Introduction
With hundreds of cities, thousands of cars, and billions of people, what is our effect on the environment? Urbanization impacts the environment through habitat loss, fragmentation, pollution, especially in cities. To better understand these effects, we studied the dynamics between carrion beetles, small mammals, and urbanization.

Carrion beetles play a constituent role in an ecosystem by recycling the nutrients from small mammal carcasses back into the soil. The populations of small mammals have an influence over the success of beetle populations by providing means for reproduction. To study the population of carrion beetles in New York City, we conducted research in five parks which differed in their level of urbanization.

Understanding the relationships between urbanization, small mammal diversity, and carrion beetle diversity can provide insight into the effects of urbanization.

Methods
Track tubes
- 2 ft gutters connected to form a tunnel with a piece of contact paper inside and inked at each opening. Three tubes were placed at each site.
- Tubes were baited for one day with oats and peanut butter.

Hanging traps
- A small perforated container holding raw chicken placed inside of a larger container filled with soapy water and hung from a tree with string.
- Traps were checked after one week.

Data Collection
- 14 sites: 4 in Central Park, 1 in Riverside Park, 2 in Highbridge Park, 3 in Inwood Hill Park, and 4 in Pelham Bay Park
- Legible tracks were identified from track tubes.
- Beetles were cleaned in ethanol and pinned.
- Urbanization was measured as distance from Times Square.

Research Question & Hypotheses
What is the impact of small mammal species richness on carrion beetle species richness across an urban gradient?
- The species richness of carrion beetles increases as urbanization decreases.
- The species richness of small mammals increases as urbanization decreases.
- The species richness of carrion beetles increases as species richness of small mammals increases.

Results

<table>
<thead>
<tr>
<th>Carrion Beetle Species Richness</th>
<th>Small Mammal Species Richness</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of sites</strong></td>
<td><strong>Number of Species</strong></td>
</tr>
<tr>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
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<tr>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
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<tr>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td><strong>Distance from Midtown (km)</strong></td>
<td><strong>Distance from Midtown (km)</strong></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
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<tr>
<td>5</td>
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<td>15</td>
<td>15</td>
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<td>20</td>
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</tr>
</tbody>
</table>

Fig. 4: Beetle species richness at each site as distance from Midtown Manhattan increases. Pearson’s r = 0.841

Fig. 5: The population of mammals at each site as distance from Midtown Manhattan increases. Pearson’s r = 0.069

Fig. 6: Mammal and beetle species richness for each site

Fig. 7: Shows the relationship between small mammal species richness and beetle species richness. Pearson’s r = 0.415

Discussion
Effects of Urbanization on Beetles
Our predictions were supported by a strong positive correlation between species richness and increasing distance from Midtown (Fig. 4).

This could be because urban parks had larger mammals which compete with beetles and are harder for them to utilize.

Effects of Urbanization on Small Mammals
Our hypothesis was rejected by a negative correlation between mammal species richness and urbanization (Fig. 5). More species were found at more urban sites.

Urban parks could be confining mammals smaller areas, making them more likely to find track tubes. Potential factors affecting this data are territorial behavior of species and environmental factors such as rain washing away prints.

Effects of Small Mammal Species on Beetle Species
Our hypothesis that an increase in the species richness of small mammals would lead to an increase in the species richness of carrion beetles was not supported. Data in Fig. 7 shows a negative correlation. However, this may be due to confounding effects of urbanization.

Future Studies
Future studies using hanging traps should use tamper-proof traps. Small mammal data could be improved by using more sites and more tubes at each site to yield more accurate results. In the future, a study may look at a comparison between mammals and beetles at sites that are at the same level of urbanization to account for the possible confounding variable seen in this study.

Overall, more sites and a longer period of time for the study would be useful for any future study using these methods.

References

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