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## Do natural ecosystems benefit from the management of Weeds of National Significance?

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## Background

- Invasive plants can adversely impact on:
  - abundance and diversity of native plants, vertebrates and invertebrates
  - ecological communities
  - ecosystem processes (nutrient cycling, soil sedimentation, hydrological cycles, fire regimes and food webs)

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## Background

- \$19.6 million / year is spent on invasive plant management in natural ecosystems in Australia\*
  - not including time spent by volunteers and annual investment in biocontrol
- ... but does this investment lead to the recovery of natural ecosystems?

http://www.pillar-frank.audiotapes.com/

\*Sinden et al. 2004

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## Project aim, scope and methods

- Aim**
  - Undertake a desktop analysis to investigate how natural ecosystems have responded following invasive plant management in Australia.
- Scope**
  - Concentrated on the 20 Weeds of National Significance (WoNS)
    - high economic and environmental impacts
    - focus of much research and on-ground management
- Methods**
  - Review the relevant scientific literature
    - Including Australian Weeds Conference Proceedings (1993–2008)
  - Survey land managers by email

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## Literature review – results

95 papers on WoNS management in Australian natural ecosystems included in the review

WoNS	No. of papers	WoNS	No. of papers
Alligator weed	8	Mesquite	3
Athel pine	1	Mimosa	15
Bitou bush/boneseed	14	Parkinsonia	5
Blackberry	3	Parthenium weed	1
Bridal creeper	4	Pond apple	0
Cabomba	0	Prickly acacia	3
Chilean needle grass	1	Rubber vine	9
Gorse	6	Salvinia	11
Hymenachne	0	Serrated tussock	0
Lantana	8	Willows	1

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## Literature review – results

Response of native communities and ecosystem processes following WoNS management

WoNS	No. of papers	
	Total	Measured the response of associated plants, animals or ecosystem processes to management
Athel pine	1	1
Bitou bush/boneseed	14	7
Bridal creeper	4	3
Lantana	8	1
Mimosa	15	4
Parthenium weed	1	1
Rubber vine	9	3
Salvinia	11	1
		<b>21*</b>

\* Duration ranged from 1 to 8 years (median 2 years, mode 3 years)

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## Literature review – results

18 papers measured the response of plant communities following WoNS management

Types of vegetation replacing the WoNS	No. of papers	References
no detail	3	Cook 1993, Paynter 2005, Collins et al. 2008
native plants	6	Melland et al. 1999*, Macleay 2004, Tomley and Evans 2004*, Brown and Grace 2005*, Thomas et al. 2006, Radford et al. 2008
native & invasive plants	4	Miller and Schultz 1993, Paynter and Flanagan 2004, Turner and Virtue 2006, Mason and French 2007
invasive plants & bare ground	3	Pritchard 1996, Brooks et al. 2004, Hennecke and French 2008
no change	2	Mason et al. 2007 (native seed banks) Turner et al. 2008 (2 of 3 sites; 15 months duration)

\* based on a few observations, without detailed data on replacement species.



## Literature review – results

- Two papers measured the response of invertebrate communities
  - no change in abundance and composition of leaf litter invertebrates following control of bitou bush with herbicides
    - glyphosate (Lindsay and French 2004)
    - metsulfuron-methyl (French and Buckley 2008)
- One paper measured the response of an ecosystem process
  - no difference in rates of native fruit removal by birds between sites infested with bitou bush and sites where the weed had been killed using herbicide.
  - lower bitou bush fruit removal from experimental stations within controlled sites than in infested sites.
- No paper reported on the response of vertebrates and below or above-ground microbial communities



## Land manager survey – results

168 survey replies received

WoNS	No. of replies	WoNS	No. of replies
Alligator weed	2	Mesquite	9
Athel pine	3	Mimosa	2
Bitou bush/boneseed	23	Parkinsonia	3
Blackberry	30	Parthenium weed	1
Bridal creeper	18	Pond apple	2
Cabomba	0	Prickly acacia	4
Chilean needle grass	5	Rubber vine	6
Gorse	14	Salvinia	2
Hymenachne	1	Serrated tussock	12
Lantana	15	Willows	16

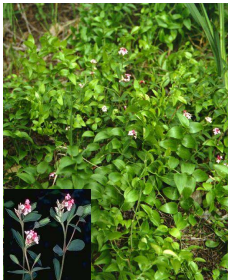


## Land manager survey – respondent statistics

State	No. of replies	Organisation	No. of replies
VIC	62	State govt	64
NSW	47	Community groups	43
QLD	25	Local govt	37
WA	15	Private landholders	11
SA	13	NRM/CMA Boards	10
TAS	4	Others	3
ACT	2		



## Land manager survey – management programs



*Pimelea spicata* threatened by bridal creeper

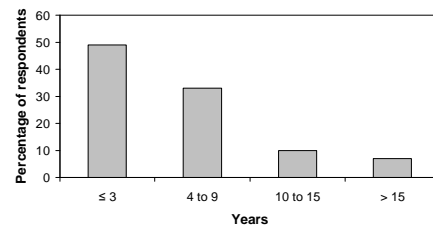
Aims of program	% of replies*
biodiversity conservation	76
weed eradication	66
weed containment	39
complying with legislation	33
neighbour/public relations	22
asset protection	20
cultural heritage protection	6
other	2

\* multiple responses were available, so totals do not add up to 100%.



## Land manager survey – management programs

- Size of areas targeted:
  - ranged from <1 to >5000 ha
  - 47% of programs covered areas ≤ 50 ha and 20% areas > 1000 ha
- Duration:



## Land manager survey – management programs



Type of management used	% of replies
herbicide	65
hand weeding	20
biological control	7
mechanical	4
other	4



## Land manager survey – evaluation

142 respondents indicated that they evaluated the outcomes of WoNS management programs

What was assessed	% of replies*
response of the WoNS to management	96
response of other invasive plants to WoNS management	27
response of native plants to WoNS management	58

\* multiple responses were available, so totals do not add up to 100%.



## Land manager survey – evaluation

Assessment method	% of replies*
observations	82
photo points	58
mapping	51
% cover	20
no. plants along transects	13
no. plants within quadrats	9

\* multiple responses were available, so totals do not add up to 100%.



## Land manager survey – outcomes



Reduction of bridal creeper density following biocontrol at Yanchep NP, WA

% reduction of WoNS-infested area following management	% of replies
1 to 50 %	22
> 50%	63
no change or increase in infested area	2
could not estimate	13



## Land manager survey – outcomes

86 respondents indicated that they formally evaluated the response of other plant species to WoNS management

WoNS	No. of replies		WoNS	No. of replies	
	Total	Formally evaluated the response of associated plants to management		Total	Formally evaluated the response of associated plants to management
Athel pine	3	1	Parkinsonia	3	1
Bitou bush/boneseed	23	16	Parthenium weed	1	1
Blackberry	30	18	Pond apple	2	2
Bridal creeper	18	8	Prickly acacia	4	1
Chilean needle grass	5	2	Rubber vine	6	4
Gorse	14	8	Serrated tussock	12	4
Lantana	15	12	Willows	16	6
Mesquite	9	2			



## Land manager survey – outcomes

Vegetation response following WoNS management *	% of replies
none (bare ground)	7
WoNS recolonised site	2
WoNS replaced by native plants only	33
WoNS replaced by native and invasive plants	52
not specified by respondent	1

\* Four respondents (5%) selected more than one category of vegetation response

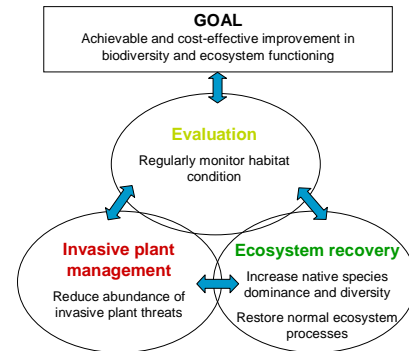


## Take home messages

- **Has managing WoNS benefited natural ecosystems in Australia?**
  - limited quantitative data documenting changes in plant communities
  - where data is available, a combination of both native and invasive plants were commonly found replacing the managed WoNS
  - lack of information on the response of animal and microbial communities and ecosystem processes
- **Recommendations:**
  - greater emphasis on evaluation
  - give priority to sites with high conservation value for invasive plant management where natural recovery is more likely
  - whole-system approach – integrate invasive plant management programs with ecosystem recovery actions



## Restoration of weed-invaded natural ecosystems



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Does invasive plant management aid the restoration of natural ecosystems?

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## Thank you

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