Influence of RowanTrees Density on Bird Species Abundance

in Kamloops, BC, Canada

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Introduction

Rowan, also known as mountain ash, is a prominent feature of urban and suburban landscapes in Kamloops, BC, Canada. Trees are appreciated for their desirable berries, which attract avian visits; rowan trees, for example, offer an important food supply for birds throughout the winter months. Density of species [can] significantly positively correlate with a measure of food availability taken from each habitat (Hutto 1985). This study aims to investigate the hypothesis that the presence and density of rowan trees have a positive impact on bird species abundance in Kamloops.

The research tries to comprehensively understand the dynamics of bird populations in the interior of British Columbia by examining the influence of rowan tree density on bird populations throughout the winter season. Past studies have highlighted a correlation between the density of fruit-bearing trees to an increase of bird species, particularly emphasizing the richness up to a saturation point of approximately 50 trees per hectare (Jakobsson and Lindborg 2017). This finding aligns with the concept of rowan tree density influencing bird populations in Kamloops, suggesting that an optimal density of rowan trees may support higher bird diversity. Given that rowan tree fruits persist into winter, the availability of this food source could substantially impact bird survival during colder months, thereby shaping bird population dynamics (Grubb 1975).

The importance of investigating the influence of rowan tree density on bird populations extends beyond ecological curiosity to directly benefit the community. Understanding how rowan tree density affects bird species abundance can inform urban planning and conservation efforts aimed at enhancing biodiversity within community landscapes. By promoting the preservation and planting of rowan trees, communities can foster healthier ecosystems and enrich local bird diversity, contributing to a more vibrant and sustainable environment for residents to enjoy and appreciate.

Therefore, this paper posits that higher densities of rowan trees positively influence bird species diversity and abundance in the interior of BC, specifically in Kamloops. The study on wintering bird flock feeding behavior, showed that birds had preferences based on habitat characteristics such as tree density and openness (Lee et al. 2005) which supports the hypothesis that regions characterized by greater densities of rowan trees will exhibit higher bird species abundance compared to areas with lower rowan tree densities. In summary, this study confirms the hypothesis that rowan tree density is correlated with increased bird species diversity and abundance during winter in Kamloops, BC.

Methodology

The study area, situated in Strathcona Park within Kamloops, British Columbia, Canada, served as the focal point for investigating the relationship between bird species diversity and the density of Rowan trees during the winter season, December to February. Utilizing a systematic approach, a main trail traversing the park, facilitated the access to various ecological zones. In order to achieve good data collection, a random point system was implemented using Google Maps, which ensured a well-defined split of the route and representative sampling across the park. The path consisted of three separate sites of the trail, including the start (highest elevation) , middle, and end (shallow terrain); which were intentionally designed to introduce variability. Random point counts were strategically placed across designated zones to provide a comprehensive assessment of bird distribution in relation to tree density. It's important to note that data collection for random point counts may vary if the area contains numerous paths, stones, or rubbish, as these factors can influence the presence of birds, particularly causing a decrease in the number of rowans (Hamberg et al. 2015).

Winters' adverse weather conditions posed challenges to consistent data collection, necessitating planning in order to get sufficient data throughout one month. Each day, attention was concentrated on a specific segment of the trail, which was further divided into designated time slots for random point counts and selected area count. This schedule was rotated daily to ensure comprehensive coverage of the study area and minimize bias in data collection. Throughout the data collection, arrangements were made due to the observation that mornings had higher bird activity while

afternoons portrayed a more subdued scene. Highlighting that winter bird counts can be conducted in both morning and midday hours with little or no qualitative loss of data (Rollfinke and Yahner 1990).

Data collection occurred twice daily, at 8:00 AM and 10:00 AM, with observations spanning a 15-minute period within a 20-meter radius of designated points along the trail. During each observation session, the presence and abundance of bird species were recorded, alongside the quantification of rowan tree density within the area. Bird species, served as the response variable, while the density of rowan and mountain ash trees, indicating the availability of food resources for birds, served as the explanatory variable. Detailed parameters including date, time, bird species observed, duration, rowan tree density, bird count and area size were documented for each session in an excel sheet. Statistical analyses of linear regression in R studio were employed to explore the relationship between rowan trees and the birds.

Results

The results of the study reveal notable variations in bird species diversity and abundance across different parts of the trail during the winter season. At the beginning of the trail, where rowan tree density was relatively high (mean = 20.4), Chickadees were the most frequently observed bird species, with an average count of 4.33 individuals during the morning sessions. However, at random points within this area, where rowan tree density was lower (mean = 7), bird sightings were notably fewer, with few to no Chickadees observed at an average count of only 0.67 individuals. Similarly, in the middle section of the trail during morning sessions, where rowan tree density was

moderate (mean = 13.6), both Chickadees and Junco species were observed, with average counts of 2.67 and 3.67 individuals respectively. In contrast, at random points within this area, where rowan tree density was lower (mean = 3.2), bird sightings were fewer, with an average count of only 0.33 individuals. At the end of the trail, where rowan tree density was relatively higher (mean = 15.6), Junco species were predominantly observed, with an average count of 4.33 individuals during the morning sessions. However, at random points within this area, where rowan tree density was even lower (mean = 1.33), bird sightings were minimal, with an average count of only 0.33 individuals.

Trail Section	Rowan Tree Density (# of trees)	Bird Species Seen	Average Bird Count (Morning)
Beginning	20.4	Chickadee	4.33
Beginning	7.0	-	0.67
Middle	13.6	Chickadee	2.67
Middle	3.2	-	0.33
Middle	13.6	Junco	3.67
Middle	3.2	-	0.33
End	15.6	Junco	4.33
End	1.33	-	0.33

Table 1. This summary table presents the rowan tree density, bird species observed, and the average bird count during the morning sessions at different sections of the trail in Strathcona Park, Kamloops, BC, Canada.

A box plot (Figure 1) was performed to illustrate the distribution of bird species count across three ranges of rowan tree density: 8-12, 12-16, and 16-22. Each boxplot represents the interquartile range (IQR) of bird species count within each range of tree density, with the solid line inside the box indicating the median count. Whiskers extend to the maximum and minimum counts within 1.5 times the IQR, while outliers beyond this range are represented as individual data points.

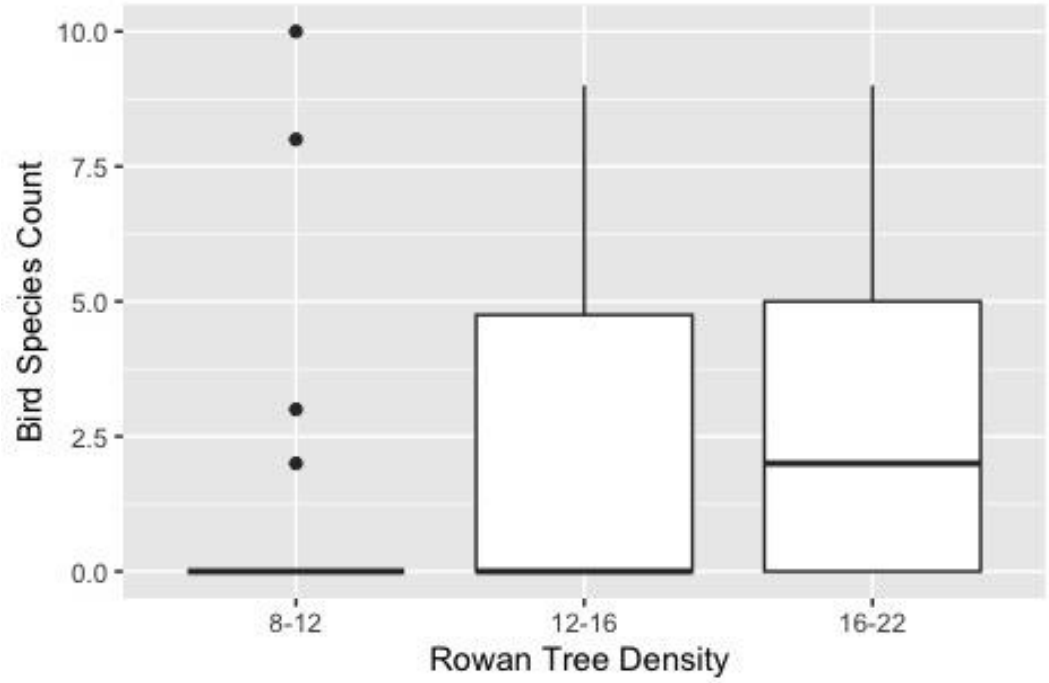

Figure 1: This boxplot illustrates the distribution of bird species count across three ranges of rowan tree density: 8-12, 12-16, and 16-22, in Strathcona Park, Kamloops, BC, Canada.

Discussion

The results of the study reveal a compelling association between the density of rowan trees and the diversity and abundance of bird species observed along the trail during winter in Strathcona Park, Kamloops, BC, Canada. (Table 1) Provides a comprehensive summary of data collection, rowan tree density, the bird species observed, and their respective average counts during morning sessions at different sections of the trail, offering a detailed overview of the studys' findings. Additionally, (Figure 1.) a box plot, visually illustrates the distribution of bird species counts across varying ranges of rowan tree density, further elucidating the relationship between tree density and bird species diversity along the trail.

The trail's entrance showed a relatively high rowan tree density (mean = 20.4), Chickadees were the predominant species observed, with an average count of 4.33 individuals during morning sessions. This observation suggests that areas with higher rowan tree densities may provide favorable conditions for Chickadees, likely due to the availability of food resources. In contrast, random points within this high-density area exhibited significantly fewer bird sightings, with no Chickadees observed and an average count of only 0.67 individuals, reinforcing the importance of rowan trees in supporting bird populations. Similarly, at the trail's end, where rowan tree density was relatively low (mean = 15.6), Junco species were predominantly observed, with an average count of 4.33 individuals during morning sessions. This again highlights the nuanced relationship between rowan tree density and bird species composition, suggesting that varying tree densities may influence the distribution and abundance of different bird species along the trail.

To highlight the significance of the empty spaces in the "Bird Species Seen" column in Table1 , there were instances where no bird species or just a handful were observed during the data collection at those particular time slots and trail sections. This could occur due to factors such as the absence of birds in the immediate vicinity during the observation period or variations in bird activity patterns due to winter conditions. These empty spaces reflect the variability in bird presence in the winter which highlights the importance of considering foraging routines of birds during this time of the year when studying bird abundance and distribution (McNamara et al. 1994) .

The analysis using linear regression revealed a significant relationship between rowan tree density and the count of birds observed at random points along the trail during the winter season ($\beta = 0.24258$, $t = 2.676$, $p = 0.00966$). The coefficient estimate suggests that for every unit increase in rowan tree density, there is a corresponding increase of approximately 0.24258 birds observed, holding other variables constant. The model's adjusted R-squared value of 0.09457 indicates that approximately 9.457% of the variance in bird count can be explained by rowan tree density. Additionally, the intercept term was found to be statistically insignificant ($\beta = -1.66592$, $t = -1.207$, $p = 0.23215$), suggesting that when rowan tree density is zero, the expected count of birds at random points is not significantly different from zero.

From the analysis and data collection the study conducted indeed reveals a positive relationship between rowan tree density and bird species diversity during winter. The research indicates a discernible pattern wherein higher densities of rowan trees correspond to increased bird sightings, with chickadees favoring areas with higher

rowan tree densities while junco species are more prevalent in areas with lower densities, but still requiring a fair density of trees.

The research findings reveal a contrast with previous studies that investigated the role of elevation in bird species richness and abundance. Specifically, a study done based on elevation, showing that lower elevations support a greater diversity of bird species and higher bird densities compared to higher elevations (Herbers et al. 2004). Another study also emphasized the importance of habitat characteristics in influencing bird species composition, beyond just area size (Blake and Karr 2024). This suggests that in addition to rowan tree density, other habitat factors within Kamloops such as vegetation structure, presence of other food sources may further influence bird populations.

To add, a key factor to take into account are the houses located close to the study area. They can impact the amount of birds due to humans feeding (bird feeders). There have been a number of correlational studies that have found an association between bird feeding and increased densities of feeding birds in urban areas (Galbraith et al. 2015). This human influence near residential areas can alter bird behavior and distribution patterns, potentially impacting the relationship between rowan tree density and bird species diversity observed in natural settings.

While this study provides valuable insights, several limitations for future research should be acknowledged. Firstly, the study's focus on a specific geographic location, time period and amount of data collected, may limit the generalizability of the findings to other regions and seasons. Additionally, factors such as habitat heterogeneity,

microclimate variability, and interspecific interactions were not explicitly addressed in this study but could influence the bird distribution patterns. Future research could explore these factors in more detail, employing a broader spatial and temporal scope to enhance our understanding of winter bird-tree interactions and their ecological implications. This future research could impact the role of rowan tree density in supporting avian biodiversity. Allowing for conservation efforts to be directed towards promoting the preservation and restoration of these tree species in suitable habitats. Moreover, incorporating considerations of tree density and distribution into urban planning and design in order to enhance habitat quality for birds, contributing to overall biodiversity in Canada.

Overall, this semester-long research results suggest that rowan tree density has a modest but significant effect on the count of birds observed at random and selected points along the trail. Specifically, each additional unit of rowan tree density corresponds to an average increase of approximately 0.24258 birds observed, indicating the importance of rowan trees as habitat and food sources for avian species during the winter months in the study area. Based on the results of the study conducted in Strathcona Park, Kamloops, BC, Canada, there is compelling evidence supporting the hypothesis that rowan tree density positively influences bird species diversity and abundance during the winter season. The analysis revealed notable variations in bird species diversity and abundance across different sections of the trail, corresponding to varying densities of rowan trees.

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