

Appendix A: Parasites and pathogens recorded from wild dogs in Australia (after Corbett 1995a) and their potential effects on wildlife, humans and livestock (after Kelly 1977).

Organism	Locality recorded	Site of infection	Affects humans?	Affects wildlife?	Affects livestock?
Cestodes					
<u>Tapeworms</u>					
<i>Echinococcus granulosus</i>	Queensland NE NSW SE Highlands	Small intestine	yes	yes	yes
<i>Taenia ovis</i>	Probably widespread at very low levels	Small intestine	no	?	yes
<i>Taenia hydatigena</i>	SE Highlands	Small intestine	no	no	yes
<i>Taenia pisiformis</i>	Central Australia SE Highlands	Small intestine	no	yes	no
<i>Taenia serialis</i>	SE Highlands	Small intestine	no	yes	no
<i>Dipylidium caninum</i>	Queensland SE Highlands	Small intestine	yes	no	no
<i>Spirometra erinacei</i>	Queensland Central Australia SE Coastal	Small intestine	yes	yes	no
Undetermined species	North Australia Barkly Tableland	Small intestine	no	no	no
Nematodes					
<u>Hookworms</u>					
<i>Uncinaria stenocephala</i>	SE Highlands	Small intestine	yes	no	no
<i>Ancylostoma caninum</i>	SE Highlands Queensland SE Coastal	Small intestine	yes	no	no
Undetermined species	North Australia	Stomach/ intestine	no	no	no

Organism	Locality recorded	Site of infection	Affects humans?	Affects wildlife?	Affects livestock?
Nematodes					
<u>Roundworms</u>					
<i>Toxacara canis</i>	SE Highlands	Small intestine	yes	no	no
Undetermined species	Central Australia North Australia	Small intestine	no	no	no
<u>Heartworm</u>					
<i>Dirofilaria immitis</i>	North Australia Barkly Tableland SE Highlands	Right ventricle and pulmonary artery	yes	no	no
<u>Lungworm</u>					
<i>Oslerus osleri</i>	SE Highlands	Trachea	no	no	no
<u>Whipworm</u>					
<i>Trichurus vulpis</i>	SE Highlands	Caecum and large intestine	no	no	no
<u>Spiruroid</u>					
<i>Cyathospirura dasyuridis</i>	SE Highlands	Alimentary tract	no	yes	no
<u>Thorn-headed worm</u>					
<i>Acanthacephala</i> sp.	Barkly Tableland	Stomach	no	no	no
Viruses					
<u>Canine distemper</u>					
Paramyxovirus	Central Australia Barkly Tableland	Respiratory tract	no	no	no
<u>Canine Hepatitis</u>					
Adenovirus	Central Australia Barkly Tableland	Liver	no	no	no
Protozoa					
<u>Coccidia</u>					
<i>Isospora rivolta</i>	SE Highlands	Alimentary tract	no	no	no
<i>Eimeria canis</i>	SE Highlands		no	no	no

Organism	Locality recorded	Site of infection	Affects humans?	Affects wildlife?	Affects livestock?
Protozoa					
<u>Sarcosporida</u>					
<i>Sarcocystis</i> sp.	Queensland SE Coastal	Striated muscle and heart muscle	no	?	?
<u>Giardia</u>					
<i>Giardia</i> sp.	SE Coastal	Gastrointestinal system	yes	?	?
Insects					
<u>Biting lice</u>					
<i>Trichodectes canis</i>	SE Australia	Skin	no	no	no
Undetermined speices	Barkly Tableland Central Australia	Skin	no	no	no
<u>Fleas</u>					
<i>Ctenocephalides canis</i>	Probably widespread	Skin	yes	no	no
<i>Ctenocephalides felis</i>	Probably widespread	Skin	yes	no	no
<i>Echidnophaga myrmecobii</i>	Central Australia Barkly Tableland	Skin	no	yes	no
Undetermined species	North Australia	Skin	no	no	no
<u>Marchflies</u>					
(Tabanidae)	Widespread	Skin	yes	yes	yes
<u>Kangaroo flies</u>					
(Hippoboscidae)	SE Coastal	Skin	no	no	no
<u>Mosquitoes</u>					
(Culicidae)	Widespread	Skin	yes	yes	yes
<u>Blowflies</u>					
(Calliphoridae)	Widespread	Wounds	no	no	yes

Organism	Locality recorded	Site of infection	Affects humans?	Affects wildlife?	Affects livestock?
Ticks					
<i>Ixodes holocyclus</i>	SE Coastal highlands	Skin	yes	yes	yes
<i>Rhipicephalus sanguineus</i>	Central Australia North Australia	Skin	no	no	?
<i>Amblyomma triguttatum</i>	Queensland	Skin	no	yes	?
Mites					
<u>Sarcoptic mange</u>					
<i>Sarcoptes scabiei</i>	Widespread	Skin	yes	yes	no
<u>Demodectic mange</u>					
<i>Demodex folliculorum</i>	Central Australia	Sebaceous glands and skin follicles around eyes and nose	yes	no	no
Pentastome Arthropod					
<u>Tongueworm</u>					
<i>Linguatula serrata</i>	SE Australia Central Qld	Nasal cavities	no	?	?
Fungus					
<u>Ringworm</u>					
<i>Microsporium canis</i>	Central Australia	Skin	yes	yes	yes
Leech					
<i>Hirudo</i> sp.	SE Highlands	Skin	yes	yes	yes

Appendix B: Getting the best out of extension: 20 recommendations to help integrate education and extension into wild dog management

(after Andrew 1999)

The following recommendations, combined with available extension materials, will help wild dog management coordinators incorporate effective education and extension into their programs. The recommendations are drawn from pest animal projects that were supported under the Bureau of Resource Sciences' Vertebrate Pest Program (1993–1996) and are aimed at government officers, researchers, extension officers and community members involved in group management. The recommendations are not in priority order although they have been grouped so that similar issues are listed together.

1. *Wild dog management is essentially a social issue.*

While it is true that effective management of wild dogs requires a certain baseline of scientific and technical information, the actual process of management is a social one involving the ideas, activities and relationships of landholders and agency representatives. This means that there is often no predictable and generalisable right or wrong answer to questions to do with management. The values and views of people should be considered and debated as part of the process of management.

2. *Agency representatives who deal with landholders need to have personal qualities, commitment and experience that are respected by the landholders they are working with. It is also important that agency representatives see their interactions with landholders as long-term relationships. Many landholders have seen a 'turnover' of government staff and extension officers and they sometimes have to repeat the same messages to consecutive government representatives. Agency representatives also need to respect the personal qualities and experience of landholders.*

This is perhaps one of the most crucial aspects of a project which involves different interest groups. Relationships between people are complex and interpersonal relationships are central to the success of projects. Projects and working arrangements can stall or fail because of personal clashes. Persistence and patience, conflict resolution abilities and a sense of humour are important attributes of good extension officers and other government officers. Extension and other government officers involved in land management issues need to develop and sustain a genuine level of familiarity and trust with the landholders that they seek to support. This genuine familiarity and trust takes time to develop. Landholders live within social settings with often long-established communication patterns. It is unrealistic to expect to be able to gain worthwhile insights into a social setting with a single, short visit.

3. *Most projects and programs need to be conducted over long periods. Consequently, project managers need to be responsive to change.*

Most farmers and graziers view their enterprise as a long-term business. Many are third, fourth or even fifth generation property owners and consider the significance of their decisions and practices on their children and grandchildren. Some see governments as only being interested in the short-term and with little commitment to the long-term viability of the agricultural sector. Projects need to reflect a commitment to long-term outcomes and must consider changes that occur within government sectors and farming and grazing communities.

4. *Landholders are ultimately responsible for 'on the ground' decisions about land management involving their land. In the long run, landholders will determine whether programs and actions succeed or fail.*

Wild dog management within the agricultural sector is mainly the responsibility of landholders. Therefore they must have a major role in decision making if strategies are to be successful. Nevertheless, they do need to actively consult other groups and individuals with a major interest in the management of wild dogs.

5. *Management options for wild dogs must be seen to be practical by landholders.*

Wild dog management options must be realistic with regard to equipment, labour requirements and cost-effectiveness, and should fit within routine farm operations. These are the practical considerations that landholders face on a daily basis but are often overlooked by researchers and/or agency representatives who have different timetables.

6. *Encourage the involvement of all stakeholders.*

It is important to attempt to involve anyone who is interested in land management issues and also to attempt to seek opinions from a wide range of community and other groups. Individuals within a community have diverse talents, interests and experience. Managers of different enterprises bring different perspectives to resource management issues. Women have contributed greatly to changes within rural communities and it is now acknowledged that they are equal partners in many rural enterprises. Elder members of communities should not be forgotten, as they often know more about a particular district than anyone else. Different cultural groups and individuals often have different traditional ways of knowing and different ways of doing things that bring a greater range of possible solutions to land management problems. Children also can become involved in projects through clubs, schools or through local events and activities. If funds are available, consider using an independent facilitator to manage diverse views or to bring diverse views together.

7. *Identify and work with key players in the community.*

Within communities there are many landowners who are respected for their land management expertise and innovation. These people are often leaders in their community. Working with these people will help gain an insider's view of local land management issues.

8. *Land management issues attract a range of views: expect and respect diversity of opinion.*

It is not reasonable to expect all landholders and agency representatives to agree on any given issue. Aim for a give and take arrangement and value argument: it is a good way of finding out what people want and feel about an issue. It is reasonable for some people to concede on some points but not on others.

9. *The scientific community, supported by government, should provide accessible information. They should also involve landholders and agency representatives in research and data collection.*

Pest animal management requires support information from research agencies and from landholders. If research is to have practical outcomes then it should include landholder information as part of the research process. Researchers should not regard landholders as just data collectors. They have an essential role in ensuring that the research is testing practical management options. Landholders observations may also provide useful directions for research.

10. *The rights of individual land ownership should be respected and data collected from properties should be treated confidentially.*

Landholders have the right to privacy and to respect of both their land and 'intellectual' property rights. Release of data identifying individual landowners should be negotiated with those landowners in the first instance. Usually, it is the pooled information that is of most value to researchers and agency representatives so that individual landholders are not identified.

11. Landholders and others often respond differently to written information and questionnaires than to conversations.

This may simply be because landholders' usual medium of communication is through conversation rather than writing. This point is important to remember when collecting data about peoples' opinions on land management issues.

12. Sustained direct communication is the most valued and effective form of conveying and receiving perspectives on the management of wild dogs.

Talking one-to-one with people is the most effective way of getting people involved and maintaining their involvement in a program. Newsletters, field days, local shed meetings, media promotion and talks at local meetings are also encouraged.

13. Access to information should be efficient and easy.

All people in a community should be informed about and able to access information associated with land management projects that is relevant to their district. Information could be presented via a number of different means such as: local media, newsletters, mail-outs, presentations at meetings and informal gatherings. Individuals and groups should be provided with a contact list of people with various types of expertise and knowledge that they can call upon if required (for example, indigenous, historical, scientific, financial etc).

14. Consider ways of getting information to the wider community and other interested groups.

Many cheap and easily accessible information channels exist to inform other people about projects. Local media will often respond to a story involving local landholders. Displays and notices on bulletin boards and notice boards at local stores, halls and at special events will help spread the news. Write stories for Landcare and other rural newsletters and write to or give talks at meetings of other groups in the district. Word-of-mouth is one of the most important ways of spreading the word about local projects.

15. Frequent, organised meetings that involve committed representatives from all stakeholder groups are necessary if 'on the ground' change is expected as an outcome.

Information about the issues to be discussed should be circulated to all stakeholders well ahead of meetings so that representatives may consult with and receive advice from their constituents. Representatives should be people within an organisation or district who have a commitment to consultation and who will give feedback to the people whose views they represent.

The management group size should be determined by the ability of those taking the main responsibility for pest management (those representing stakeholders) to feedback information on a regular basis and receive responses from others and to meet any queries from those whom they represent. Mechanisms for informing all people should be clearly thought out so that representatives do not merely 'rubber-stamp' proposals and actions that their constituents may not know about.

16. Meetings should always have a clear purpose that relates to the needs of landholders. They should be held at times that suit landholder schedules.

The best meetings are those that reflect wild dog management developments that have occurred on the ground between meetings, rather than those that can be perceived as purely paper exercises. Meetings should also be held at times that are negotiated with landholders. This includes consideration of seasonal work, day of the week, time of day, and length of the meeting. Try to tie wild dog management meetings into existing meetings such as landcare and bushfire meetings. Often a social event such as barbecue is a useful way of bringing people together. This also gives people time to discuss issues in a relaxed atmosphere.

17. *Wild dog management practices need to be viewed within a broader legal and policy context.*

Governments at all levels should provide broader framework considerations (for example Ecologically Sustainable Development, biological diversity, legislative requirements) within which on the ground pest management practices can be located and to which they can contribute. Plain language versions of these policy statements should be made readily available to all participants.

18. *All costs and benefits need to be considered.*

Whatever technique is used to calculate costs and benefits it should be remembered that different managers have different concerns and priorities. Many aspects of land management and broader lifestyle interests have values that are difficult to quantify in monetary terms and cannot necessarily be generalised. A common difficulty with attempts at cost–benefit analysis is the time it takes and the complexity of some formulas that seem irrelevant to landholders. This is so, particularly for those who consider that the impact of any pest is worth managing or, at the other extreme, those that are completely uninterested in pest management regardless of the demonstrated economic benefit.

19. *The pain and suffering of animals should be considered in decision making.*

Ethical considerations are an aspect of pest animal management that cannot be ignored. Many methods of pest management inevitably inflict pain and suffering on animals. Discussion about this issue and relevant information about various management methods must be considered as part of any pest animal management project if these methods are to be regarded as best practice. The most humane methods available should be preferred.

20. *Cultural and heritage issues should be considered in decision making.*

Many land management decisions affect cultural and heritage sites. Consideration must be given to the relationship between cultural and economic interests as part of any pest animal project.

Some suggested extension materials

- a. National pest management guidelines including this publication. Other guidelines are available for rabbits, foxes, feral goats, feral pigs, rodents, feral horses and carp.

Australia's Pest Animals: New Solutions to Old Problems (Olsen 1998)

New Approaches to Managing Pest Animals (an extension folder)

These are available from the Bureau of Rural Sciences in Canberra (internet:

<http://www.affa.gov.au/outputs/ruralscience.html>).

- b. State and Territory agriculture and conservation departments provide factsheets on various pest animal issues.
- c. Specific local information can be obtained from regional agricultural protection officer and/or park service.

Appendix C: Authors' biographies

Peter Fleming

Peter Fleming is a senior research officer with the Vertebrate Pest Research Unit of NSW Agriculture. Since 1983, he has studied the impacts and management of flying foxes, bird pests, European red foxes, feral pigs and feral goats. Most of Peter's research has been in the highlands of eastern New South Wales where he is primarily interested in assessing the impacts of wild dogs on livestock production and the improvement of management strategies for wild canids. Peter has published over 60 research and extension articles about vertebrate pests. He is currently researching the interactions of feral goats and domestic livestock for exotic disease contingency planning, and is also responsible for an integrated program for wild dog management in south-eastern New South Wales and the Australian Capital Territory.

Laurie Corbett

Dr Laurie Corbett is a specialist in ecosystem assessment and management with over 30 years field experience studying the ecology of vertebrate predators and their prey, fire ecology and the management of feral animals. He has extensive knowledge of canids, felids, raptors and reptiles in Australia, Scotland and south-east Asia and is recognised as a world authority on dingoes. He is the author or co-author of more than 140 publications, of which over 50 specifically relate to wild dogs. Formerly with the CSIRO Division of Wildlife & Ecology, Dr Corbett is currently a principal ecologist with EWL Sciences Pty Ltd, based in Darwin.

Robert Harden

Robert Harden is the Vertebrate Pests Team Leader in the Biodiversity Research Group of NSW National Parks and Wildlife Service. He has more than 30 years of research experience of the ecology and management of wild dogs in the eastern highlands of NSW and has published many research and extension articles on vertebrate pest management. His recent research includes the development of management strategies for introduced rodents on Lord Howe Island, the rehabilitation of the Lord Howe Island woodhen, the management of feral goat impact in the eastern highlands of NSW and the impact of fox baiting on spotted-tailed quolls.

Peter Thomson

Peter Thomson is a research scientist with over 20 years field experience working on the ecology and management of canids in Australia. Much of his career was devoted to a long-term study of dingoes in the north-west and Nullarbor areas of WA, and in more recent years, to various studies relating to the control of foxes. He has published numerous articles and scientific papers on dingoes and foxes. He leads the Vertebrate Pest Research group of Agriculture Western Australia and is currently involved in studies on a number of different pests.

Abbreviations and Acronyms

ANKC	Australian National Kennel Council	NHT	Natural Heritage Trust
ANZFAS	Australian and New Zealand Federation of Animal Societies	NLP	National Landcare Program
APB	Agriculture Protection Board (Western Australia)	NPWS	National Parks and Wildlife Service (New South Wales)
APCC	Animal and Plant Control Commission, South Australia	PWC	Parks and Wildlife Commission (Northern Territory)
AGWEST	Agriculture Western Australia	QDNR	Department of Natural Resources (Queensland)
BRS	Bureau of Rural Sciences (formerly Bureau of Resource Sciences)	RLPB	Rural Lands Protection Board (New South Wales)
CALMWA	Department of Conservation and Land Management (Western Australia)	RSPCA	Royal Society for the Prevention of Cruelty to Animals (Australia)
CPUE	Catch-per-unit-effort	SCARM	Standing Committee on Agriculture and Resource Management
CWR	Critical Weight Range (mammals weighing 35–5500 grams)	<i>s.d.</i>	Standard deviation
DNA	Deoxyribonucleic acid	SDP	Stochastic dynamic programming
ESD	Ecologically Sustainable Development	VPC	Vertebrate Pests Committee
GPS	Global positioning system	WDCA	Wild Dog Control Association (New South Wales)
NERDA	New England Rural Development Association	WDDB	Wild Dog Destruction Board (western New South Wales)
NFACP	National Feral Animal Control Program (a NHT program)		

Glossary

1080: Sodium fluoroacetate. An acute metabolic poison without antidote; particularly toxic to canids.

Bait: Attractive substance fed to pest animals that can be used to carry a poison or contraceptive or to lure animals into traps.

Bait mound: Specialised bait station where bait is buried in the centre of a mound of friable soil to minimise bait removal by non-target animals.

Bait station: A specific site used for the repeated placement of bait.

Biocontrol (biological control): Control of pest populations using a specific biological agent such as a virus, bacterium or predator (for example, myxomatosis).

Biodiversity: Biological diversity. The natural diversity of living things, usually defined at three levels: genetic, species and ecosystem.

Blastocyst: Early, multicellular stage of embryo development in marsupials at which development is postponed. Delayed implantation of the blastocyst in the uterus allows birth to correspond with seasonal flushes of food or the loss of an embryo or pouch young.

Bounty (bonus): Predetermined reward paid on presentation of evidence (for example, scalp) of the destruction of an animal (for example, wild dog).

Canid: A member of the family Canidae comprising 13 species of wolves, jackals, dogs and foxes.

Carnivore: A flesh-eating animal or a member of the Order Carnivora.

Carnivora: Order of mammals including wolves, dogs, foxes, otters, cats, weasels, bears, raccoons, civets and hyenas.

Carrying capacity: Density of an uncontrolled population of animals that is in equilibrium with their natural resources and competitors.

Chromosome: Threadlike structure in the nucleus of a cell which carries the genetic material (genes) of heredity.

Commensal dogs: Wild dogs (including dingoes, domestic breeds and hybrids) living in close association with but independently of humans (for example, dingoes foraging in rubbish bins at camping grounds on Fraser Island).

Competition: A number of organisms of the same or different species using common resources that are in short supply (exploitation competition), or organisms seeking a common and abundant resource harming each other in the process (interference competition).

Conservation values: Values attributed to maintaining biodiversity, including the preservation of viable populations of native species and natural communities over their natural range, preservation of wilderness and prevention of land degradation.

Conspecific: A member of the same species.

Contingent value: The unpriced value that people place on maintaining things such as open space, clean air and endangered species. The social value of these things is often poorly represented by the market value of the land where they occur. Contingent value can be estimated by asking consumers of their willingness to pay to maintain a resource.

Correlation: Statistical relationship between two or more variables where a change in one variable is reflected in a proportional change in the other.

Critical weight range (CWR) mammals:

Australian mammals with live weights between 35 grams and 5500 grams that are believed to be more vulnerable to extinction by predation.

Curvilinear relationship: Curved line relationship between two or more variables.

Demographics: Statistics relating to population dynamics, including birth rates, mortality rates, age and sex ratios.

Density dependence: Regulation of the size of a population by mechanisms that tend to retard population growth as density increases and enhance population growth as density declines.

Dingoes: Native dogs of Asia selected by humans from wolves. Present in Australia before domestic dogs. Pure dingoes are populations or individuals that have not hybridised with domestic dogs or hybrids.

Discount rate: The rate used to calculate the present value of future benefits or costs. It is calculated using the reverse equation to that used to calculate interest rates on invested money.

Dispersal: Movement of an animal away from its birth or breeding site.

Dispersion: The spatial pattern of a population of organisms relative to one another.

Distribution: The geographical area (range) in which a group of organisms occurs.

Diurnal: Active during the day.

DNA: (deoxyribonucleic acid) The genetic material in the cells of most living organisms, which is a major constituent of the chromosomes in the cell nucleus.

DNA fingerprinting (or mapping): A technique in which an individual's DNA is analysed to reveal the pattern of genetic material within particular segments. This pattern is claimed to be unique to individuals, and closely related individuals have similar patterns.

Dogger, dogman: A pest controller who specialises in the removal of wild dogs, usually by trapping or shooting.

Domestic dogs: Dog breeds (other than dingoes) selected by humans, initially from wolves, that usually live in association with humans. This selection process is ongoing.

Ecosystem: Ecological system formed by interaction of living things and their environment.

Efficacy: Ability to produce desired effects.

Efficiency: The accomplishment of desired effects in relation to the effort (or cost) expended to produce those effects (often expressed as a rate).

Endangered species: Species in danger of extinction and whose survival is unlikely if causal threatening processes continue to operate.

Endemic: Limited to a certain region, country or group.

Endemic disease: Disease that occurs in a region or country.

Eradication: Permanent removal of all individuals of a species from a defined area.

Exotic: Introduced from another country (for example, exotic species).

Exotic disease: Disease that does not occur in a region or country.

Extant: Still existing; not destroyed or extinct.

Extrapolation: Interpreting data beyond the dimensions within which it is collected (for example, assuming conclusions drawn from data collected in one region will be relevant elsewhere).

Fecundity: The number of live births over an interval of time.

Feral: Domesticated species that has established a wild population.

Feral dogs: Wild-living dogs of domestic breeds.

Fertility: The ability to produce young.

Free-roaming dogs: Dogs that are owned by humans but not always restrained and so are free to travel away from their owner's residence (includes commensal dogs).

Friable: [Soil that is] easily crumbled.

Functional response: Relationship between per capita food intake rate and food availability.

Genotype: Genetic constitution of an organism.

Gestation: Pregnancy.

Global positioning system (GPS): Small device that uses satellite signals to accurately locate the user's position (latitude, longitude and altitude).

Gregarious: Living in groups.

Home range: Area that an animal (or group of animals) ranges over during normal daily activities. The boundaries of the home range may be marked (for example, wild dogs use scent marks) and may (see territory) or may not be defended, depending on species.

Howl up: Wild dogs are lured to a hunter imitating the howling of a dingo.

Hybrids: Progeny resulting from the crossbreeding of two different species or subspecies and the descendants of crossbred progeny (for example, dogs resulting from crossbreeding of a dingo and a domestic dog).

Hydatidosis: Disease caused by hydatid worm (*Echinococcus granulosus*) infection.

Immunocontraception: A form of fertility control where a substance that triggers an immune reaction causes sterility or reduced fertility in affected animals.

Indices of abundance: Field signs that can give a relative measure of dog abundance (for example, howls, fresh droppings, tracks, bait acceptance).

Ingested: Taken orally.

Intangibles: Values that cannot be numerically quantified (for example, that for which it is difficult to estimate a money value).

Interference competition: see Competition.

Isopleth: A line drawn on a map through points having the same numerical value for any element (for example, an isobar joins points with the same barometric pressure).

Karyotype: Number and structure (gene sequence) of the chromosomes in the nucleus of a cell. All the cells in an individual have the same karyotype (except for sperm and egg cells).

Latent period: The time lag between an action and a response.

LD₅₀: Dose (per kilogram of body weight) that will, on average, kill 50% of treated animals.

LD₁₀₀: Dose (per kilogram of body weight) that will, on average, kill 100% of treated animals.

Linear programming: A mathematical modelling approach that uses simultaneous linear equations for optimising decisions under resource limitations. A linear programming problem has a linear objective function (for example, to maximise whole-farm gross margins from livestock production) and a set of linear constraints (for example, the density of wild dogs, enterprise type, labour and capital resources) arranged in an array.

Linear relationship: Straight-line relationship between two or more variables.

Lure: Attractant (usually an odour-producing substance) which is used to enhance the effectiveness of baiting programs or to attract an animal to a trap site.

M-44 ejector: mechanical ejector for delivering encapsulated toxin to canids. The device is triggered by the canid pulling on bait material connected to the ejector. This releases a compressed spring within the ejector which drives a rod through a toxin capsule, propelling the contents of the capsule into the animal's mouth. The advantages of this system are that devices can be left loaded as sentinel stations, without degradation of the toxin over time. The pull pressure can also be adjusted so that it is only likely to be triggered by canids and the device ensures that the full complement of toxin is ingested to reduce sub-lethal poisoning.

Marginal benefits: The shift in benefit values that occur as incremental changes are made in the factor(s) which affect level of benefits (for example, changes to livestock losses that occur as wild dog density is reduced).

Marginal costs: The shift in cost values that occur as incremental changes are made in the factor(s) which affect level of costs (for example, changes in the cost of finding and removing an extra wild dog that occur as wild dog density is reduced).

Mark-recapture: Technique of live catching, tagging, releasing and then recapturing animals, and using a formula to estimate population size from the proportion of recaptured animals that are tagged.

Market failure: Occurs when resources are not allocated efficiently through the use of the market, that is, when the costs and benefits to society are not equated by the natural market forces of supply and demand (for example, unsustainable use of natural resources or development of social inequities).

Mesopredator release: The process whereby the removal or loss of higher order predators results in the increase in abundance of and substitution by lower order predators. The negative impacts of mesopredators on small mammal populations may be greater than the higher order predators.

Monoestrus: Having a single oestrus period in one sexual season or year.

Morbidity rate: Proportion of a population affected by disease for a given time interval. Usually expressed as a per capita rate.

Mortality rate: Proportion of a population dying during a given time interval. Usually expressed as an instantaneous per capita rate. In seasonal breeders such as dingoes mortality may be an annual death rate.

Nocturnal: Active at night.

Non-target (animal/species): Animal or species that is accidentally killed or injured by a control measure (for example, domestic dogs or native wildlife caught in wild dog traps).

Oestrus: The phase of the female reproductive cycle when they are fertile and ovulation occurs, sometime referred to as 'sexual heat'.

Opportunistic feeding: Non-selective feeding occurring when the opportunity arises.

Pack: A social grouping of canids, usually genetically related. Wild dogs may hunt as a whole pack, as a sub-group or individually.

Per capita: Per head of population (for example, food consumption per sheep is per capita food consumption).

Pest: Harmful, destructive or troublesome organism.

Phenotype: The characters of an organism due to the interaction of genotype and environment.

Population: Groups of animals of a particular species occupying an area where they are subject to the same broad set of environmental or management conditions.

Population dynamics: The process of numerical and structural change within populations resulting from births, deaths and movements.

Population limitation: A factor is limiting if a change in the factor produces a change in average or equilibrium density of a population. For example, predation by wild dogs may limit the density of a prey population if abundance of the prey is higher when wild dogs are absent.

Population regulation: A factor is regulating if the percentage mortality that it causes increases with population density (sometimes called density-dependent regulation). For example, a disease may regulate wild dog abundance if it causes higher percentage mortality as wild dog density increases.

Predator: An animal that kills other animals for food.

Prevalence: The number of instances of disease, or related attributes (e.g. infection or presence of antibodies) in a known population at a designated time, without distinction between old and new cases.

Prey: An animal hunted or seized as food by a flesh-eating animal.

RANGEPACK: A computer software package (produced by CSIRO) with modules that aid management decisions for livestock enterprises, particularly for those in the arid zone. Modules include *Herd-Econ*, which models herd dynamics and property economics, *Climate* that uses past rainfall data to model the probability of rainfall events and *Paddock*, which predicts grazing patterns within paddocks.

Pro-oestrus: Preparatory phase of the oestrus cycle when the female reproductive system is active but preceding ovulation (egg release).

Reactive control: Control activities in response to the presence of or damage by vertebrate pests.

Regression equation: An equation which describes the relationship between two or more variables.

Species: Group of interbreeding individuals not breeding with another such group and which has characteristics that distinguish it from other groups.

Species-specific: Affecting only the targeted species.

Standard deviation (s.d.): The standard deviation of a sample is an estimate of its variability around a mean value, and is calculated from the square root of the variance (s^2):

$$s.d. = \sqrt{\sum_{i=1}^n (x_i - \bar{x})^2 / n - 1}$$

where x_i = value of each measurement from 1– i ; \bar{x} = sample mean; and n = sample size.

Strategic control: Using historical evidence and current knowledge to devise strategies that prevent damage caused by vertebrate pests before damage commences.

Stochastic: Incorporating some degree of natural variation which has a mathematically calculable probability.

Stochastic dynamic programming: A mathematical approach to modelling the effects of problems (such as weeds, pests or harvest rates) on production systems, which incorporates measured uncertainty (stochasticity) and the dynamics of the population (of weeds, pests or resource). The objective function is often specified as the present value of the expected returns, which may include the decision makers' risk preference.

Subspecies: Group of individuals within a species, having certain characteristics which distinguish them from other members of the species, and forming a breeding group.

Surplus killing: Predatory activity where prey are attacked and killed in excess of the immediate and short-term food requirements of the predator (Kruuk 1972b). Surplus killing behaviour may result in a number of surviving prey showing injuries.

Sustainability: Continuing in present form and at current level in the longer term.

Sustained control: Continued control in the longer term.

Territory: The area occupied by an animal, or by a pair or group of animals, which it or they will defend against intruders. 'Territory' and 'home range' are synonymous for some canids.

Transect: A line (linear plot) through a study area on which data collection occurs.

Trap night: One trap set for one night (for example, if three traps were set for two nights each, this would be six trap nights).

Top order predator: Animal at the top of the food chain. These animals are only preyed upon by other top order predators including humans.

Ungulate: Hoofed herbivore such as the horse, goat, sheep, pig and antelope.

Unpriced value: Values for things that are not exchanged in regular markets and as such do not have a monetary price, for example, scenery.

Varanid: The family Varanidae comprises a group of about 30 species, generally known in Australia as goannas.

Vertebrate: Animal with a backbone.

Wild dogs: All wild-living dogs, including feral dogs, dingoes and hybrids.

Wilderness: Land that has been essentially unmodified since European settlement.

x-axis: The horizontal axis on a graph.

y-axis: The vertical axis on a graph.

Zoonoses: Diseases that are transmitted between animals and humans.

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Managing the Impacts of Dingoes and Other Wild Dogs is the first book to provide a comprehensive review of the history and biology of wild dogs in Australia, the damage they cause, and community attitudes to their management.

Australia's wild dogs include dingoes, introduced around 4000 years ago, feral domestic dogs and hybrids between the two. They are widely distributed throughout Australia. Predation and harassment of stock by wild dogs causes millions of dollars worth of losses to Australian sheep, cattle and goat producers each year. There are also opportunity costs in areas where sheep are not grazed because of the high risk of wild dog predation. For this reason, wild dog control is a significant expense for many pastoralists and government agencies. Yet conservation of pure dingoes is also important and is threatened by their hybridisation with feral domestic dogs on the mainland.

Key strategies for successful wild dog management are recommended by the authors, who are scientific experts on wild dog management. The strategies are illustrated by case studies.

Managing the Impacts of Dingoes and Other Wild Dogs is an essential guide for policy makers, pastoralists, conservation reserve managers and all those interested in wild dog management.