

When wild dogs come to town: Management in peri-urban areas where dogs, policy and people meet

PETER FLEMING¹, GUY BALLARD¹, PAUL MEEK^{1,2},
BENJAMIN ALLEN^{1,3}, MATTHEW GENTLE³ AND GREG MIFSUD^{2,3}

¹ Vertebrate Pest Research Unit, Biosecurity NSW, NSW Department of Primary Industries

² Invasive Animals Cooperative Research Centre

³ Biosecurity Queensland, Department of Employment, Economic Development and Innovation

Traditionally, society has focussed on what to do about unrestrained town dogs that wander through urban areas and beyond. Far less attention has been given to the issue of wild dogs that come to town.

These animals are frequently undetected, or misidentified, but available information suggests they are becoming increasingly common visitors to towns and cities throughout eastern Australia.

As threats to domestic animals, and potentially to humans, we must consider how we can effectively manage the problem when most wild dog related legislation and policy is geared towards rural scenarios. We review what is known about peri-urban wild dogs, highlight knowledge gaps and key limitations to effective management and discuss research priorities for avoiding significant human-animal, animal-animal and human-human conflicts in the future.

Introduction

Dogs have always come to town and, indeed, that anthropic behaviour probably started the selection of dogs from wolves (von Holdt *et al.* 2010). The varied relationship between dogs and urban humans is ongoing and worldwide, but, with notable exceptions (e.g. Beck 1973), is little studied. The free-ranging dogs that are in and around Australian towns fall along a continuum from totally restrained pets that rarely leave their owner's house, through unrestrained pets that are free to range away from home, through stray un-owned dogs, to totally free-ranging dingoes and other wild dogs.

Dingoes, most likely tame and restrained, came to Australia from the north on the boats of South East Asian traders about 4,500 years ago (Corbett 2001; but see Oskarsson *et al.* 2011 for a possible earlier date of entry). These dogs were likely

originally associated with the camps of indigenous Australians, before hearing the "call of the wild" (London 1903) and straying into independence well before Europeans reached Australia. Dingoes have filled a commensal role with indigenous Australians, sometimes being kin, companions, hunters, bedwarmers and food (Smith and Litchfield 2009), and always being scavengers (e.g. Allen 2010). The different roles of dingoes are recognised in some Indigenous languages, where there were different words for dogs in different places. For example, in the Warlpiri language of the Tanami region, camp dogs can be *jarntu* and *maliki* and dingoes can be *waltiki* and *warnapari* (Swartz 2012).

The dogs brought to Australia by Europeans have become unrestrained and come to town (where they have "gone to town") since early in European settlement. In the early 1800s, interestingly-worded laws were passed to control them in the growing townships, e.g. the *NSW Dog Nuisance Act 1830*:

"the Streets of the Towns of Sydney Parramatta Liverpool and Windsor are infested by the great number of dogs which are allowed to go loose at all hours of the day and night to the danger of passengers as well as to the great annoyance of the inhabitants at large ... if any dog ... shall be at large and shall attack any person passing in a street of any town or on any highway or turnpike road on foot on horseback or in a carriage the owner or proprietor of such dog shall forfeit and pay a fine" (Gamble *et al.* 1988).

Free-ranging dogs continue to cause problems for human communities, and skin infections and bites by dogs can be a serious issue of public health, particularly for children (e.g. Currie and Carapetis 2000; Ozanne-Smith *et al.* 2001). Here we briefly review the impacts and management of peri-urban dogs in Australia, highlight knowledge gaps and key limitations to effective management of free-ranging

dogs in and around urban areas and identify areas of research involvement in the issues pertaining to their management.

Impacts

The negative impacts of urban and peri-urban free-ranging dogs are of growing public concern, particularly in remote communities and eastern Australian coastal cities (Atkinson 2008; D. Sheil, Senior Pest Management Officer, Morton Bay Regional Council, pers. comm. 2011). Human and companion animal safety are the issues that cause most angst, but human amenity and environmental impacts are also important. Potential threats to public health include: direct attack on people resulting in mauling and rarely death (Healy 2007); direct attack on companion animals and/or domestic livestock resulting in mauling and commonly their death and distress for the owners; a potential source of parasite infection for ruminants (e.g. neosporosis, infectious agent *Neospora caninum*, King *et al.* 2011); a potential source of zoonotic infection (e.g. hydatids, agent *Echinococcus granulosus*, Jenkins 2006; toxoplasmosis, agent *Toxoplasma gondii*, Etheredge *et al.* 2004) through contamination of school grounds, municipal parks and bushland reserves with free-ranging dog droppings; loss of amenity through disturbance or fouling of public infrastructure including rubbish bins; psychological and emotional trauma caused by the loss of domestic animals (Fleming *et al.* 2010); and fear of free-ranging dog attacks on people and resultant alteration or curtailment of normal human activities.

Other studies have investigated disease prevalence among dogs associated with remote communities (e.g. Brown *et al.* 2006; King *et al.* 2012). Allen (2006a; b) showed that a large proportion (17 of 30) of free-ranging dog faecal samples collected in peri-urban areas of south east Queensland contained propagules of zoonotic organisms.

The effects of free-ranging dogs on urban and peri-urban wildlife is also understudied, but free-ranging dogs are recognised as a threat to peri-urban koala populations in communities from south east Queensland (McAlpine *et al.* 2006) to the Central Coast of New South Wales (Lunney *et al.* 2007). Impacts on wildlife includes disease interactions where dogs are an intermediate host in a sylvatic cycle, e.g. hydatidosis of brush-tailed rock-wallabies, *Petrogale penicillata* (Barnes *et al.* 2010), or are direct carriers of diseases that affect domestic dogs (e.g. mange).

With the notable exceptions of cases such as Azaria Chamberlain and Clinton Gage where their deaths were ascribed to attack by free-ranging dingoes at Uluru and Fraser Island respectively, data

about attacks by free-ranging dogs in peri-urban environments are impossible to dissect from general dog attacks.

In NSW it has been required since 2008 that Councils report dog attacks to the Department of Premier and Cabinet (e.g. Division of Local Government 2012). However, it is difficult to determine which of the 5,140 attacks by unrestrained dogs in 2010/11 on people and pets were by truly free-ranging dogs. Pets attacked by dogs usually died (Division of Local Government 2012), which causes trauma for the owners. This human aspect of dog attacks has not been unstudied.

Although veterinary practitioners treat pets attacked by free-ranging dogs, it is impossible to tease out those caused by the un-owned dogs from those caused by the merely unrestrained. There is little information recorded about attacks on pets and livestock on small acreage near urban environments. One exception is the Kempsey district on the north coast of NSW, where between 280 and 813 pets and small livestock were killed annually by free-ranging dogs for the years 2003 to 2008 (Willey *et al.* 2008).

All these negative impacts of free-ranging dogs cause conflict, which is exacerbated because of the contradiction with the beneficial roles that dogs are presumed to have for people (e.g. Beck 2000; Hergovich *et al.* 2002). Attacks by dogs often have lasting effects on the relationships between people and dogs.

Policy and management

Management of free-ranging dogs in urban and adjoining rural areas is complicated by a lack of knowledge on free-ranging dog ecology by affected stakeholders, many of whom are unaware of the local presence of free-ranging dogs until they are involved in an incident (Allen 2006a; Atkinson 2008).

Legislation and policy about the management of free-ranging dogs varies between States, and its implementation in urban and peri-urban areas is sometimes confounded because of uncertainty about the status of the dogs. In New South Wales for example, pet and working dogs fall under the *Companion Animals Act 1998*, with responsibility for their activity falling on the owner. Un-restrained dogs are not considered to be controlled by their owners and so can be impounded by council staff or can be killed on agricultural holdings. However, it is difficult for a council worker to restrain a free-ranging dog in an urban or peri-urban area when it has no owner or experience of being handled. Such dogs are considered "wild dogs" under the *Rural Lands Protection Act 1998*, and are required to be controlled by land owners and occupiers, but are often not recognised for what they are in closer-

settled environments. Uncertainty about status sometimes leads to inaction because responsibility is not clear.

Ecology

The ecology of free-ranging dogs in and around human communities is fertile ground for research. Only one study has been undertaken about the ecology of peri-urban wild dogs in eastern Australia (Allen 2006a; b) and Newsome (2011) investigated aspects of free-ranging dog ecology around a remote mining community in the Tanami Desert. Both these studies showed the importance of human resource subsidies to wild dog movement behaviour and diet.

The movements of nine dingo-like free-ranging dogs in south east Queensland coastal communities over a few months indicated that home range sizes in urban settings were very much smaller (mean 2.2 km², 100% MCP estimate, Allen 2006a) than for free-ranging dogs in eastern agri-ecosystems (27km²; ~10–100 km²; 42.5–124.3km² for Harden 1985; Claridge *et al.* 2009; Robley *et al.* 2010 respectively, all 100% MCP estimates). However, Allen's (2006a) study was short term (7–45 days) with high frequency of GPS logging of locations and needs to be repeated over a longer time frame to ascertain seasonal differences in home range size and use.

Newsome's (2011) study could not have been in a more different environment to Allen's (2006a). The mine community had a two refuse tips, the vast majority of food waste going into one of which. However, Newsome (2011) found that home range size for dingoes wholly associated with the mine community was about 40 times smaller (10km², 85% Kernel estimate) than dingoes that lived away from the mine, which supported Allen's findings. The small home range sizes are likely the product of purposeful and accidental anthropogenic food subsidies (Newsome 2011). Although Allen and Leung (2012) briefly report the diets of peri-urban dogs in their broader examination of free-ranging dog diets, the importance of highly digestible domestic dog food and refuse to peri-urban dogs and its influence on their movements is unknown. One could reasonably expect on the basis of Newsome (2011) that sources of regular subsidy would be more visited by free-ranging dogs, and that these are likely foci for aggressive and other interactions with pets and children.

Knowledge gaps and research

Free-ranging dog management in peri-urban settings is often contentious and difficult to implement given the variety of stakeholders with wide-ranging and often conflicting ideologies. The

dingo proportion is often held as iconic and subject to conservation efforts, yet once pets or people are attacked or harassed these attitudes can be rapidly reversed. This conflict is compounded by a general lack of understanding about wild dog ecology and the effectiveness of management techniques in these environments.

Impacts of free-ranging dogs are increasingly being felt by livestock producers on small holdings and residents of towns and suburbs throughout the more populated areas of eastern NSW and Queensland (e.g. Willey *et al.* 2008). Generally, the impacts on people, livestock and pets have not been quantified or analysed for patterns that might suggest mitigation strategies. Free-ranging dogs in these areas can also have substantial impacts on increasingly fragmented conservation estates around human communities and these too are mostly unquantified.

The disease implications of free-ranging dogs where dogs and people interact are also unquantified. The contacts between free-ranging and restrained dogs are fundamentally important for predicting the epidemiology of diseases such as mange and rabies, yet there have been no studies to date of this important interaction. A collaborative project addressing rabies preparedness is being undertaken between Animal Management in Rural and Remote Indigenous Communities (AMRRIC), University of New England, University of Sydney and the authors.

In various forums, bodies such as AMRRIC and local governments throughout Australia have consistently identified the need to improve our understanding of peri-urban free-ranging dog ecology and behaviour so that tools, strategies and policies can be developed for their management. This information is required to assist in planning and coordinating control activities and raise the awareness and capacity of communities to deal with the issue.

The Invasive Animals Cooperative Research Centre, with councils from south east Queensland and north eastern NSW, is embarking on a project that will develop best practice management strategies and guidelines for implementation in peri-urban areas. Specifically, the project will study detailed daily movements, survival rates, and habitat use within participating local government areas. Stomachs and faeces will be collected and analysed for dietary composition and dependence on human provided subsidies. This will provide an indication of the relative importance of native and anthropogenic food sources, potential impact on native fauna and competition with other species, and likely foraging places. Tissue samples will be collected from free-

ranging dogs euthanized as part of routine control programs conducted within and adjacent to peri-urban research sites. Samples will be assessed for genetic purity (i.e. domestic dog versus dingo origin) and gene flow between sampled populations. Gene flow can be used to determine if a region acts as a single/multiple demographic management unit (based on dispersal among locations) and appropriate management units can be set. Patterns of movement between and within rural and urban dog populations can also be determined. This information will provide direction for more targeted wild dog management. Most importantly, the impacts of free-ranging dogs on people, their pets and livestock and iconic urban wildlife will be assessed.

References

- Allen, B. L. (2006a). 'The spatial ecology and zoonoses of urban dingoes – a preliminary investigation'. Honours Thesis. (The University of Queensland: Gatton).
- Allen, B. L. (2006b). Urban dingoes (*Canis lupus dingo* and hybrids) and human hydatid disease (*Echinococcus granulosus*) in Queensland, Australia. In: *22nd Vertebrate Pest Conference* (eds R. M. Timm and J. M. O'Brien) pp. 334-338. The University of California, Davis, Berkeley, California.
- Allen, B. L. (2010). Skin and bone: Observations of dingo scavenging during a chronic food shortage. *Australian Mammalogy* **32**, 1-2.
- Allen, B. L. and Leung, L. K.-P. (2012). Assessing predation risk to threatened fauna from their prevalence in predator scats: dingoes and rodents in arid Australia. *PLoS ONE* **7**, e36426.
- Atkinson, S. A. (2008). Dingo control or conservation? Attitudes towards urban dingoes (*Canis lupus dingo*) as an aid to dingo management. In: *23rd Vertebrate Pest Conference* (eds R. M. Timm and M. B. Madon) pp. 145-147. University of California, Davis, California.
- Barnes, T. S., Goldizen, A. W., Morton, J. M. and Coleman, G. T. (2010). Parasites of the brush-tailed rock-wallaby (*Petrogale penicillata*). *Journal of Wildlife Diseases* **46**, 218-228.
- Beck, A. M. (1973). 'The ecology of stray dogs: a study of free-ranging urban animals'. (York Press: Baltimore).
- Beck, A. M. (2000). The human-dog relationship: a tale of two species. In: 'Dogs, zoonoses and public health.' (Eds C. N. L. MacPherson, F. X. Meslin and A. I. Wandeler). pp. 1-16. (CABI: Wallingford).
- Brown, G. K., Canfield, P. J., Dunstan, R. H., Roberts, T. K., Martin, A. R., Brown, C. S. and Irving, R. (2006). Detection of *Anaplasma platys* and *Babesia canis vogeli* and their impact on platelet numbers in free-roaming dogs associated with remote Aboriginal communities in Australia. *Australian Veterinary Journal* **84**, 321-325.
- Claridge, A. W., Mills, D. J., Hunt, R., Jenkins, D. J. and Bean, J. (2009). Satellite tracking of wild dogs in south-eastern mainland Australian forests: Implications for management of a problematic top-order carnivore. *Forest Ecology and Management* **258**, 814-822.
- Corbett, L. K. (2001). 'The dingo in Australia and Asia'. (J.B. Books, South Australia: Marleston).
- Currie, B. J. and Carapetis, J. R. (2000). Skin infections and infestations in Aboriginal communities in northern Australia. *Australasian Journal of Dermatology* **41**, 139-143.
- Division of Local Government. (2012). 'Council reports of dog attacks in NSW 2010/11'. (NSW Department of Premier and Cabinet: Sydney).
- Etheredge, G. D., Michael, G., Muehlenbein, M. P. and Frenkel, J. K. (2004). The roles of cats and dogs in the transmission of *Toxoplasma* infection in Kuna and Embera children in eastern Panama. *Revista Panamericana de Salud Publica/Pan American Journal of Public Health* **16**, 176-186.
- Fleming, P. J. S., Allen, B. L. and Ballard, G.-A. (2010). Seven considerations about dingoes as biodiversity engineers: the socioecological niches of dogs in Australia. *Australian Mammalogy*, -.
- Gamble, H., Scott, R., Phegan, C. and Byrne, P. (1988). 2. The history of the law relating to dogs. In: *Report 52 (1988) - Community Law Reform Program: Tenth Report - Liability For Injuries Caused by Dogs*. NSW Law Reform Commission.
- Harden, R. H. (1985). The Ecology of the Dingo in Northeastern New-South-Wales .1. Movements and Home Range. *Australian Wildlife Research* **12**, 25-37.
- Healy, S. (2007). Deadly dingoes: 'wild' or simply requiring 'due process'. *Social Studies of Science* **37**, 443-471.
- Hergovich, A., Monshi, B., Semmler, G. and Zieglmayer, V. (2002). The effects of the presence of a dog in the classroom. *Anthrozoos* **15**, 37-50.
- Jenkins, D. J. (2006). *Echinococcus granulosus* in Australia, widespread and doing well! *Parasitology International* **55**, S203-S206.
- King, J. S., Brown, G. K., Jenkins, D. J., Ellis, J. T., Fleming, P. J. S., Windsor, P. A. and Šlapeta, J. (2012). Oocysts and high seroprevalence of *Neospora caninum* in dogs living in remote Aboriginal communities and wild dogs in Australia. *Veterinary Parasitology* **187**, 85-92.
- King, J. S., Jenkins, D. J., Ellis, J. T., Fleming, P., Windsor, P. A. and Šlapeta, J. (2011). Implications of wild dog ecology on the sylvatic and domestic life cycle of *Neospora caninum* in Australia. *The Veterinary Journal* **188**, 24-33.
- Lunney, D., Gresser, S., O'Neill, L. E., Matthews, A. and Rhodes, J. (2007). The Impact of Fire and Dogs on Koalas at Port Stephens, New South Wales, Using Population Viability Analysis. *Pacific Conservation Biology* **13**, 189-201.
- McAlpine, C. A., Rhodes, J. R., Callaghan, J. G., Bowen, M. E., Lunney, D., Mitchell, D. L., Pullar, D. V. and Possingham, H. P. (2006). The importance of forest area and configuration relative to local habitat factors for conserving forest mammals: A case study of koalas in Queensland, Australia. *Biological Conservation* **132**, 153-165.
- Newsome, T. (2011). 'Ecology of the Dingo (*Canis lupus dingo*) in the Tanami Desert in relation to Human-Resource Subsidies'. Thesis. (University of Sydney: Sydney).
- Oskarsson, M. C. R., Klütsch, C. F. C., Boonyaparakob, U., Wilton, A., Tanabe, Y. and Savolainen, P. (2011). Mitochondrial DNA data indicate an introduction through Mainland Southeast Asia for Australian dingoes and Polynesian domestic dogs. *Proceedings of the Royal Society B: Biological Sciences*.
- Ozanne-Smith, J., Ashby, K. and Stathakis, V. Z. (2001). Dog bite and injury prevention—analysis, critical review, and research agenda. *Injury Prevention* **7**, 321-326.
- Robley, A., Gormley, A., Forsyth, D. M., Wilton, A. N. and Stephens, D. (2010). Movements and habitat selection by wild dogs in eastern Victoria. *Australian Mammalogy* **32**, 23-32.
- Smith, B. P. and Litchfield, C. A. (2009). A review of the relationship between indigenous Australians, dingoes (*Canis dingo*) and domestic dogs (*Canis familiaris*). *Anthrozoos* **22**, 111-128.

Swartz, S. (2012). Warlpiri-English Interactive Dictionary. In: *Aboriginal Languages of Australia Virtual Library: Aboriginal and Torres Strait Islander Languages* (ed D. Nathan). AuSIL.

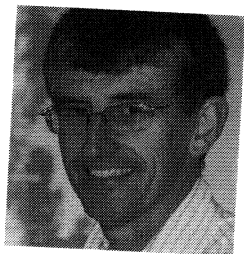
von Holdt, B. M., Pollinger, J. P., Lohmueller, K. E., Han, E., Parker, H. G., Quignon, P., Degenhardt, J. D., Boyko, A. R., Earl, D. A., Auton, A., Reynolds, A., Bryc, K., Brisbin, A., Knowles, J. C., Mosher, D. S., Spady, T. C., Elkhoulou, A., Geffen, E., Pilot, M., Jedrzejewski, W., Greco, C., Randi, E., Bannasch, D., Wilton, A., Shearman, J., Musiani, M., Cargill, M., Jones, P. G., Qian, Z., Huang, W., Ding, Z.-L., Zhang, Y.-P., Bustamante, C. D., Ostrander, E. A., Novembre, J. and Wayne, R. K. (2010). Genome-wide SNP and haplotype analyses reveal a rich history underlying dog domestication. *Nature* **464**, 898-902.

Willey, J., Zejbrlik, K., Jeffery, A., Croft, G. and Thompson, M. (2008). Wild Dog Management Plan for the Kempsey Rural Lands Protection Board District. Kempsey Rural Lands Protection Board, Kempsey.

About the authors

Peter Fleming

Dr Peter Fleming is Research Leader with the Vertebrate Pest Research Unit of NSW DPI, which he has worked with since 1983. He is currently involved in programs to improve management of feral goats, and dingoes and other free-ranging dogs in Australian ecosystems. Like his species of interest, Peter is a generalist, having investigated the impacts of rabbits, pest birds and flying foxes, and improvements to the control of feral pigs and red foxes. Peter undertook his PhD on the behavioural ecology of feral goats for exotic disease transmission modelling, but is mostly recognised for his work on introduced canids and aerial survey methods. He is current President of the Australasian Wildlife Management Society.



CONTACT

Peter Fleming

Email: peter.fleming@industry.nsw.gov.au



Guy Ballard

Guy's interests include wildlife ecology and management, especially those scenarios involving human-human or human-wildlife conflict. Since 2007 he's worked as part of an Invasive Animals CRC team undertaking research on wild dogs (including dingoes) in various parts of Australia. As well as working to improve our understanding of wild dog ecology, Guy facilitated across-tenure wild dog management plans to balance control and dingo conservation objectives in north eastern NSW. Since 2010, he has been involved in a large-scale project to determine the effectiveness of aerial baiting for wild dog and fox control and has investigated the movements of free-ranging dogs and red foxes in and around small holiday townships and rural communities on the north coast of NSW and in remote communities of the Tanami Desert. Guy is also involved in research on the distribution and abundance of rangeland goats and the movement behaviour and management of brush-tailed rock-wallabies.



CONTACT

Guy Ballard

Email: guy.ballard@dpi.nsw.gov.au



A series of horizontal dotted lines spanning the width of the page, intended for handwritten notes. There are 25 lines in total, starting from the line below the pencil icon and ending at the bottom of the page.