

The effects of urban development on habitat use in the golden-cheeked warbler

Darren Proppe, Wild Basin Creative Research Center & St. Edward's University

As the human population in western Austin and Travis County continues to grow, highway use and development continue to increase. In response to rapid growth in the Texas Hill Country region, the Balcones Canyonlands Preserve (BCP) has set aside over 35,000 acres of preserve land to protect endangered species, such as the golden-cheeked warbler (*Setophaga chrysoparia*). However, the organisms that utilize these preserves may still be impacted by development that occurs outside preserve boundaries. Golden-cheeked warblers in particular, may be impacted by development because they utilize larger patches of undeveloped land, rely on acoustic communication, and are susceptible to predators associated with human development (e.g., blue jays, *Cyanocitta cristata*).

Our goal was to assess the impact of urbanization on habitat use by the golden cheeked warbler. We used impervious surface as a proxy for urbanization and quantified habitat use by the likelihood that a golden-cheeked warbler was observed within a 100 m cell on 100-acre survey plots on the Balcones Canyonlands Preserve. We selected 10, 100-acre intensive survey plots for study where golden-cheeked warbler territories had been delineated every year between 2011 – 2019 by staff and volunteers from the City of Austin and Travis County (Figure 1). Specifically, we retained all bird observations from 2011, 2013, 2016, and 2019 because these years also correlated with published years of impervious surface datasets available from the National Land Cover Database (NLCD). To assess warbler use across the landscape, we placed a virtual 100 m grid over the entirety of all 100 acre-plots. For each year, we quantified the number of sightings within each cell. Further, we quantified the percentage of land classified as impervious surface within 1 km of each cell. We also included GPS coordinates for the centroid of each cell to look for a general spatial shift in habitat use (e.g., potential westward movement away from development). Analysis was conducted in R by four students at Calvin University (Jose Hernandez, John Hong, David Martinez Vasquez, Tom Takeuchi) in consultation with a faculty statistician (Dr. Stacy DeRuiter) and the report author.

Our results reveal a strong aversion to urbanization, as represented by impervious surface, in golden-cheeked warblers (Figure 2). Warbler sightings within a cell averaged near one and were as high as eight with 0% impervious surface, but the mean and range fell to zero birds between 10-15% impervious surface. Impervious surface increased slightly from 2011 to 2019 (Figure 3). Although likely driven by multiple factors, bird observations also fell over the same time period on several intensive plots (Figure 4). Our results support the notion that golden cheeked warblers will select habitat with little to no impervious surface within a buffer of 1 km. This required buffer could, in fact, be much larger but we can safely assume that tracts with $< 2 \text{ km}^2$ of appropriate habitat are unlikely to support warbler use.

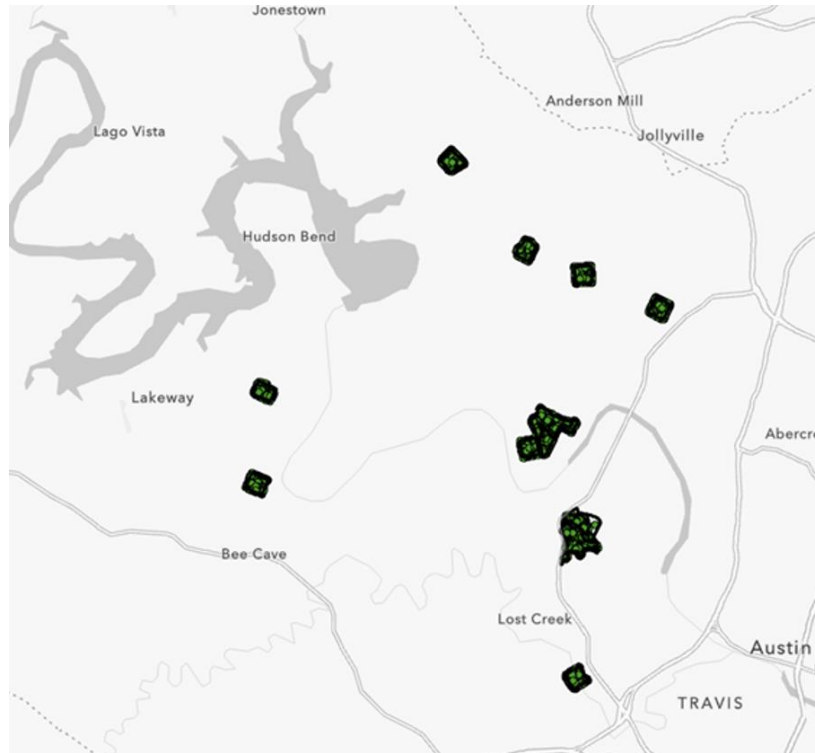


Figure 1. Ten 100-acre intensive plots used for our analysis

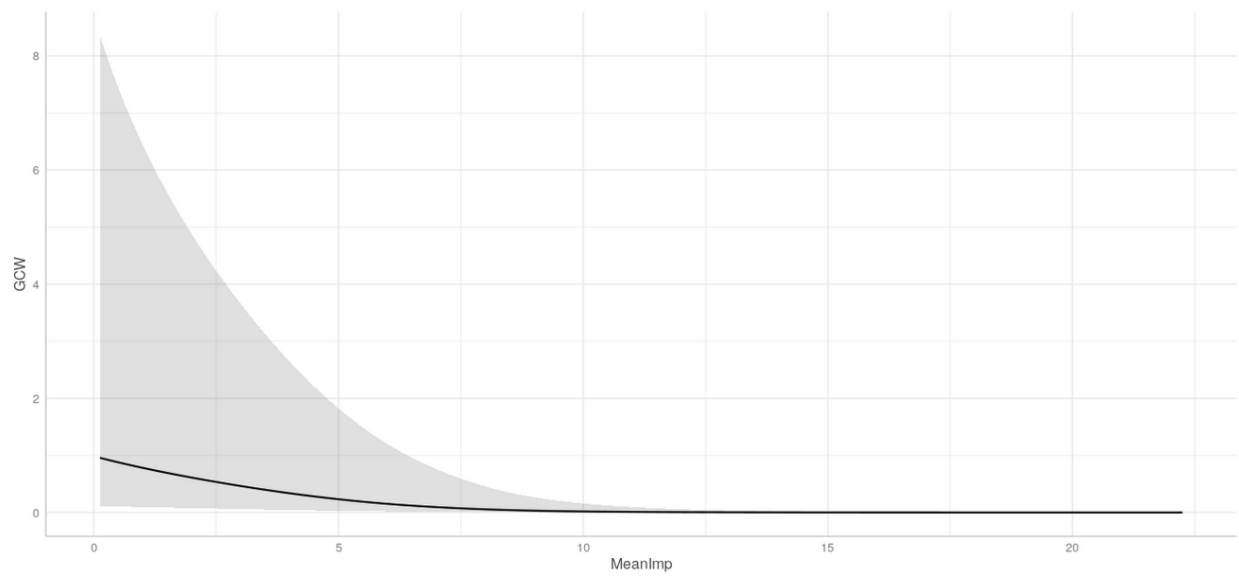


Figure 2. Numbers of golden-cheeked warblers observed in a cell (GCW) as impervious surface within a 1 km buffer (MeanImp) increased.

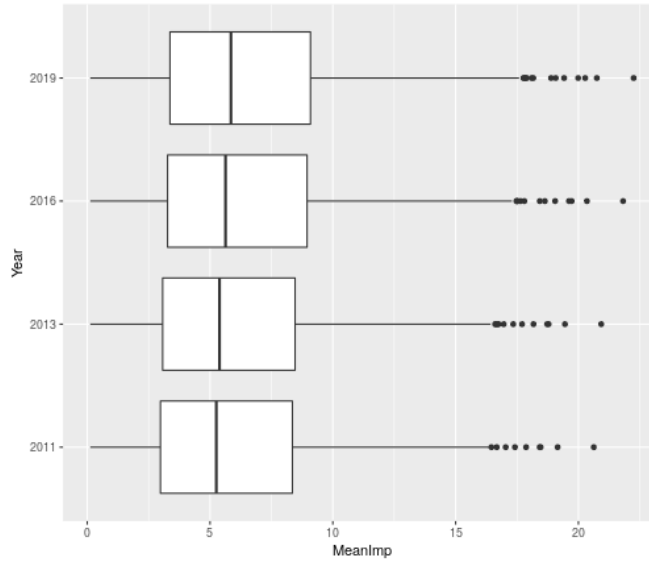


Figure 3. Percent impervious surface (MeanImp) across all cells by year

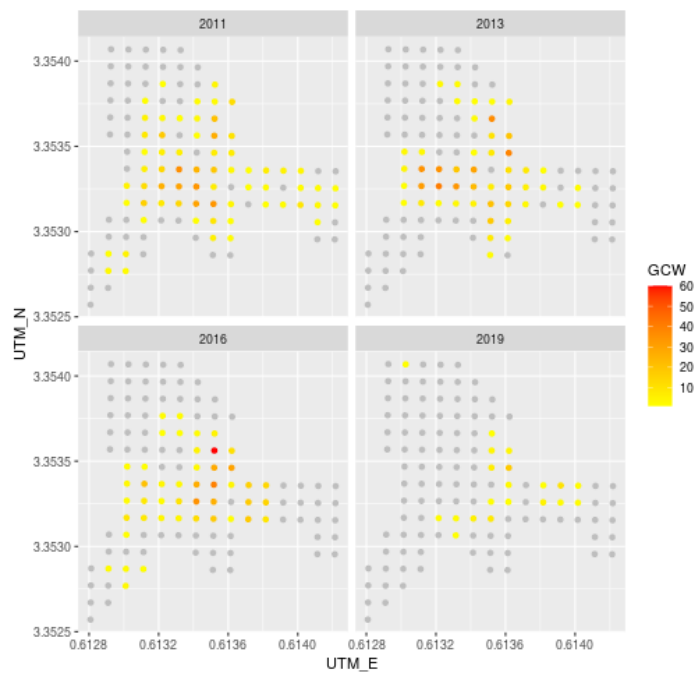


Figure 4. Golden-cheeked warbler observations dropped over time in several plots. Grey cells had no observations, while yellow to red cells had recorded with the numbers of observations per cell increasing from yellow to red coloration. The example shown here is Wild Basin Wilderness Preserve.