

# Benefits of rabbit bio-controls to the environment

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BIO-SCIENCE**



**Bilbies Not Bunnies**

# Extraordinary mammal losses

- 28/273 extinct; 108/273 threatened or near threatened; combined 50%
- Losses due to
  - extreme overgrazing (livestock, rabbits)
  - Changed land management
  - Invasive predators (cats, foxes)



# Solutions?

- Research Projects
- Landscape conservation and land management (e.g. BHA/AWC/NFSA)
- Fenced reserves

Newhaven sanctuary, NT; photo: AWC

# Where do rabbits fit in?

- Ecosystem engineers
- Hold vegetation in early successional stage; prevent regeneration
- Flow on impacts:
  - Food for herbivores
  - Vegetation as shelter
  - Predation



# Rabbit Impacts

- Spread weeds
- Rabbits preventing regeneration of plant communities for 130 years → shrub populations of old scattered individuals
- ↓ soil porosity; ↑ soil bulk density
- Limit long-term success of contemporary mammal reintroductions
- Bilbies vs rabbit diggings



Photos: Brian Cooke



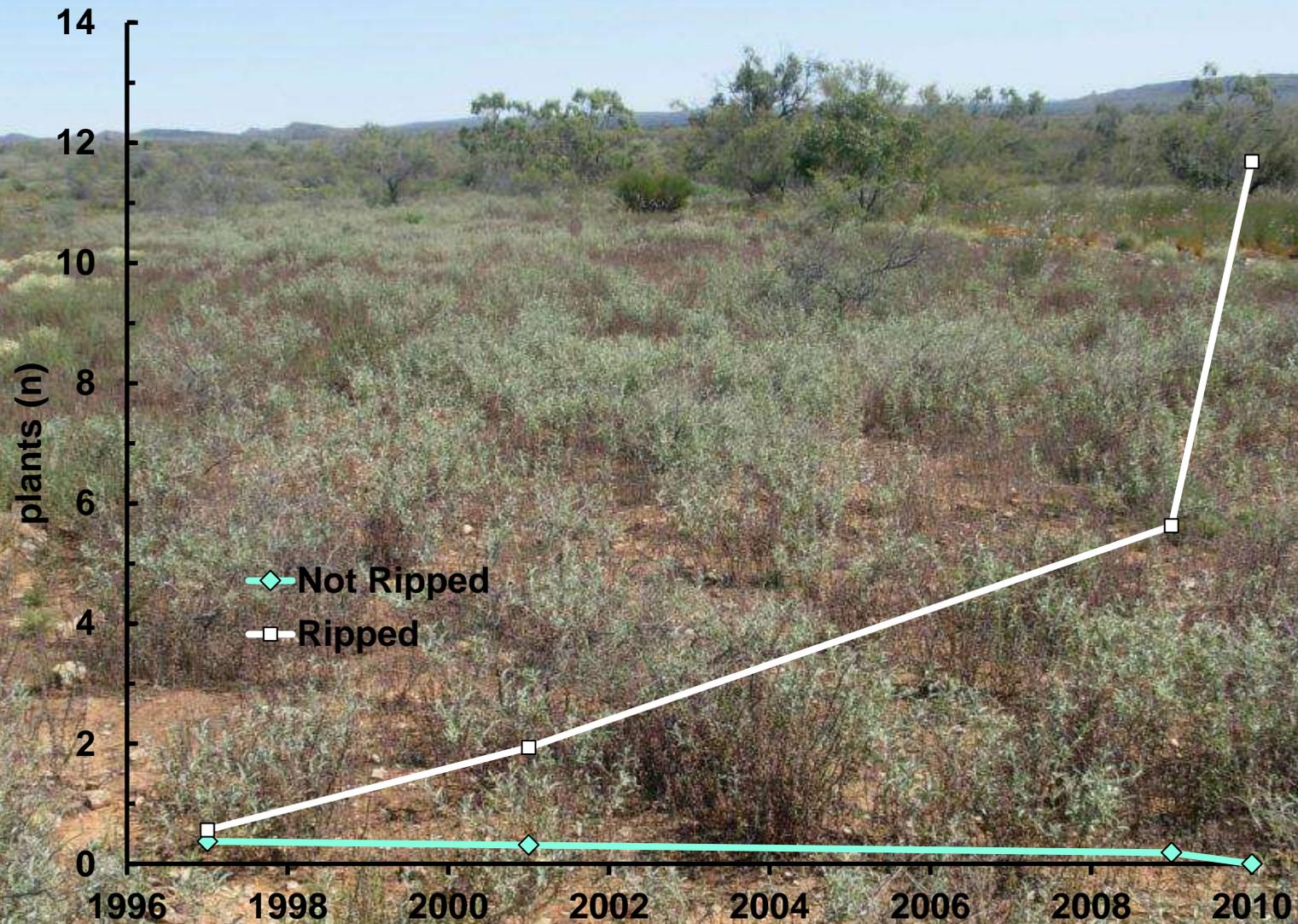
Rabbit plague beside the dingo fence; 1988

'Quinyambie' station, SA (adjacent to the NSW border)

# Pre-myxomatosis (1950) overgrazing, including by rabbits, causing soil drift



“ The deserted police station by Mungaranie bore,  
half-buried in the drift ”



**Response in bitter saltbush (*Atriplex stipitata*) following rabbit control.  
Flinders Ranges National Park (SA)**

# Reviewed documented benefits of rabbit biocontrol

- Narrative review
- Benefits observed over 70 year period
- Three biological controls that each lead to unprecedented reduction in rabbits at landscape-scales

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**Recovering Australia's arid-zone ecosystems: learning from continental-scale rabbit control experiments**

Graeme Finlayson<sup>1,2,3</sup>, Patrick Taggart<sup>4,5</sup>, Brian Cooke<sup>3,6,7</sup>

Introduced rabbits are a continuing threat to native Australian flora and fauna. Three interventions using biological control agents, myxomatosis, European rabbit fleas, and rabbit hemorrhagic disease, have reduced rabbit abundance and kept numbers low over the last 70 years. We considered the benefits of biological control for native fauna to put the role of rabbits in influencing vegetation cover, food supply, and predation into better perspective. Numerous examples exist demonstrating increases in native vegetation and the expansion and recovery of native animal populations at landscape scales following intense rabbit suppression. Ongoing research on methods for supplementing the impact of biological control agents and managing introduced predators are needed to restore Australia's arid-zone ecosystems. However, many biologists and rangeland managers first need to reevaluate the misconception that removing rabbits also introduces other serious and insurmountable problems such as prey-switching by introduced cats and foxes.

**Key words:** myxomatosis, native fauna, predators, prey-switching, rabbit fleas, rabbit hemorrhagic disease, restoration, vegetation

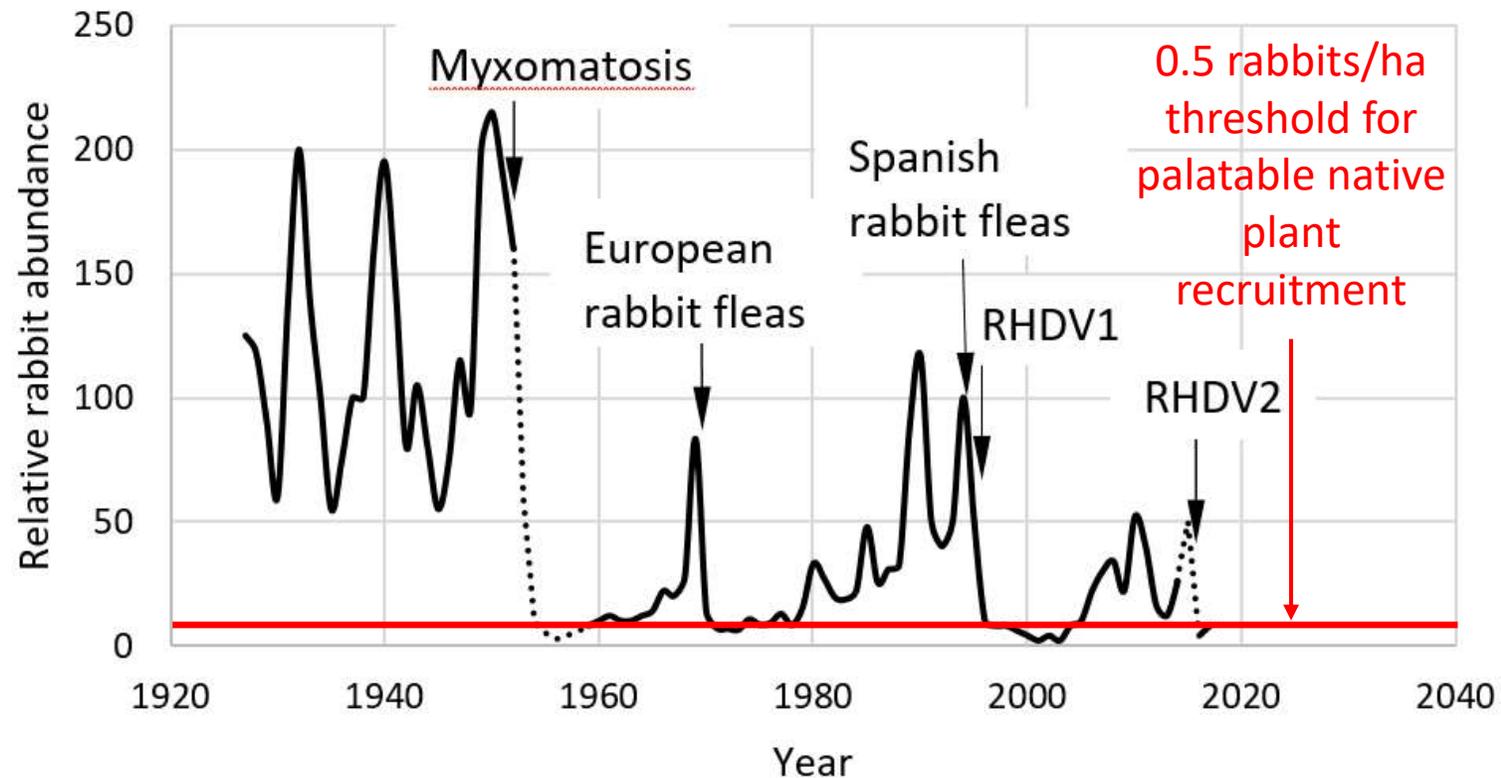
\* Article also featured in **THE CONVERSATION**

# Myxomatosis



- Introduced 1950
- Minimal interest in environmental and conservation benefits at the time
- 99% mortality during initial epizootic
- Persistent in most populations, still killing approx. 50% infected rabbits
- Up to 2011 it is estimated to have saved Australia's agricultural industries \$AUD53 billion.
- Inestimable environmental benefits

## North-east South Australia



# Myxomatosis

- Widespread regeneration in sheoaks (Cooke 1998 Aust J Ecology)

TABLE 2. Damage to sheoak seedlings planted 28/8/84 in an area from which marsupials had been excluded. The numbers of seedlings in each damage class are indicated; damage classes are as in Table 1

Grazed by: Damage class:	Treatment														
	Fully guarded Ungrazed (control)					Marsupial-proof guard Rabbits only					Unguarded Rabbits only				
	0	1	2	3	4	0	1	2	3	4	0	1	2	3	4
At planting	10					10					10				
30/8/84	10					10					10				
8/9/84	10					7	2	1					2	6	2
26/9/84	10								8	2				3	7

- Red kangaroo numbers boomed – landholders suddenly ‘involved in shooting war’

# Rabbit fleas

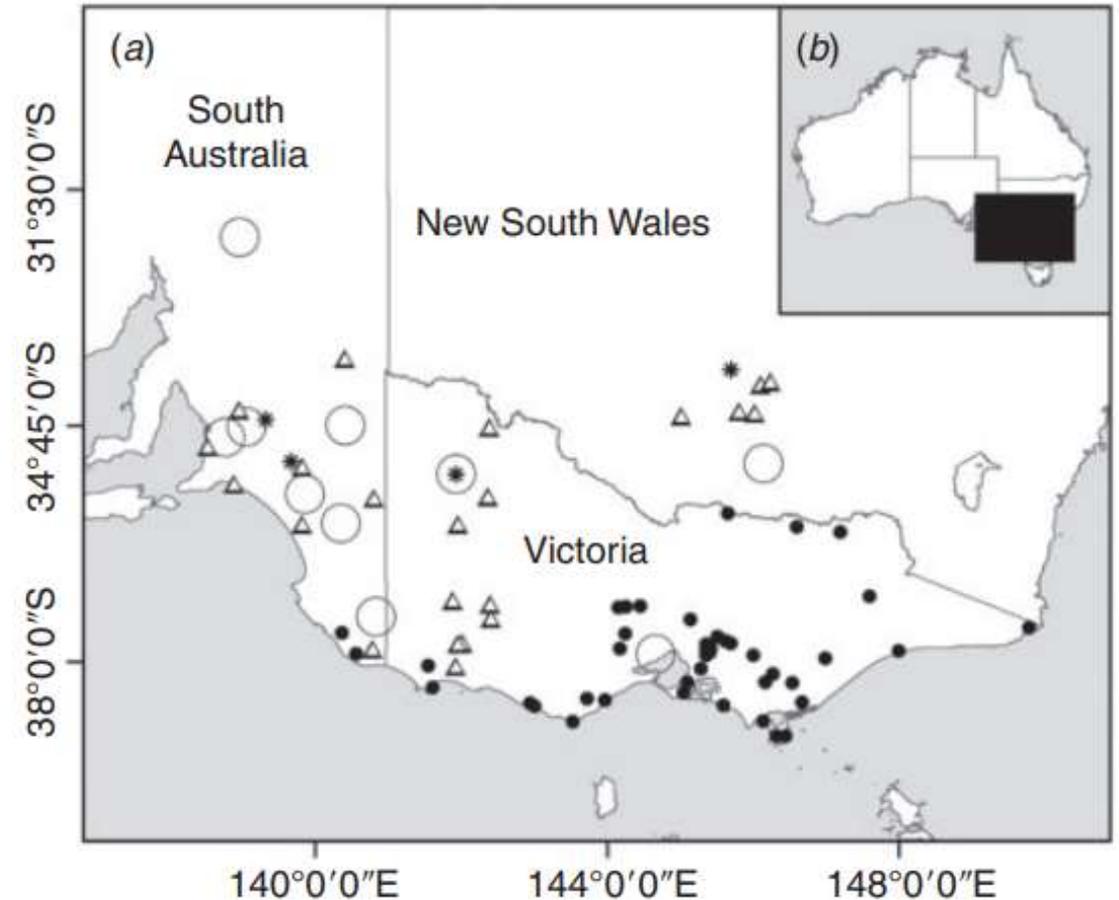
- **European rabbit fleas** were introduced in 1968 to improve transmission of myxomatosis
- **Spanish arid-adapted rabbit fleas** were introduced in 1993 to enable the spread of myxomatosis into the arid-zone



Photo: Britannica

# European rabbit fleas

- Native grasses became more prolific along Mt Lofty Range, SA
- Southern hairy-nosed wombat and swamp wallabies expanded their ranges



**Fig. 1.** (a) ●, Distribution of swamp wallabies in Victoria and South Australia as indicated from newspaper reports 1885 to 1956. △, Extension of known range since late 1970s as reported in text. \*, Recent observations of swamp wallabies reported by author. ○, Experimental rabbit flea release areas. (b) Inset showing region of Australia considered.

# Rabbit Haemorrhagic Disease Virus (RHDV)

- RHDV1 introduced in 1995
- RHDV2 first detected in NSW rabbit blood samples collected in 2013
- Initial 0-97% reductions in rabbit populations
- Sustained impact but some recovery, variable between geographic regions
- With myxo has provided an additional \$AUD17 billion economic benefit



RHDV1 killed rabbit Y3444 at Turretfield, South Australia (August 2015)



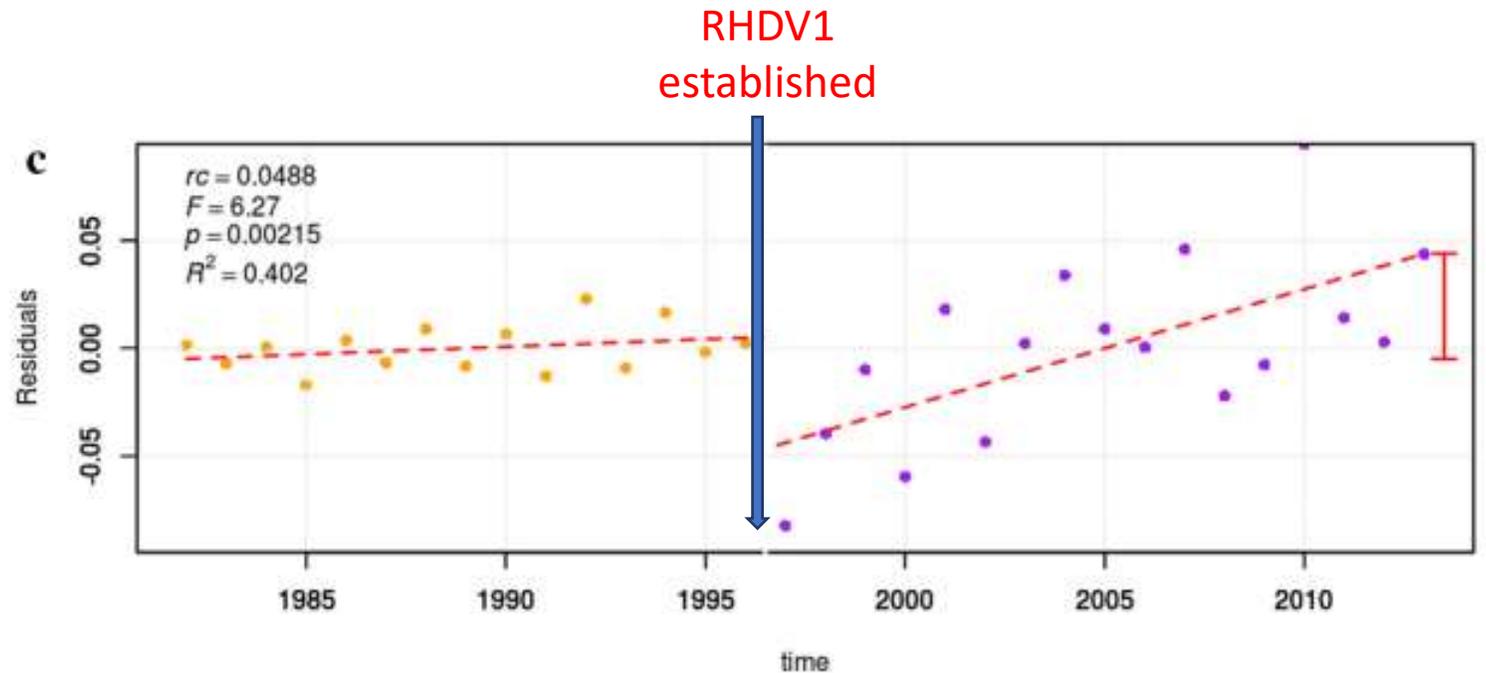
RHDV2 killed rabbit Y3423 at Turretfield, South Australia (May 2016)

# Rabbit Haemorrhagic Disease Virus (RHDV)

- Vegetation regeneration observed in satellite imagery

(Burrell *et al.* 2017 *Remote Sensing of Environment*)

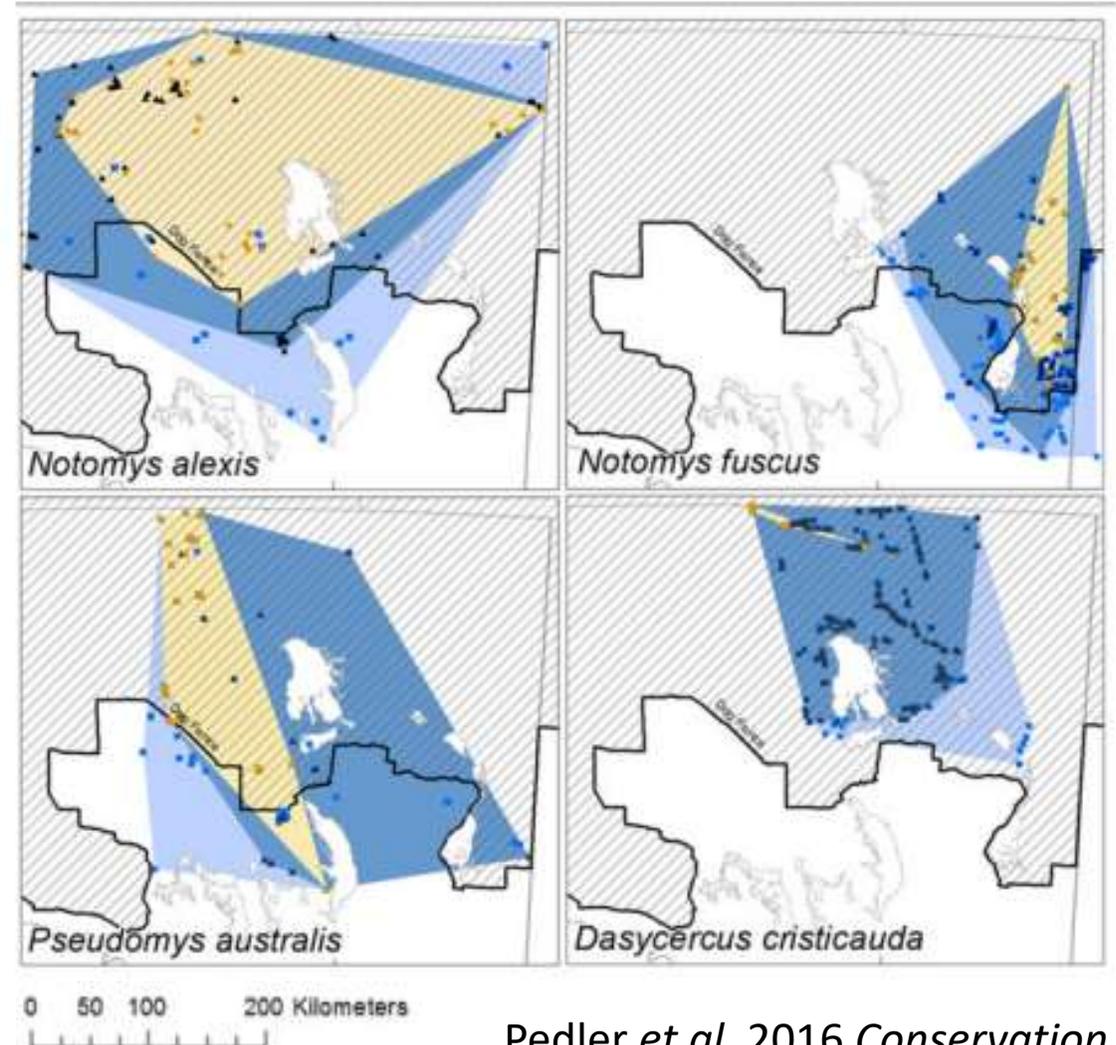
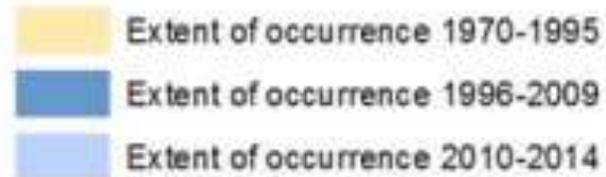
- Widespread regeneration of native vegetation (native pine, needle bush, umbrella wattle, witchetty bush, twin-leaved emu bush)



Vegetation recovery in the Simpson-Strzelecki Dunefield Bioregion after RHDV1 established in 1996

# Rabbit Haemorrhagic Disease Virus

- Dusky hopping mouse, spinifex hopping mouse, plains rat & crest-tailed mulgara all expanded ranges
- Red kangaroos became 2-3 times more abundant



# Myxomatosis AND RHDV: when 1 + 1 = 2.1



**Rabbit Pt1731, infected with myxomatosis but positive to RHDV1 at Turretfield, South Australia (October 2008)**

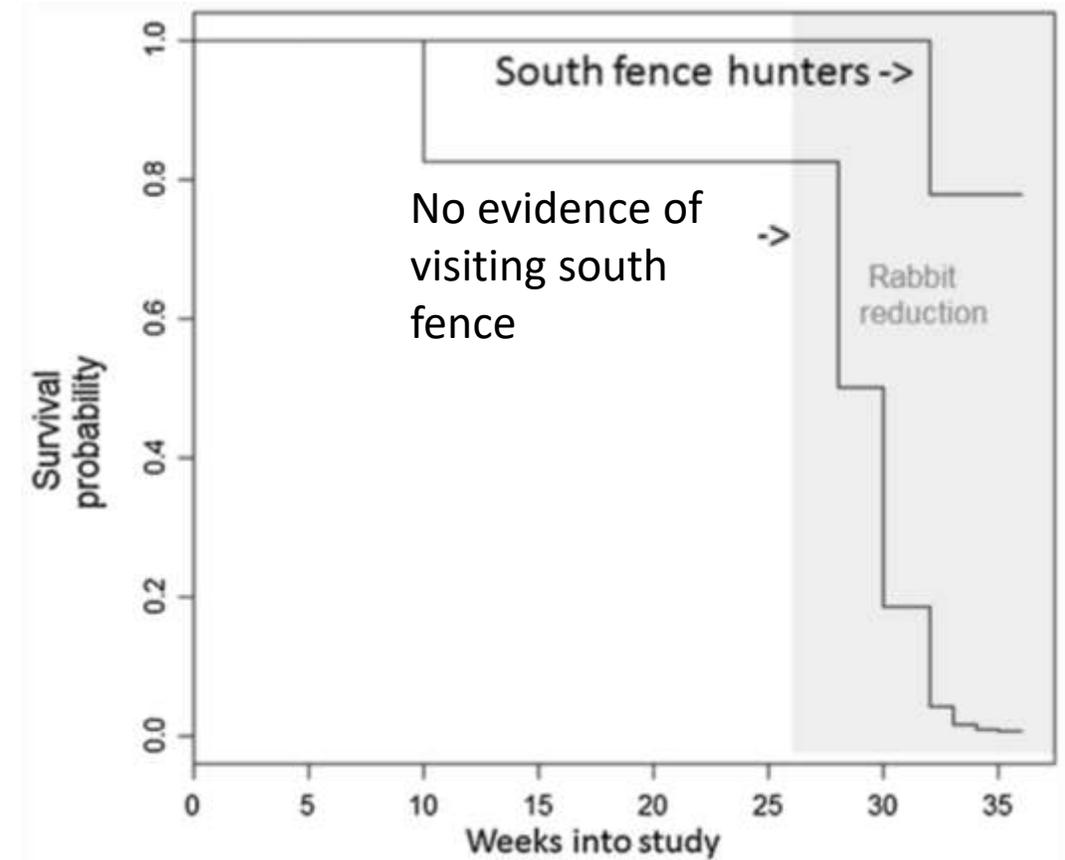
Analysis of 18 years of rabbit capture-mark-recapture data shows that if a rabbit survives myxomatosis it has 10% worse survival when it gets RHDV

*(Barnett et al. 2018 Journal of Applied Ecology)*

# More than just predators

- Rabbits comprise major component of diet of invasive predators in arid-zone
- Removal of rabbits may lead to immediate, short-term prey switching
- BUT, ↓ rabbits ultimately lead to ↓ invasive predators & widespread & long-term benefit to natives
- Rabbit reduction is of no detriment, or even of benefit, to native predators

Feral cat survival after rabbit control



# Arid-zone restoration must focus on rabbits

- Numerous examples of plant/animal communities benefiting at landscape-scales post substantial reduction of rabbits
- No additional mammal extinctions post rabbit biocontrols
- Benefits all occurred in absence of landscape-scale predator control
- Could leporid herpesvirus 4 help drive rabbit numbers and their continued impacts even lower?

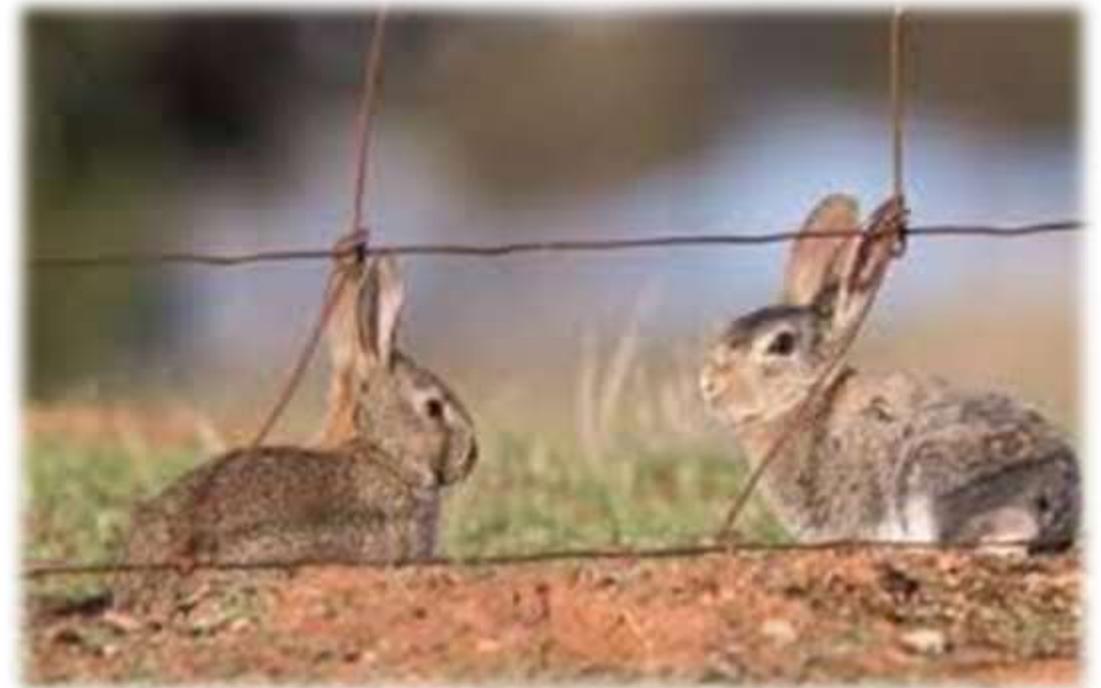


Photo: PestSmart