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LEED Certified Buildings and Bird-Friendly Window Design

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Abstract

(text, single spaced, TNR 11, left)
Green buildings (i.e., LEED certified buildings) emphasize access to daylight and views for occupants' wellbeing, comfort, and productivity. Window glazing allows access to daylight and views but is often detrimental to birds. Annually, up to a billion bird in the United States die due to window collisions. A comprehensive literature review and data analysis of LEED and methods of deterring collisions was conducted to determine solutions to limit bird deaths at LEED certified buildings. Deterrence factors of building design, outdoor surroundings, and occupant behavior were evaluated, due to their collective impact on bird-window collisions. To best prevent collisions and adhere to LEED, window glazing with visual markers and sound deterrents should be used. Certain façades should be avoided and building lights should be turned off during migration season. Additionally, vegetation near buildings is encouraged in LEED certification, but increases the frequency of bird-window collisions. These findings suggest that LEED, particularly the credit "Daylight and Quality Views," is not completely aligned with current bird-safe design practices. While certain window glazing is acceptable for both LEED and bird-safe design, the two are not mutually exclusive. Due to this, it is recommended that window glazing that aligns with LEED and is bird-safe, is made clear within the LEED "Daylighting and Quality Views" credit description. LEED and bird-safe design practices also have contradictory views on vegetation near buildings. There should also be further research into if vegetation near buildings would still increase bird-window collisions if deterrent factors, such as bird-safe windows, were utilized.

Keywords: Sustainable construction, urban design, LEED, bird-window collisions

Background

LEED certified green buildings are becoming increasingly prevalent worldwide, which is advantageous for environmental sustainability and human health but not necessarily for birds. The LEED credit, Daylight and Quality Views, places emphasis on large, visible windows, which is beneficial for occupant health but, not for birds, who perceive reflections on windows as reality, thereby flying into them. Moreover, a 2016 study conducted by Duke University suggested that LEED buildings have the potential to cause more bird-window collisions (Ocampo-Peñuela et al., 2016). This is due to the tendency of LEED buildings to have a larger

percentage of building façade composed of windows, when compared to non-LEED buildings. It is estimated that around “988 million birds” die yearly due to collisions with buildings in the United States alone which is problematic for species survival and ecosystem health (American Bird Conservatory, 2014).

Figure 1. Magnolia Warblers dead from collision with Texas buildings (Henderson, 2017)

This project aims to determine how it is possible for buildings to be both LEED certified and bird-friendly. With effects of climate change becoming more pronounced coupled with worldwide urban development accelerating, it is of utmost importance to keep buildings as environmentally friendly as possible by use of green building certification systems, such as LEED. It is also necessary to protect birds while still promoting the widespread adoption of green buildings. Due to increased development around the world, birds are losing their natural habitats, and being introduced to new urban threats, such as vehicles, domesticated cats, and

building windows (U.S. Fish and Wildlife Service, 2022). Therefore, extra effort should be made to limit the number of preventable bird deaths due to window collisions.

Methodology

A comprehensive literature review and data analysis of LEED credit descriptions and methods of deterring bird-window collisions were conducted to determine solutions to limit bird deaths. The LEED credit "Daylight and Quality Views" was analyzed extensively, due to its emphasis on window design (USGBC, 2018). The deterrence factors of window features, immediate outdoor surroundings, and occupant behavior were evaluated, due to the collective impact these factors have on bird-window collisions. The results were then collectively analyzed to determine how buildings could best align with both current LEED practices and current bird-friendly design standards.

Review of Literature

Window Glazing

To best conform to both LEED and bird-friendly design standards, window glazing should provide adequate daylighting and views, while also limiting bird-window collisions. The LEED credit "Daylight and Quality Views" recommends that to achieve good daylighting and views, buildings should have lots of windows and largely unobstructed views (USGBC, 2018). To align with the daylight portion of this LEED credit, window glazing cannot obstruct views or distort the color balance by use of tint (USGBC, 2018). Patterns on windows, such as frits, are acceptable if the view is not compromised (USGBC, 2018).

A commonly used method of preventing collisions, while also ensuring good daylighting and views, is by use of fritted glass, etched glass, or other visual markers, such as adhesive film (USGBC, 2018; UF Planning, Design, and Construction, 2021). These visual markers allow birds to perceive windows as solid objects they cannot fly into. For visual markers to be effective (i.e. for birds to 'see' them), the individual elements of the pattern design must be kept close together, "less than 4" vertically and 2" horizontally" (UF Planning, Design, and Construction, 2021). Additionally, all efforts should be made to avoid reflective window glazing, since this type of glazing is especially harmful for bird-window collisions (Klem et al., 2009).

Figure 2. Window with bird-safe film (Betuel, 2019)

Other Building Designs and Features

Building façade has an impact on the frequency of bird-window collisions. Alcoves cause high rates of collisions, due to the creation of a bird "entrapment" zone (Riding et al., 2020). Porticos are similar in function to alcoves but, do not cause an unusually high number of collisions, thus serving as an effective alternative façade (Riding et al., 2020). Installing operable blinds and awnings can simultaneously serve in deterring bird-window collisions and improving building occupant comfort (UF Planning, Design, and Construction, 2021; USGBC, 2018).

Occupant Behavior

Having lights on inside a building can be harmful to birds, as it can lead to collisions with windows at a greater extent. A 2020 study found lots of support for switching off building lights at night to limit bird collisions (Lao et al., 2020). While turning of building lights at night is advantageous for birds throughout the year, it is especially important during migration season, when more birds than average are flying through a given area (The Academy of Natural Sciences of Drexel University, 2021). Over 30 cities across the United States participate in the "Lights Out" program, which is an initiative that encourages building owners and occupants to turn off interior building lights during bird migration season so that mass bird casualty events resulting

from window collisions can be prevented (The Academy of Natural Sciences of Drexel University, 2021).

Outdoor Elements Impacting Collisions

In the LEED credit "Daylight and Quality Views," what building occupants visually see outside of a window matters in determination of whether a view is considered 'quality' or not (USGBC, 2018). To achieve quality views, it is suggested that views should include two or more of the following criteria: "(1) flora, fauna, or sky; (2) movement; and (3) objects at least 25 feet" from the window's exterior (USGBC, 2018). In this situation, an example of movement would be vehicles or moving (USGBC, 2018). Natural processes, such as rain falling, are not considered adequate movement (USGBC, 2018).

The outdoor environment adjacent to a building impacts the frequency of bird-window collisions, as well as the quality of the view. Birds are more drawn to areas with greenery, such as trees and green walls (Klem et al., 2009; Chiquet et al., 2013). They are also more likely to have a fatal window strike when a building is in a largely undeveloped area (Hager et al., 2013). While decreasing the amount of greenery near a building decreases collisions, it also decreases quality views for building occupants. To ensure both fewer bird-window collisions and quality views, certain vegetation and deterrent techniques should be utilized.

A 2020 study found that compared to other vegetation, pear trees near a building significantly increases the number of bird-window collisions (Brown, 2020). A different study found that many bird deaths occur due to many bird feeders being located near windows (Klem et al., 2009). Both studies suggest that locating birds' food sources, such as fruit trees and bird feeders (that are typically filled with birdseed), nearby windows contribute to a rise in bird-window collision and subsequent bird deaths. Regarding grass, a 1980 study in the United Kingdom found that when compared to short grass, tall grass can significantly deter birds from an area (Brough & Bridgman, 1980). Replacing short grass with tall grass near buildings will decrease the number of birds in an area, meaning that the chance for bird window collisions has the potential to decrease due to this deterrence technique.

The use of sound fields around a building has proven to be effective in decreasing collisions (Swaddle & Ingrassia, 2017). These sound fields are audible to birds but not humans. Frequent human activity is an also effective visual deterrent, since it frightens birds (Bishop et al., 2013).

Results

After analyzing LEED credit descriptions and methods of deterring bird-window collisions, it was found that the two design standards are not completely aligned with each other. For window glazing, there are options that work for both the LEED and bird-safe design standards but, this information is not easily accessible within the LEED "Daylight and Quality Views" credit requirement description, as glazings that are both bird-friendly and good for views are not explicitly mentioned within this credit description (USGBC, 2018). Also, there are differing recommendations between the two building design standards regarding the location of vegetation and wildlife near buildings. LEED favors having vegetation and/or wildlife within viewable distance from a building window (USGBC, 2018). This poses problems for birds, who are attracted to vegetation and are, by nature, wildlife, meaning that, in accordance with the LEED credit "Daylight and Quality Views," birds near buildings are advantageous since they are fauna and thus, a quality view (USGBC, 2018). This completely contradicts with bird-friendly design standards, which aim to deter birds from buildings as much as possible to limit bird-window collisions.

While there are some LEED and bird-safe design recommendations that contradict each other, there are others that align. Operable blinds/awnings can assist in preventing bird-window collisions since they serve as a visual marker (UF Planning, Design, and Construction, 2021). They are also favored in LEED green buildings, since they can increase occupant comfort by allowing occupants to adjust lighting as they seem fit (USGBC, 2018).

The bird-safe building design recommendation of turning off lights when it is dark outside, and especially so during bird migration season, does easily align with the LEED Energy and Atmosphere (EA) category, which aims to save energy (Lao et al., 2020; The Academy of Natural Sciences of Drexel University, 2021; USGBC, 2018). This action of turning off lights is beneficial in saving both bird lives and energy.

Suggestions

Due to the findings of this project, it is suggested that the LEED "Daylighting and Quality Views" credit description specifies which types of LEED suggested window glazings also align with bird-safe design standards. This is so it is easily known which glazings simultaneously align with both standards when the credit description is read by those pursuing

LEED certification for a building. Due to the contradictory views on vegetation and wildlife near buildings amongst the two standards, further research should be conducted on this issue to determine the best overall solution. It would be useful for a future study to evaluate if vegetation and/or bird wildlife nearby buildings still increases the incident of bird-window collisions if deterrent factors, such as visual markers on windows, were utilized.

It also would be useful if a permanent LEED credit that addresses bird-window collisions is added. While there are some pilot credits, such as "SSpc55", which awards a credit to buildings with deterrents to prevent collisions, it would be beneficial for bird safety to make a credit like this permanent (Metaliz, 2022). A potential bird safety LEED credit could also integrate multiple different strategies to limit bird-window collisions, such as turning off building lights at night, using bird-safe window glazing, and limit bird food sources near buildings, amongst others.

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