

Biodiversity in urban environments may be increasing over time, and this great barred frog (*Mixophyes fasciolatus*) may be evidence of that. These frogs are not considered urban animals but naturalist Robert Ashdown found this one outside his house in suburban Toowoomba, far from bushland. Photo: Robert Ashdown



FIFTY YEARS OF urban ecology

Many native species have demonstrated extraordinary abilities to adapt quickly to urban landscapes. Darryl Jones charts the rise of urban ecology over the past 50 years.

Urban habitats proceed from a maelstrom of disruption. When bushland is bulldozed to make way for suburbs or supermarkets, very few species remain during the early stages. While some move to nearby patches of bush, this can cause severe disruption to animals already there. Those capable of larger movements may leave the area of disturbance, but it is a brutal reality that urbanisation often leads directly to the death of vast numbers of animals.

Recolonisation starts immediately. Apart from extreme sites such as inner city buildings or car parks, almost all urban landscapes come to be dominated by vegetation. Even lawn and sports field monocultures are rapidly invaded by uninvited plants and animals. In gardens, the opportunities for exploitation are broad.

It has long been acknowledged that some species excel in urban environments. Those familiar to city dwellers from Moscow to Melbourne, including rats, pigeons, sparrows and dandelions, are quintessentially 'street smart' and seem able to prosper almost anywhere. More surprising to many people have been the Australian natives that also prosper. Adaptations to urbanisation are occurring remarkably rapidly, over decades not centuries.

Cities as ecosystems

The portrayal of the city as an ecosystem has been resisted and still faces plenty of objections. Cities are the very epitome of human excess: too much artificial and too little natural. No wonder it took so long for the field now known as urban ecology to emerge.

The late 1970s saw the first concerted research into the ecology of urban-dwelling wildlife, and in 1979 *Wildlife Australia* dedicated an issue to 'Wildlife in the city'. Veteran naturalist Vincent Serventy editorialised about the tendency of developers 'to makes cities into biological deserts', before introducing content rich in detailed descriptions of inner city waterways, bird-attracting gardens (a seemingly innocent noisy miner was featured on the cover) and even a feature celebrating urban reptiles. Of particular significance was the announcement of the Brisbane Wildlife Survey by Wally Davies. Introducing this pioneering example of citizen science, Wally soundly articulated the need for an understanding of the poorly appreciated biodiversity of the subtropical capital. This influential combination of old-fashioned naturalist skills and modern science was eventually summarised in the book *Wildlife of the Brisbane Area*, and was

an inspiration for the mega-best seller *Wildlife of Greater Brisbane* (1995, 2007).

In Victoria, similarly farsighted ventures were underway: a plan to map the birds of the Melbourne region was set in train in 1976 and eventually led to the first bird atlas in Australia. With such early and ambitious foundations, it is hardly surprising that Australian urban ecology has been internationally influential.

Trends in urbanisation

One reason for Australians' embrace of urban ecology is that we are heavily urbanised. In 2008, for the first time in history, the majority of humans worldwide were living in urban areas. But Australians have been predominantly urban since European colonisation, and increasingly so. In the past 50 years, the population of Australia has more than doubled from 11 million to 23 million, while the proportion in major urban centres has risen from 68 to 83 percent (19 million).

The characteristics of urban environments have changed. Our houses have been getting bigger – over the past 25 years the average floor area of new houses has increased by more than 50 percent – and gardens have changed dramatically due to the much greater use of native plants instead of traditional European ornamentals. Interest in 'wildlife-friendly' gardens has seen a massive increase in nectar-rich plants such as grevilleas.

The importance of being urban

Real ecology, it was once decreed, could only be understood away from the influence of humans. However, a few intrepid researchers began to look seriously at the plants and animals that occurred in urban environments, with the first serious studies in the 1970s, including in Australia. During the 1980s and 1990s, the number of researchers in urban ecology exploded worldwide. Today, with specialist journals and conferences on urban biodiversity and conservation commonplace, it is easy to forget how far attitudes have come in such a short time.

There are many reasons for ecologists to focus on urban areas. These often coincide with areas of high native species richness and endemism, and provide the opportunity to test many ecological theories because of the rapidity and extent of change, and because urban and forested habitats often occur side by side, close to universities, providing convenient opportunities for comparison. With most people living in cities, urban wildlife also offers the best prospect to connect people to nature.

Urban ecosystems are governed by the same ecological 'laws' as elsewhere but the importance of particular ecological patterns and processes differ from less disturbed systems. They are often more island-like, represent early successional stages and are more easily invaded by exotic species.

One reason for the species richness of urban areas is their heterogeneity – they provide many different natural and artificial niches and conditions. They are often in areas of naturally high species diversity and endemism, such as coastal and tropical regions. Sydney's location was chosen because of its harbor, a product of eroding sandstone, and this same sandstone supports a rich flora, including endemic plants. There are three main responses of wildlife to urbanisation. Some fail to persist, even in remnant patches ('urban-sensitive'); others can survive in vegetation patches, and are likely to be affected by fragmentation ('matrix-sensitive'); and some are able to persist, even thrive, within the built matrix ('matrix-occupying').

A 2006 review of studies on Australian urban fauna from 1990 to 2005, of which I was one author, shows how sparse yet is our knowledge of most urban wildlife – particularly of aquatic life and invertebrates – and of long-term trends. Even of mammals, most studies have been of easily observed species or those that elicit an emotive public response.

The best known urban inhabitants are birds. Almost all studies prior to 1990 and more than one third of the

Areas of urban development coincide closely with many areas of highest species diversity and endemism in Australia and with areas of greatest alterations to habitat and the greatest numbers and proportions of threatened species. Australia State of the Environment 2011



Animals in cities challenge our perception of what the word 'habitat' means, by living, and often thriving, in highly contrived settings. Spider wasps (*Cryptocheilus* species) indicate a rich food web because they prey on spiders, which in turn feed on small insects. All the water and fertiliser used in cities help sustain high numbers of invertebrates. Photo: Robert Ashdown

63 reviewed studies from 1990 to 2005 were of birds. Australia's urban bird communities are dominated by a few very successful native species, which tend to be large and assertive, including magpies, currawongs, noisy miners and rainbow lorikeets. The 'matrix-sensitive' species are often small insect-eating or nectar-eating birds that rely on structurally complex and floristically diverse habitats. As urban areas are in a continual state of flux, so too are the birds. As time since development increases, bird assemblages tend to become more distinct from peri-urban and nonurban communities and more similar to those in other urban environments.

After clearing or disturbance, forest remnants often degrade and diminish over time but populations of long-lived animals can hang on for decades without having a future. We need long-term studies of viability.

Diversity tends to peak at intermediate levels of urbanisation. Burning topics for urban ecologists are how much habitat is enough to sustain viable populations and how should this habitat be spatially arranged in the landscape? A common dilemma for local governments is whether to prioritise habitat restoration or an increase in the area of habitat and its connectivity. Urban ecology studies need to consider the responses of multiple species rather than extrapolate from the few that are well known.

Dramatic changes in fortune are

characteristic of urban environments, but winners and losers can be hard to predict. In 1965, the sparrow was described in *Wildlife Australia* as 'a hardy, high-spirited, energetic and adaptable bird which has survived for centuries in close enmity with men' and WPSQ's *Garden Bird Counts* in 1982 showed it was the number one bird in gardens. No one would have predicted the virtual demise of this once 'commonest bird in the world', a poorly understood decline occurring throughout the world (in an interesting irony noisy miners may be largely responsible in Australia). And no one would have predicted the spectacular success of the brush-turkey, now rampant in eastern Australian suburbs from Sydney north, nor the survival in some cities of the bush stone-curlew. Despite seemingly being 'too dumb, too big and too low' (to quote one expert) to survive the cats, cars and kids of suburbia, both species have done ridiculously well in some urban centres in Queensland. We have much yet to learn about why some species are successful urban adaptors. ■

SOURCE: Garden J, et al. 2006. Review of the ecology of Australian urban fauna... *Austral Ecology* 31: 126–148

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