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Available on CD - Powerpoint Presentations
Contact the Program Manager ganderso@parks.vic.gov.au

- Principles for effective feral pig control. Jim Hone.
- An Overview of Current Techniques for Feral Pig Control. John Meany
- Animal Welfare and Best Practice Pest Animal Control: Development of Codes of Practice and Standard Operating Procedures. Glen Saunders and Trudy Sharp
- Involvement of the National Feral Animal Control Program (NFACP) in feral pig management. Quentin Hart
- Feral Pig Management in Victoria. Peter Kambouris & Charlie Pascoe
- A Co-operative Feral Pig Control Program in the South East Forests of NSW. Dayna Blackmore
- Oberon Pest Management Group. John Meany

The Commonwealth Department of Environment and Heritage has recently published the following text. It provides an excellent overview of the issues and includes a good Reference section. It is available from their publications section – Phone (02) 6274-1111, or online at www.deh.gov.au/biodiversity/threatened/tap/pig.

Threat Abatement Plan for Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs.
INTRODUCTION

The Natural Heritage Working Group of the Australian Alps Cooperative Management Program has implemented a series of best practice workshops for agency staff involved in the management of invasive species in the Alps. The aim of these workshops is to review or communicate on the progress of recent research, share information on management programs and techniques, discuss management issues and strategies, and identify future research requirements. The first of these workshops was on feral horses.

Land managers within the Australian Alps program consider that damage caused by feral pigs is a threat to the environmental and social values in all 11 Australian Alps national parks. Feral Pigs are listed in the report ‘Treasures of the Alps’ as being of the highest priority for threat abatement across all jurisdictions in the Alps. However, the control methods used, and priority assigned to feral pig control varies considerably across jurisdictions.

The workshop on feral pigs is timely as it is likely that the ACT and NSW will progressively move towards more socially acceptable humane control methods. The most commonly used feral pig toxin in the ACT and parts of the NSW Alps parks (warfarin) has recently been identified as not meeting best practice requirements for humane control. There is no guarantee that permits obtained to use warfarin will continue to be issued by the regulating authority.

WORKSHOP OBJECTIVES

The aims of the workshop were:

- To provide agency staff and program co-ordinators with an opportunity to exchange information on current pig control strategies and techniques, and to become familiar with programs being undertaken in other jurisdictions in south-eastern Australia and identify ‘best practice’.
- To discuss aspects of pig biology, behaviour and impact as a means to improve control effectiveness with existing tools.
- To understand the range of community, stakeholder, neighbour and agency views on feral pigs and feral pig control and how these can affect control programs in the Australian Alps parks.
- To encourage the adoption of humane practices as an essential element of best practice control. Provide information on the development of Standard Operating Procedures and the Code of Practice for feral pig control.
- To identify knowledge gaps or barriers to effective control, and
- To provide information on new products and proposed research into feral pig control.
WORKSHOP SESSIONS

Issue: **Lack of Local Knowledge**

Solutions:

- Succession planning
- Developing hands on skill within local team
- Consistency of operator(s)
- Knowing where to bait/trap
- Being able to read sign
- Being familiar with the local area
- Documenting relevant information to assist in succession
- Adaptive management (learn by doing)
- Be aware of all available information/resources, including broader information (see below)

Issue: **Lack of awareness of available information**

Solutions:

- Proceedings and attached references and web links
- Staff exchange. Visiting others who have more experience

Issue: **Communication**

Solutions:

- Interagency cooperation
- Cross-tenure control programs
- Building relationships with Private landholders
- Pre-programming of control works to ensure resource availability (but allow necessary flexibility)
- Learn from others (do not reinvent the wheel)
- Networking
- Communications plan / strategy (see Proceedings)

Issue: **Setting priorities and objectives**

Solutions:

- Set an objective(s) that can be measured (SMART)
- Determine whether objective is managing pig numbers or pig impacts (eg area of rooting, threatened communities)
- Develop a plan and work to it
- Accept that pigs impact on biodiversity and are a potential vector for disease
- Consider legislative, policy, strategy, recovery plan obligations
- Need to achieve high level of control to achieve significant benefit (low level of control may be wasted effort)
- Target poor seasons for more sustained knock-down (ie longer-term results)
KNOWLEDGE GAPS & BARRIERS

Issue: Resources

Solutions:
• Prioritise. Do a little bit well.
• Communicate upwards to those with the ability to influence future resourcing
• Look laterally for resources – neighbours, students, grants, friends groups, CMAs, etc.

Issue: Unrealistic management expectations

Solutions:
• Communication upwards to establish realistic expectations
• Having clear, approved objectives
• Low levels of infestations cost more per unit effort than high infestations
• Support messaging with evidence from monitoring

MONITORING

Issue: What to monitor

Solutions:
• Depends on objectives & resources.
• PV Feral Pig monitoring protocol (append to proceedings).
• Captures per unit effort

Issue: Research question

Solutions:
• Combine with other monitoring programs where possible

Issue: How much monitoring should you be doing?

Solutions:

Issue: How do you monitor

Solutions: PV Feral Pig monitoring protocol (append to proceedings).

Issue: Defining impacts

Solutions:

Issue: How to deal with isolated / low density populations

Solutions:
• Use lots of resources per unit outcome
• Accept low detectability
• Attempt to remove founders before population establishment

Issue: How to detect and manage isolated, new or low density populations?
Solutions: Get out and have a good go at catching/killing them

Issue: Better targeting of populations (where are they)?
Solutions: Use baits/attractants to bring pigs to accessible sites

Issue: Understanding risks of secondary poisoning
Solutions: CRC research related to new Feral Pig bait

Issue: Risks of weed spread from grain baits
Solutions:
  • Boil seed
  • Cracked seed
  • Rely on weather to kill germinants
  • Choose bait carefully
  • Ensure bait in not contaminated

Issue: Management of pig hunters
Solutions:
  • Public awareness
  • Effective enforcement (eg Khancoban NPWS)
  • Partnerships/engagement with Game Council / Sporting Shooters Assoc.
  • Seek hunting opportunities on other land tenures

Issue: What are the effects of wild dog control on feral pig populations
Solutions:
  • Research question
  • Dogs possibly effective in reducing piglets

Issue: Collation of information
Solutions:
  • feral.org.au
  • Simple, concise summary of information relevant to Alps
  • Collation of existing Alps field data

Issue: What are pig movements?
Solutions:
  • Collation of existing info
• Alps-specific research

Issue: **Decision support system for most appropriate techniques.** What is the best combination of techniques for an effective integrated control program?
Solutions:
• Determine objectives
• Provide case studies (BRS guidelines)
• Develop an Alps case study

Issue: **What level of impact is acceptable (tolerable)?**
Solutions:
• Relate back to objectives
• Adaptive management

Issue: **What about Pig carcass disposal**
Solutions: Dispose of carcasses where not a food resource for wild dogs

Issue: **What are the biodiversity impacts of feral pigs?**
Solutions: Research question

Issue: Monitoring guidelines/manual

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**Community Stakeholder / Neighbour Perspectives in Feral Pig Control and How they Impact on Control Programs within Parks**

**Problems:**

• Community perception that it is a Government problem
• Landholders not aware of Government programs
• Government program timing not appropriate
• Community perception of lack of timely Government response
• Ingrained negative view of Government
• Some landholders don’t cooperate in control programs
• Lack of awareness of the problem
• Pigs less of a problem – competing priorities
• Landholders/community negative perception of toxic baits
• With baiting don’t see direct evidence of effectiveness-
• Inability to demonstrate success of baiting (and so leads to inappropriate measure (eg bait uptake))
• Non-target species in baiting
• Peri-urban population don’t want control practices near them

Hunters;
• Want access
• Think they are part of the solution
• Want a sustainable harvest
• Interference by hunters in control programs – deliberate and unintentional

Solutions

Communication strategy (Media etc)
Field days, face to face, target key people
Community awareness / education
Listening to neighbours – what problems are
Keep landholders informed of problems – including results/successes
More field days – face to face contact with landholders

Awareness of emerging problems
Awareness of health (disease) issues

Lending traps to landholders
Get successful program in one area then expand
Government act as facilitators for programs – foster involvement and ownership

Sporting shooters
Principles for effective feral pig control

Jim Hone
University of Canberra

The following was adapted by Trish Macdonald, from Jim Hone’s address to the Workshop.

Structure of the presentation: 1. Aims
2. Strategies
3. Implementation
4. Evaluation
5. Review and conclusions

Aims

What are the aims of control?
• To control the Impacts: reduce, remove, or prevent impacts, on production, species or biological communities?

or

• To control the Pests: reduce, or remove pests, stop population growth?

Aims will vary, but there has to be aim(s)

• Be aware of “Mission creep” eg. The aim of controlling feral pig effects on biodiversity becomes simply controlling pig numbers (which is not the same thing)

Aim of park management

The Namadgi National Park Plan of Management 1986 states that the Aim is “to protect the park and adjacent areas from damaging effects of … pest plants and animals”

• Is management adaptive?

• Aim, strategies, implementation of strategy, evaluation, assessment of strategy vs aim (Walker 1998)

2. Strategies

Strategies to achieve aim(s) - Are you looking at:

• Impact control vs pest control?
• Targeting pest individuals vs the whole population?
• Pre-emptive vs reactive control?
• Targeting impacted species where they could have source populations vs random control?
• Lethal vs non-lethal control?
• Control methods with little or no side effects
• Control methods acceptable to broad community
Often control is implemented before all strategies have been identified or evaluated and then hoped that control is robust to ignorance.

**You need to base management on evidence vs advocacy.**

Strategies should be consistent with those outlined by Choquenot *et al.* (1996) Managing Vertebrate Pests. Feral Pigs. BRS

3. Implementation

The best strategy should be identified and put into practice. This can include studying aspects of the problem (the impacts) as control proceeds.

**Impacts** - Some aspects of impacts of feral pigs

- Feral pigs root up the ground in feeding on plant roots and invertebrates eg earthworms, butterfly larvae
- The ground disturbance causes park visitors to complain and some plant species increase (eg shrubs) and others decrease (eg lilies)

The effects of ground rooting can be modelled using the theory of island biogeography (*a priori* hypothesis)

![Graph showing the predicted effects of increasing ground disturbance on plant species richness](image)

**The predicted effects of increasing ground disturbance on plant species richness** (Hone 2002)
Results of impacts from plots in Namadgi National Park

Discussion of impacts
• When pig disturbance is rare then individual plants are removed by pigs but the species occurs elsewhere on a plot. Further disturbance has little effect on richness.
• When pig disturbance is widespread each plant species has only one or two individuals. Further disturbance removes those species and richness declines quickly.

Feral pigs as disease hosts
• Pigs are susceptible to many diseases currently exotic to Australia, eg FMD, CSF, ASF, TGE
• Modelling has estimated likely trends in FMD, CSF, TGE epidemics and control levels needed for disease eradication
• $K_T = 0.03$ pigs/sq.km in Namadgi National Park (Pech & McIlroy 1990)

Dynamics with no control
• Feral pigs introduced to Namadgi National Park in 1959 in a truck accident
• The pigs spread at 4km/year to 1984
• In 1986 population density estimated at 1.7 pigs/sq.km. Likely growth was an eruptive fluctuation (slow then rapid increase), then halted by pig control starting in 1985 (hypothesis)
Demography: survival ($l_x$), fecundity ($m_x$) and net reproductive rate ($l_x m_x$) of feral pigs (after Saunders 1993)

Sensitivity analysis

• In stable ($\lambda = 1/\text{yr}$) and decreasing ($\lambda = 0.57/\text{yr}$) populations, $\lambda$ most sensitive to changes in annual juvenile survival
• In an increasing ($\lambda = 1.98/\text{yr}$) population, $\lambda$ most sensitive to annual adult survival and annual juvenile survival

The management implications of this?

4. Evaluation

Evaluation of whether aims are achieved can be in terms of,

• Science; ecology, toxicology
• Economics; costs and benefits
• Social acceptance; acceptance vs protests
• Environment; impacts reduced with little or no side effects

Evaluation: Impact and Pig Control

• Impacts managed by lethal control by annual poisoning with warfarin (first generation anticoagulant) in autumn. Pigs very susceptible especially females (Hone & Kleba 1985).
• With first pig control, $r = -0.99/\text{year}$ at poisoned sites ($P<0.05$), and $r = -0.27/\text{year}$ at non-poisoned sites ($P>0.05$) (Hone & Stone 1989)

Pig Control

• Evaluation of poisoning using two methods of counting estimated
  – 89% of pigs ate bait (wheat) and died (McIlroy et al. 1989),
  – 6% ate bait and survived and
  – 5% did not eat bait (Hone 2002)

• Suggests there is scope for warfarin resistance and bait aversion to develop
Evaluation methods
• Ground rooting estimated using a line intercept method
• Index of pig abundance estimated using counts of fresh dung pellets on strip plots. The index is positively correlated with observed pig density ($r = 0.81$, $P<0.01$) (Hone 1995)
Evaluations monthly initially, now annually (50km)

Long-term trends in an index of pig abundance

Negative density-dependence in population growth? ($D_T \sim 0.5\%$)
Long-term trends in an index of ground rooting

Control; rooting v pigs?

*Since 1988/9 there has been an increase (P<0.05) in the occurrence of ground rooting, but no increase (P>0.05) in an index of pig abundance. Why? Suggest that rooting per pig has increased either as vegetation changes (succession hypo), or age/sex structure of pig population has changed (resistance hypo)

Relationship between ground rooting and pig abundance (P<0.01). (R_T ~ 10%)
Disturbance vs density; theoretical equilibrium relationships

Disturbance v density
The positive theoretical relationships described by the model are generic, and not specifically related only to feral pigs
Similar empirical relationships have been reported for trampling by horses, and by humans (Liddle 1997)

What level of pig control is needed?
If the aim is to stop pig population growth; \( p = 1 - \left(\frac{1}{\lambda}\right) \), where \( p \) = maximum proportion to remove each year. Maximum \( \lambda \) is 2.1, so \( p_{\text{max}} = 0.52 \)
If the aim is to reduce ground rooting then you must decide to what level, because of the curved relationship between disturbance (rooting) and density
• Future trends in pig density depend on whether lethal control continues or not
• If control continues, three hypotheses of the future are;
  – extinction (inbreeding, Allee effect),
  – low abundance continues (control effective),
  – abundance increases (warfarin resistance develops, bait aversion develops).

Change control method?

The future; control continues?

The future; eradication?

Criteria suggested for eradication (Bomford & O’Brien 1995) are:

Criteria 1. Rate of removal greater than rate of increase
Criteria 2. All individuals susceptible to control
Criteria 3. No immigration

Are these criteria essential, and are they met in Namadgi?

Criteria 1 is essential and has been met
Criteria 2 is not essential. Source/sink structure. Necessary in source populations
Criteria 3 Necessary.

Conclusion: eradication is not achievable

If pig control ceases, four hypotheses;
  - extinction (inbreeding, Allee effect),
  - low abundance (predator pit),
  - slow increase in abundance (predator-induced),
-rapid increase at $r_m$ (food hypothesis)
In the longer-term abundance may stabilise (equilibrium hypothesis) or show eruptive fluctuation without equilibrium (non-equilibrium hypothesis)

![Graph showing population growth over time with different growth rates.

The future; control ceases?

![Graph showing long-term population growth after control ceases.

5. Review and conclusions

Has pig control resulted in Namadgi National Park achieving the aim in the Plan of Management?
Impacts have been reduced, but have park values been protected?
Namadgi has achieved what no other park in Australia can demonstrate

Gaps in knowledge;
• Biodiversity effects of pigs, and of pig control
• Economics of control, including alternative control methods

Acknowledgements
• University of Canberra (funding)
• Glen Saunders, John McIlroy, Roger Pech, Mike Braysher
• Namadgi National Park staff

References
Hone (2002) *Biological Conservation* 105, 231-42
Saunders (1993) *Wildlife Research* 20, 559-69
An Overview of Current Techniques for Feral Pig Control.

John A Meaney
Agricultural Protection Officer,
NSW Department of Primary Industries, Goulburn, NSW

History of Feral pigs in Australia.
Feral pigs have been on the continent of Australia at least since European settlement. They are descended from domestic stock brought in from Europe as well as from Asia by early settlers and traders. Some of these animals escaped or were released into the wild where they survived due to their ability to adapt to the new environment.

They are now present in all States and Territories of Australia, ranging from the tropical wetlands and coastal ranges of northern and eastern Australia, through the semi-arid rivercourse country of Queensland, New South Wales and South Australia, the southern forests of Western Australia and in the sub-alpine regions of NSW and Victoria. Much of this spread may have been by natural migration in the early years but, in the last 50 years or so, many cases of deliberate transportation and release into new areas have been suspected.

Population dynamics.
When attempting to devise a strategy for controlling feral pigs we need to understand something of their breeding potential, which can influence the end result of our efforts. In good seasons, pigs can breed all year round though research into sub-alpine populations suggest a breeding season from November to May, (Saunders, 1988). Sows are capable of breeding once they reach 8-9 months of age or weigh between 28 – 30 kg. Gestation period is about 114 days, or 3 months, 3 weeks and 3 days as a general guide. Litter size depends on the age of the sow and her body condition. Younger sows may have 4-6 young, while older, more experienced sows may have up to 13 piglets. Survival of the young depends on seasonal conditions with fewer surviving in periods of drought than in good seasons. Adverse climatic conditions of very high or low temperatures can be especially harmful for very young piglets. There is also the risk of predation on young piglets by foxes, wild dogs and eagles, not to mention human hunters.

Home range also affects how we develop a control plan. Saunders (1988) in his study of feral pigs in a tablelands vs sub-alpine environment found that tablelands pigs home range was influenced by closer human settlement and interaction with rural industries such as farming and forestry enterprises. He determined that boars had a range of 10.7km², while sows had a range of 4.9km². This was compared to a pig population at Long Plain in Kosciuszko National Park where boars had a range of 34.6 km² and sows, 10.2 km² which he attributed to the absence of major barriers to movement and the less reliable food sources due to seasonal conditions. In comparison, McIlroy found that pigs in Namadji National Park in the Australian Capital Territory had very similar ranges for boars and sows, of 6.6 km² and 5.5km² respectively.
Feral pigs are omnivorous however they generally fed on pasture and vegetation, with the ability to take advantage of insects, small animals, carrion and crops to round out the diet. They also prefer areas with reliable water and feed supplies that are secluded and with protection from extremes of temperature and climate.

Reasons for Control.
Most of the reasons for control of feral pigs have been traditionally for protection of primary industries, eg, cropping, lamb production and the potential threat of pigs action as reservoirs or vectors of exotic animal diseases. There is however an increasing awareness of their threat to the environment and native fauna and flora, especially those that are listed as threatened or endangered.
The management of control programs is also influenced by the ability of pigs to quickly return to pre control densities. In Hone, O’Grady and Pedersen, (1980), Caughley (1977) is quoted that when pig populations are exposed to control levels of 70% per year, that it would take 42 years to reach eradication. Their graph depicting response to 50% and 90% kill rate in good and bad seasons also shows how, in good seasons, pig numbers return to pre control densities very quickly.

Approved control methods.
The control methods discussed here are poison baiting with 1080 Poison, trapping and shooting from aircraft while removal of harbour and habitat modification and fencing may also be options in certain areas.

1080 poison baiting.
In NSW, poison baiting of feral pigs is permitted under a Pesticide Control Order issued by the Environment Protection Authority, Department of Environment and Conservation, which lays down the conditions for use of 1080 poison for feral pig control. Baits may only prepared by Authorised Control Officers who have been trained in the mixing, preparation and handling of 1080 poison and bait materials. Baits can then be put out by other persons under direction of an ACO.
To reduce the risk of non-target animals accessing poisoned bait material it is often the practice to erect bait stations. These structures are fenced enclosures to which pigs can gain access by pushing under the bottom, barbed, wire which normally deters other animals. Bait material such as grain, diced fruit or vegetables or feed pellets are placed in heaps inside the enclosure, far enough away from the edge to prevent other animals reaching the bait. To avoid bait being trampled, spoiled or affected by rain it is often fed out in drum feeders that are located in the centre of the bait station. These have the advantage of allowing the operator to more accurately calculate the amount of feed eaten.

Trapping.
Trapping is a common control method, especially in areas where poisoning is not an option. Once pigs are detected in an area small piles of feed are put out to attract them. Once the pigs start taking bait the number of piles is
reduced to location where traps can be set up. It is wise to feed the trap open for a few days or until there is sign of pigs entering the trap for the feed. The trap can then be set with trails of feed leading to the entrance. Once set, traps need to be checked daily to ensure that there are no problems with the gate set up, to destroy and remove any pigs caught and to rebait if necessary. There is also the animal welfare issue of having captive pigs in a trap for long periods without water and shade, especially in hot weather. One drawback of trapping is the setup cost with traps costing around $500 each. This is a deterrent especially in areas where hunters are likely to damage or completely remove traps. Another difficulty is the setting up of traps in hilly or steep terrain, which can require manhandling of trap panels, bait material and tools needed to build them.

**Aerial shooting.**

Shooting from helicopters has become an effective tool for control of vertebrate pests in recent years. It has the advantage of allowing quick coverage of large areas of country, can be used in difficult terrain and impassable ground conditions such as floods and does not require much input from landholders. It does however require authorised and trained shooters and hire charges for helicopters are expensive, especially if flying time is extended because pig populations are scattered and of low density. Aerial shooting has been used in tablelands country to reasonable effect but there is always the problem caused by thick timber cover. This reduces visibility of target animals with the accompanying risk of not knowing what else was in there. There have also been reports of feral pigs and feral goats taking cover in dense undergrowth when aerial shooting operations have been used regularly in their area. It appears that this could be a learned response which may seriously affect the accuracy of population counts, leading to poor choices in control strategies and ineffective control work.

**Judas Pig.**

The Judas animal concept is most effective on animals that tend to be gregarious, such as goats, pigs, etc. An individual animal is trapped, fitted with a radio collar or similar tracking device and released back into the wild in an area known to contain scattered populations of that species. At predetermined intervals the monitored animal is tracked down and any animals in its company are destroyed by aerial shooting or are trapped and shot. The Judas is then set free to locate other groups in the area. This strategy can also be used in “remote area” control programs where a team of operators can be airlifted into the location of a Judas animal, along with the necessary equipment, bait material and poison. The team locates the pest animals, free feeds and poison baits the area and cleans up before being airlifted back out.

**Note:** The Powerpoint presentation that accompanied this paper is included in Attachment CD. It includes diagrams and plans of several traps and drum feeders.
Animal Welfare And Best Practice Pest Animal Control: Development Of Codes Of Practice and Standard Operating Procedures

Glen Saunders and Trudy Sharp
NSW Department of Primary Industries

The following was adapted by Trish Macdonald, from Glen Saunders’ address to the Workshop.

What is best practice?

A structured and consistent approach to the management of vertebrate pests in an attempt to achieve enduring and cost-effective outcomes. “Best practice” is defined as the best practice agreed at a particular time following consideration of scientific information and accumulated experience.

What is best practice?

• The trigger?
• Who’s responsibility / a champion?
• Define the problem
• Develop a management plan
  —Objectives, area (nil tenure), land management unit’s, control techniques & strategies
• Implement - cooperative action
• Monitor, evaluate, re-assess

Why follow best practice?

• Endorsement of scientifically based, humane, national standards
• Recognition that management concentrate on reducing impact not just numbers (eg bounties)
• Promotion through publication of guidelines and defendable / accountable procedures

Animal Welfare and Pest Control – What’s the problem?

• 88.4% of NSW population and 84% of seats are in urban or coastal electorates
• Animal welfare issues are receiving increasing scrutiny and political reaction eg. Guy Fawkes Feral Horse cull, use of 1080 toxin.
• Current approaches are perceived to focus on lethality & cost-effectiveness
Definitions of terms: Welfare and Humane

**Broom 1997**
“welfare – an animals’ state as regards its attempts to cope with its environment”

**Australian Veterinary Association, 1997**
“Humane – causing the minimum pain, suffering and distress possible. To be humane is to show consideration, empathy and sympathy for an animal, an avoidance of (unnecessary) stress, and the demonstration of compassion and tenderness towards our fellow creatures”

**RSPCA 2005**
“Humane vertebrate pest control is the development and selection of feasible control programs and techniques that avoid or minimise pain, suffering and distress to target and non-target animals”

**Singer 1997**
“The ethic of concern for all sentient beings is the most defensible basis for resolving conflicts between the interests of humans and animals” ie. No discrimination between wild & domestic, overabundant & rare, native & exotic animals

**Anon 2004**
“To ignore the need to nationally address animal welfare concerns, particularly for the short-term protection of unacceptable practices, jeopardises the transparency, public acceptance and long-term implementation of effective pest animal control programs”

**O’connor et al. 2005**
“It is the conflict between the welfare of individual sentient animals (animal rights ethic) and concern for the ecosystem as a whole (biocentric ethic) that has become the core problem for wildlife managers”

---------------------------------------------

The National Heritage Trust called for a tender for the provision of a project

“that develops an agreed code of practice and standard operating procedures for the humane capture, handling or destruction of feral animals in Australia “

NSW Department of Primary Industries won the tender for developing the Code of Practice

Outline of the process used in developing the Code of Practice
•Desktop review – control methods and procedures used by all jurisdictions, scientific literature, legislation, existing cops and sops
•Identify gaps in knowledge
• Prepare draft documents  
• Seek stakeholder comment (responses from 31 individuals and 10 organisations)  
• Preparation of final drafts

Relevant Commonwealth, ACT And NSW Legislation
• Commonwealth Agricultural And Veterinary Chemicals Code Act 1994  
• Environment Protection And Biodiversity Conservation Act 1999  
• ACT Animal Welfare Act 1999  
• New South Wales Prevention of Cruelty to Animals Act 1979  
• Pesticides Act 1999

Existing Codes Of Practice And Strategies (Commonwealth)
• Model Code Of Practice For The Welfare Of Animals: Destruction Or Capture, Handling And Marketing Of Feral Livestock (Pigs, Donkeys, Horses, Cattle, Buffalo, Camels And Deer) 1991  
• Code Of Practice For Humane Shooting Of Kangaroos 1998  
• The Australian Animal Welfare Strategy  
• Commonwealth Codes of practice: Rabbits  
  Foxes  
  Feral pigs  
  Wild dogs  
  Feral cats  
  Feral goats  
  Feral horse

Standard Operating Procedures for control of Feral Pigs included
• Trapping of feral pigs  
• Aerial shooting of feral pigs  
• Ground shooting of feral pigs  
• Use of judas pigs for location and control of feral pigs  
• Poisoning of feral pigs using 1080

  Each of these Standard Operating Procedures covers:  
  • Application of technique  
  • Animal welfare considerations  
  • Non target issues  
  • OH&S issues  
  • Equipment required  
  • Procedures  
  • Further information & references

Note: Standard Operating Procedures were not written for methods or toxins that were considered inhumane even if they were still in use by some
jurisdictions eg. Steel jaw traps, strychnine, yellow phosphorous, warfarin, chloropicrin

The Department of Environment and Heritage will promote the use of the documents for control work that it contracts. Parks Australia and the Department of Defence have both indicated their support of the documents. NSW has adopted it after minor modification (Pest Animal Council 2005) Other jurisdictions can adopt or modify the documents according to their needs – or ignore

Involvement of the National Feral Animal Control Program (NFACP) in feral pig management

Quentin Hart
Bureau of Rural Sciences
GPO Box 858
CANBERRA ACT 2601
quentin.hart@brs.gov.au
02-272 3801

National Feral Animal Control Program

- The National Feral Animal Control Program (NFACP) is a Natural Heritage Trust Program administered by the Bureau of Rural Sciences in Canberra.

- In 1996, NFACP published national management guidelines for feral pigs. This book was written by feral pig experts (David Choquenot, John McIlroy and Terry Korn) and contains a detailed compilation of information on: feral pig biology, ecology and impacts; control techniques; State policy and management approaches; community attitudes; and, research needs. This book has been used for extension materials and to guide research needs. It is out-of-print, but available on CD or as a download from www.brs.gov.au/feral

- NFACP has supported a wide range of feral pig research projects over the past decade. Most early projects were in Far North Queensland, but more recently we have funded feral pig research projects in Western Australia and New South Wales. We are also providing some support for the Manufactured Feral Pig Bait (Pest Animal Control CRC project) which is conducting trials throughout Australia. A list of NFACP feral pig research projects is provided at Attachment A and project reports and extension links for these projects can be found at www.brs.gov.au/feral

- NFACP has administered some routine pest animal control programs including a $1Mn program to control feral animals during drought (2003-04) and a $200K program to control feral pigs (2004-05). Some of these projects were undertaken in the Alps region. We have also supported a major wild dog research project in the Alps that was conducted over a five-year period and provides a useful template for other ‘holistic’ (management/research/monitoring/training/extension components) pest animal projects.

Feral pig control issues

- Inadequate kill rates (<70%) in many cases. Feral pigs have a high reproductive capacity and are mobile and can therefore re-establish quickly unless there is effective control over a large area. High percentage
Kill rates will not be achieved by a single control technique in many areas, so integrated control will be required (usually baiting and trapping). There will be some pigs (e.g. large boars) that may be doing a disproportionate amount of damage but will not take bait or enter a trap. Such animals may be able to be removed through hunting and may even have local bounties placed on them (e.g. Far North Queensland), but these approaches are clearly problematic for National Parks.

- Concerns about 1080
  - General community perceptions about 1080
  - High dose rate needed for feral pigs
  - Concerns about direct non-target (native species and farm dogs) risks from pig bait and due to secondary poisoning (pig muscle/organs and vomitus)
  - Concerns about humaneness and effectiveness of 1080 for feral pigs, particularly in relation to vomiting and potential for sub-lethal dosing (particularly for larger pigs).

- The Manufactured Feral Pig Bait that is being developed has the potential to overcome many of the above issues. Field testing suggests that there is reduced non-target take of baits, and even if small mammals nibble the edges of baits, they will not be affected by the centrally located 1080. Nonetheless, it is possible that where there are high densities of medium-sized mammals such as brush-tailed possums, there may be some non-target impact – this emphasises the importance of free-feeding (possibly with motion-activated digital cameras) to confirm feral pig take in sensitive areas.

- Whilst some people propose warfarin as an alternative to 1080 to reduce non-target impacts, there are clearly a number of native mammals that may be affected by warfarin-laced grain. There are also concerns about the humaneness of warfarin with many believing that internal haemorrhaging and inter-joint bleeding (and subsequent lameness) will result in significant pain and stress for a large intelligent animal such as feral pigs.

- The use of CSSP/SAP (‘yellow phosphorous’) for feral pigs is not relevant to the Alps situation. It is available as a ‘take home’ product by landholders in western NSW and in Queensland. Its effect on the gastrointestinal tract would suggest it to be clearly inhumane, and there are significant non-target concerns about the way it is often used in practice (applied to surface of carcasses with little control over dose rate). The Australian Pesticides and Veterinary Medicines Authority are aware of these issues and hopefully the product will be de-registered in the near future.

- For a mobile animal such as feral pigs, it is essential to coordinate control actions over large areas across all land tenures. The ‘nil tenure’ approach developed for wild dogs is one model that can be used. It is also important not to rely on any single technique. Baiting once a year in a few areas, and ad hoc, uncoordinated trapping may not achieve sufficient feral pig control.
Long-term monitoring of feral pigs and their impacts (e.g. work of Jim Hone) is critical to get a handle on what is being achieved in the context of seasonal variation, bushfires etc.

Research and government policy processes

- There are a number of research and government policy processes under way at the moment that may affect future feral pig management
  - Pest Animal Control CRC, DEH, NFACP and State research (these groups are in regular contact to coordinate activities as much as possible)
  - DEH Feral Pig Threat Abatement Plan about to be published
  - Invasive Species Framework and Australian Pest Animal Strategy (to be finalised in 2006)
  - House of Representatives Inquiry into agricultural impacts of feral animals (to be finalised late 2005/early 2006?)
  - Codes of Practice/Standard Operating Procedures for humane control of feral animals and RSPCA Humane Vertebrate Pest Control discussion paper.

Feral pig management/research in the context of the NHT

- Feral pigs as a natural resource management/conservation issue:
  - $100Mn pa agricultural cost
  - $? environmental cost
  - $5Mn pa control costs (very conservative)
  - $1.5Mn pa research costs (very conservative)

- Natural Heritage Trust (www.nht.gov.au) funding sources
  - National Component (e.g. NFACP, DEH TAPs)
  - National Competitive Component
  - Regional Component (NRM groups/CMA plans)
  - Regional Competitive Component
  - Envirofund (<$50K, 'ad hoc' projects)

- NHT National Component – National Feral Animal Control Program
  - one funding round per year (administers $700K per year)
  - not for routine feral animal control (supports applied research and extension)
  - provided support for five-year wild dog project which included the Alps region. Project achieved a number of things including wild dog control, trapper training and improved monitoring of wild dogs and their impacts. Project was also involved in the development of the ‘nil tenure’ approach.

- NHT Regional Component
  - the bulk of NHT funds is available through this component
  - regions set their own resource management/conservation priorities
  - need to liaise with DIPNR to ensure feral animal/weed issues are included in current/future investment plans.
• Envirofund
  - potential source of funds to do some low-level routine management work that has not been locked into the regional plan and is not eligible for funding under the NHT National Component.

• Wildlife and Exotic Disease Preparedness Program (contact: chris.bunn@daff.gov.au)
  - one funding round per year
  - supports workshops and field work relating to wild animal monitoring/sampling.

**NSW DPI/BRS monitoring manual**

• Monitoring is a critical component of any pest animal management program to quantify what you are achieving.

• Ideally monitoring would focus on impacts, but using pest animal density as an indicator of impact is usually more realistic.

• NSW DPI/BRS Manual (available late 2005?) provides detailed guidance for monitoring a range of pest animals including feral pigs:

  **Monitoring feral pig density**
  - aerial surveys
  - trapping (CPUE, capture-recapture, radio telemetry)
  - satellite and GPS telemetry
  - index-removal-index
    - bait uptake
    - dung counts
    - DNA sampling
    - track counts.

  **Monitoring feral pig impacts**
  - sign counts
  - lamb predation
  - crop damage
  - vulnerable native species
  - mapping feral pig damage and density.
Qld
Monitoring systems for feral pigs (Completed)
$60,000/1998/3YRS
(TOTAL NFACP FUNDING/NFACP FUNDING ROUND/PROJECT DURATION)
Project assessed impact of feral pigs in sugarcane/banana-growing areas of north Queensland. This information allowed derivation of density:damage relationships which can be used to develop performance indicators for north Queensland and other feral pig management programs. This information is essential to allow landholders and government agencies to determine the most cost-effective level of feral pig control – i.e. the point where control costs and subsequent damage mitigation are optimised.
Contact: jim.mitchell@nrm.qld.gov.au

Economic evaluation of feral pig control strategies in North Queensland (Completed)
$18,202/2000/1YR
The costs of feral pig impact on high-value sugarcane and horticultural enterprises in north Queensland can be considerable. Management of feral pigs in the area is problematic due to the large areas of inaccessible rainforest surrounding plantations, high rainfall and non-target issues which limit the potential of baiting. This project assessed the economics of a range of control strategies (particularly trapping) to reduce feral pig damage.
Contact: quentin.hart@brs.gov.au

Integrated feral predator control in south-west Queensland (Completed)
$102,300/1999/2YRS
Project involved large-scale aerial baiting for maximum sustained impact on feral pig, wild dog and fox populations.
Contact: melissa.derrick@nrm.qld.gov.au

Best practice feral pig management in the Burdekin River Catchment (Completed)
$28,000/2003/1YR
This project demonstrated the effectiveness of three feral pig management strategies on beef grazing properties in a dry tropical savannah environment.
Contact: jim.mitchell@nrm.qld.gov.au

Target-specific bait/delivery systems for alternative feral pig control toxins (Completed)
$34,250/2003/1YR
This project assessed pig-specific delivery systems (based on bait medium and attractants) and investigated warfarin tablets and cyanide as alternative toxins to 1080.
Contact: peter.elsworth@nrm.qld.gov.au
Improving feral pig baiting strategies (Ongoing)
$25,800/2004/1YR
There has been little evaluation of feral pig baiting strategies in northern Queensland despite the fact that this area poses a significant risk of being an introduction point for an emergency animal disease outbreak. This project assessed the optimum feral pig baiting strategy to reduce feral pig impacts.
Contact: jim.mitchell@nrm.qld.gov.au

Refinement of a 1080 bait degradation model (New)
$48,000/2005/3YRS
1080 baiting is a vital component of pest animal control in Australia. This project will investigate the effects of temperature, rainfall, soil conditions and bait age on rates of 1080 loss in meat baits. Results will have implications for improved baiting strategies.
Contact: joe.scanlan@nrm.qld.gov.au

Effective 1080 baiting for feral pigs (New)
$81,900/2005/3YRS
This project aims to improve the effectiveness of feral pig control in Australia by determining appropriate 1080 content in baits and the best baiting strategies for maximum population control.
Contact: matthew.gentle@nrm.qld.gov.au

WA
Further development of feral pig baits and control strategies (Ongoing)
$157,550/2003/3YRS
This project is testing a range of bait mediums in cropping and rangeland situations in Western Australia. Project will involve collaboration with interstate counterparts to improve the effectiveness of baiting strategies.
Contact: ltwigg@agric.wa.gov.au

NSW
Development and refinement of feral pig control strategies (New)
$99,500/2005/3YRS
Improved management of feral pigs in Australia has become a high-profile issue for agricultural industries and environmental management in recent years. This project will look at monitoring and control options to maximise feral pig damage reduction with a given level of resources.
Contact: glen.saunders@agric.nsw.gov.au

CRC
Development and registration of manufactured feral pig baits (Ongoing)
$48,000/2004/1YR
This project will work with industry groups and feral pig experts to develop a manufactured feral pig bait. Such a product would improve the efficacy and safety of feral pig control and respond to current industry concerns about the immediate (agricultural and environmental) and potential (emergency animal disease threat) impacts of feral pigs.
Contact: steve.lapidge@pestanimal.crc.org.au

Predicting natural boundaries for feral pig populations to establish improved management units (New) $21,870/2005/2YRS
This project will use genetic sampling techniques to determine boundaries across which there is little feral pig migration which may therefore represent useful management units.
Contact: brendan.cowled@pestanimal.crc.org.au
Ever since the Feral Pig Action Agenda (June 2003):
1. Developing PIGOUT™ manufactured feral pig bait with Meat and Livestock Australia and the National Feral Animal Control Program.
2. Identification of new humane and target specific feral pig toxins that will be developed under the Invasive Animals CRC.
3. Recommending that the Australian Vertebrate Pests Committee prepare a National Pest Animal Strategy (now underway).
4. With Australian Veterinary Association and Cattle Council Australia, obtained inclusion of the sentiments from the FPAA in the Commonwealth feral pig Threat Abatement Plan.
5. Supporting CCA and AVA in instigating and/or contributing to Federal Government Senate and House of Representatives Inquiries into Invasive Species.
6. Completed the Commonwealth Department of Environment and Heritage Tender ‘Feral pig Control Review’.
7. Suite of research projects explained later.

Development of PIGOUT™

Reason for project
Baiting is a widespread and accepted means of feral pig control, however problems occur with;
1. it being labour-intensive,
2. a reliance of graziers on government for 1080,
3. delivering sufficient toxin to pigs (~72 mg 1080),
4. non-target species exposure,
5. both pig toxins (1080 & CSSP) being under government review and warfarin not available,
6. no shelf-stable bait that can assist land managers such as exists for foxes (FOXOFF®).

Bait substrate pen trials
- Compared meat, grain and 7 prototype manufactured baits in randomised paired-sample trials.
- Measured choice and time to consumption.
- Statistically significant differences occurred between pen tested bait substrates.
- Results indicated that 3 manufactured bait types were as or more desirable than traditional baits.
- Manufactured baits were more likely to be found and consumed than traditional baits (P=0.014) in an open paddock.

Feral pig bait field trials

Cunnamulla stations
• Two prototype baits varieties were tested against fresh meat baits (kangaroo).
• Each bait contained a different biomarker- lophenoxic acid (IPA), Tetracycline or Rhodamine B.
• Three sites, each approximately 100 km², were delivered a unique bait-biomarker combination.
• A forth site was baited with triple biomarked baits as biomarker controls.
• Feral pigs at all sites aerially shot to assess bait uptake five days later.
• Non-target uptake assessed at fifth site.
• Results indicated Tetracycline or Rhodamine were undetectable, even in positive trials.
• Uptake of manufactured baits with IPA was 80% and meat baits with IPA 52%.
• There was no non-target takes of manufactured baits.

Arthursleigh Farm
Tested target-specificity of manufactured bait.
• Traditional non-toxic baits (meat and grain)
  1. Native species 43/159= 27% consumption
  2. Stock 21/159 = 13% consumption
• Manufactured non-toxic baits
  1. Native species 6/521= 1% consumption
  2. Stock 3/521= >1% consumption
• Feral Pigs scoffed all baits near them.

Namadgi National Park
• Non-toxic manufactured baits were deployed during a warfarin baiting campaign in NNP.
• Allowed a comparison of substrates for desirability to native species, feral pigs and canids.
• No significant difference in feral pig uptake between manufactured baits and wheat baits after similar exposure.
• Birds and macropods were significantly more likely to take soaked wheat baits than manufactured baits.
• Foxes ate or removed manufactured baits.

Wrotham Park Station
• Toxic PIGOUT and meat baits compared near Cairns, north Queensland, using aerial baiting.
• Initial 42% reduction in feral pig activity at two separate PIGOUT sites, which was deemed not high enough. Meat baits returned an 18% reduction in feral pig activity.
• Monitored meat baits were less target specific than manufactured baits.
• Bait prototype and trial methodology improved for latter trials.

Is PIGOUT attractive to Quolls?
• Tested in a high density quoll population near Dorrigo National Park, New South Wales, using 200 bait nights.
• No quoll or other marsupial carnivore takes were recorded.
• Result confirms the high level of manufactured bait target specificity.

**Kangaroo Island**
• Feral pig activity significantly decline at 3 baited sites by a mean of 81%.
• Feral pig activity did not significantly change at 3 control sites.
• All age classes targeted equally.
• Two non-target mortalities- possum and rat.

**Welford National Park**
• Overall, out of 43 exposed pigs in Welford NP (3 populations) 36 died, resulting in an 84% mean knockdown.
• No recorded non-target bait consumption.
• Both sexes and all age classes targeted without bias.
• Pigs consumed PIGOUT on night 1 of lethal baiting and were dead by morning.
• Potential non-target secondary poisoning was minimal, with only a few species consuming carcases.
• Feral pigs will clearly consume PIGOUT baits without prior exposure.

Final field testing, residue essays and stability testing is currently occurring. It is anticipated that the product will begin the registration process by the end of 2005, and hopefully become available in late 2006 or 2007.

**Other feral pig research at the Pest Animal Control CRC**

**Process of Achilles Heel Review**
• Browse veterinary literature from the last century and search for substances that are toxic to swine.
• Review the physiology and biochemistry of feral pigs to look for ‘chinks in their armour’.
• Trial specific substance that target such ‘chinks’ e.g. pigs are deficient in sulpho-transferase which detoxifies many drugs such as amphetamines.

Desirable attributes of a new toxin are:
  i. Safe for human operators.
  ii. Highly toxic for feral pigs.
  iii. Readily accepted in baits and deliverable in baits.
  iv. Target specific.
  v. Humane (mechanism of action, speed of action, pathology, clinical signs and duration, sub-lethal doses, reports from humans).
  vi. Lack of residues or bioaccumulation.
  vii. Antidote available.
  viii. Cheap and readily available toxin.
  ix. Already registered for other purposes.
  x. Literature published already to expedite registration.
  xi. Acceptable to trading partners.

• Completed toxin search, with two potential actives being identified.
In the process of reviewing physiology and toxicology and this may lead to additional potential actives.

- Proof of concept will hopefully be achieved in pen trials in 2006.
- If promising results are obtained, the active/s will be developed under the new Invasive Animals CRC.

**Vaccine & contraceptive delivery**

- The United States Department of Agriculture has developed a GnRH fertility vaccine for ‘feral hogs’ that is so far effective for 3 years.
- They are also interested in orally delivering a pseudo-rabies vaccine.
- Recent pen and field trials in Australia and America have been completed successfully.

**Natural boundaries to feral pig dispersal**

- Previously found no genetic structuring in the feral pig population in an area of over 10,000 km² near Cunnamulla, Queensland.
- Currently combining genetics and Geographical Information Systems to assess natural pig boundaries over 1 M km² using pig tissue samples from ‘chiller boxes’.

Natural boundaries or ‘genetic fences’ are the basis of effective feral pig population and/or disease control.
Invasive Animals CRC
a new offensive against pest animals

The Pest Animal control Cooperative Research Centre was established in 1999 and has aimed to "Develop practical, cost-effective and socially acceptable products and strategies to reduce pest animal damage in Australia".

From 1 July 2005, the Pest Animal Control CRC will become the Invasive Animal Cooperative Research Centre (IA CRC). The IA CRC will be an exciting venture that aims to counteract the impact of Invasive animals through the development and application of new technologies and by integrating approaches across agencies and jurisdictions. It is the first time that research, industry, environmental, commercial and government agencies will work together to create and apply solutions for invasive animal threats.

The significant achievements of the PAC CRC will provide a strong foundation on which the Invasive Animal CRC can build a confident, balanced and comprehensive research portfolio.

Why Invasive Animals?

Invasive animals cost Australasia at least $720 million p.a. through environmental, economic and social damage. Most agricultural sectors suffer significant economic losses from invasive animals through predation of livestock, crop damage, competition for feed and costs of control. Invasive animals have been a major factor in Australia’s unenviable record of having nearly half the known mammalian extinctions worldwide in the past 200 years and are strongly implicated in the serious decline of Australia’s native freshwater fish populations. Invasive animals have markedly altered our landscapes, reduced our biodiversity and through events such as mouse plagues, disrupted communities.

Focusing the Nation’s expertise

Reducing the impact of invasive animal pests must be achieved by a partnership between the public and private sectors. No individual land manager or agency carries the whole invasive pest animal problem but all are responsible for making a contribution and a commitment to the solution. Invasive pests do not recognise land tenure, and roam freely across the 23% of Australia under public control, the 14% in Aboriginal and Torres Strait Islander custody, and the 63% in private hands.

Comprising a large number of members, the IA CRC will, for the first time, bring together private and public land managers to integrate approaches to invasive animal management. This unique partnership will deliver the means to deal with existing high profile invasive animal pests as well as those that have the potential to cause catastrophic impacts in the future.
Research Focus

As its core business, the Invasive Animals CRC aims to:

- reduce the impacts of foxes, wild dogs, feral pigs, feral cats and rodents;
- deliver improved quality and availability of inland water through reduced impacts and rates of spread of carp and other pest fish species;
- increase agricultural profitability through improved integration of existing biological, conventional and newly developed control options for rabbits;
- reduce the risk of disease transfer from invasive animals to livestock and humans;
- reduce the risk of economic losses, environmental damage and social stress by forecasting and responding to potential, new, expanding or emerging invasive animal problems;
- facilitate growth in Australian invasive animal pest control industries by supporting industry in the registration, marketing, export and community uptake of products;
- increase professional and practical skills base in invasive animal management through education, training and community awareness;
- establish national and local benchmarks for invasive animal impact, density and distribution from which performance on delivery of all outcomes can be assessed.

These IA CRC outcomes will benefit a range of Australian sectors and deliver these services at a continental scale. Key sectors include the grains, horticultural and viticultural industries (rodents and/or birds), extensive grazing industries (wild dogs, foxes, rabbits and disease risk), water use in agriculture, tourism and fisheries (carp) and the environment (all species).

Invasive Animals CRC Participants

**Industry:**
Animal Control Technologies; Australian Veterinary Association; Australian Wildlife Conservancy; Australian Wool Innovation Ltd; CarpBusters Inc; Cattle Council of Australia; Grains Research and Development Corporation; K&L Fisheries Global Pl; Meat and Livestock Australia; Murray Darling Basin Commission; Parasitech; Pestal Ltd; ValueMetrics Australia;

**University:**
Australian National University; University of Canberra; University of Minnesota; University of Queensland; University of Sydney; University of Western Australia; University of York

**Australian Government:**
Bureau of Rural Science; Commonwealth Dept of Environment and Heritage; CSIRO

**State Government:**
Animal and Plant Control Commission of South Australia; Environment ACT; NSW Dept of Environment and Conservation; NSW Dept of Primary Industries; QLD Dept of Natural Resources and Mines; QLD Dept of Primary Industries; South Australian Research & Development Institute; State Council of NSW Rural Lands Protection Boards; Tasmanian Dept of Primary Industries, Water and Environment; Victorian Dept of Primary Industries; Victorian Dept of Sustainability and Environment; WA Conservation and Land Management

**Other:**
New Zealand Dept of Conservation; New Zealand Landcare Research; UK Central Science Laboratory; United States Dept of Agriculture - National Wildlife Research Center; WWF Australia

*The Pest Animal Control CRC and Invasive Animals CRC are funded and supported by the Australian Government's Cooperative Research Centre's Program.*
Feral Pig Control in Namadgi National Park – ACT

Bill Woodruff
ACT Parks and Conservation Service
Environment ACT

Overview

The control of pest animals in the ACT is guided by the framework outlined in the ACT Vertebrate Pest Strategy. The recently enacted Pest Plants and Animals Act 2005 (May) provides for the Minister to declare pest animals and management plans for declared pests may need to be prepared. In addition, Environment ACT is required to prepare an annual pest animal control program and activity report.

Feral pigs are widely distributed throughout forested and pastoral areas of the ACT, particularly west of the Murrumbidgee River where the majority of routine control action is undertaken.

NNP was declared over an area of 94,000 ha in 1984 and now occupies an area of approximately 106,000 ha or 43% of the total area of the ACT. The park includes lowland plains of the Monaro, dry open forest, tall open forest, sub alpine herb fields, rocky heaths and swamps. It is also an area of biogeographic overlap between montane and coastal escarpment ecosystems. Prior to declaration much of the area initially included in the park was protected by its inclusion in the Gudgenby Nature Reserve and Cotter River Water Catchment area.

A consequence of this long period of protection is that much of the park has been relatively free from human associated impacts and retains outstanding conservation values, including an array if rare, restricted or uncommon species and communities, eg. Corroboree Frog, Broad Toothed Rate, Two Spined Blackfish, Macquarie Perch, Trout Cod, alpine plants, lowland grassy woodlands. Feral pigs are also present throughout most of the park and live amongst, and compete with, these values.

There are two theories proposed for the presence of feral pigs in the park;

1. Hone (2001) Accidental introduction following a motor vehicle accident in 1959. By mid 1980’s pigs were very abundant in the park, estimated density 1.4 km\(^{-2}\).

2. Boreham (1981) Feral pigs have been present in the area since at least 1844, including records of an early pastoral family in the Naas Creek Valley selling bacon to the Sydney Markets. One report suggests that an unstated number of pigs were released in the Boboyan District in 1900. Pigs said have existed in nearby Yaouk and Brindabella Valleys since 1925. Sightings were rare in Cotter Catchment area until 1958.
Behaviour and impacts

Pigs in Namadgi generally move down from areas of higher elevation with the onset of cold weather and by late Autumn in most years they have moved into areas where tracks are accessible for baiting prior to winter snow falls. This is also the time of year when sows have young at foot, the availability of alternative food is limited and staff resources are most available following the completion of the annual weed and bushfire programs.

Most damage caused by pigs occurs in October and is most common at higher elevations and flatter slopes in drainage lines. Damage is least likely to occur in June and in the Eastern forest areas with dry sclerophyll understorey.

Rooting appears to favour an apparent increase in Ti tree and bulbous species such as Vanilla Lilly. There is some evidence to suggest that species richness in disturbed areas may increase immediately following activity, but by 4 months this is not significant. Species richness data suggests that pigs forage mainly for common species, but less common species may be affected. Whilst areas are generally very slow to recover from rooting they tend to have recovered at least partially between disturbances. Weed invasion in sub alpine herbfields may increase as a result of rooting.

Extensive feral pig damage can have significant visual impacts and affect visitor perceptions of overall park management standards.

History of Control

The earliest control program documented was trapping undertaken in the Boboyan Pine Plantation 1974-75. In 1977 an investigation was carried out on the biology and behaviour and by 1980 survey and trial work was being undertaken to assess the susceptibility of pigs to baits and effectiveness of trapping.

In 1985 trials were being conducted on the use of warfarin poison. In 1986/87 based on research conducted by CSIRO Wildlife and Ecology and NSW Department of Agriculture a park wide program was initiated to assess the effectiveness of strategies for control in the event of an outbreak of Foot and Mouth Disease. Monitoring demonstrated an average 94% reduction of pigs in study area.

Pig control using warfarin poison has been undertaken annually in NNP since these trials. The program can take up to 14 days and involve up to 4000 bait stations being laid at 100 metre intervals along management tracks. Free feeds of soaked wheat are placed at each bait station and checked daily for up to 10 days. Baits taken are replaced by poison baits (dyed and covered to reduce non target take) and checked daily. Poison baits taken are replaced for three consecutive days in order to provide a lethal dose: relies on pigs revisiting each day.
In recent years co-operative baiting programs have been conducted with adjoining NSW National Park staff.

Trapping has recently been re-introduced as a control method by feral animal control staff where opportunities exist for it to be done efficiently as part of other routine activities: ie. wild dog baiting and trapping lines.

**Monitoring**

Environment ACT is fortunate that Dr Jim Hone – University of Canberra has been monitoring pig damage and dung across the park since 1985. His results demonstrate that a significant and sustained reduction in pig both numbers and impacts has been achieved.

Records of bait take from the poisoning program indicate that bait take is highest along trails on the edge of the park. This may imply that migration from adjoining areas is the main source of new pigs in NNP.

**Major Issues**

Whilst pigs are relatively susceptible to warfarin poison it is no longer considered to be a humane control method. Environment ACT has a responsibility to investigate alternatives. The non target effects of the warfarin program have not been adequately researched.

Obtaining co-operation from adjoining rural neighbours is difficult. One reason proposed is that the program is undertaken in Autumn, which corresponds to the time of year when damage is least likely to occur. Neighbours usually do not perceive they have a problem when the program is undertaken.

Implications of increased focus on wild dog control. Predation is considered to be one reason why piglets suffer high rates of mortality in NNP: based on study undertaken prior to when the current program was initiated.

In contrast to more arid areas where poisoning programs can be successfully targeted at watering points during dry periods, in most years adequate water is available throughout alps parks so control must be undertaken over a wide area.

**References**


Feral Pig Management in Victoria

Peter Kambouris & Charlie Pascoe
Parks Victoria (Bairnsdale & Bright)

Victorian Feral Pig Management Framework

Catchment and Land Protection Act 1994
Provides the legislative framework for pest management in Victoria and declares feral pigs as an established pest animal.

Victorian Pest Management Framework
Provides the strategic framework for pest plant and animal management in Victoria.

Feral Pig & Feral Goat Management Strategy
Provides the strategic framework for feral pig management in Victoria.

Regional Feral Pig (and goat) Action Plans
Will guide regional (eg Gippsland / North East Victoria) feral pig management and control programs and provide a basis for seeking funding.

Legislation

Catchment & Land Protection Act 1994
-Basis for control of declared pest plants & animals

Other Legislation that requires effective pest management, either directly or indirectly:
- National Parks Act 1975
- Forest Act 1958
- Crown Land (Reserves) Act 1978
- Land Act 1958
- Conservation Forests & Land act 1958
- Flora & Fauna Guarantee Act 1988
- Prevention of Cruelty to Animals Act 1986

Victorian Pest Management Framework
Focus on pests declared under CaLP Act 1994 & their management on public land

- Weeds
- Rabbits
- Wild Dogs
- **Feral Pigs & Goats**
- Foxes
- Public land pest management

**Feral Pig & Goat Management Strategy**

- Pigs found across Victoria, mainly on public land.
- Threaten biodiversity and agricultural values through habitat and land degradation and predatory feeding.
- Pig management is a community issue as, if effective, it directly benefits the whole community.

**Aim**

To protect biodiversity and primary production through:
- Mapping extent.
- Assessing impacts.
- Promoting and implementing an integrated, coordinated and cooperative cross-tenure approach through effective partnerships.
- Supporting regional strategies where pigs are an agreed community problem.
- Implementing consistent monitoring to ensure effectiveness.

**Actions**

1. Map extent & assess impacts (DSE & PV)
2. Improve processes for setting priorities and decision making (DSE)
3. Strategic management programs using regional Action Plans (CMAs, DSE & PV)
4. Build partnerships to ensure statewide & regional coordination (DSE & CMAs)
5. Implement ‘best practice’ feral pig management (DSE & PV)
6. Target research for ‘best practice’ management (DSE)
7. Implement effective monitoring, reporting and evaluation (DSE & CMAs)

**Responsibilities**

- Department of Sustainability and Environment (DSE)
  - Statewide policy & legislative responsibility for pest management
  - Coordinates implementation of management programs
  - Management of public land and water
- thru DSE Divisions (Crown Land Mgt, Forest Mgt) & Parks Victoria
• Catchment Management Authorities (CMAs)
  – Responsibility to implement Regional Action Plans
• Gippsland Action Plan proposed
  – Inform communities about programs, priorities and funding for feral pig management

**Policies**

• PV Policies
  – No Parks Victoria policies on feral pigs, although other policies have some relevance:
    - 2.1.1 Wildlife control in parks
    - 2.6.2 Use of 1080 in parks
    - 7.1.2P Firearm use in park management

• DSE Policies
  – DSE Feral Pig Management Policy 05-20-0173-1
  – VERMIN PAK (1987)

**Pigs in the Victorian Alps**

Victorian Alpine Area includes the Australian Alps National Parks:
  – Alpine National Park
  – Snowy River National Park
  – Mount Buffalo National Park
  – Baw Baw National Park,
and adjacent State Forests and other public and private land in Gippsland and North East Victoria

**Distribution:** Many disjunct populations of pigs
- Snowy River, Suggan Buggan, Tingaringy, Mt Pinnibar, Buenba Flat, Native Cat Flat
- Recent reports from: Dargo High Plains, Spion Kopje
- Nearby areas: Mount Lawson State Park / Burrowa-Pine Mountain NP / Shelley, Mt Samaria / Tolmie, Mt Stanley / Beechworth, Errinundra, Coopracambra, East Gippsland coast, Gippsland Lakes.

**Extent**
- Most populations small and isolated.
- Few actual sightings; often difficult to find active sign.
- No information on numbers or densities.
- Predominantly in forests & heathlands, but also in pine plantations and open country.
- Overall distribution appears to be increasing.
- Human-assisted dispersal.
- Possibly dispersing independently south from NSW and west from Snowy River.
Values at risk from Pigs in the Victorian Alps
- Wilderness (eg Tingaringy, Buchan Headwaters, Snowy, Bowan).
- Catchment values
- Rainforest & other riparian vegetation communities
- Threatening process for significant flora & fauna
  - eg Long-footed Potoroo - habitat disturbance and competition for food resources
- Agricultural land productivity
- Disease spread risk for humans and livestock

Park Management Plans

Alpine National Park Management Plan (1992) - 4 unit plans
- Cobberas Tingaringy Unit & Dartmouth Unit Management Plans note presence of pigs “but their signs (rooting and scratching) and sightings indicate only a very small, highly mobile population.”
- Wonnangatta Moroka Unit & Bogong Unit Plans state no pigs present.

ACTIONS:
- Feral pigs are a high priority for control.
- To be eliminated from units where they occur if possible, using shooting, baiting and trapping.
- Monitor and prevent establishment in areas where not already present.
Pigs warrant active control due to their low population levels and localised environmental impacts with control more effective at early stages.

**ACTIONS:**
- Prepare PP&A strategy that addresses priorities for funding, control techniques and monitoring, including pigs.
- Liaise and coordinate control efforts with neighbouring land holders where possible.

Baw Baw & Mount Buffalo National Parks
No pigs.

Forest Management Plans

- Threat to health of humans and livestock by carrying diseases including TB, brucellosis, and in the event of an outbreak of exotic diseases would provide a wild reservoir for as foot & mouth, Swine fever and Bluetongue
- Cause soil erosion through rooting and wallowing behaviour
- Acknowledges over 1000 pigs caught at Nunatak from 1986 and that increasing sighting becoming common with migratory nature making individuals or small family groups difficult to locate and control
- Once located, can be shot, snared, trapped or poisoned.

**ACTIONS:**
Pig populations monitored and action taken when infestations located.

- Recognises pigs in the Benambra area as localised and in low abundance

**ACTIONS:**
- Of particular importance to control in Gippsland because of their potential to cause serious damage to forest environments and their potential role as livestock disease vectors

North East Forest Management Plan
- Feral pigs are localised or ‘less common’ (than foxes, wild dogs and rabbits).
- Feral pigs can potentially damage forest environments and act as disease vectors.

**ACTIONS:**
- Prepare and implement 3-year pest animal control programs.
- Maintain comprehensive records of pest animal occurrences and control programs.

Pig Control in the Victorian Alps

Trapping & Snaring
- Mostly ad-hoc and reactionary / opportunistic
- DPI dogmen historically / DSE land stewardship positions currently
- PV staff gaining experience
- Outsource via contract delivery where necessary
Inter-agency Partnerships

• PV & DSE (Forest Management)
  - Cooperative on-ground approach in East Gippsland and Eastern Alps.

• DPI & land management agencies / community
  - Past effective on-ground cooperation with land management agencies and community.
  - Rely on direction from DPI senior management or DSE to recognise and assist in response to the clear and increasing risk of feral pigs in Victoria.

• East Gippsland Feral Pig Regional Action Plan
  - To be priority driven and tenure blind.
  - Coordinated approach to also involve community response.
  - To also assist in attracting funding for prioritised actions.

• CMAs
  - Have responsibilities under Feral Pig & Goat Strategy & need to be brought on board.

Interstate Partnerships

• Interstate
  - SE IPAWG (South East Inter State Pest Animal Working Group)
  - Initiative by NSW & Victorian agency staff for management of dogs
  - Operating successfully for several years
  - Allows for coordination of programs as well as skill and information sharing
  - Includes NSW NPWS from Bombala, Jindabyne & Merimbula; NSW SF from Eden and Bombala; Representation of RLPBs; and East Gippsland representatives from Parks Victoria, DPI and DSE
  - Pig forum established as growing need apparent
  - 2 very successful skills and training feral pig workshops held for all stakeholders in Orbost and Nungatta
  - Strongly encourage a similar cross-border / cross-tenure Alpine liaison group be established for a coordinated approach to pest animal management west of the Snowy River.

Feral Pig Monitoring

• No formal monitoring undertaken to date
• PV feral pig monitoring protocol
  - Recently developed
  - Yet to be field tested

Future plans for feral pig control

• Enhance cross-tenure inter-agency approach.
• Encourage involvement of other neighbours.
• Eradicate isolated & emerging populations.
• Containment (preventing spread and expansion) of existing populations
• Develop coordinated monitoring programs

Potential Issues & Gaps
• Awareness of feral pig problem
• Whole of government approach
• Legal & illegal hunting
• Ongoing deliberate releases
• Remoteness of many populations
• Trapping very time consuming
• Staff skills, experience and firearms authorisations
• Availability of dogmen
• Reporting mechanisms and databases in different agencies
• Lack of records on state wide data bases

SUMMARY: Expanding problem
• Increasing awareness
• Increased resources
• Lack of whole-of-government commitment
• Ad-hoc control to date
• Emerging partnerships & strategies
A Feral Pig Control Program in Kosciuszko National Park, NSW

Presentation by Craig Smith, NSW NPWS

Aerial Shooting Program in the Jagungal Wilderness

Since the early 1970’s an ad hoc program of occasional shooting and trapping of feral pigs had occurred in the Jagungal Wilderness.

In the 1990’s pigs started to move into the Jagungal Wilderness area, with the consequent impacts on biodiversity (eg threatened species such as the corroboree frog). These impacts were occurring in areas that were popular for recreational pursuits.

A program of trapping and ground shooting commenced, but the feral pig environmental impacts were not significantly reduced.

It was felt that a 90% kill rate was required to reduce environmental impacts. In 2000 Jim Hone suggested that the Park use a relative abundance assessment, and count the number of pig kills using aerial shooting and baiting against that.

To assist in finding feral pigs in this sub-alpine–alpine environment a Judas Pig program was established, and trialing of transmitters was carried out. Aerial (helicopter) tracking commenced. It was found that using the same staff as regular fliers produced significantly improved results. Those who knew the equipment and had learnt the land from the air had developed an important level of expertise.

General feeling that the program is working in this area (no supporting statistics were provided). Since commencing the program in 2001 they have made adaptations to their program as they have learnt from successes and failures – eg they now fly in August following the pig tracks as they begin to move with the spring thaw

**Recommendation:** use local knowledge and expertise – learn the behaviour of feral pigs in your area and use that knowledge to enhance your control program.
A Co-operative Feral Pig Control Program in the South East Forests of NSW

Dayna Blackmore,
Ranger, Bombala
Parks and Wildlife Division
Department of Environment and Conservation

An Outline of the Presentation

How did Interstate Pest Animal Working Group (IPAWG) evolve?

**Development Stages:**
Steve Cameron (NPWS)
Bryce Thornhill (formally State Forests)
& David Krajca (DPI)

**The Working Group**
NPWS
Forests NSW
Bombala RLPB
South Coast RLPB
Private Landholders
DPI
Parks Victoria

Cross-tenure approach to feral pig management

**Bringing relevant parties together: Workshops held**
  1996 Practical Field Days
  Feral Pig Expo 2004

**How Feral Pig Control Methods evolved?**
  Early Trap Design
  VS.
  Current Trap Design

**Gaps in the project**

**The learning process**

**Success of the project**

*COMMUNICATION IS THE KEY*

**Further Information**

Steve Cameron
Field Officer (Pest Management)
Bombala NPWS, Ph: (02) 6458 4231
Franz Peters  
Area Manager  
Bombala NPWS  
Email: franz.peters@environment.nsw.gov.au  
Ph: (02) 6458 4080

Dayna Blackmore  
Ranger  
Bombala NPWS  
Email: dayna.blackmore@environment.nsw.gov.au  
Ph: (02) 6458 4080
OBERON PEST ANIMAL MANAGEMENT GROUP

John Meany
Agricultural Protection Officer
NSW Department of Primary Industries
Goulburn

An Outline of the Presentation

History of the Group
1985-Meeting of NPWS, Forestry Comm., Carcoar RLPB and Dept of Agriculture to control feral pig incursions onto lands in Mt. Werong, Jerrong, Gurnang, Tuglow and Jaunter areas on western side of Kanangra Boyd and Blue Mountains National Park

Action taken and results
- Govt agencies and RLPB put in funding to buy traps and grain for feed
- Landholders to set up and maintain traps on private lands
- Govt agencies to develop control strategies for own lands
- Results were variable and overall disappointing due to lack of expertise by landholders, poor trapping success and mobility of pigs across boundaries
- Program lapsed till September 1988 when meeting at Oberon Council Chambers brought together representatives of
  - Dept of Agriculture
  - NPWS
  - Forestry
  - Carcoar, Bathurst, Goulburn, MossVale RLPBs
  - Water Board
  - United Landholders Association
  - Meetings in March and April 1989
- A control program was devised to start in July 1989 and to operate till September
- A meeting in December reviewed results and agreed to an annual Autumn-Winter control program
- Results were encouraging and landholders saw that Govt agencies were dedicated to the project

1989 Results

<table>
<thead>
<tr>
<th>Organisation</th>
<th>trapped</th>
<th>shot</th>
<th>poisoned</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carcoar RLPB</td>
<td>-</td>
<td>2</td>
<td>50&lt;sup&gt;a&lt;/sup&gt;</td>
<td>52</td>
</tr>
<tr>
<td>NPWS</td>
<td>9</td>
<td>-</td>
<td>111&lt;sup&gt;a&lt;/sup&gt;</td>
<td>120</td>
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<tr>
<td>Water Board</td>
<td>70</td>
<td>23</td>
<td>57&lt;sup&gt;b&lt;/sup&gt;</td>
<td>150</td>
</tr>
<tr>
<td>Forestry</td>
<td>116</td>
<td>-</td>
<td>15&lt;sup&gt;a&lt;/sup&gt;</td>
<td>131</td>
</tr>
<tr>
<td>TOTAL</td>
<td>195</td>
<td>25</td>
<td>233</td>
<td>453</td>
</tr>
</tbody>
</table>

Where a = Number assumed poisoned @ 2kg bait/pig
b = sows found poisoned or trapped carried 406 unborn piglets.

- 1990 NPWS results

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Total grain used (incl free feeds)</td>
<td>7 tonne</td>
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<tr>
<td>Total grain poisoned with 1080</td>
<td>560 kg</td>
</tr>
<tr>
<td>Total grain eaten by pigs</td>
<td>360 kg</td>
</tr>
<tr>
<td>Average time to free feed</td>
<td>7 days</td>
</tr>
<tr>
<td>Average time to feed from drum feeders</td>
<td>5 days</td>
</tr>
<tr>
<td>Total time of free feeding</td>
<td>12 days</td>
</tr>
<tr>
<td>Number of pigs poisoned</td>
<td>360^a</td>
</tr>
<tr>
<td>Number pigs shot</td>
<td>40</td>
</tr>
<tr>
<td>Total</td>
<td>400</td>
</tr>
<tr>
<td>• based on 1 kg poison bait per pig</td>
<td></td>
</tr>
<tr>
<td>Total time</td>
<td>14 weeks</td>
</tr>
<tr>
<td>Total man days</td>
<td>163 days</td>
</tr>
<tr>
<td>Total costs (wages, fuel, materials, accommodation)</td>
<td>$29522</td>
</tr>
<tr>
<td>Cost per pig</td>
<td>$73.00</td>
</tr>
</tbody>
</table>

The program so far

Over last 10 years the project has developed several large cooperative programs, eg,
NPWS – Sydney Water around Lake Burrendong
Cox’s River- Megalong Valley
NPWS remote area control in Coxs and Kowmung River systems
Coxs River Catchment Program

• Cooperative program – RLPB, landholders, NPWS, SCA, Forests NSW
• Trapping program using shared resources, eg traps, bait grain, servicing of traps
• 25 traps provided free by RLPB/NPWS
• Trapping selected as more acceptable than poison.
• Boiled grain/molasses bait offered free
• Results to date

2001 254 pigs destroyed
2002 210 pigs destroyed
2003 220 pigs destroyed
2004 190 pigs destroyed

• Program is on-going but some problems with reinvasion from untreated areas and uncooperative landholders