Relationships Between Bat Activity and Select Atmospheric Parameters in Two Suburban Habitats

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Abstract

This study explores the connection between atmospheric conditions, ***suburban land use***, and bat presence to understand and make sense of how environmental factors influence ***bat activity*** and population. The research highlights three key questions and concepts which consist of: how ***atmospheric parameters*** such as temperature, wind speed, humidity, and barometric pressure affect bat presence and activity, whether bats can serve as ***bioindicators*** of environmental quality, and how habitat variations in suburban environments impact/affect bat diversity. All the data recorded and collected was from two local suburban locations which were Kinloch (Site 1) and Hillcrest (Site 2) Elementary schools park area, using acoustic devices known as the Echo Meter Touch. This device along with GLOBE protocols were used to record bat presence, species frequency/variation, and environmental elements that influence bat activity. Findings in the beginning of the study indicate that activity is higher in areas with a surplus of vegetation and trees, with little to no human disturbance, proving that suburban development and artificial lighting may adversely affect bat populations. Results also suggest and support the idea that changes in bat diversity are directly proportional to quality of the environment, highlighting the bats as true bioindicators. These findings contribute to understanding urban wildlife ecology and provide sufficient insight into how suburban planning can better support and aid bat ***conservation***. Future research could expand and build upon these findings and indications by incorporating additional sites and long term (longitudinal) studies to monitor and assess seasonal trends that occur within the bat habitat.

Discussion

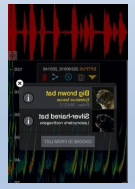
This study explores the connection between atmospheric conditions, ***suburban land use***, and bat presence to understand and make sense of how environmental factors influence ***bat activity*** and population. The research highlights three key questions and concepts which consist of: how ***atmospheric parameters*** such as temperature, wind speed, humidity, and barometric pressure affect bat presence and activity, whether bats can serve as ***bioindicators*** of environmental quality, and how habitat variations in suburban environments impact/affect bat diversity. All the data recorded and collected was from two local suburban locations which were Kinloch (Site 1) and Hillcrest (Site 2) Elementary schools park area, using acoustic devices known as the Echo Meter Touch. This device along with GLOBE protocols were used to record bat presence, species frequency/variation, and environmental elements that influence bat activity. Findings in the beginning of the study indicate that activity is higher in areas with a surplus of vegetation and trees, with little to no human disturbance, proving that suburban development and artificial lighting may adversely affect bat populations. Results also suggest and support the idea that changes in bat diversity are directly proportional to quality of the environment, highlighting the bats as true bioindicators. These findings contribute to understanding urban wildlife ecology and provide sufficient insight into how suburban planning can better support and aid bat ***conservation***. Future research could expand and build upon these findings and indications by incorporating additional sites and long term (longitudinal) studies to monitor and assess seasonal trends that occur within the bat habitat.

Methodology

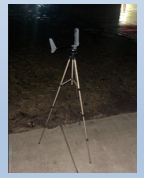
This is an arial shot of Kinloch Elementary (Site 1)

This is an arial shot of Hilcrest Elementary (Site 2)

An Eco meter was used along with a phone in order to record bat data.



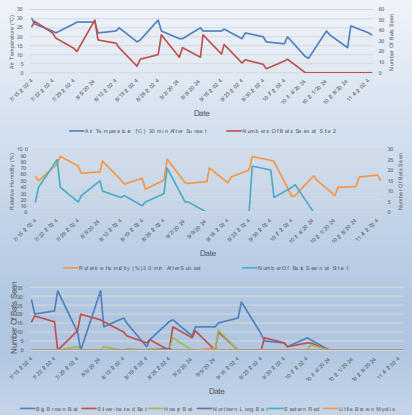
All recordings were stored in the Eco Meter app where the recordings were categorized

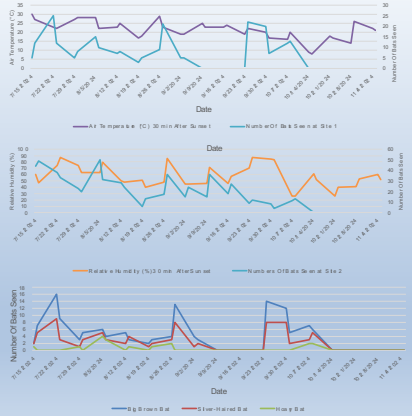


In order to measure the atmospheric temperature, a portable weather station was set up

The group of student researchers preparing to gather the first batch of data before sunset.

Results





Conclusion

This study explores the connection between atmospheric conditions, ***suburban land use***, and bat presence to understand and make sense of how environmental factors influence ***bat activity*** and population. The research highlights three key questions and concepts which consist of: how ***atmospheric parameters*** such as temperature, wind speed, humidity, and barometric pressure affect bat presence and activity, whether bats can serve as ***bioindicators*** of environmental quality, and how habitat variations in suburban environments impact/affect bat diversity. All the data recorded and collected was from two local suburban locations which were Kinloch (Site 1) and Hillcrest (Site 2) Elementary schools park area, using acoustic devices known as the Echo Meter Touch. This device along with GLOBE protocols were used to record bat presence, species frequency/variation, and environmental elements that influence bat activity. Findings in the beginning of the study indicate that activity is higher in areas with a surplus of vegetation and trees, with little to no human disturbance, proving that suburban development and artificial lighting may adversely affect bat populations. Results also suggest and support the idea that changes in bat diversity are directly proportional to quality of the environment, highlighting the bats as true bioindicators. These findings contribute to understanding urban wildlife ecology and provide sufficient insight into how suburban planning can better support and aid bat ***conservation***. Future research could expand and build upon these findings and indications by incorporating additional sites and long term (longitudinal) studies to monitor and assess seasonal trends that occur within the bat habitat.

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Citations

O'Shea, Thomas J., et al. "Multiple mortality events in bats: a global review." Mammal Review, vol. 46, no. 3, 2016, pp. 175-190.

McGuire, Liam P., et al. "Wind speed alters nightly and seasonal patterns of bat activity at a wind farm." Journal of Mammalogy, vol. 99, no. 4, 2018, pp. 749-759.

Foy-Elsenbold, Annina, et al. "Landscape connectivity, habitat structure and activity of bat guilds in farmland-dominated matrices." Journal of Applied Ecology, vol. 50, no. 1, 2013, pp. 252-261.

Plummer, Katherine E., et al. "The effect of habitat type on bat activity: A multi-year study in a wind farm landscape." Wildlife Biology, vol. 2021, no. 1, 2021, article wlb.00828.

Weller, Theodore J., et al. "Bat activity rates do not predict bat fatality rates at wind energy facilities." Journal of Mammalogy, vol. 97, no. 6, 2016, pp. 1655-1668.

Gonsalves, Lotny, et al. "Barometric pressure triggers arousal from torpor in hibernating bats." PLOS ONE, vol. 8, no. 7, 2013, article e69207.

Rowse, Elizabeth G., et al. "Dark matters: The effects of artificial lighting on bats." Biodiversity and Conservation, vol. 25, no. 11, 2016, pp. 2153-2175.

Echo Meter Touch EM3+ User Manual: Wildlife Acoustics <http://www.wildlifeacoustics.com/echo-meter-touch/help.pdf>