

## 2024 Grassland Breeding Bird Census in the Beaverhill Natural Area



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## Abstract

In the last several decades, populations of grassland bird species have been steadily declining due to agricultural advancement into grassland bird species habitat, as well as the use of pesticides and herbicides (Mahoney et al. 2022). The Beaverhill Natural Area is unique in that the grassland grid is relatively undisturbed allowing grassland bird species to forage and nest. The Grassland Breeding Bird Census is conducted by interns each summer for the Beaverhill Bird Observatory near Tofield, Alberta, to monitor grassland breeding bird territory abundance in the Beaverhill Natural Area. This study analysed whether breeding bird territory densities were associated with annual precipitation levels in the Beaverhill Natural Area from 2016 to 2024. Results indicated that precipitation during the months of June and July since 2016 has had less importance on territories held by grassland bird species than previously hypothesised.

## Introduction

Alberta's grassland biomes are among the most dynamic ecosystems. These biomes house many diverse birds, wildlife, and plants that are key to indicating the ecosystem's health. Grassland birds all rely on different aspects of the grassland biome for breeding, nesting, and foraging, and Alberta's grassland birds play an important role in their ecosystem by managing a variety of insects such as grasshoppers, flies, mosquitoes and ticks. Grassland birds also contribute to the pollination, and dispersal of grassland plant seeds within the biome (Cirino, 2023). Grassland birds are also naturally adapted to the ever-dynamic grassland ecosystem, with changing periods of drought to excessively wet seasons with an abundance of rain.

In Canada since 1970, 64% of grassland endemic bird species have declined by 87% (Mahony et al. 2022). Contributing factors include advancing agricultural settlement into grassland biomes for commercial farming and cattle grazing. The introduction of herbicides and pesticides, and intense grazing depletes grassland birds of their food sources which are primarily insects and various grass seeds. The declining landscape heterogeneity also decreases opportunities for nesting and foraging among grassland bird species (Mahoney et al. 2022). An estimated 75% of wild grassland has been lost to agriculture in Canada (Downes et al. 2011). The grassland grid in Beaverhill Natural Area is unique in that the constant refilling and drying cycle of Beaverhill Lake makes cultivation for agriculture difficult, and this has allowed the preservation of the Beaverhill Natural Area. This allows grassland bird species to nest and forage efficiently and relatively undisturbed in their once-historic breeding grounds. Outside of agricultural effects, it has been hypothesised that rainfall may play a role in the success of grassland bird species in establishing and maintaining territories, and the number of territories held by various grassland species.

The previous 2023 season was particularly wet in June with a decrease in precipitation in July, and it has been hypothesised in previous years that when precipitation increases, the number of territories held by grassland birds also increases. The opposite would also be true, as was the case with 2024's precipitation, that with lower precipitation there would be fewer territories held by grassland bird species. This hypothesis would be supported by the theory that with increased precipitation, aquatic insect larvae such as mosquitoes and dragonflies increase. With increased precipitation we also see better conditions for snails and slugs to thrive among the grasslands, providing food for many insectivorous grassland bird species. With increased precipitation, we will also see an increase in the growth of grassland grasses such as blue grama, meadow foxtail, red fescue, and reed canary grass that produces seeds that many grassland birds feed on. All of these contributing factors play a key role in the demand on the grassland food web and with an abundance of food the more territories grassland birds can hold.

## Methods

This study uses the spot mapping or territory mapping census repeated 6 times to determine the number of territories of each grassland bird species in the study area. The grassland grid is divided into an irregular 500 x 500-metre-sized grid with each point spaced fifty metres apart located in the Beaverhill Natural area, which is located near Tofield, Alberta. The points are labelled from letters A to H, rows A to F contain points numbered 0-11, row G has points 0-9, and row H contains points 0-8. The census began at the first point, A0, in the southwest corner. Censuses began at approximately 6:30 each morning and took between 3-4 hours to finish. Censuses were completed on June 12, July 1st, July 4th, July 6th, July 10, and July 18th. A Garmin GPS used by Beaverhill Bird Observatory staff was used to locate each grid point within the grid. Bird identification was done mainly by listening to

songs and calls, by sight through binoculars or by the naked eye, and then recorded onto a grid sheet using a four-letter species code and correlated song or calling symbol. Usage of Merlin Bird Sound ID by Cornell Lab of Ornithology was also used occasionally for identification and identification confirmation. Counter singing was marked by a line between two or sometimes more birds singing simultaneously. The length of time at each point was determined by the density of bird occupation, which was determined by the amount of signing and calling at each grid point. Measurements also recorded included the temperature for each day, historical rainfall data as well as current rainfall data for hypothesis deliberation.

## Census Area

The Beaverhill Grassland Grid is located in and around Beaverhill Lake bisected by Duck Drive. The 500 by 500 metre grid is made up of varying habitat types such as forest, grassland, and wetland. In recent years, the willow shrubs and aspen forest has expanded into the grassier areas of the grid and with heavier precipitation the grassland soil becomes waterlogged. For instance, Rows A to B today are primarily made up of poplar forest habitats overlapping Duck Drive into grid points A8 and A9 which are located in Sora Pond. Rows C and D consist of mixed deciduous tree stands, willow shrubs and a mix of grassland, and grid points D to H are primarily grasslands with the occasional willow stand.

## Results

**Table 1** *Number of territories and densities by species for the 2024 census*

<b>Bird Species</b>	<b>Territories Held</b>	<b>Territories per acre (density)</b>
Song Sparrow	11	0.25

Nelson's Sparrow	8	0.18
Common Yellowthroat	8	0.18
Yellow Warbler	30	0.68
Clay-coloured Sparrow	24	0.55
Red-winged Blackbird	11	0.25
Savannah Sparrow	14	0.32
Black-capped Chickadee	2	0.05
Least Flycatcher	10	0.23
LeConte's Sparrow	13	0.30
Sedge Wren	1	0.01
House Wren	4	0.09
Marsh Wren	0	0.00
Alder Flycatcher	7	0.16

*Note.* Density was calculated using an area of 43.8 acres.

**Table 2** *Number of individual territories organised by species compared to previous years*

<b>Species</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>
<b>Song Sparrow</b>	<b>0</b>	<b>3</b>	<b>4</b>	<b>7</b>	<b>3</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>11</b>
<b>Nelson's Sparrow</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>19</b>	<b>13</b>	<b>9</b>	<b>8</b>	<b>8</b>
<b>Common Yellowthroat</b>	<b>0</b>	<b>1</b>	<b>9</b>	<b>19</b>	<b>24</b>	<b>49</b>	<b>21</b>	<b>23</b>	<b>8</b>
<b>Yellow Warbler</b>	<b>43</b>	<b>24</b>	<b>20</b>	<b>25</b>	<b>24</b>	<b>41</b>	<b>26</b>	<b>36</b>	<b>30</b>
<b>Clay-Coloured sparrow</b>	<b>83</b>	<b>42</b>	<b>23</b>	<b>49</b>	<b>32</b>	<b>48</b>	<b>31</b>	<b>43</b>	<b>24</b>
<b>Red-Winged Blackbird</b>	<b>1</b>	<b>4</b>	<b>2</b>	<b>16</b>	<b>20</b>	<b>18</b>	<b>17</b>	<b>19</b>	<b>11</b>
<b>Savannah Sparrow</b>	<b>52</b>	<b>32</b>	<b>6</b>	<b>14</b>	<b>8</b>	<b>7</b>	<b>12</b>	<b>4</b>	<b>14</b>

<b>Black-capped Chickadee</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>7</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>Least Flycatcher</b>	<b>27</b>	<b>3</b>	<b>2</b>	<b>16</b>	<b>15</b>	<b>21</b>	<b>24</b>	<b>26</b>	<b>21</b>
<b>LeConte's Sparrow</b>	<b>7</b>	<b>0</b>	<b>0</b>	<b>39</b>	<b>31</b>	<b>24</b>	<b>12</b>	<b>9</b>	<b>13</b>
<b>Sedge Wren</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>5</b>	<b>12</b>	<b>6</b>	<b>5</b>	<b>0</b>	<b>1</b>
<b>House Wren</b>	<b>1</b>	<b>4</b>	<b>1</b>	<b>2</b>	<b>4</b>	<b>1</b>	<b>4</b>	<b>4</b>	<b>4</b>
<b>Marsh Wren</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Alder Flycatcher</b>	<b>13</b>	<b>5</b>	<b>12</b>	<b>10</b>	<b>0</b>	<b>6</b>	<b>1</b>	<b>3</b>	<b>7</b>
<b>Warbling Vireo</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>0</b>

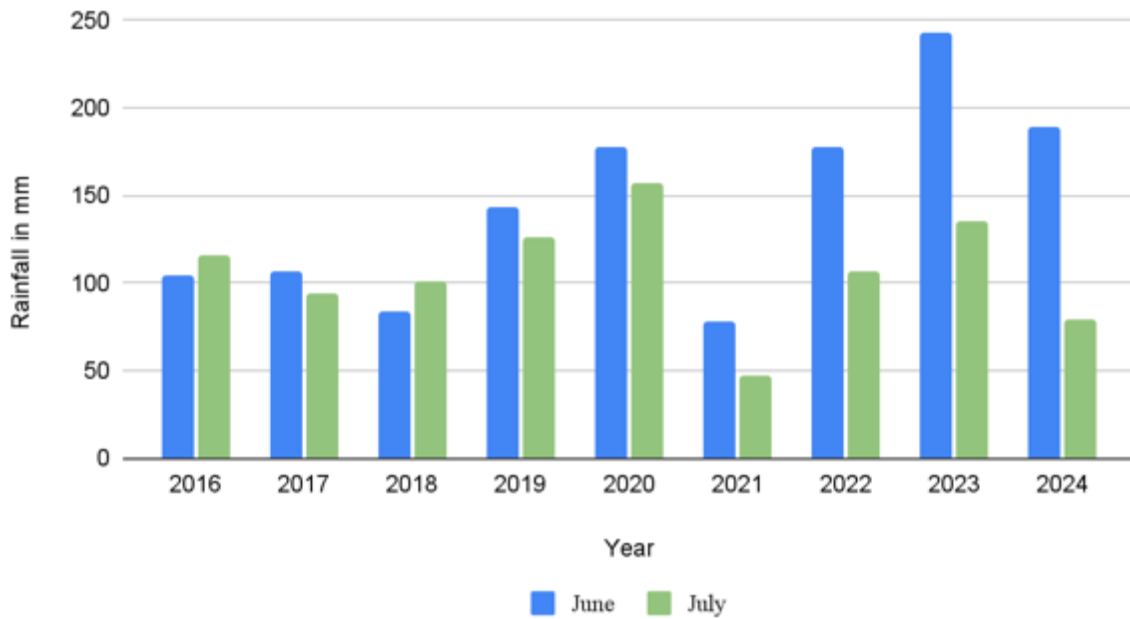
**Table 3***Historic and present rain data for Beaverhill Lake*

<b>Month</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>
<b>June</b>	104.11 mm	106.76 mm	83.65 mm	143.87 mm	177.73 mm	78.06 mm	177.57 mm	243.35 mm	188.78 mm
<b>July</b>	116.20 mm	94.31 mm	101.36 mm	126.15 mm	157.65 mm	46.62 mm	107.01 mm	134.90 mm	79.29 mm

*Note.* Data Collected from Weather API, and may be subject to weather station inaccuracies.

<https://www.weatherapi.com/history/q/tofield-317738?loc=317738>

**Figure 1**  
Historic and present rainfall data for Beaverhill Lake



*Note.* This figure visually represents the monthly precipitation distribution for June and July since 2016.

## Discussion

In previous years it has been hypothesised that with an increase in precipitation, the territories held by grassland birds would increase. In theory, with increased precipitation, the food sources for grassland birds such as plant seeds, insects and berries would flourish. When comparing historic (2016 to 2023) and 2024 rain data, 2024 had been a drier year compared to previous years. However, it was observed that the soil within the grid maintained its waterlogged state consistently among all the surveys, and the grasses had grown upwards of 4.5 feet among some survey spots. The constant waterlogged state may be caused by the refilling cycle that has been observed for Beaverhill Lake to follow over the cycle of roughly 20 years, which results in a higher water table (Holroyd, 2022). Beaverhill Lake last dried up



in the early 2000s but has now been filling up again since 2016, and as of 2020 was about 75% of its original size (Holroyd, 2022).

When looking at the territory data, Song Sparrows, Savannah Sparrows, LeConte's Sparrows, Alder Flycatchers and a single Sedge Wren all held more territories than the previous year. Nelson's Sparrow, Black-Capped Chickadee, and House Wren all held the same number of territories as last year. The species that were observed to have the least number of territories compared to the last year were the Common Yellowthroat with a 65% decrease in territories, Yellow Warblers with a 16% decrease, Clay-coloured Sparrows with a 44% decrease, Red-winged Blackbird with a 42% decrease, and Least Flycatcher with a 19% decrease. When observing and comparing historic rain data and the number of territories held by grassland birds, we notice that in years of high precipitation such as 2023, there isn't a strong increase in territories held as we would expect from our hypothesis with only 53% of grassland birds observing a stable amount of territories or a territory increase. Territories held by grassland birds remained stable or increased in size for 57% of species observed for the 2024 census even with lower precipitation than the previous year. When observing the 2021 precipitation data with the lowest amount of precipitation since 2016, we observe that 53% of grassland bird species had more territories when compared to 2023, even though 2023 had significantly higher rainfall levels. This suggests the conclusion that the significance of rainfall affecting the number of territories held by grassland birds is not as important of a factor as we hypothesised.

The 2024 year did observe the fewest number of territories held by Common Yellowthroats since 2017. The diet of the Common Yellowthroat consists of primarily insects such as grasshoppers, mayflies, dragonflies and various insect larvae (Audubon, 2024). The Common Yellowthroat diet is similar to most grassland bird species, and with the increase in territories among 57% of species observed we can conclude that the decrease in Common

Yellowthroat population is not a result of lack of food or other resources available. The increase of territories held by other grassland species would pose the risk of more interspecies competition for adequate nesting as a more likely explanation for the decrease as the food source, plant source and many grassland species remained stable or increased.

When comparing and examining historic rainfall data to the relevance in grassland bird species territories increasing or decreasing, we notice that the territories held by grassland bird species fluctuated independently from rainfall data. During years when precipitation was high, or when precipitation was low, the number of territories increased or remained stable more often than it decreased. This finding concludes that other factors have more significance in the number of territories of grassland bird species in the grassland grid. Based on in-field observations and research the most important factor that could be affecting the success of grassland bird species creating, holding and maintaining territories is the filling and drying cycle of Beaverhill Lake. It is possible that many grassland species such as the Common Yellowthroat may have moved farther past the grassland grid for more optimal nesting and foraging as Beaverhill Lake refills due to the increased abundance of aquatic-reliant insects. Species such as Song Sparrows and Savannah Sparrows may be taking their place which is why we are observing a higher number of territories among those species. Another possibility is increased interspecies competition between grassland bird species, forcing other grassland species to relocate for better foraging and nesting opportunities. Species such as Yellow Warblers are likely to have held territories deeper into the adjacent forest as the waterlogged state of the grassland grid is not suitable for Yellow Warblers and Warbling Vireos that prefer hunting and nesting in deciduous forests (Audubon, 2024).

## Conclusion

When reviewing the 2016-2024 grassland bird species territory data, 57% of grassland species increased or remained stable despite the decrease in precipitation during the 2024 census. When observing the historical precipitation, a consistent trend of gradual grassland species territory stability or increase since 2018, independent of reported variable precipitation during June and July. We can conclude that precipitation does not have as important of a role in predicting the number of territories held by grassland bird species as was once hypothesised. A much more likely explanation may be found in monitoring the water levels of Beaverhill Lake and comparing the water level data to the number of territories held by grassland birds with the hypothesis of positive correlation. Some other variables to consider would be the types of insects observed within the grassland grid and observing what grassland birds eat them. Another consideration would be observing interspecies competition for adequate nesting and foraging territory as with increased food supply there is an increased demand on the food web within the grassland grid, alongside the demand for nesting grounds. In the future it may be necessary to adjust the location of the grassland grid as the adjacent forest grows northward into the grid and as Sora Pond refills as well for more accurate reporting of grassland bird species.

As grassland bird species territories have been relatively stable and/or increasing despite drastic changes in precipitation in June and July from 2016 to 2024, we can conclude that rainfall does not have as much of an effect on the number of territories held as was once hypothesised. Research into alternate variables may need to be investigated to find an explanation that elucidates the changes in the dynamic grassland bird species' territory changes from year to year.

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