

# THE FORAGING HABITS OF AMERICAN ROBINS (*TURDUS MIGRATORIUS*) AND EASTERN GREY SQUIRRELS (*SCIURUS CAROLINENSIS*) IN AREAS OF VARYING TRAFFIC CONDITIONS THROUGHOUT THE JUNIATA COLLEGE CAMPUS

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## ABSTRACT

The effect of anthropogenic noise pollution on natural ecological systems and animals is a complex topic that is actively trying to be understood by scientists worldwide. In this experiment, it was hypothesized that if the activity of traffic and noise around a location decreased, the feeding occurrences observed of eastern gray squirrels and American robins would increase across the Juniata College Campus. To conduct this experiment, researchers counted feeding occurrences of squirrels and robins across three locations of various noise and traffic levels. It was found that the high foot traffic area had the most feeding occurrences of robins and squirrels. Surprisingly, no feeding observations were made in the forest area with no surrounding traffic or anthropogenic noise pollution. Given the amount of wildlife observed near traffic, this study supports the idea that more of an effort should be made to mitigate the negative effects this traffic has on the abundant wildlife species, such as through automobile collisions and habitat fragmentation. Therefore, these results also provide a sound foundation for the argument of increasing natural habitats for terrestrial and avian species across the Juniata College campus.

*Key words: Foraging habits, American robins, Turdus migratorius, Eastern Gray Squirrels, Sciurus carolinensis*

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## INTRODUCTION

While on a hike in the remote woods, it would overall not be uncommon or unlikely to see wildlife such as deer, squirrels, or birds foraging for food or in search of shelter. However, the same cannot be said of more populated or busy areas. Generally, many animals avoid or are typically not seen in areas with a lot of activity or high noise levels. This phenomenon of anthropogenic noise affecting the behavior of animals has been shown to have significant environmental consequences. As a form of noise pollution, it must be considered a serious mode of environmental change as it affects aquatic, avian, and terrestrial species (Kunc & Schmidt 2019).

Many studies have proven this by showing the negative effects roads have on wildlife due to many factors such as population fragmentation, pollution, habitat loss, noise, and direct collisions with cars. Also, the factors of road mortality and traffic noise have been studied regarding their important effects on many wild avian species (Husby 2017). Overall, roads, and the traffic on them, decrease the populations of many species because of this range of factors (Fahrig & Rytwinski 2009). In addition, given that several hundred million terrestrial and avian animals are killed in collisions with cars every year, it is expected that bird and squirrel densities be lower in areas closer to roads with considerable amounts of traffic.

Overall, a species' vulnerability to traffic conditions is influenced by its ecological traits, adaptations, and even behavioral responses like reproductive rate and mobility. While the material and surface of the road might cause animals to avoid areas of high traffic, other disturbances from traffic like chemical emissions, noise, and light also show significant effects on animal behavior and abundance (Rytwinski & Fahrig 2015).

More specifically, it has been shown that mammals, such as squirrels, with lower reproductive rates are more susceptible to road mortality. As a result, they are more likely to avoid roads and experience habitat and population fragmentation. Also, birds with larger territories, high body masses, and that fly at low levels are more susceptible to road mortality (Fahrig & Rytwinski 2009).

To expand, many scientists have recently become intrigued by how species' populations and abundances are negatively affected by their experience of anthropogenically driven environmental changes, whether it be noise from physical human movement or automobile movement. Just as human health can be negatively impacted by noise pollution, the same can be said of terrestrial and aquatic wildlife. Various species across several different taxonomic groups show a significant response to noise. For example, anthropogenic noise negatively impacts bats hunting efficiency (Kunc & Schmidt 2019). However, the effect of several types of anthropogenic noise and human activity on the foraging behavior and abundance of specific species has yet to be studied.

To study this trend, experimentation can be done in the branch of ecology called foraging ecology. Foraging ecology is the branch of scientific study and behavioral ecology that answers these questions of how and why an animal behaves the way it does. Specifically, foraging ecology deals with theories and explanations as to how an animal is best able to forage or find the food necessary for its survival and reproduction (Libretexts 2022).

Through the lens of foraging ecology, the behavior of a species tells a lot about its niche in its environment and community. In general, natural selection favors species that have as little negative competition as possible with other species and those that find and use food most effectively. Therefore, ecological communities are structured by the

competition for food and the passage of food through trophic levels and energy chains from prey to predators.

In addition, human foot traffic can potentially increase predator-prey interactions, among other far-reaching ecological effects. This is caused because, as animals attempt to avoid people, they can adapt their behavior by becoming more nocturnal or more arboreal. They might also begin avoiding trails on which humans commonly travel (Griffiths & van Schaik 1993). These behavioral changes not only affect their competition with other species but also an increased potential to interact with new predators or stressors.

Therefore, in this experiment, the foraging habits of eastern gray squirrels and American robins according to the amount of nearby human and automobile traffic was tested. It was hypothesized that if the activity of traffic around a location decreased, the feeding occurrences observed of eastern gray squirrels and American robins would increase because they will experience less fear and stress from the loud surroundings. Contrarily, the null hypothesis states that if the activity of traffic around a location decreased, the feeding occurrences observed of eastern gray squirrels and American robins would not be affected or change.

## FIELD SITE

Observations were held at three contrasting locations throughout the Juniata College Campus. Location #1 was The Quad on Juniata Campus which is a high foot traffic area. This means that this area typically has higher noise levels as a result of human activity and movement. Location #2 was outside of the Brumbaugh Academic Center and in front of Moore Street on the Juniata College campus. This area is characterized by a lot of noise resulting from automobile traffic. Location #3 was the Peace Chapel which is a low-traffic area. This area is a forested location where the noise from both automobile traffic and foot traffic is not as present as in the other locations (Figure 1). Each observation location had trees and patches of grass and are therefore potentially suitable habitats for American robins and Eastern gray squirrels.

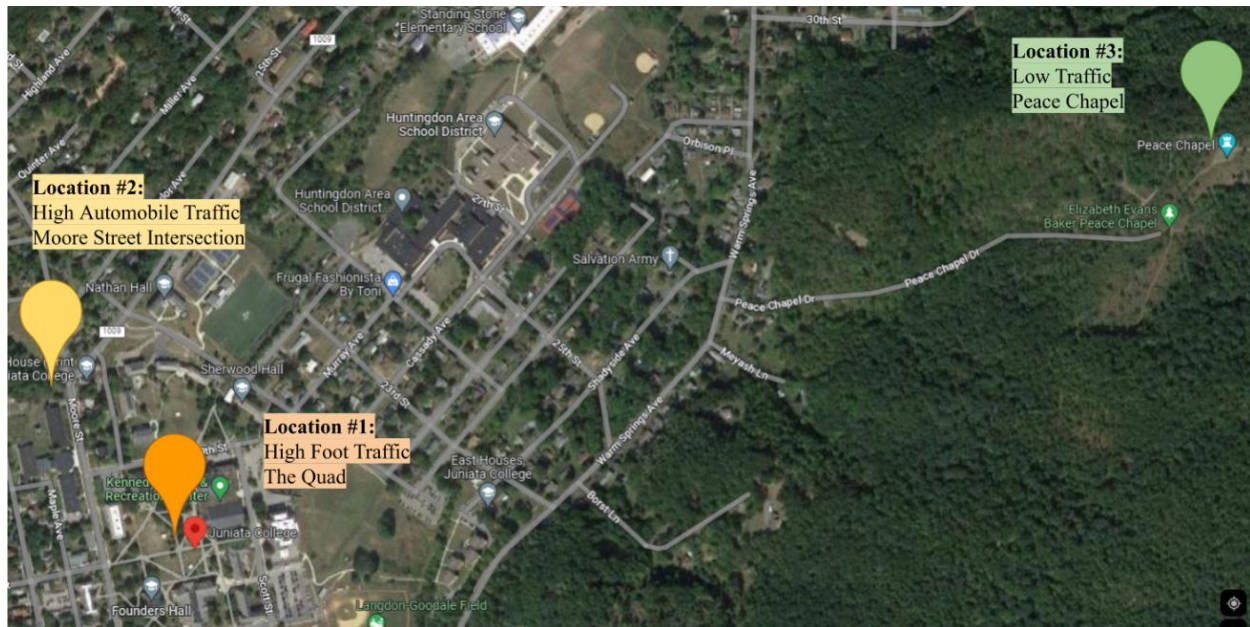


Figure 1. Google Maps satellite image of the Juniata College campus with the three field sites labeled: High Foot Traffic Area, High Automobile Traffic Area, and Low-Traffic Areas

## MATERIAL AND METHODS

To begin the experiment, three plastic dishes were filled with “Feathered Friend” Striped Sunflower Seed Wild Bird Food, which is marketed as a high energy, high protein seed to attract a variety of larger birds. At the same time and day, one researcher was dispatched to each location detailed in Figure 1 to simultaneously collect data. The plastic dishes of sunflower seeds were placed at the foot of a tree at each location. Then, the feeding occurrences of robins and squirrels from these dishes were simultaneously observed from a large distance and recorded at each of the three location sites for the duration of between a half hour to an hour. This was repeated over the span of several days in 2023. In this experiment, a feeding occurrence was defined as when an animal touched or interacted with the striped sunflower seeds from the plastic dish.

Overall, data was collected over a total of eight non-consecutive days. The dates over which data collection occurred were March 29<sup>th</sup>, March 30<sup>th</sup>, April 3<sup>rd</sup>, April 4<sup>th</sup>, April 5<sup>th</sup>, April 10<sup>th</sup>, April 12<sup>th</sup>, and April 13<sup>th</sup>. Data was first collected between 1:30-2:30 PM on March 29<sup>th</sup>, but each subsequent session was held in the hours around dusk (7:30-8:00 PM) to increase the probability of squirrel and robin activity. This is because squirrels are most active in late afternoons (*Squirrels*). Also, robins are most commonly seen foraging in flocks at night (Kaufman 2019).

At the beginning of each data collection session, the outdoor temperature was also recorded. Following the completion of data collection, several statistical analysis tests were run to determine the significance of any gathered information.

## RESULTS

The only location where squirrels were observed foraging from the sunflower seed dishes was in the high foot traffic location. This area had the most observed feeding occurrences of both robins and squirrels. No feeding activity was observed at all in the low-traffic, forested location (Table 1). These results were reorganized in Table 2 to afford a more concise table on which statistical analysis could be performed. Table 3 was utilized to perform Pearson’s product-moment correlation testing for the feeding total of the high foot traffic location to the high car traffic location.

Regarding this statistical analysis, the Pearson’s product-moment correlation statistical test for total feeding occurrences at the high foot traffic location versus total feeding occurrences at the high automobile traffic location showed a strong direct association. Another Pearson’s product-moment correlation test for feeding instances of robins at the high foot traffic location versus feeding instances of robins at the high automobile traffic location showed a strong, direct association (Table 4). Then, a Kruskal Wallis Rank Sum statistical test for the independence of Robin feeding instances versus Squirrel feeding

instances at the high foot traffic location indicated that these variables are independent (Table 5).

In addition, a chi-squared statistical analysis comparing robin feeding occurrences and location resulted in a  $p=.000233$ . Another chi-squared statistical analysis compared feeding instances of squirrels and location which resulted in a  $p=.032752$ . Both results are significant at  $p < .05$  (Table 6).

Various two sample T-Tests were performed to determine if there were any significant differences between the feeding instances of robins and grey squirrels and both high foot traffic and high automobile traffic areas (Table 7).

Table 1. Feeding occurrences of robins and squirrels observed at a high foot traffic location, high automobile traffic location, and a general low-traffic area in Huntingdon County.

Date Time Temperature	High Foot Traffic Area (The Quad)		High Automobile Traffic Area (Moore Street)		Low-Traffic Area (Peace Chapel)	
	Robins	Squirrels	Robins	Squirrels	Robins	Squirrels
3/29/23 1:30-2:30PM 53°F	0	0	0	0	0	0
3/30/23 7:30-8:00PM 49°F	3	3	3	0	0	0
4/3/23 7:30-8:00PM 69°F	1	4	1	0	0	0
4/4/23 7:30-8:00PM 71.6°F	1	0	0	0	0	0
4/5/23 7:30-8:00PM 78°F	6	1	1	0	0	0
4/10/23 7:30-8:00PM 79°F	15	2	4	0	0	0
4/12/23 7:30-8:00PM 77°F	2	0	1	0	0	0
4/13/23 7:30-8:00PM 76°F	1	1	6	0	0	0
<b>Totals</b>	<b>29</b>	<b>11</b>	<b>16</b>	<b>0</b>	<b>0</b>	<b>0</b>

Table 2. Concise organization of data from Table 1 used for statistical analysis.

	Temperature	Date	Robin_1	Squirrel_1	Total_1	Robin_2	Squirrel_2	Total_2	Robin_3	Squirrel_3	Total_3
1	53.0	3/29/23	0	0	0	0	0	0	0	0	0
2	49.0	3/30/23	3	3	6	3	0	3	0	0	0
3	69.0	4/3/23	1	4	5	1	0	1	0	0	0

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4	71.6	4/4/23	1	0	1	0	0	0	0	0	0
5	78.0	4/5/23	6	1	7	1	0	1	0	0	0
6	79.0	4/10/23	15	2	17	4	0	4	0	0	0
7	77.0	4/12/23	2	0	2	1	0	1	0	0	0
8	76.0	4/13/23	1	1	2	6	0	6	0	0	0
9	NA		29	11	40	16	0	16	0	0	0
<p>Key:                  Underscore 1 is the High Foot Traffic area in the Quad                  Underscore 2 is the High Automobile Traffic area near Moore Street and Cold springs Road                  Underscore 3 is the Low-Traffic Area at peace chapel</p>											

Table 3. Pearson's product-moment correlation data for statistical test Feeding Total of High Foot Traffic vs High Car Traffic.

	Total 1 (High Foot Traffic)	Total 2 (High Car Traffic)
1	0	0
2	6	3
3	5	1
4	1	0
5	7	1
6	17	4
7	2	1
8	2	6
Total	40	16

Table 4. Pearson's product-moment correlation statistical tests for association between two variables

<p>Feeding Total of High Foot Traffic vs. High Car Traffic</p> <p>Pearson's product-moment correlation                      data: AD\$Total_1 and AD\$Total_2                      t = 5.5976, df = 7, p-value = 0.000818                      alternative hypothesis: true correlation is not equal to 0                      95 percent confidence interval: 0.6005778 0.9798727                      sample estimates: cor 0.9040951</p> <p>There is a strong, direct association between the instances of feeding in the high foot traffic vs high automobile traffic area.</p>
<p>Feeding Instances of Robins at High Foot Traffic vs. High Automobile Traffic</p> <p>Pearson's product-moment correlation                      data: AD\$Robin_1 and AD\$Robin_2                      t = 4.7226, df = 7, p-value = 0.002151                      alternative hypothesis: true correlation is not equal to 0                      95 percent confidence interval: 0.4952273 0.9728681                      sample estimates: cor 0.8724183</p>

There is a strong direct association between the instances of robins feeding at high foot traffic and high automobile traffic.

*Table 5. Kruskal Wallis Rank Sum statistical tests for the independence of Robin Feeding Instances vs Squirrel Feeding Instances at High Foot Traffic Areas.*

Kruskal-Wallis rank sum test: Robin Feeding Instances vs Squirrel Feeding Instances at High Foot Traffic Areas  
 data: AD\$Robin\_1 by AD\$\$Squirrel\_1  
 Kruskal-Wallis chi-squared = 5.7931, df = 5, p-value = 0.3269  
 The total feeding instances of Robins and Squirrels at the high foot traffic area are independent.

*Table 6. Results of the two-chi-square statistical analysis.*

Robin Chi ^2 Results				
	Robin High Foot Traffic	Robin High Car Traffic	Robin Low-Traffic	Row Totals
Observed	29 (22.24) [2.05]	16 (15.67) [0.01]	1 (8.09) [6.21]	46
Expected	15 (21.76) [2.10]	15 (15.33) [0.01]	15 (7.91) [6.35]	45
<b>Column Totals</b>	44	31	16	<b>91 (Grand Total)</b>

The chi-square statistic is 16.7278. The *p*-value is .000233. The result is significant at *p* < .05.

*The feeding instances of Robins is related to the amount and type of traffic in the area.*

*\*Please note that in the table above the low-traffic observed data was changed to a value of 1. This is to allow the calculations to run and does not change the overall understanding of the data.*

Squirrel Chi ^2 Results				
	Squirrel High Foot Traffic	Squirrel High Car Traffic	Squirrel Low-Traffic	Row Totals
Observed	11 (7.80) [1.31]	1 (2.60) [0.98]	1 (2.60) [0.98]	13
Expected	4 (7.20) [1.42]	4 (2.40) [1.07]	4 (2.40) [1.07]	12
<b>Column Totals</b>	15	5	5	<b>25 (Grand Total)</b>

The chi-square statistic is 6.8376. The *p*-value is .032752. The result is significant at *p* < .05.

*The feeding instances of squirrels is related to the amount and type of traffic in the area.*

*\*Please note that in the table above the observed values for the low-traffic and the high car traffic squirrel data were changed to a value of 1. This is to allow the calculations to run and does not change the overall understanding of the data.*

*Table 7. Results of Various Two Sample T Tests. None of the tests were found to be significant, and we accept the null hypothesis*

Welch Two Sample t-test: Robin Feeding Instances at High Foot Traffic Vs High Car Traffic  
 data: AD\$Robin\_1 and AD\$Robin\_2  
 t = 0.79512, df = 12.117, p-value = 0.4418  
 alternative hypothesis: true difference in means is not equal to 0  
 95 percent confidence interval: -5.018817 10.796595  
 sample estimates: mean of x mean of y 6.444444 3.555556

There is no significant difference between the feeding instances of robins between the high foot traffic areas and high automobile traffic areas.
Welch Two Sample t-test: Squirrel Feeding Instances at High Foot Traffic Vs High Car Traffic  data: AD\$\$quirrel_1 and AD\$\$quirrel_2 t = 2.0929, df = 8, p-value = 0.06971 alternative hypothesis: true difference in means is not equal to 0 95 percent confidence interval: -0.2489423 5.1378311 sample estimates: mean of x mean of y 2.444444 0.000000
There is no significant difference between the feeding instances of squirrels between the high foot traffic areas and high automobile traffic areas.
Welch Two Sample t-test: Total Feeding Instances at High Foot Traffic vs High Car Traffic  data: AD\$Total_1 and AD\$Total_2 t = 1.1673, df = 10.481, p-value = 0.269 alternative hypothesis: true difference in means is not equal to 0 95 percent confidence interval: -4.78419 15.45086 sample estimates: mean of x mean of y 8.888889 3.555556
There is no significant difference between the total feeding instances at high foot traffic areas and high automobile traffic areas.

## DISCUSSION

The results of this experiment were unexpected. As shown in Table 1, there were no observed feeding occurrences of robins or squirrels at the low-traffic area which was originally predicted to have the most observed feeding occurrences. Instead, the area of high human foot traffic was observed to have the most occurrences. Location #2 of high automobile traffic also showed robin feeding occurrences (Table 2). As shown in Table 6, the feeding occurrences of robins, squirrels were significantly different from the expected between the high automobile traffic location and the high human foot traffic location. Therefore, the two variables, traffic level and feeding instances are not independent of each other. However, the Two Sample T-test, which measures if two populations are equal, was not found to be significant. This could be changed with a larger study and more data points which would make the data more normal.

Given the results of Pearson's product-moment analyses, there is a strong, direct association between the instances of feeding in the high foot traffic versus the high automobile traffic area. There is also a strong direct association between the instances of robins feeding at high foot traffic and high automobile traffic. This means that there is a strong linear relationship between the variables of traffic level and

feeding instances. As traffic level changes so will the number of animals that feed in the area. An increase in automobile traffic in a neighborhood can affect how many squirrels or robins will feed in the area. Also, the total feeding instances of robins and squirrels at the high foot traffic area are independent of each other and were not found to be significant (Table 5). Therefore, the number of robins feeding in an area does not affect the number of squirrels feeding in the area. The two organisms' feeding habits, in this case, are unrelated.

Because of this, the hypothesis that if the activity of traffic around a location decreased, the feeding occurrences observed of Eastern Gray squirrels and American robins would increase because they will experience less fear and stress from the loud commotion is rejected. There was no data from the low traffic area, but in a longer study with more data points that could change. Based on the results of this study, if the activity of traffic around a location increases, the feeding occurrences observed of Eastern Gray squirrels and American Robins also increase. Given the results of this study, it is possible that with a larger sample size at more locations, the results could be different, and the data could become more normal.

These trends might also possibly be explained by different traits in the squirrel and robin populations in the three locations. While it is known why animals avoid high automobile traffic areas, the difference in animal abundances between areas of foot traffic and areas of automobile traffic has yet to be distinctly compared. However, we can extrapolate that

the robins and squirrels in the populations of both high-traffic locations could have acclimated to the noise and activity of humans and automobiles in the area.

It has previously been cited in literature that, at roads where the density of traffic is higher and moving at a faster pace, the bird abundances are lower (Husby 2017). A reason for this trend could be the decreased amount of vegetation surrounding larger roads. However, studies indicate that birds show an active avoidance behavior of loud cars by either increasing their flight height or avoiding the roads altogether because, when comparing two roads of the same size and the same amount of surrounding vegetation, birds were less likely to be observed around the road with more automobile traffic. Also, for many species, traffic noise is one of the greatest factors leading to differences in breeding densities (Husby 2017).

Other differences in behavior could also account for our results. For example, it could be theorized that wildlife in forested areas away from human activity would be less adventurous in their foraging habits and take less risks. Higher-traffic environments have both fewer predators and more irregular sources of food, such as trash cans or litter, and so encourage active and constant exploratory behavior to utilize their resources. In contrast, the forest presents the risk of predation, which discourages careless foraging, and has sources of food which may be more fixed and regular.

The relatively short data collection periods may have exacerbated these behavioral differences. The squirrels and robins in and around campus would be more accustomed to human activity and would thus not be as cautious when presented with it, while forest inhabiting individuals would be more disturbed by the intrusion of researchers. This may have caused the low-traffic site to not record any feeding events, as the wildlife would have been either driven from the area or scared into inactivity and not have had time to return and begin.

Also, the daily weather could have affected the observed trends of robin and squirrel abundance. During this experiment, peak robin feeding occurrences were observed on April 10<sup>th</sup>, 2023. This likely occurred because of the rainstorm that had occurred the day prior. Rainy weather makes it easier for robins to forage for food because insects and worms, which are their preferred foods, are easier to find in rainy weather (Garrett 2019).

It has been proven that roads used for automobile traffic have fragmented the natural habitats and changed the behavior of many avian and terrestrial species. Given that there are not a lot of

natural habitats left for these present populations to find shelter, they may currently be forced to use these less-than-ideal locations as their homes. Crossing structures could be installed to improve habitat connectivity, keep wildlife off the roads and decrease the number of inevitable automobile collisions with them (Rytwinski & Fahrig 2015).

The fact that these species are using these locations as their habitat could have long-term effects on their natural competitors, too. A study has shown that the effect of intense human foot traffic on wildlife has been shown to mirror the effects of hunting (Griffiths & van Schaik 1993). The presence of humans eventually can reduce predation on the habituated species by their natural predators, which could ultimately reduce the populations of any competitor species from resource domination (Griffiths & van Schaik 1993).

Overall, the high populations of wildlife inhabiting these busy areas are concerning given that there are many negative effects that roads and humans have on wildlife, such as vehicle-caused mortality (Husby 2017). Therefore, the long-term implications of this study may be far-reaching. While they do not indicate the negative effects of human-generated anthropogenic noise on wildlife population abundance, they support the notion that more can be done to mitigate the effects of habitat fragmentation caused by the construction of Juniata College.

It has been proven that roads used for automobile traffic have fragmented the natural habitats and changed the behavior of many avian and terrestrial species. Given that there are not a lot of natural habitats left for these present populations to find shelter, they may currently be forced to use these less-than-ideal locations as their homes. Crossing structures could be installed to improve habitat connectivity, keep wildlife off the roads and decrease the number of inevitable automobile collisions with them (Rytwinski & Fahrig 2015).

Given the amount of wildlife observed near traffic, this study supports the idea that more of an effort should be made to mitigate these negative effects that traffic has on the abundant wildlife species like automobile collisions and habitat fragmentation. Therefore, these results also provide a sound foundation for the argument of increasing natural habitats for terrestrial and avian species across the Juniata College campus to provide them with space away from traffic to inhabit.

Overall, when interacting with nature, conducting field research, or even just hiking on a trail where one might only have a minor interaction with wildlife, it is important to evaluate the environmental impact human intervention has on natural habitats.

Though, it may be ever more important to be conscious of human development in previously natural environments. Even a simple sidewalk through campus is an indication of the fragmentation humans have created in wildlife habitats.

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## LITERATURE CITED

- Fahrig, L., and T. Rytwinski. 2009. Effects of roads on animal abundance: an empirical review and synthesis. *Ecology and Society* **14**: 2-16
- Garrett, D. 2019. "Where do birds go when it rains?" *Chipper Birds* website accessed April 2023. [chipperbirds.com/where-do-birds-go-when-it-rains/#:~:text=Robins%2C%20thrushes%2C%20and%20warblers%20can.](https://chipperbirds.com/where-do-birds-go-when-it-rains/#:~:text=Robins%2C%20thrushes%2C%20and%20warblers%20can.)
- Griffiths, M., and C. P. van Schaik. 1993. The Impact of Human Traffic on the Abundance and Activity Periods of Sumatran Rain Forest Wildlife. *Conservation Biology* **7**: 623–626.
- Husby, Magne. 2017. Traffic influence on roadside bird abundance and behaviour. *Acta Ornithologica* **52**: 93-103.
- Kaufman, K. 2019. American robin. *Audubon* website accessed April 2023. <https://www.audubon.org/field-guide/bird/american-robin>
- Kunc HP, and R. Schmidt. 2019. The effects of anthropogenic noise on animals: a meta-analysis. *Biology Letters*. **15**: 20190649.(<http://dx.doi.org/10.1098/rsbl.2019.0649>)
- Libretexts. 2022. Foraging Ecology. *Biology LibreTexts* website accessed April 2023. [https://bio.libretexts.org/Courses/Gettysburg\\_College/01%3A\\_Ecology\\_for\\_All/11%3A\\_Behavioral\\_Ecology/11.02%3A\\_Foraging\\_Ecology#:~:text=Foraging%20is%20searching%20for%20wild,environment%20where%20the%20animal%20lives.](https://bio.libretexts.org/Courses/Gettysburg_College/01%3A_Ecology_for_All/11%3A_Behavioral_Ecology/11.02%3A_Foraging_Ecology#:~:text=Foraging%20is%20searching%20for%20wild,environment%20where%20the%20animal%20lives.)
- Rytwinski, T. and L. Fahrig. 2015. The impacts of roads and traffic on terrestrial animal populations. In *Handbook of Road Ecology* **28**, pp. 237-246, *Wiley Online Library*. (<https://doi.org/10.1002/9781118568170.ch28>)
- Pennsylvania Game Commission. (n.d.). *Squirrels*. Pennsylvania Game Commission website accessed April 2023. <https://www.pgc.pa.gov/Education/Wildlife/NotesIndex/Pages/Squirrels.aspx#:~:text=They%20are%20most%20active%20in>