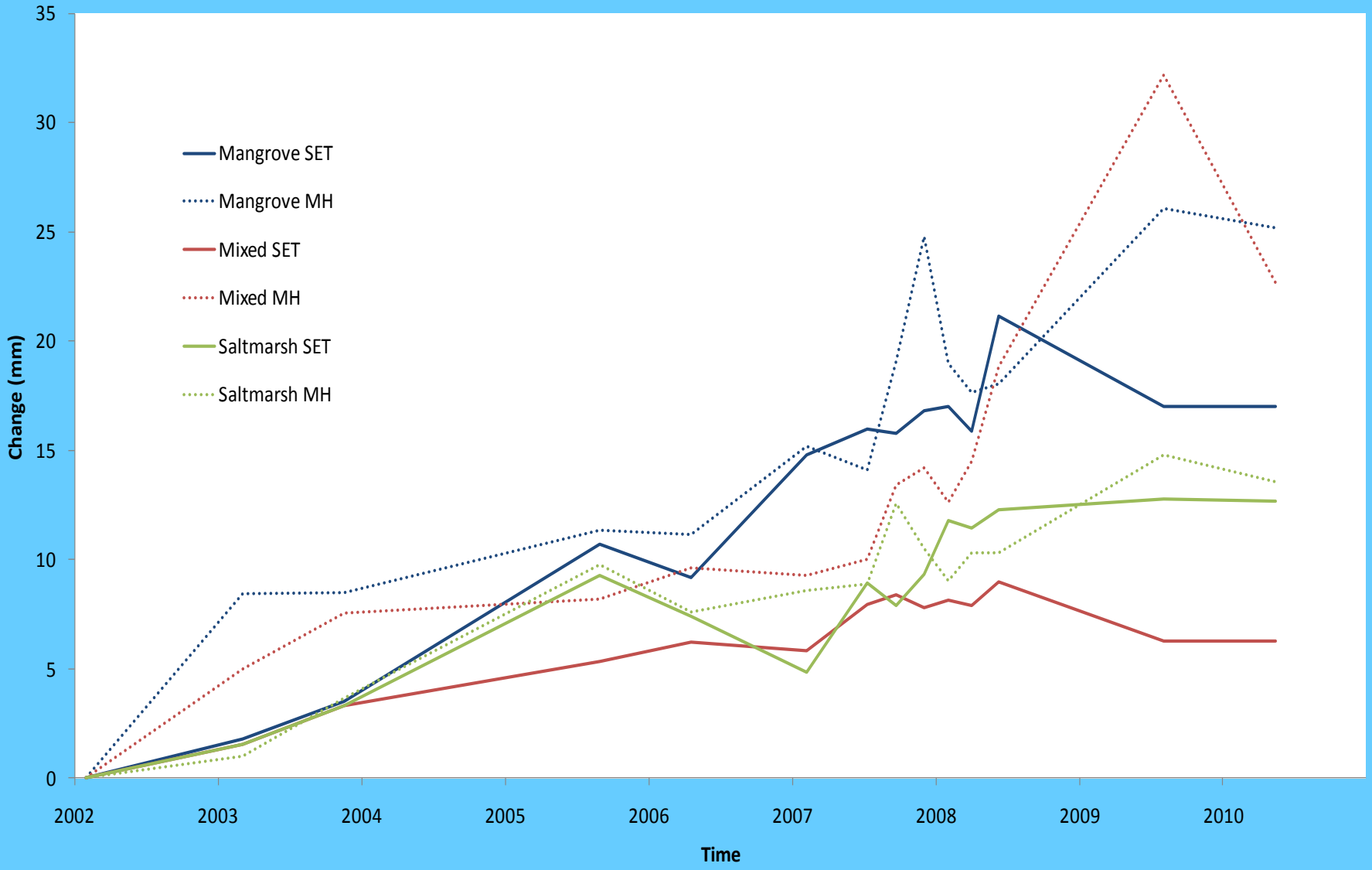
Carbon sequestration estimates derived using material accumulated above the feldspar horizons

Howe A.J., Rodriquez J.F. and Saco P.M. (2009)
Surface evolution and carbon sequestration in disturbed and undisturbed wetland soils of the Hunter estuary, southeast Australia
*Estuarine Coastal and Shelf Science* 84: 75-83

# Current Mangrove-Saltmarsh extent



# Measured accretion and elevation gain- Hunter estuary



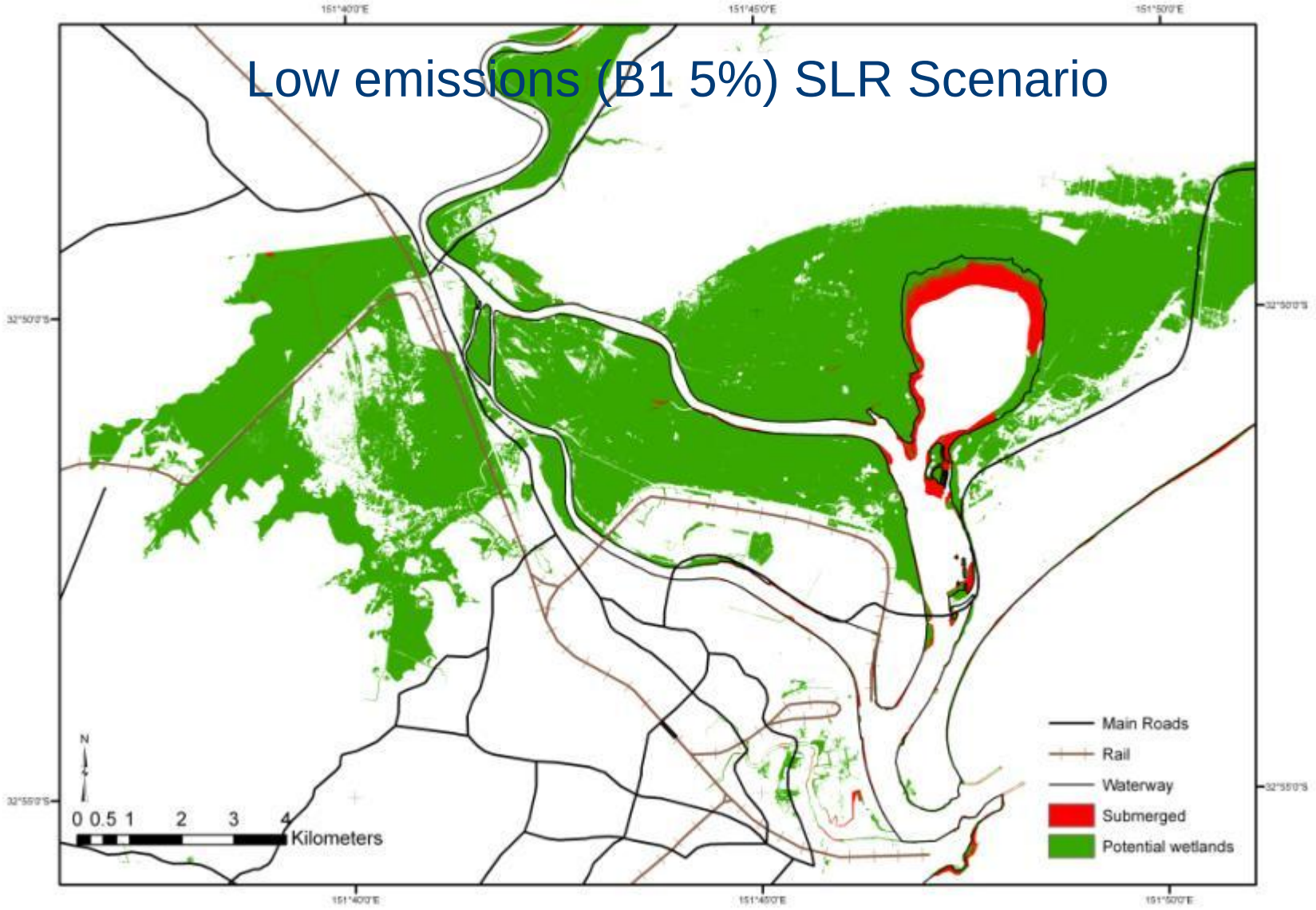
# Kerrlyee's model

- Model incorporates
  - Wetland elevation
  - Monthly mean water level
  - Monthly maximum water level
  - Distance from the main channel
  - Rainfall intensity

to model elevation change

Rogers K., Saintilan N. and Copeland C. 2012. Modelling wetland surface elevation dynamics and its application to forecasting the effects of sea-level rise on estuarine wetlands Ecological Modelling 244: 148-157

# Vulnerability Assessment: Hunter River Case Study



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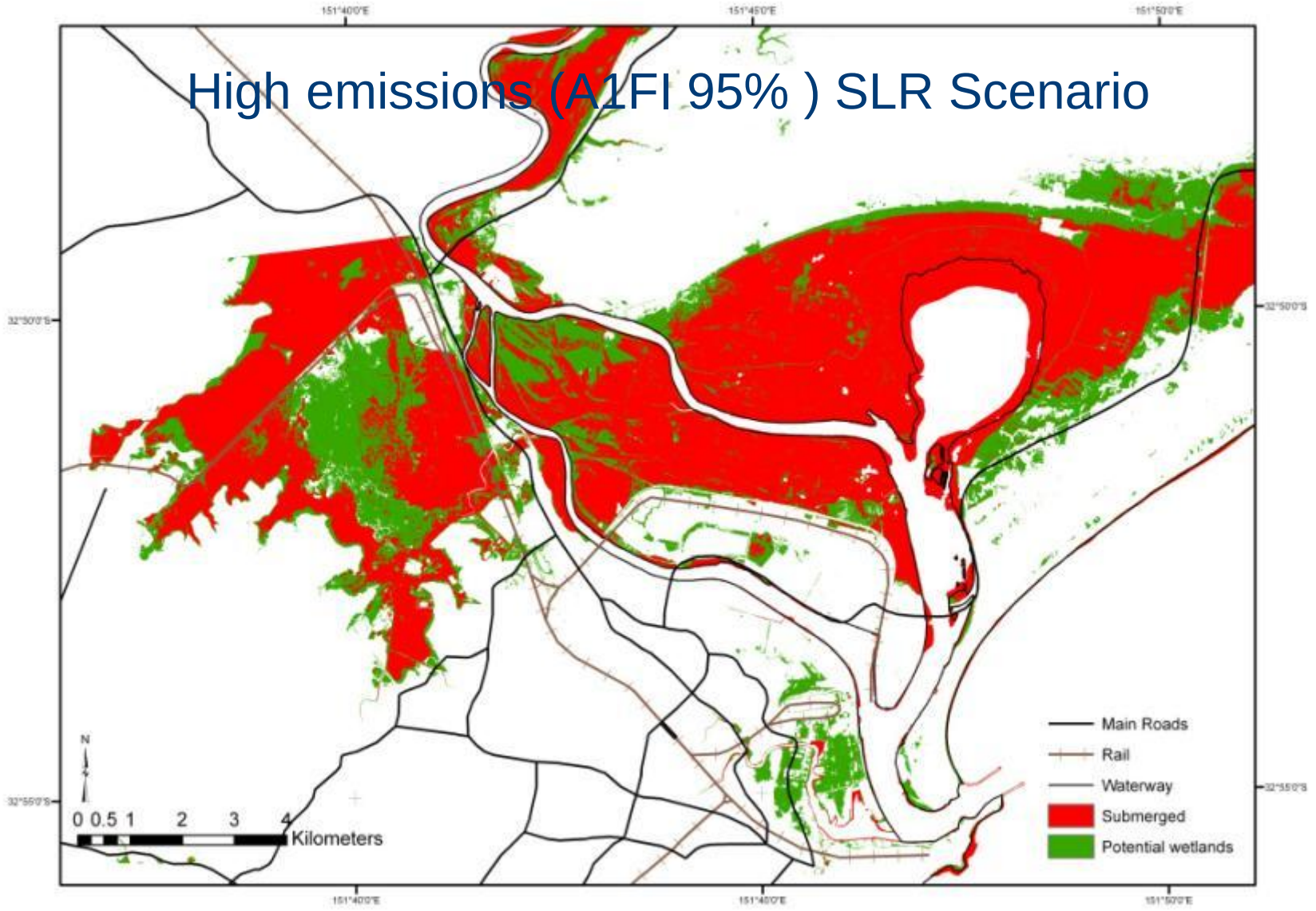

# Model outputs- Hunter

| | High emissions- floodgates open | High emissions- floodgates closed | Low emissions- floodgates open | Low emissions- floodgates closed |
|---|---|---|---|---|
| Wetland area (ha) | 3039 | 800 | 8193 | 3153 |
| Carbon sequestration (tonnes) | 775075 | 490280 | 602035 | 389349 |

# Important caveat

- We assumed that wetland submergence did not lead to carbon loss to atmosphere
  - But see DeLaune R.D. and White J.R. (2012) in *Climate Change* 110: 297-314, and tomorrow's session
- Freshwater swamps likely emitters
- Floodgates might be managed to promote resilience

# Implications

- Static planning tools (SEPP14; Ramsar) don't deal well with dynamic landscapes
- Aquatic assets exist in 4 dimensions: protection and planning instruments must recognise this if they are to deal effectively with climate change
- Extent of coastal squeeze depends on the management of structures