# Introduction

The importance of long-term studies in ecology is well recognized (Likens, 1989; Fidino and Magle, 2017). Despite this, temporal explorations of ecological phenomena are rarer and funded less than their short-term but spatially expansive counterparts (Hughes et al. 2017). This contrast potentially arises from one key difference between space and time – space may be manipulated over varying scales while time itself cannot be fundamentally changed (Wolkovich et al. 2014). While ecologists may alter the relative timing of events (e.g., Vanette & Fukami, 2014), it is impossible to alter time absolutely. Therefore, to increase temporal extent we either require the time to do so, historically published datasets for comparison, or both (Fidino and Magle 2017). And although long-term datasets are becoming more common (Wolkovich et al. 2014), there is a general paucity of long-term data throughout many fields of ecology.

In urban avian ecology, long-term studies are relatively rare but increasing (Fidino and Magle 2017). At the community level, long-term studies typically monitor breeding birds in urban green space over time as the surrounding environment urbanizes. Some trends across studies are unclear. For example, as green space urbanizes over time alpha diversity can increase (Abs and Bergen 2008), decrease (Catterall et al. 2010, Pidgeon et al. 2014, Strohbach et al. 2014), or not change at all (Jones and Wieneke 2000, Shultz et al. 2012). Yet, while the total number of species may not change as urbanization increases, species composition does (Aldrich and Coffin 1980, Jones and Wieneke 2000, Strohbach et al. 2014). Reasons for temporal shifts in species composition include climate change (Travis 2003), maturation of landscaped vegetation (Jones and Wieneke 2000, Gleditsch 2016), the spread of invasive species (Foster et al. 2002), or habitat loss (Tait et al. 2005, Walk et al. 2010).

TO DO:

1. Last sentence in P2, hits on importance of the work.
2. P3 on why we need to look at migratory period as well
3. P4 pivots into our study.

the species who make up

This lack of generality is related to how avian communities shift as urbanization increases. For and reported factors related to community

given that a high rate of temporal turnover in the

one emerging observed pattern across studies is a high rate of temporal turnover

is the high rate of temporal turnover in the urban species spe

As monitored locations urbanize through time these studies have revealed both increases or decreases in alpha diversity over time

a high rate of temporal turnover in the urban species spool was an incredibly common trend across studies. Reported factors related to community turnover include

Such research has revealed several subtle trends. For example, while changes in alpha diversity were equivocal at sampled locations that urbanize through time, studies often observed a high rate of turnover in species composition through time Such turnover is likely the result of habitat loss and fragmentation, which may negatively influence species, combined with the maturation of landscape vegetation which positively influences other.

Collectively, long-term urban bird research illustrates the dynamic response birds may have to urbanization. While the process of urbanization results in habitat loss and increased habitat fragmentation, which may negatively influence species,

Such studies are important

In a systematic review of long-term urban bird research,

Long-term ecological studies are necessary to understand slow processes, rare events such as species invasions (Strayer et al. 2006), or complex phenomena (Wolkovich et al. 2014).

One aspect of this observed trend is the general paucity of long-term data throughout many fields of ecology.

Methods

Study Area

At 481 hectares, Lincoln Park is the largest park in Chicago, IL, USA. Lincoln Park is predominately linear in nature and lays along the shore of lake Michigan as far south as Navy Pier in Downtown Chicago and 11.91 km northwards to the Edgewater community area. Lincoln Park was historically much smaller than it’s current size,

The study transect measures a continuous 2.45 KM from the northern-most starting point (41.932099, -87.638674), to the southern-most (41.911257, -87.628814). The site surrounding the transect is a 71.43 hectare park space comprised of North Pond Nature Sanctuary, Alfred Caldwell Lily Pool, Lincoln Park Zoo, Nature Boardwalk, and Lincoln Park South Fields comprise the site that holds the transect in Chicago, IL.

To assess bird species composition and presence, an observer walked the transect Monday – Friday from March through April starting at roughly 0800 hours walking at a steady rate, 2 MPH, until complete. In May, transect walks were increased to daily, Sunday – Saturday starting at 0800 hours. Two trained observers (MF and KL) conducted the transects. In an effort to only count species exhibiting site use, birds were identified by sight and sound within no more than 50 m of the line transect. Species detected were recorded using the American Ornithological Union Standardized Alpha Codes.

Frequency of transect walks replicated theorized birding activities by Herbert and Alice Walter to produce ‘Wild Birds in City Parks.’

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