

Invasive animals, particularly foxes, cats, rabbits and rats, have caused most of Australia's animal extinctions and imperil many more species. Hard-hoofed feral herbivores like goats and deer damage wildlife habitats and threaten many rare plants.

How to control feral animals effectively and humanely to protect native species and ecosystems is one of the greatest challenges of conservation management. There is a role for volunteer shooters but only where it contributes to beneficial outcomes for the environment (or agriculture).

## Requirements of feral animal control

"There are three essential requirements for a pest control technique – necessity, effectiveness and humaneness."

Trudy Sharp & Glen Saunders, NSW Government<sup>1</sup>

Government protocols for feral animal control programs require that they be carefully planned and coordinated to meet defined objectives of desired environmental or economic outcomes.<sup>2</sup> They should adhere to standard operating procedures, using effective and humane methods. If shooting is used, it should be carried out by skilled operators. Programs should be monitored to assess whether objectives are met. Effective programs should reduce "the need to cull large numbers of animals on a regular basis".<sup>3</sup>

Ad hoc recreational hunting such as that practiced in NSW state forests breaches feral animal control protocols in virtually every way. There are no defined objectives, no assessment of whether ground shooting is an effective and appropriate method for the purpose, no integration with other programs, no quality control, no monitoring.

## The difficulty of achieving population reduction

Most young animals do not survive, for there are not enough resources for all that are born. Of feral pigs studied in Kosciuszko National Park, about 15% survived one year.<sup>4</sup> Just 1-10% of rabbits usually survive their first year<sup>5</sup> and only 20% of foxes may do so.<sup>6</sup> The rest (the 'doomed surplus') are killed by starvation, predators or disease.

So, a hunter who kills a fox is unlikely to have any impact on a fox population, either because the fox would die anyway or because its death allows another fox to survive due to reduced competition for food and territories. Most foxes killed by recreational hunters are the less wary juveniles, with low prospects of survival.<sup>7</sup>

Unless hunters kill more feral animals than can be replaced each year, they do not reduce their populations. This fact is well recognised by feral animal experts, who have learned from past failures about the high levels of control need to achieve population reductions.

The thresholds for population reduction vary between species, regions and seasons, but the figures in Table 1 give some idea of how difficult it is to achieve, particularly of the most fecund species such as rabbits. It means that large numbers of feral animals can be killed for no environmental (or agricultural) benefit.

Compare the southern right whale (*Eubalaena australis*) with the black rat (*Rattus rattus*). The whales don't reproduce until they're nine years old and under ideal conditions can increase their population by just 7% a year. Killing more than 6% a year would cause extinction. Black rats start reproducing when they're

only three months old, and can more than triple their population in a year. More than 90% may have to be killed annually to reduce populations. For sambar that figure is 40% and for cats close to 60%.

**Table 1.** Estimated proportions that need to be killed annually to achieve population reduction

Invasive animal	Maximum annual rate of population growth	Threshold to halt max. population growth
Brown rat ( <i>Rattus norvegicus</i> ) <sup>8</sup>	471%	95%
Black rat ( <i>Rattus rattus</i> ) <sup>9</sup>	357%	91%
House mouse ( <i>Mus domesticus</i> ) <sup>10</sup>	341%	97%
Rabbit ( <i>Oryctolagus cuniculus</i> ) <sup>11</sup>	206%	87%
Fox ( <i>Vulpes vulpes</i> ) <sup>12</sup>	105%	65%
Cat ( <i>Felis catus</i> ) <sup>13</sup>	99%	57%
Hog deer ( <i>Axis porcinus</i> ) <sup>14</sup>	85%	53%
Chital ( <i>Axis axis</i> ) <sup>15</sup>	76%	49%
Rusa deer ( <i>Cervus timorensis</i> ) <sup>16</sup>	70%	46%
Pig ( <i>Sus scrofa</i> ) <sup>17</sup>	69-78%	~70%
Sambar ( <i>Cervus unicolor</i> ) <sup>18</sup>	55%	40%
Goat ( <i>Capra hircus</i> ) <sup>19</sup>	53%	35%
Fallow deer ( <i>Dama dama</i> ) <sup>20</sup>	45%	34%

Such figures explain why feral animal control generally can't be achieved by ad hoc hunting. They explain why a 2002-03 hunting bounty on foxes in Victoria did not work despite an apparently huge tally of 170,000 dead foxes. A review by government biologists found that the bounty would have reduced fox abundance in less than 4% of the state, that there was a mismatch between hunting effort and where fox control was most needed, and that numbers would quickly bounce back or climb even higher as a consequence of hunting.<sup>21</sup> (The area of NSW state forests open to recreational hunting is about 10% of the area of Victoria, but the numbers of foxes killed in 2010-11 by recreational hunters in the forests was less than 1% of the level achieved under the failed Victorian bounty.) The fox bounty joined the long list of failed bounty attempts in Australia, which have typically reduced targeted animal numbers by only 2-10 per cent, far too little to reduce populations.<sup>22</sup>

## Ground shooting

One reason that hunting is ineffective is that ground shooting, particularly by day, is generally not efficient, except in small areas and when used in conjunction with other methods. Hunters also have highly variable skill levels (no skills tests are conducted for licensing).

The goals of recreational hunting and feral animal control are different. Hunters are often motivated to maintain feral animal populations for future hunting, and leave the young and females. "Hunters have a very proud history of maintaining sustainable populations of game species that they wish to utilize," says the Sporting Shooters Association.<sup>23</sup>

Hunter often prefer to kill large trophy males (with antlers), which does not assist with population control in polygamous species such as deer, pigs and goats because the remaining males can inseminate all the

females. The NSW Game Council's licensing system deliberately spreads hunters out over NSW forests (at most 1 hunter/400 ha) limiting their capacity to exert pressure in any one area.

## When recreational hunting can be effective

Skilled recreational shooters *can* contribute to feral animal control in the following circumstances:

- when they participate in professional control programs – skilled recreational shooters have been used to supplement aerial shooting and baiting in Operation Bounceback in South Australia, for example; or
- when they exert sufficient sustained pressure over small accessible areas, such as may occur on farms.

**Table 2.** Efficacy of ground shooting (by skilled shooters) for feral animal control

Feral animal	Assessment of efficacy of ground shooting in government documents	Numbers killed by recreational hunters in state forests, 2010-11	Estimated Australian population
Rabbits <sup>24</sup>	"not an effective means of reducing rabbit populations"; "may have limited use in controlling light ... infestations, but ... ineffective in significantly reducing populations or even maintaining them at low levels".	6621	Many million (10 billion in 1926) <sup>25</sup>
Foxes <sup>26</sup>	"ineffective in significantly reducing fox populations, particularly over the longer-term"	1325	7 million <sup>27</sup>
Pigs <sup>28</sup>	"except in exceptional circumstances...not considered to be an effective technique for control"; "can be counterproductive to other techniques in that it can disperse pigs or make them more wary"	2296	4-24 million <sup>29</sup>
Goats <sup>30</sup>	"only suitable for smaller scale operations" or "if used in conjunction with other control methods such as mustering or trapping"	2647	3 million <sup>31</sup>
Deer <sup>32</sup>	"considered to be the most effective technique currently available" [however, aerial shooting can achieve much greater effectiveness]; "To keep stress to a minimum, shooting operations should occur on moonless nights with the aid of spotlights"; "Silenced rifles may also reduce animal disturbance and facilitate accurate shooting."	512	
Dogs <sup>33</sup>	"not effective"; "not appropriate for reducing populations over extensive areas"; "suited to control of small populations or problem individuals"	72	
Cats <sup>34</sup>	"limited effectiveness"; "best suited to smaller isolated areas such as islands".	167	18 million <sup>35</sup>

**Table 3.** Game Council performance statistics, NSW state forests, 2007-2011<sup>36</sup>

	2007-08	2008-09	2009-10	2010-11
Feral animals killed (rabbits, foxes, goats, pigs, dogs, hares, deer)	7761	11,197	15,232	14,161
Rabbits killed (% of total animals killed)	4076 (53%)	5453 (49%)	8335 (55%)	6621 (47%)
Area state forest for hunting (ha)	1.8 million	2.2 million	2.2 million	2.2 million
Feral animals killed / area	1 per ~230 ha	1 per 196 ha	1 per 144 ha	1 per 155 ha
Hunting days in state forests (assuming each Game Council 'permission' is for 1 day)	8600	12,733	20,761	21,354
Feral animal killed / hunting day	0.9	0.9	0.7	0.7
State government funding of Game Council	\$3.52 million	\$2.88 million	\$2.53 million	\$2.56 million
Government funding / feral animal killed	\$453	\$257	\$166	\$180

## Outcomes in NSW State forests

The NSW Game Council claims that recreational hunters are providing a cost-effective conservation service across close to 2 million hectares of state forest. They base their claim on the biologically bogus premise that whenever hunters kill a feral animal they reduce the population and thereby reduce environmental harm. They conduct no monitoring to substantiate claimed environmental benefits, simply referring to numbers of feral animals killed. But it is clear from the small numbers killed (compared to likely populations) that they cannot achieve the claimed benefits (see Table 3).

Recreational hunters (12,000 were licensed to shoot in state forests in 2010-11) have killed no more than 15,000 feral animals a year across close to 2 million hectares of state forest. About half the animals killed have been rabbits, for which shooting is ineffectual, and the overall average has been one feral animal killed per 150 hectares of state forest per year.

## Skill and animal welfare

Some recreational hunters are highly skilled but many are not, and there are no shooting competency tests to acquire a Game Council licence (just a written exam). It is apparent from the overall performance – an average 0.7 feral animals killed per hunting day in 2010-11 (mostly rabbits) – that many hunters are not skilled. A New Zealand assessment found that fewer than 5 per cent of recreational hunters shot more than half the deer killed.<sup>37</sup> Even the former chairman of the Game Council, Robert Borsak, wasn't impressed by hunter performance, commenting on a blog site:<sup>38</sup>

“From the Hunt Returns that are coming in (there is no reason to believe that they are not fair dinkum), for the 4 months to end October, 12,824 animals have been sighted & 2,035 (16%) of all kinds, have been killed. Not a great success rate.”

The lack of skill has major animal welfare (and human safety) implications. According to NSW government codes of practice for humane control of feral animals,

shooting can be humane when it is carried out by “experienced, skilled shooters”. For deer, it is recommended that hunters “be able to consistently shoot a group of not less than 3 shots within a 10cm target at 100 metres”. The Game Council relies on a mandatory code of practice as the basis for claims that licenced hunters hunt humanely but a code does not make hunters skilled.

Also according to the NSW government codes of practice, humaneness requires that shooting of feral animals “should only be used in a strategic manner as part of a co-ordinated program designed to achieve sustained effective control.” Because recreational hunting in state forests does not achieve effective feral animal control, it breaches welfare standards by promoting killing that provides no benefit other than recreational pleasure for hunters.

## The ‘free service’ that costs taxpayers a fortune

The Game Council claims that hunters offer a free or cost-effective hunting service for the benefit of the public. If it is not effective, recreational hunting cannot be cost-effective, even if it was done for free. It is far from free: \$14.5 million of public funding has been granted to the Game Council from 2003 to 2011 (see Table 4). The cost to the public has been an average \$264 per animal killed on public lands from 2007-11.<sup>39</sup>

**Table 4.** NSW Game Council funding, 2003-11<sup>40</sup>

Year	NSW Government funding	License fee revenue
2003-04	\$750,000	-
2004-05	-	\$426,000
2005-06	\$2,000,000	\$379,000
2006-07	\$250,000	\$467,000
2007-08	\$3,517,000	\$546,000
2008-09	\$2,884,000	\$730,000
2009-10	\$2,527,000	\$920,000
2010-11	\$2,556,000	\$974,000
Total	\$14,484,000	\$4,442,000

If spent on professional feral animal control programs, the \$15 million spent on the Game Council could have achieved substantial outcomes for conservation. The \$2.5 million granted last year could have paid for effective fox control over a much larger area than the state forests.<sup>41</sup>

Originally, it was intended the Game Council would become self-funding, but there seems no prospect of this, as licence fees from hunters account for less than

one-third of Game Council revenue 8 years after establishing the licensing system.

## Summary: Why recreational hunting is generally not effective

Feral animals are typically highly fecund and many populations are saturated with a large 'doomed surplus' (who would normally die due to lack of resources), which enables them to quickly replace animals killed by hunters.

- Ground shooting (even using skilled shooters) is not an effective means of primary control for most feral animals and according to government standards should only be used as part of co-ordinated programs, usually as a supplement to other methods.
- Hunting in NSW state forests is ad hoc with no specific environmental goals, planning or monitoring. The licensing system deliberately spreads hunters out (at most 1 hunter/400 ha).
- Hunters often prefer to kill large trophy males, which makes little contribution to control because in polygamous species such as deer, pigs and goats the remaining males can inseminate all the females.
- Hunters are often motivated to maintain feral animal populations for future hunting, leaving young and females.
- Hunters have highly variable skill levels (no skills tests are conducted for licensing) – in 2010-11, each hunting day in state forests resulted on average in 0.7 feral animals killed.

## Potential adverse outcomes

Hunters have exacerbated feral animal problems by undermining feral animal control and through the actions of maverick hunters in spreading feral animals. The Invasive Species Council is particularly concerned by the growing influence of the hunting lobby over feral animal policy.

Deer are probably Australia's worst emerging feral animal threat,<sup>42</sup> set to rival "feral pigs and feral goats in distribution, abundance and impacts in the near future."<sup>43</sup> Populations are expanding and spreading into new areas.<sup>44</sup> Herbivory and degradation by feral deer are listed as a key threatening process in NSW. Yet deer are largely protected for hunters in NSW (and Victoria and Tasmania). Unlike other feral animals recognised as threats to biodiversity and agriculture, there are restrictions on deer control on private land. Other than landholders, their household and employees, anyone shooting deer has to be licensed by the Game Council and cannot shoot deer at night or with spotlights, which is more effective than day shooting.

The hunting lobby periodically denies that deer cause environmental problems and has opposed declarations of feral deer as pests or threats. In Victoria, the Australian Deer Association took the government to court to try to stop the declaration of sambar as a threatening process. In NSW, the Game Council has declared its opposition to any pest declaration for deer.<sup>45</sup>

Much of the deer problem Australia faces is due to hunters shifting them into new areas. A survey in 2000 found that 58% of populations had probably established due to illegal translocation.<sup>46</sup> Feral deer were observed in 30 new locations in NSW between 2002 and 2004.<sup>47</sup>

Hunters have also illegally shifted pigs into new areas, as substantiated by genetic evidence.<sup>48</sup> The national threat abatement plan for feral pigs notes that “continued release of feral pigs for hunting, either in new areas or in areas that they do not currently occupy is a major threat to effective management of feral pigs and their damage.”<sup>49</sup> It also notes concerns that the dogs may take non-target wildlife “as it is not possible for hunters to continuously control their dogs during hunting forays”.<sup>50</sup> Escaped hunting dogs are a major environmental and agricultural problem.

Recreational hunting can make professional control more difficult and expensive by altering the behaviour of targeted animals.<sup>51</sup> Animals subject to shooting disturbance are likely to become more wary – pigs and some deer species, for example, forage more at night than during the day – and may inhabit more secure areas within their range or move elsewhere.<sup>52</sup>

settlement (dwarf emu species on Kangaroo Island and King Island) and numerous extinctions following the introduction of foxes and rabbits for hunting. It might be fair to say that hunters are ‘first in extinctions’ in Australia.

The main hunting lobbies have demonstrated an anti-conservation agenda by opposing national park declarations and proposing to release new exotic animals. The *Game and Feral Animal Control Act Amendment Bill 2009*, introduced by the Shooters Party but rejected by the NSW Government, would have made it legal to release exotic game bird species that have been assessed by the Australian Vertebrate Pests Committee as posing a serious or extreme pest threat to Australia.

## First in conservation?



The Game Council has run advertisements with the tagline ‘Hunters – First in Conservation’. This can be taken to mean that hunters are either the foremost conservationists or that they were the earliest conservationists. The conservation record of early white hunters includes the first, and possibly the second, extinction in Australia after European

## Endnotes

<sup>1</sup> NSW Government codes of practice, eg. Sharp T, Saunders G. 2007. Model code of practice for the humane control of wild dogs. NSW Department of Primary Industries. [www.invasiveanimals.com/downloads/COP\\_for\\_wild\\_dogs.pdf](http://www.invasiveanimals.com/downloads/COP_for_wild_dogs.pdf)

<sup>2</sup> See various standard operating procedures at <http://www.dpi.nsw.gov.au/agriculture/pests-weeds/vertebrate-pests/codes/humane-pest-animal-control>.

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<sup>6</sup> Queensland Government. 2010. European red fox *Vulpes vulpes*. Fact sheet. Department of Employment, Economic Development and Innovation.

<sup>7</sup> Fairbridge D, Marks C. 2005. *Evaluation of the 2002/03 Victorian Fox Bounty Trial*. Vertebrate Pest Research Unit, Department of Primary Industries, Frankston.

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<sup>9</sup> Hone et al. 2010. See Note 8.

<sup>10</sup> Hone J. 1999. On rate of increase ( $r$ ); patterns of variation in Australian mammals and implications for wildlife management. *Journal of Applied Ecology*, 36, 709-718.

<sup>11</sup> Hone 1999. See Note 10.

<sup>12</sup> Hone 1999. See Note 10.

<sup>13</sup> Hone et al. 2010. See Note 8.

<sup>14</sup> Hone et al. 2010. See Note 8.

<sup>15</sup> Hone et al. 2010. See Note 8.

<sup>16</sup> Hone et al. 2010. See Note 8.

<sup>17</sup> Saunders G. 1993. Observations on the effectiveness of shooting feral pigs from helicopters. *Wildlife Research* 20: 771-76.

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<sup>18</sup> Hone et al. 2010. See Note 8.

<sup>19</sup> Parkes JP, Henzell R and Pickles G (1996). *Managing vertebrate pests: feral goats*. Bureau of Resource Sciences., Canberra.

<sup>20</sup> Hone et al. 2010. See Note 8.

<sup>21</sup> Fairbridge D, Marks C. 2005. Evaluation of the 2002/03 Victorian Fox Bounty Trial. Frankston: Vertebrate Pest Research Unit, Department of Primary Industries.

<sup>22</sup> Hassall and Associates. 1998. *Economic evaluation of the role of bounties in vertebrate pest management. Prepared for the Bureau of Resource Sciences, April 1998*. [http://www.feral.org.au/feral\\_documents/00023.pdf](http://www.feral.org.au/feral_documents/00023.pdf).

<sup>23</sup> [http://www.ssaa.org.au/notice-board/2009/2009-03\\_march-president-message.html](http://www.ssaa.org.au/notice-board/2009/2009-03_march-president-message.html)

<sup>24</sup> Commonwealth of Australia. 2007. Background document for the threat abatement plan for competition and land degradation by feral rabbits. Canberra: Department of Environment and Water Resources. [www.environment.gov.au/biodiversity/threatened/tap-drafts.html](http://www.environment.gov.au/biodiversity/threatened/tap-drafts.html).

<sup>25</sup> <http://www.dpi.vic.gov.au/agriculture/pests-diseases-and-weeds/pest-animals/lc0298-rabbits-and-their-impact>

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<sup>31</sup> Commonwealth of Australia. 2007. Background document for the threat abatement plan for competition and land degradation by feral goats. Canberra: Department of the Environment and Water Resources.

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<sup>41</sup> Commonwealth of Australia (2007, see note 25) notes that the estimated cost of fox control is about \$1.3 million for control over about 35 000 square km per year.

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<sup>46</sup> Moriarty A. 2004. The liberation, distribution, abundance and management of wild deer in Australia. *Wildlife Research* 31:291–299

<sup>47</sup> West P, Saunders G. 2007. *Pest Animal Survey: A review of the distribution, impacts and control of invasive animals throughout NSW and the ACT*. NSW Department of Primary Industries. Some may be due to greater awareness of deer, some due to escapes from deer farms, but many or most have probably been moved to establish populations for hunting.

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<sup>49</sup> Commonwealth of Australia. 2005. Threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs. Canberra: Department of the Environment and Heritage. [www.environment.gov.au/biodiversity/threatened/tap-approved.html](http://www.environment.gov.au/biodiversity/threatened/tap-approved.html).

<sup>50</sup> Commonwealth of Australia. 2005. Threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs. Canberra: Department of the Environment and Heritage. [www.environment.gov.au/biodiversity/threatened/tap-approved.html](http://www.environment.gov.au/biodiversity/threatened/tap-approved.html).

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