internal report 436

Assessment of threats to marine and coastal environments in the tropics

Seminar presented to AMSA

P Bayliss & C Camilleri

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supervising scientist

Assessment of Threats to Marine & Coastal Environments in the Tropics

Peter Bayliss and Caroline Camilleri

Thanks to:

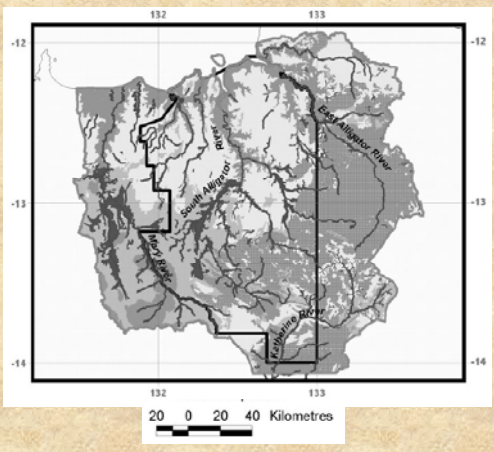
Kirrilly Pfitzner
George Begg
Maria Bellio
Dave Walden
Alicia Hogan
Caroline Camilleri
James Boyden

Seminar Outline

- Supervising Scientist Division & eriss
- National Centre for Tropical Wetlands Research
- Ecological Risk Assessment Program
  - Ecotoxicological impacts
  - Landscape-wide impacts
- Marine & coastal issues – future eriss research
  - Shorebird conservation
  - Mangrove response to coastal environmental change
  - Indigenous perspectives
  - Modelling coastal ecosystems

Supervising Scientist Division

- Part of Environment Australia
- Statuatory domain – Alligator Rivers Region (ARR)



Kakadu National Park
- *World Heritage*
- *Ramsar wetlands*

Supervising Scientist Division

- **Two branches**
  - ***Environmental Research Institute of the Supervising Scientist (ERISS)***
    - ***impact of U-mining on environment & people of ARR***
    - ***ecology & conservation of tropical wetlands***
  - ***Office of the Supervising Scientist (OSS)***
    - ***Supervision, audit & policy functions w.r.t. U-mining in ARR***

ERISS

Research Programs

1. **Environmental Radioactivity – Paul Martin**
2. **Ecosystem Protection – Chris Humphrey**
3. **Hydrological & Ecological Processes – Ken Evans**
4. **Ecological Risk Assessment – Peter Bayliss**

- **Research Support & Communications Program - Jacqui Rovis-Hermann**

National Centre for Tropical Wetlands Research

The nctwr is a collaborative venture between eriss, JCU, NTU, UWA

- **The partner organisations have strong disciplinary bases related to wetland science**
- **A highly experienced team in wetland research and management, including coasts**

Ecological Risk Assessment Program

- **We provide advice on the importance of threats to the biological diversity & functioning of tropical wetlands in the ARR & elsewhere**
- **"Wetlands" include coasts & offshore islands**

Wetlands Risk Assessment Framework

- **Risk assessment is estimating the probability of an adverse event**
- **To improve management & policy decisions**

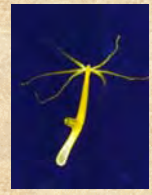
Ecological Risk Assessment Program

- *Ecotoxicology*
  - *Localised impacts from pollutants – e.g. downstream effects of mining, chemical spills etc*
- *Landscape Monitoring & Assessment*
  - *Regional to global impacts – e.g. invasive species (weeds & animals); fire; infrastructure; climate change & rising sea levels*

Ecotoxicology

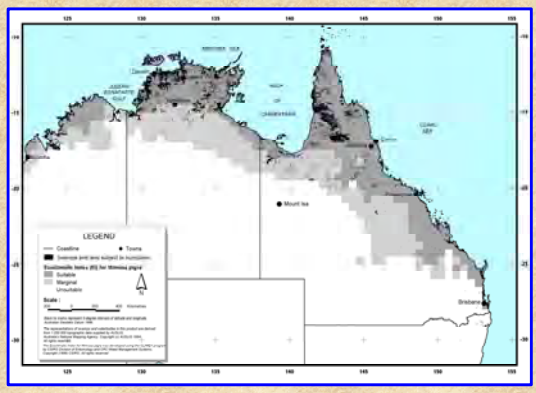
- *Primary role – maintain high water quality standards coming off mining lease onto World Heritage Kakadu National Park*
- *The toxicity of waste water from the Ranger uranium mine is assessed to determine "safe" dilution levels before release*
- *Advanced test protocols developed & can be applied to other toxicants/pollutants (e.g. MgS04, herbicides, etc)*




Landscape – Mimosa

Dave Walden *et al.* (2002): A Risk Assessment of the Tropical Wetland Weed *Mimosa pigra* in Northern Australia



Wetlands across northern Australia potentially at risk of mimosa infestation, based on 1:250K topographical wetland data & potential distribution using CLIMEX

Landscape – cane toads

- **Preliminary Risk Assessment of Cane Toads in Kakadu NP (van Dam, Walden & Begg 2000).**

- **Used a "wetlands risk assessment approach".**
  - **define problem**
  - **determine potential extent & effects**
  - **identify risk & species at risk**
  - **identify uncertainty & information gaps**
  - **make recommendations for monitoring**

Landscape – climate change

- **Advise Ramsar on the impacts of climate change to wetlands & methods of assessing their vulnerability.**
- **van Dam R, Gitay H & Finlayson CM, Orlando B & Davidson NC (2002). Climate change & wetlands: impacts, adaptation and mitigation.**
- **Locally, we will help Kakadu assess impacts of saltwater intrusion on World Heritage values of ARR.**

Landscape – saltwater intrusion

For example, by deriving salinity risk profiles for key freshwater wetlands on kakadu NP (e.g. Magela floodplains, Boggy Plain)

MARINE & COASTAL ISSUES

- **Emerging issues northern Australia, great opportunities – but needs strategic positioning & partnerships**
- **Dr Ilse Kiessling – adjunct fellow with NTU KCTWM & CINCRM, works for the National Oceans Office & on the Advsiory Committee nctwr – one of our advisors on marine & coastal issues.**
- **Report for NTU: State of play in marine & coastal management in northern Australia: an overview of planning, management, research & policy initiatives (2002)**
  - **jurisdiction & management**
  - **values & uses: economic (fisheries, aquaculture, tourism), environmental & cultural**
  - **threats to values**
  - **strategic opportunities & key planning initiatives**
  - **existing capacities & stakeholders**
  - **advocates strongly a partnership approach**

Future research relevant to marine & coastal issues

Ecotoxicology

- **Assess risks from Mimosa herbicides & other agricultural chemicals (sources of land-based pollution)**
- **Assess risks to wetlands from effects of saltwater intrusion**
  - **derive site-specific Trigger Values for salt**
  - **determine saltwater tolerances of key tropical freshwater plants**
- **Determine potential for marine & coastal ecotoxicology work (e.g. oil/gas developments) in tropical Australia & Asia-Pacific**

Future research relevant to marine & coastal issues

Landscapes

- Assess impacts climate change in ARR & elsewhere
- Northern Rivers Assessment Program (WA to GoC Qld)
- Assess threats to marine & coastal wetlands
- Monitor & assess migratory shorebirds & their habitats
- Help Aboriginal communties in Arnhem Land develop catchment management plans, including coastline & offshore islands
- Develop decision support tools incorporating
  - ecosystem models
  - indigenous perspectives
  - socio-economic frameworks

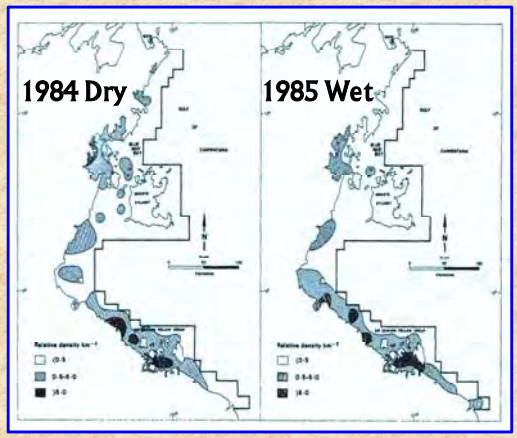
Assess threats to marine & coastal environment in tropics

- Iconic wildlife – dugongs, dolphins, crocodiles, sea turtles, shorebirds



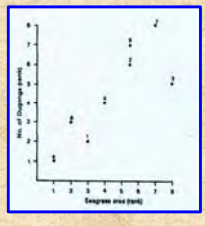

- Coastal habitats – offshore islands, mangroves, fisheries, aquaculture, & tourism, indigenous coastal communities, pollution (marine debris, mining impacts)

Iconic Wildlife
Dugongs & Dolphins in the NT Gulf



Dugongs

Bayliss & Freeland (1989)



Dugong abundance vs seagrass extent

Dolphins

Similar spatial pattern found between Irrawaddy River dolphin & abundance of commercial fish (catch/effort)

Freeland & Bayliss (1989)

Waterbirds in the Asia Pacific Region

404 sp of waterbirds

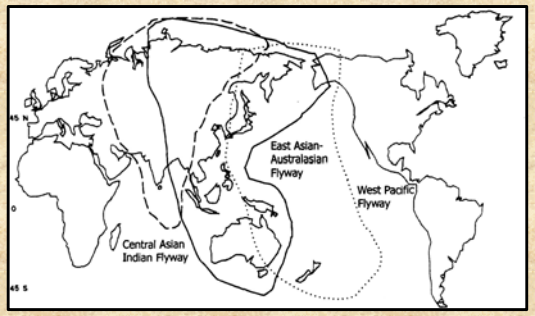
(103 shorebirds)

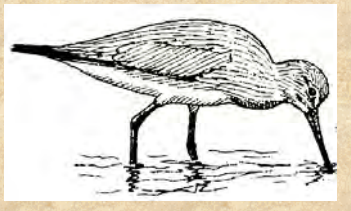
203 sp migratory

(77 shorebirds)

'birds ecologically dependent on wetlands' including known as wildfowl, waterfowl, shorebirds and waders

'species in which the entire population (or >1%) cyclically and predictably cross one or more national jurisdictional boundaries'





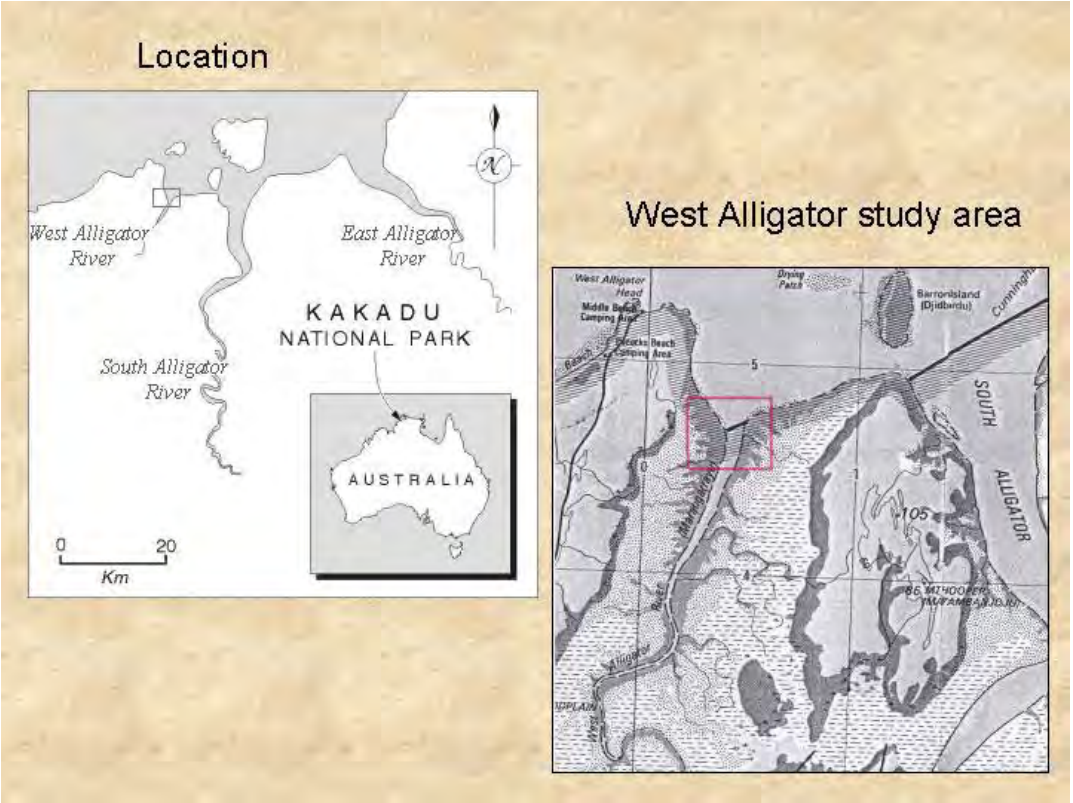
Shorebird Conservation Project

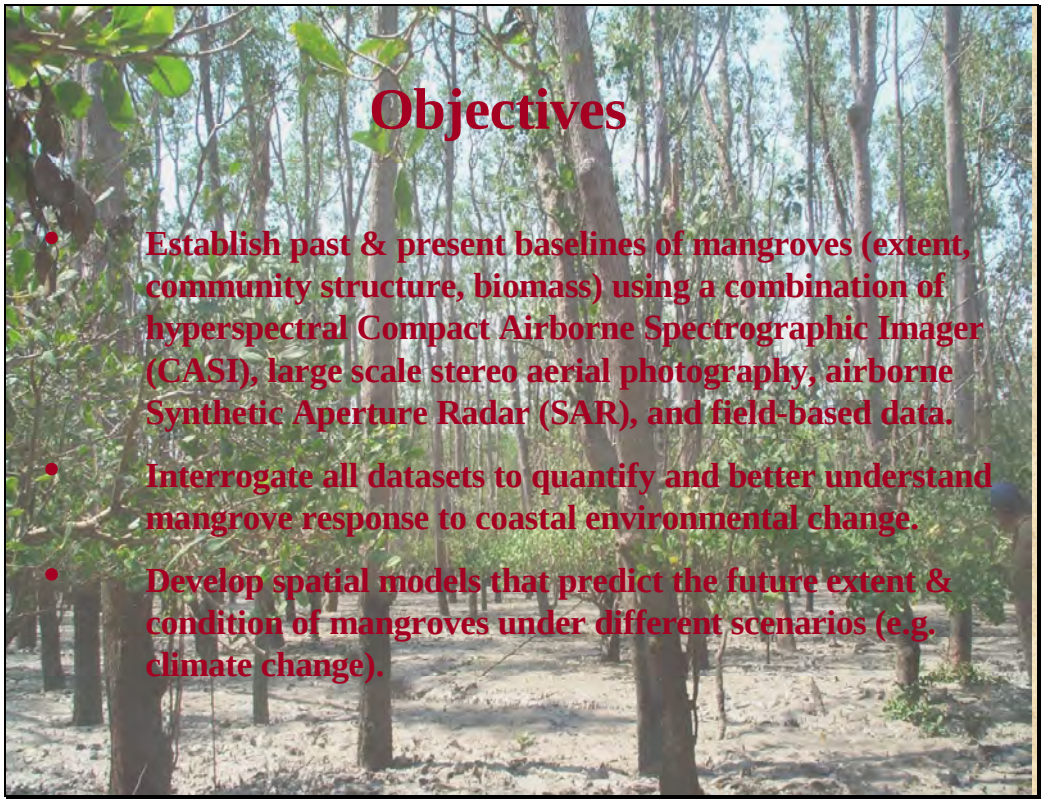
(part of proposed National Waterbird Monitoring & Assessment Program)

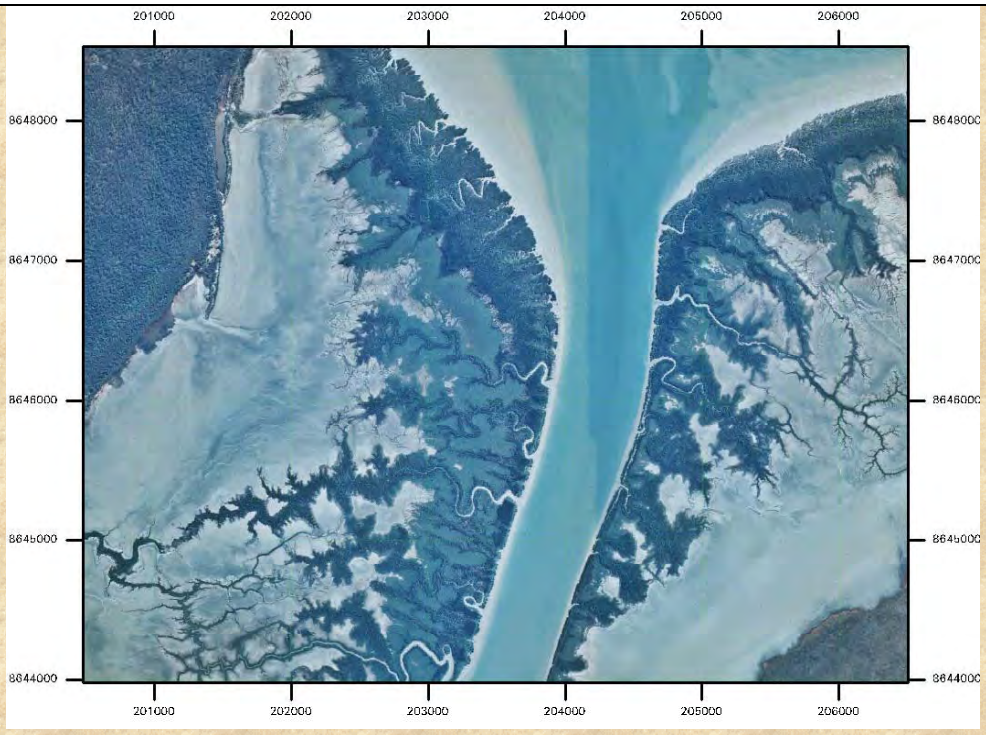
- **Main collaborators NT – Maria Bellio & Ray Chatto (NT P&WC)**
- **Other collaborators - Birds Australia, Wetlands International, EA, nctwr, WA & Qld govts**
- **Use multi-scalar Wetlands Inventory, Assessment & Monitoring Systems**
- **Use landscape analysis to identify important conservation areas for shorebirds along coastline**

Mangrove response to coastal environmental change

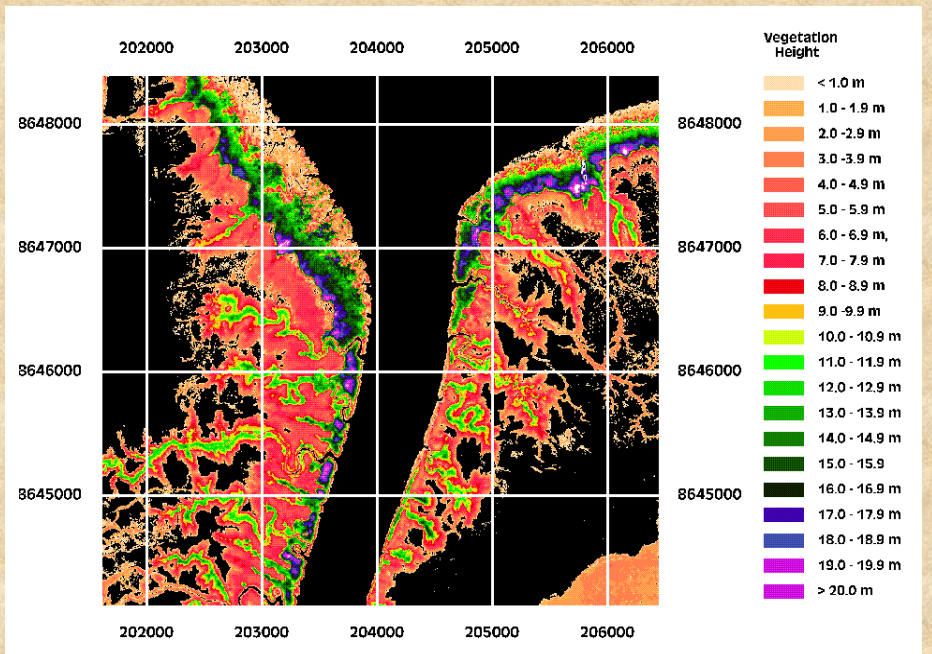
- **West Alligator study (Kirrilly Pfitzner)**
- **East Alligator study (George Begg)**


Location
West Alligator River
East Alligator River
South Alligator River
KAKADU NATIONAL PARK
AUSTRALIA
0
20
Km
West Alligator study area
SOUTH ALLIGATOR
105

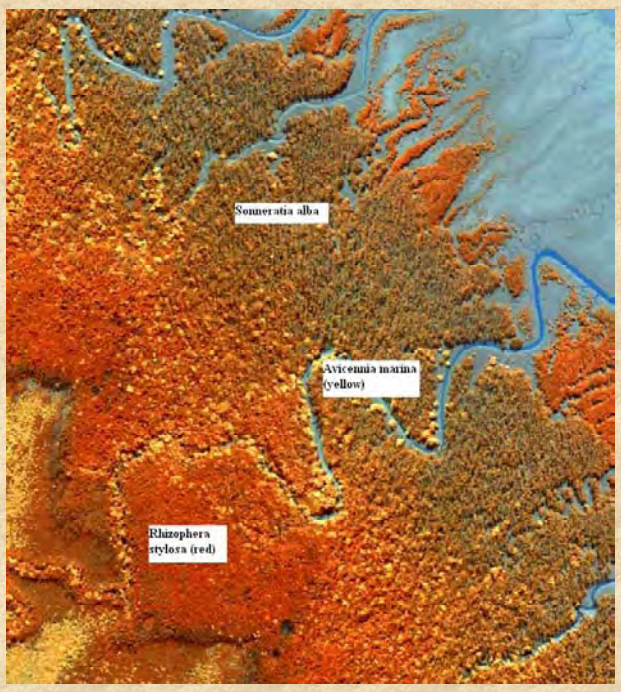

Objectives
• Establish past & present baselines of mangroves (extent, community structure, biomass) using a combination of hyperspectral Compact Airborne Spectrographic Imager (CASI), large scale stereo aerial photography, airborne Synthetic Aperture Radar (SAR), and field-based data.
• Interrogate all datasets to quantify and better understand mangrove response to coastal environmental change.
• Develop spatial models that predict the future extent & condition of mangroves under different scenarios (e.g. climate change).



Aerial photography – West Alligator River mouth



Estimated height of mangrove canopies - West Alligator River. Derived from 1991 true colour aerial photography.



Airborne CASI data - western bank of West Alligator River

East Alligator mangroves

Background

- **1981 – Australian Littoral Society survey**

(7 sites established, 10 x 10m quadrats, substrate level, mangrove species composition, canopy density, height & other things measured)

- **1993 – mangroves remeasured (Griffith Uni.)**
- **2002 – transects relocated and remarked, co-ordinates fixed (GPS)**

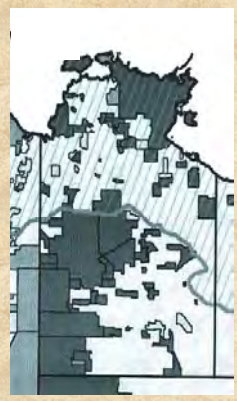
East Alligator mangrove transects

East Alligator mangroves: future work

Focus: Sea level change in van Diemen Gulf as driver for saline intrusion in ARR

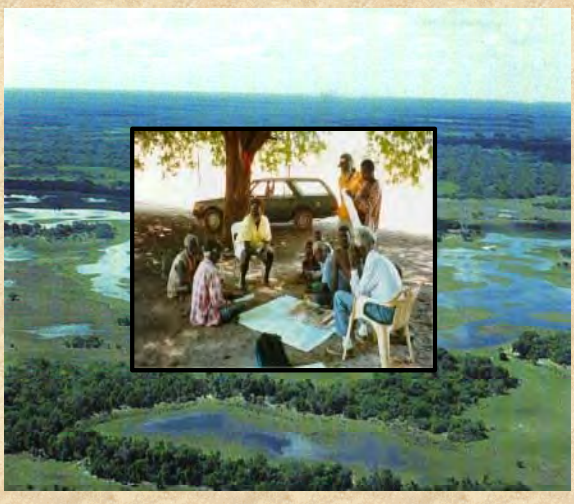
- re-survey of mangroves at all 7 sites in 2003
- re-measure sediment levels (tidal inundation frequency)

Incorporate Indigenous perspectives into coastal wetland management in northern Australia



In NT

~28% Population
~44% Land
~85% Coastline



Indigenous Perspectives

1. *Cultural values of water*

2. *Catchment & coastal management planning*

3. *Sustainable use of living natural resources*

Modelling coastal ecosystems

- **Need to understand *dynamics* of ecosystems to manage them**
- **Ecosystem models are abstractions of reality used to:**
  - **understand ecological processes & identify knowledge gaps**
  - **predict management outcomes (via scenario simulation)**
- **Basically a Decision Support Tool for land managers & policy makers**
- **But need to integrate biophysical & socio-economic/cultural frameworks**

Socio-economic		Biophysical
• defining people's values • how decisions are made • benefits & costs of actions	⟷	• geomorphological • hydrological • flora & fauna

Modelling Coastal Processes in ARR

- To assess effects of climate change
- At least 4 basic submodels, made spatially explicit via GIS:

1. Hydrodynamic - space-time variation in water flow
2. Hydrochemistry – transport & transformation of key chemical variables (nutrients & sediments)
3. Lower trophic level – primary, invertebrate & small forage fish production
4. Population dynamics of key top predator indicator species (e.g. fish, waterbirds) – biomass or abundance