UrBAC

Urban Biodiversity Awareness Consortium

http://urbac.wildlife.org.au

Australasian Urban Ecology Research Colloquium (AUERC)

2005

Mini-Proceedings

Colloquium held:
Saturday, 3rd December, 2005

At:
The University of Queensland
St. Lucia, Brisbane, Australia

SPONSORS

The AUERC 2005 was made possible through the financial and in-kind contributions of:

Brisbane City Council

Griffith University

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Feedback and Updates since the AUERC 2005

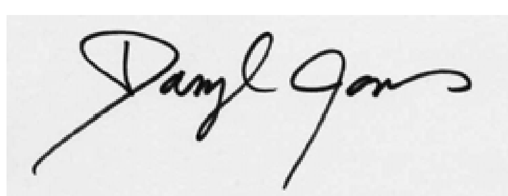
Thankyou all for making UrBAC's first AUERC a smashing success! We are delighted that this event was received so enthusiastically. AUERC delegates travelled from across Australia and New Zealand and represented a diverse range of backgrounds including: universities, local city councils, and government and non-government agencies. We sincerely appreciated the effort made by many delegates to travel to Brisbane for the day's event. Thanks especially to all of our speakers and poster presenters – what a fascinating and exciting range of projects are being undertaken in Australian and New Zealand urban landscapes.

The feedback received from the AUERC delegates was overwhelmingly positive. The day was considered extremely worthwhile and there was an overall consensus for UrBAC to host similar events annually. In response to this positive feedback and enthusiasm, UrBAC has decided to host an annual colloquium targeting various issues of urban wildlife research, education and planning and management. Accordingly, planning is currently underway for the next UrBAC colloquium, which will be organised and hosted by UrBAC's Planning Working Group. The theme of this colloquium will be 'Planning for Urban Wildlife', with the focus on wildlife-friendly urban planning and design. Stay tuned to UrBAC's website (http://urbac.wildlife.org.au) for further details.

We would like to take this opportunity to thank our sponsors, The University of Queensland, Griffith University and Brisbane City Council for helping to make this day possible!! The following mini-proceedings provides a summary of the talks presented at the AUERC 2005. Contact details for AUERC delegates and other interested people are listed on pages 5-6 to encourage and broaden the urban ecology researcher's communication network and foster the sharing of new projects, information and ideas.

We thank you all again for your support and encouragement and we look forward to meeting with you at UrBAC's next colloquium.

Sincerely –



Jenni Garden & Darryl Jones
(AUERC 2005 Organising Committee)

UrBAC – Who? What? Why? Where?

UrBAC's Aim

To gather and disseminate information, research and build experience in order to protect, enhance and manage biodiversity in settled areas of SEQ

UrBAC's Story

During the Wildlife Preservation Society of Queensland's (WPSQ) Urban Wildlife Forum in June 2003, delegates agreed that settled areas of South-east Queensland (SEQ) have significant conservation value, high levels of biodiversity and that there is an urgent need for improved understanding and management of the natural values in this region. A resolution was passed to form an advisory body to support stakeholders in urban wildlife management in working towards the best possible biodiversity conservation outcomes for the future of SEQ. On 15th October, 2003 an interim steering committee (ISC) of the Urban Biodiversity Advisory Consortium (UrBAC) met to formulate strategies to take the forum resolution forward. The interim steering committee initially included representatives from QPWS, Brisbane City and Redland Shire Councils, Griffith University, University of Queensland and Dept Natural Resources and Mines, RSPCA and WPSQ.

Having reviewed the Urban Wildlife Forum workshop outcomes, the ISC established a mission statement: "To gather and disseminate information, research and build experience in order to protect, enhance and manage biodiversity in settled areas of SEQ". UrBAC seeks the support and involvement of a wide range of stakeholders so that it can fulfil its aim of providing a common thread for decision makers and policy setters to make informed and consistent decisions for the best conservation and community outcomes in the SEQ bio-region.

More recently, a permanent UrBAC steering committee was formed. This committee includes voluntary representatives from Brisbane City Council, Redland Shire Council, Griffith University, the University of Queensland, and WPSQ

Stakeholders involved in biodiversity conservation have been invited to form a Reference Group, with one of the first activities being to develop a detailed scoping document. The reference group will include a wide range of representation from areas such as EPA/QPWS, Education, Local Governments, Departments of Natural Resources, Primary Industries, Main Roads and Natural Resources and Mines, Queensland Universities, Conservation and Landcare groups, nursery and pet industries, animal welfare and rehabilitation groups, as well as various commercial interests.

In addition to the reference group, three main working groups will be established to address certain key issues raised at the Forum. These are Education, Research, and Planning. A communication program is being developed to keep all parties informed as UrBAC evolves. For more details about UrBAC and to be put on our mailing list, please contact us via email (UrBAC@wildlife.org.au). The Urban Biodiversity Awareness Consortium Website is hosted by the Wildlife Preservation Society of Queensland.

TABLE OF CONTENTS

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Living with urban wildlife: A new ethic for a new system

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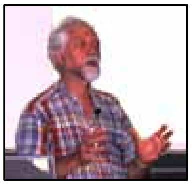

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Overview

In *Urban wildlife. More than meets the eye* (Lunney & Burgin 2004), we drew a number of conclusions:

a) The most striking feature of urban wildlife studies is the revelation of its vast diversity from small invertebrates, to large vertebrates,

b) The themes need to be pulled together to come up with a common strategy for managing wildlife in the urban environment,

c) People's attitudes to wildlife form a key element,

d) There are many local and species-specific strategies that reflect the different starting points of the observer, the wildlife manager and the urban dweller, and

e) In less than three decades we have moved from not recognising urban wildlife as part of the city ecosystem (Blair 1974; Sandercock 1976), to the emergence of a discipline in urban wildlife.

Some strong points emerge from all the stories:

a) The geographic area is most likely to be "(sub)urban wildlife". Urban is shorthand.

b) A clash of paradigms (Lunney *et al.* 2002) arises when a local community group attempts all phases of the work without the backing of a rigorous science-based program.

c) The approach is well-removed from dedicating national parks and emphasising threatened species.

d) The connection between conservation objectives and the attitudes/perceptions has yet to be clarified.

Urban environments are new ecosystems. Until cities are seen as wildlife ecosystems, wildlife will be an afterthought.

A new ethic is required to help with the decisions on individual animals, habitats, community attitudes to populations, including pests.

In the context of a review of research ethics, Elliott and Brown (1997) made the observation that the question of what humans owe to nonhuman animals has traditionally been argued over the boundary of what philosophers call the "moral community". They framed the problem by asking: on what basis do you include baboons but not bats, bats but not beetles, beetles but not bacteria?

In *Understanding Ethics,* Preston (1996) states: "I believe there is no higher ethical calling than to protect the well-being of life-systems on planet Earth and to speak on behalf of future generations of human and non-human beings".

Preston identifies two broad assumptions: anthropocentrism, which is the view that *Homo sapiens* is the central moral concern; and ecocentrism, which is the view that the whole of nature should be given moral consideration.

Even if one rejects anthropocentrism, the question still remains as to whether there is a hierarchy of beings when it comes to moral concern.

Preston gives the following example:

"On the extensionist argument, we might maintain that the interests of humans to build a road through a rare koala habitat do not over-ride the interests of koalas."

Preston considers that an ethic of responsibility that challenges both environmentalists and community decision-makers could provide a means to avoid the excesses of anthropocentrism and see through the blindspots of ecocentrism.

Conclusions

a) Urban wildlife encompasses far more than fits the normal world of a zoologist.

b) Conversely, without zoologists, society's efforts to conserve urban wildlife will be a limited cause.

c) Living with urban wildlife requires us to develop a new ethic for a new ecosystem.

Related Publications

Blair T.L. (1974) *The International Urban Crisis.* Paladin, St Albans, Herts, UK.

Preston N. (1996) *Understanding Ethics.* The Federation Press, Annandale, NSW, Australia.

Elliott D. & Brown M. (1997) Animal experimentation and ethics. *In:* D. Elliott & J.E. Sterns (Eds) *Research Ethics. A Reader*. Pp. 246-58. University Press of New England, Hanover, USA.

Lunney D. & Burgin S. (Eds) (2004) *Urban Wildlife: More than Meets the Eye*. Royal Zoological Society of NSW, Mosman, NSW.

Lunney D., Dickman C. & Burgin S. (Eds) (2002) *A clash of paradigms: Community and research-based conservation*. Royal Zoological Society of New South Wales, Mosman, NSW.

Sandercock L. (1976) *Cities for Sale. Property, politics, and urban planning in Australia.* Heinemann, London.

Urban ecology research in New Zealand

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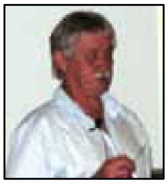

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This research is a collaborative project between Lincoln University and Manaaki-Whenua Landcare Research.

Background

Today 84% of the New Zealand population lives in urban areas (Auckland 1.3 million, Wellington 460,000 and Christchurch 350, 000). Urban ecology research in NZ has focused historically on naturalization of plants in urban areas, and the protection of small remnants of albeit degraded freshwater wetland, salt marsh and podocarp forest (and an accumulating record over at least the last 20 years of their natural history). Most cities now have species lists and subjective accounts of habitat. There has been some preliminary quantitative urban forestry research - determining abundances and proportions of largely planted native trees and shrubs and patterns of spontaneous regeneration in urban areas. Monitoring of instream life is now operating in several cities. At least 30 years of experience has been devoted to problems of restoration of lost native plant communities in different urban centers. There has also been recent attention given to social aspects of ecological restoration, especially about preferences for exotic and native flora – the former being generally better marketed and dominant in the urban dweller’s daily experience. Contemporary research related to the urban physical environment includes using lichens as pollution indicators and monitoring of air and water quality.

Project Overview

Recent research centers around a government funded Low Impact Urban Design and Development programme (LIUDD) whose main thrust is to minimise or mitigate impacts of flashy, contaminated, storm-water from impervious surfaces and encourage energy efficient and sustainable building design, transport systems and waste management. Associated with this LIUDD programme are initiatives to enhance the biodiversity component of urban biotopes. Because there has been no systematic study of urban biotopes in New Zealand the first task has been to inventory and sample these typical and unique city habitats and their natural analogues in search of appropriate species that have so far failed to colonise the urban environment.

Ongoing Work

Questions of improving native biodiversity in urban areas and finding practical ways of retaining national identity through using native plant materials (plant signatures) are among the most crucial for the future of New Zealand's urban ecology and cultural maturity.

Related Publications

Ignatieva M.E. & **Stewart G.H**. (2006) Homogeneity of urban biotopes and similarity of landscape design language in former colonial cities. *In:* M.J. McDonnell, A. Hahs & J. Breuste (Eds), *Comparative Ecology of Cities and Towns,* Cambridge University Press, Cambridge, U.K. (in press).

Stewart G.H. (Ed.) (2005) Programme and abstracts, "Meaning and design of nature for the urban built environment" conference, Lincoln University, 24-26 August, 2005. 32pp.

Stewart G.H., Ignatieva M.E., Meurk C.D. & Earl R.D. (2004) The re-emergence of indigenous forest in an urban environment, Christchurch, New Zealand. *Urban Forestry and Urban Greening* **2,** 149-158.

Stewart G.H. & Ignatieva M.E. (Eds.) (2000) Urban biodiversity and ecology as a basis for holistic planning and design. *Proceedings of a workshop held at Lincoln University 28/29 October 2000.* Wickliffe Press Ltd, Christchurch, New Zealand. 110pp.

What to expect from urban wild dogs (*Canis lupus dingo*, *C.l. domesticus* and their hybrids) and hydatids (*Echinococcus granulosus*)

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This research is being conducted as an Honours project, due to be completed in 2006, and also acts as a pilot study for a larger, long-term research project to commence in 2007.

Background

The last decade has witnessed an increase in human-wild dog interactions along most of the eastern seaboard from Sydney north, but particularly in Queensland. Most local government authorities affected by wild dog problems undertake routine pest animal control, with exceptional circumstances occurring in the greater Brisbane area, the Gold and Sunshine Coasts, Gladstone, Mackay, Rockhampton, and Townsville. As human development expands and wildlife habitat contracts, greater human-animal interaction and presence of wild dogs in urban contexts can be expected in the future. Urban wild dogs cause significant impacts on domestic pets and livestock, and pose four potential threats to human health and safety, especially in bushland suburbs, or suburbs adjacent to riparian landscapes. These threats are: attacks on humans; attacks on domestic animals; zoonotic parasites and diseases transmitted by wild dogs; and psychological and emotional trauma to affected residents. These risks often cause substantial economic loss, yet can often be difficult to quantify.

Project Overview

Essential to the effective management of urban wild dogs and their zoonotic parasites and pathogens, is a correct and thorough understanding of their behavioural ecology and disease epidemiology *in urban areas*. In order to explore these risks, research has begun to monitor wild dogs in three urban districts in metropolitan and regional Queensland using GPS datalogging collars to determine habitat use by urban wild dogs; assess their reliance on native bushland areas; and evaluate the potential role of wild dogs in the epidemiology of human hydatid infection (caused by the parasitic tapeworm *Echinococcus granulosus*). Preliminary results indicate that similar to urban predators on other continents (urban foxes *Vulpes vulpes* and urban coyotes *Canis latrans*), urban wild dogs in Queensland have smaller home ranges than their rural counterparts, exhibit flexible habitat requirements in a resource-rich urban environment, and potentially have a critical role in the transmission of *E. granulosus* to humans in built-up areas. These factors combine to require an intensive and cooperative management approach from several wild dog and human management agencies, against a common, adaptable, flexible, and successful urban predator.

Ongoing Work

Forthcoming information from this current study may include:

- A review entitled 'What to expect from urban dingoes: Lessons learned from urban foxes and coyotes'
- An assessment of GPS data-logging collar performance for wild dogs in urban areas
- An analysis of movements and habitat use by urban wild dogs in Queensland
- An investigation of the potential role of urban wild dogs in the transmission of human hydatid disease, and other zoonoses.

This project acts as preliminary (pilot) research towards a larger, long-term study to be conducted in 2007-2009. This larger study hopes to investigate dingoes in urban sugar cane land, their dispersal before, during, and after residential development of this land, and the control of dingoes and disease through pest animal management in urban cane land.

Plant traits and local extinctions along an urban-rural gradient

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Background

The local extinction of plant species in fragmented landscapes is often studied using the theory of island biogeography. The theory suggests that the size, shape, distance to nearest neighbour, and perimeter to area ratio of patches of remnant vegetation are important predictors of the rate of species extinction. It also assumes that the matrix has no influence on the embedded patches; that is, that it is neutral. In reality this assumption is seldom met, particularly in human dominated landscapes where the surrounding landscape matrix may exert an overwhelming influence on patches of remnant vegetation. Different landscape contexts (i.e. urban, rural or forest) could be expected to have different levels of influence on the endogenous and exogenous ecological processes that determine the persistence of species in remnant patches. However, this has rarely been studied.

Project Overview

To test the influence of landscape context we surveyed 30 native grassland remnants along a 400 kilometer urban to rural gradient in Victoria, Australia. Native grasslands are one of the most endangered ecosystems in southeastern Australia. They are extremely fragmented and populations of many rare plant species are restricted to small, isolated remnants in urban and rural landscapes. All sites had under gone comprehensive botanical survey between 1979 and 1990 and remained as native grassland in 2000.

Sites were re-surveyed in the spring and summer of 2001-2002. Survey effort was standardised through the participation of the same recorders on each occasion and implementation of a standard survey technique. Psuedo turnover or false absences (i.e. recording a species as absent when it was in fact present) has been highlighted as a problem in similar local extinction studies. We minimised psuedo turnover by restricting our study to small sites (average size 4.5ha), surveying each site on three occasions and ignoring annual species.

Data for the following species attributes was compiled for the 181 species recorded during the study: lifeform, dispersal mechanism, the presence or absence of vegetative reproduction, seed mass, the presence or absence of persistent soil seed bank and, the rarity of the species in the Victorian western basalt plains grassland flora. The influence of species attributes on the probability of local extinction was modeled using Bayesian logistic regression with monte-carlo markov chain (MCMC) methods in the WinBUGS v.1.4 program. There are a number of advantages of using a Bayesian modeling approach including being able to incorporate existing data and uncertainty into an analysis by specifying prior distributions, their ability to handle missing data and advantages in comparing models.

289 (26%) of the 1104 plant populations present in the 1980's were not relocated and were presumed locally extinct. Different suites of species were lost from urban compared to rural grasslands, but species common in both landscapes had consistently higher extinction rates in urban grasslands, which also lost more populations than rural patches. The Bayesian logistic regression models consistently predicted that species growing in urban grasslands had a higher probability of local extinction than those growing in rural grasslands. The models indicated the species attributes that increased the risk of local extinction were seeds dispersed by wind or adhesion, growing buds at or below the soil surface, low seed mass and soil stored seed. The presence of vegetative reproduction reduced the probability of local extinction. Rare species were more likely to become locally extinct in rural landscapes but rarity did not influence the probability of local extinction in urban grasslands.

Conclusions

Urbanisation has a strong influence on the species composition of urban grasslands and substantially increases the probability of local extinction risk for plants with particular combinations of functional traits.

Related Publications

Williams N.S.G., Morgan J.W., McDonnell M.J. & McCarthy M.A. (2005) Plant traits and local extinctions in natural grasslands along an urban - rural gradient. *Journal of Ecology* **93,** 1203-1213.

Factors affecting fish diversity in Brisbane freshwater creeks

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Background

Australia is home to approximately 180 native freshwater fish species, but over 50 of these species are endangered, vulnerable or rare. Twenty-six species have been recorded in recent (2000-2005) Brisbane creek surveys coordinated by the Aquatic Ecology Research Group at the University of Queensland.

Project Results

Comparisons of the results of these surveys with those from surveys in the late 1970s and early 1980s indicates that several native species are now rare or have patchy distributions in the Brisbane area, while the occurrence of exotic, introduced species (notably livebearers such as gambusia, swordtails, platies and guppies), has increased. Exotic species accounted for 77% of all individuals collected in the surveys. The high abundance of exotics is of concern because introduced fish species can have a number of negative impacts on natives, including food competition and predation on eggs and larvae. In addition, interference competition by species such as gambusia (*Gambusia holbrooki*) involves fin-nipping, which can lead to damage and disease.

Threats to stream fish diversity in urban settings include riparian clearing, channelisation, modified flow patterns, reduced water quality, exotic invasions and barriers to movement and migration. All these pressures can be observed in the Brisbane area. Our survey data reveal that the number of native species present at a site shows a significant positive correlation with habitat diversity, the numbers of aquatic macrophyte species, water velocity and stream width, and a negative correlation with the percentage of exotic individuals.

Fish in these urbanized creeks are affected by the additive impacts of environmental variables. Our behavioural experiments indicate that habitat complexity plays an important role in mediating interactions between coexisting fish species, and therefore moderating the negative effects of exotics on natives.

Conclusions

Creek rehabilitation strategies aimed at maintaining and increasing native fish diversity should acknowledge such effects, as well as the individual habitat requirements of different native species. It is also important to recognize the extreme hydrology of urbanised streams, which are susceptible both to flash flooding and to relatively severe drought conditions. In this context, rehabilitation success should be improved by integrating features such as detention basins, off-stream ponds, baffles, deep pools and in-stream habitat structure into stream designs.

Related Publications

Chapman P. & **Warburton K**. (2006) Post-flood movements and population differentiation in gambusia (*Gambusia holbrooki*). *Ecology of Freshwater Fish* 15.

Can major urban roads be fauna-friendly? The case of Compton road

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Background

Compton Road is a major east-west arterial road located separating Karawatha Forest Park from Kuraby Bushlands within the nationally-significant Greenback Corridor in south-eastern Brisbane. The forests on either side of the road support a diverse community of vertebrates including four species of gliders (including greater gliders and feather-tailed gliders), koalas, three species of macropod and numerous small mammals. The road had long been a major barrier to animal movement and road kill rates were high. A proposal by Brisbane City Council (BCC) to double the size of the road from two to four-lanes provided to a significant challenge to the planners involved: 'Can a larger road be designed to have less impact while enabling safe movement by fauna?" BCC met this significant challenge by incorporating into the design of the new road a comprehensive range of features to facilitate safe movement across the road (including purpose-built fauna culverts, possum road bridges, glider poles and, most spectacularly, a large-scale 'land bridge') as well as an innovative exclusion fence to prevent most animals from gaining access to the roadway.

Project Overview

Monitoring of selected populations of vertebrates occurring in the forests on either side of the road began in early 2004, four-months prior to the start of road construction, and recommenced in February 2005 following the opening of the newly up-graded road. Intensive monitoring of the two fauna underpasses and the land bridge commenced in August 2005, employing two passive tracking techniques. Only the first eight weeks of monitoring data are presented here. Underpass use was assessed using sand tracking: sand strips were established 1-2m inside both ends of underpasses and checked twice weekly in the early mornings of two consecutive days. The sand was smoothed on the afternoon preceding the checking visit. Tracks detected in the sand were recorded and identified as accurately as possible. Use of the land bridge was assessed by pellet (scats or droppings) counts made twice weekly. All pellets found on the facility were collected and kept for subsequent identification. The number of pellets was recorded for three zones of the land-bridge: the two sloped sides and the flat top.

Underpasses

A total of 144 vertebrate tracks were detected over the eight weeks, of which 12.5% represented complete crossings. Tracks were detected immediately with approximately 12 individuals using the underpasses in week 1 and increasing steadily to a total of almost 40 in week 8 (early October); this trend was positive (r= 6.667) and significant (p=0.07). The most frequently detected taxa using the underpasses were 'small mammal' (primarily *Rattus* species)(41.7%), birds (18.8%) and bandicoots (8.3%). Similar percentages of cats (4.9%) and dasyurids (both *Antechinus* and *Planigale*)(5.6%) were detected.

Land-bridge

Similarly, many animals made use of the land-bridge soon after it was available. On average, 22, 4 and 28 pellets were detected from the three zones of the bridge each week, indicating considerable traffic. These pellets were deposited by foraging animals, 58% of which were hares and 37% macropods (red-necked wallaby, swamp wallaby and eastern grey kangaroo)

Conclusion

Despite considerable scepticism concerning whether these facilities would be used by wildlife, these preliminary results clearly indicate that use was widespread, began very soon after the end of the disturbances associated with construction, increased over the time of monitoring, and involved a wide range of species. These data strongly support the often controversial claims that wildlife will use road crossing facilities, and vindicate the decisions made to design a wildlife friendly road.

Related Publications

Fauna use of underpasses and the land bridge at:

Bond A. & **Jones D.N.** (2006) *Compton Road: Results from six months passive monitoring.* Report to Brisbane City Council, Brisbane. pp 21.

Bond A. & **Jones D.N.** (in prep) Passive monitoring fauna use of underpasses and overpasses at Compton Road, South-east Queensland. To be submitted to *Wildlife Research*

Road mortality, macropods and mitigation

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Background

Linear infrastructure such as roads and highways is extensively subdividing vital habitats and vulnerable wildlife populations. While road mortality is the most direct and obvious impact on wildlife, few comprehensive studies have been undertaken to determine the long term magnitude of this impact. What is evident however, is that road mortality affects species differently. Australian mammals are especially vulnerable to road mortality because of nocturnal habits, cryptic body colouring and roadside habitat utilisation for feeding and socialising.

Project Overview

In this study, road-kill surveys were conducted along 35.5 km of road through Mount Cotton, Sheldon and Burbank. A total of 63 road kill mammals were recorded with macropods accounting for the highest mortality count during the survey period. I found a significant sex bias toward male red-necked wallabies as well as a potential association between road-kill rate of macropods and habitat type. The results of this study compared to records for Compton Road, Kuraby, a 1.3 km section of road dissecting Kuraby bushlands and the regionally significant Karawatha Forest. Wildlife mitigation infrastructure was included in the recent upgrade of Compton Road including a land bridge, culverts and exclusion fencing. Before and after upgrade monitoring data was collated and compared against the control sites. Although mammal road mortality rates of treated (before mitigation) and control sites were not significantly different, Compton Road had significantly less mammal mortality due to vehicle collision, post mitigation installation.

Conclusion

Based on the success of Compton Road at reducing mammal road-kill, mitigatory action is recommended for within the control site area. Further research is also required to assess the long-term road-kill impact on local macropod populations, particularly in areas where macropod road mortality is prevalent, considering also the social and reproductive implications of male sex bias and habitat association.

Can we conserve an endangered snake in conservation reserves on Sydney's urban fringe?

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Background

Conservation reserves are commonly relied on as a primary means of conserving threatened species. However, reserves within or close to urban areas may be less effective in this because they are used heavily for recreation by urban dwellers. This is an area of urban ecology that has received scant attention. The highly endangered Broad-headed Snake (*Hoplocephalus bungaroides*) provides an interesting case study in this regard. It is endemic to the Sydney basin where it is dependent on loose sandstone rocks for shelter. It has declined dramatically in distribution and abundance in the last 100 years due to urban expansion and the collection of bushrock for garden ornamentation.

Project Overview

We conducted surveys for this species at 236 sites across 10 conservation reserves to assess its present day distribution. Despite the apparent suitability of much of the habitat surveyed, few Broad-headed Snakes were detected and in only four reserves. Habitat disturbance was common across the reserves. We conducted detailed studies of disturbance in Royal National Park, which forms the southern boundary of Sydney's urban area. It is estimated that over 3 million people visit this reserve each year. We constructed small (10-rock) outcrops near (<300 m) and far (>400 m) from roads and walking tracks to assess the frequency of anthropogenic disturbance (mostly due to vandalism and reptile poaching) and to assess the attractiveness of constructed outcrops to this endangered snake. The frequency of disturbance events was significantly influenced by distance, occurring 2-8 times per year more often at near compared to far sites. The number of small outcrops disturbed at least twice over a 6-year period was significantly dependent on distance category. Broad-headed Snakes used far outcrops significantly more than near outcrops. A similar result was obtained from fixed transects surveyed over the same 6-year period. This suggests that Broad-headed Snakes avoided or were collected from near outcrops.

Conclusion

Our studies suggest that distance from roads and tracks can be used as a surrogate for the frequency of habitat disturbance and that it is within the control of reserve managers to conserve threatened species in reserves heavily used by urban dwellers.

The distribution and abundance of the platypus in urban Brisbane: A community research project

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Background

The platypus is a widespread species which is known to occur within the waterways of several major Australian cities, including Brisbane. The species is an obligate predator on freshwater invertebrates of which it must consume large amounts daily. The platypus also depends on low water salinity for function of its electro-sensory apparatus, and it depends on healthy stream-banks for denning and nesting. As such it is a potentially powerful indicator of all-of-catchment health. Despite this, there is no benchmark levels recorded for the sub-catchment scale distribution patterns of the species, nor of its population numbers.

Project Overview

In order to redress this, and to evaluate the feasibility of community monitoring of platypus numbers, we compiled all available information on the platypus in Brisbane and conducted a pilot-study using community volunteers, to conduct population monitoring of the species at selected sites.

A total of 159 platypus records for the greater Brisbane area (i.e. built-up areas of the Brisbane City, Redlands and Pine Rivers LGA's) were collated including 89 from existing sources. Seventy platypus records were collected by Wildlife Queensland during a twelve month awareness raising campaign. These records show that the species is found throughout the Pine River catchment and the northern Brisbane LGA sub-catchments of the Brisbane River. The species appears to be very scarce, if not absent from most of the southern Brisbane and Redlands LGA sub-catchments of the Brisbane River. Community platypus monitoring events held in the Moggill Creek and Enoggera Creek catchments of the Brisbane River elicited strong community participation.

Conclusion

This study shows that community information can greatly inform our knowledge of the distribution of this high profile and recognizable species. The results of our monitoring surveys are the less useful, primarily because of the small survey effort conducted to date. That aside, the community model used for these monitoring surveys works well and will be expanded in 2006.

Reproductive biology of the Australian brush-turkey (Alectura lathami) in an urban environment

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This research forms part of a PhD project, due to be completed in 2007.

Background

The Australian Brush-turkey *(Alectura lathami)* belongs to a unique group of birds, the megapodes, which use environmental heat to incubate their eggs and provide no parental care to their offspring. While this project focuses on the effect of incubation temperature on the energetics of embryonic development and hatchling quality, it also explores the behavioural ecology and natural history of this species. Over the last 30 years Brush-turkeys and their incubation mounds have become a familiar sight in many Brisbane suburbs.

Project Overview

Studying the ecology, behaviour and physiology of a population of about 10 individuals on the St. Lucia campus of UQ has conserved financial resources and provided unique research opportunities. Their proximity has instigated a technique for the collection of freshly laid eggs for artificial incubation experiments, as females are habituated to humans, they copulate and lay within metres of busy footpaths and roads. Also, because individuals are hard to observe in the thick vegetation of their natural habitat, the open urban environment is beneficial for monitoring their behaviour. In particular, social interactions of chicks have not previously been described from non-captive populations.

Egg laying behaviour has been observed over sixty times on campus and documented on film in order to identify individuals. In general, females visit mounds to copulate, lay eggs and to inspect mounds and male quality. The egg laying process can take between 20-90 minutes and usually occurs in the few hours following dawn. At dusk, Brush-turkeys roost communally in large trees. Due to their aggressive nature there is a lot of jostling for position at communal roosts and at incubation mounds.

Conclusion

The urban environment can have both positive and negative effects on Brush-turkey populations. Some advantages of human presence are evident; garden taps and sprinklers provide water for drinking and to moisten mounds which would otherwise be too dry to function effectively. Furthermore, males often claim man-made piles of compost, woodchips, grass clippings, soil, sand and other waste material and not only do females lay in them, but chicks are successfully incubated.

Turtle recall

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Background

Red-eared slider turtles are a native of the Mississippi basin. They are popular as pets and for food – so popular that the USA exports around 12 million of them each year. Sliders have become established in many of the countries where they have been imported, and evidence for serious impacts on native fauna is mounting where these animals become naturalised. It has never been legal to keep these animals in Australia, but it is known that limited numbers have been available through the black market pet trade.

Project Overview

Recently, a wild population of sliders was found in southeast Queensland. This presentation provided a history of the cooperative eradication program and discussed its progress, findings and future. The project is a good example of cooperation and adaptive management of an exotic pest.

The roosting ecology and conservation of the white-striped freetail bat *Tadarida australis* in urban Brisbane

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This research forms part of a PhD, completed in 2006.

Background

With more than 80 species, bats (Mega- and Microchiroptera) comprise more than 30% of Australian native mammals. More than half of Australian microchiropterans (insectivorous bats) roost in tree hollows yet relatively little is known about their roost ecology.

In South-East Queensland, 23 insectivorous bat species, birds, marsupials and insects use tree hollows as roosts for individuals or colonies. The factors associated with production of hollows in trees are large size, overmaturity, death, rot, fire and insect attack. These requirements are usually found in old stands. However, hollows suitable for the larger vertebrate fauna form only after about 200 years (e.g., *Eucalyptus pilularis* - Blackbutt). Few old trees that may provide suitable roosts for bats and other arboreal vertebrates are available in suburban areas due to vegetation clearance on private land, and trimming of old trees on public and private land.

Brisbane, the capital city of Queensland, and the greater Brisbane region, cover some 3000 square kilometres and contains one of the fastest growing urban areas in the world with the fastest rate of population growth of any region in Australia. At present, very little is known about the availability of habitat trees in urban Brisbane, or of the conditions required or preferred by the animals that use them.

Use of natural tree roost sites by Tadarida australis

The white-striped freetail bat (*Tadarida australis*, Molossidae) is distributed throughout Australia apart from the northernmost regions and Tasmania. This species is endemic to Australia, where its conservation status is common to uncommon in numerous habitats. *T. australis* are large bats (25-40g) and are described in the literature to roost in trees either alone or in groups up to 20 individuals (Richards and Rhodes in preparation).

This study in Brisbane found *T. australis* to roost in hollows in old eucalypt trees, especially in Forest Red Gums *(E. tereticornis*) and in Grey Gums *(E. propinqua)* with colony sizes up to 300 individuals. Many of these mature, big trees with *T. australis* colonies are found in suburbs, especially in Brisbane City Council parklands (Rhodes and Wardell-Johnson 2006).

Habitat tree conservation in Brisbane

Hollow-bearing trees provide important habitat requirements for many native Australian animals in urban, rural and forested environments. Habitat loss is often considered to be a main factor contributing to the decline of biodiversity, including bats, in an area despite continued provision of food and water. With increasing fears of public liability most old trees in public areas are intensively managed by city councils. Dead or potentially dangerous branches are trimmed, resulting in the loss of hollows in terminal branches while dead trees and trees that show signs of late stages of senescence are usually removed.

Project Overview

Over a period of three years I studied the roost ecology of the white-striped freetail bat (*Tadarida australis*) and identified roost trees used by this species. I compared these roost trees with control trees of similar age and tree characteristics and found that urbanisation in Brisbane lead to hollow-deficient eucalypt stands. Almost two-thirds of the roost trees used by the white-striped freetail bat were found on public or Crown land, emphasising the importance of retaining mature habitat trees on public areas (Rhodes and Wardell-Johnson 2006). However, large numbers of habitat trees are unlikely to be recruited into urban areas in the immediate future, so the focus should be on the maintenance of the existing hollow-bearing trees. I used network analysis as a useful tool for understanding the structural organisation of habitat tree usage (Rhodes et al. in press). This allowed the informed judgment of the relative importance of individual trees and enabled me to make conservation and management recommendations to Brisbane City Council (Rhodes 2003).

Use of artificial roost sites

Nest boxes have been used as an important wildlife management tool in situations where hollow availability can limit population levels. In Australian suburbia where old tree stands are limited, nest boxes may be the only source of hollows for wildlife populations and therefore could provide habitat, which is essential for these species to persist in the area. In Europe and in the United States of America, bat boxes have been shown to provide suitable roosts for many bat species, where roost sites became scarce. In Australia, however, the systematic use of bat boxes to provide roosts is at an early stage and literature and information about other bat box usage in Australia is virtually non-existent.

This part of the PhD research assesses the acceptance of artificial roosts by microchiropterans in urban Brisbane and the costs and benefits associated with it.

Related Publications

Rhodes M. & Wardell-Johnson G. (2006) Roost tree characteristics determine use by the white-striped freetail bat (Tadarida australis, Chiroptera: Molossidae) in suburban subtropical Brisbane, Australia. *Austral Ecology* **31**, 228-239.

Rhodes M., Wardell-Johnson G., Rhodes M.P. & Raymond B. (in press) Applying network theory to the conservation of habitat trees in urban environments: A case study from Brisbane, Australia. *Conservation Biology.*

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Richards G. & **Rhodes M**. (in press) *White-striped freetail bat (Tadarida australis).* In: R. Strahan (ed.), The Mammals of Australia. 3rd edition, Reed Books, Chatswood.

Ecological restoration in Hamilton City, north island, New Zealand

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Background

Hamilton City (9427 ha) is located in the centre of one of the most severely modified landscapes in New Zealand. Less than 20 ha of high quality indigenous species dominated ecosystem occurs in the City and only 1.6% of the original indigenous vegetation remains within the surrounding Hamilton Ecological District (159,376 ha). A gradual recognition of the magnitude of landscape transformation has gathered momentum to the stage that there is now a concerted public and private effort to retrofit the City by restoring and reconstructing indigenous ecosystems. The initial focus was on rehabilitating existing key sites but has shifted to restoring parts the distinctive gully landform that occupies some 750 ha or 8% of the City. As a result some 187 ha of land or 2% of the City area is being actively restored comprising 142 ha on public land and 45 ha on private land. A new initiative at Waiwhakareke (Horseshoe Lake) Natural Heritage Park will involve reconstruction from scratch of a range of ecosystems characteristic of the ecological district over an area of 60 ha. Restoration planting began here in September 2004 and already exceeds 2 ha.

Project Overview

Recently completed research (Mackay 2006) to assist the City's gully restoration programme has involved assessing the success of restoration plantings in achieving desired ecosystem states. Some 62 variable area plots were measured to cover the range (chronosequence) of planting ages (0-30 years), maintenance treatments (low vs high), and initial states (bare vs existing canopy) on gully slopes, the landform on which most of the restoration planting in the City occurs. Data collected from 4 plots in natural regenerating forests within or near the City were used as baselines to assess progress towards establishment of natural functioning ecosystems. Results showed that it is comparatively easy to establish a low diversity indigenous forest canopy on bared sites within 20 years, and by this stage, some early maturing canopy species will be starting to regenerate. Indigenous ferns, including tree ferns, colonize the restored stands unaided. Although restored stand basal areas are comparable with natural regenerating forests, the excessive use of well known pioneer plants and the tendency for failure of early planted mid- and later successional species leads to stalling of forest development. From 20 years on, the indigenous restoration plantings decline in indigenous species richness and cover and there is an increase in exotic species colonization especially in canopy gaps. Amongst the colonizers are several troublesome weeds (e.g., Japanese honeysuckle) with the potential to out compete indigenous species. Because of isolation and lack of seed sources, the expected mid- and late-successional shrub and tree species need to be introduced to the restored stands via enrichment planting or seeding. Most management programmes fail to recognize this requirement and valuable progress is lost. The challenge now is to build the lessons learned from this research into new and existing restoration planting programmes in the City.

Ongoing Work

Our newly funded research programme (New Zealand Foundation for Research, Science and Technology contract UOW0501) takes up further questions posed by regional end-users and places them in a national and international context to ensure current knowledge is built on and extended. The overall research design is generic to restoration/reconstruction projects and is therefore as widely applicable to other parts of New Zealand as possible.

1. What is the context for indigenous restoration? (B.D. Clarkson & W. Puke)

It is necessary to provide a context within which a vision can be articulated and restoration goals can be achieved. We will provide this context both from Mätauranga Mäori and ecological perspectives, by determining past composition and abundance of indigenous species.

Limited research has been conducted to date on the original vegetation composition of the Hamilton area. This has focused on remnant forest composition and the known environmental tolerances of key species. We will collaborate with a plant macrofossil expert (Bev Clarkson, Landcare Research) and a tephra chronology expert (David Lowe, Department of Earth Sciences, University of Waikato) to analyse deposits using proven methods.

Use of local knowledge is critical in empowering local communities to own and solve local ecological restoration problems. We will investigate the environmental knowledge available in Mäori oral history to provide a broader context for the restoration projects being undertaken. The methodology will follow that used for the 2002 report, *Ngä Tapuwae O Hotumauea* (Mäori Landmarks on Riverside Reserves), produced for the Hamilton City Council by Ngä Mana Toopu O Kirikiriroa Limited Resource and Cultural Consultants. The results of this research will be presented firstly to hui of Ngäti Wairere and, depending on their wishes, will then be disseminated to a wider audience. An analysis of how Mäori perspectives overlap with and complement current ecological approaches will be undertaken.

2. How do we carry out restoration in a highly fragmented urban environment? (B.D. Clarkson; I. Duggan; C.E.C. Gemmill; I. Hogg)

In New Zealand only a limited number of studies have attempted to measure the results of restoration plantings. There is also debate about whether plantings should be in proportion to the original forest composition and structure. Drawing on experience with previous restoration projects we will take a natural experimental approach and use a chronosequence framework. Restoration plantings of known age will be used to better understand the reasons for revegetation failure or success, explore alternative successional pathways to restoring vegetation communities, and determine how invertebrate guild composition might indicate progress towards achieving restoration goals. Notional restoration target communities in the closest largely unmodified forest and wetland reserves will provide baselines. These results will be used to inform the reconstruction process which will be developed for Waiwhakareke over the next four years. At Waiwhakareke we will establish a randomised block design experiment to test the most effective way of reconstructing kauri (*Agathis australis*) dominated forest and the peat lake margin wetland. Different treatments in replicate plots of at least $100m^2$ will comprise the range of possibilities from direct succession in which the characteristic dominants are planted directly into pasture, versus establishment of a nurse crop followed by later enhancement planting, allowing us to determine rates and extent of return to a functioning ecosystem. This experiment and its ongoing measurement and maintenance will also provide an opportunity for participatory research as well as basic “hands-on” training in standard planting and aftercare procedures.

Dispersal of native invertebrates among habitats is critical for both the recolonisation of restored habitats as well as genetic exchange among extant populations. Unfortunately, our ability to detect and predict such events is limited by logistic constraints (e.g., marking/tagging animals) as well as shortfalls in taxonomy. It is estimated that current inventories of New Zealand aquatic invertebrates may be underestimated (conservatively) by 3-5 times. In order to adequately document extant species resources, as well as changes resulting from revegetation in ongoing restoration efforts, we propose a two-prong approach. Firstly, to document extant species resources, we will employ state-of-the-art “barcoding” techniques using sequence diversity in a single gene locus. The approach will enable a rapid and unambiguous taxonomic assignment for all invertebrate species irrespective of current morphometric/taxonomic shortfalls. Secondly, we will monitor haplotype diversity within selected target species to determine existing levels of genetic exchange among extant populations. This will enable us to determine the effectiveness of restoration for terrestrial and aquatic invertebrate communities.

Restoration projects commonly focus on the revegetation of sites using ubiquitous, easily grown native trees. There is considerable debate on the need to ecosource species (i.e., using local provenance seed in restoration projects). The obligation to ecosource is often driven by the premise that plant populations are locally adapted to their environment. This is based primarily on anecdotal evidence and morphologically based provenance data and has not been rigorously tested within a scientific experimental framework. Restoration projects within New Zealand have focused on rural areas, rather than urban areas, and generally have not incorporated a genetic approach. However, population-level genetic assessments of source populations have shown to be vital in determining a positive outcome in some restoration projects. To determine the impact that genetic variation has on the success of restoration projects we will use standard molecular techniques to assess levels of genetic variability of *in situ* plant populations. Potential source populations at geographical distances up to 100km away from the revegetation site will be examined to test the degree of correlation of genetic difference and geographic distance across several ecological district boundaries. Unnatural amounts of gene flow between populations could result in significant alteration of the natural genetic composition of *in situ* populations, leading to either inbreeding or outbreeding depression. The results of this work will provide essential data to develop guidelines for collection of seeds to be used in restoration projects.

3. How do we eradicate pests (weeds and animals) effectively in an urban environment in the presence of people and pets? (J. Waas)

Work is already being conducted at CBER (in conjunction with Landcare Research) on the effects of magpie on native bird assemblages and abundance in New Zealand. Anecdotal reports suggest that mynas are more of a problem than magpies within North Island cities and have been linked to avian extinctions on other Pacific Islands. Recent work by others suggests the impact of myna may be profound. We will compare native bird abundance and community composition within the territories of urban myna to that in equivalent urban “control” plots free of myna. A large-scale nest-monitoring project (involving 24hr surveillance cameras with time lapse video) will also be established to identify, for the first time, the main predators of avian young in urban New Zealand habitats, and to assess their relative contributions to the decline of native bird populations in cities. The research, in conjunction with the parallel work on magpie, will provide valuable information on the role of avian pests in relation to that played by mammals. The information will also allow us to develop wildlife management protocols to protect and expand native bird populations in the urban landscape.

4. How do we encourage people to learn about biodiversity in an urban context? (M. Jay)

We know from our experience with the Hamilton City gully restoration programme that we attract or capture and involve only a narrow range of society. If reconstruction of indigenous ecosystems in urban environments is to be more widely successful, we need to enhance and expand the involvement of a wider range of society. To achieve this, we will identify common themes and principles of community involvement in urban ecological restoration by conducting interviews with key informants. We will summarise experience gained by the Department of Conservation, Karori Reservoir Reserve, Soames Island restoration project, Travis Wetland and Hamilton City Council on the most effective methods for involving people in ecological restoration. Research methods will involve in-depth interviews of key informants and focus group meetings with a sample of people in Hamilton who have and have not been involved as participants in ecological restoration projects.

5. What legal issues do community groups face in organizing restoration and working on different lands, and how can legal obstacles be removed? (B. Barton)

We know from experience and anecdotal reports that legal issues can present significant obstacles for community groups (e.g. corporate structure of the group, its fit with the regulatory framework, relations with landowners, and relations with funding agencies). We will identify what these legal issues are, using methods of literature analysis and interview to understand obstacles, followed by legal analysis to determine the present situation. We will then investigate how the obstacles can be removed, and identify workable solutions for community groups and statutory agencies. The results will enable community groups to work more effectively in bioregional restoration.

A final milestone for our research programme will be to hold, in June 2009 at the University of Waikato, a national workshop on urban ecological restoration.

Related Publications

Clarkson B.D. (2006) Ecological restoration in Hamilton City. *Proceedings of Greening the City Conference (21-24 October 2003, Christchurch, New Zealand).* pp93-101.

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Unpublished MSc thesis, Department of Biological Sciences, The University of Waikato. 127pp+ appendices.

Wall K. & **Clarkson B.D.** (2002) *Gully restoration guide – a guide to assist in the ecological restoration of Hamilton's gully systems* (2nd Edition). Hamilton City Council, Hamilton. 56pp.

Whaley P.T., **Clarkson B.D.** & Smale M.C. (1997) Claudelands Bush: Ecology of an urban kahikatea (*Dacrycarpus dacrydioides*) forest remnant in Hamilton, New Zealand. *Tane* **36**, 131-155.

Inferring persistence of indigenous mammals in response to urbanisation

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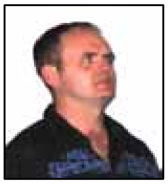

Background

The number and extent of human settlements around the world are increasing as the human population grows and people move from rural to urban areas. The decline and ultimately the local extinction of many indigenous species from a range of taxonomic groups within urbanised areas is a recurring theme from cities around the world. However, determining whether a species has become extinct can be difficult because sufficient survey effort may be too costly and expert opinion may involve considerable subjective bias.

Project Overview

In this study, we compared the results of four quantitative assessments of the probability of persistence of indigenous mammals within Melbourne, Australia. Our comparisons were methodological, taxonomic and spatial. Less than half (26) of the original 54 species that occurred in Melbourne prior to European settlement have a greater than 95% probability of being extant at the end of 2000. Mammals occurring in local government areas (LGAs) within 10 km of the central business district of Melbourne were less likely to be extant, with 29% of species having a greater than 95% probability of persisting, compared to 48% in the outer LGAs. The group of species most negatively affected by urbanisation were the small, ground-dwelling mammals, with just two out of 15 species having a greater than 10% probability of persisting. All four methods gave broadly similar results, with the Bayesian approach consistently suggesting higher probabilities of species persistence.

Conclusions

The decline in the number of species is likely to continue with the ongoing expansion of Melbourne. The greatest opportunity to conserve the maximum number of species of mammal within Melbourne is in the outer LGAs where they remain extant. We recommend that state and local governments design and adopt a comprehensive strategy for managing habitat networks that cross jurisdictional boundaries and encompass the greater Melbourne area to enhance prospects for the survival of mammals.

Related Publications

van der Ree R. & McCarthy M.A. (2005) Inferring persistence of indigenous mammals in response to urbanisation. *Animal Conservation* **8**, 309-319.

van der Ree R., McDonnell M.J., Temby I.D., Nelson J. & Whittingham E. (2006) The establishment and dynamics of a recently established urban camp of flying foxes outside their geographic range. *Journal of Zoology (London)* **268**, 177-185.

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Conserving and restoring wildlife in fragmented urban landscapes

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This research forms part of a PhD, due to be completed in 2006.

This research is a collaborative project between The University of Queensland and Brisbane City Council.

Background

Habitat loss, fragmentation and degradation resulting from urban development are the leading anthropogenic causes of global biodiversity loss. Within Australia, all major urban developments occur in tropical and coastal regions, areas that also support the majority of the country's wildlife diversity. Although many species are capable of adapting to and surviving within the urban environment, numerous other species are either restricted to remnant vegetation fragments within the urban matrix, or undergo localised extinctions. Despite an awareness of the overall threat of urbanisation to the continued persistence of many native wildlife species, the processes enabling wildlife to persist in urban areas are not well understood. Consequently, urban planning and management decisions are often ineffective or incompatible for the long-term conservation of urban wildlife.

Project Overview

This project applies a spatially explicit landscape approach to determine the relative importance of site, patch and landscape level variables for determining the presence and absence of native terrestrial reptile and native terrestrial small mammal species living within Brisbane's fragmented urban environment. In particular, the project aims to consider: (1) How much habitat is enough? (2) How should this habitat be configured spatially? (3) What is the relative role of patch condition and patch size for determining the presence or absence of target species? and, (4) How can we develop, improve and integrate biodiversity conservation guidelines for urban planning and landscape management actions?

Overall, 333 trap nights were conducted across 59 sites using a combination of cage traps, Elliott traps, dry pit-fall traps, hair funnels, direct observation and scat analysis were used to identify the presence of target species within each site. Habitat assessments were also conducted at each site in order to determine habitat characteristics of each site at the local level (<1 ha).

A total of 34 target species, representing 15 family groups, were identified from the wildlife surveys. The majority of these species were native (82%), and were dominated by reptile species (68%). Of particular interest from the species identified were the presence of the Common dunnart, the Yellow-footed Antechinus, and the Common planigale; species which are considered relatively rare in the survey areas, and have been allocated a 'significant species' conservation status in Brisbane City Council's *Brisbane City Plan 2000* (Brisbane City Council, Natural Assets Planning Scheme Policy, vol.2).

Ongoing Work

The results from the wildlife surveys and local level habitat assessments, combined with information about habitat characteristics at the patch (1-100s ha) and landscape (100s-1000s ha) levels will be used to investigate the relative importance of habitat characteristics for various individual target species and groups of target species. At this stage in the project, all field surveys have been completed and statistical analyses are currently underway. Given the currently incomplete nature of this project, no final results are yet available. It is expected though that most of the detailed data analysis will be completed by mid-2006; with final results and recommendations being available towards the end of 2006.

Related Publications

Garden J.G., McAlpine C.A., Jones D., Peterson A. & Possingham H. (2006) Review of the ecology of Australian urban fauna: A focus on spatially explicit processes. *Austral Ecology* **31**, 126-148.

Garden J.G., McAlpine C.A., Possingham H. and Jones D. (in prep) Habitat structural complexity is more important than vegetation composition for local-level management of native terrestrial reptile and small mammal species living in urban remnants: A case study from Brisbane, Australia. Submitted to *Austral Ecology*.