internal report 432

Consultation with Kakadu Research Advisory Committee and invited researchers

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supervising scientist

Consultation with Kakadu Research Advisory Committee and invited researchers

13th February 2003

By Peter Bayliss, James Boyden, Dave Walden & Caroline Camilleri

Environmental Research Institute of the Supervising Scientist

Ecological Risk Assessment Program

Contents

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Agenda

1. Introduction

- Welcome and introductions
- Purpose of meeting – to suggest research, monitoring & management issues & strategies for the fifth Management Plan, to be forwarded to the Kakadu Board for consideration

2. Issues for discussion

- Opportunity for participants to identify issues they would like discussed during the day

3. The Kakadu framework

- The country, Aboriginal Land, National Park, funds & resources, the Management Plan

4. Soils, water and landscapes

- Rehabilitation & revegetation
- Saltwater intrusion
- Water quality
- Groundwater hydrology
- Landscape research – floodplains, wetlands, forests, savannas, habitat mapping etc
- Climate change

5. Introduced plants, animals and pathogens

- Weeds

    - Strategic management & regional context
    - Mimosa
    - Exotic grasses
    - Other weeds
- Other introduced plants (in Jabiru, leases, outstations etc)
- Introduced animals
    - Strategic management & regional context
    - Cane toads
    - Feral ants & other invertebrates
    - Other introduced animals & pathogens
- Integrated pest management

6. Fire

- Bininj managing country with fire
- Asset & boundary protection
- Fire mapping & GIS
- Fire plot monitoring
- Strategic management

7. Native Plants

- Bininj traditional use & management of plants
- Rare, threatened & declining plants & communities
- Other plants

8. Native Animals

- Bininj traditional use & management of animals
- Rare, threatened, declining & migratory animals
- Crocodiles
- Other animals

9. Fishing

- Fishing for consumption and ‘catch and release’ fishing
- Non-target impacts (habitats, riparian rookeries, etc)
- Impacts of coastal and inshore commercial fishing

10. Commercial use of wildlife

- Guidelines & regulations
- Animals – crocodile eggs, crocodiles, other
- Plants – seeds, plant materials
- Cultural tourism – hunting, gathering, art & crafts

11. Bio-prospecting (Commercial & semi-commercial)

- Guidelines & regulations
- Minimising adverse impacts
- Maximising benefits for traditional owners

12. Cultural resource management, research & monitoring

- Bininj management of cultural heritage
- Traditional knowledge and management practices

13. Visitor management, research, surveys and monitoring

- Visitor surveys & related research
- Monitoring environmental & social impacts
- Strategic management of visitors

14. Planning, funding, managing, communicating about and involving people in research

- Strategic planning for research
- Funding and other resources for research and monitoring
- Managing research activities – in-house, cooperative, consultancies, permits
- Ethics, methods & intellectual property
- Communicating about research
- Involving people – park staff, bininj, volunteers, organised groups
- Information management – databases, GISs
- Information for decision-making
- Role of KRAC

15. Monitoring implementation of the Management Plan

16. Guiding Principles for the fifth Management Plan

- Joint management
- Looking after country & culture
- Visitor management
- Working with stakeholders
- Strategic management
- Overall guiding principles

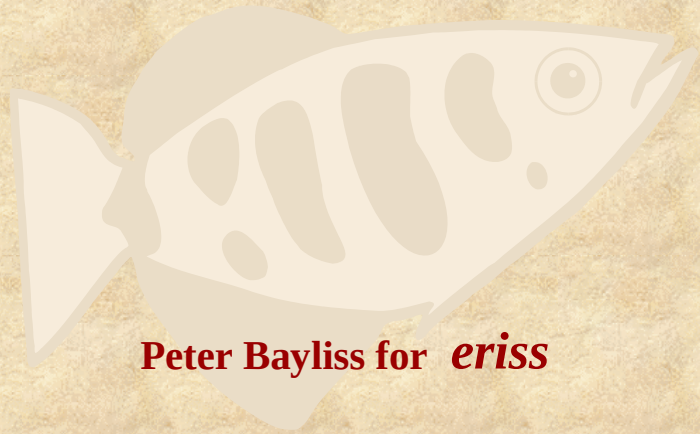
17. *eriss* Landscape Projects

- Invasive species (weeds & feral animals)
- Waterbirds in Alligator Rivers Region
- Assessment of mangrove change in the Alligator Rivers Region
- Boggy Plain Indigenous fire management project (& multiple impacts)
- Other ***eriss*** Landscape Projects

18. Other issues

Powerpoint slides

Eriss ISP – Landscape Projects in Alligator Rivers Region



Peter Bayliss for *eriss*

Outline Talk

- Supervising Scientist Division & *eriss*
- National Centre for Tropical Wetlands Research
- ISP – Landscape Projects
  - Background
  - Indigenous perspectives
    - Boggy Plain
    - Invasive species management (mimosa & ferals)
    - Climate change & salt water
    - Marine & coastal (mangroves)
    - Waterbirds
    - Modelling ecosystems

Supervising Scientist Division

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

National Centre for Tropical Wetlands Research

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

- **Partners have much experience & expertise in tropical wetland science & management**
- **Until recently we haven't had any significant runs on the ladder – now we have two !**

ERISS

Four 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 - Jacqui Rovis Hermann**

ERA Program

- ***Ecotoxicology***
  - **Site impacts from chemical pollutants – downstream effects of mining (e.g. uranium & magnesium salts)**
  - **Regional pollutants (e.g. herbicides, endocrine disruptors)**
- ***Landscape Monitoring & Assessment***
  - **Regional to global impacts due to:**
    - **Invasive species (weeds & feral animals)**
    - **Infrastructure (tourism, mines etc)**
    - **Saltwater intrusion due to climate change & rising sea levels**

Eriss LandscapeTeam

- **Dave Walden (GIS, weeds & ferals)**
- **Caroline Camilleri (coastal, communications)**
- **James Boyden (GIS, remote sensing)**
- **Peter Bayliss (community participation, wildlife management, landscapes, modelling)**

ISP - Background

- **World Heritage Committee asked Independent Science Panel (ISP) & IUCN to assess likely impacts of the Jabiluka Mill Alternative.**
- **ISP reported that risks to natural World Heritage values of Kakadu from JMA likely to be small, & that the ARR may be subject to major changes unrelated to mining (e.g. pests, climate change).**
- **And that there may also be unforeseen problems arising from mining.**
- ***ISP – concluded that landscape-scale monitoring & research is needed to distinguish mining impacts from other impacts.***
- **Commonwealth agreed to fund a landscape-scale program in ARR, & within the context of other research needs (e.g. impacts of invasive sp).**
- **Initial discussions held with PAN, KRAC & an ARRTC review. But most important – need to present program to Kakadu BoM.**

Landscape Projects

- **Usually involve only the biophysical sciences**
  - **For example, the *eriss* program structure**
- **BUT - to be relevant we need to incorporate:**
  - **Indigenous values & perspectives**
  - **Socio-economic frameworks**
  - **Ecosystem & adaptive management concepts**

ISP Landscape Projects

1. **Help assess weed impacts on Magela & Boggy Plain**
2. **Feral animal management Kakadu: with TOs, KCTWM & PAN:**
   - **help determine pest values & cost of damage**
   - **help develop bioeconomic pest control framework**
3. **Help assess World Heritage waterbird values of ARR and, for context, determine national perspective**
4. **Help TOs assess multiple landscape impacts (weeds, pigs, saltwater intrusion) at Boggy Plain, South Alligator River, & monitor use of fire as a customary management tool**
5. **Help assess threats to marine & coastal ecosystems in ARR**
6. **Develop ecosystem models of ARR for more effective Ecological Risk Assessments**

ISP Landscape Projects (cont.)

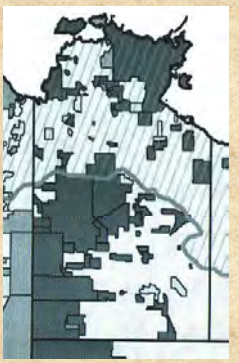
Other Eriss ISP Landscape projects in other Programs

8. Mapping radiological anomalies
9. Catalogue of research undertaken in ARR
10. Landscape mapping of the ARR
11. Mapping biophysical features of Magela Creek and floodplain
12. Mapping changes to Melaleuca distribution on the Magela floodplain
13. Changes to important & significant habitats & native species in KNP
14. Fish communities of Gulungul creek
15. Alligator Rivers Region soil database
16. Determination of hydrological regions

Landscape projects outside ARR

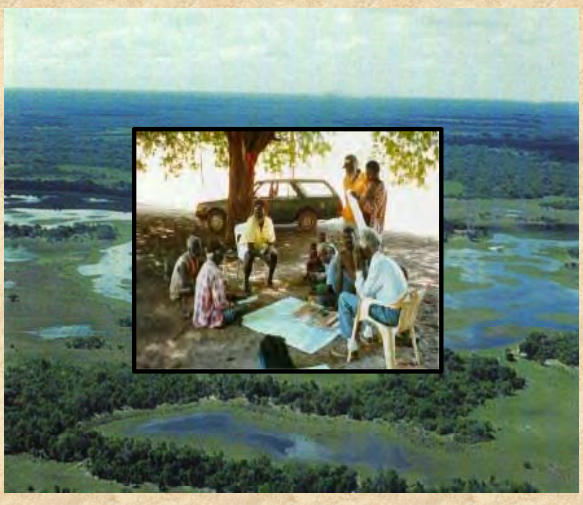
1. **Help develop catchment management plans for Indigenous communties in Arnhem Land**
   - Mixture of external grants
2. **Northern Rivers Assessment Program**
   - Between King River in WA to tip Cape York Peninsula in Qld
   - LWA & EA funded – $2.5 mill over 3 years
   - Facilitated through NCTWR
3. **National Waterbird Monitoring Program**
   - $1 mill already allocated to shorebirds
   - Tropical bit facilitated through NCTWR

Indigenous perspectives of 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*

Indigenous Perspectives

1. *Cultural values of water*

- **Largely ignored in government policy & management**
- **New (2001) NWQM Strategy & revised Guidelines recognises cultural values of water (e.g. scared sites, spiritual, customary use & commercial access)**
- **But needs appropriate consultation process at local & regional levels (e.g. Darwin Harbour)**

Indigenous Perspectives

2. *Catchment & coastal management planning*

- **No management plan for any of the 11 major catchments in NT outside KNP**
- **Within existing community capacity building programs, help develop catchment management plans in Arnhem Land & elsewhere**
- **Partners - NLC, EA-Indigenous Programs, NTU (CINCRM, KCTWM)**

Indigenous Perspectives

3. *Sustainable use of living natural resources*

- **Remote Indigenous communities - minimal economic development, low income & welfare dependence – land unsuitable for conventional economies**
- **New "sunrise" sustainable community-based economies using living resources may address socio-economic & environmental needs**



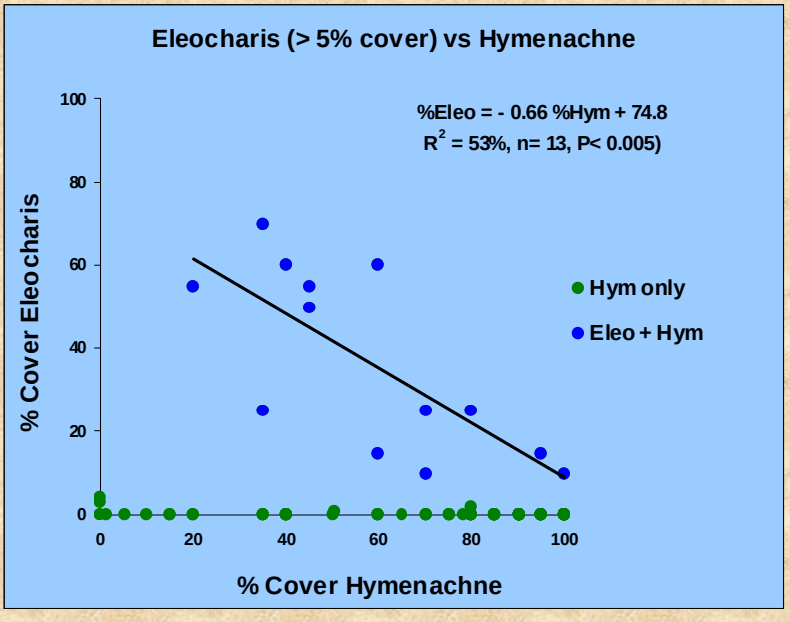

Indigenous Perspectives & KNP

- **Kakadu is seen as highly resourced.**
- **But cultural resouce management issues outlined above are equally relevant.**
- **It's about empowerment & ownership, not just resources.**
- **Participatory research is one way to empower communities.**

BOGGY PLAIN




BOGGY PLAIN



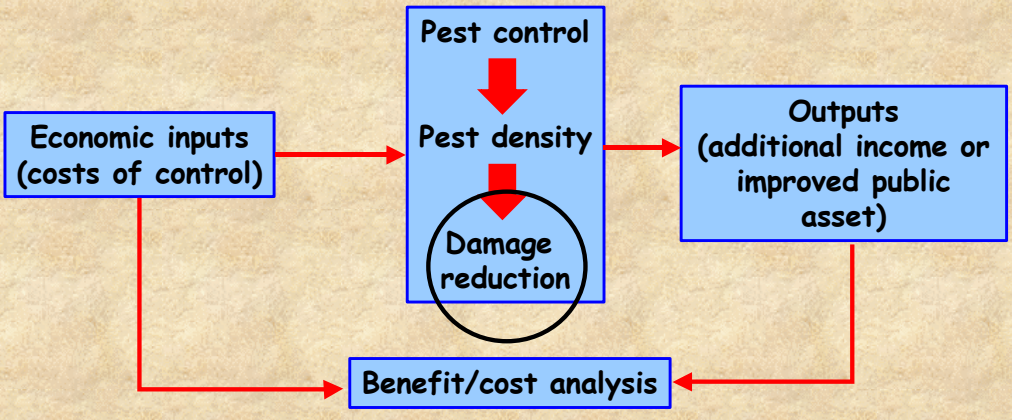
BOGGY PLAIN

- Across all sample plots the abundance (% cover) of weeds increased with increased extent of new pig rooting
- Other work:
  - remote sensing capture (airborne hyperspectral Oct. 2002) & calibration with hand-held spectrophotometer
  - fire scars mapped Nov-Dec. 2002
  - re-sample vegetation March/April 2003
  - multispectral capture (Quickbird) April 2003
  - other possibles – hydrological profile (DBIRD offer), salinity risk profile (eriss)

Managing invasive species impacts (weeds & ferals)

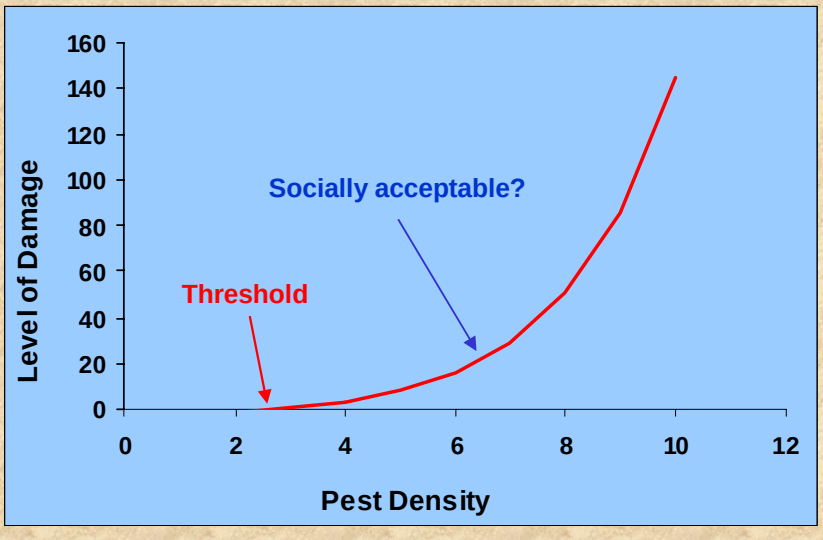
- Involves making choices
  - how much management intervention at what cost ($) ?
  - what benefit is delivered ?
- Challenge is to make choices that are
  - sensible
  - pragmatic
  - defensible
  - incorporates land owner values
- Requires benefits & costs to be balanced
  - past focus on “activity-based” management
  - need new focus on “damage-based” management within a budget
  - that is, use bioeconomic framework or models

Bioeconomic modelling

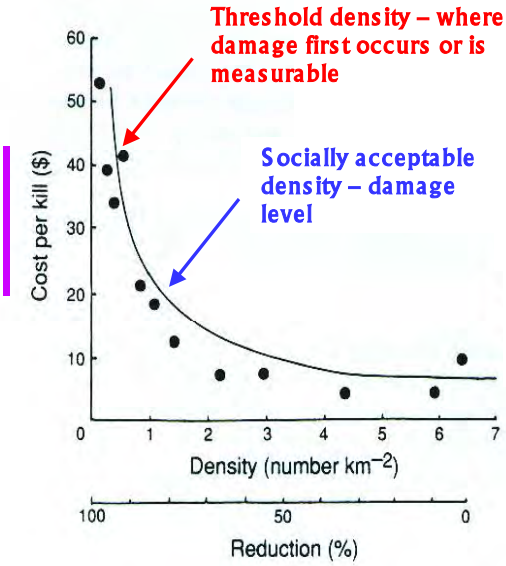


Monetary benefit/cost analysis
Benefit maximisation
Cost minimisation

THEORETICAL DAMAGE - DENSITY RELATIONSHIP



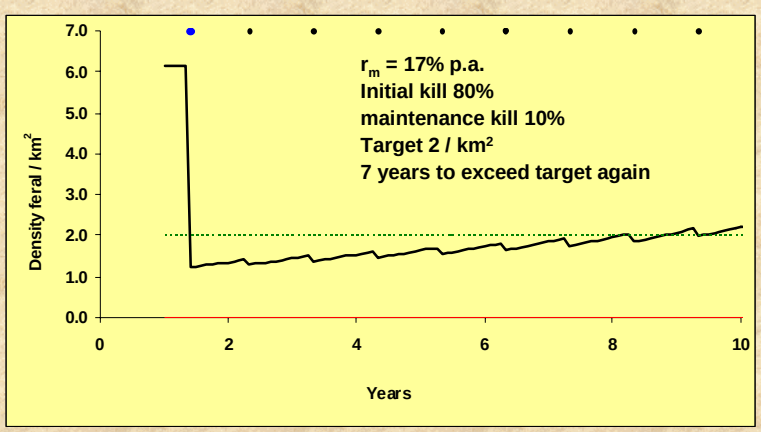
BUFFALO COST- OF- CONTROL CURVE & TARGET DENSITY



$C = 22.4\ D^{-0.673}$

Bayliss & Yeomans (1989)

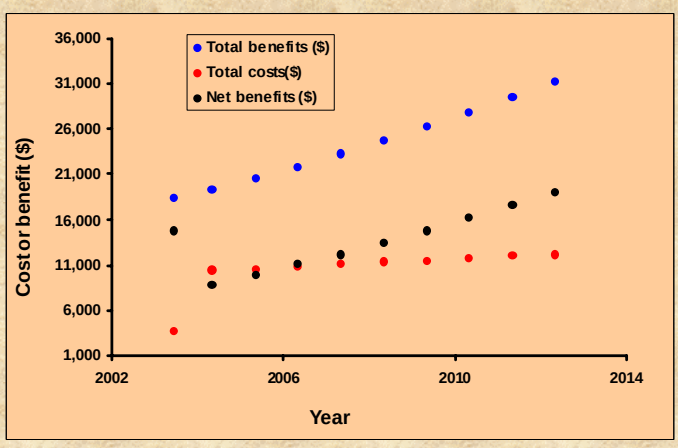
SIMULATED BUFFALO CONTROL KAKADU



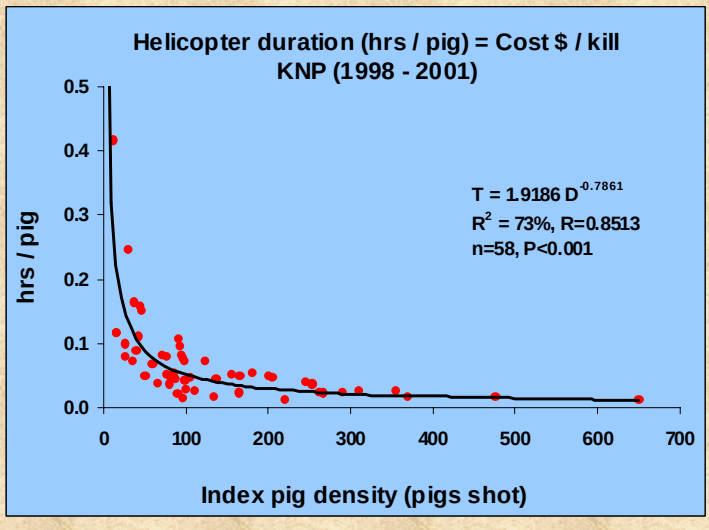
COST-OF-CONTROL OR HARVEST / HABITAT			
		Costs / km^2 / yr	Total $
Initial cost		$36.91	$3,691
Maintenance cost		$113	$101,709
Total cost f	10 Years		$105,400

SIMULATED BUFFALO HARVEST KAKADU

For BUFFALO	
Year start	2003
Year end	2023
Simulation Years	10
Price $/head	$150.0
Total Return	$243,245
Total Cost	$105,400
Net cost or benefit	$137,845
Net annual Return	$13,785 p.a
Total annual cost	$10,540 p.a.
$ cost helicopter/hr	$1,000

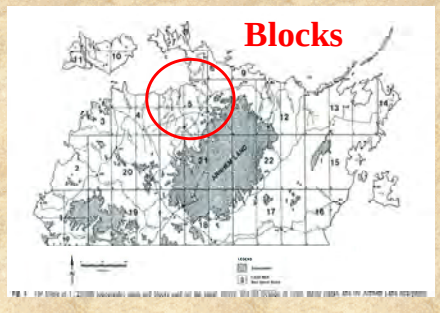


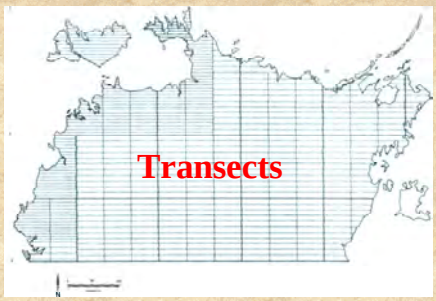
PIG CONTROL – KAKADU – COST CURVE

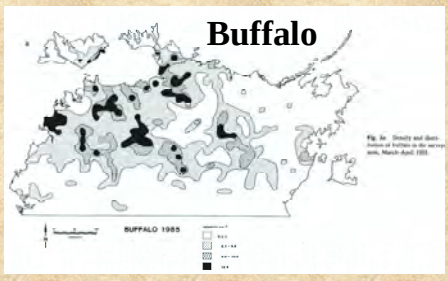


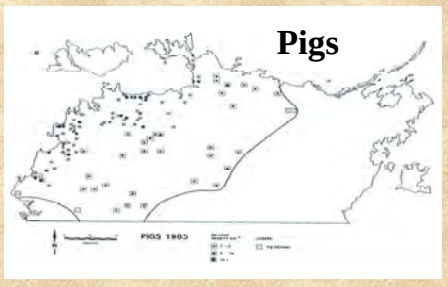
NB: Still need to add all other costs – ammo, salary etc

But we also need current information on feral animal distribution & abundance – over small & large areas - by aerial survey methods (Bayliss 1985)



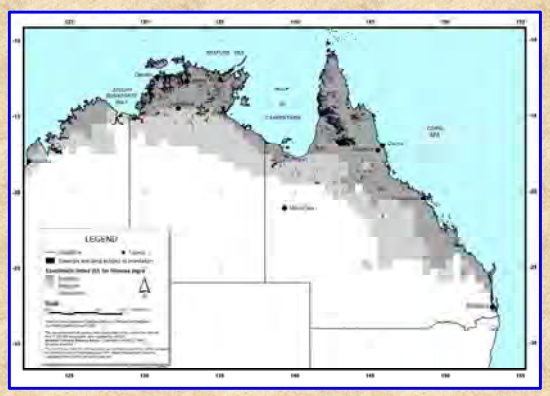






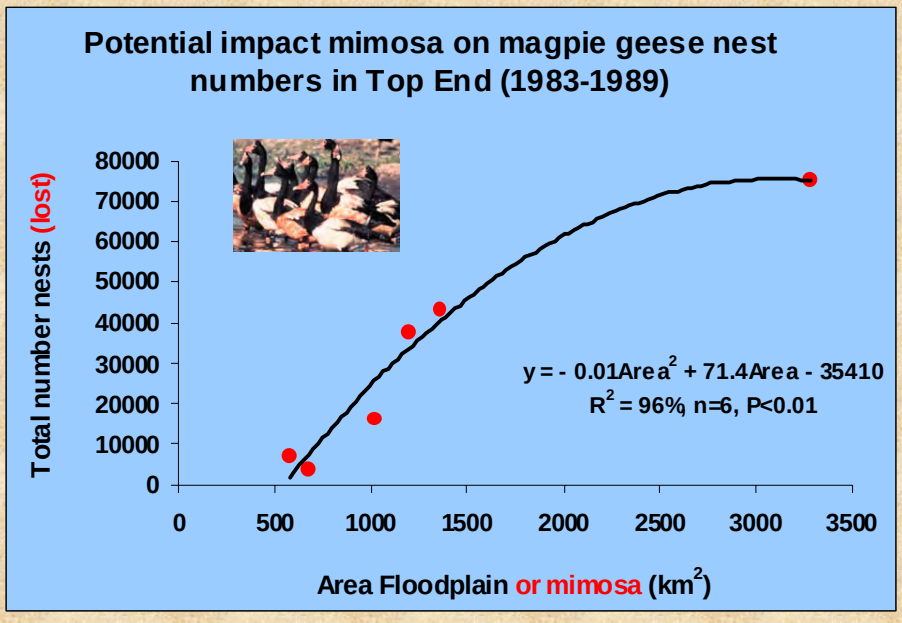
Mimosa Risk Assessment northern Australia

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

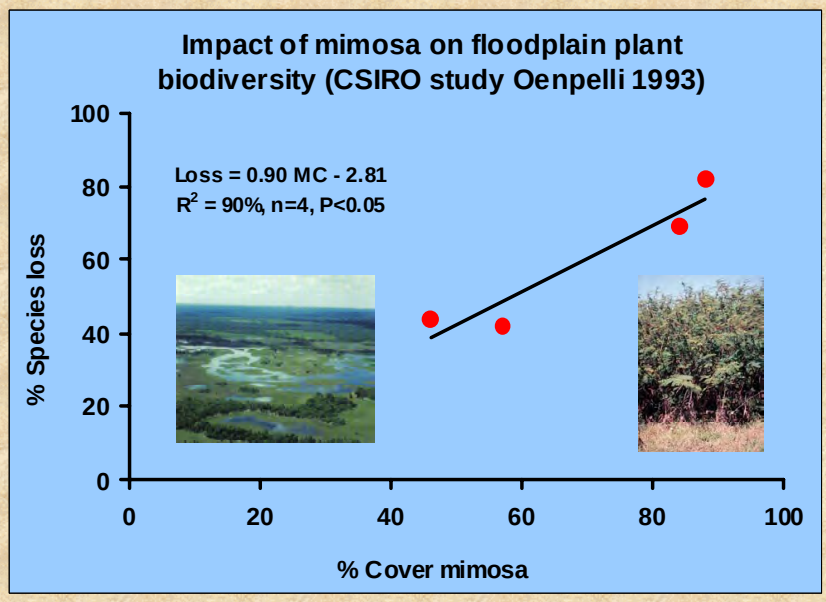


Wetlands across northern Australia potentially at risk of mimosa infestation, based on 1:250K topographical wetland data & potential distribution using CLIMEX

POTENTIAL IMPACTS OF MIMOSA WATERBIRD HABITAT



POTENTIAL IMPACT OF MIMOSA WETLAND PLANT DIVERSITY

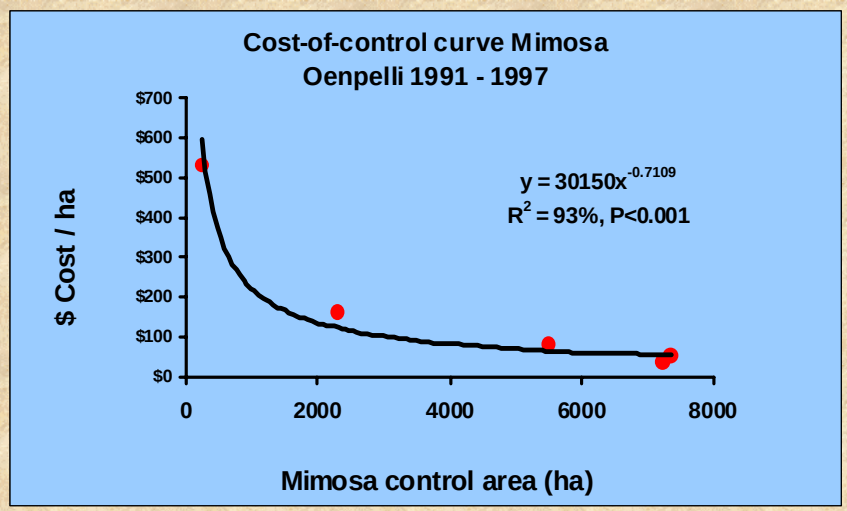


PLUS THE HUGE IMPACT OF MIMOSA

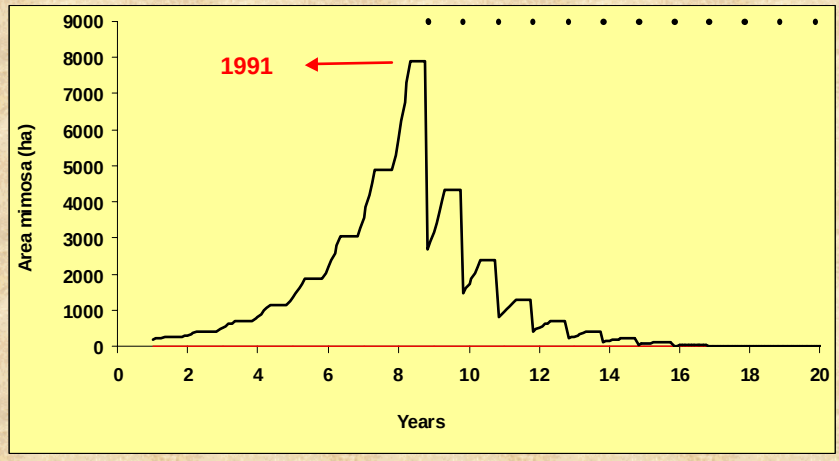
ON CUSTOMARY HARVESTING OF

WETLAND RESOURCES

Mimosa control on Oenpelli floodplain

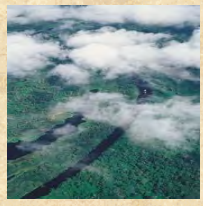


MIMOSA CONTROL OENPELLI (1991 – 1997)



	Costs/ha	Total Costs
Initial cost ($/ha)	$51	$404,162
Mean annual maint cost ($/ha/yr)	$218	$247,707
Total cost ($/ha) for	$1,139	$1,642,696

Climate change impacts



- **We advise Ramsar on the impacts of climate change to wetlands & methods of assessing their vulnerability.**
- **In the ARR we can help assess impacts of possible saltwater intrusion on World Heritage & cultural values by ....**

Saltwater intrusion

..... deriving salinity risk profiles for key freshwater wetlands (e.g. Magela floodplains, Boggy Plain)

Assess threats to marine & coastal environment in tropics

- **Iconic wildlife with high Indigenous value – dugongs, crocodiles & sea turtles**

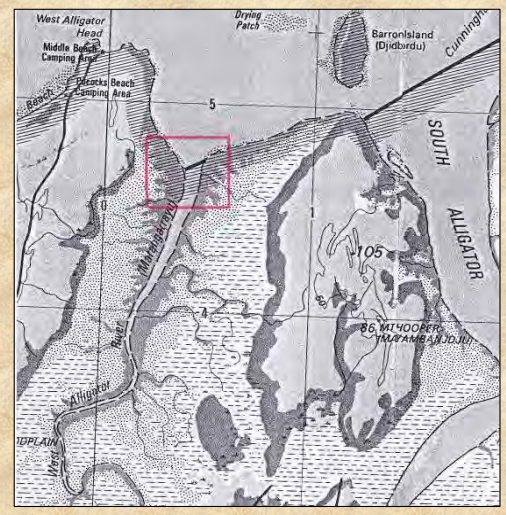
- **Coastal habitats – offshore islands, mangroves, pollution (marine debris, mining impacts)**

Mangrove response to coastal environmental change

- West Alligator study
- East Alligator study

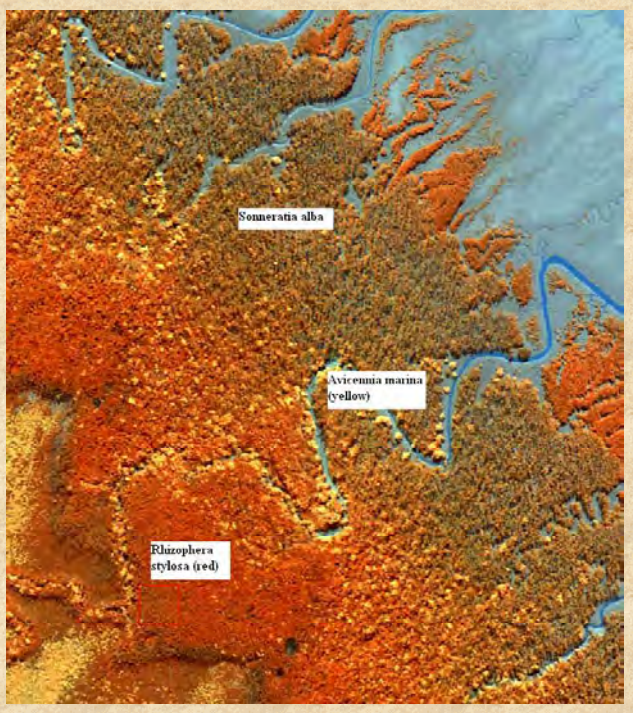
West Alligator Mangroves

(with U NSW, PAN, eriss)



Objectives

- Establish past & present baselines of mangroves (extent, community structure, biomass) using latest remote sensing technology & field-based data.
- Examine all information to better understand mangrove response to coastal environmental change.
- Develop spatial models that predict the condition of mangroves under different scenarios (e.g. climate change).



Airborne CASI data - western bank of West Alligator River

East Alligator mangroves

- 1981 – Australian Littoral Society survey
  - 7 sites 10 x 10m quadrats at substrate level
  - mangrove species composition, canopy density, height & other things
- 1993 – mangroves remeasured (Griffith Uni.)
- 2002 – transects relocated & remarked, GPS coordinates fixed

Will be 20 years of data to monitor change

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)

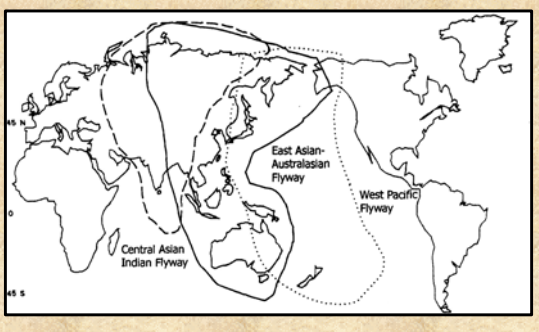
Shorebirds in the Asia Pacific Region

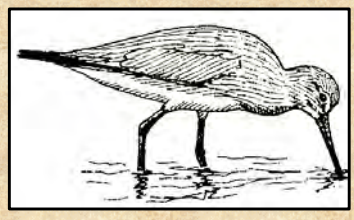
404 sp of waterbirds

(103 shorebirds)

203 sp migratory

(77 shorebirds)





Proposed National Waterbird Program

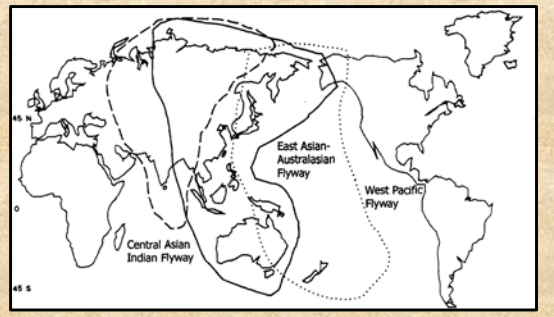
- **Funded by EA, northern Australian bit facilitated by NCTWR**
- **Key collaborators in the NT – KCTWM, P&WC, PAN, NLC**
- **Other collaborators - Birds Australia, Wetlands International, EA, NCTWR, WA & Qld govts**
- **Use landscape analysis to identify important conservation areas along coastline, & spatial & temporal patterns**
- **Links to the ISP Landscape & Northern Rivers Assessment projects**

Waterbird monitoring program: multi-scalar

- International – migratory waterbird flyways
- Asia-Pacific region
- National
  - SE coast Australia
  - Murray-Darling Basin
  - Desert – Lake Eyre Basin (LEB)
  - Northern tropics
    - Alligator Rivers Region
    - Magela Creek & Boggy Plain

Global scale

Point or site scale



Waterbird monitoring program "Top End" of the NT (1983 – 2003)

Boggy Plain

Was most extensive *Eleocharis* swamp in NT with 85% geese in dry

Magela Creek catchment

Alligator Rivers Region

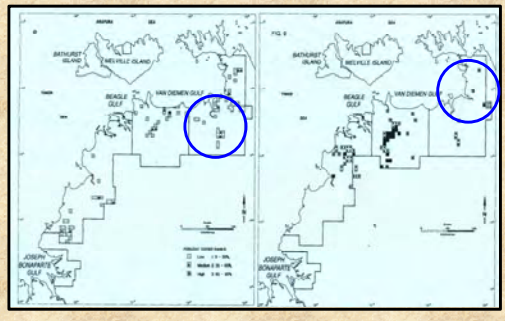
- Morton OSS data
- Bayliss data
- P&WC data

Magpie Geese & habitat in the "Top End" of the NT

1983 Dry 1983/84 Wet

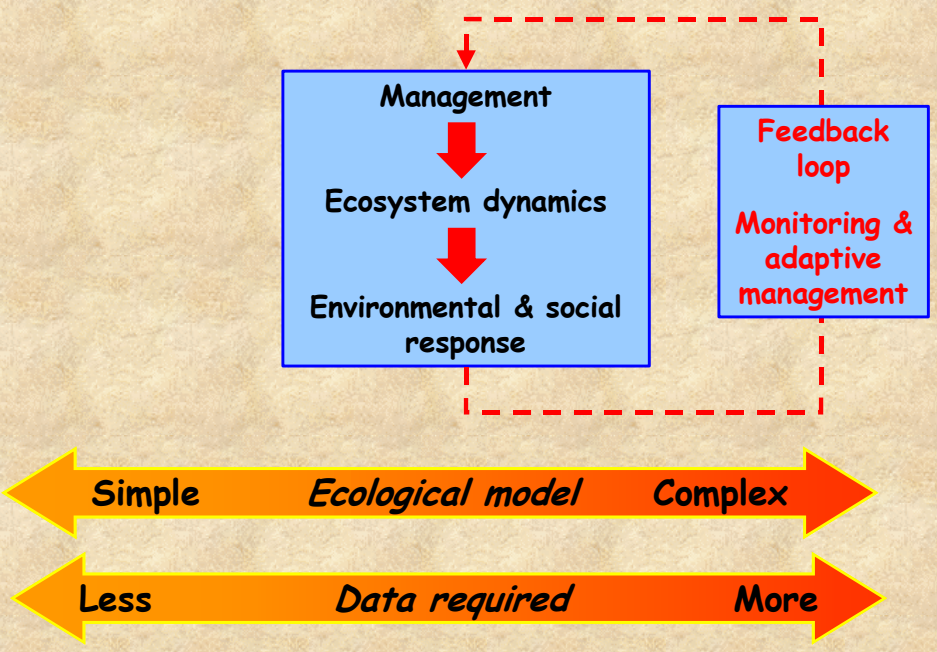
Standardised counts

Eleocharis (+) Mimosa (-)



Visual cover ranks – replace with remote sensing data

Ecosystem modelling



Modelling ecosystems in ARR

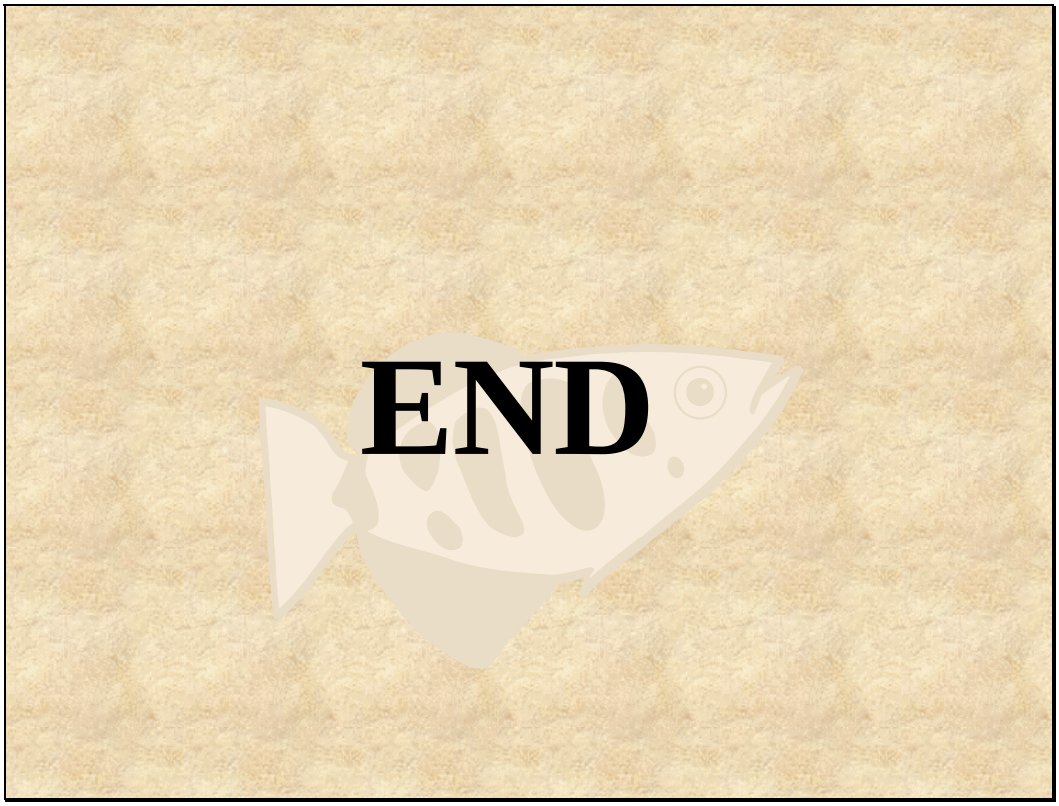
- Need to understand *dynamics* of ecosystems to manage them
- Ecosystem models are abstractions of reality used to:
  - understand ecological processes & identify knowledge gaps
  - predict management outcomes (via scenario simulation – "what if")
- Can be a useful Decision Support Tool for natural & cultural resource managers
- But we need to integrate biophysical & socio-economic/cultural frameworks

Socio-economic
- defining people's values
- how decisions are made
- benefits & costs of actions

Biophysical
- geomorphology
- hydrology
- flora & fauna

Modelling Ecological Processes in ARR

- To assess effects of multiple impacts from the scale of mine sites to catchments
- At least 4 basic submodels, made spatially explicit in a 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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