Bat activity and forest characteristics in managed Adirondack forests

Julia Rizzo¹, Vanessa Rojas², Stacy McNulty³, Gregory McGee¹

¹SUNY College of Environmental Science and Forestry (SUNY-ESF), ²Syracuse, NY
³SUNY-ESF Ranger School, Wanakena, NY

ABSTRACT

Insectivorous bats play important roles in forest ecosystems and their protection is critical. However, Myotis bat populations in North America have declined rapidly and are threatened due to white-nose syndrome (WNS) and habitat degradation. Apart from mitigating WNS, we can also assist the recovery of Myotis species by incorporating forest management strategies that improve summer roosting and foraging success. We analyzed bat acoustic activity in the central Adirondack region of New York at an experimental forest management site at SUNY-ESF Huntington Wildlife Forest and at a nearby traditionally managed shelterwood site. To determine the link between bat habitat use and forest structural characteristics, we compared bat acoustic activity and vegetation data at these sites. Our analyses show that forest variables such as canopy cover and sapling density affect probability of bat habitat use. The results of this study can inform forest management decision-making and aid in the conservation of imperiled bat species.

OBJECTIVES

• Determine probability of Myotis habitat use at differently-managed shelterwood sites and an unmanaged control site
• Evaluate which forest structural characteristics are most informative in predicting Myotis habitat use

STUDY SITES

Location of Electric Fence (EF) site within SUNY-ESF HWF and Goodnow Flow (GF) study site
EF site has 7 blocks with irregular shelterwood cut and 7 uncut control blocks. GF site has commercial shelterwood management.

VEGETATION SAMPLING

• 5 fixed-radius plots at every detector
• Counted saplings, recorded size class
• Recorded canopy cover at plot center
• Recorded DBH and Tree-Related Microhabitats (TReMs) of trees >10cm (Larrieu et al. 2018, Basile et al. 2020)

ACOUSTIC SAMPLING

• Pettersson D500x ultrasonic detectors
• EF: 16 points; ≥ 14 nights each summer, 2021-2022
• GF: 6 points; ≥ 14 nights, summer 2022
• Analyzed using Kaleidoscope Pro software

OCCUPANCY MODELING

<table>
<thead>
<tr>
<th>Detection Variables</th>
<th>Occupancy variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature (°C)</td>
<td>Canopy cover (%a)</td>
</tr>
<tr>
<td>Relative humidity (%)</td>
<td>Sapling density (avg #/ha)</td>
</tr>
<tr>
<td>Wind speed (m/s)</td>
<td>Distance from water (m)</td>
</tr>
<tr>
<td>Precipitation (cm)</td>
<td>Average basal area (m²/ha)</td>
</tr>
<tr>
<td>Day of year</td>
<td>TReM variables: Average density of snags, cavities, rot holes, and peeling bark (avg #/ha)</td>
</tr>
</tbody>
</table>

Used occupancy modeling and Akaike’s Information Criterion (AIC) to determine the relationships between bat habitat use and forest characteristics. We fit models allowing occupancy (Ψ) and detection probability (p) to vary by detector location (MacKenzie et al. 2017). Ran 6 detection models for single and multi-season models. Ran 9 occupancy models for single-season model and 4 for multi-season model.

RESULTS

Average basal area (m²/ha) was significantly different between cuts and controls (p<0.001)
Average canopy cover (% classes) was significantly different between cuts and controls (p<0.001)
Average sapling density/ha was significantly different between cuts and controls (p<0.001)

DISCUSSION

• We found the structure between the EF and GF cuts and the control site to be significantly different. The reduction in canopy cover and removal of sapling layer led to increased probability of Myotis habitat use. This is consistent with previous findings in the study region (Gallagher et al. 2021).
• Differences in Tree-Related Microhabitat (TReM) (e.g., cavities, rot holes, peeling bark) densities were not significant between EF and GF sites. The retention of green trees did not significantly increase TReM densities, these variables did not influence Myotis habitat use.
• Green-tree retention may be important for providing roost trees on managed landscapes, though it did not affect foraging habitat use.
• Further studies using mist netting and radiotelemetry are needed to see if Myotis bats are using the retained trees in the managed landscape.

REFERENCES

Will provide references upon request.

ACKNOWLEDGEMENTS

Monica Edgerton, Laurel Schuster, Alexa Carlson, and Hannah Allen for help with project development and data collection. F&W Forestry and Bill Van Gorp for access to Goodnow Flow study site. NYS Mesonet for weather data. T. Uring and Mabel Walker Research Fellowship Program, McIntire Stennis Seed Grant, American Society of Mammologists Grants-In-Aid, SUNY-ESF GSA Research Award, SUNY-ESF GSA Professional Development Award, Holohil Grant Program, and the Cross Apprenticeship for funding.