

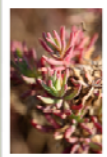
CLIMATE CHANGE AND SEA LEVEL RISE: DESIGNING MIGRATION CORRIDORS FOR COASTAL WETLANDS

Perhans K, Traill L, Lovelock C, Wilson K, Rhodes J, Prohaska A, Possingham H

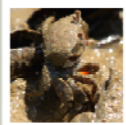
(1) Coastal wetlands at risk



Grey mangrove (*Avicennia marina*) in Tinchi Tamba wetlands



Austral sea-lilte (*Sueda australis*)



Tuxedo crab (*Australoplax tridentata*)



Claypan and saltmarsh in Boondall wetlands



Christmas jewel spider (*Australantha minax*)

Mangroves and saltmarshes provide important habitats for birds, bats and insects and nursery areas for fish, prawns and crabs. They form a buffer between land and water by trapping and processing sediment and nutrients. Mangroves also stabilise the shoreline against storm and wave erosion.

The wetlands along the coast of South East Queensland are under pressure from rapid urban expansion, coastal development, agriculture, grazing, and altered hydrology.

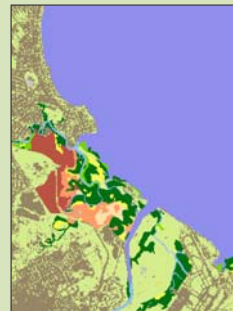
Climate change adds other pressures: increasing storm frequency, changes in rainfall patterns and rising sea levels. In response to sea level rise, wetlands have the capacity to slowly adjust vertically and migrate inland but urban barriers are often in the way, causing "coastal squeeze".

The aim of our project is to model changes in wetland distribution in response to sea level rise and to investigate different conservation planning options.

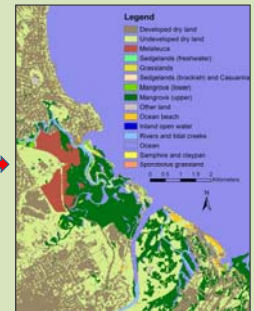


(2) Modelling changes in wetland distribution

We used the 'Sea Level Affecting Marshes Model' (SLAMM; <http://warrenpinnacle.com/prof/slamm>) to simulate future changes in wetland distribution.



Year 2009



Year 2100

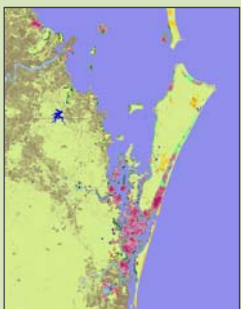
Although SLAMM was developed in the US, we found that we could adapt the model to Australian sub-tropical wetland types. The model has clear advantages over a simple 'bath tub' inundation model when predicting wetland changes in response to sea level rise, as a number of additional key processes can be included:

- Accretion
- Erosion
- Storm frequency and overwash
- Salinity and freshwater flow changes
- Wetland landward migration

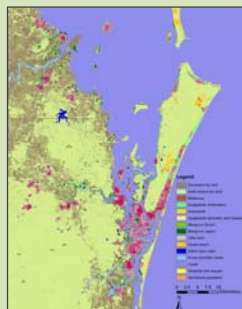
Conclusions

With a sea level rise of 1 metre by 2100, the area of mangrove increases greatly along the coasts at the expense of saltmarsh, and water channels widen. Further inland, new areas of sedgeland and Casuarina emerge in low-lying areas and along rivers and creeks. We are currently re-running the model with more fine-scale LiDAR elevation data to refine these predictions.

(3) Locating conservation areas



Year 2009



Year 2100

The planning software Marxan (www.uq.edu.au/marxan) was used to study the effect of sea level rise on the optimal location of conservation areas.

In Marxan, planning units are created, a target is set for each wetland type, the total area or land cost is minimised and connectivity between areas can be accounted for. Through simulated annealing the software gives a number of near-optimal solutions.

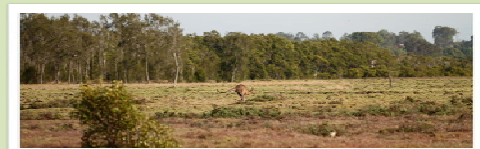
When constructing these maps, we used 16 ha planning units, a target of 30% coverage of each wetland type, the total area selected was minimised, and we derived 100 near-optimal solutions. Colours show selection frequency (bright pink areas were selected in >30 of the 100 solutions, dark pink in >70).

Conclusions

In 2100, a larger total area was needed to meet the wetland targets and connectivity requirements. More areas were located further inland and along rivers and creeks, emphasising the need for a proactive approach to also assign currently non-wetland areas as potential future migration areas.

(4) Also in the project

- The optimal timing of conservation area establishment – waiting for better knowledge or act now? (K Perhans)
- Population viability analysis and conservation planning for a unique and threatened species - false water rat (*Xeromyx myoides*) (L Traill)
- Conflicts between conservation needs, human adaptation responses and urban growth (K Wilson)



Grey kangaroo (*Macropus giganteus*) on saltmarsh in Tinchi Tamba wetlands

ATBC Conference 2010
19 - 24 July in Bali, Indonesia

All photos by Johan Emilson



Karin Perhans
Spatial Ecology Lab
School of Biological Sciences
k.perhans@uq.edu.au



The Swedish Research Council Formas
Committed to excellence in research for sustainable development