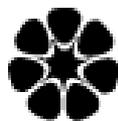


Integrating herbicide & mechanical control treatments with fire & biological control to manage an invasive wetland shrub, *Mimosa pigra*



Quentin Paynter, Grant Flanagan



Northern Territory Government
Department of Infrastructure, Planning and Environment

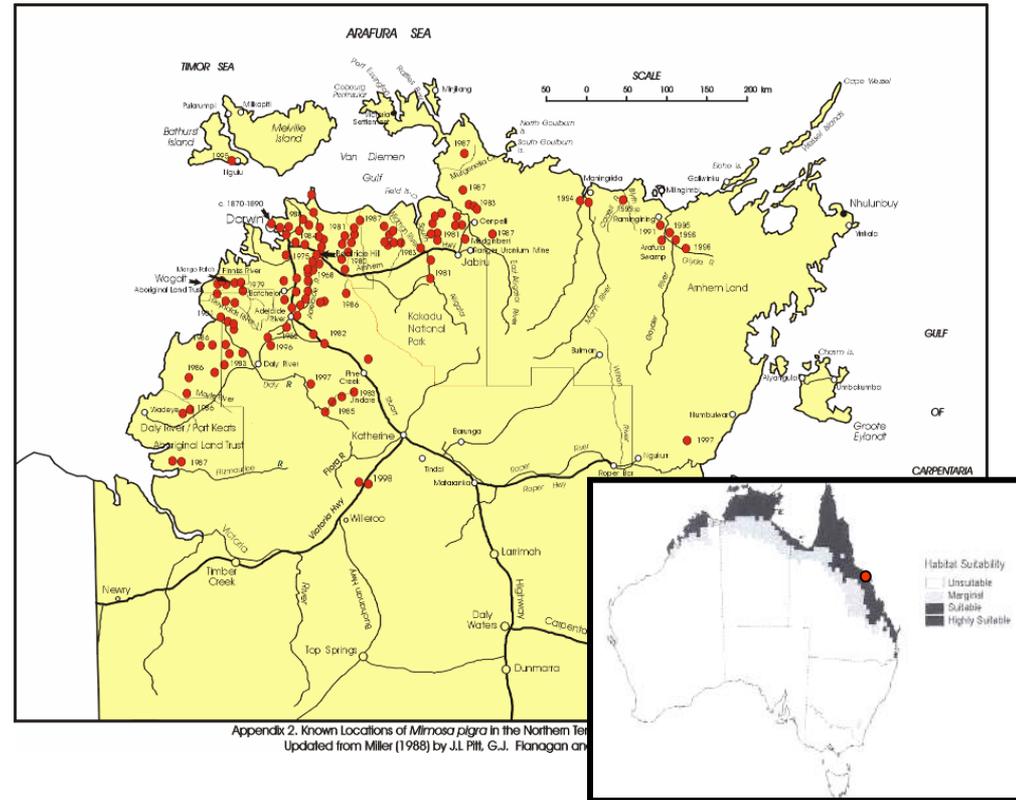


Manaaki Whenua
Landcare Research



Government of South Australia
Kangaroo Island Natural Resources
Management Board

Mimosa pigra L. Fabaceae



Native to neotropics; invasive throughout old world tropics
Forms impenetrable thickets in N. Australian monsoonal wetlands
By late 90s, several biocontrol agents released, but still invasive

Evaluating biological control impact (1998 - 2003)

➤ Data collection

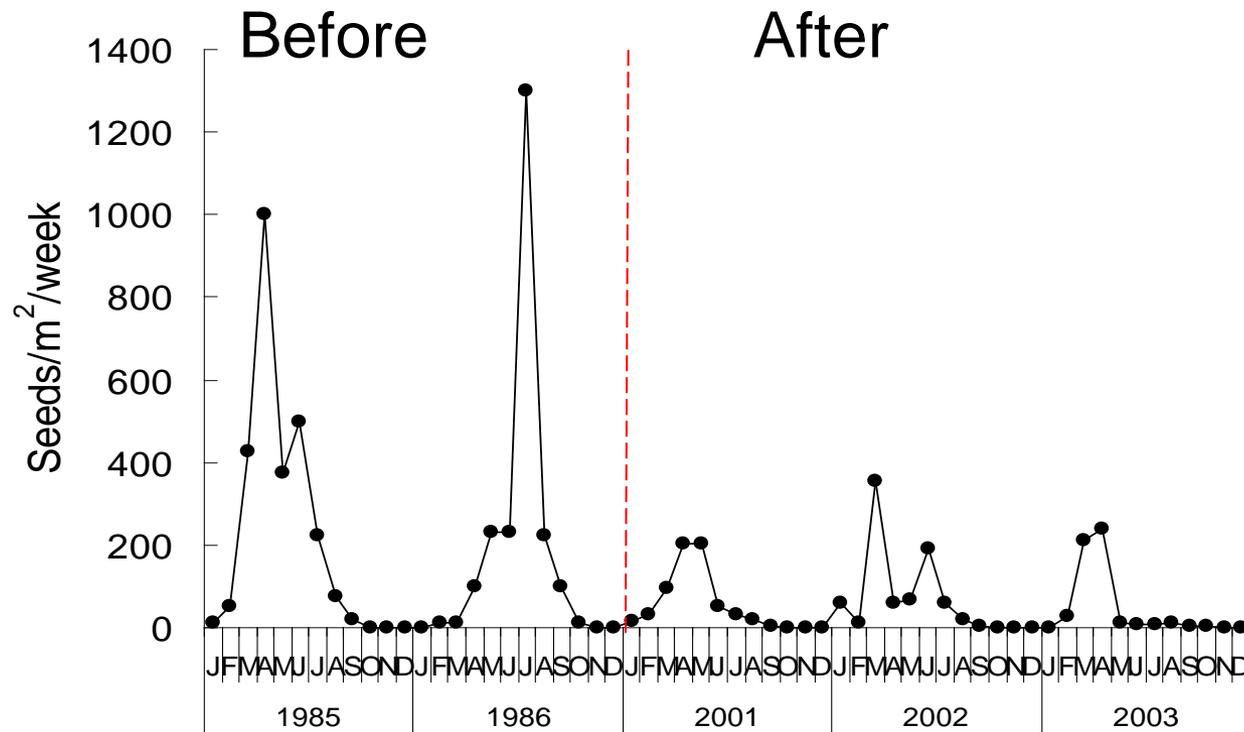
- Comparison with the past
- Comparing sites with/without *Carmentia mimosae*

➤ Modeling

- Biological control not yet successful - can success/failure be predicted?
- How might biological control integrate with other methods

Comparisons with past

Big (70%) drop in seed rain¹



¹Paynter (2006) *Biological Control* 38: 1066-1073

Comparing sites +/- *Carmentis mimosa*

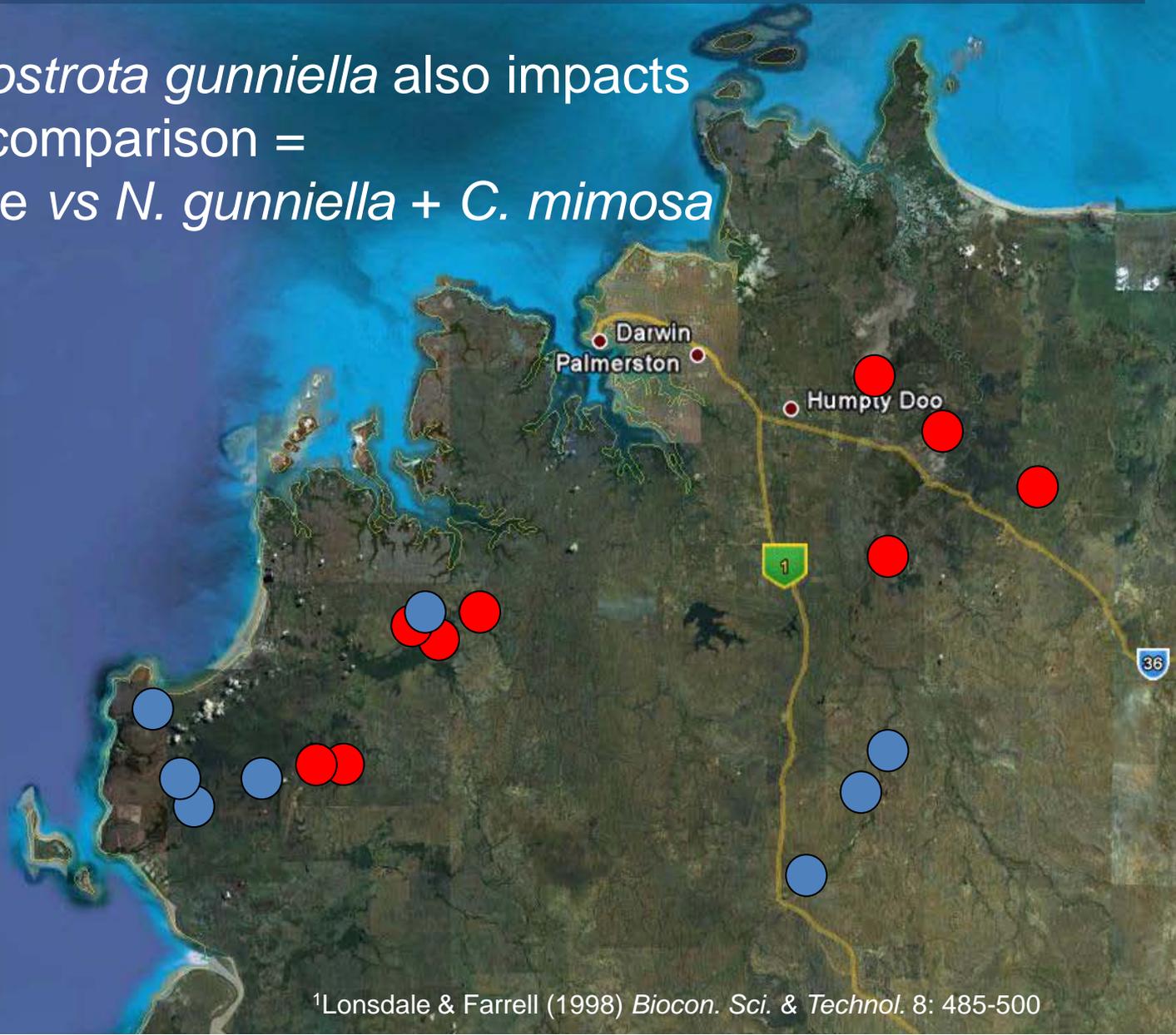
Ubiquitous *Neurostrotia gunniella* also impacts on mimosa¹, so comparison =
N. gunniella alone vs *N. gunniella* + *C. mimosa*



C. mimosa



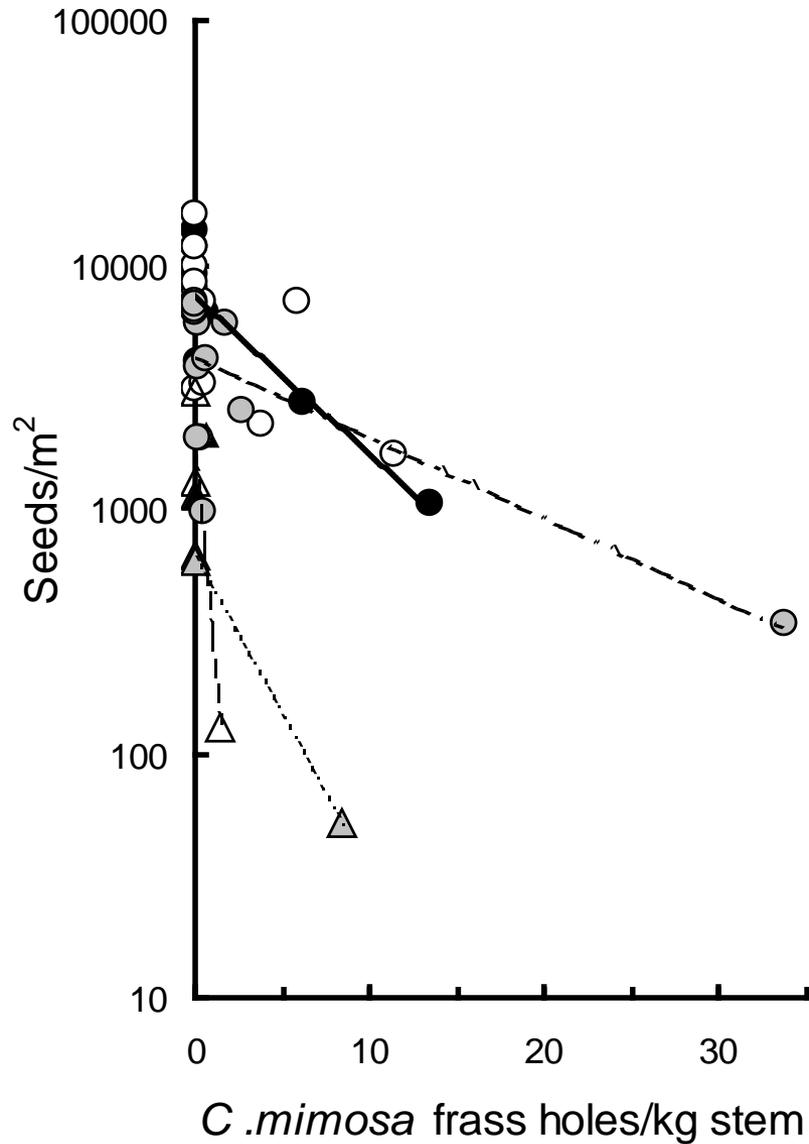
N. gunniella



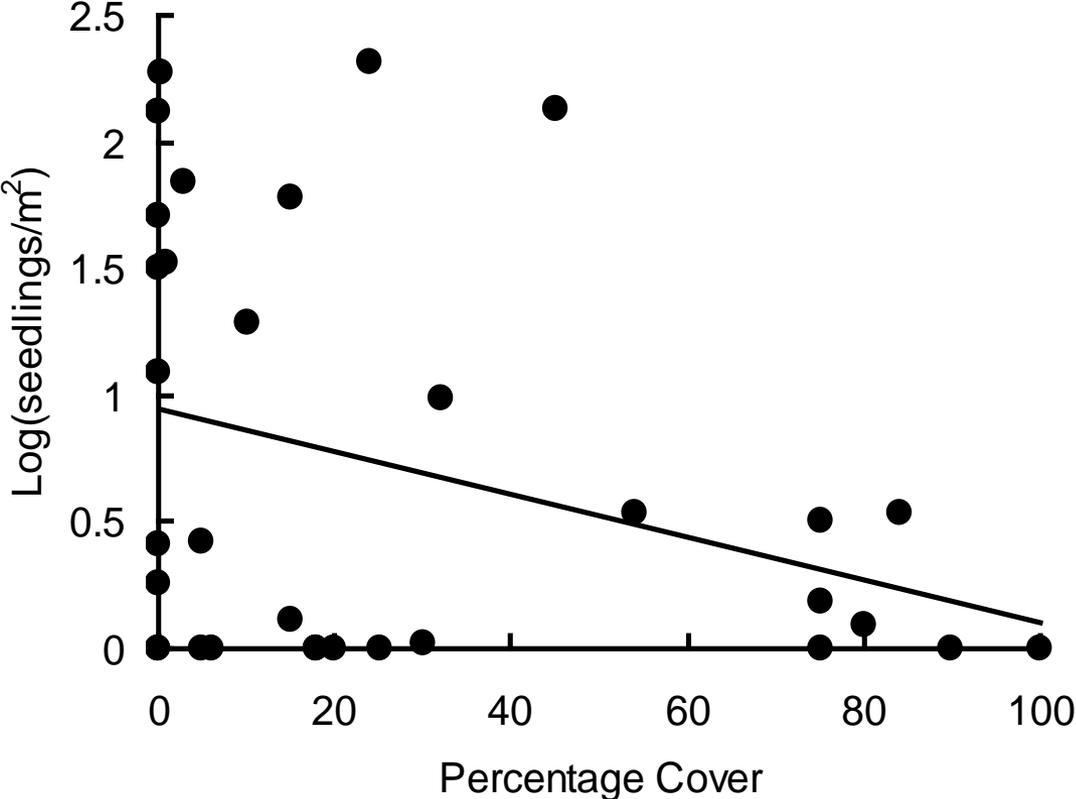
¹Lonsdale & Farrell (1998) *Biocon. Sci. & Technol.* 8: 485-500



C. mimosa impact: seed rain



C. mimosa defoliation: increased % cover of competing vegetation, smothering mimosa seedlings, preventing re-establishment¹



¹Paynter (2005) *Journal of Applied Ecology* 42: 1054-1062

- As shown for *N. gunniella*¹, *C. mimosa* attack was aggregated at stand edges²

After 3 yrs observations

- Half the *C. mimosa* absent sites had expanded
- All *C. mimosa* present sites static or had slowly contracted from the edge ($P < 0.05$)



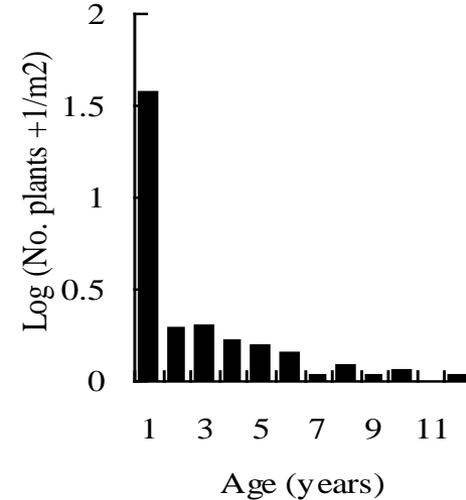
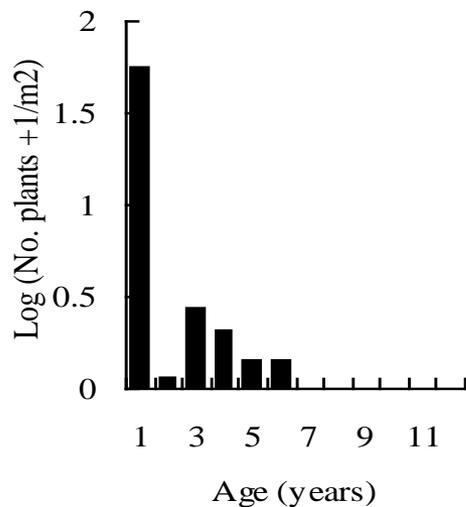
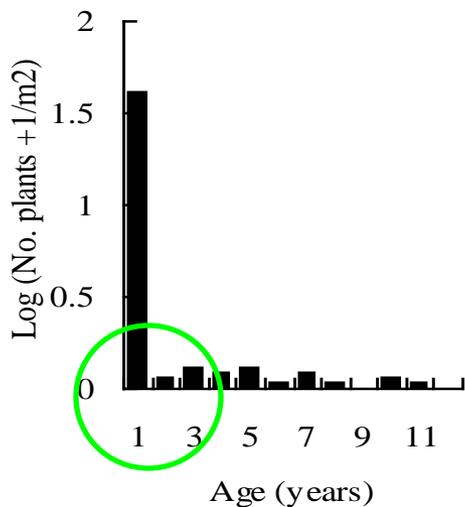
Stand	<i>C. mimosa</i> present	<i>C. mimosa</i> absent
Expanded	0	4
Unchanged	6	4
Contracted	3	0

¹Smith & Wilson (1995). J. Austral. Ent. Soc., 34, 177-180

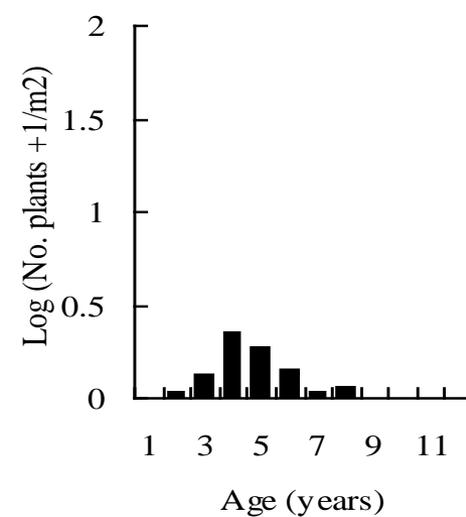
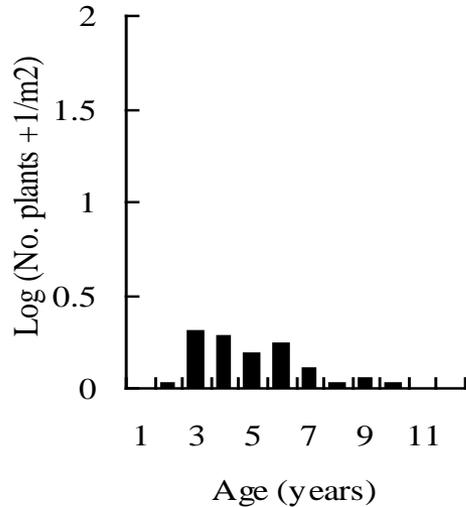
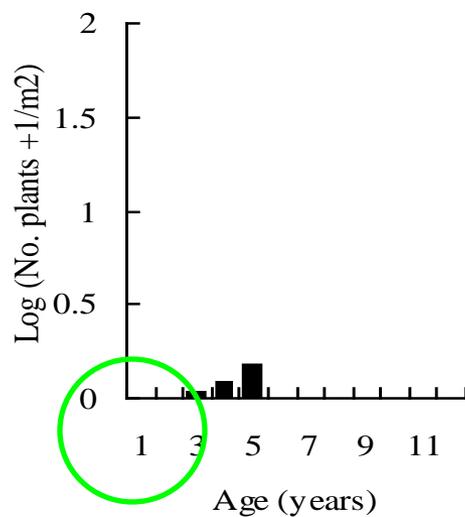
²Paynter (2006) *Biological Control* 38: 1066-1073

Age structures indicate the end is nigh for mimosa

Advancing stands with *C. mimosa* absent



Contracting stands with *C. mimosa* present



Simulation models¹

- ~~But the model is based on the same data as the real world. degrees is (only) great & EoA/Df. Stov control low huge mimosa infestations~~



Yvonne Buckley



¹Buckley *et al.* (2004) *J. Appl. Ecol.* 41: 547-560

Integrated Weed Management Trial

- What treatments or treatment combinations are best?
- How do they interact with biocontrol?

In 1997 -2000 CSIRO & NT Government conducted large-scale (128 ha) IWM study at Twin Hills Station



Control options¹



Herbicide

Bulldozing



Fire

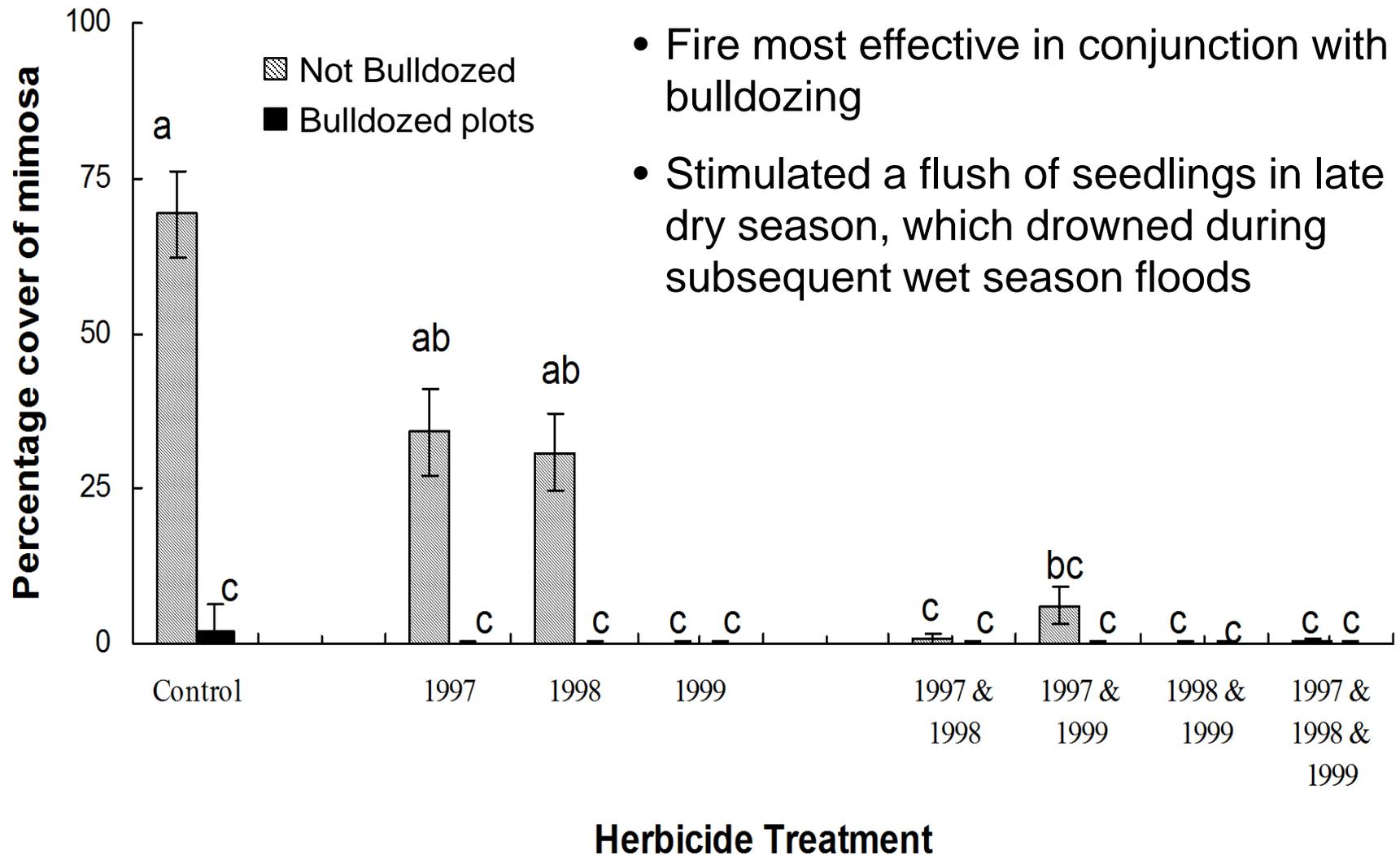
Treatments:

- Controls, plus
- Herbicide (1-3 applications in 1997-1999 wet seasons)
- Bulldozing (1998; alone or in combination with herbicide) then
- Fire applied to the entire site in the 2000 dry season

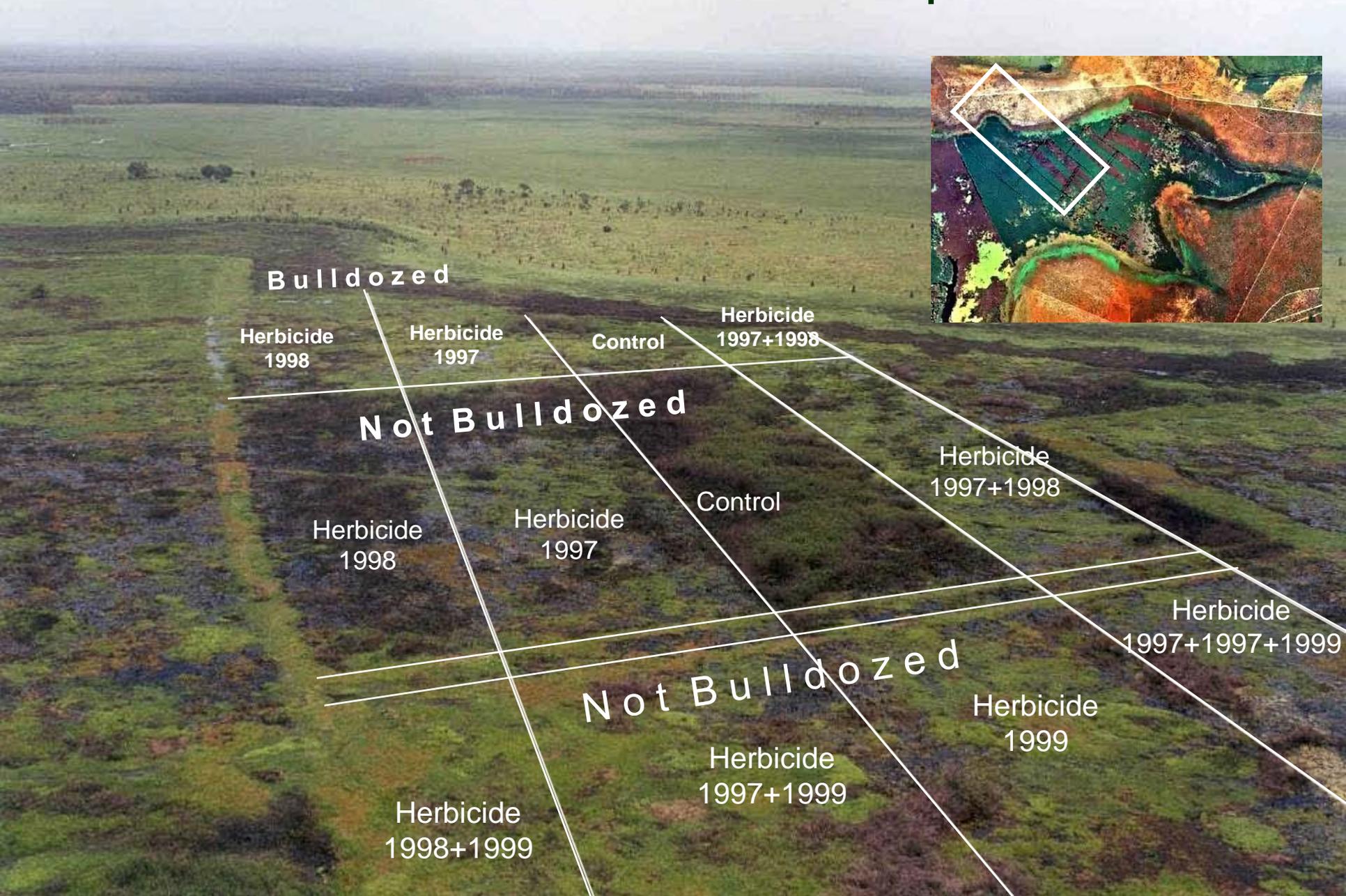


- Data collected annually on impact of treatments on :
- mimosa & competing veg (e.g. % cover)
- biocontrol agent abundance

% cover after all treatments 1 yr after fire



Aerial view of 1 sub-block post-fire



Bulldozed

Herbicide
1998

Herbicide
1997

Control

Herbicide
1997+1998

Not Bulldozed

Herbicide
1998

Herbicide
1997

Control

Herbicide
1997+1998

Not Bulldozed

Herbicide
1998+1999

Herbicide
1997+1999

Herbicide
1999

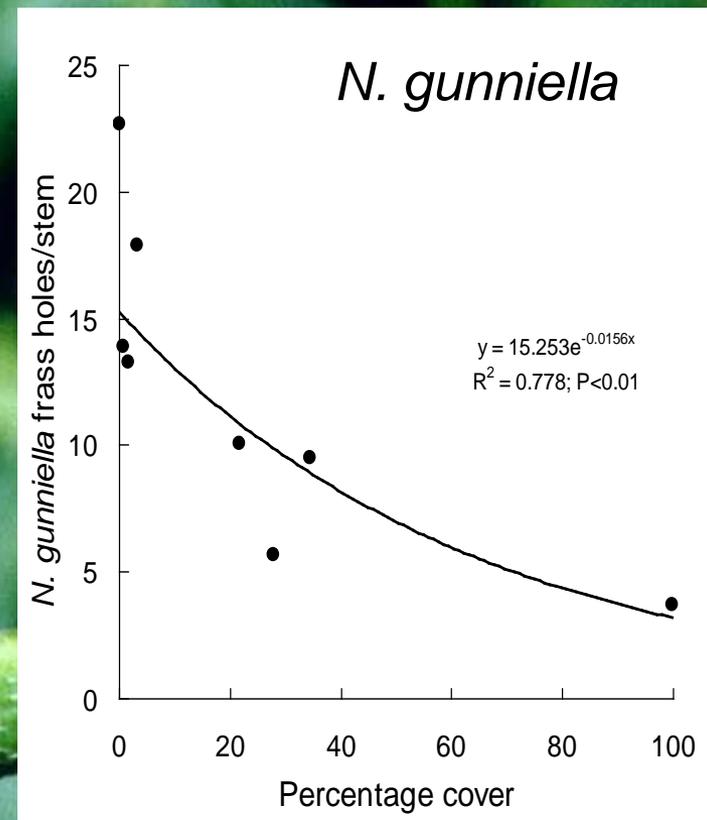
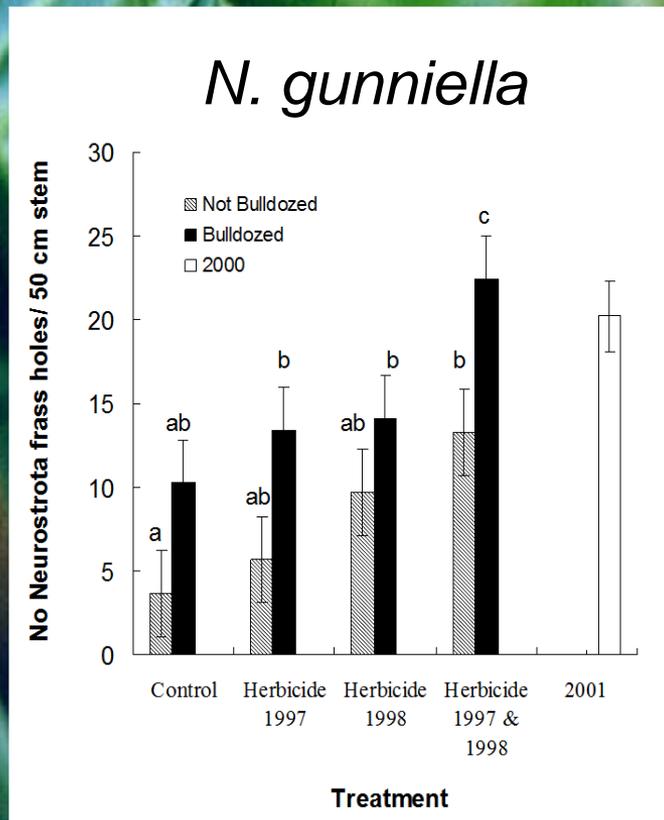
Herbicide
1997+1997+1999

Success!

- Several treatment combinations worked!
- Remaining mimosa treated in 2001
- Only relatively minor follow-up control required since then
- Did biocontrol help?



- *C. mimosa* & *N. gunniella* boomed on mimosa regenerating after herbicide & bulldozing
- *N. gunniella* boomed within 1 yr of fire
- Mimosa seedlings noticeably stunted



Control treatments fragmented thickets, increasing the proportion of susceptible 'edge' plants

Summary

- Biocontrol integrated well with other options: agents increased after herbicide & bulldozing & recolonised plots soon after fire. In particular, *N.gunniella* outbreaks stunted seedlings & reduced survival during floods
- Models¹ indicated 2-year treatments (e.g. 1999 herbicide application + fire 2000) should only succeed with additional impact of biocontrol & several 2-year treatments succeeded!
- Pre-*C. mimosa* fires rarely penetrated far into dense mimosa stands²; by increasing flammable deadwood & fuel loads beneath mimosa stands *C. mimosa* may enhance the impact of fire

¹Buckley et al. 2004 *J. Appl. Ecol.* **41**: 547-560

²Lonsdale & Miller (1993) *J. Env. Manag.*, **30**: 77–87



Thanks & goodbye!