

Spatial modelling of landscape and environmental change

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Spatio-temporal environmental modelling

Environmental Models:

1. Clarify the issues in a debate
2. Enforce a discipline of analysis and discourse among stakeholders
3. Support decision through relevant advice

(King and Kraemer, 1993)

Estuarine Sedimentation Model

- Sea level rise results in increased inundation and coastal erosion - major implications for inter-tidal coastal ecosystems
- Ecosystem response relative to sea-level rise is dependent on sedimentation rate and consequently the maintenance of relative elevation.
- Spatial model for predicting the impact of sea-level rise on remnant saltwater wetland ecosystems using GIS

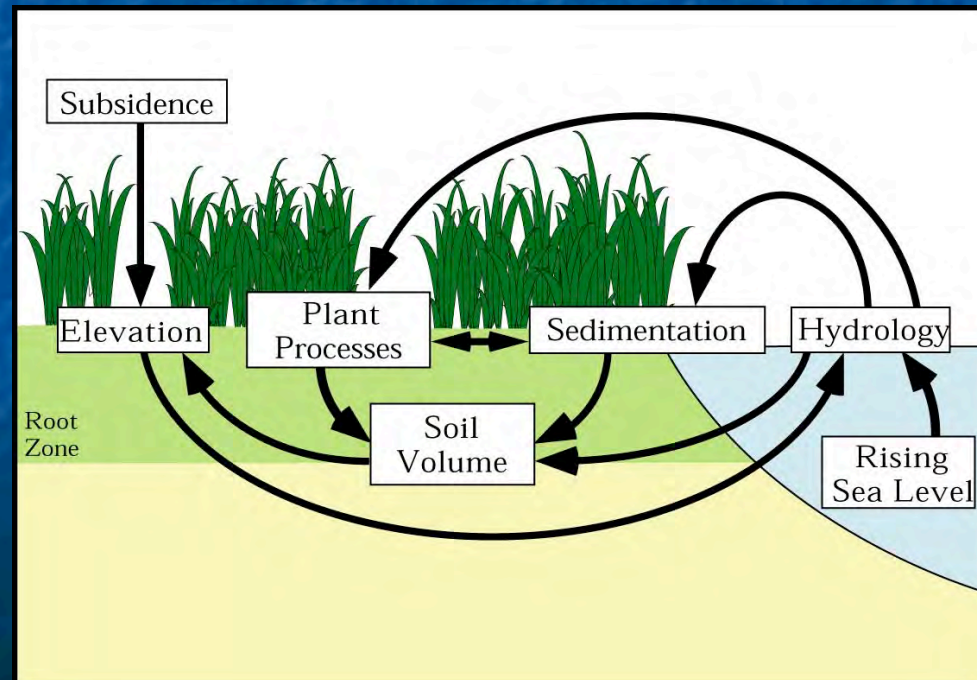
Sydney Olympic Park 



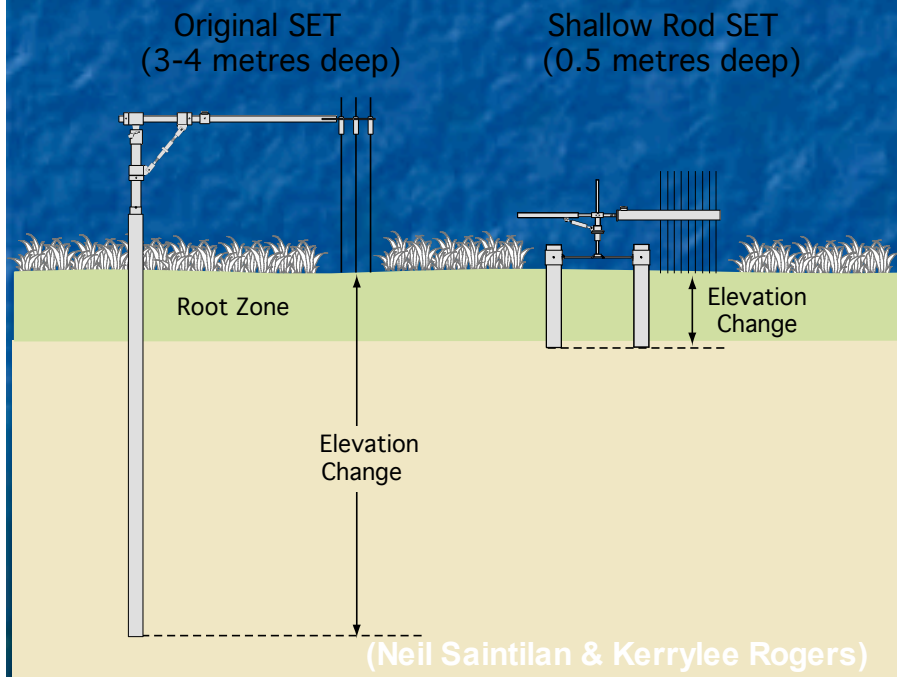
The University of Sydney



- How will coastal wetland ecosystems respond to changing sea-levels?
 - Biophysical interactions
 - Processes of erosion and inundation
 - Autocompaction, groundwater discharge and plant productivity

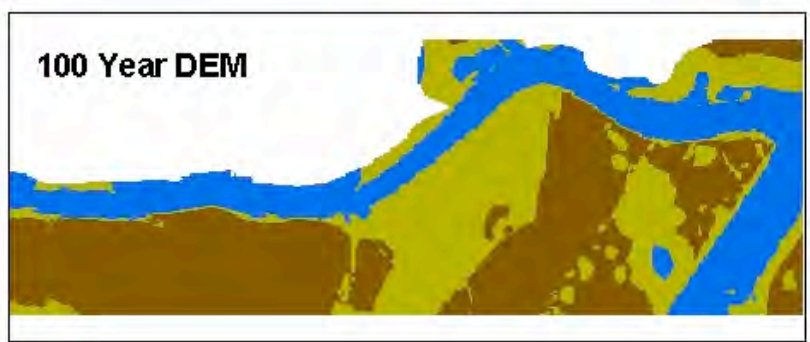
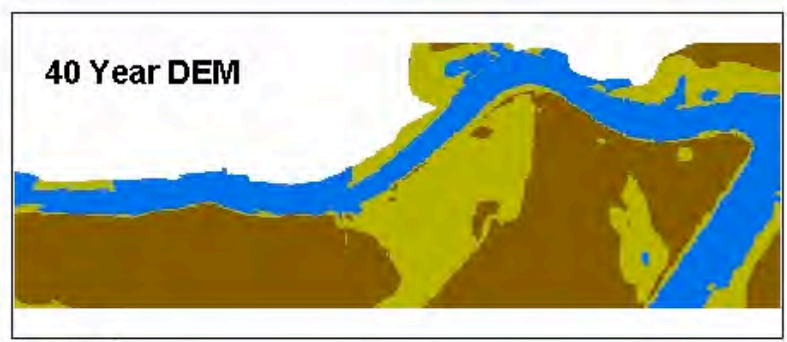
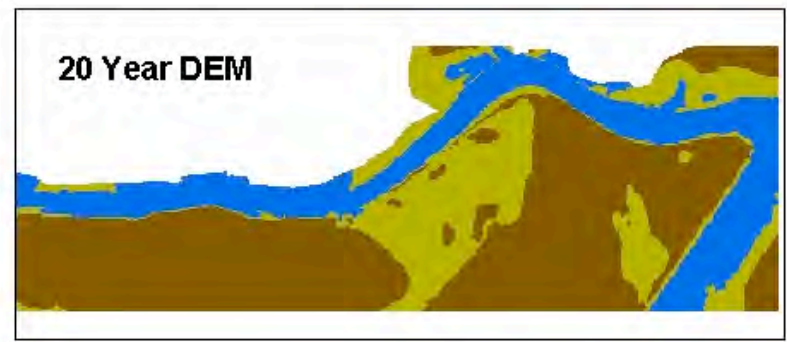
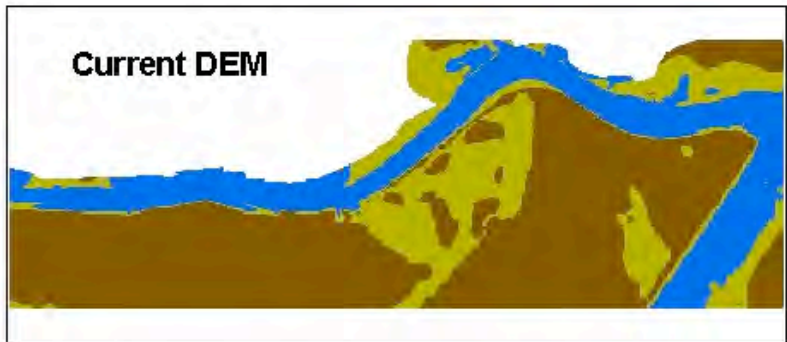


- SET platforms, AP/multi-spectral imagery, DEM
- Model used to explore the interaction between variation in rates of sea-level rise, sediment supply and inter-tidal compaction

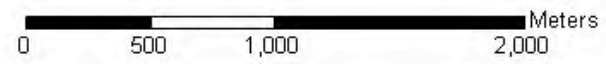


- Evolution of the estuary in the ESM is governed by three factors: (1) sea level change; (2) elevation-dependent accommodation space available for sediment deposition and; (3) inundation-dependent vertical accretion of sediment.
- It provides a management tool to quantify, spatially represent and visualise predicted changes in the elevation profile of intertidal coastal environments.

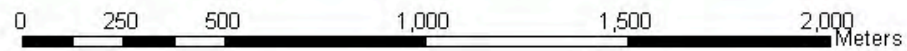
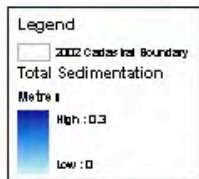




- Legend**
- Subtidal
 - Intertidal
 - Supratidal



A



B

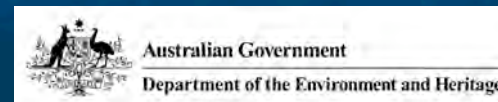
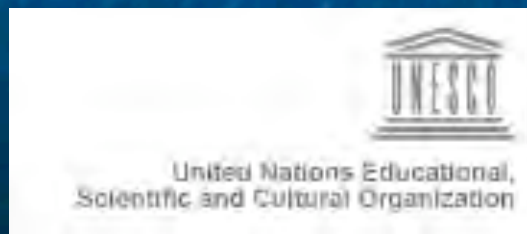




Vegetation Change Detection

- Adopts a combination of remote sensing, spatial analysis and qualitative data to examine vegetation change within the Angkor environs between 1940 and 2005.
- Landscape ecology – patterns of habitat fragmentation

ARC Linkage Grant (5 years \$1.2 million)





- *Identify the process of change in vegetation communities between 1940 and 2005.*
- *Can remotely sensed data provide insight on the impact of subsistence use of the Angkor forests by local residents?*
- *Do these combined spatial analysis and qualitative survey approaches provide an effective method for evaluating the appropriateness of current forest use policies within the Angkor World Heritage Site?*



Sustainable Usage Level Project

- Adopt principles of **Agent Based Modelling** to develop a simulation based approach for addressing issues associated with congestion within the tourist areas of the park and quantify sustainable levels of visitor usage.
- Provide a comprehensive and dynamic understanding of visitor behaviour and the way in which they interact with the environment and sites of cultural significance.
- Interactively examine the management implications of alternative visitor usage scenarios and quantify impacts.



Geocomputation – recent developments

- Extension of Map Algebra (formalisations operating on spatial elements as variables) extended into dynamic spatial modelling languages
- GIS software incorporating model construction environments (eg. ModelBuilder)
- Computer visualisation
- XML – opens up possibilities for dynamically evolving spatio-temporal models

Conclusion

- Computer simulation replaces analytic model development as systems modelled become larger, more integrated and more complex
- Need to ensure that spatial database development occurs in parallel with model development