**2023 Grassland Breeding Bird Census in the Beaverhill Natural Area**

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**Abstract**

In the last several years, populations of grassland bird species have declined. The Grassland Breeding Bird Census is conducted by interns each summer for the Beaverhill Bird Observatory near Tofield, Alberta, to monitor breeding bird territory abundance in the Beaverhill Natural Area. This study analyzed whether breeding bird species territory densities were associated with annual precipitation levels in the Beaverhill Natural Area from 2016 to 2023. Results showed that breeding bird territory abundance may not be affected by annual rainfall or that rainfall has remained relatively stable over time.

**Introduction**

Grassland biomes are important habitats for a diverse range of bird species and other wildlife (Stanton et al., 2018). Many grassland bird species rely on different aspects of grassland biomes for breeding and foraging (Bird, 2010). For example, LeConte's Sparrows hide in the grass and run along the ground while foraging for seeds and insects (Bird, 2010). Also, many grassland bird species nest on the ground and rely on the protection provided by thick grasses (Bird, 2010). Urban and agricultural developments continually threaten grassland habitats that many animals rely on worldwide. In their 2022 annual plowing report, the World Wildlife Fund found that over 75 percent of Canada's native grasslands have been plowed (World Wildlife Fund, 2022). Increased pesticide use also negatively impacts the health of grassland bird populations (Mahony et al., 2022). Due to the loss of protected grassland areas, many grassland birds are considered at risk in North America. In general, grassland bird species continue to decline in numbers (Mahony et al., 2022). Breeding bird surveys have revealed that grassland bird species have declined by 57 percent since 1970 in Canada (North American Bird Conservation Initiative Canada, 2019). Baird's sparrows have lost 50 percent of the habitat in Canada they rely on during the summer months (North American Bird Conservation Initiative Canada, 2019).

Monitoring protected grassland areas annually in the summer provides essential information about breeding bird population trends in these areas that can help inform native grassland conservation efforts. Breeding bird censuses provide a wealth of knowledge about bird populations inhabiting grassland areas and their migration patterns. Monitoring breeding bird populations can also provide data about indicator species. For example, Yellow Warblers have been considered an indicator species for healthy riparian habitats (Giermakowski et al., 2016).

Changing population trends provide information about habitats across years, which helps researchers track climate and environmental changes. For this study, a breeding bird census was completed in the protected Beaverhill Natural Area. This year, 2023, the Beaverhill Natural Area encountered drought until the end of July, which may have affected the presence and abundance of certain breeding bird populations within the breeding grid compared to previous census years with higher precipitation levels. This study compared annual population trends by examining whether historical and current annual rainfall levels were correlated with breeding bird territory numbers. Increased annual precipitation levels were hypothesized to be positively associated with more breeding bird territories for species that prefer marshes and wetter habitats.

**Methods**

This study uses the spot mapping or territory mapping census repeated 6 times to determine the number of territories of each species in the study area (Hall 1964, James and Shugart 1970, Kennedy et al 1999). The study area for the grassland grid census is divided into a 500-meter-sized grid with each point spaced fifty meters apart located in the Beaverhill Natural area, which is located near Tofield, Alberta. The points are labelled from letter A to H, rows A-F contains points numbered 0-11, row G has points 0-9, and row H contains points 0-8. The censuses began at the first point, A0, in the southwest corner. censuses began at approximately 5:20 each morning and took between 4 and 6 hours to finish. Censuses were completed on June 1, June 6, June 14, June 26, July 5, and July 12. To navigate censuses, a Garmin GPS was used to locate each grid point, which had each grid point input as waypoints before beginning censuses. Bird calls and songs at each grid point were recorded onto the data sheets during the censuses. Bird identifications were completed mainly by listening to songs, sometimes by sight, and then recorded onto a grid sheet by species code. Counter singing was marked by a dotted line

between two birds singing simultaneously. Data was collected at every grid point for a few minutes in duration. The length of time at each point depended on the presence of calls. Additional measurements that were considered in the analysis of this data are rainfall precipitation levels for each year. A time series analysis graph displays the historical data on annual territories by bird species from 2016-2023.

**Census Area**

The Beaverhill Grassland Grid is located near the shores of Beaverhill Lake. The 500-meter grid for censusing is made up of varying habitat types. In recent years, the forest has expanded into the grassier areas of the grid. For instance, Rows A to B today are primarily made up of forest habitat, grid points A8 and A9 are located in Sora Pond, rows C and D consists of forest and willow thickets, grid points D to H, is mostly grasslands with some sparse shrubs.

**Results**

A total of 183 territories were recorded this year. The most abundant species recorded in the Beaverhill Lake grassland area were Clay-colored Sparrows with 43 territories. Additional frequent species heard were Yellow Warblers with 36 territories, Least Flycatchers with 26 territories, and Common Yellowthroats with 23 territories. Least Flycatchers and Yellow Warblers were the most common in the forested areas. In the grassland areas, sparrow species and Common Yellowthroats were more frequent.

**Table 1**

*Number of territories and densities by species for the 2023 study*

| Species | Number of Territories | Densities (Territories per acre) |
|---|---|---|
| Clay-colored Sparrow | 43 | 0.98 |

| | | |
|---|---|---|
| Yellow Warbler | 36 | 0.82 |
| Least Flycatcher | 26 | 0.59 |
| Common Yellowthroat | 23 | 0.53 |
| Red-Winged Blackbird | 19 | 0.43 |
| LeConte's Sparrow | 9 | 0.21 |
| Savannah Sparrow | 4 | 0.09 |
| Nelson's Sparrow | 8 | 0.18 |
| Sedge Wren | 0 | 0.00 |
| House Wren | 4 | 0.09 |
| Warbling Vireo | 3 | 0.07 |
| Black-capped Chickadee | 2 | 0.05 |
| Alder Flycatcher | 3 | 0.07 |
| Song Sparrow | 3 | 0.07 |

*Note*. This table shows the breeding bird species territory density in the Grassland Grid for 2023, showing species abundance. Density was calculated using an area of 43.8 acres.

**Table 2**

*Number of territories by species compared to previous years*

| Species | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|
| Alder Flycatcher | 13 | 5 | 12 | 10 | 0 | 6 | 1 | 3 |
| Least Flycatcher | 27 | 3 | 2 | 16 | 15 | 21 | 24 | 26 |
| House Wren | 1 | 4 | 1 | 2 | 4 | 1 | 4 | 4 |
| Sedge Wren | 0 | 0 | 0 | 5 | 12 | 6 | 5 | 0 |
| Gray Catbird | 0 | 0 | 3 | 0 | 0 | 0 | 1 | 0 |
| Yellow Warbler | 43 | 24 | 20 | 25 | 24 | 41 | 26 | 36 |
| Common Yellowthroat | 0 | 1 | 9 | 19 | 24 | 49 | 21 | 23 |
| Savannah Sparrow | 52 | 32 | 6 | 14 | 8 | 7 | 12 | 4 |

| Clay-colored Sparrow | 83 | 42 | 23 | 49 | 32 | 48 | 31 | 43 |
|---|---|---|---|---|---|---|---|---|
| LeConte's Sparrow | 7 | 0 | 0 | 39 | 31 | 24 | 12 | 9 |
| Nelson's Sparrow | 0 | 0 | 0 | 0 | 19 | 13 | 9 | 8 |
| Song Sparrow | 0 | 3 | 4 | 7 | 3 | 0 | 1 | 3 |
| Red-winged Blackbird | 1 | 4 | 2 | 16 | 20 | 18 | 17 | 19 |
| Black-capped Chickadee | 3 | 0 | 0 | 7 | 0 | 0 | 2 | 2 |
| Warbling Vireo | 0 | 0 | 0 | 3 | 0 | 0 | 4 | 3 |

*Note*. This table shows the annual number of breeding bird species territories in the Grassland Grid, which shows changes in species abundance across an 8-year period.
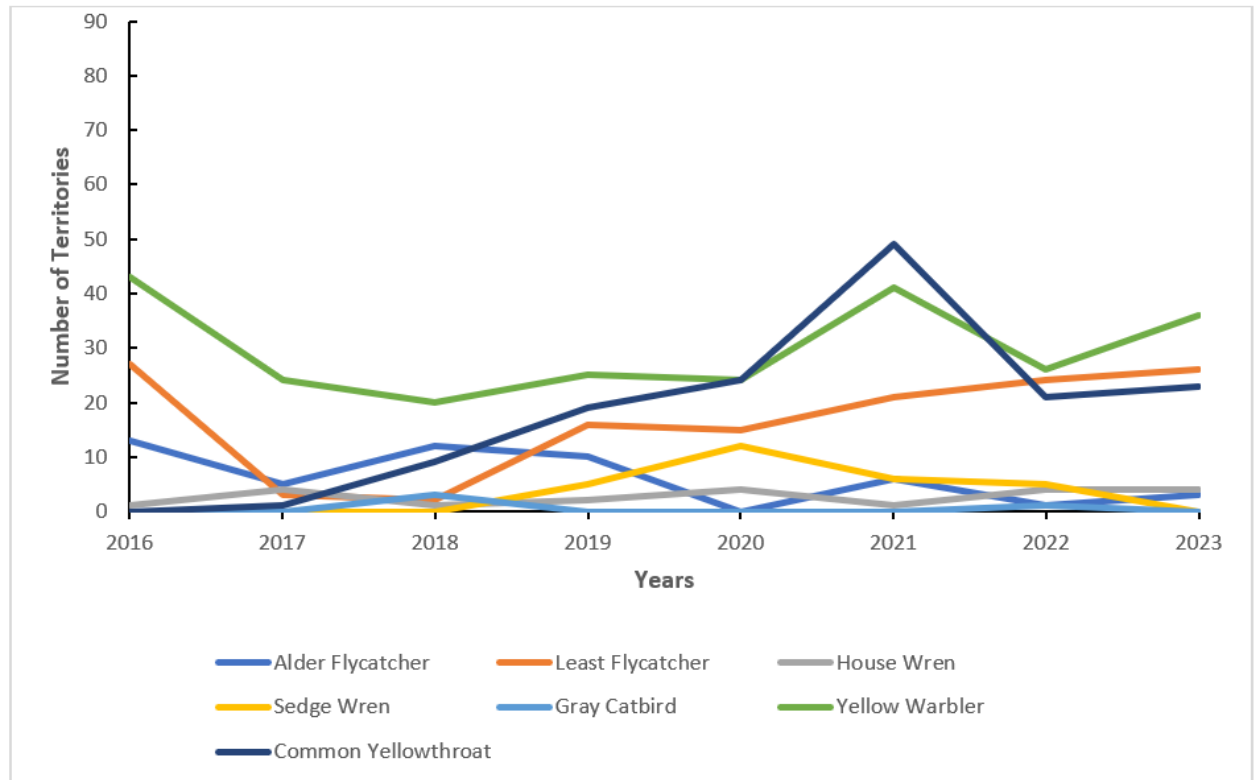
**Figure 1**

Precipitation Levels in Tofield, Alberta
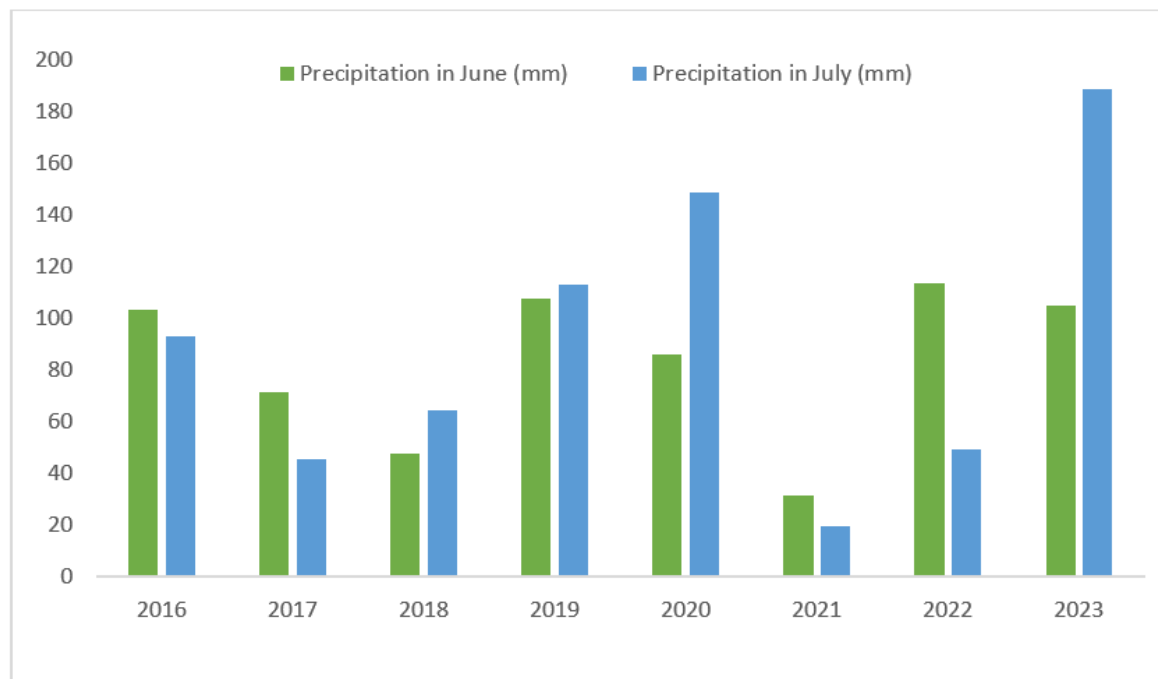


*Note*. The total monthly precipitation (mm) for the months of June and July seen in Tofield, Alberta, over an 8-year period was collected from the Alberta government's historical weather database from the Shonts AGCM station (ACIS).
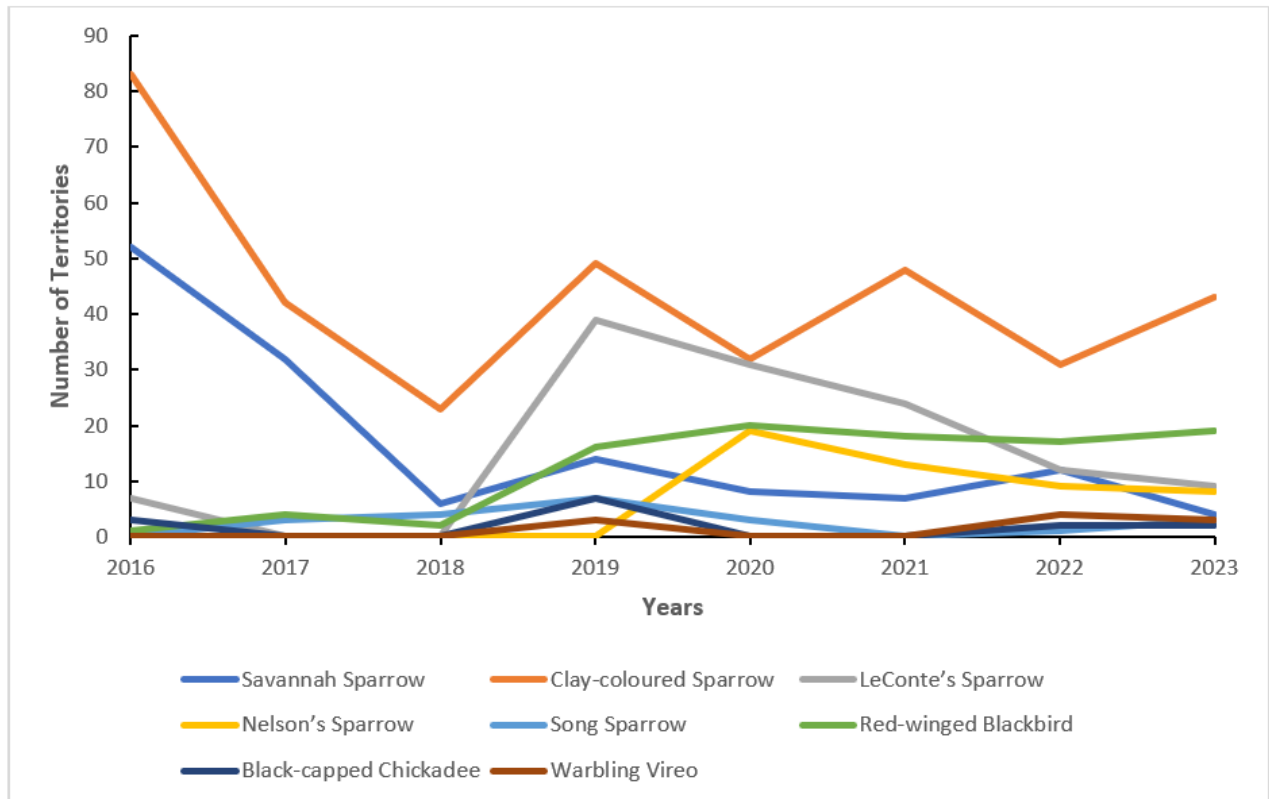
**Figure 2**

Times Series Analysis of Territory Numbers of Breeding Bird Species



*Note*. The total breeding bird species territory numbers for Alder Flycatchers, Least Flycatchers, House Wrens, Sedge Wrens, Gray Catbirds, Yellow Warblers and Common Yellowthroats across an 8-year period in the Beaverhill Natural area Grassland Grid.

**Figure 3**

Time Series Analysis of Territory Numbers of Breeding Bird Species



*Note*. The total breeding bird species territory numbers for Savannah Sparrows, Clay-colored Sparrows, LeConte's Sparrows, Nelson's Sparrows, Song Sparrows, Red-winged Blackbirds, Black-capped Chickadees, and Warbling Vireos during an 8-year period in the Beaverhill Natural Area Grassland Grid.

**Discussion**

In 2022, 31 territories of Clay-colored Sparrows were observed. This year this number increased to 43 territories. 36 Yellow Warbler territories were identified, which increased from 26 in last year's census. Several species increased slightly by 2-3 territories in 2023 versus 2022: Least Flycatcher, Alder Flycatcher, Common Yellowthroat, Song Sparrow, and Red-winged Blackbird. The grassland census area remained quite dry this season compared to some previous years through the breeding season, which may have slightly reduced the marshland-like habitats some grassland bird species prefer. Nelson's Sparrow territories declined by one from 9 in the previous year to 8. Savannah Sparrow territories were reduced from 12 last year to 4. Similarly, no Sedge Wren territories were identified this year, which occurred last in 2018. LeConte's Sparrows had 9 territories, which declined from 12 in 2022. House Wren territories remained at 4, akin to last year. Black-capped Chickadees had 2 territories again in 2023. Warbling Vireos, however, increased their territory from 2 in 2022 to 3 this year. Compared to last year, there was not a significant reduction or increase in territory densities for most species. Since 2016, Savannah Sparrow territories have shown the sharpest decline. Some species' territories increased compared to previous years, while others remained similar or decreased slightly.

Average precipitation levels (mm) from 2016-2023 were calculated for the breeding season months of June and July. A Pearson correlation coefficient was computed to assess the linear relationship between annual precipitation levels and breeding bird territory numbers. Correlation coefficients were calculated in the program Excel. A weak negative correlation was found between annual precipitation levels and the number of Alder Flycatcher territories ($r(6) = -0.24$, $p = 0.57$). A moderately strong positive correlation existed between annual precipitation levels and the number of Least Flycatcher territories ($r(6) = 0.43$, $p = 0.29$). A moderately strong

positive correlation was also found for House Wren territories (r(6) = 0.47, p = 0.24). No correlation was found for Sedge Wren territories (r(6) =0.07, p = 0.86). Yellow Warbler territories also showed no correlation (r(6) = 0.01, p = 0.99). Similarly, Savannah Sparrow territories had no correlation (r(6) =-0.03, p = 0.42). A weak negative correlation existed between annual precipitation levels and the number of Gray Catbird territories (r(6) = -0.33, p = 0.48). A very weak negative correlation existed for Common Yellowthroat territories (r(6) = -0.19, p = 0.64). A very weak positive correlation was found between precipitation levels and Clay-colored Sparrow territories (r(7)= 0.13, p = 0.90). A weak positive correlation was found for LeConte's Sparrow territories (r(7)= 0.24, p = 0.57). A very weak positive correlation was shown between precipitation levels and Nelson's Sparrow territories (r(7) = 0.11, p = 0.80). A weak positive correlation was found between annual precipitation levels and the number of Song Sparrow territories (r(7)= 0.35, p = 0.40). A weak positive correlation also existed between annual precipitation levels and the number of Red-winged Blackbird territories (r(6) = 0.34, p = 0.47). Precipitation levels and Black-capped Chickadee territory numbers were moderately strongly correlated (r(6)= 0.46, p = 0. 25). Warbling Vireos territory numbers also revealed a moderately strong correlation (r(6) = 0.48, p = 0.23).

The results of these correlations are not statistically significant, which could mean that rainfall has either been relatively stable over time or has not influenced breeding bird territory density in the grassland grid. Overall, the correlations showed minimal support for the hypothesis only in one species, Red-winged Blackbirds, which use wetlands as their habitats. Flooding appears to be a low risk for Red-winged Blackbird nesting success (Robinson & McChesney, 2022). However, other correlations showed that lower precipitation levels appear to be moderately associated with an increase in some breeding bird territories. Future research

could further examine correlations between precipitation levels and species territory abundance during the breeding season.

The encroaching presence of the forest on grassy areas provides a possible explanation for the increase of territories of forest-dwelling birds counted in the Grassland Grid Census. Future censuses will be able to continue to monitor how these changing environmental influences affect breeding bird territory densities on the grid. Regular habitat analysis can help document the forest succession. Limitations of this study include observer error and observer differences because each year, different interns complete the censuses. When marking approximate birdsongs on the grids by ear, there is room for mistakes in these estimations. When birds moved quickly and could not be identified, these were not marked on the grid, influencing the number of territories included in the final data analysis. Additionally, birds who only called for a short duration and stopped before an identification could be made were not marked down on the data sheets.

**Conclusion**

This census supplied additional bird species data in the grassland grid at Beaverhill Natural Area for the 2023 breeding season. By analyzing historical annual precipitation data and breeding bird territory numbers, this paper explored how breeding bird territories may be impacted in response to changing environments and climates. The analysis results were not statistically significant, inferring that rainfall has been mostly stable or did not impact breeding bird territory abundance.

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