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
## Does invasive plant management aid the restoration of natural ecosystems?

Adele Reid, [Louise Morin](#), Paul Downey, Kris French & John Virtue



## 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)

## 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.edu/magazine/2012/02/

\*Sinden et al. 2004



## 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



## 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             |




## 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)



## 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)<br>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             |

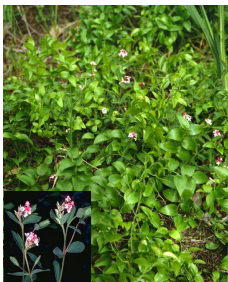


## Land manager survey – respondent statistics

| 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

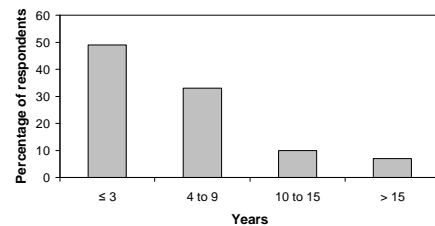
| Aims of program              | % of replies* |
|------------------------------|---------------|
| biodiversity conservation    | 76            |
| weed eradication             | 66            |
| weed containment             | 39            |
| complying with legislation   | 33            |
| neighbour/public 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

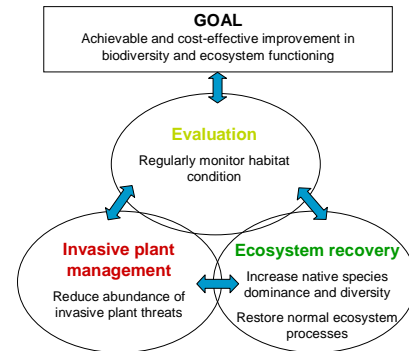


## Take home messages

- **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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## Thank you

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