parklife

Drivers of biodiversity in Johannesburg's urban green spaces

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Today more people live in cities than ever before. With urbanisation only set to increase, it has never been more important to understand how biodiversity and all the benefits it provides is distributed across these expanding cityscapes. Colonisation by novel species and the extirpation of other species from urban areas results in an uneven distribution of biodiversity within a city. One good predictor of urban biodiversity, in developed nations at least, is the wealth of a neighbourhood. Typically, wealthier neighbourhoods have a higher diversity of plants, reptiles and birds than poorer neighbourhoods. This so-called 'luxury effect' is explained by a host of factors, including the amount of available green space, water availability and the historic land use of an area.

While the luxury effect has been well researched in developed northern temperate nations, it is still unclear whether it applies in developing nations and in more tropical areas. South Africa provides an excellent case study, as it is a developing country with both high biodiversity and high socio-economic inequality. In this regard, the green spaces of the City of Johannesburg provide an ideal opportunity to investigate the luxury effect in a novel setting. And what better group to use to explore these patterns than the numerous and easily identifiable birds?

To tackle these questions, researchers from the University of the Witwatersrand and the FitzPatrick Institute of African Ornithology selected 29 parks and nature reserves across the city, from Soweto to Sandton. These green spaces differ in size, vegetation structure and, crucially, in the socio-economic status of their surrounding communities. Within each park, we conducted counts at multiple points in different habitats, recording all birds seen or heard in a 50-metre radius.

One of the most striking results is the incredible diversity of birds in Johannesburg. We recorded more than 160 species, ranging from the petite Orange-breasted Waxbill to the powerful Verreaux's Eagle. Individual parks supported an average of 38 species, with over 50 species recorded in four parks. This is many more than were found during similar studies of parks in European and North American cities.

While the bird diversity itself was notable, its drivers are fascinating. Despite Johannesburg having some of the most extreme disparity in wealth between different populations and areas, there was no evidence of a luxury effect, with median household income in surrounding areas having no effect on bird richness or diversity. A landscape factor, wetland connectivity, hinted at the mechanism buffering parks in poorer neighborhoods. Wetlands that are well connected in and around green spaces had a significant positive effect on bird diversity, as these networks provide water, food and habitat resources, as well as corridors for birds to move through the urban landscape.

What makes these wetlands particularly interesting in terms of the luxury effect is that they are often associated with densely urbanised informal settlements. An intriguing example of this is Soweto, which has an extensive network of wetlands and associated parks. The link between these heavily urbanised settlements and wetlands might have its origins in the apartheid era, when urban planners used natural barriers, such as wetlands, to separate populations of different races. Our findings emphasise the importance of historical land use and urban planning legacies on the distribution of biodiversity in Johannesburg. The results also highlight how important water availability may be for the luxury effect and hint at a useful tool that current city planners can use to promote biodiversity in urban green spaces to ensure equitable access for all urban dwellers.

Surprisingly, increasing natural land cover decreased bird diversity. However, Highveld grasslands are fairly depauperate and few grassland species have colonised urban green spaces. It seems a mix of trees and grassland produces a heterogeneous and connected cityscape important for fostering bird diversity. Our results indicate the need to consider the ecological context of a city when assessing the biodiversity found in urban areas. The birds in Johannesburg's green spaces highlight how historical, socio-economic and ecological circumstances combine to shape urban diversity.

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above *The highly urbanised area around River Park on the border of Alexandra.*

left *The tiny and colourful Orange-breasted Waxbill was found in several wetlands.*

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