



# Non-uniform bird assemblages in urban environments: the influence of streetscape vegetation

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## Abstract

The urban landscape encompasses a broad spectrum of variable environments ranging from remnant patches to highly modified streetscapes. Despite the expansion of urban environments, few studies have examined the influence of urbanization on faunal diversity, particularly in the Southern Hemisphere. In this study, four broad habitat types were recognized in the urban environment, representing a continuum of modification ranging from parks with remnant vegetation to streetscapes dominated by native vegetation and those dominated by exotic vegetation to recently developed streetscapes. Bird censuses were conducted at 36 sites throughout urban Melbourne, with nine sites surveyed in each habitat type. The four habitat types supported significantly different bird communities based on species richness, abundance and composition suggesting that bird assemblages of urban environments are non-uniform. Parks and native streetscapes generally supported fewer introduced species than exotic and recently developed streetscapes. Overall abundance and richness of species were lower in the exotic and recently developed streetscapes than in parks and native streetscapes. Significant differences were also observed in foraging guilds within the four habitat types, with parks having the most foraging guilds and recently developed streetscapes having the fewest. The transition from native to exotic streetscapes saw the progressive loss of insectivorous and nectarivorous species reflecting a reliance by these species on structurally diverse and/or native vegetation for both shelter and food resources. The implementation of effective strategies and incentives which encourage the planting of structurally diverse native vegetation in streetscapes and gardens should be paramount if avian biodiversity is to be retained and enhanced in urban environments. It is also critical to encourage the maintenance of the existing remnant vegetation in the urban environment.

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## 1. Introduction

By world standards, Australia's population is highly urbanized, with over 85% of its citizens residing in urban centres (Bridgman et al., 1995). Further, urban environments in Australia, as they do internationally, continue to expand rapidly giving rise to many social

and environmental issues that are becoming prominent in public debate and the political agenda. One emerging issue is the impact of this expansion and the types of urban land use on biodiversity.

Biodiversity conservation in urban environments is now a global focus of research (e.g. Morneau et al., 1999; Park and Lee, 2000; Clergeau et al., 2001; Porter et al., 2001). There is growing recognition of the important role that urban environments can play in the conservation of biodiversity (Savard et al., 2000), especially the remnants of natural ecosystems that per-

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sist in and around urban areas (Bolger et al., 1997; Crooks et al., 2001).

Many studies examining the effect of urbanization on biodiversity have used birds to investigate factors influencing the distribution, abundance and conservation status of urban fauna (e.g. Catterall et al., 1991; Fernández-Juricic, 2000; Cooper, 2002; Jokimäki et al., 2002). Birds are a useful model to examine these processes as they can be surveyed and identified readily (compared with groups such as invertebrates or reptiles), and the large number of species and individuals makes results amenable to statistical analysis. Furthermore, birds are a conspicuous element of the urban fauna meaning that research outcomes can be conveyed to residents and stakeholders in a form that can be easily understood.

The majority of research involving birds in urban environments has occurred in the Northern Hemisphere (e.g. Morneau et al., 1999; Park and Lee, 2000; Savard et al., 2000; Cooper, 2002). While some studies on urban bird ecology in Australian cities have been undertaken (e.g. Jones, 1981; Green, 1984; Wood, 1996), there remains a paucity of information pertaining to the structure of bird assemblages in temperate urban environments of the Southern Hemisphere. In Australian cities, a relatively rapid transition (approximately 200 years) from pre-European settlement habitat to a highly modified urban environment has occurred. This is in contrast to established European cities and thus research outcomes from European cities may not be applicable in Australia.

The urban landscape encompasses a broad spectrum of variable environments. These range from highly developed and modified city centres to variegated streetscapes in suburban areas, interspersed with patches of relatively undisturbed natural habitat, often set aside as parks and reserves. The wide range of environments and levels of disturbance have the potential to support a diverse avifauna ranging from native species reliant on indigenous habitat to opportunistic species (both native and introduced) which exploit modified habitats. Few studies have explored the relationships between broad habitat types in urban areas and faunal diversity.

This paper seeks to examine the relationship between the structure and composition of bird assemblages across a continuum of modification. This is

achieved by examining richness and abundance of species and the number of foraging guilds in parks and a variety of streetscape habitats exhibiting different types of vegetation.

## 2. Study sites and methods

Research was conducted in Melbourne, Victoria, Australia (37°50'S, 44°58'E), which has a human population of almost 3.5 million. Despite this high population, housing density remains relatively low, and consequently a large urban sprawl has developed. Founded in 1835, Melbourne is a relatively recently settled city in world terms.

Melbourne is located on the coast of Victoria and experiences a temperate climate with a mean annual rainfall of 657 mm (Land Conservation Council, 1991). A wide range of natural vegetation types occurred prior to settlement including forests, woodlands, heathlands, wetlands and grasslands. Small remnants of many of these habitats may still be found within parks embedded in the urban matrix.

The urban area was divided into four broad habitat types representative of a continuum of modification:

- *Parks*: Predominantly woodland/forest remnants of indigenous vegetation, including revegetated areas and plantings of non-indigenous natives. Parks ranged in size from 6 to 300 ha and differed in vegetation types, purpose and land-use histories. Parks were embedded in the urban matrix, avoiding large blocks of indigenous vegetation along the urban–rural fringe.
- *Native streetscapes*: Established residential streetscapes that contained predominantly native Australian (but not necessarily locally indigenous) trees (e.g. Red-flowering Gum *Eucalyptus ficifolia*, Mugga Ironbark *E. sideroxylon* and Spotted Gum *Corymbia maculata*).
- *Exotic streetscapes*: Established residential streetscapes that contained predominantly mature exotic (non-Australian) trees, including deciduous and evergreen trees.
- *Recently developed streetscapes*: Recently landscaped residential streetscapes lacking mature trees. These occur in new housing estates characterized by limited planting and structural diversity. Plant-

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