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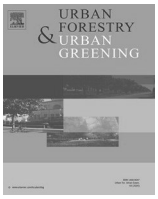

Bird species richness across a Northern Andean city: Effects of size, shape, land cover, and vegetation of urban green spaces

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ABSTRACT

Cities are human-dominated ecosystems where landscape transformation decreases biodiversity, a conservation concern when urbanization sprawls into biodiversity hotspots with high endemism. We aimed to evaluate the effects of site-specific features such as size and shape of green spaces, land cover, and vegetation on bird species richness in Medellín, Colombia, a city of Northern Andes (n = 44 urban green spaces sampled from February 2018 to February 2019). We found 255 plant species: 23 % of trees and 41 % of understory were native *sensu stricto* (local origin); most native species and individuals were in green spaces lacking vegetation management. Bird species richness (25.80 ± 8.05 resident species per sampling point; 83 resident species overall) increased towards larger and more regular-shaped urban green spaces (squared or rounded), with less percentage of impervious surfaces and more of grass–shrubs, and less influence of introduced trees in habitat structure (i.e. less crown coverage, basal area, and average height). Bird species richness also increased when richness or abundance of native understory vegetation *sensu lato* (local or regional origin) increased, but introduced trees dominance represented higher and most significant effects to explain bird species richness. Increasing edge effects across urban green spaces and human-related habitat transformation favoring non-native vegetation might represent significant constraints for enhancing local biodiversity in highly developed Andean cities.

1. Introduction

Cities reflect modern human life and its impacts on the planet. Besides topography and climate, human dynamics influence the composition and structure of cities, where natural landscapes are transformed into novel ecosystems with reduced and structurally simple green spaces (Aronson et al., 2017; Paz Silva et al., 2015; Shih, 2018). Non-native introduced vegetation dominates urban green spaces (Nielsen et al., 2013), which are mainly managed to improve public health and social interaction (Dooling et al., 2006; McDonnell, 2011; Wolch et al., 2014). Although some bird species benefit from non-native vegetation in cities that offer novel resources (Chace and Walsh, 2006; Jasmani et al., 2017), planted or naturalized vegetation has limited contribution in maintaining local biodiversity (Aronson et al., 2017; Chong et al., 2014).

Recent thinking in urban planning includes biodiversity conservation as a key factor to make cities sustainable (Botzat et al., 2016; Puppim De Oliveira et al., 2011; Threlfall and Kendal, 2018), but decision-makers might fail to implement better practices without ecological studies, as responses to urbanization depend on city characteristics and surrounding landscape (Aronson et al., 2014; Kowarik, 2011; Mcdonald et al., 2009). This is particularly challenging when cities are located in biodiversity hotspots with high endemism and species turnover such as the Tropical Andes (Cincotta et al., 2000; Rahbek et al., 2019), where urban bird studies are mainly species lists that have limited use in biodiversity conservation (Ortega-Álvarez and Macgregor-Fors, 2011).

Birds are well-known bioindicators in urban ecosystems (Macgregor-Fors et al., 2015; Marzluff et al., 2001; Mckinney, 2008) as alpha biodiversity measurements like species richness respond to green space features at local scales (Marzluff et al., 2001; Mckinney, 2008; Tryjanowski et al., 2017): larger and more regular-shaped urban green spaces (e.g. squared, rounded) are richer because they promote species persistence due to species–area relationships (Beninde et al., 2015; Fernández-Juricic and Jokimäki, 2001; Nielsen et al., 2013); they also mitigate urban environmental pressures and edge effects (Fernández-Juricic, 2004), whereas smaller and less regular-shaped green spaces

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