

Urban wildlife management: forming an Australian synthesis

Daniel Lunney¹ and Shelley Burgin²

¹Department of Environment and Conservation (NSW), PO Box 2220, Hurstville NSW 2220

²University of Western Sydney, Richmond campus, Locked Bag 1797, South Penrith Distribution Centre, NSW 1797

ABSTRACT

This chapter is a response to Recher's call that, "somebody needs to pull together those common themes and come up with a common strategy for managing wildlife in the urban environment". The diversity of chapters herein provided the editors with a rich source that lead into the web of current ideas surrounding the topic. To examine the origin and development of current ideas, we conducted a search of books and journals and found that the content is mainly of a practical, and not theoretical nature, neither is it integrated across the disciplines from art to architecture. Managing urban native species includes managing them as urban pests, such as the common brushtail possum whose populations are literally going through the roof. Birds seem ideally suited to an urban lifestyle because they can fly in and out of backyards and remnant bush, but only some species have become the "winners" in an urban environment while others have become the "losers". Urban fauna includes endangered populations of animals in specific localities, and in such cases a supportive local community is vital to their long-term survival. Twenty years ago it would have been inconceivable that an insect ecologist be part of a forum on urban bushland fauna. Now it is unimaginable that such a specialist would be absent. There has been a proliferation of studies, ideas, position statements, web pages, courses and a collective recognition of the value of urban wildlife over the last two decades. Many local and species-specific strategies are already taking shape, reflecting a diversity of opinions and viewpoints. We look forward to the next critical decades in the evolution of a thriving discipline of urban wildlife management and offer this book as a contribution towards the formation of an Australian synthesis on the subject.

Key words: urban wildlife, pest species management, urban bush, bushland remnants, urban ecology, urban fauna, endangered species.

Introduction

Recher's (2004) paper, which opened the forum, presented a number of common themes. These included the value of retained habitat in an urban environment, the benefit of long-term studies and the recognition that urban wildlife exists in its own ecosystem – a city ecosystem – with its own ecological frame of reference. Recher's well-articulated recognition in the plenary session that "somebody needs to pull together those common themes and come up with a common strategy for managing wildlife in the urban environment" was met with resounding applause. The urban wildlife forum, as recorded here with a diverse range of topics, offers a contribution towards such a synthesis. Urban wildlife is a rich thread of new ideas and practical programs running across the world, and the problems and the opportunities to be found in New York and London are similar to those of Brisbane and Perth. To capture this breadth, this chapter starts by accepting Recher's challenge in the plenary session to prepare "a synthesis of all the papers presented today" then it broadens the scope to examine other work written on the subject both in Australia and overseas.

The most striking feature of this book is the revelation of the vast diversity of wildlife to be found in the urban environment, from small and cryptic invertebrates, to larger vertebrates, such as fish, frogs and reptiles to such

charismatic species as the common brushtail possum and koalas and deer in the urban fringe. The second notable feature is that people's attitudes to wildlife form a key element in understanding issues as diverse as the reasons for feeding backyard birds, for culling deer on the city's outskirts, or for conserving urban bushland or other remnants of native vegetation, including wetlands. The third salient feature of this book is that zoologists have been working independently of bush restoration efforts, which may be creating inappropriate habitats for wildlife in the absence of zoological advice. Thus, there is a pressing need to combine the various scientific and community efforts under the one banner of "urban wildlife management". If we are to have a zoologically rich urban future, then not only must the disciplines be integrated, but there also needs to be an inter-disciplinary grasp of how urban habitats are lost and created and how community attitudes are formed and dispelled. Above all, a vision that maximizes our zoological heritage in an urban world needs to be articulated. That heritage has started to become the focus of groups such as the NSW National Parks Association, which in 1996 mounted a lecture series on "Urban wildlife in the greater Sydney region", Victoria's *Land for Wildlife* program as shown by Monash City Council in suburban Mount Waverley (Gittens and Grant 1998), and by the Sydney's suburban Ku-ring-gai Volunteer Bushcare Group with its 2003

conference theme of “Forgotten Friends and Foes”. Urban wildlife is not just a sub-set of some other broader category of Australian ecosystems: it is a new discipline, developing its own combination of theory and practice (Lunney and Burgin 2004). As a recent branch of biodiversity conservation, it has yet to gain recognition in biodiversity strategies or in State of the Environment reports.

Individuals from disparate backgrounds have been laying the groundwork for this new discipline for some 20 years. Clyne (1982, 1984, 1993) used a seasonal theme in her approach to ‘wildlife in the suburbs’, Low (2002) reversed the standard nature conservation position and argued that wilderness is a myth and nature lives in our cities in gardens, and Benson and Howell (1995) and Howell and Benson (2000) have studied Sydney’s bushland with the view that there is more than meets the eye and that, in the past, it has been taken for granted.

Whether you are in Sydney, Melbourne, Brisbane, Hobart or Perth, the same range of issues face wildlife managers. Most Australian cities are maritime and, therefore, are in catchments undergoing rapid growth. This point is widely recognised (Hutchings and Lunney 2003) and was made in a dramatic example by Gee Chapman to Alexandra de Blas in the ABC program *Earthbeat* (26 July 2003, <http://www.abc.net.au/rn/science/earth/stories/s910227.htm>), which signalled the arrival of the discipline in Australia when a group of urban ecologists gathered “to discuss the challenges facing the often ignored animals competing for space in our towns and cities.” Gee Chapman from the Centre for Research on Ecological Impacts of Coastal Cities at the University of Sydney (e.g. Underwood and Chapman 2002, 2003), reported that she was working successfully with engineers and others in some of the councils around Sydney Harbour to make additional habitat such as “rock pools half way up vertical sea walls that octopus...can live in”. On the interface between the sea and the land, natural habitats have been replaced with artificial ones such as vertical sea-walls, runways in the middle of harbours, docks, piers and marinas where it is now possible to create new artificial habitats for sea creatures. In this way, the ecology of cities presents a new focus, new limitations, and new opportunities such as designer rock pools on sea walls for our rich octopus fauna.

Urban Birds

The initial perception that flies from the pages of this book is that birds and urban wildlife are interchangeable terms for some people and that birds are by far the most conspicuous wildlife elements in most urban environments. Birds seem ideally suited to an urban lifestyle because they can fly in and out of backyards and remnant bush. Some are noticeable because they are large and showy, they respond if fed, and they have beautiful calls. However, long before the end of Catterall’s (2004) chapter it becomes apparent that among the birds there are winners and losers. The winners are the large-bodied birds while the more cryptic, small-bodied birds are disadvantaged, even in the leafier suburbs. Without Catterall’s detailed research, it would be impossible to analyse the presence of urban birds in such a useful way.

Howard and Jones (2004) looked at Brisbane’s urban birds through the eyes of those who feed them and contrasted their views with those of the professional wildlife manager. They found many backyards where birds were encouraged to feed, sometimes by the creation of showy plantings under a light canopy of eucalypts. This resulted in backyards filling with what Catterall (2004) has dubbed Aussie icons, that is, the winners. As professional attitude collectors, Howard and Jones (2004) have produced a statement of resident intent that puts many residents on a collision course with a wildlife manager armed with Catterall’s text under his/her arm. Through their *Birds in Backyard* program, Parsons and Major (2004) have produced findings that support the work of Catterall (2004) and links it with Howard and Jones’ (2004) research to show how to increase community understanding of the effect of personal decisions on wildlife diversity. Together with Catterall, they recognised the need for more research on the habitat of the noisy miner *Manorina melanocephala* to be able to create conditions less attractive to this aggressive native species and more attractive to smaller species.

Kings Park in Perth (Western Australia) is a gem. It is an urban bushland, much valued by the locals, in the heart of the city. Recher (2004) has identified its pivotal role in maintaining avifauna in the city. The avifauna in the park is part of an urban matrix where street plantings and backyard plants are crucial to the movements of many species. The long study period reported in Recher’s chapter, which began with Dom Serventy’s efforts between the wars, has revealed the fluctuations in the avifauna of a city park. Some species have come, some species have gone, and all have been influenced by park management by matters such as clearing and bushfire. Recher made the point that we need to view city birdlife separately from the birdlife of rural areas or national parks, and as having a diversity with its own dynamics. Recher, ever controversial, advocates living with exotic species if it helps enrich our avifauna and encourages managerial and public support for a greener view of our city’s future.

One of the breakthroughs in urban planning, as recognised by Buckley (2004), is that one can take a strategic approach to conserving biodiversity. Among the actions identified by Buckley was the Green Web Sydney Plan of 1997, which contains the view that councils should aim to prepare landscape design control plans for the protection and enhancement of indigenous flora and fauna. For the birds in metropolitan Phoenix, Arizona, landscape design and scale were shown to be strong influences on whether an area was attractive to a given bird species (Hostetler and Knowles-Yanez 2003). With the growing knowledge base in Australia (e.g. Catterall, Parsons and Major, Recher, Kavanagh 2004), and working within community constraints and preferences (identified by Howard and Jones, and Davies *et al.* 2004), it is now possible to incorporate a particular construction (structure, planting, trimming) of bird habitat that would reduce the over abundance of some species, encourage shy species, and create a pattern of urban design that

gives greater opportunities for a more diverse future in our urban avifauna. With this increasing zoological research coming from one direction, and planning guides, such as the *Biodiversity Planning Guide for NSW Local government* (Fallding *et al.* 2001) coming from another, there is an increasing scope that once disparate disciplines are converging to the benefit of urban wildlife.

Urban bush

Adam (2004) reminded the reader that the primary reason for the configuration of urban bushland has nothing to do with urban wildlife management. This 21st century view of the value of wildlife now has to fit with whatever habitats happen to remain, the patches we call remnant bush. To those with a long-term involvement in the selection and management of national parks across Australia, there is nothing odd about this position. We might think of national parks as being the crown jewels in biodiversity conservation but, in reality, they are often just leftover areas of non arable land. With urban parks, the concept of amenity has a long history and did not include the aim of encouraging native animals. Even a modern railway station, with a pleasing display of exotic plants in full flower, attracts awards. It is still a part of Australia's English heritage so it is not surprising that in the 19th century, with a countryside seen to be "plagued" with marsupials (kangaroos and wallabies) (Reed and Lunney 1990, Hrdina 1997), it is unlikely that townsfolk would have gone out of their way to plant indigenous species that would encourage local wildlife. City gardens and streetscapes were filled with English or other exotic plants for similar reasons

The effort of trying to conserve remnant bush is a relatively recent phenomenon. Adam (2004) identified that the two triggers for the awakening of this interest in Sydney was the fight in 1970 to save Kelly's bush in Hunters Hill, which led to the world's first green ban, and the Bradley sisters' initiation of bush regeneration. He also pointed out that profits accrued from property development on the urban fringe make it unlikely that urban bush will be retained in outer Sydney, despite the recent recognition of the value of urban bush. He remarked grimly that, "recent mapping and inventory exercises across western Sydney, although valuable have a strong element of closing the stable door after the horse has bolted". There is no doubt that human population pressure is the single most important factor influencing the future of urban wildlife. Nevertheless, without a vision, an urban philosophy of conservation and a recognition of its ecological underpinning, no provision will be made for conserving urban bush and urban wildlife. The continuing rise of urban populations in Australia makes it all the more urgent to recognise that the diversity of urban wildlife is dependent on our ability to intelligently manage it across all land tenures, from the public creeks, rivers, parks and estuaries to privately-owned land.

Urban fauna: expanding the vision from snails to owls

Everyone knows what the common garden snail *Helix aspersa* looks like and the damage it can cause. Few people know that these garden pests are introduced species and that Australia has a rich native snail fauna (Clark 2004). These native snails are urban fauna and those who have read Clark's account will be amazed by both the diversity of species and the tiny range that an individual occupies. One large human stride can cover the area of a life cycle of one native snail and by the time one has walked 350 m there is an entirely different population of snails. This finding was derived from Clark's genetic investigation, which showed how the applications of modern science are yielding more secrets of urban wildlife. The concept of snails as urban fauna does not have a long and illustrious history and Clark's small piece should be the beginning of a much more exciting future for this neglected component of our fauna, and its habitats, such as in the fast-disappearing vegetation of the Cumberland Plain of western Sydney.

Insects have a long history of public mistrust and Hochuli *et al.* (2004) have capitalized on this fear in a witty way with their chapter title: "Has fragmentation taken the sting out of insect herbivory?" However, they are serious in their view that we need to understand insect ecology as a special study in managing urban bushland remnants. They have taken the unusual approach of testing hypotheses associated with habitat fragmentation and found that ecological processes were disrupted by the losses of species from higher trophic levels. This led them to conclude that not only do remnants act as refuges for our insect fauna, but they also provide valuable opportunities for research and education. The real novelty of this chapter, though, is the very idea that insects should be considered as urban fauna. When this point is truly understood, appreciation of the biological diversity of urban remnants will rise 100-fold.¹ What Hochuli *et al.* (2004) have done is to greatly strengthen the case for conserving a wide diversity of urban bushland habitats and to link new strands of ideas – those circulating among the world of invertebrate biologists – to the conservation of urban bush. Indeed, the conservation of the invertebrates of the urban bush will, in turn, play a crucial role in the survival of these remnants because of their ecological role. Twenty years ago it would have been inconceivable that an insect ecologist would have been part of a forum on urban bushland fauna. Now it is unimaginable that such a specialist could be absent from any such forum. In fact, with the decline of large vertebrates, the invertebrates will play an ever-increasing part of our enjoyment and education (Emery and Emery 2004) of urban wildlife.

Banks (2004) has been studying his quarantined population of long-nosed bandicoots *Perameles nasuta* at North Head in Sydney Harbour. These bandicoots were once widespread and common throughout Sydney, but are now confined to diminishing populations, some of which

¹ That was the central thesis behind another RZS publication, *The other 99%. The conservation and biodiversity of invertebrates* (Ponder and Lunney 1999).

are entirely isolated. The population at the Quarantine Station became the first Endangered Population under the *Threatened Species Conservation Act 1995* and Banks has turned a qualitative evaluation of their problems into a rigorous numerical evaluation of options for management. Although Banks refers to the “off the shelf” population viability model for simulating population change, population viability analysis has been a tool of wildlife managers for only a decade or so. Given the rise in the value of modelling with increasing computer literacy and capacity, there is no doubt that Banks’ study will be identified as among the first to apply new tools to urban wildlife management. In this sense, his work is parallel to Hochuli *et al.* (2004) in that both have taken an experimental approach to their problem.

Urban owls move from one tiny patch of remnant bush, such as that which preoccupied Banks (2004), to travel across the widest possible area of Sydney. This is the geographical frame of reference you need when studying owls. They have large home ranges and highly specific needs. The numbers of some species are low while others have reached into the heart of Sydney. One was recorded as a marauder among the flying-foxes in the Botanic Gardens and it attracted media attention (Lunney and Matthews 2003). Owls have a wide appeal, and Kavanagh’s (2004) chapter has provided an arresting piece that puts Australian urban owls on the international map. In the future, one can expect to see owls become one of the international markers of success or failure in urban wildlife management.

If we ran a competition for the group of animals that surprised you most as being on the list of urban fauna, our bet is that you would find fish to be the most likely candidate. The hegemony of garden birds as urban fauna has caused people to think of terrestrial habitats but logically, the mud flats with their wading birds are part of the urban wildlife habitat, as are the semi-submerged urban forest of mangroves as well as the freshwater and marine habitats in urban rivers and creeks. Australia has a vast band of amateur fishers and a long history of commercial fishing, so it should not be so surprising for fish to be thought of as urban fauna. Gibbs (2004) makes a water-tight case for fish as urban wildlife, despite the fact that the tidal habitats in which he conducted his research have concrete pipes, walls and grids. This estuarine world again features in the chapters by Hutchings (2004) and Yerman and Ross (2004). Given that most of Australia’s population live in maritime cities, we should really regard mangroves, salt marshes, fish and gastropods and other invertebrates all as urban wildlife. They are studied by specialists in the various zoological fields, but when one stands back from the individual taxa one can see that all these habitats are a part of the city. Consider the irony that confronted Hutchings (2004) when she wryly remarked that Australians are willing to pay high prices for waterfront land but will “weed their adjacent mudflat or sandy shore to ensure that no mangroves survive to obscure their view”. A new approach to urban wildlife management requires an approach which protects the unweeded mangroves and seashores as habitats and breeding grounds for their resident species. In turn, this

requires a vision of urban wildlife which is articulated by the community, council planners, state authorities and the academic community and is demonstrated in practical lessons from junior primary school through to senior high school classes, as shown by Emery and Emery (2004).

Cryptic fauna can be endangered populations in specific localities, such as long-nosed bandicoots at North Head (Banks 2004), little penguins *Eudyptula minor* at Manly (Bourne and Klomp 2004) or a diffuse low-density population of koalas *Phascolarctos cinereus*, a vulnerable species in peri-urban Sydney (Ward and Close 2004). A common theme among these accounts is the vital contribution of a supportive local community to the long-term survival of these populations, whether the community consists of householders living in the vicinity of areas where little penguins walk up and down steps, or whether they are members of the public reporting sightings of koalas in a survey. The koala issue in particular requires the involvement of the local community, and such research is still in its infancy in Australia, yet is already proving to be most valuable (Davies *et al.* 2004). This approach has proved as successful for quolls and platypus as it has for koalas because they are large, readily identified creatures (Lunney and Matthews 2001, Lunney *et al.* 2001, 2002b, 2004). Such an approach is likely to be more successful in urban environments than protected reserves in rural areas because people have greater knowledge of fauna in their backyards than they do of uninhabited forested areas in their district. The potential of this approach for a range of species was examined in the coastal township of Iluka (Lunney *et al.* 2000b), and in the research of Shine and Koenig (2001) in Sydney, who also concluded that this avenue of information has much to offer. The koala research of Ward and Close (2004) required a great deal of effort, as they point out, but without that level of commitment by both the community and the local university their information would not have come to light. Unless urban fauna, such as koalas, can be mapped against habitat variables, soil types, bushfire history, land tenure, land-use history and impediments to animal movement, such as highways, even the charismatic and loved megafauna are likely to be lost from urban areas through neglect.

If ever a group of animals had to struggle against a long history of European fear and ignorance, it would be the group that gives almost everyone the creeps. Collectively, the group is known as the herpetofauna, from the Greek word *herpes* “to creep”. The showcase in the British Museum showing British herpetofauna is a tiny cabinet indeed. A quick blink of the eye and you are into the next section with its amazing array of dinosaurs and other wonders of the world. By contrast, Australia has a rich herpetofauna and a diverse group of people taking an active interest in this group (Lunney and Ayers 1993a). Some of Australia’s leading zoologists, such as Rick Shine, value keen-eyed backyard herpetologists, because observations in urban backyards have significantly added to herpetological information (Shine and Koenig 2001, Masters and Shine 2003). Bushland remnants have also played a significant role in supporting our herpetofaunal heritage (White and Burgin 2004). Yerman and Ross

(2004), Hochuli *et al.* (2004) and Catterall (2004), have demonstrated the impact of habitat fragmentation and isolation on saltmarsh invertebrates, insects and birds that parallels the conclusions for reptiles and frogs by White and Burgin (2004). The concept of sustaining our urban wildlife depends on maintaining this herpetofaunal heritage, which includes the iconic and endangered green and golden bell frog *Litoria aurea* at the Sydney Olympic site and the spectacular green tree frog *Litoria caerulea*, which has been lost from most of its habitat across Sydney. A frogless Sydney may have seemed unimaginable when the boom of the green tree frog once recorded that water was running down the gutters and pipes of Sydney's homes. As White and Burgin (2004) noted, this prince of frogs has been given the kiss of death and it is now banished to the peri-urban areas. Collecting tadpoles and watching them metamorphose was a standard childhood activity in the post-war years. Frogs and tadpoles were so common, a bit like fresh air, that there seemed to be no need for their protection. Forty years later the situation had changed drastically for the frogs, which were formally recognised as fauna and gained the protection of the law in New South Wales only in 1992 (Lunney and Ayers 1993b). Now most species are in rapid retreat and the urban survivors, such as the striped marsh frog *Limnodynastes peronii* (Hengl and Burgin 2002, Schell and Burgin 2003), are few. A similar fate has befallen the reptiles, with the harshest impact being on the snakes (White and Burgin 2004).

Almost all Sydney gardens still support the tiny skinks, such as the grass skink *Lampropholis guichenoti* and the delicate skink *L. delicata*. The adults of these animals weigh a mere one gram. Large species, such as the bearded dragons *Pogona barbata*, once widespread across Sydney, are now difficult to find. They depend on bushland remnants and their current distribution reflects the impact of land clearing, housing and the associated degradation of natural habitats as a result of urbanization. White and Burgin (2004) examined a series of habitat remnants and found bearded dragons only on the city's outer margin. That this process of loss has been underway for many decades is evident from the map based on information by R. Wells in Lunney (1986), which used this species' distribution as a primary step in grasping its ecology.

A well-known kids' game is snakes and ladders. You roll the dice and land on a square with a ladder or snake. You win by climbing the ladders, you lose by sliding down the snakes. In Sydney's urban housing boom, ladders are going up everywhere, but with the loss of bushland to houses, it is the snakes themselves that are sliding. White and Burgin (2004) showed that snake species are in rapid decline throughout Sydney's bushland remnants but are still present in outer Sydney. This is a striking loss. It parallels the losses of such mammals as bandicoots (Banks 2004) and confirms Adam's (2004) fears that urban bushland areas are at best a living museum and more likely a cemetery for our snakes and large lizards. These reptiles need to overcome the twin barriers of public dislike and habitat loss. It is a fearful combination and arguably our reptile and frog fauna are among the heaviest losers in urban environments as a result.

Urban wildlife perceived as pests

Witches' brews traditionally feature frogs and bats. Bats comprise the least appreciated group of mammals in Australia, whether we are talking about flying-foxes (Eby and Lunney 2002) or small insectivorous bats, such as the large bent-winged bat *Miniopterus schreibersii*, which has been found in houses and tunnels around Sydney (Hoye and Spence 2004). Hoye and Spence firmly dispel the myth that bats are urban survivors and, as such, can endure the loss of roost caves and forest foraging habitat. Bats are a great addition to the urban scene and their role in urban landscapes is being increasingly recognised and publicised by organisations such as Bat Conservation International in the USA (<http://www.batcon.org/>) and the Bat Conservation Trust in the UK (www.bats.org.uk). In Australia, they are among the most unloved of our urban wildlife. Hoye and Spence plotted the distribution of the large bent-winged bat and showed how populations through the 20th century were steadily lost. Although these bats can fly hundreds of kilometres, this has not prevented them from accompanying Sydney's earthbound bandicoot down the same path to extinction. At issue is the management of urban bat habitat and the mistreatment of bats when they are found roosting in tunnels and houses. Bats are perceived as pests, but the work of Hoye and Spence has moved them unequivocally into the category of threatened species. They have been recognised in NSW as a threatened species under the *Threatened Species Conservation Act 1995* since 1992 (Lunney *et al.* 2000a), but this formal classification still does not remove their pest status in the minds of many, as it has not for the grey-headed flying-fox *Pteropus poliocephalus* (Eby and Lunney 2002).

The work on flying-foxes by a Brisbane community wildlife group (<http://www.theca.asn.au/ffw/whatis.htm>) reflects a variety of issues that were the focus of a Royal Zoological Society of NSW forum on NSW flying-foxes (Eby and Lunney 2002). These animals are one of the problem species to manage and we hope that the involvement of so many urban dwellers with these spectacular bats will lead to a more rational approach to their conservation and management. Bat workers are intensely aware of the conundrum that a species, which is regarded as a pest by some people, should simultaneously be listed as threatened. This website makes a useful contribution to the scope of describing urban wildlife management as well as dealing with the problems of conserving one of the world's great bats: called *Food for Wildlife*, this project works with the community to increase food resources and habitat for urban wildlife. The project started as a response to the declining food resources for flying-foxes and other wildlife in southeast Queensland. With the help of over 40 community and school groups, the *Food for Wildlife* project aimed to plant suitable native tree species within the foraging range of five flying-fox camps in and around Brisbane.

In Melbourne, however, a recent abundance of flying-foxes has created a problem. Urban biologist, Mark McDonnell (*Earthbeat*, 26 July 2003, see ABC website) noted that since 1995, flying-foxes have been in the Botanic Gardens

year-round, reaching peak numbers of 30,000 individuals in 2002 in the middle of summer which, he commented, “is a lot of animals in the Botanic Gardens”. He observed: “The issue that we have is that they’re very important animals to Australia but they’re in the wrong place”. He attributes their presence in the Botanic Gardens to drought in rural areas which is driving them into cities in search of food. The bats are attracted in large numbers to the food which has been planted, it seems, expressly for them. As McDonnell explained: “The reason they’re in Melbourne is very simple...since the ‘70s, Melburnians have planted street trees and garden trees and park trees that are from New South Wales and Queensland...[that are] common and standard food resources for the grey headed flying fox.... just looking at street trees, our estimates...suggest that there’s over 600,000 trees, mature trees, on the streets of Melbourne which can be a food resource for flying foxes. No wonder they’re here”. And they are there, in large enough numbers to be regarded as a pest. The dilemma for Melburnians now is that if the bats’ tree resources were to be destroyed, then the visual amenity of Melbourne would be greatly affected, as would a wide range of other urban wildlife species. This has great implications for urban wildlife management. A major point here is that any planting program is creating habitat for some species, and if the consequences for fauna are not considered along with the visual appearance of the vegetation at the outset, then the type of problem identified by Mark McDonnell will be repeated.

By contrast, there is little doubt that Temby (2004) is dealing with a native species that is a pest in many locations. Seagulls, as silver gulls *Larus novaehollandiae* are commonly known, are proliferating in urban Melbourne, over-fed on waste food that is a feature of affluent Australia. They are a pest on roofs and in some work locations, where they reach hazard status. They are native birds and, like Ross’ (2004) Australian white ibis *Threskiornis molucca*, are among the native species that have become super-abundant and a pest that needs to be controlled. The contrast between the silver gull and another marine bird, the little penguin (Bourne and Klomp 2004), highlights a major issue of wildlife management in Australia. Whereas most species, such as the little penguin, are declining, a few are increasing to pest proportions and need to be actively managed. There is vastly more effort going into the recovery of threatened species than into the suppression of excessive numbers of a few species. This dichotomy is as apparent in urban populations as it is in rural areas.

If wildlife managers do not succeed in devising plans that are acceptable to the community to control burgeoning populations, then pest species will continue to proliferate and do great damage to the cause of urban wildlife conservation. No manager wants to go out and euthanase excess animals, so there must be a willingness to devote as much energy to the philosophy and ecological understanding of this task as to the recovery plan of a threatened species. The way in which wildlife is portrayed in the media is a vital element in this process, as has been identified in a previous RZS forum (Lunney *et*

al. 2003), and it is one that will be a constant concern for any wildlife manager. Without a cogent plan, the urban wildlife manager can suffer some frightful media exposure, as was demonstrated vividly by Martin (2003) in relation to Brisbane’s flying-foxes.

Managing urban wildlife populations requires putting aside current mainstream biodiversity concerns such as the selection of a comprehensive and adequate reserve system and placing the focus squarely on wildlife in urban areas, where entirely different conditions prevail. As an example of this point, it is noted that out of the eight endemic species listed as pests in rural areas (*Biodiversity Theme Report of the 2001 Commonwealth State of the Environment Report*, Williams *et al.* 2001) not one is an urban pest. The dilemmas of managing native species that are pests in urban areas highlight not only the rural-urban gap in pest species management, but also the gap in our recognition that urban wildlife management needs its own code, and is not just an extension of a national approach to biodiversity conservation. This situation was reflected in the *Biodiversity* theme report, which found that most native wildlife is declining across Australia, and ignored the burgeoning populations of some native species in unnatural environments, such as urban areas. This illustrates that urban issues are below the threshold of national reporting and are not getting the attention they deserve.

The management of brushtail possums *Trichosurus vulpecula* brings this problem of control of pest species into sharp focus because many people enjoy possums yet, in some locations, they are pests. Matthews *et al.* (2004) highlight the dilemmas faced by the management of this attractive animal in Sydney. The management policy of this species has been revised by the NSW Department of Environment and Conservation since the presentation by Matthews *et al.* at the forum and the revision has taken into account the major difficulties identified in this chapter.

Managing native species as urban pests includes managing those species whose populations are literally going through the roof, such as the common brushtail possum. The urban numbers of these possums contrasts with their populations throughout most of their range in rural Australia, which are in sharp decline (Kerle 2001). The agony of having to regard these handsome possums as a pest was recognised by James Woodford (*Sydney Morning Herald* 28-29 June 2003), who wrote, “At the Royal Botanic Gardens, possum magic has become possum tragic”. (A reference to the children’s picture book *Possum Magic* by Mem Fox 1983). Woodford reports: “facing severe tree damage caused by excessive numbers of the marsupials, the gardens have had 30 brushtails ‘euthanased’ by vets in the last year”. This dilemma was captured by the engaging photograph of a possum with the Opera House in the background (Figure 1). These are both icons that have to be managed, and in relation to possums, this is a problem faced across the geographical breadth of Sydney (Matthews *et al.* 2004). Whether the pests are possums, seagulls, kangaroos (Grigg 2002), dingoes (Dickman and Lunney 2001) or flying-foxes (Eby and Lunney 2002), we are not well-equipped ecologically or philosophically to handle the problem of native species as pests.



"We are not culling for culling's sake" . . . a possum at Mrs Macquarie's Chair. The Royal Botanic Gardens have become overloaded with possums. Photo: Rick Stevens

Pity the poor possum drawn to the bright city lights

James Woodford

At the Royal Botanic Gardens, possum magic has become possum tragic.

Facing severe tree damage caused by excessive numbers of the marsupials, the gardens have had 30 brushtails "euthanased" by vets in the past year.

Marksman have also been shooting sacred ibis - about 60 adults have been put down. Around 100 nests have been dismantled and their eggs discarded.

The birds have become a public nuisance across Sydney and pose health risks because they carry salmonella. At the gardens, ibis damage the palm

collection by nesting in fronds.

The euthanasia program is the first time in Sydney that the National Parks and Wildlife Service has licensed a culling program of brushtail possums. A licence will be issued permitting another 30 to be given lethal injections in the next 12 months.

Also, a government taskforce, the Wildlife Issues Advisory Panel, is soon to release a set of guidelines for the control of Sydney's exploding possum population. The director-general of the service, Brian Gilligan, says it is likely more culling licences will need to be issued.

"You can't alter the environment to the extent we have in Sydney without creating

some problem native species," Mr Gilligan said. Euthanasia had to be discussed.

"It will just not be worthwhile to trap animals and put them back into the wild.

"We are going to have to look at culling in other locations. We are going to have more of these problems and we are just going to have to confront it."

The environmental co-ordinator at the gardens, Pat Houlcroft, says although no one knows the population, the number of possums living there is staggering.

Mr Houlcroft says possums from the inner city are being trapped and then dumped at the gardens, creating fights for space.

"Brushtails are so territorial that the animals do enormous damage to each other to the point of disembowelling each other," he said. "What seems a benign act of relocating is actually quite cruel."

Staff cage small plants and wrap tree trunks in perspex to prevent possums reaching tree crowns to slow the rate that foliage is stripped.

Even chilli paste is sprayed on some plants in an attempt to deter the brushtails. Deterrence will remain the organisation's first preference, Mr Houlcroft says.

"We are not culling for culling's sake. We only cull when the damage is at an extreme level and as a last resort."

Possums are protected in NSW and catching them without a licence is illegal but approvals are issued free, and traps can be bought or hired. However, the possum must be freed into the property where it was trapped.

The wildlife management officer with the National Parks and Wildlife Service, Geoff Ross, says that possum numbers have grown because urban areas offer increased food resources, and roof cavities offer perfect nest sites.

Brushtails are also renowned for their ability to protect themselves, even against cats and dogs. "You have to be as tenacious as the animal if you want to target possums in your house," Mr Ross said.

Figure 1. The common brushtail possum *Trichosurus vulpecula* set against the Sydney's Opera House. While this magnificent photograph identifies it as urban wildlife, James Woodford's telling piece poses the dilemmas faced in managing this native species in an urban context. (Photograph reproduced by permission from Fairfax photos and the text by James Woodford.)

The management of deer at Sydney's urban fringe has an unusual dimension in that although they are an introduced species that have become a pest because they damage habitats, some people do not want to see them destroyed. They are a Walt Disney icon and there is a palpable public hostility to shooting "Bambi", although land managers certainly want them culled or removed (Moriarty 2004). Moreover, deer are of considerable value as venison and they are a saleable item, dead or alive. It is in this context that a management plan for deer is being devised on the basis of scientific research (Moriarty 2004). Howard and Jones (2004) and Davies *et al.*

(2004) have identified that wildlife managers must also find out what the public thinks of certain issues if they are to have any support for their management plans. There is no doubt from a land manager's viewpoint that the deer have to be culled, but there is also no doubt that this issue has a significant social dimension that is richly deserving of much research, a point that Davies *et al.* (2004) make strongly. The point is driven home even further when the issues raised by urban cats and their relationship to wildlife are examined in detail. The chapter by Grayson and Calver (2004) deals with attitudes to cats and their management, assuming that wildlife managers regard cats

as a threat to native wildlife. The issue is how the public perceives this, and how the matter should be managed. The general point that emerges from chapters by Howard and Jones, Grayson and Calver, Parsons and Major and Davies *et al.* is that attitudes to wildlife are a crucial element in the wildlife management equation. Wildlife managers who simply look at the facts and figures of population size and the problems caused by a particular species will face setbacks if they do not take community attitudes into account.

What's happening overseas?

When we looked at what is happening in other urbanized places around the world, we were struck by outlooks ranging from an examination of “the unofficial countryside”, i.e. urban green spaces with wildlife (Mabey 1999) to the *Zoo In My Backyard* (Lingard 1965). We were also supplied with a valuable reading list from the pioneering Australian urban wildlife ecologist Darryl Jones (Appendix 1).

Looking at the international scene via the internet, it was remarkable how some governments have so clearly formulated a view of urban wildlife and were encouraging others to participate and enjoy it. For example, Michigan State Government (<http://www.michigan.gov/emi>) has the link “Urban wildlife viewing” where it espouses the unexpected birding opportunities that can be found throughout Michigan’s urban environment. The reader is told that downtown Detroit is fast becoming a prime viewing location for peregrine falcons that soar above the traffic and dive and turn at speeds of up to 200 miles per hour through the wind tunnels created by Detroit’s buildings. Readers are encouraged to provide nest boxes or purchase a wildlife habitat vehicle licence plate and are offered additional websites for information. The emphasis is on birds that can be seen and heard in a city landscape. For most Australians, Detroit means the city of cars, baseball and basketball. That the peregrine falcon is now a symbol of civic pride is uplifting for the spirit, as it was no doubt intended. Also attractive is the option of having wildlife habitat advertised on a motor vehicle licence plate. What a great advertising idea and a novel source of revenue!

The Nevada Fish and Wildlife Office (<http://nevada.fws.gov/UrbanWildlife/urban.htm>) covers a span of issues on its website, most prominently the need to both encourage and discourage selected species. The site is well-illustrated and presents information on urban wildlife, protection of backyard wildlife, attraction of wildlife and the safe discouraging of unwanted wildlife. Information was provided for bothersome birds, protecting cats from coyotes and birds, bat and owl conservation, removal of bats from homes, protection of burrowing owls and keeping racoons from garages. The recurrence of nuisance racoons implies they are a widespread urban pest problem just like our common brushtail possums (Matthews *et al.* 2004). The issue of cats is also common to different countries (Grayson and Calver 2004), but the concept of keeping cats safe from coyotes is novel. Creating boxes for urban bats is encouraging given the long dark history of these magnificent creatures in European culture.

Bats occupy the category of the least known of our urban wildlife. This was recognised in the University of Missouri Extension site (<http://muextension.missouri.edu/xplor/miscpubs/mx0130.htm>), which noted that when not in flight, most Missouri bats rest in the dark seclusion of natural places such as caves, hollow trees and rock crevices but may also occupy vacant buildings, church steeples, attics, and spaces between walls and belfries. Their beneficial attributes were highlighted; for example, they are insectivorous, they do not destroy property by gnawing or chewing, they are unique as flying mammals, and the incidence of disease transmission to humans is low and it was suggested that for these reasons they “should not be needlessly destroyed”. The detailed methodical account at the Missouri site has the potential to reduce fear in handling these animals. By contrast, we found no such clear set of instructions in Australia.

The Louisiana Department of Wildlife and Fisheries website (<http://www.deq.state.la.us/assistance/earthday/landscape.htm>) contains a feature on landscaping for wildlife with material and ideas that are immediately relevant to Australia. It acknowledged that attitudes are changing and that wildlife watching is increasing in popularity across the US. This echoes the finding of Davies *et al.* (2004) for Australia. Increasingly, people are buying bird feeders, binoculars and identification guides and commenting that interaction with wildlife brings greater pleasure than most other activities. The website offers advice and links that provide information on how to restore habitat in urban areas, how to attract wildlife, how to plant native flora to attract wildlife and enhance wildlife habitat. Readers were told that by restoration of some natural habitat (that is, providing food, water and shelter), they could effectively reintroduce some native wildlife species, while the use of only exotic plants would attract few native animals to the garden. Details were also provided on how to develop a landscape plan with a diversity of plant species and structure (such as ponds, rock and brush piles) to maximise wildlife diversity and abundance for the owner’s enjoyment. The reader was told that, “insects, amphibians, reptiles and small mammals will find homes in these places, and will provide food and shelter for other wildlife”. This very modern view represents a convergence with the Australian accounts by Catterall (2004), Ross (2004) and Hochuli *et al.* (2004).

The link in the United Kingdom between urban wildlife and the UK biodiversity action plan was presented in *Green Spaces, Better Places* (<http://www.english-nature.org.uk/news/story.asp?ID=369>). English Nature – the government department in England responsible for nature conservation – welcomed its publication and urged the government to consider implementing its recommendations. This included a £500 million funding initiative to improve existing parks and create new ones. English Nature welcomed “the recognition given in the report to the role of parks and urban green spaces in supporting biodiversity and reinforcing that vital contact with nature that people seek. Nationally important populations of wildlife...are found in urban green spaces”. It was also evident from this official UK position that there is an urban advisor, an encouraging sign of a growing sense of an urban wildlife discipline.

What emerged from these government websites was a good grasp of local knowledge, a fresh image of urban wildlife, and a pragmatic approach to what is possible. The idealism of seeing and enjoying wildlife did not overshadow the reality that some species are pests, and that individuals do have choices. There was encouragement to plan for wildlife, restore part of what has been lost and to promote a range of species. The simple lessons of diversity of wildlife being linked to habitats provided by native vegetation planted in backyards parallels the insights provided in Australia, for example, by Buckley (2004) and Parsons and Major (2004). With such support, backyards in the future will be more alive with wildlife and a native wildlife ethic will have been sown (see Burgin 2004).

Overseas NGOs

Overseas non-government organisations (NGOs) provide further insights into current attitudes in relation to wildlife in cities. Some NGOs have shown a preparedness to accommodate pests in cities, as was evident in this item from Canada (<http://www.vcn.bc.ca/spes/urbanwildlife/>): "In Vancouver, the opportunity to see 'wild' animals venturing into one's back garden or down the roads, from coyotes and rascally raccoons that raid garbage bins to black-tailed deer and skunks, is an all too-common occurrence [sic]... Raccoons and squirrels begging for food...while 'cute' to many people, ...should be left alone. Their wildness should be respected, as should their teeth". To achieve its goal of coexistence, the Stanley Park Ecology Society employs stewardship projects to enhance the local habitat and to increase public education. These range from the Coexisting With Coyotes program to the Barn Owl Nesting Restoration Project and Burrowing Owl Recovery Team.

In the university city of Oxford, the Oxford Urban Wildlife Group advertised its aims as "to discover and conserve, for the benefit of the public at large, the wildlife interest and amenity of wildlife areas in Oxford. The Group has been involved in the creation and maintenance of an urban nature reserve and promoting the principles and practices of nature conservation to the public, including young people." (<http://www.oncf.org.uk/tucd51.htm>).

Some community groups have local government support. For example, the Exeter Urban Wildlife Group was set up by the local city council as part of local Agenda 21, the environmental agenda established at the Earth Summit in Rio de Janeiro in 1992 (<http://beehive.thissexeter.co.uk/default.asp?WCI=SiteHome&ID=9088>). The group aims to encourage interest and awareness of local wildlife and the natural environment, protect the city's diverse habitats and promote wider enjoyment of local green spaces. Activities include encouraging wildlife friendly management of churchyards as green spaces within the city; enhancement of wildlife potential in Exeter's countryside; provision of comments on environmentally sensitive planning applications that threaten important sites within the city boundaries; conducting a survey of Exeter's birds and studying some of the local ancient hedgerows. The site noted that the group was voluntary, and was made up of people with interests in wildlife and natural environments much

like similar community groups in Australia. However, many such groups in Australia focus on revegetation with native plants and rank the restoration of wildlife as secondary on their list of aims.

Communication and education are essential to the success of any urban wildlife management program. A site posted by the Environmental Literacy Council on Urban Wildlife (<http://www.enviroliteracy.org/article.php/603.html>) noted the most visible animals as well as the cryptic species, and provided a series of links. One can note from studying the site that although managing wildlife in the US is mainly a state government matter, many other agencies are involved, including local councils, cities, rehabilitation centres and wildlife societies. The site recognised that: "Wildlife can be found almost everywhere, even in densely populated urban areas, if you observe closely". The site also listed links with teaching resources such as the New York City Public Library's "Urban Neighbors" which offered a sample of the library's collected and displayed artwork depicting over 250 different wildlife species in New York City. Such an exhibition would be a great idea for any library in Australia. This site highlighted some issues that were not mentioned on other sites. The most important was the possibility of zoonotic diseases, that is, diseases people can catch from animals. Given this potential source of fear of urban wildlife, it will be necessary to include veterinary and public health advice as part of any effective urban wildlife program, a point that has been noted for flying-foxes in Australia (Field 2002).

The members of Bat Conservation International, based in the city of Austin, Texas, are treated to a spectacle of a huge bat exodus in the evenings as they fly out from under a bridge. This specialist group has made remarkable progress in moving public attitudes to bats. The Australasian Bat Society (<http://ausbats.org.au/>) also fosters such an outlook yet, as most of us who study bats know, it will take a while before bats are as welcome as the birds that flit through the foliage of our backyard shrubs and trees.

Urban wildlife as a separate discipline

University extension courses provide valuable training in urban wildlife management. The novel value of the Illinois site Urban Wildlife: Challenges and Opportunities (<http://www.urbanext.uiuc.edu/lcr/LGIEN2002-0014.html>) is its clear presentation of habitat manipulation as the most effective strategy not only for attracting wildlife to urban environments but also reducing numbers of a particular species. The site pointed out that wildlife needs four elements to survive: food, water, shelter and space such that the animal can access each safely on a daily basis. One or more of these factors need to be manipulated in order to control urban wildlife populations. Habitat manipulation is far more effective for long-term wildlife control than direct population reduction. Such phrases reaffirm the basic lesson of living with wildlife (as found in Hutchings 2004; Recher 2004; Ross 2004; Yerman and Ross 2004, and Appendix 3), and centre urban wildlife management within the fundamental precepts of ecology.

That the subject of urban wildlife is gaining serious academic attention is illustrated by segments from the “Urban Wildlife Symposium TWS Annual Conference, Nashville, Tenn, 12-16 September 2000.” http://www.rw.ttu.edu/urbwlf/urban_wildlife_symposium_abstrac.htm. What was noticeable is the role that evaluation plays in any urban wildlife program, the importance of taking an overview, and of working with data, not just qualitative statements. The most relevant presentation on this website to Australia was the paper by Vandruff and Adams on “The future of urban wildlife conservation”. It noted that a broadening coalition of stakeholders demanding veterinary-like services for individual wild animals and local populations is predicted, challenges for multi-disciplinary efforts involving regional and city planners, natural resource managers, and urban conservationists, that the scale of needs and opportunities ranged from the backyard sanctuary to the regional (landscape) level and suggested that the priorities for urban wildlife conservation were: a. an accelerating need for an understanding of and programs addressing wildlife damage management; b. planning and mitigation of the impacts of urbanization on wildlife, valued ecosystems (e.g., wetlands), and human-wildlife interactions (e.g., artificial feeding); c. restoration and management of urban green spaces, and d. research and educational programs directed at the “social need” for wildlife and nature...” This paper both pointed to the way forward as well as recognising the existing roadblocks to effective urban wildlife programs. What was also evident was that it was a university department that undertook such a review, and thus confirms that leadership in this matter spans the range of interested parties from wildlife carer groups, community wildlife groups, local councils, state government departments and national agencies and the universities.

The Australian Wildlife Management Society (AWMS) position statement (<http://www.awms.org/positionstatements/urban.html>) identifies urban wildlife as a separate, but workable, professional discipline. It stresses that the most important role in environmental management is one of education and the shaping of attitudes, a view shared by Davies *et al.* (2004) and Howard and Jones (2004). The statement emphasises the importance of population management and its integration with formal planning systems. It recognises that urban wildlife matters require the same principles as do other wildlife management issues. The statement refers to difficult topics not mentioned elsewhere such as euthanasia, translocation and ethics, and as such it is a model for the professional wildlife manager, or anyone wishing to employ such a person.

If we examine some of the urban wildlife jobs that have been advertised and some of the relevant courses, it is possible to give a sense of where current thinking is focused. Appendix 2 contains job advertisements taken from the web. From the job descriptions, one gains a sense of what is needed of an applicant. It would be great to see a string of such job advertisements appear in

Australian newspapers. Birmingham University posted an interesting job for an urban wildlife researcher on its website: the candidate was to study “Biodiversity in urban habitat patches (<http://urgent.nerc.ac.uk/index.html>). To analyse the extent to which our flora and fauna utilise the ‘urban greenways’, both as wildlife corridors and as habitats, and to model and predict biodiversity in cities”. The specific objectives of the position were to “investigate the potential for using an existing database of species distribution and habitat characteristics for modelling the dynamics of wildlife in conurbations; characterise the biota of the urban environment and develop indices which can be used to predict flora and fauna patterns in the urban environment; analyse the richness of species, the distribution of genetic diversity, and abundance of selected species in connected and isolated habitats in order to quantify patch area and distance effects; analyse the importance of barriers and corridors in shaping dispersal processes in the urban environment; model the distribution of species in the urban landscape and develop spatially-explicit population and individual-based models for investigating the response and persistence of urban wildlife to changes in urban landscapes; [and] validate these models...” One is struck by the academic language - analyse, model, predict, investigate, quantify and validate. These are fine goals, and in any substantial program one would ask for such a commitment of intellectual effort. From the point of view of rigour, such clear statements of standards are essential. It is our opinion that too much funding and resources have been allocated to community groups who neither see nor accept that such rigour is essential (Lunney *et al.* 2002a).

van der Ree (2004) is one such pioneer of this new approach to urban ecological studies. Based in Melbourne, he is part of a team that organises large databases of urban wildlife using computer modelling to interpret changes in distributions. This is intricate science in that it uses contemporary survey, recording and modelling techniques and handles large bodies of data in a systematic manner. The novelty lies in that it is being done as an urban exercise. It will become one of the foundation stones of any comprehensive wildlife management strategy for a city. Another approach is Kavanagh’s (2004) owl distribution maps, which drew heavily on the Atlas of New South Wales Wildlife run by the NSW National Parks and Wildlife Service (now the Department of Environment and Conservation), supplemented by the excellent database of Birds Australia. When this approach is combined with the intensive modelling of a population, as demonstrated by Banks (2004), the thoughtful synthesis of a range of studies of Brisbane birds by Catterall (2004), and the experimental design approach by Hochuli *et al.* (2004), one of the clear paths to the future is evident. Anecdotal information has been the primary source of management decisions of most urban wildlife management to date (Davies *et al.* 2004), so the publication in this volume of the systematic work by van der Ree, Kavanagh, Banks and Catterall, to name but a few of the contributors, has set a benchmark for the emerging discipline of urban

wildlife management in Australia. The real value arising from such research will, however, be achieved through partnerships among researchers, planners, wildlife carers, bush regenerators, community groups and those interested in public education, as well as the millions of Australians who live in cities and towns who are keen on wildlife and are looking for leadership in this matter.

The views put forward in this book encourage education, a green web, community involvement, a bold tackling of pest species issues, valuing invertebrates and presenting the subject as a discipline to encourage like-minded people to use their diversity of approaches to conserve urban wildlife. Ideally, wildlife management specialists from state agencies would be charged with urban wildlife management, such as the little penguin in Sydney Harbour (Bourne and Klomp 2004) and would work closely with community groups, local government wildlife specialists, and academics, as is described in the *Birds in Backyards* study of Parsons and Major (2004) and the programs identified in Davies *et al.* (2004).

The way forward

We agree with Recher on the need for “a common strategy for managing wildlife in the urban environment”. In our quest for this ideal we have not only drawn on each chapter to help construct an Australian vision of urban wildlife, but we have also searched the web and dipped into the writings and musings of a variety of urban thinkers and concluded that an Australian synthesis is only beginning to emerge. Urban wildlife needs a new totem, and Turpin and Crawford (2004) have shown that it is possible to make your own wildlife totem in a city landscape. The totem may change for each person, but it is the vision, the enthusiasm for wildlife, the willingness to work across disciplines, that will retain and value what wildlife remains and recreate habitats and opportunities that have faded.

Indeed, on that latter point, it is becoming increasingly important to record what was present, as was so skilfully done by Keast (1995) in his personal account of the birds of Sydney 50 years ago.

In this book we have tried to produce the beginnings of an Australian synthesis through the eyes of working zoologists, but in doing so we acknowledge that there are other eyes and thus other elements of any common strategy that have yet to be incorporated into strategies for managing urban wildlife. There has been a proliferation of studies, ideas, position statements, web pages, courses and a collective recognition of the value of urban wildlife over the last two decades. There is a clear indication that urban wildlife is coalescing into a discipline in its own right. In less than three decades we have moved from not recognising urban wildlife as part of the urban planning debate (Blair 1974, Stretton 1975; Sandercock 1976), to the emergence of a discipline in urban wildlife as demonstrated in the pages of this volume. Australia needs to develop its own synthesis, drawing on the models in the UK and the USA. Already, there are many local and species-specific strategies taking shape; there are position statements, academic courses and job descriptions; and the diversity of views reflects the different starting points of the observer, the wildlife manager and the urban dweller. It is in this context that education and practice will be so vital, and we look forward to the next 20 years and the evolution of a thriving discipline of urban wildlife management from Manly with its little penguins, on the east coast, to King's Park with its urban avifauna, on the west coast and every city and town, big or small, in between.

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(Note: the references in the body of the text with a 2004 date that do not appear below refer to the chapters in this book that can be found in the contents page.)

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APPENDIX I Appendix I. An Primer for Urban Wildlife in Australia: Ecology, Conservation and Management.

(This reading list, set out as primer, was kindly sent to us by Darryl Jones. Its particular value is that it presents a well-rounded, field-tested response to the need for an Australian synthesis on the subject from a university teaching perspective. It also shows the international breadth of the subject and where the current emphases are placed, and it gives readers a strong sense that such a discipline does exist. We appreciate being able to include it in this book. – eds.)

Darryl Jones
Suburban Wildlife Research Group
Australian School of Environmental Studies
Griffith University
Nathan, Qld. 4111

Context.

The aim of this set of readings is to provide an introduction to some of the key issues necessary for a general understanding of the urban wildlife in an Australian context. The selection is intentionally limited; the objective is to suggest a breadth of subjects rather than to canvass all approaches to a particular issue.

Published information relating to research and management of wildlife in urban areas in Australia is extremely limited; indeed, the papers presented in the present volume are certainly the most significant contribution to the field as it currently stands in Australia. Nonetheless, there are many Australian and international publications of considerable importance and relevance to understanding the complex dimensions of urban wildlife.

As will become clear to anyone entering this field, the literature of urban ecology is often remarkably difficult to find or obtain. This is partly due to the legacy of being a neglected branch of ecology and wildlife management; until very recently there were no journals specialised in or even promoting the publication of research associated with urban wildlife, and very few scientific books devoted to the subject. Those seeking to find papers and articles in the field were forced to search for obscure journals or undertake difficult international negotiations in an attempt to obtain poorly publicised conference proceedings. Things have improved considerably (see below) but some of the works listed may prove difficult to procure. The Suburban Wildlife Research Group is willing to provide copies of the more difficult items, if necessary.

I Primary Resources

(a) The Main Books

There are three essential books that may be regarded as foundational to this field. None is Australian but all contain much that is directly applicable here. Adams (1994) must be regarded as one of the most important and influential publications yet to emerge, and is thoroughly recommended. Gilbert (1989) is thoroughly English and, although less directly relevant to Australian conditions, does contain excellent reviews of the many dimensions of the field. Marzluff *et al.* (2001) is very recent and very valuable (and very expensive!). Although focussed on birds, it is international (meaning there are examples from North American and Europe) in perspective and will be immensely influential because of its critical approach and emphasis on improving urban ecological studies.

Adams, L.W. (1994). *Urban Wildlife Habitats: A Landscape Perspective.* University of Minnesota Press, Minnesota.

Gilbert, O.L. (1989). *The Ecology of Urban Habitats.* Chapman & Hall, London.

Marzluff, J.M., Bowman, R. and Donnelly, R. (eds.) (2001). *Avian ecology and Conservation in an Urbanizing World.* Kluwer, Norwell, USA.

(b) Journals

Although *Landscape and Urban Planning* does publish many relevant studies, urban wildlife research is just as likely to be found in any of the ecology, wildlife management or bird journals: for example, *Ecography*, *Biological Conservation*, *Condor* and *Wildlife Society Bulletin*. Many Australian studies have also appeared in *Emu*, *Wildlife Research*, *Austral Ecology* and *Pacific Conservation Biology*.

(c) Popular Books

These are valuable for their perspectives and ideas, though some aspects may be somewhat dated or questionable. This is certainly the case with Low's extremely controversial book; whatever your views, you should read this.

Goodwin, D. (1978). *Birds of Man's World.* University of Queensland Press, Brisbane.

Low, T. (2002). *The New Nature.* Penguin, Sydney.

McLoughlin, J.C. (1978). *The Animals Among us: Wildlife in the City.* Viking, New York.

APPENDIX I (d) Additional Resources

There are two excellent organizations devoted to providing news and ideas on urban wildlife.

(1) *The Urban Open Space Manager* is a quarterly newsletter published by Urban Wildlife Resources, 5130 W. Running Brook Rd., Columbia, MD 21044 USA (www.erols.com/urbanwildlife) for US\$18 per annum. This newsletter, edited by Lowell Adams, provided summaries of relevant published research from a variety of international journals. This organization also sells three key publications: *Urban Wildlife Habitats* (see above) and two important conferences proceedings: *Integrating Man and Nature in the Metropolitan Environment* (1987) and *Wildlife Conservation in Metropolitan Environments* (1991).

(2) English Nature, the statutory body responsible for promoting conservation in England, publishes the magazine, *Urbio: Urban Biodiversity and Human Nature*. This appears three times a year and can be obtained free of charge from English Nature (www.english-nature.org.uk).

Selected Publications

Key Early Ideas and Studies

Davies, B.N.K. (1976). Wildlife, urbanisation and industry. *Biological Conservation* 10: 249-291.

Emlen, J.T. (1974). An urban bird community in Tucson, Arizona: Derivation, structure, regulation. *Condor* 76: 184-197.

Erz, W. (1966). Ecological principles on the urbanisation of birds. *Ostrich (Supplement)* 6: 357-363.

Owens, J. & Owens, D.F. (1975). Suburban gardens: England's most important nature reserve? *Environmental Conservation* 2: 53-59.

Habitat and Landscape Issues

Dickman, C.R. (1987). Habitat fragmentation and vertebrate species richness in an urban environment. *Journal of Applied Ecology* 24: 337-351.

McConnell, M.J. & Pickett, S.T.A. (1990). Ecosystem structure and function along urban-rural gradients: An unexploited opportunity. *Ecology* 71: 1232-1237.

Miller, J.R., Fraterroigo, J.M., Hobbs, N.T., Theobald, D.M. and Wiens, J.A. (2001). Urbanisation, avian communities and landscape ecology. In Marzluff, J.M., Bowman, R. and Donnelly, R. (eds). *Avian ecology and Conservation in an Urbanizing World*. Kluwer, Norwell, USA.

Rottenborn, S.C. (1999). Predicting the impacts of urbanisation on riparian bird communities. *Biological Conservation* 88: 289-299.

Sewell, S.R. & Catterall, C.P. (1998). Bushland modification and styles of urban development: Their effects on birds in Southeast Queensland. *Wildlife Research* 25: 41-63.

Management and Ecology of Selected Species

Fearn, S., Robinson, B. Sambono and Shine, R. (2001). Pythons in the pergola: the ecology of "nuisance" carpet pythons (*Morelia spilota*) from suburban habitats in south-eastern Queensland. *Wildlife Research* 28: 573-579.

Jones, D.N. and Everding, S.E. (1991). Australian Brush-turkeys in a suburban environment: Implication for conflict and conservation. *Wildlife Research* 18: 285-297.

Major, R.E., Gowing, G. and Kendal, C.E. (1996). Nest predation in Australian urban environments and the role of the pied currawong, *Strepera graculina*. *Australian Journal of Ecology* 21: 399-409.

Marks, C.A. and Bloomfield, T.E. (1999). Distribution and density estimates for urban foxes (*Vulpes vulpes*) in Melbourne: implications for rabies control. *Wildlife Research* 26: 763-775.

Management Issues

Conover, M.R. (1997). Wildlife management by metropolitan residents in the United States: practices, perceptions, costs and values. *Wildlife Society Bulletin* 25: 306-311.

Craven, S., Barnes, T. and Kania, G. (1998). Towards a professional position on the translocation of problem wildlife. *Wildlife Society Bulletin* 26: 171-177.

Pietsch, R.S. (1994). The fate of urban Common Brushtail Possums translocated to sclerophyll forest. In Serena, M. (ed.). *Reintroduction Biology of Australian and New Zealand Fauna*. Surrey Beatty and Sons, Sydney.

Conservation Issues

Cannon, A. (1999). The significance of private gardens for bird conservation. *Bird Conservation International* 9: 287-297.

Fernandez-Juricic, E and Jokimaki, J. (2001). A habitat island approach to conserving birds in urban landscapes: Case studies from southern and northern Europe. *Biodiversity and Conservation* 10: 2023-2043.

Murphy, D.D. (1988). Challenges to biodiversity in urban areas. In Wilson, E.O. (ed.). *Biodiversity*. National Academy Press, Washington.

Uhl, C.F. (1998). Conservation biology in your own back yard. *Conservation Biology* 12: 1175-1177.

The Human Dimension: The Importance of the “People Factor”

Decker, D.J. and Chase, L.C. (1997). Human dimension of living with wildlife – a management challenge for the 21st century. *Human Dimension of Wildlife* 25: 788-795.

Rohde, C.L.E. and Kendle, A.D. (1994). Human well-being, natural landscapes and wildlife in urban areas: a review. *English Nature Science Report No. 22, English Nature*.

Shine, R. and Koenig, J. (2001). Snakes in the garden: an analysis of reptiles “rescued” by community-based wildlife carers. *Biological Conservation* 102: 271-283.

Lunney, D., O’Neill, L., Matthews, A. and Coburn, D. (2000.) Contribution of community knowledge of vertebrate fauna to management and planning. *Ecological Management and Restoration* 1: 175-84.

Lunney, D., Matthews, A., Moon, C. and Turbill, J. (2002.) Achieving fauna conservation on private land: reflections on a ten-year project. *Ecological Management and Restoration* 3: 90-96.

Wildlife-human Conflicts

Brandt, A. (1997). Not in my backyard. *Audubon (Sept./Oct.)*: 58-62, 86-87, 102-103.

Ehrenfeld, D. (2001). Strangers in our own land. *Orion (Autumn)*: 8-11.

Porter, W.F. (1997). Ignorance, arrogance, and the process of managing overabundant deer. *Wildlife Society Bulletin* 25: 408-412.

Minnis, D.L. (2001). Issue management: part and parcel of wildlife management. *Wildlife Society Bulletin* 29: 988-994.

Lunney, D., Reid, A. and Matthews, A. (2002). Community perceptions of flying-foxes in New South Wales. Pp. 160-175 in *Managing the Grey-headed Flying-fox as a Threatened Species in NSW*. edited by P. Eby and D. Lunney. Royal Zoological Society of NSW, Mosman.

Three new but crucial references.

Alberti, M., Marzluff, J.M., Shulenberger, E., Bradley, G., Ryan, C. and Zumbrennen, (2003). Integrating humans into ecology: Opportunities and challenges for studying urban ecosystems. *BioScience* 53 (12).

McKinney M.L. (2002). Urbanization, biodiversity and conservation. *BioScience* 52: 883-890.

Palumbi, S.R. (2001). Humans as the world’s greatest evolutionary force. *Science* 293: 1786-1790.

APPENDIX 2 Appendix 2. Jobs in urban wildlife.

The following four job advertisements are shown here with their web source. The objective of including these advertisements is to show what a job as an urban wildlife manager/researcher looks like, what qualifications are required and the current emphases, particularly the need to work with people and to be able to deal with animal-human conflicts as well as to conduct a research program.

1. "Texas Parks & Wildlife Department. Urban Wildlife Program. (<http://alum.biology.uh.edu/bbua/Urban-wildlife.htm>) . This program began in 1993. There are currently 7 urban biologists working in Texas with 2 more slated to start in the near future. An urban biologist is one who works with both people and wildlife in urban environments. Urban biologists in Texas are charged with developing methods to reconnect broad cross-sections of the urban population with nature on a personal level. They also provide the information that urbanites need in order to make sound decisions regarding natural resource management. This is important because over 80% of Texans now live in a few highly urbanized areas."
2. "Employer: Illinois natural History Survey. (<http://www.agnr.umd.edu/users/careers/Jobs/12999J-1.htm>). Position: Wildlife Ecologist-Urban Wildlife and Wildlife-human conflict management. Qualifications: This position requires a Ph.D. in wildlife ecology, natural resource management, or closely related field. The candidate must have experience with the design, interpretation, and publication of research focusing on the ecology and management of wildlife in conflict with human interests and should be familiar with the culture and practice of wildlife management in the Midwest. Prior experience with a wildlife management agency is preferred. The candidate must have an aptitude for cooperative/interdisciplinary research with the IDNR and the University of Illinois and must be able to make sound value judgments and articulate professional opinions to granting agencies, management agencies, the scientific community, and the general public. Description: The candidate is expected to initiate and maintain an extramurally-funded research program on questions related to the ecology and management of wildlife in conflict with human interests in Illinois and elsewhere. The candidate is expected to act as the point person and principle researcher on urban wildlife issues, agricultural crop damage issues, and nuisance wildlife for the Center of Wildlife Ecology. Research responsibilities will include regular publication in peer reviewed journals, presentations at scientific meetings, and frequent interacting with urban and rural constituents. Salary: \$43,000 to \$46,000 (Assistant), \$47,000 to \$56,000 (Associate)."
3. "The Missouri Department of Conservation has a position available for an Urban Wildlife Biologist in Kirkwood, Missouri. Salary range: Annually \$32,424 - \$57,576. Duties and responsibilities: Provides wildlife information and consultation to individuals, groups, city, county, state and federal governments and real estate developers for conservation and development of urban wildlife habitat and urban wildlife issues; develops and implements urban wildlife management plans in coordination with Urban Forester, Fisheries Biologist, and other Department personnel; provides response to public inquiries relating to wildlife habitat and behavior; coordinates civic club and volunteer group projects at designated locations; works closely with Metro Media Specialist for development of media coverage; develops programs and presentations for workshops and seminars; develops urban wildlife management guidelines and publications relative to biological and cultural carrying capacity; coordinates outdoor programs with agencies and organizations and assists with publicity, activities and programs; manages human- wildlife conflict program; monitors efforts of nuisance wildlife control operators and provides input to further department program goals; and performs other duties as required. Qualifications: Graduation from an accredited college or university with a Bachelor's Degree in Biological Sciences, Zoology, Wildlife Management, Urban Wildlife Management or closely related subjects and three (3) years of professional experience in wildlife research, management or other applicable work; or an equivalent combination of education and experience. A Master's Degree and experience in Urban Wildlife Management are desirable. Approval as Certified Wildlife Biologist by The Wildlife Society is desired."
4. "Research Assistant School of Geosciences Fixed Term Appointment (2 years). An enthusiastic person is sought to work on an ARC-funded project that examines how Australians construct nature - both conceptually and materially - in the hybrid social and ecological space of the suburban backyard. Selection criteria include: an Honours degree or equivalent in a relevant discipline; experience in semi-structured interviewing and/or ethnography, and in the analysis of qualitative research materials; excellent communication skills; project management; computer skills; willingness and ability to undertake fieldwork in the Illawarra and Sydney regions. Some weekend work will be required. For further information and a detailed position profile contact This is a full time position, but proposals for part time or job share will be considered. Annual Salary \$36,307 to \$42,116. The advertisement was distributed in February 2002 on an email network with the reference being to www.uow.edu.au/vacancies."

APPENDIX 3 Appendix 3. Courses in urban wildlife.

The first two courses were found on the web and provide a summary of how a professional wildlife manager is viewed from the perspective of academic training. The third course was derived from the ideas thrown up in the editing of this book, and while the course is imaginary at this stage, it reflects current thinking on this matter in Australia. Part of the inspiration for its structure comes from the material provided by Darryl Jones in Appendix 1, which is already a well-structured start to any course. What emerges from these courses is ideas, a sense of the future and a statement that we have yet to see a synthesis of urban wildlife management take the form of a course structure.

1. WFSC 405 Urban Wildlife and Fisheries – Course Syllabus (<http://wfscnet.tamu.edu/courses/wfsc405.htm>). Course Justification

Urban fish and wildlife resources have been largely neglected by professional ecologists and natural resource managers and administrators, but have emerged as an expanding and integral component of wildlife and fisheries sciences (VanDruff 1979, Duttweiler 1984). There are no formal undergraduate training programs in urban wildlife or fisheries ecology and management at any university in the United States (Adams et al. 1987, and VanDruff, personal communication). However, most humans share the landscape and exist in daily association with urban wildlife. New employment opportunities for wildlife and fisheries biologists have evolved from this urban human/wildlife association. These opportunities include environmental planners for city, county or state governments; wildlife or fisheries biologists with private consulting firms; urban forestry or extension programs; or educators in private or public educational programs. For example, the nongame urban wildlife and fisheries program within the Texas Parks and Wildlife Department has grown from a staff of 3 to 10 within the last five years. The College of Agriculture and Life Sciences has recognized the need to address urban issues and initiated the development of a directional emphasis task force on urban programs. Finally, the adoption of an urban wildlife and fisheries course would involve little restructuring of university and departmental core curricula. Objective. The urban wildlife and fisheries course is designed to provide students with exposure to and a knowledge of contemporary concerns involving “wildlife” (e.g., fin, feather, fur) in the urbanized landscape. The course will cover the following areas as they relate to the course objective: 1. ecology of the urban environment. 2. occurrence of wildlife and conditions of habitat. 3. the biology, especially adaptations, of important urban species and groups. 4. introduction to pertinent literature, especially current publications, dealing with techniques of study, research, and management of urban wildlife. 5. current and needed research on urban wildlife. 6. agencies’ responsibilities and programs. One of the sections in the proposed course outline gave a list of headings for any future course and simultaneously identifies the issues facing urban wildlife managers: “VII. Special Management Considerations. A. Airports; B. Corridors and Greenbelts; C. Zoonoses (e.g., brucellosis and Lyme disease); D. Residential Sites; E. Habitat Restoration and Management; F. Urban Forests; G. Urban Parks; H. Urban Wetlands; I. Backyard Enhancements.” “Literature Cited. Adams, L.W., D.L. Leedy, and C.E. Olson. 1987. Urban wildlife research and education in North American colleges and universities. *Wildl. Soc. Bull.* 15:584-590. Duttweiler, M.W. 1984. Training needs of urban fishing planning and management personnel. pages 67-70 in L.J. Allen, ed. *Urban Fishing Symposium*. American Fisheries Society, Bethesda, MD. VanDruff, L.W. 1979. Urban wildlife-neglected resource. Pages 184-190 in R.D. Teaque.

2. Urban Wildlife Management. Required Textbook, Wheater, C.P. 1999. *Urban habitats*. Routledge, London. (<http://www.missouri.edu/~snrnilon/fw336.htm>) World Wide Urban Wildlife Links (Because urban wildlife management takes place all over the world).
3. Urban wildlife management course in the mind’s eye. You have just picked up a brochure on course options at the University of Western Sydney. The brochure has not been written yet but it is in our mind’s eye. What is presented here is part detail and partly thinking aloud. Our objective is to frame a vision, a philosophy, and to anchor the course as belonging to a biological or environmental strand of science. What follows is just a stretch of the imagination. We would be delighted if segments from the chapter were lifted and appeared courses across Australia.

How did we come to the decision that it should be an undergraduate course, rooted in the biological or environmental strand of science? Bush regeneration courses, which underpin the maintenance and/or expansion of vegetation in urban areas, in some respects parallel an urban wildlife course as we envisage it and are thoroughly grounded in the ecological/environmental strands of TAFE courses. However, while there is undoubtedly an intellectual stretch in the bush regeneration courses, they tend to be more concerned about the “hands on” of restoration, planting and maintenance of vegetation while the management of wildlife in our suburbs as we perceive it requires a much more integrative approach, with a more rigorous underpinning of the sciences.

The underpinning feature of this volume is ecology. However, an ecology course would not provide all the tools for the management of urban wildlife. One critical element that would be missing is the

training to effectively liaise with local and state government, researchers and the broader community to deal with conflict, to work cooperatively and to act as a vehicle to change attitudes. For example, to encourage people to accept current policies on possums and to release problem animals effectively at the point of capture (Matthews *et al.* 2004) or to encourage people to change their gardens to encourage the small-bodied birds that will reduce their dependence on commercial chemicals (Catterall 2004) or to change attitudes towards feeding (Howard and Jones 2004) requires both the knowledge and the skills to communicate the information. Hence the graduate must have skills in identification of the species status through a detailed background research of the autecology of the target species. This often requires exceptional skills in tracking down disparate information from a diversity of sources and the integration of such information. Alternatively, it may simply mean undertaking the research to determine status, which may come from either community survey or from ecological research. However, the acquisition of knowledge alone would not be sufficient to manage the species. The graduate would then need to effectively convey this information to the broader community as a basis for attitudinal change.

The process would require the collection of population ecology information and dynamic distribution maps requiring GIS skills, as well as the provision of community education, the ability to monitor change and the exercise of adaptive management skills to ensure that management of the manipulated population achieves the desired outcomes. Hence, ecological skills alone would not be sufficient for good management. To obtain attitudinal shift requires excellent people skills and nowhere are they more important than where the actions of the professional are going to impact directly on large numbers of urban stakeholders across the full spectrum of socio-economic, ethnic, age and educational backgrounds. Stakeholders will display the full spectrum of attitudes, from complete rejection of the concept that wildlife has a place in the suburbs, through different levels of acceptance and willingness to participate in maintaining wildlife, to the animal welfare lobby with an abhorrence for the manipulation of numbers or willingness to change habitats of a lifetime, no matter what the implications for the longer term viability of the community within which the species is a component. In parallel with a change in attitudes, there is a need for legislative and political change. A graduate in “Urban Wildlife” would, therefore, also require a basic understanding of the process of such change.

With such multi-disciplinary requirements for urban wildlife management and the theoretical underpinning required, an undergraduate university degree would be the appropriate level of study, although there would also be scope for coursework programs at the postgraduate level for graduates with degrees such as biological sciences, environmental science, town planning, and engineering. We anticipate that within a decade, degrees in “Urban Wildlife” will be established in many universities internationally and graduates will be in demand across the spectrum of disciplines related to urban management, including in state government (eg. urban planning, national parks management) and local government agencies. Urban landcare, consultants and educational institutions will increasingly seek appropriately skilled people with a heightened awareness of the consequences of neglecting urban wildlife that may allow some species to become locally extinct while others create havoc because they reach pest proportions.