Nightwing News

The Newsletter of the Southeastern Bat Diversity Network

Volume 108, Number 1 Spring 2018

PRESIDENT'S ADDRESS

Katrina Morris

I hope you were able to attend the most recent Joint Bat Working Group meeting in Roanoke, VA this past March. A summary of the meeting is included in this newsletter in case you missed it. I want to extend a huge THANK YOU to the host committee who put together this excellent meeting. Rick Reynolds and his crew faced unforeseen challenges during planning and they were able to pull off a meeting with great new information, valuable discussions and a good introduction to the beautiful town of Roanoke.

The spring meeting was attended by close to 400 people! I am amazed at how much our regional bat working groups have grown over the past ten years. With this increase in growth, I would expect an increase in participation in the leadership of these working groups. But that's not happening at the same pace.

If you look back at the history of SBDN, you'll see the same names repeated over and over again: Mary Kay Clark, Tim Carter, Joy O'Keefe, etc. It's understandable to have the same people on the list year after year when these groups were just getting started and bat biologists were rare. But now, 22 years later with a substantial increase in the amount of bat work and bat biologists, the SBDN leadership should be filled with new faces.

As I mentioned at our SBDN business meeting in Roanoke, we will be having elections this fall. Three positions will be open including President-Elect, Secretary and Board Member at Large. More information about these positions, our executive committee and a link to our bylaws can be found here: https://sbdn.org/about-us/. If you have questions, I'm sure any of the current officers would be happy to help!

If you're not quite ready for that level of leadership, one of our committees might be a good place for you to start. You can find a list of the committees and their contact information in this newsletter. If you think you have something to contribute, contact the chair and see if they are in need of some new membership. If you want to start something new, let me know. New ideas are always welcome and the executive committee appreciates your suggestions for positive change.

Finally, if you want to get involved on a more local level, consider your state bat working group. We currently have links to six state working groups listed on our website (https://sbdn.org/links/) and there are other active state groups in the southeast. Many of these groups have regular meetings and some have yearly mist-net events. These groups face the same problems as SBDN and the other regional bat working groups. Most of the work is taken on by a few individuals. Maybe you can change that by volunteering to help.

Be on the lookout for the call for nominations for the SBDN Executive Committee this fall. And look closely at your state update in the next Nightwing Newsletter. Maybe you'll find a new opportunity to devote a small amount of your time to a hard-working group that needs your help. And in the process, you'll be rewarded with new experiences, new ideas and new connections. I promise it's worth your time.

Thank you for all that you do for SBDN and for bats. Good luck with all your summer fieldwork!

Trina

706-557-3220

In This Issue

Executive Committee Meeting

Southeastern Bat Diversity Network
Executive Committee
Minutes of the Annual Board Meeting
March 26, 2018

Attendees

Trina Morris, President
Brian Carver, Past President
Luke Dodd, Treasurer
Katherine Caldwell, Secretary
Pete Pattavina, Member at Large
Steve Samoray, Incoming President Elect

Action Items

AI1: Morris, Samoray, and Carver work together to update and post the meeting host package to the website.
AI2: Morris work with contributors to post bat blitz host package to website.
AI3: Dodd make document for student travel award reimbursement.
AI4: Carver contact Rojas and Wilhide to find out timeline for newsletter and if they want to contact state biologists or if Carver should do this.
AI5: Carver work with poster committee to make progress on poster this summer.
AI6: Pattavina check on whether board is indemnified.
AI7: Dodd and Caldwell get membership records updated.

Call to order: 3:35PM EST, President Morris

General Discussion

Discussion about next year's joint meeting, led by Rick Reynolds – VA Fish and Game

Next year's annual meeting will include SBDN, NEBWG, and MWBWG, taking place in Roanoke, VA from 26 – 30 March 2018 (Tuesday – Thursday). The location is near downtown, has an airport shuttle, and is close to food and other options. There is a local pub within walking distance where the social may happen. There is one big room with dividers for the meetings. Lots of people are involved in helping to plan the meeting – Pete Pattavina, Trina Morris, Rob Meis, Tim Carter, Emily Davis, Mark Ford, Paul Moosman, Jeff Gruver, Karen Powers. The hotel has an association with Virginia Tech and tried to get free parking, but couldn't work it out. However, the hotel put in for a grant to help cover some expenses and was awarded $2500. NEBWG has offered up $2000, and the host committee would like to ask for $2000 from SBDN. MWBWG is too new to have surplus funds to contribute. Trying to keep registration costs down. There will be committees set up in order to get everything done. There isn't a program topic at the moment but the format will be similar with the Colloquium on the last day. The registration doesn't have to go through the venue so the registration cost will be similar to previous joint meetings. Registration is going through Organization for Bat Conservation (Rob Meis).

October 2017 Executive Committee Meeting Action Items:

- Action Item 1 irrelevant because dealt with 2017 bat blitz.
- Morris contacted Carter about meeting host package and will take this over. **AI1:** Morris, Samoray, and Carver work together to update and post the meeting host package to the website.
- Morris contacted Whitby about bat blitz host package and will take this over. **AI2:** Morris will work with contributors to post bat blitz host package to website.
- Dodd developed template for reimbursing student award recipient for travel expenses. **AI3:** Dodd will put template into document form.
- Not done. **AI4:** Carver contact Vanessa Rojas and J.D. Wilhide to find out timeline for newsletter and if they want to contact state biologists for updates or if Carver should do this.
- Action item 6 done
- Carver has made initial contacts with state working groups. **AI5:** Carver work with poster committee to make progress on poster this summer.
- Action Items 8 – 12 done.

New Business:

Membership

Members paid their dues in multiple ways this year (through Organization for Bat Conservation, mailed checks, at JBWG Meeting, and through SBDN website), so we need to get the membership list up to date between now and the next conference call. Created action item for Dodd and Caldwell.

Treasurer's Report

As of 24 March 2018, there were $83,010.74 in SBDN accounts. Of that, $3,954.33 was in our general account. Membership dues remain our primary source of operating income. The largest expenses we incurred this past year were related to tax preparation ($600) and website maintenance ($400 + $250). The loss of $1,599.78 in 2017 was mostly in relation to the 2017 SBDN / Colloquium Meeting. The inflow of funds for 2017 totaled $84,240.45, whereas outflows totaled $85,840.23. We serve as a bank for 5 different state bat working groups (AL, GA, KY, NC, TN). As is readily apparent from the amount of money moving through our bank account, and the amount of money held on behalf of various functions and groups, we perform a valuable service to the bat community.

Since the close of the 2017 year, much of the Treasury's effort has been placed on the current meeting. As has been well-discussed in conference calls and miscellaneous written correspondence, starting in Nov 2017, the Organization for Bat Conservation (OBC) was collecting pre-registration funds for this meeting. By mid-Feb 2018, OBC began a process of shutting down and dissolving. At that time OBC had not provided any pre-registration funds to the meeting organizers (i.e., MWBWG, NEBWG, SBDN). It was uncertain if those funds would be available for the meeting. Late February 2018, meeting organizers met to prepare a plan to cover the gap in funds to ensure this meeting would proceed as planned. Since then, OBC has provided 87% of these meeting funds. OBC has further reinforced that the various bat working groups should expect the remaining $5,000 unrecovered funds to be delivered in the coming weeks concurrent with auction.

Many years ago, Tim Carter took $10,000 and placed it in a reoccurring 30 day CD. This CD was closed out on 23 Feb 2018. Over the course of this investment we earned $70.49. Thus, the total of 10,079.49 is now integrated into our general checking account.

On a final note, Dodd started as Treasurer in March 2017. Since then, there have been 149 transactions entered into the Treasury. Respectfully submitted: 26 March 2018 – By Luke Dodd – SBDN Treasurer.

Post-Script – all outstanding pre-registration funds due from OBC have been delivered in full.
Noted: 21 April 2018 – By Luke Dodd – SBDN Treasurer.

COMMITTEES

- **Awards Committee**: Nikki Castleberry will present at the end of the meeting. Awards will not be split up by separate working group because it is too complicated, so there will be a bat oral and poster award and a non-bat oral and poster award. There will be no student talks in the afternoon on Thursday so award winners can be determined on time. Judging packages are at the registration table.
- **Bat Blitz Committee**: Michael Whitby will not be at the meeting, so Jason Robinson will give update. 2018 blitz planning is going well and Josh Campbell will present on Sewanee, TN blitz during business meeting. The save the date has gone out for this blitz. North Carolina is tentatively planning 2019 blitz, pending funding.
- **Membership Committee**: Scott Bergeson will not be at the meeting, so Chris Comer will present.
- **Website Committee**: Samoray: Jason Robinson has been working with Samoray and will be webmaster while Samoray is president. Website provides registration for state working group meetings. Recently updated white-nose syndrome page.
- **WNS Committee:** Pattavina: Going to give update at business meeting. Overall, national information isn't trickling into the Southeast. Pattavina tried to get Southeast portal on the whitenosesyndrome.org website to no avail. He will add this to the SBDN website and will include common human-bat issues/questions, state contacts and reports, and active grants.
- **NABCA Update**: Morris: NABCA will have booth at the meeting. They are trying to encourage people to go on to the wiki and make edits (http://batconservationalliance.wikidot.com/). They have received minimal hits on the website and Facebook page, so talk to the people at the booth and think about ways to make it better.

2019 SBDN meeting, Jacksonville, Florida

Samoray: Terry Doonan will present on 2019 meeting at SBDN business meeting. Meeting will be in Jacksonville, Florida Feb 21-22. The meeting planning is going well. Going to ask for funding from Disney.

Future SBDN Meeting Discussion

Morris checked meeting history dating back to 1991. This year's meeting is timely since the last Virginia meeting was in 2008. States with recent meetings: NC, AL, TX, TN, MS, KY. States due for a meeting: Florida (2007), Arkansas (2009), Georgia (2004), South Carolina (2002). Morris has been preparing for a 2020 meeting in Athens, GA. South Carolina could be considered for 2021. Arkansas could be considered for 2022.

Discussion about Frequency of Joint Meetings & Future Meeting Finances

Carver remarks we have recently held joint meetings about every three years. These meetings are longer and more expensive, resulting in some regular attendees not being able to attend. These meetings are also financially complicated and SBDN takes on the financial liabilities. Should we develop guidance on how often to hold joint meetings? Morris remarks an every 5-year schedule seems reasonable. The Western Bat Working Group wants to hold a joint meeting with SBDN – perhaps schedule this for 2023.

State Working Group Meetings

Morris went to Florida Bat Working Group Meeting and Alabama Bat Working Group Meeting this year and realized SBDN could have a better connection with state working groups. Consider having an SBDN board member at each state working group to answer questions and form a better connection, especially with new working groups.

Elections

Will be electing a new president, new secretary, and new board member at large at the end of 2018. Be thinking about people we can get more involved in the board and on committees. Samoray will take over as president after 2019 business meeting.

Will hold next conference call in the fall. Trina will send an email to schedule this meeting.

Meeting adjourned: 4:52PM EST

Executive Committee Contact Information

President:
Trina Morris
Wildlife Biologist
Georgia Department of Natural Resources
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President Elect:
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Past President:
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Treasurer:
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Secretary:
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Wildlife Diversity Biologist
Associate Wildlife Biologist®
NC Wildlife Resources Commission
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828-545-8328
Katherine.caldwell@ncwildlife.org

Board Member at Large:
Pete Pattavina
Bat Biologist/Southeast White-nose Syndrome Coordinator
U.S. Fish and Wildlife Service
105 West Park Drive, Suite D
Athens, GA 30606
706-613-9493, ext. 236
pete_pattavina@fws.gov

2017–2019 Executive Committee

L to R: Pete Pattavina, Member At-Large; Steve Samoray, President-Elect; Katherine Caldwell, Secretary; Brian Carver, Past President; Trina Morris, President; Luke Dodd, Treasurer

Committee Contact Information

BAT BLITZ COMMITTEE

Member	Affiliation	E-Mail
Michael Whitby (Chair)	University of Nebraska-Lincoln	michael.whitby@gmail.com
Leanne Burns	Clemson University	lkburns@clemson.edu
Tim Carter	Ball State University	tccarter@bsu.edu
Nikki Castleberry	University of Georgia	neotoma@uga.edu
Dennis Krusac	US Forest Service	dkrusac@fs.fed.us
Bree McMurray	MO DOT	mobatgirl1@yahoo.com
Katrina Morris	Georgia DNR	Katrina.morris@dnr.state.ga.us
Joy O'Keefe	Indiana State University	joyokeefe@gmail.com
Gary Libby	Skybax Ecological Services, LLC	garylibby@windstream.net
Jason Robinson	Biological Systems Consultants, Inc	jason@biologicalsystemsconsultants.com

AWARDS COMMITTEE

Steven Burnett (Chair)	Clayton College & State University	StephenBurnett@mail.clayton.edu
Nikki Castleberry	Georgia Museum of Natural History	neotoma@uga.edu
Chris Comer	Stephen F. Austin State University	comerce@sfasu.edu
Lisa Gatens	NC Museum of Natural Sciences	lisa.gatens@naturalsciences.org

MEMBERSHIP COMMITTEE

Chris Comer (co-chair)	Stephen F. Austin State University	comerce@sfasu.edu
Scott Bergeson (co-chair)	Indiana State University	sbergeson@gmail.com
Steve Thomas	Mammoth Cave National Park	steve_thomas@nps.gov
Blake Sasse	Arkansas Game and Fish Commission	dbsasse@agfc.state.ar.us

WHITE-NOSE SYNDROME COMMITTEE

Pete Pattavina (Chair)	U.S. Fish and Wildlife Service	pete_pattavina@fws.gov
Katie Gillies	Bat Conservation International	kgillies@batcon.org
Katherine Caldwell	NC Wildlife Resources Commission	katherine.caldwell@ncwildlife.org
Dottie Brown	Ecological Solutions, Inc.	dottiebrown@ecologicalsolutions.net
Caroline Byrne	Biodiversity Research Institute	caroline.bryne@briloon.org
Emma Willcox	University of Tennessee	ewillcox@utk.edu

BYLAWS COMMITTEE

Nikki Castleberry (Chair)	Georgia Museum of Natural History	neotoma@uga.edu
Tim Carter	Ball State University	tccarter@bsu.edu
Brian Carver	Tennessee Technological University	bcarver@tntech.edu

WEBSITE COMMITTEE

Steve Samoray (Chair)	Copperhead Consulting	ssamoray@copperheadconsulting.com
Kristina Hammond	WEST, Inc.	khammond68@yahoo.com
Sara Samoray	BDY Environmental	sara.samoray@gmail.com

Committee Reports

AWARDS COMMITTEE

Travel awards to NASBR in Knoxville, TN – Awarded to Pallavi Sirajuddin from Clemson University .
Presentation: *Torpor patterns of tri-colored bats in white-nose syndrome positive and negative sites.*

2018 Joint Meeting: Thanks to committee members for their hard work and thanks to the local folks who have been setting up judging, awards, etc. so that this can all go smoothly.

Mammal Colloquium Best Presentation: Heather N. Abernathy-Conners

How Do Large Mammals Weather the Storm: Movement and Habitat Selection of White-Tailed Deer During Hurricane Irma

Mammal Colloquium Best Poster: Emily D. Thorne

A Multivariate Analysis of Complex relationships Between Den Selection by Eastern Spotted Skunks (*Spilogale putorius*) and Environmental Variation.

Joint Bat Working Group Best Presentation: Elysia Webb

Habitat Preference and Movement Patterns of Florida Bonneted Bats (*Eumops floridanus*).

We'll be sending out call for applications in April. We make the due date early enough before the NASBR abstract deadline so that you'll know if you have the money before you have to submit to the meeting.

If you know of anyone you think should be nominated for other awards (lifetime achievement, service to SBDN, etc.) please contact any members of the committee.

MEMBERSHIP COMMITTEE

Committee co-chair Scott Bergeson dug into the last 3 years' membership numbers to look for patterns that could inform us about membership. Not surprisingly, SBDN membership tracks annual meeting attendance pretty closely, with high membership in years when we have joint meetings and low membership in years when the meeting is in a location that is relatively remote. Furthermore, annual retention over that time frame was only 52%, with 440 different members since 2003. Therefore, we propose that upcoming initiatives focus on member retention and keeping people as members even when they cannot attend the annual meeting. We are welcome to ideas on how to do this, including ways to add value to the membership itself and/or ways to remind member to renew even if they are not coming to the annual meeting.

Committee Reports

BAT BLITZ COMMITTEE

Looking for 2019 and beyond proposals - Contact Jason Robinson if interested

Priority areas Identified include (based on previous blitz locations)

Virginia
Louisiana
Mississippi
Arkansas
Texas

Working on updating blitz host packet (still).

Jason Robinson

jason@biologicalsystemsconsultants.com

Website Committee

The website continues to operate as a source for SBDN announcements and news and has taken on an increased role with the various state working groups by providing registration and payment options. We have also added Jason Robinson to the committee. He has been a great help posting new content and filling in missing information from past events.

Past issues of NightWing News are available on the website at: https://sbdn.org/newsletter/

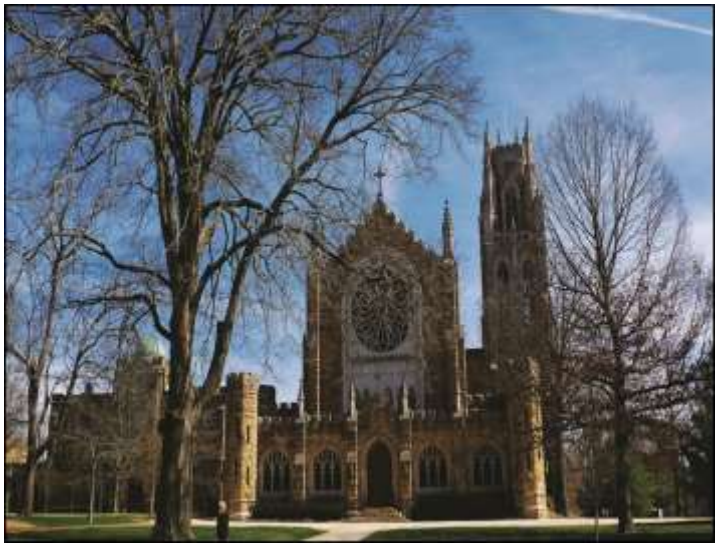
2018 SBDN BAT BLITZ

Southeastern Bat Diversity Network

Host Facility

Sewanee: The University of the South

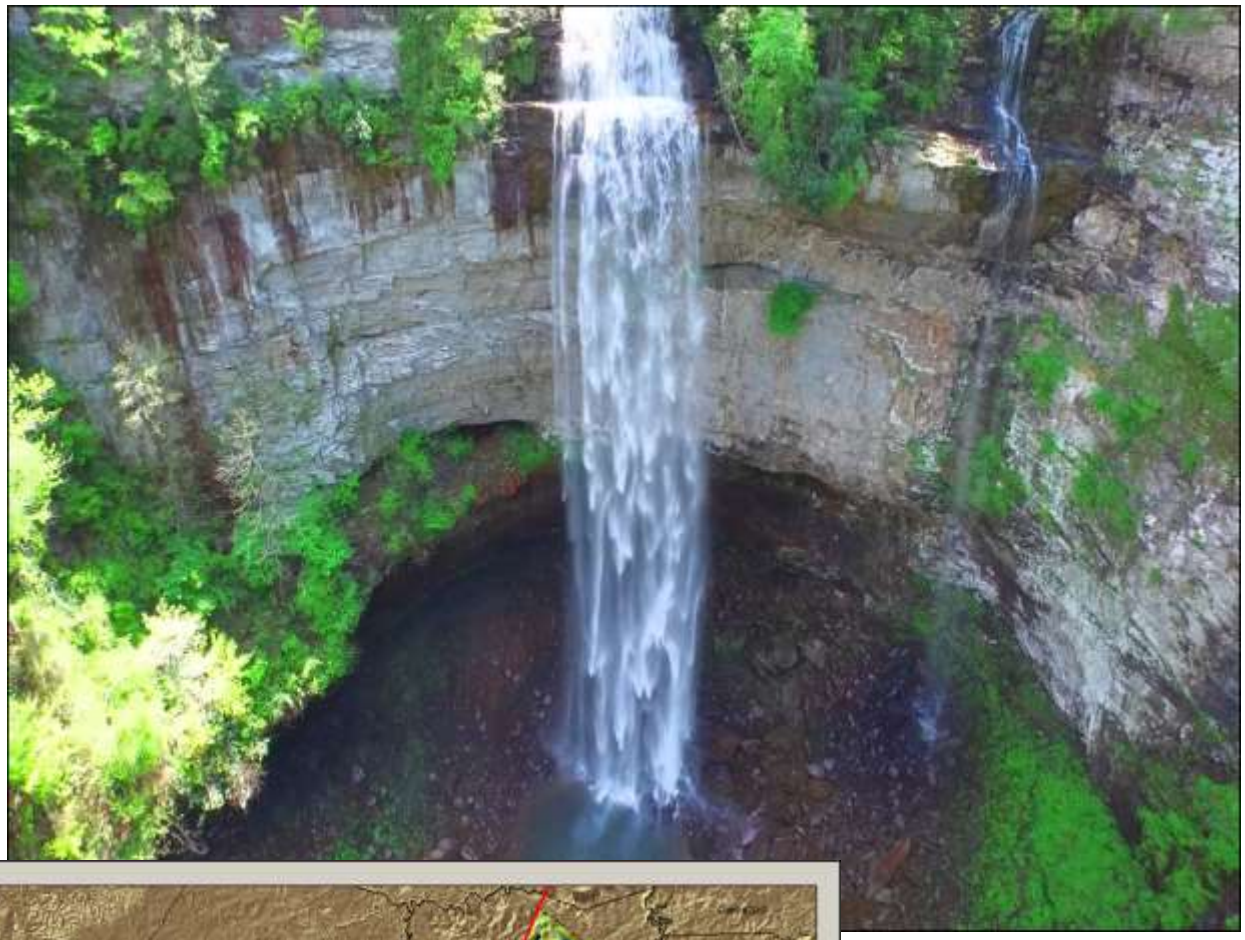
July 23-27, 2018

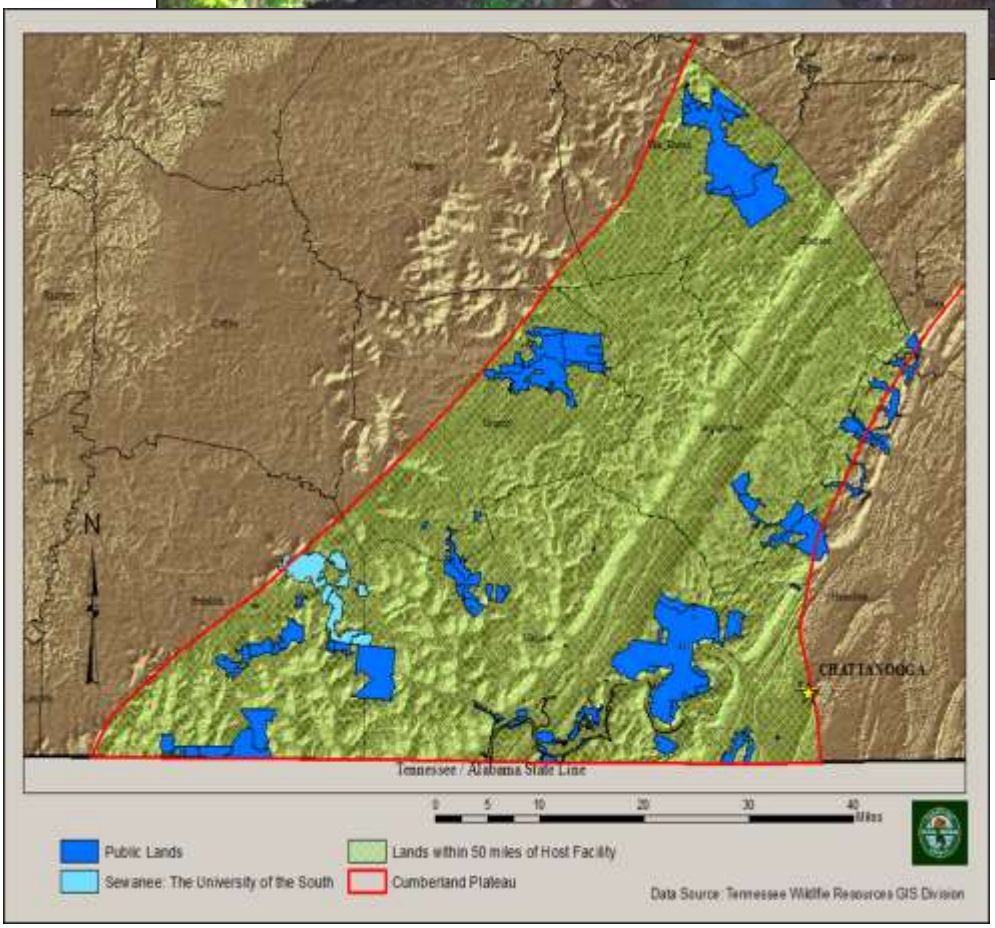


- Reserving dorm rooms
- Double Occupancy
- Providing all meals
- Daily activities include:
- Canoeing/Kayaking
- Hiking
- Horseback riding
- Nightly netting

TENNESSEE WILDLIFE RESOURCES AGENCY

2018 SBDN BAT BLITZ Cont.





Mark your calendars

for

July 23-27!!

Looking forward

to seeing you and

catching some bats

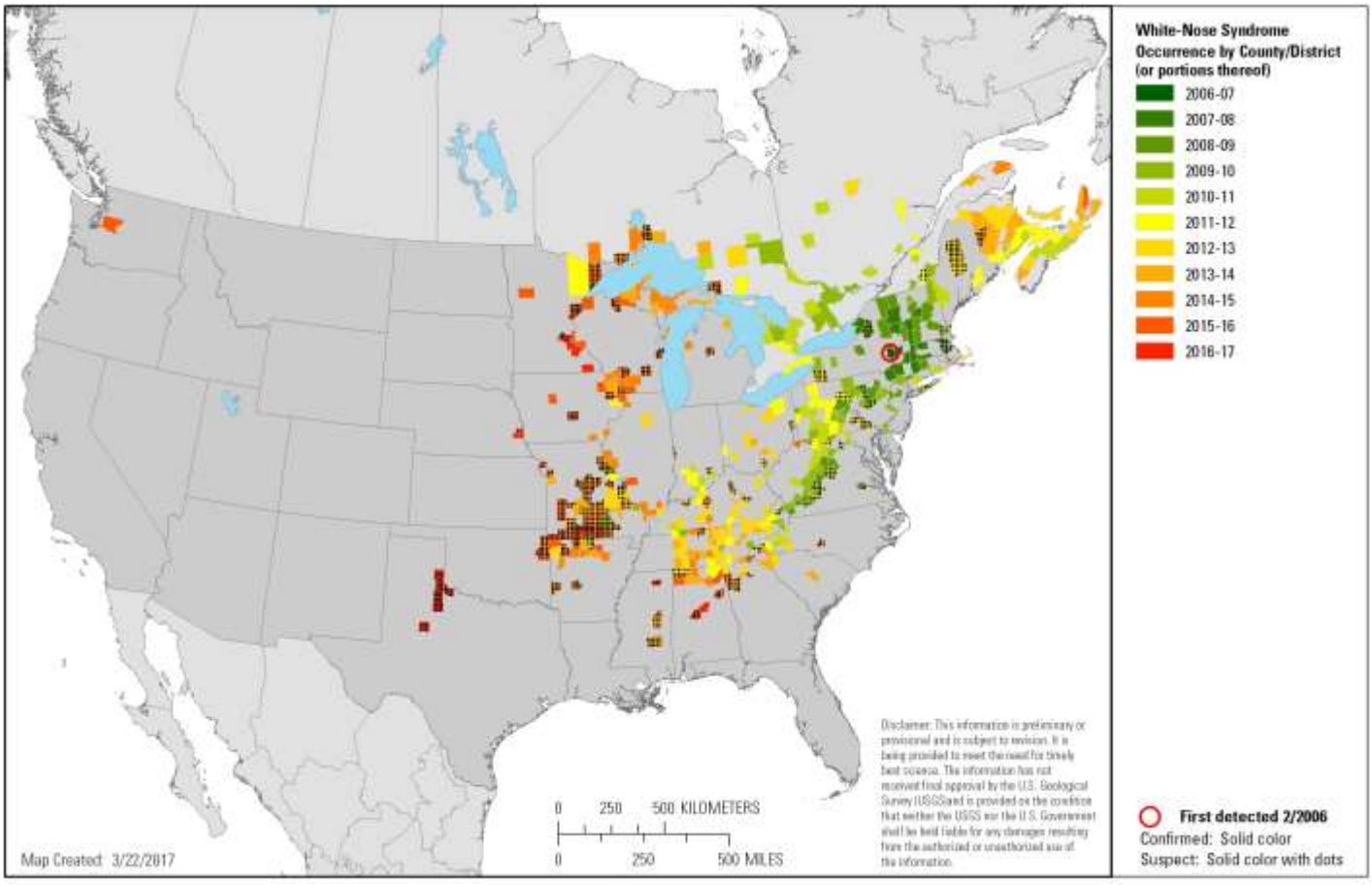
in

Sewanee, Tennessee.

White-Nose Syndrome Update

South Carolina: The fungus that causes white-nose syndrome (Pseudogymnoascus destructans) is now present in three new counties in South Carolina: Greenville, Union and Lancaster. The South Carolina Department of Natural Resources (SCDNR) recently received confirmation from the National Wildlife Health Center that the fungus was present on bats in each of these counties. This doubles the previous number of counties known to have the fungus in South Carolina. Previously known counties Oconee, Pickens and Richland not only harbor the fungus, but signs of WNS have also been seen in bats there.

Texas: The fungus that causes white-nose syndrome has been found for the first time in Texas. The fungus has been detected in samples taken from three bat species in six West Texas counties — Childress, Collingsworth, Cottle, Hardeman, King and Scurry. A research team from Texas A&M University and Bat Conservation International report the samples showed fungus present on tri-colored, cave myotis and Townsend's big-eared bats. No cases of the disease were found in those counties. Texas is home to more than 30 bat species which control insect populations and help with crop pollination.



Map depicts the first time WNS is reported suspect or confirmed in a county or district (or portions thereof); each time period in the legend spans a winter bat hibernation period.
Citation: White-nose syndrome occurrence map - by year (2017). Data Last Updated: 3/22/2017. Available at: https://www.whitenosesyndrome.org/resources/map.

North American Joint Bat Working Group Meeting Summary

28th Annual Colloquium on the Conservation of Mammals in the Southeastern U.S.
23rd Annual Meeting of the Southeastern Bat Diversity Network
16th Meeting of the Northeast Bat Working Group
10th Meeting of the Midwest Bat Working Group

March 26—29, 2018
The Hotel Roanoke & Conference Center
A Doubletree Hotel
Roanoke, Virginia

Annual Meeting Summary

The meeting was attended by over 300 people. There were informative presentations, productive working group meetings, fun field trips, and more! Thanks to everyone for your participation.

Poster session and social. Thanks to our hosts for a great meeting location and all of their time and hard work they put into our meeting.

Members of the Alabama Bat Working Group (Shannon Holbrook, Lydia Moore, Nick Sharp, and Tom Counts) representing at JBWG.

Annual Meeting Summary

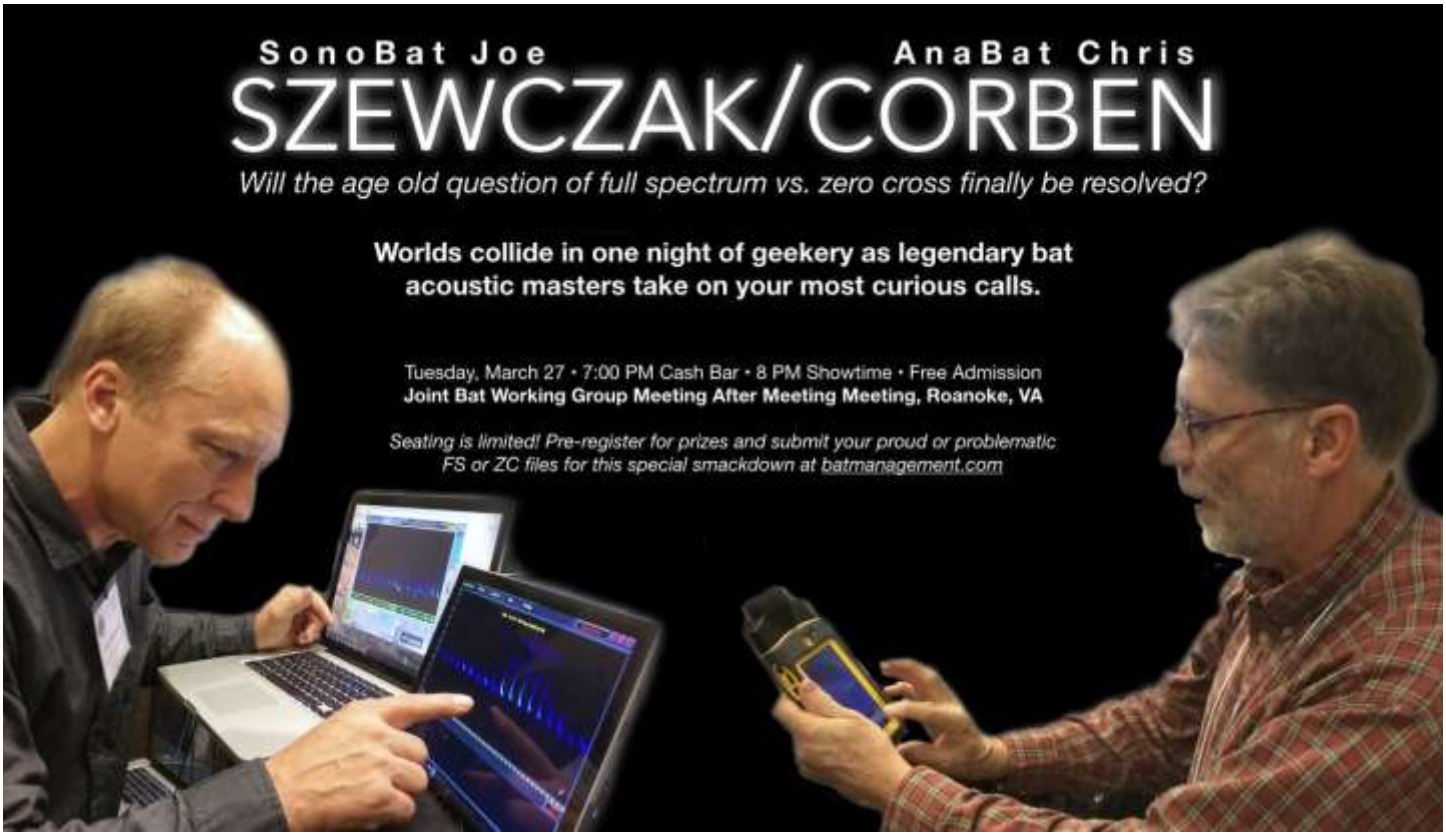
Eastern Small-Footed Bat Field Trip

Attendees of the field trip had a great time exploring eastern small-footed habitat.

Photos submitted by James Cox.

Awards and Recognition

2018 Stump the Geeks Eastern Edition



Awards and Recognition

Best Bat Poster

Morgan Kinniry

(*Accepted by Nikki Castleberry*)

The effect of altitude on frequency, duration, and bandwidth of echolocation calls of *Tadarida brasiliensis* recorded with an unmanned aerial vehicle

Best Bat Presentation

Elysia Webb

Habitat preference and movement patterns of Florida bonneted bats (*Eumops floridanus*)

Awards and Recognition

Best Non-Bat Poster

Emily D. Thorne

(*Accepted by Mark Ford*)

A multivariate analysis of complex relationships between den selection by eastern spotted skunks (*Spilogale putorius*) and environmental variation

Best Non-Bat Presentation

Heather N. Abernathy-Connors

How do large mammals weather the storm: Movement and habitat selection of white -tailed deer during Hurricane Irma

Awards and Recognition

SBDN SERVICE AWARD

Purpose: To recognize outstanding service and contributions to the Southeastern Bat Diversity Network.

Nomination Procedure: The SBDN awards committee will call for nominations in September or October of each year through the SBDN mailing list. Nominations will be submitted to the committee by December 1. Nominations can be submitted by any SBDN member, including members of the Executive Committee and the Awards Committee. Nominations will consist of a letter that describes the nominee's service to SBDN. The committee will review the nominations and evaluate them based on significance of the contributions to SBDN. One name will be forwarded to the SBDN Executive Committee for final approval by January 1. If no worthy nominees have been submitted for consideration, no name will be forwarded to the Executive Committee.

Award Process: The awardee will be announced at the SBDN annual meeting, usually held in February. A plaque will be presented to the awardee by the previous recipient or the SBDN president. The Awards committee will be responsible for obtaining the plaque and funds will be provided by SBDN. A copy of the nomination letter and pictures of the award presentation will be deposited in the SBDN archive.

SBDN LIFETIME ACHIEVEMENT AWARD

Purpose: To recognize individuals who have made significant contributions to the conservation of southeastern bats through research, education, or management efforts. The intent of this award is to recognize more senior individuals who have amassed a variety of accomplishments throughout their careers. The award is SBDN's highest honor. The award may not be given every year.

Nomination Procedure: The SBDN awards committee will call for nominations in September or October of each year through the SBDN mailing list. Nominations can be submitted by any SBDN member, including members of the Executive Committee and the Awards Committee. Nominations will be submitted to the committee by December 1. Nominations will consist of: 1) a letter that describes the nominee's accomplishments and how they have impacted bat conservation in the southeast, and 2) the nominee's Curriculum Vitae. The committee will review the nominations and evaluate them based on the totality of the accomplishments and their impact on bat conservation and/or our understanding of bat ecology. The committee will forward one name to the SBDN Executive Committee for final approval by January 1. If no worthy nominees have been submitted for consideration, no name will be forwarded to the Executive Committee.

Award Process: The awardee will be announced at the SBDN annual meeting, usually held in February. A plaque will be presented to the awardee by the previous recipient or the SBDN president. The Awards committee will be responsible for obtaining the plaque and funds will be provided by SBDN. A copy of the nomination letter, the awardees' CV, and pictures of the award presentation will be deposited in the SBDN archive.

STUDENT TRAVEL AWARD

The Southeastern Bat Diversity Network (SBDN) established an annual Student Travel Award in 2006 to financially assist one student attending the North American Symposium on Bat Research (NASBR). If you are a student enrolled in a university in the Southeastern US and are planning to give an oral or poster presentation at NASBR in 2018 (www.nasbr.org), you are qualified to apply for a student travel award from SBDN. Information on the award and the application process are available at: http://www.sbdn.org/files/SBDN_Student_Award.pdf. **DEADLINE for 2018 applications will be June 15, 2018**. Send applications to Stephen Burnett via email (sburnett@clayton.edu) or snail mail (Stephen Burnett, Department of Natural Sciences, Clayton State University, 2000 Clayton State Blvd, Morrow GA 30260). E-mail submissions are preferred. Contact Stephen Burnett (sburnett@clayton.edu) if you have questions.

History of Meetings

Colloquium	SBDN	Year	Location	Host
28th	23rd	2018	Roanoke, Virginia	Joint Bat Working Group Meeting
27th	22nd	2017	Asheville, NC	Tim Carter, MaryKay Clark, Katherine Caldwell
26th	21st	2016	Guntersville, AL	Tennessee Valley Authority
25th	20th	2015	St. Louis, MO	Joint Bat Working Group Meeting
24th	19th	2014	Nacogdoches, TX	Chris Comer
23rd	18th	2013	Fall Creek Falls, TN	Brian Carver
22nd	17th	2012	Louisville, MS	Darren Miller
21st	16th	2011	Louisville, KY	Tim Carter & Brooke Hines
20th	15th	2010	Asheville, NC	Mary Kay Clark
19th	14th	2009	Jonesboro, AR	Tom Risch & Blake Sasse
18th	13th	2008	Blacksburg, VA	Michael St. Germain
17th	12th	2007	Destin, FL	Jeff Gore
16th	11th	2006	Chattanooga, TN	Tim Carter & Troy Best
15th	10th	2005	Paris Landing, TN	John Nelson
14th	9th	2004	Helen, GA	Steven Castleberry
13th	8th	2003	Mississippi State, MS	Darren Miller
12th	7th	2002	Clemson, SC	Susan Loeb
11th	6th	2001	Memphis, TN	Michael Kennedy
10th	5th	2000	Guntersville, AL	Troy Best
9th	4th	1999	Wytheville, VA	Rick Reynolds
8th	3rd	1998	Hot Springs, AR	David Saugey
7th	2nd	1997	Black Mountain, NC	Mary Kay Clark
6th	1st	1996	Somerset, KY	Mike Lacki
5th		1995	Cookeville, TN	Michael Harvey
4th		1994	Athens, GA	Joshua Laerm
3rd		1993	Mountain View, AR	Gary Heidt & Rick McDaniel
2nd		1992	Guntersville, AL	Troy Best
1st		1991	Memphis, TN	Mike Kennedy

Upcoming Events

29th Mammal Colloquium and 24th SBDN Meeting

The Lexington Hotel & Conference Center
Jacksonville, Florida
Located on the Southbank of the St. John's River in downtown Jacksonville - Jacksonville Riverwalk

22–23 February 2018

American Society of MAMMALOGISTS 2018 MANHATTAN, KANSAS

98th Annual Meeting of the American Society of Mammalogists
June 25–29, 2018
Campus of Kansas State University

25th Annual Conference of the Wildlife Society
October 7–11, 2018
Cleveland, OH

Upcoming Events

14TH ANNUAL BAT FEST

August 18th, 2018

Congress Ave Bridge

4pm to Midnight

1.5 million Mexican free-tailed bats emerging from under the bridge

48TH NORTH AMERICAN SYMPOSIUM ON BAT RESEARCH

24-27 October 2018

Puerto Vallarta, Mexico

Westin Resort and Spa

Center for Bat Research, Outreach, and Conservation
INDIANA STATE UNIVERSITY

BAT FESTIVAL

12th Annual Indiana Bat Festival

A Year in the Lives of Bats

September 15, 2018

Closing Comments

FROM THE EDITOR:

The Spring Newsletter focuses on the Annual meeting and this year being a joint meeting with the Northeast, Midwest and Southeast was truly amazing.

A "Very Special Thank You" to all those that were involved in pulling together the many details to make sure we all had a great Joint meeting.

See something interesting, take a picture and tell us about it!

Be Safe, Take Good Notes
and As Always
Try To Have Some Fun Along the Way!

2018 North American Joint Bat Working Group Meeting Abstracts

CONTRIBUTED ORAL PRESENTATION ABSTRACTS

Listed in order of presenter's last name.

HOW DO LARGE MAMMALS WEATHER THE STORM: MOVEMENT AND HABITAT SELECTION OF WHITE TAILED DEER DURING HURRICANE IRMA

Heather N. Abernathy-Conners[1], Daniel A. Crawford[1], Elina P. Garrison[2], Richard B. Chandler[3], Mike L. Conner[4], Karl V. Miller[3], and Michael J. Cherry[1]. (1)*Fish and Wildlife Conservation, Virginia Polytechnic Institute and State University, 310 West Campus Drive, Blacksburg, VA 24061. (2)Florida Fish and Wildlife Conservation Commission, 1105 SW Williston Road, Gainesville, FL 32601. (3)Warnell School of Forestry and Natural Resources, The University of Georgia, 180 E Green St, Athens, GA 30602. (4) Joseph W. Jones Ecological Research Center, 3988 Jones Center Drive, Newton, GA 39870.*

Extreme weather events can have dramatic impacts on biological systems. However, little information exists on how large mammals cope with such events. Hurricane Irma, hit southwest Florida on September 10, 2017 where we were monitoring 84 white-tailed deer (*Odocoileus virginianus*; hereafter deer) with GPS collars. The eye of hurricane Irma passed within 13 miles of our study area bringing 11.74 inches of rain and sustained winds of 134 mph. We utilized this opportunity to examine survival, movement patterns, and habitat selection of deer during such an event. No collared deer died during the storm. Deer movement patterns differed by sex, but habitat selection did not. Movement rates of females were 49% greater during the storm ($p = 0.003$) compared to a seven days before and after the storm, while males did not significantly alter movement rates ($p = 0.58$). Further, 64% of females and 14% of males left their seasonal home ranges during the storm; home range size was not a determinant as to whether deer left their seasonal home range, rather this behavior was sex specific. On the day of Hurricane Irma, deer selected pine-dominated uplands, and avoided freshwater marsh and wet prairies. To our knowledge, this study is the first to use GPS collar data to elucidate survival, movement rates, and habitat selection by deer during a hurricane. More broadly, our results demonstrate the resiliency of a species that inhabit frequently disturbed ecosystems.

BAT AND INSECT RESPONSES TO SHELTERWOOD AND PATCH CUT HARVESTS IN APPALACHIAN HARDWOOD FORESTS

Phillip L. Arant*, Michael J. Lacki, John M. Lhotka, and Jeffrey W. Stringer. *Department of Forestry and Natural Resources, University of Kentucky, Lexington, KY 40546.*

Activity patterns of bats and insect communities are influenced by horizontal and vertical structure in their foraging environment. Shelterwood and patch cut harvests change these features, altering the structural arrangement and density of clutter from its original state. Two approximately 120-ha sites in eastern Kentucky, Kentucky Ridge State Forest and a site on private timber land, were harvested with a 40-ha shelterwood and 40-ha set of patch cuts performed in each. The remaining 40-ha parcels served as un-harvested units. We monitored shifts in bat activity with SM3 acoustic detectors, and changes in insect communities using light traps to sample primarily Lepidopteran and Coleopteran diversity. Light traps were placed at mid-slope points in shelterwood harvests and patch cuts and compared to the un-harvested sample. Bat detectors were placed at ridgetop, mid-slope, and riparian points in shelterwood and control habitats and ridgetop and mid-slope points in patch cuts. Bat calls were assigned to most likely species using Kaleidoscope software. Both shelterwood harvests and patch cuts increased bat activity in the vicinity of detectors, with activity increases predominately due to eastern red bats (*Lasiurus borealis*) and big brown bats (*Eptesicus fuscus*). Activity of *Myotis* species remained high in un-harvested areas, but dropped in frequency with shelterwood and patch cut harvests. No difference was observed in total insect abundance, Lepidopteran abundance, and Coleopteran abundance between un-harvested and harvested units. For at least the forests sampled, our data support the premise that habitat structure plays a greater role in affecting foraging behavior of bats than does the relative abundance of insects across habitats.

ACOUSTIC MONITORING TO DETERMINE NORTHERN LONG-EARED BAT (*MYOTIS SEPTENTRIONALIS*) DISTRIBUTION IN IOWA

Julia Baker and Julie A. Blanchong. *Department of Natural Resource Ecology and Management*, *Iowa State University, Ames, IA*

Iowa is a major contributor to wind energy production in the United States and the number of turbines in the state will continue to increase. However, bat fatalities at wind facilities are a significant conservation concern. A collaborative project among USFWS, Iowa Department of Natural Resources, and MidAmerican Energy aims to better understand the potential impact of wind energy development in Iowa on the recently listed northern long-eared bat (NLEB). In 2016 and 2017 summer acoustic

surveys were conducted across 60 counties in central and western Iowa to determine the presence or probable absence of NLEBs within forested areas identified as potentially good habitat. Acoustic methods were also used to monitor the timing and magnitude of NLEB activity during the spring and fall at potential hibernacula in eastern and central Iowa. The greatest numbers of files identified as NLEB calls were recorded in north central Iowa during summer 2016 and 2017. During spring 2016, NLEB calls were first detected in the third week of March. Monitoring began earlier in spring 2017 and NLEB calls were first recorded in the first week of March. In fall 2016, NLEB calls were detected into the last week of November. Monitoring was conducted later into fall of 2017 and NLEB calls were recorded into December. Data from the summer surveys were used to identify areas where NLEBs could be captured to track migration routes using radio telemetry and data from the hibernacula surveys were used to identify sites where video monitoring could help confirm whether NLEB were using the hibernacula sites. Information about where NLEB are present in Iowa, what migration pathways they use, and where they may be hibernating could aid mitigation efforts by allowing wind energy producers to place turbines away from areas that are heavily used by the NLEB.

Current Distribution of Bats in New Hampshire Based on State-wide Acoustic Survey

Sarah A. Barnum, Jamie O'Brien, and Jason Collins. *Normandeau Associates, Bedford, NH 03110; Stowe, PA*

As bat populations of all species face greater pressures due to white-nose syndrome, wind power development, habitat loss, and/or climate change, improved understanding of baseline distributions is increasingly important. Using auto-reviewed acoustic survey data collected from 2015 through 2017, we analyzed the current distribution of New Hampshire's eight resident bat species during the summer season. Our analysis considered 1,635 detector nights, collected at 530 detector locations (average nights/detector = 3.1, range 2-10) along a roughly north-south state-wide transect, representing 42 towns, and 8 of the State's ecoregions. Species and number of species detected were mapped by detector, town, and ecoregion. The influence of number of survey nights on number of species detected was examined at each scale. The influence of elevation and latitude was examined at the detector scale. *Eptesicus fuscus* was most commonly detected (35% of detectors), while *Myotis septentrionalis*, *M. leibii*, and *Perimyotis subflavus* were least common, detected at 8%, 2% and 1% of detectors, respectively. *M. lucifugus, Lasiurus cinereus*, *L. borealis*, and *Lasionycteris noctivagans* were recorded at 29%, 29%, 31%, and 23% of detectors, respectively. Although survey effort varied by year, this pattern of relative species abundance was reflected for each survey year. At least 1 bat species was detected at 56% of detectors, with most (48%) detecting from 1 to 4 species. No single detector recorded more than 7 species; 2 towns and 3 ecoregions had all 8 species. Number of survey nights did not appear to influence the number of species recorded at any scale. Both latitude and elevation appear to have a negative influence on number of species recorded at a detector. However, the distribution maps suggest that each of NH's bat species continues to occur throughout the State, with even the rarest species widely detected.

BATS ACROSS THE SPACE-TIME CONTINUUM – A THEORY OF RELATIVE ACTIVITY

Elaine Barr*, Alex Silvis, W.M. Ford. *Department of Fish and Wildlife Conservation, Virginia Tech, Blacksburg, VA 24060 (EB); RES, Warrenton, Virginia, 20187 (AS); U.S. Geological Survey, Virginia Cooperative Fish and Wildlife Research Unit (WMF)*

For many bat species, populations generally have declined in a consistent pattern with spread of whitenose syndrome (WNS). Nonetheless, the realized impacts have varied within states or geographic regions owing to the vagaries of landscape composition, environmental conditions, bat species distribution, and community assemblage. Together these factors complicate "one size fits all" survey guidelines for Indiana bat (*Myotis sodalis*) and northern long-eared bat (*Myotis septentrionalis*) monitoring. Our goal was to better characterize the variability of region and landscape within region as well as geographic/temporal relationship to WNS on bats to inform future management efforts. Accordingly, we monitored 36 fixed acoustic stations in matched upland forest canopy gaps, forested riparian corridors and forest/field edges from the Atlantic Ocean to the Mississippi River Valley across Virginia, West Virginia, Ohio and Kentucky from 15 May to 15 August, 2017. As expected, myotid activity was higher in riparian corridors, with upland forest canopy gaps equally important for the northern long-eared bat. Location along the time-since-WNS gradient had a significant impact on relative activity of most affected species. Relative activity of northern long-eared and Indiana bats was higher in the first third of the sampling period, whereas activity levels for less WNS-impacted and/or migratory species were higher in the middle or late summer. The former may provide additional evidence of earlier maternity colony formation followed by earlier colony dissolution and unsuccessful reproduction.

FIRE-ADAPTED? RECREATING HISTORICAL FIRE REGIMES MAY BENEFIT AN ENDANGERED BAT

Elizabeth C. Braun de Torrez, Holly K. Ober, and Robert A. McCleery. *Department of Wildlife Ecology and Conservation, University of Florida, Gainesville, FL 32611*

Fire suppression has altered ecological communities globally. Prescribed fire regimes strive to restore function to these fire-dependent ecosystems by mimicking natural fire regimes. Although fire frequency is a widely acknowledged component of fire regimes, the importance of fire seasonality for biodiversity is unclear. In subtropical Florida, fire historically occurred primarily at the transition from the dry to wet season (early wet) when dry fuel accumulation coincides with a high incidence of lightning. We investigated the effects of fire frequency and season on endangered Florida bonneted bats (*Eumops floridanus*), a species endemic

to a region that evolved with frequent fires. We surveyed bat activity acoustically in 149 sites, and evaluated the effects of fire frequency for all burns, and for burns conducted during three seasons (dry, early wet, wet), using burn records from the previous 18 years. Variation in bat activity was best explained by both fire frequency and season: bat activity decreased with early wet season burn interval and increased with dry season burn interval. Bat activity and foraging activity were highest in sites burned at 3-5 year intervals during the early wet season. Fires during the historic fire season at this moderate frequency may lead to optimal effects on bat habitat through increases in roost, flight space, and insect prey availability. We suggest that Florida bonneted bats are fire-adapted and benefit from prescribed burn regimes that closely mimic historical fire regimes, and encourage consideration of both fire frequency and seasonality when managing ecosystems with fire.

IMPACTS OF WNS ON A PRIORITY ONE INDIANA BAT HIBERNACULA.

Timothy C. Carter, Joseph A. Kath, and Bradley J. Steffen. *Department of Biology, Ball State University, Muncie, IN (TCC); Endangered Species Program, Illinois Department of Natural Resources, Springfield, IL (JAK).*

Magazine Mine was abandoned in 1980; it was first discovered being used by bats in 1998. At that time hibernating bats were documented and a survey was scheduled. In 1999, an official survey documented about 9,000 Indiana bats (*Myotis sodalis*). Continued biannual surveys documented a rapid increase in hibernating population of Indiana bats. By 2011 the population has increased to an estimated 45,000+. Unfortunately, liability concerns prevented access to the site for further surveys. In 2017, the site was acquired by the Organization for Bat Conservation. With that acquisition, surveys were again allowed at the site. In Feb 2018, Magazine Mine was surveyed for the first time since 2011. It also represents the first survey of the site since WNS has affected bats in Illinois. WNS was first documented in Illinois in 2013. Magazine Mine and all of Southern Illinois had multiple documented cases by 2014. The structure of Magazine Mine and similar microcrystalline silica mines promotes a dryer hibernation environment than other sites. It has been hoped that the conditions within these mines including Magazine Mine would minimize the effect of the WNS fungus on bats and therefor increase survival.

CLASSIFIER TEST REDUX: SIGNAL ANALYSIS SOFTWARE AS SURVEY TOOLS FOR DETERMINING *MYOTIS* SPECIES OCCUPANCY

J.D. Chenger and J.D. Tyburec. *Bat Conservation and Management, Inc., 1263 Claremont Road, Carlisle PA 17015; Bat Survey Solutions, LLC., P.O. Box 86493, Tucson AZ 85754*

Bat detectors may seem an easy, efficient, and effective way to sample for species occurrence without the time, energy, effort, and training involved in identifying bats in the hand. Some permitting agencies have promoted acoustic surveys for bats and have developed guidelines for their implementation. Many researchers have applied these protocols far beyond their intended or perhaps practical use. These guidelines rely heavily upon advances in the automatic classification of echolocation recordings provided by relatively newly developed signal analysis software programs, yet few attempts have been made for cross comparisons among programs. The most well known effort by the US government tests eleven, but is mainly concerned with only two, of the more than forty US bat species. This point is sometimes lost on researchers who may apply auto-classification to bat surveys without full knowledge of their limitations. Suboptimal field recordings where conditions are noisier and call quality is worse than the library files classifiers are built upon may contribute to the presumed classifier performance not reflecting the true accuracy, particularly with Zero-Cross data most classifiers use. While full spectrum recording reduces issues classifying noisy data, to date few if any tests have been presented analyzing full spectrum recordings. Comparing classifiers requires sets of species-known recordings, most of which come from handreleased or known bats tracked and recorded in ways that may not provide natural call variants as recorded from unfettered bats in actual field settings. Sets of recordings made in natural situations with a strong inference of known species, for example down flight from a known roost, can circumvent such limitations and uncertainties and provide useful comparative tests of classifier performance. We will present comparative classifications from sets of recordings recorded in situations with known species presence from a variety of locations across North America.

NORTHERN LONG-EARED BAT SUMMER ROOST SELECTION ON COASTAL PLAIN SOUTH CAROLINA

Kristi Confortin and Dorothy Brown. *Ecological Solutions Inc., 630 Colonial Park Drive, Suite 200, Roswell, Georgia, 30075.*

Historically, northern long-eared (*Myotis septentrionalis*) bats were only documented in Greenville, Oconee, and Pickens Counties in upstate South Carolina. However, in the fall of 2016 two northern long-eared bats, an adult female and sub-adult male, were captured in Beaufort County in the coastal plain of South Carolina. Then, in 2017, Ecological Solutions documented a population of this bat species while conducting a research project for Central Electric Power Cooperative Inc. within the Francis Marion National Forest (FMNF). From June-August, Ecological Solutions surveyed 30 sites for a total of 60 net nights in two counties (Charleston and Berkeley) associated with the FMNF. Nine northern long-eared bats (4 adult females, 3 adult males, 1 juvenile female, and 1 juvenile male were captured and tracked to 30 roost trees. Although, large portions of FMNF are intensively managed monoculture pine stands for timber sales and as red cockaded woodpecker (*Picoides borealis*) habitat, there are large areas of mature mixed pine, hardwood forest, and hardwood riparian forest. Of the thirty roost trees documented, 20 roost trees were live pine species including loblolly pine (*Pinus taeda*), longleaf yellow pine (*Pinus palustris*), and shortleaf pine (*Pinus echinate*).

Intensively managed, open pine forests are not typically associated with northern long-eared bats as preferred roosting or foraging habitat; however, within the FMNF, many of the transmitted northern long-eared bats were tracked to this habitat type and roosted in live pine trees. As observed, this area provides suitable habitat to support a northern long-eared bat population and may be crucial for this species. However, additional data collection is needed in order to more fully describe the behavior and activity of these disjunct costal populations in managed forest.

DIURNAL ROOSTS AND FORAGING ACTIVITY OF NORTHERN LONG-EARED BATS (*MYOTIS SEPTENTRIONALIS*) AT TWO WIND ENERGY DEVELOPMENT PROJECTS IN SOUTHWESTERN PENNSYLVANIA

Scott M. Conover, Jason P. Ritzert, Benjamin T. Hale, and Grant P. Gardner. *Western Ecosystems Technology, Inc., Lemoyne, PA.*

Summer maternity season surveys during the pre-construction phase of wind energy development provide valuable data on the summer activity of resident bat species. Data yielded by these studies give stakeholders a snapshot of habitat utilization in the context of planned development. We captured a total of 12 northern long-eared bats (*Myotis septentrionalis;* MYSE) at two proposed wind farm locations in Somerset County, Pennsylvania during the 2015 and 2016 summer maternity seasons. Nine MYSE (eight females and one male) were outfitted with radio transmitters and tracked to 28 diurnal roosts using radio telemetry. Foraging movements were tracked with mobile telemetry stations during 21 nights. Nightly minimum convex polygons (MCP) and 95% fixed kernel utilization distributions (UD) were calculated for each tracked individual. All diurnal roosts were located in trees with 43% of roost locations in black locust (*Robinia pseudoacacia*). We compare 18 nightly UD and MCP from 8 bats which varied widely among individuals and between sampling locations.

THE COLD NEVER BOTHERED US ANYWAY: MIGRATION AND TORPOR OF MID-ATLANTIC BATS

S. M. Deeley*, W.M. Ford, E. Barr, and M. St. Germain. *Department of Fish and Wildlife Conservation, Virginia Tech, Blacksburg, VA 24061 (SMD, EB, MS.); U.S. Geological Survey, Virginia Cooperative Fish and Wildlife Research Unit (WMF).*

With the discovery of overwintering northern long-eared bats (*Myotis septentrionalis*) in eastern North Carolina and southeastern Virginia, we undertook a pilot acoustic sampling effort along the Potomac River and I-95 corridors from the District of Columbia (D.C.) to the North Carolina line from October 2016 to March 2017. At 94 locations, we totaled 12,314 detector nights and identified the presence of 9 species. We modeled nightly activity levels using a kernel density estimator across fall, winter and spring seasons. Relative activity levels were highly variable among bat species and trends in activity from north to south during the fall and then south to north during the spring were evident; all species showed some level of activity throughout the duration of the survey effort. During the winter period, southeastern myotis (*Myotis austroriparius*), little brown bat (*Myotis lucifugus*), northern long-eared bat (*Myotis septentrionalis*) and Indiana bat (*Myotis sodalis*) activity was concentrated in southeastern Virginia, complimenting recent acoustic and mist-net capture findings in eastern North Carolina. Although low, some northern long-eared bat activity was recorded throughout fall, winter and early spring as far north as D.C. metro area. Relative bat activity for eastern red bats (*Lasiurus borealis*) and silver-haired (*Lasionycteris noctivagans*) bats shifted from mid-Virginia to southcentral Virginia between the fall and winter. Throughout the study period, big brown bat (*Eptesicus fuscus*) activity remained highest in D.C. and to the northwest along the tri-state Potomac River corridor. Hoary bats (*Lasiurus cinereus*) relative activity showed similar pattern around D.C. but with an additional activity center during the fall and spring in the southwestern portion of the Fall Line. Because caves and mines are absent from this region's geology except for areas northwest of D.C., acquisition of data on overwintering day-roosts or aberrant hibernacula should a conservation priority in Virginia and the surrounding mid-Atlantic.

POST-WNS NORTHERN LONG-EARED BAT DAY-ROOSTS IN A RESIDUAL POPULATION

Jesse L. De La Cruz1*, Ryan L. Ward2, Eric S. Schroder2, W. Mark Ford3,4, Elaine Barr3, Tomas Nocera3. *1Conservation Management Institute at Virginia Tech, 1900 Kraft Drive, Suite 250, Blacksburg, VA 24061. 2AllStar Ecology LLC, 1582 Meadowdale Road, Fairmont, WV 26554. 3Department of Fish and Wildlife Conservation, College of Natural Resources and Environment, Virginia Tech, Blacksburg, VA, 24060. 4US Geological Survey, Virginia Cooperative Fish and Wildlife Research Unit, Blacksburg, VA 24061.*

White-nose Syndrome (WNS) impacts have been most severe for the northern longeared bat (*Myotis septentrionalis*). Although pre-WNS knowledge about day-roost use and roostarea size in the Northeast, Appalachians and Ohio Valley is high, post-WNS day-roost characterization is limited by lack of captured bats. At present, however, there appears to be a substantial residual population of northern long-eared bats in the upper Ohio River Valley. Accordingly, we have opportunistically radio-tagged northern long-eared bats in this region to determine if day-roost characteristics e.g., tree species, slope position, have changed since the onset of WNS. In 2015, 2016 and 2017, we mist-netted and radio-tagged northern long-eared bats in Monroe and Noble counties in Ohio and Doddridge, Harrison, Marshall, Ritchie and Tyler counties in West Virginia to examine day-roost type and roost area extent. Of the 50 dayroosts located, we observed use of 13 tree species, an unidentified snag, and a telephone pole. The majority of day-roost found (60%) were in either red maple (*Acer rubrum*; *n* = 16) or sassafras (*Sassafras albidum*; *n* = 14) trees or snags and averaged 23.2 ± 13.1 cm. in diameter. Mean colony roost-area extent based on 9 minimum convex polygons was 1.69 ± 2.0 ha. Based on roost locations, and *n* = 3 roost triangulations, MAXENT analyses (AUC = 85.6 ± 2.5) characterized highly suitable day-roost habitat as mid-aged to older (≥ 50 yr.) hardwood forest patches of at least 100–200 ha at elevations of 300-365 m on southwest

to northwest slopes. High (81–100%) and medium-high (61–80%) roosting-habitat suitability classes were uncommon across the landscape (2.4% and 7.1%, respectively), with the broad medium-to-high classes (41–100%) collectively comprising 27.7% of the region. Overall, day-roost type and landscape position were similar to those reported for northern long-eared bats elsewhere in the Ohio River Valley and Appalachians pre-WNS suggesting that management efforts using pre- WNS data still have conservation relevance in the region for northern long-eared bats.

CAN AUTOMATED SOFTWARE TELL BATS FROM FLYING SQUIRRELS?

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Automated bat call identification software has expedited the processing of the copious amount of call files collected during ultrasonic acoustic surveys. These software programs determine which call files have tonal qualities and subsequently identify those call files to bat species using classifiers specifying call parameters. Although ultrasonic calls of bats have been studied extensively, ultrasonic calls of other mammals, such as flying squirrels (*Glaucomys* spp.) have been recently discovered and classified. Flying squirrels call between 7-25 kHz. The majority of bat species produce ultrasonic calls ≥30 kHz. However, hoary bats (*Lasiurus cinereus*) produce calls between 15-39 kHz, some of which have a similar shape to common flying squirrel calls. Since automated call identification does not exist for flying squirrels, we have identified acoustic files by hand, separating flying squirrel calls from bat calls. We used visually confirmed flying squirrel and bat calls to test to see if three automated bat call software programs (SonoBat, Kaleidoscope, and EchoClass) misidentified flying squirrel calls as bat calls.

AIRPORT EXPANSION AND ENDANGERED BATS: DEVELOPMENT AND MITIGATION NEAR THE INDIANAPOLIS INTERNATIONAL AIRPORT

Timothy J. Divoll1* and Joy M. O'Keefe1. *1Indiana State University, Center for Bat Research, Outreach, and Conservation, Terre Haute, IN 47809.*

Economic prosperity and globalization are major drivers for development of international airports, but aviation-oriented businesses and residential development are by-products of airport business models. To address the habitat needs of endangered wildlife species, it may be necessary to mitigate for airport expansion and associated development projects. We analyzed foraging data from 57 Indiana bats (*Myotis sodalis*) during three time periods (1998–1999: premitigation; 2005–2006: during mitigation, and 2014–2016: post-mitigation) of a long-term study near the Indianapolis International Airport. At this site, both developed and forested land cover increased between 1998 and 2016 (34.1% and 3.3%, respectively). Mitigation actions included converting 323 ha of residential lots back to forest, and creation of a 56 ha wetland and an 85 ha multi-use park. With a weighted compositional approach, we related bat use of landscape cover types to changes in land cover during each period. We then compared competing hypotheses to explain changes in bat foraging space use with an information theoretic approach. With the addition of a major highway interchange within the bat colony's foraging area, bats increased space use, presumably in search of new habitat. In all periods, bats selected for forested habitat; as trees in replanted forest and designated parks matured, bats reduced their foraging ranges. Restoring hardwood forest, creating wetlands, and setting aside parklands were effective proactive mitigation measures for the colony of Indiana bats near the Indianapolis International Airport. Similar actions should also benefit other wildlife where human development and habitat needs intersect.

USING CITIZEN SCIENTISTS AND CAMERA TRAPS TO SURVEY FOR EASTERN SPOTTED SKUNKS IN ALABAMA

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Eastern spotted skunks (*Spilogale putorius*) have significantly declined in abundance across their range over the last half century. In Alabama, eastern spotted skunks are a state-protected species of high conservation concern and appear to be relatively rare. Given their secretive and noxious habits, little is known about their basic natural history and distribution in the state. Our objective was to conduct a statewide survey during 2017 in Alabama to determine the distribution and landscape associations of eastern spotted skunks. We collaborated with local land managers to deploy 209 camera traps across public lands in Alabama. We also encouraged the general public to report sightings of skunks through social media and iNaturalist.org. Camera trap surveys only detected 2 eastern spotted skunks, whereas citizen scientists reported 20 sightings, the majority of which included coordinates and a picture. Eastern spotted skunk sightings occurred across the state suggesting the species is still widely distributed, but likely rare in abundance. Sightings of live animals primarily occurred in forested areas throughout the state and at higher elevations north of the fall line. Our results highlight the effectiveness of citizen scientists in documenting rare and elusive species compared to more intensive survey efforts by professional scientists.

FINE SCALE HABITAT SELECTION BY EASTERN SPOTTED SKUNKS IN THE SOUTH CAROLINA APPALACHIANS.

Robin Y. Eng*, David S. Jachowski. *Clemson University, Clemson, SC 29634.*

For many years eastern spotted skunks (*Spilogale putorius*) were considered locally extinct in South Carolina. In 2015, an extant population was discovered in the northwestern corner of the state where the Appalachian mountains drop off into the foothills of South Carolina. During the summers of 2016 and 2017 we used ground-based VHF radio-telemetry to track 15 spotted skunks (10 males, 5 females) to their precise daytime resting sites in the South Carolina Appalachians. We performed a discrete choice analysis to evaluate fine scale habitat selection of eastern spotted skunks by collecting vegetation and topographic habitat data at both the identified rest sites and a "paired-available" site within a nightly-traversable distance for spotted skunks (50-250 meters). Over the course of two summers we identified 226 rest sites at 198 unique locations (12% re-use). We observed that 62% (n=140) of sites were in underground burrows, 27% (n=61) were located in tree cavities, and 10% (n=22) were in fallen logs or coarse woody debris (CWD). Only two sites were found in rocky outcrops, and one rest site was found in an above ground stick pile. Results from our discrete choice analysis indicate that spotted skunks in this region prefer areas with high understory cover, which is consistent with several previous studies of eastern spotted skunks in other portions of their range. We also found that spotted skunks preferred sites nearer to ravines or drainages and areas with a higher abundance of CWD. Our findings suggest that drainages could represent travel corridors and preferred foraging habitat, particularly where there is abundant understory cover and CWD which likely provide cover from avian predators and access to protective rest site structures. These findings also suggest that for eastern spotted skunks, current management aimed at reducing understory complexity and accumulated CWD may actually be detrimental.

IMPACTS OF RECENT HURRICANES TO THE ENDANGERED ANASTASIA ISLAND BEACH MOUSE (*PEROMYSCUS POLIONOTUS PHASMA*)

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The Anastasia Island beach mouse (AIBM; *Peromyscus polionotus phasma*) occurs only in St. Johns County, along the Atlantic coast of Florida, and is federally listed as Endangered. The current range of the AIBM is limited to Anastasia Island, where most potentially suitable habitat occurs in Anastasia State Park (ASP), at the northern end of the island, and approximately 16 km south in Fort Matanzas National Monument (FMNM), at the southern end of the island. On 7 October 2016, Hurricane Matthew moved north along the Atlantic coast of Florida causing major flooding, wind damage, and erosion along the east coast, producing extensive degradation and destruction to the dune habitats occupied by AIBM. Assessments of AIBM immediately after the hurricane found no signs of mice in FMNM; AIBM were found at ASP, though only in areas farthest inland from the ocean. Post-hurricane trapping surveys at ASP did not detect AIBM in October 2016 or March 2017. As concerns over the status and persistence of AIBM increased, we initiated a supplemental feeding and monitoring project at both ASP and FMNM in May 2017. AIBM detections increased from 6% in May to 40% in July at ASP and from 0% in May to 80% in July at FMNM. However, recovery of the AIBM populations and their habitat was set back on 10 September 2017 when Hurricane Irma hit Florida. Again, Anastasia Island experienced heavy flooding and storm surge which caused further loss of dune habitats. To better evaluate the scope and impacts from these hurricanes to the AIBM populations and their habitats, we are implementing an occupancy-based monitoring protocol to investigate population trends for this species at both ASP and FMNM.

PROMOTING ACTIONS TO CONSERVE BATS—BATCONSERVATIONALLIANCE.WIKIDOT.COM

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One of the challenges facing conservation scientists is ensuring their information reaches managers undertaking conservation actions. Many practitioners do not stay current with scientific literature and, even if aware of new research, may not link the results to management actions. The North American Bat Conservation Alliance (NABCA) was formed to facilitate coordination and communication among parties interested in bat conservation in North America. To support this mandate, as a first step, we worked with the bat community to identify and assess threats to bat populations. A publication describing the results of this process is currently in preparation. As a second step, we launched a Wiki (http://batconservationalliance.wikidot.com/) to share information on ways to address threats to bats. A Wiki is a website where any member of the community (including general public) can register and enter or edit existing information (the best known example being Wikipedia). The NABCA Wiki is organized based on IUCN threat classifications, with a brief overview of each threat and its potential importance. The main feature is a flexible area for discussing and sharing information on ways to address these threats. As with Wikipedia, users are encouraged to contribute new information as well as review, correct or augment existing information. Ideally, information will be presented in

easy to read summaries with links to more detailed documents or scientific literature. Scientists could highlight implications of their recently published research; managers could describe what worked (or didn't). Contributors are encouraged to present different perspectives, to recognize uncertainty, and to provide links to evidence in support of a perspective. The success of this venture will depend on whether the scientific community uses it to share information, and whether the conservation community finds it useful to identify options and actions to conserve bats.

EVALUATING PATTERNS IN BAT OCCUPANCY AND RELATIVE ACTIVITY ACROSS TOPOGRAPHIC CLASSES AT MARINE CORPS BASE QUANTICO AND PRINCE WILLIAM FOREST PARK

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A priori identification of bat travel corridors and foraging areas can help improve the efficiency of both acoustic and mist-net survey efforts. Because most research has shown that riparian corridors and bottomland areas typically contain the highest levels of bat activity on most landscapes or that distance to water is an important correlate to activity, more nuanced understanding of landform topography influence on bats merits investigation. To examine this, we characterized Marine Corps Base Quantico and Prince William Forest Park, located along the Fall Line in northeastern Virginia, into three landform classes: concave/sheltered, flat/transitional, and convex/exposed using landform index within a GIS and placed numerous zero-crossing/frequency division acoustic detectors within each class in the summer of 2017. We used Kaleidoscope Pro to identify echolocation pulses to species to compute site/night occupancy and nightly relative activity values. Results from generalized linear mixed models showed that Myotid bats, i.e., *Myotis austroparius, Myotis lucifugus* and *Myotis septentrionalis*, had higher levels of activity in concave landform classes. Other species showed similar trends, albeit not at a statistically significant level. *Lasiurus cinereus* was most associated with convex (ridge) landform classes. Work combining other landscape and vegetation metrics in conjunction with landform class is ongoing.

SPATIAL DISTRIBUTION OF INSECT-DERIVED NUTRIENTS AT MAMMOTH CAVE NATIONAL PARK

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Nutritional studies have provided evidence that insectivores, including bats, may forage selectively. Although taxonomic selection may be impossible due to acoustic constraints, the ability to differentiate among prey of various sizes is well-established. This may provide adequate opportunity for nutrient-specific foraging. Our objective was to characterize the nutrient composition of insect communities at Mammoth Cave National Park, Kentucky. Insects were collected using 10-W blacklight traps deployed along randomly generated transects. Captured insects were identified to order and counted. We estimated the elemental composition and mean C:N ratio of Coleoptera, Diptera, Hymenoptera, and Lepidoptera collected in each trap on the basis of measurements reported in the literature. We generated maps visualizing mean insect abundance and C:N ratios across the landscape. Moran's I statistic was not significant for the insect abundance dataset ($P = 0.07$) or the C:N ratio dataset ($P = 0.40$). We fit generalized linear mixed models to test for differences in insect abundance and C:N ratio across the landscape. For both models, site was included as a fixed effect and month within year as a nested random effect. Site was a significant predictor of insect abundance for only 2 of 20 land parcels (both $P = 0.01$). For all other sites, $P > 0.05$. Site was a significant predictor of C:N ratio for 2 of 20 land parcels (both $P = 0.04$), neither of which significantly predicted abundance. For all remaining sites, $P > 0.05$. We observed little variation in the elemental composition of insect communities across the dataset. Given these site differences, as well as the observable differences between maps of insect abundance and C:N ratios, our findings suggest spatial patterns in C:N ratio do not reflect the distribution of insects across the landscape and may provide evidence that an optimal bat diet may require selective foraging.

BAT BEHAVIORAL RESPONSES TO WHITE-NOSE SYNDROME AND IMPLICATIONS FOR RESISTANCE AND TOLERANCE

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Years after the onset of white-nose syndrome (WNS), an emerging infectious disease of hibernating bats caused by the fungus *Pseudogymnoascus destructans* (Pd), bat colonies continue to survive in contaminated areas despite episodes of mass mortality. However, the ultimate fate of remnant populations of affected bats remains uncertain, and the future trajectory of these populations may depend upon intraspecific differences in affected bats' behavior and physiology, which may engender differences in pathogen exposure and disease susceptibility. Specifically, it remains unclear to what extent behavioral changes including altered activity levels during hibernation are adaptive and whether they vary with bats' age and previous exposure to the disease. We thus aimed to clarify how bats from different age classes and with varying experience with WNS behaviorally respond to Pd

infection. Using infrared video recordings, we quantified and systematically compared behavioral changes during the hibernation period in response to WNS in juvenile and adult little brown bats (*Myotis lucifugus*) that had been captured from colonies with different WNS experience. Analysis suggests all groups of infected bats initially exhibited increased grooming and overall activity relative to controls, but also seemed to reduce some active behaviors in late winter. These behavioral differences may represent adaptive changes by experienced bats to reduce infection loads while maximizing energy conservation. Investigating how these variables relate to infection severity, WNS mortality, and physiological variables influencing host susceptibility will clarify the influence of behavior on bat responses to WNS and deepen our comprehension of WNS pathogenesis and epidemiology. Such deeper understanding will enable managers to more effectively predict the progression of the disease and its effect on bats over time, and to target individuals most vulnerable to the disease.

IMPLEMENTING NEW METHODS TO ASSESS THE SCALE OF EFFECT OF LANDSCAPE VARIABLES ON OCCURRENCE OF MYOTIS SEPTENTRIONALIS

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The spatial scale at which an environmental variable influences species occurrence (i.e., "scale of effect") is often unknown. Current methods to ascertain the spatial scale of selection focus on buffering sample locations with concentric polygons and selecting the most appropriate polygon size through model selection. However, this process has several problems. First, selecting scales using concentric polygons is contrived, and never achieves a true estimate of scale. Second, every portion of the landscape feature within the polygon is treated as if it has equal influence, when in reality the effect of the landscape feature should decrease as you move away from the sample location. We applied a newly developed method that accounts for these shortcoming to better assess the scale at which landscape variables effect the occurrence of *Myotis septentrionalis* in Georgia. This technique uses weighted kernels to assess the influence of landscape variables based on proximity to sampling locations. Scale parameters of the smoothing kernel and the effect of the variable on occurrence are estimated using maximum likelihood. Results from this approach are compared to models constructed using concentric polygons, where polygon sizes were selected based on biological relevance.

TEN YEARS OF ACOUSTIC BAT SURVEYS: DOCUMENTING TRENDS IN MYOTIS ACTIVITY IN THE NORTHEAST

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Analysis of a long-term acoustic dataset reveals distinct changes in activity of bat species affected white-nose syndrome (WNS) in several northeastern states (ME, NH, VT, NY, PA, WV). We analyzed trends in annual bat activity and determined whether activity decreased as expected after the discovery of WNS in each state, whether these decreases varied in intensity by region, and whether timing of decreases corresponded with the year of discovery. Whereas acoustic data provide limited information on bat population size on a local scale, widespread trends over long time periods can provide evidence of population-level effects of WNS. Such information can supplement quantitative population estimates from winter hibernacula counts, which are known to undercount certain species, and which are limited for some states. As well, current research suggests summer populations of Myotis species have declined at a slower rate than species counted in hibernacula. This study helps clarify regional patterns in bat activity while supplementing hibernacula counts and providing additional spatial coverage, providing new information about the spread of WNS and its devastating effects on the populations of affected species.

DEN SITE SELECTION OF FLORIDA SPOTTED SKUNKS (*SPILOGALE PUTORIUS AMBARVALIS*) IN A DRY PRAIRIE ECOSYSTEM

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The eastern spotted skunk (*Spilogale putorius*) has experienced a major decline since the mid-20th century, and the species is of conservation concern in many states. However, recent research indicates that the subspecies inhabiting peninsular Florida, *S. p. ambarvalis*, is relatively abundant in the endemic dry prairie ecosystem. Previous research has revealed that the subspecies is an important nest predator of the Florida grasshopper sparrow (*Ammodramus savannarum floridanus*), a critically endangered resident of the dry prairie, highlighting a conservation need to better understand spotted skunk ecology in this ecosystem. We studied spotted skunks at Three Lakes Management Area in central Florida to evaluate potential factors influencing den site selection of skunks in this ecosystem (e.g., habitat characteristics, den characteristics, prescribed fire management). In 2016 and 2017, we fitted 36 skunks with radio collars to track them to their den sites. We characterized habitat and den covariates at 757 used sites and 757 unused, available sites. Spotted skunks used five types of den site, but they were seven times more likely to select a mammal burrow over an above-ground den (the second most common site type). Additionally, the odds of a spotted skunk selecting a den site were positively correlated with the amount of visual obstruction, the number of nearby burrows, and the percent of palmetto leaves at a site. The percent of water at a site was negatively correlated with the odds of a skunk selecting it.

This study represents one of the first detailed studies on *S. p. ambarvalis*, increasing our knowledge of this subspecies and allowing for further comparisons with other subspecies. Furthermore, the importance of cover to spotted skunk den site selection will allow us to recommend possible management strategies, such as more intense prescribed fire applications, to mitigate predation pressure on the declining Florida grasshopper sparrow.

A GENERALIZABLE RAPID RESPONSE MODEL FOR REDUCING BAT FATALITIES AND IMPROVING POWER PRODUCTION AT WIND ENERGY FACILITIES

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Migratory tree bats comprise a large proportion of bat fatalities known to occur at North American wind energy facilities, while *Myotis* species, along with other species that do not migrate on continental scales, are also being impacted. However, we know little about the relative impacts of curtailment techniques on bat species that interact with wind turbines. Here we evaluate the performance of a generalizable rapid response model for reducing bat fatalities and improving power production at wind facilities. This study was conducted at a wind energy site in Wisconsin during 2015 and used information derived from a Turbine Integrated Mortality Reduction (TIMR) system that used real-time acoustic bat activity and wind speed data to make curtailment decisions at randomly-selected control turbines (N=10) versus treatment turbines (N=10). We combined searcher efficiency and carcass persistence estimates with carcass data using 3 approaches to fatality estimation: the Erickson et al., the Huso, and the Korner- Nievergelt et al. estimators. Our results show that the TIMR approach significantly reduced fatality estimates for treatment relative to control turbines for pooled data, and for each of 5 species: pooled data (-83.6%); eastern red bat (*Lasiurus borealis,* -84.6%); hoary bat (*Lasiurus cinereus,* -78.1%); silver-haired bat (*Lasionycteris noctivagans,* -98.3%); big brown bat (*Eptesicus fuscus,* -75.0%); and little brown bat (*Myotis lucifugus,* -89.5%). The TIMR approach reduced curtailment time by 48% for treatment turbines relative to estimated production using blanket 7 meter/second curtailment, and increased production by 135 megawatt hours per turbine per season. Although future studies are needed to validate this approach, we conclude that this curtailment model significantly reduced fatalities associated with all species evaluated, each of which has broad distributions in North America and different ecological affinities. We anticipate that this approach is likely to significantly reduce bat fatalities in other ecoregions and with other species assemblages.

TESTING THE MANY-EYES HYPOTHESIS OF INTERSPECIFIC INTERACTIONS: RACCOONS ARE VIGILANCE PARASITES OF DEER

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Vigilance of prey is linked to predation risk, and vigilance creates a tradeoff between foraging and mitigating the risk of being killed. When prey species overlap spatiotemporally, interspecific interactions that affect vigilance and feeding rate may influence fitness of the prey species. Prey should benefit from the presence of more individuals, including those of other prey species, according to the "many-eyes hypothesis." However, few studies have documented mutualistic interspecific shared vigilance among prey species. We used camera traps at standardized forage patches to quantify feeding rates of and the interaction between white-tailed deer (*Odocoileus virginianus*) and raccoons (*Procyon lotor*) at Fort Bragg Military Installation, North Carolina. We predicted that deer and raccoons would increase feeding rate as interspecific group size increased based on the many-eyes hypothesis. In August 2011 – 2013, we collected 51,492 and 9,504 photos of deer and raccoons, respectively; they co-occurred in 2,527 photos. Deer and raccoon feeding rates were positively correlated, indicating they were vigilant to the same risk cues. However, raccoons increased feeding rate 11% in the presence of deer, whereas deer decreased feeding rate 42% in the presence of raccoons. Thus, raccoons apparently benefited from the presence of deer by increasing feeding rate, indicating the many-eyes hypothesis provides a plausible explanation for raccoons. However, why raccoons have an apparently antagonistic effect on deer feeding rate is unknown. Our data indicate that some prey may interspecifically share vigilance even when the interaction is antagonistic to the other prey species.

SEARCHING FOR BAT HIBERNACULA IN IOWA WITH SCENT DETECTION DOGS

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Determining where bats overwinter is challenging due to the fact that suitable habitat includes not only large, obvious caves, but also narrow fissures in rock faces where visual inspection is not feasible, and acoustic monitoring may be overwhelming. Working Dogs for Conservation (WD4C) was contracted to explore detection dogs as a means of adding *scent* monitoring to other available methods. To that end, WD4C trained two dogs to the scent of *Myotis* species with the use of gauze swabs rubbed along the bodies of wild bats, and then live *Myotis* and *Eptesicus* bats. Dogs were fielded in central Iowa late in the hibernation season (February/March 2017) and again in early season (November 2017) at locations ranging from those never-before-scouted, to

those which are known to be frequently used by bats. The dogs located 19 and 16 points of interest in the spring and fall, respectively. At one location the handler visually confirmed two bats flying out of a fissure where the dog had just demonstrated interest. However, during the fall deployment, AnaBat detectors were unable to confirm current bat presence at the points of interest. From these two deployments, we confidently assert that dogs are helpful in narrowing down areas to focus additional monitoring resources. However, if managers want to use conservation detection dogs' points of interest as definitive data points of current presence—without confirmation by other means—there is more work to be done. We have yet to quantify detection (and false positive) rates. WD4C invites and welcomes collaboration that would help quantify this issue, such as pairing with telemetry, or other means to work dogs in a "known" scenario which would be required for quantification. This presentation will discuss the advantages and challenges of the methodology, and offer suggestions for future use.

PSEUDOGYMNOASCUS DESTRUCTANS REMAINS A PROBLEM IN REMNANT _MYOTIS_ POPULATIONS

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Pseudogymnoascus destructans presence was found on 4 of 49 captured *Myotis* bats (2 *Myotis lucifugus*, 2 *Myotis leibii*) as well as a roost site of a lactating female *Myotis leibii*. A juvenile *Myotis leibii*, caught in August, tested positive for *Pd*, which matched deformities and scarring on both ears. The *Pseudogymnoascus destructans* positive results represent 8% of the sampled bats and approximately a 90% increase from bats captured and tested in 2016 (1/108, [<1%]). Similarly, from 2016 to 2017 there was an increase of 10.6% in the number of bats that received a Wing-Damage Score of two or greater. 2017 results suggest that depressed populations of bats remain very susceptible to *Pseudogymnoascus destructans*. We explore relationships to weather, continued use of infected roost sites, and other factors.

NORTHERN LONG-EARED BAT FALL ACTIVITY IN WEST VIRGINIA: WHAT ARE THEY DOING?

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The northern long-eared bat (*Myotis septentrionalis*; MYSE) is listed as a federally threatened species due to declines from white-nose syndrome (WNS). Basic life history data are incomplete, including where the majority of these bats overwinter. We captured and radio-tagged nine MYSE in autumn 2017 in northern West Virginia with the intent to track migrating bats. In September and October, bats were fitted with radio transmitters and tracked using ground-based crews and a Cessna 172 aircraft. Duration of tracking varied per bat. We found bats to forage predominately within deciduous forests with average foraging areas of 305.5±90.3 ha and 74.7±20.6 ha for 95% and 50% kernel analysis, respectively. Bats roosted mainly in live maple trees (*Acer* sp.). On two occasions, two individual bats were not heard during aerial day searches but were heard at night foraging within their typical foraging areas suggesting that bats may have been roosting in rock shelters. We did not document any bats migrating during the project which concluded on 11 October. The signals for two bats were lost on nights when ground crews were deployed because weather prevented the plane from flying. These signals were not heard the following days during ground and aerial searches, so bats could have gone into hibernacula on these nights with inclement weather. It is inconclusive if the remaining tagged bats were going to migrate since four bats were still fitted with active transmitters on the last day of the project. It is possible that these bats do not migrate in this region of WV and instead, use rock features within their summer grounds. Additional research is needed later in the fall to determine if MYSE migrate to overwinter hibernacula, or if they choose alternate hibernacula such as rock crevices.

STATUS OF A NON-HIBERNATING POPULATION OF _MYOTIS SEPTENTRIONALIS_ IN COASTAL PLAIN NORTH CAROLINA

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When the Northern Long-eared Bat (*Myotis septentrionalis*) was listed as a federally threatened species in April 2015, its distribution and behavior in eastern North Carolina was poorly understood. Although previously well-documented in the Blue Ridge Mountains Region of western North Carolina, *M. septentrionalis* was only recently discovered in eastern North Carolina in 2007. A five-year effort was begun in 2015 to better understand the species' distribution and behavior in eastern North Carolina. I report several new county records of *M. septentrionalis* from the Coastal Plain Region of North Carolina obtained through mist netting efforts in 2015–2018. Captures occurred during all four seasons of the year. I also report the occurrence of non-hibernating winter behavior of *M. septentrionalis* in the Coastal Plain of North Carolina. Transmittered *M. septentrionalis* were tracked through all months of winter and were observed utilizing multiple tree roosts. This portion of the state is nearly devoid of caves or mines suitable for hibernacula, but also experiences milder winters in comparison to most of the species' range. Without dependence upon caves or mines for hibernation, this population of *M. septentrionalis* is less likely to experience mortality from white-nose syndrome (WNS). The lack of mist net captures within the Piedmont Region of North Carolina suggests geographically disjunct populations of *M. septentrionalis* in North Carolina, with most of the centrally-located Piedmont separating the WNS-affected population in the west from the non-WNS-affected population in the east. This hypothesis is supported by North American Bat Monitoring Program acoustic data which suggest little to no presence of *M. septentrionalis* in most of the Piedmont of North Carolina.

TROPHIC NICHE PARTITIONING WITHIN A POST-WHITE-NOSE SYNDROME BAT COMMUNITY IN WESTERN KENTUCKY

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The decline of cave-dwelling bats since the introduction of white-nose syndrome (WNS) to North America led to changes in community interactions as evidenced by spatial and temporal partitioning investigations. Indirect effects, such as disease-mediated competition at the community level, can influence the ability of imperiled species to recover because of competitive exclusion. To further investigate community structure following WNS, we assessed the diet of sympatric species with differential WNS susceptibility using molecular techniques. In western Kentucky, *Perimyotis subflavus* (susceptible) populations severely declined following WNS occurrence. Conversely, *Nycticeius humeralis* (non-susceptible) populations increased markedly. We collected guano from *N. humeralis* (n=37) and *P. subflavus* (n=9) captured in mist nets during summer 2016. Arthropod DNA was extracted from the guano and a 157-177 bp target region of insect-COI was amplified. Sequences were analyzed to the lowest taxonomic level provided by the online Barcode of Life Database. *Nycticeius humeralis* consumed 184 genera belonging to 12 arthropod orders, while *P. subflavus* ate 90 genera from 7 arthropod orders. Coleoptera and Diptera were the most commonly consumed prey items for both bat species. All orders consumed by *P. subflavus* were also eaten by *N. humeralis*. There was high interspecific dietary niche overlap observed at the ordinal level, however, there was not a significant overlap observed at the MOTU level. These data contribute to our understanding of the prey requirements of an imperiled and expanding bat species, post-WNS bat community structure, and the value of molecularly derived diet data.

Activity patterns of bats at Shenandoah National Park

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Considering bats' euthermic nature, high energetic demands, and interspecific competition, differential utilization of complex, mountainous landscapes among species seems plausible. To investigate potential spatiotemporal activity trends of bats in the central Appalachians, we conducted acoustic survey at Shenandoah National Park by deploying detectors in 5 transects of 6 sites each oriented by elevation (high >985m, mid 800-985m, and low <800 m) and aspect (xeric - 157.5-292.5° and mesic - 0-112.5°; 337.5-0°) from May-August in 2016 and 2017. Generalized linear mixed models revealed significant interactive effects of Julian date and elevation on nightly activity for: big-brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), hoary bat (*L. cinereus*), little brown bat (*Myotis lucifugus*), northern long-eared bat (*M. septentrionalis*), Indiana bat (*M. sodalis*), and tricolored bat (*Perimyotis subflavus*). Activity of northern long-eared bats was highest at mid elevations, peaking from late-June to late-July. Indiana and little brown bat activity exhibited similar trends being greatest at high elevations with bimodal peaks in the first and third weeks of June. Tricolored bat activity was most dynamic, showing peaks in activity at low elevations in mid-May, high elevations in July, and low elevations in mid-August. Big brown bat activity was greatest at high elevations, peaking in late July; eastern red bat activity was greatest at mid elevations with a sharp peak in the last week of June; and hoary bat activity showed a sharp peak at high elevations at the end of May. Further analysis will include aspect and weather in modeling activity, as well as examination of hourly activity.

ROOST SELECTION OF SOUTHEASTERN MYOTIS IN AN OLD-GROWTH BOTTOMLAND HARDWOOD FOREST

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Little is known about the roosting habits of southeastern myotis, *Myotis austroriparius*, in Coastal Plain forests. Our objective was to quantify characteristics of roosts selected by southeastern myotis in Congaree National Park, an old-growth bottomland hardwood forest in the Upper Coastal Plain of South Carolina during Winter (November-March) 2015-16 and 2016-17 and Summer (May-August) 2015 and 2016. We located roosts through opportunistic cavity searches and tracking radio-tagged bats to roosts. We quantified tree characteristics, the herbaceous layer in front of the cavity opening, the surrounding vegetation, canopy closure, and cavity opening size of roost and random trees. We ran logistic regression models to test which characteristics were the most important for distinguishing all roosts versus random trees, winter roosts versus summer roosts, summer roosts versus random trees, and winter roosts versus random trees. Although we located many canopy roosts during the study, our analyses were conducted only on roosts with basal cavity openings. There were no significant differences between winter and summer roosts or between winter roosts and random trees. Tree stand composition, percent herb cover in front of the cavity opening, and canopy closure were not significantly different between all roost and random trees. However, roost trees had significantly smaller cavity opening areas than random trees (P = 0.006), significantly larger diameter at breast height (P =0.016), and smoother cavity interior texture (P = 0.062). Cavity opening area and diameter at breast height also differed significantly between summer roost

and random trees (*P* =0.024 and *P*= 0.039, respectively). This suggests that roosts are selected for their cavity properties rather than for their surrounding habitat, perhaps to decrease risk of predation, improve thermoregulation, and provide larger spaces for maternity aggregations.

DRONES FOR RECORDING BATS: CHALLENGES, RESULTS, AND ETHICAL CONSIDERATIONS

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Brazilian free-tailed bats form large maternal colonies numbering in the millions across Unmanned aerial vehicles (UAVs) are becoming popular for wildlife monitoring, but direct recordings of animal vocalizations have not been accomplished, likely due to the noise generated by the UAV. Echolocating bats, especially *Tadarida brasiliensis,* are good candidates for UAV recording due to their high-speed, high-altitude flight. We developed a UAV system that physically isolates UAV noise so we can record, with 3D maneuverability, ultrasonic audio and spatial thermal data of bat flight at altitude. We tested the noise of our UAV with various payloads and microphone configurations to characterize the ultrasonic noise of our system, physically isolate drone noise from the microphone, and maximize UAV flight performance. Over 84 minutes of recordings, we captured 3,847 echolocation signals from bats with corresponding thermal data of bat flight. Furthermore, this first documented successful recording of animal sounds in their natural habitat demonstrate that UAVs can be important tools for bioacoustic monitoring, and we discuss the ethical considerations for such monitoring.

UNEXPECTED USE OF ANTHROPOGENIC STRUCTURES AND URBAN AREAS BY THE NORTHEN LONG-EARED BAT

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The Vermont Agency of Transportation (VTrans) intends to replace two deteriorated bridges over a railroad in Addison County, Vermont. VHB completed three consecutive nights of acoustic monitoring and exit surveys at the bridge locations during July 2016 to determine the presence/ probable absence of bridge-roosting bats. Exit surveys revealed that between one and six bats emerged from each bridge during every survey night. The times of emergence observations were correlated with the time stamps of echolocation calls, which suggested that Indiana bats, northern long-eared bats and/or little brown bats were present. Due to ongoing deterioration of the bridges and the related public safety concern, the bridges were scheduled for emergency demolition in the summer of 2017. Accordingly, exclusionary measures were deployed to prevent bats from reoccupying the bridges in the preceding spring. The original intended plan to mist-net the bridges to determine which species may be roosting inside of them was therefore not possible. However, the flight corridor beneath the bridges was targeted instead to capture bats flying nearby. Three of the six female northern long-eared bats that were captured in a single night were transmittered and tracked for up to 10 days. Tracking and exit surveys at six newly discovered urban roosts was a collaborative effort between the Vermont Fish and Wildlife Department, VTrans, and VHB. The data collected during this survey effort, conducted in part as mitigation for the unavoidable loss of bridge roosting habitat, supplements the knowledge base for the northern long-eared bat.

DIGITAL ENDOSCOPE: A TECHNIQUE TO MONITOR ARTIFICIAL ROOSTING STRUCTURES FOR BATS

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Bat boxes and other types of artificial roosting structures are becoming more prevalent for project mitigation or conservation measures. Agencies often require follow-up monitoring of these structures to determine occupancy and, if possible, species abundance and composition. Due to the number of structures being installed on the landscape, there is a need to increase monitoring efficiency while also trying to minimize disturbance or stress to roosting bats. Common methods employed for monitoring occupancy include guano inspections, listening for bat vocalizations, and looking up into structures using flashlights. Determining occupancy estimates or species abundance or composition normally requires further investigations, and often include methods such as acoustics, emergence surveys, and/or mist netting. All of these methods have intrinsic strengths and weaknesses, which are heavily influenced by site and environmental conditions, available equipment and manpower, and types of roosting structures. During monitoring efforts in the summer of 2017, GAI Consultants, Inc. (GAI) biologists tested the use of a digital endoscope to inspect the interior of roosting structures in order to visually identify and count bats. Use of the endoscope allowed real-time viewing of the roosting structures and collection of video and photographic data for follow-up verification and documentation. Using a multi-tiered approach that included use of the endoscope, GAI inspected a total of 154 artificial structures (including standard 3-chamber boxes, standard 1-chamber boxes, 1-chambered rocket boxes, and artificial bark poles) and identified a combined total of approximately 100 *Myotis septentrionalis* and *Eptesicus fuscus* occupying the structures. Benefits of endoscope use include portability, applicability among varying structure types, reduced disturbance compared to mist netting, visual documentation of data, and highly increased labor efficiency.

AN INVESTIGATION OF THE NIGHTLY FORAGING PATTERNS OF BATS IN RELATION TO AUDITORY PREDATOR CUES

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The relationship between foraging bats and nocturnal predators is understudied in eastern North America. While there are no known specialized bat predators, evidence of owl predation is documented in the literature. Our study objective was to determine if bats alter nightly foraging activity in response to a perceived predation threat. Full-spectrum acoustic monitoring was used to assess bat activity at a Kentucky Army National Guard installation in the Interior River Valleys and Hills Ecoregion of western Kentucky. Survey locations were selected at sites previously identified in 2016 to have relatively high amounts of bat activity. Replicate detectors were deployed for three consecutive nights across four such sites, with different auditory treatments broadcast from water-proof speakers each night. Treatments were broadcast at 80.5 ± 0.8 dB within 1 m of detectors. Auditory treatments were randomly assigned across survey points nightly and included: owl calls (*Strix varia* and *Bubo virginianus*), ambient noise as a mixture of insect and frog sounds, and a silent control. Treatments were broadcast for 30 sec every 10 min throughout survey nights. Echolocation passes, comprised of five or more individual pulses, were identified using Kaleidoscope Pro. Passes were then sorted into hourly bins (post-sunset). Sampling spanned 36 survey locations, and accounted for 90 detector-nights and 7754 identified bat passes. The total number of bat passes recorded within a survey night did not vary across sites, nor as a consequence of auditory cues or season ($P > 0.05$). Data analyses to date suggest auditory cues did not alter hourly activity patterns of large-bodied bats (*Eptesicus fuscus*, *Lasiurus borealis*) nor small-bodied bats (*Perimyotis subflavus*). Our study implies that bats were not responsive to auditory cues, but did exhibit differential patterns of hourly activity.

LASIURINE BATS AND WIND ENERGY: A UNITED NATIONS-BASED INITIATIVE FOR CONSERVATION AND SUSTAINABLE ENERGY

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Bats of the genus *Lasiurus* are widespread and usually abundant, and they are also severely affected by wind farms. We worked with the government of Peru and international NGOs to have four species listed under Appendix II of the Convention on Migratory Species. After a side event where we presented the urgency to enlist the species, the proposal was presented by Peru in Manila, the Philippines in October 2017 and adopted by consensus. The CMS is a United Nations-based convention with headquarters in Bonn, Germany. It provides a global platform for the conservation and sustainable use of migratory animals and their habitats. CMS brings together the States through which migratory animals pass, the so-called Range States, and provides a legal foundation for internationally coordinated conservation measures throughout the migratory range of particular species. Listing a species in CMS Appendix II means that the parties should prepare and implement agreements covering the conservation and management of migratory species included in it. Given the severe impact wind energy has on this group of species, and the relatively easy and inexpensive mitigation measures, we encouraged parties to the CMS to enact these mitigation measures in a coordinated, cooperative fashion. Several countries pledged immediate action along those lines. This needs to be endorsed, adopted, and enacted across the range of the species, from Canada to Argentina and Chile. Different agreements, from the Trilateral Committee for Wildlife and Ecosystem Conservation and Management to the Convention on Biological Diversity and others provide suitable platforms to join forces across countries to protect these and other species by improving wind energy production practices. Future uplisting into Appendix I, which requires parties to provide immediate protection for migratory species included in it, is not ruled out.

MODELING THE EFFECTS OF WHITE-NOSE SYNDROME ON THE BAT COMMUNITY IN WISCONSIN

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White-nose syndrome (WNS) is a disease of bats caused by an invasive fungal pathogen (*Pseudogymnoascus destructans),* that is traumatically affecting several cave-dwelling species of North America. The disease has spread to numerous counties in Wisconsin since its initial discovery in 2014. The disease has impacted half of the species of bats in Wisconsin, including the big brown bat (*Eptesicus fuscus),* little brown bat *(Myotis lucifugus),* northern long-eared bat *(Myotis septentrionalis),* and tri-colored bat (*Perimyotis subflavus).* Our study's objective is to determine the historic site occupancy of bats in Wisconsin from 2007 to present in relation to WNS exposure. We used recorded echolocation calls from 5 permanent long-term bat monitoring stations (LTBMS) located across Wisconsin in 2007-2017. We used Kaleidoscope to automatically classify calls to species and manually vetted each that was identified. We used Bayesian multispecies site occupancy models to compare community dynamics of bats before and after 2014. This study could greatly improve the understanding of the impact WNS poses as it spreads across North America.

IMPORTANT HABITAT CHARACTERISTICS FOR EASTERN RED BAT REPRODUCTION IN SOUTHEAST OHIO

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The eastern red bat (*Lasiurus borealis*) is believed to be experiencing population declines due to collisions with commercial wind turbines and habitat loss. To determine the effects of habitat degradation on red bats, and to generate recommendations for land use managers to improve conditions for the species, we studied mist-net capture rates, acoustic activity, and dayroosting habitat at two study locations in southeastern Ohio. We gathered these data within a state dedicated nature preserve and at a recently reforested coal mining property to assess effects of habitat degradation. During the summers of 2016 and 2017, we netted a total of 40 nights and captured 72 red bats. Capture rates differed for both females and males between the mined land and nature preserve. We caught 1.08 males and 0.4 females per night at the preserve in comparison to the 0.80 males and 0 females per night at the mined land. Preliminary analyses suggest that day-roosts (n = 19) used by females (n = 10) and day-roosts (n = 22) used by males (n = 27) at the preserve were larger in diameter ($H = 26.5$, $P < 0.01$) and height ($H = 21.7$, $P < 0.01$) than trees used at the previously mined forest. We also found that the nature preserve had a higher basal area of larger trees than our mined site ($H = 10.3$, $P < 0.01$). These data suggest that forests at the mined site are not sufficient for reproductive female red bats due to overall smaller trees and a poor forest structure. Additional information to be presented will include thermoregulatory data collected from eastern red bats throughout the summer of 2017.

EFFECTS OF HABITAT STUCTURE IN LONGLEAF PINE FORESTS ON BATS

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Overharvesting and fire suppression have resulted in a 97% reduction in acreage of longleaf pine (*Pinus palustris*) forests, which are endemic to the southeastern United States. As forest managers restore the longleaf ecosystem, interest in how the resulting habitat will affect bats is increasing. Mature, well maintained longleaf pine forests have a unique structure that consists of widely spaced trees with little to no midstory and a relatively open canopy. Research in other types of forests have found patterns of forest use by bats that are associated with different forest structure, with some species of bat selecting more open habitats and others selecting moderately cluttered habitats. However, there is little information on the effect of structure in longleaf pine forests on occupancy by bats. The goal of our study was to determine how habitat structure in longleaf pine forests affects occupancy by bats. During May-July 2017, bats were acoustically recorded at 19 longleaf pine stands in Conecuh National Forest in south Alabama. Detectors recorded bats simultaneously at 1m and 11m above the ground for three consecutive nights at each stand. Habitat structure of the midstory and canopy was measured using typical field methods, including diameter at breast height, tree height, height to the first limb, and midstory density. In addition to field measurements, habitat structure was evaluated using a portable, ground-based light detection and ranging (LiDAR) scanner. The effects of habitat structure in longleaf pine forests on bats was assessed using occupancy modeling. The results of this study will help forest managers restore longleaf pine forests in a way that is beneficial to longleaf while also providing suitable habitat for bats within the forest.

OBSERVATIONS OF FALL MIGRATORY BEHAVIOR FROM TWO SPECIES OF MYOTIS BATS IN CENTRAL IOWA

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Little is known about the migratory ecology of northern long-eared bats (*Myotis septentrionalis*) and little brown bats (*Myotis lucifugus*), especially during the fall. Existing studies generally focus on the spring migratory period and on different, but related, species (i.e., the Indiana bat; *Myotis sodalis*). Without data on the fall migratory ecology of these bat species, it is difficult to understand what resources are critical to migrating bats and to determine the risks they face during migration. Western EcoSystems Technology, Inc. (WEST), in collaboration with the Iowa Department of Natural Resources (IDNR), U.S. Fish and Wildlife Service (USFWS) and MidAmerican Energy Company (MEC), conducted a pilot study during Fall 2016 to evaluate migratory movements of the northern long-eared bat and little brown bat. The primary objectives of the pilot study were to characterize the timing and trajectory of fall migration for these bats in Iowa and to evaluate the effectiveness of a passive telemetry tower array for studying bat migration. Bats were captured during the late summer and fall of 2016 in the core study area in Pocahontas County and Humboldt County, Iowa. Bats were tracked using Lotek NanoTag coded radio transmitters and an array of telemetry towers equipped with Lotek VHF Receiver Dataloggers (Lotek Wireless, Inc, Ontario, Canada). Sixteen bats, including thirteen northern long-eared bats and three little brown bats, yielded information on migration timing and direction. Bats exhibited a variety of flight behaviors and trajectories including long-distance movements (> 1 mile) along the Des Moines River corridor and bidirectional movements, i.e. long-distance movements that occurred in opposing directions in the same night. Bats were tracked up to 34.9 linear km from the core study area and individual bats moved up to 61.8 km in a single night. These long-distance movements occurred from August 31 to September 22.

DRIVERS OF FALL AND SPRING HOURLY ACTIVITY PATTERNS OF MIGRATORY BAT SPECIES IN THE CENTRAL APPALACHIANS.

Michael S. Muthersbaugh*, Alexander Silvis, and W. Mark Ford. *Department of Fish and Wildlife Conservation, Virginia Polytechnic Institute and State University (MM); Resource Environmental Solutions (AS); U.S. Geological Survey, Virginia Cooperative Fish and Wildlife Research Unit (WMF)*

Wind energy development continues to expand in the East. Although a "green" renewable energy source with no carbon footprint, impacts on migratory bat populations are significant. Despite high bat mortality at some wind energy sites, especially in the central Appalachians during the spring and autumn, seasonal and spatial bat activity patterns are poorly known in the region. Nonetheless, these data are critical for assessing current and future wind energy risks to migratory bats. To examine bat activity patterns in the fall and spring in the central Appalachians on landscapes with moderate to high wind resources, we used acoustics to capture bat activity on five ridgelines and adjacent sideslopes in the autumn of 2015 and 2016 and the spring of 2016 and 2017. Overall migratory bat activity decreased through the sample period in autumn, with a slight peak in mid-October. Overall migratory bat activity generally increased but was more variable through the sample period in spring. Drivers of activity varied among bat species, but date, hour of night, and ambient temperature generally had the largest effects on hourly migratory bat activity. Understanding hourly drivers of migratory bat activity patterns may assist with the development of wind energy best management practices or mitigation strategies to reduce bat mortality.

2018 USFWS BAT UPDATES

Robyn A. Niver, Mike Armstrong, Barbara Douglas, Andrew King, Lori Pruitt, and Shauna Marquardt. *U. S. Fish and Wildlife Service (USFWS), Cortland, NY 13045 (RN)*; *USFWS, Frankfort, KY 40601 (MA); USFWS, Elkins, WV 26241 (BD); USFWS, Bloomington, IN 47403 (AK and LP); USFWS, Colombia, MO 65203 (SM)*

This presentation will serve as an update on several U.S. Fish and Wildlife Service national efforts for the federally-listed endangered Indiana bat (*Myotis sodalis*), gray bat (*M. grisescens*), Virginia big-eared bat (*Corynorhinus townsendii virginianus*) and threatened northern long-eared bat (*M. septentrionalis*). The presentation will include any available updates on recent winter counts, summer survey guidance, future training opportunities, 5-year reviews, rangewide consultations, national in-lieu fee option for Indiana bat mitigation, and northern long-eared bat litigation. We will also provide any available updates on status assessments for other bat species.

WNS-INDUCED TEMPORAL AND SPATIAL CHANGES IN LITTLE BROWN BAT ACTIVTY

Tomás Nocera*, Christopher A. Dobony, Alex Silvis, W.M. Ford. *Department of Fish and Wildlife Conservation, Virginia Tech, Blacksburg, VA 24060 (TN); Fort Drum Military Installation, Natural Resources Branch, Ft. Drum, NY 13602(CD); RES, Warrenton, Virginia, 20187 (AS); U.S. Geological Survey, Virginia Cooperative Fish and Wildlife Research Unit (WMF)*

How bat distribution and habitat associations have changed at the local to sub-landscape scale has received little attention to date despite being a critical information needed for managers. To better understand the spatial nature of population decline, we modelled, activity patterns from acoustic surveys for the little brown bat (*Myotis lucifugus*) on Fort Drum Army Installation in New York over 15 summers (2003-2017) that span the pre-WNS, WNS advent (2009) and post-WNS periods- using a set of generalized linear mixed models. As expected, our top model indicated significant differences between years ($p < 0.05$) with significant declines in activity post-WNS. Little brown bat activity was most associated with woody wetland habitats over the entire study duration, however, the spatial patterns of high activity areas were variable over years, with the areal extent of these high activity areas decreasing post-WNS.

LET'S JUST AGREE TO DISAGREE: COMPARING AUTO-ACOUSTIC IDENTIFICATION PROGRAMS

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With the declines in the distribution and abundance of WNS-affected bat species, increased reliance on acoustic monitoring is now the new "normal" .As such, the ability to accurately identify individual bat species with acoustic identification program has become increasingly important. We assessed rates of misclassification between the three USFWS approved acoustic identification software programs (Kaleidoscope Pro 4.2.0, Echoclass 3.1, and Bat Call Identification (BCID) 2.7d) using acoustic data collected in the summer from 2003- 2017 at Fort Drum, New York. Levels of disagreement between programs were assessed through pairwise comparisons on an individual file level using annual confusion matrices. Yearly file comparisons between programs allowed us to assess shifts in program accuracy as bat species abundance and composition changed. Inter-program agreement, estimated by Cohen's Kappa, showed high levels of fluctuations among years (0.2 - 0.6), indicative of poor agreement between programs on a file level. However, night/site level pairwise comparative analysis indicated that the programs are consistent in determining simple occupancy.

WNS-INDUCED TEMPORAL AND SPATIAL CHANGES IN LITTLE BROWN BAT ACTIVITY

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ACOUSTIC MONITORING OF INSECTIVOROUS BATS OF MEXICO: INITIATIVES, IMPLEMENTATION, AND POLICY MAKING

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Mexico is rapidly becoming a leader in acoustic monitoring of bats. With the sixth largest bat fauna in the world, this is not easy to do. Two different approaches have been taken to this effect. A group of Mexican researchers belonging to different universities, research centers and governmental agencies, started an acoustic project in Mexico with a major goal to obtain the echolocation recordings of all insectivorous bats of Mexico. The proposal was funded CONABIO (National Commission of Biodiversity), with some specific goals such as developing a standardized protocol to record bat calls in the whole country and to construct an online platform with the bioacoustics records shared open. This project has documented 1500 bat calls of 60 insectivorous species belonging to 7 different families. Additionally this library has 2184 bat calls obtained by different recording methods. Another initiative, led by scientists from Mexico, Germany, and Panama, was invited by the Ministry of the Environment (SEMARNAT) to prepare an acoustic monitoring protocol that has so far been implemented in 500 sites in 10 Mexican states, gathering tens of thousands of calls. Experts of both groups taught seven different workshops in four different countries, training over 100 biologists to record bat sounds in Mexico, east Africa, Costa Rica, and other places. An online platform housed in CONABIO will provide free access and will be continuously updated with new records. Future goals include the developing of an interactive field guide with specific recordings, publication of data in professional journals, and influencing policy using bats as indicators of ecosystem functioning.

THERMAL VIDEO AND ACOUSTIC MONITORING OF POTENTIAL NORTHERN LONG-EARED BAT (*MYOTIS SEPTENTRIONALIS*) HIBERNACULA IN IOWA

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The northern long-eared bat (NLEB) is known to occur throughout the state of Iowa during the summer; however, little is known about its use of winter habitat (hibernacula) in the state. Threats, such as white-nose syndrome (WNS) and collision with wind energy turbines, make it necessary to understand life history traits that may make NLEB susceptible to such risks. Northcentral Iowa NLEB populations are found in areas of the state without any cave or mine structures, which are known to serve as hibernacula in other parts of the species' range, posing the questions how do NLEB utilize the Iowa landscape during the winter, and how does this use affect susceptibility to WNS? The purpose of this study was to monitor and collect acoustic data and thermal and near-infrared video from potential NLEB hibernacula in Iowa. Collected data were used to assess bat presence (all species), and activity at each monitored hibernaculum. This study is in conjunction with radio-telemetry data from Copperhead Consulting (Paint Lick, Kentucky) and previously identified locations from Working Dogs for Conservation (Bozeman, Montana) trained in NLEB scent identification. In 2017, eight potential NLEB hibernacula (seven via dogs, one via radio-telemetry) were monitored with acoustic detectors and thermal and near-infrared cameras from September-November. The number of NLEB calls recorded varied significantly between sites; however, timing and activity spikes were similar. Thermal cameras recorded bat activity with varying levels of success. Few bats were recorded on thermal cameras, potentially due to a limited number of individual bats utilizing the survey locations. The type of habitat where hibernacula were determined, as well as the number individuals found using these areas for hibernation, may limit the susceptibility of these populations to WNS.

EFFECTS OF FOREST MANAGEMENT TECHNIQUES ON BAT HABITAT USE AT FORT INDIANTOWN GAP, PA

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Bats are currently facing a host of threats, including habitat destruction, wind power, and white nose syndrome. Recent research suggests that conservation of summer habitat may be one of the most effective conservation strategies for threatened bat species, even for bats negatively affected by threats other than summer habitat loss. It is thus imperative to gain a greater understanding of the habitat needs of bats, but it remains unclear how current forestry practices, such as prescribed fire and thinning, affect the bat community. Both burning and thinning reduce clutter and increase insect abundance, which should be beneficial to bats. Additionally, both techniques are expected to shift the forest community from being maple/birch dominated back to an oak/hickory system, which may also be beneficial for bat species. The objective of this study was to assess the impacts of forest management techniques on bat community composition and species richness. We focused on the bat community at Fort Indiantown Gap National Guard Training Center, a military installation in south-central Pennsylvania, where data on forest composition, management treatments, and bat species presence has been collected since 2003. We combined these existing data with data from passive acoustic monitoring and mist-netting during the summers of 2016 and 2017, permitting an examination of changes in the bat community by forest treatment over time. We hypothesized that bat community composition will change following prescribed burning and forest thinning. Specifically, we predicted that species richness would be greater with higher burning rates from prescribed fire and higher rates of mechanical thinning. Investigating these relationships can further our understanding of the effects of forest management on bat diversity, and better inform land managers of best practices to manage bat summer roosting and foraging habitats.

POPULATION ESTIMATES OF THE ALLEGHENY WOODRAT (*NEOTOMA MAGISTER*) IN MARYLAND BASED ON LONG-TERM CAPTURE-RECAPTURE DATA

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Allegheny woodrats (*Neotoma magister*) are experiencing population declines in the northeastern portion of their range, and are ranked as S1 and listed as Endangered in Maryland. As a response to reported declines in these states, woodrats have been the focus of ongoing population monitoring in Maryland since 1990. Annual live trapping has occurred at 3 sites, including Savage River State Forest's High Rock Area in Garrett County, Dan's Mountain Wildlife Management Area and Fort Hill Nature Conservancy Preserve in Allegany County. Biennial live trapping has occurred at 2 additional sites, including Indian Springs Wildlife Management Area in Washington County and Frederick City Watershed in Frederick County. Between 10-35 (X = 24) Tomahawk live traps baited with oats and peanut butter were placed (10-20m apart) near known, or likely, woodrat middens or latrines, including near overhangs, and talus areas for 2 trap-nights. To date, over 7,000 trap-nights have been conducted. Population size estimates for the 5 sites over the 26-year period will be analyzed using the spatially explicitly recapture program (SECR) in R. Preliminary analysis of the data supports the hypothesis that woodrat populations are continuing to decline in Maryland, and that there are certain sites in Maryland which represent critical habitat and strong-holds for woodrats. The results of this data-set will be used to support a larger project that is identifying and targeting intervention strategies for woodrat recovery in Maryland.

MULTI-YEAR COLLABORATIVE STUDY TO ASSESS THE DISTRIBUTION AND MIGRATORY MOVEMENTS OF NORTHERN LONG-EARED BAT (*MYOTIS SEPTENTRIONALIS)* ACROSS THE STATE OF IOWA

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With the decline and subsequent federal listing of the northern long-eared bat, there has been a growing interest in this species, especially in the context of understanding the risk to the species from wind turbines. Over the past three years, IADNR, Mid-American Energy, USFWS, Iowa State University, WEST, Inc., Copperhead Consulting, Stantec, and Working Dogs for Conservation have worked in partnership on a large-scale, multi-faceted study to define the life history and ecology of northern long-eared bats across Iowa. Through acoustics, active and passive radio-tracking, infrared camera recordings, and trained conservation dogs, we have greatly increased not only our understanding of northern long-eared bat summer, winter, and migration habits in the State of Iowa but also the efficacy of the methods available to study them in this landscape. In this introduction, we describe the context, impetus, and public-private partnerships established to enable the completion of this large study.

EFFECTS OF FOREST THINNING ON BAT FORAGING ACTIVITY IN THE NORTHEASTERN UNITED STATES

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Many North American bat species are experiencing severe population declines due to white-nose syndrome and other threats. While researchers seek direct solutions to these threats, wildlife managers need strategies to improve habitat that will create immediate positive effects on bat populations. This includes evaluation of the effects of common forest management practices, such as selective tree harvest, on a wide range of bat species. Our study evaluated the effects of forest thinning on nightly bat activity at Fort Indiantown Gap National Guard Training Center in central Pennsylvania. The chosen forest stands were extremely dense due to fire suppression that was typical of the northeastern United States over the past century. In spring 2017, we selectively thinned half of these forest plots to promote fire-tolerant tree species that were more typical of the region prior to anthropogenic land use. We used acoustic sampling to compare bat activity in forest plots that were thinned to adjacent unthinned forest plots. We recorded for three nights at each location with Pettersson d500x detectors and analyzed calls using Sonobat 4.0.7. We included the following predictors in our generalized linear models of bat activity: thinned vs. unthinned, stand basal area, elevation, and distance to road. We used Akaike Information Criterion to select the best model to explain bat activity. Forest thinning was positively associated with most species: *Eptesicus fuscus*, *Myotis leibii*, *Lasionycteris noctivagans*, *Lasiurus borealis*, and *Lasiurus cinereus*. The association was negative for *Myotis septentrionalis*, which is a species adapted to foraging in clutter. Recordings of *Myotis lucifugus/sodalis* and *Perimyotis subflavus* calls were too rare to construct reliable models. We plan to replicate the study this year to determine whether the benefits of selective forest thinning persist across years.

DISTANCE SAMPLING FOR SOUTHEASTERN POCKET GOPHERS (*GEOMYS PINETIS*)

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Natural open pine forests, particularly longleaf pine (*Pinus palustris*), contain diverse faunal communities. Due to extensive degradation and fragmentation, many taxa within the longleaf pine forest are species of conservation concern. The southeastern pocket gopher (*Geomys pinetis*) is a fossorial rodent that can be considered an ecosystem engineer within open pine forests due their consumption of roots and vegetation and due to their creation of mounds of soil resulting from tunneling activities. To better understand and manage this species, we developed a modified line transect distance sampling protocol to assess suitable habitat and monitor population abundance of southeastern pocket gophers. The methodology will aid in the development of a decision support tool to inform management strategies for the species, including implications for translocation protocols. We implemented this protocol throughout the range of the species at 58 sites in Alabama, 55 sites in Florida, and 76 sites in Georgia randomly selected and stratified within accessible private and public land with a National Landcover Database category including pine or grassland. I am currently analyzing the data and will present preliminary results including the protocol design and abundance and detection indices from distance sampling.

NABAT: NORTH AMERICA UNITES TO SYSTEMATICALLY DOCUMENT BAT POPULATIONS

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North American bats face unprecedented risks from continuing and emerging threats including white-nose syndrome, wind energy development, and habitat loss. Many species of bats are thought to be experiencing unparalleled population declines never before documented. To better understand the true ecological consequences of these observed population declines, the North American Bat Monitoring Program (NABat) was conceived. As a statistically robust and standardized bat monitoring program, NABat is focused on the 47 species of bats that are shared by Canada, United States, and Mexico and is designed to be a multinational, inter-agency collaborative monitoring effort. NABat seeks to improve the state of conservation science for bats by providing standardized protocols and facilitating cross-boundary agency coordination and sharing of limited resources. NABat will provide managers and policy makers with the information they need on bat population distributions and trends to effectively manage bats, detect early warning signs of population declines, assess species vulnerability to potential threats, and measure recovery. Since implementation in 2015, NABat monitoring is now occurring in more than 40 states and 10 Canadian provinces. As monitoring data increases through time, NABat will provide analyses of status and trends, document changes in species distributions, help focus conservation efforts, and monitor efficacy of conservation and adaptive management efforts. I will present an overview of the NABat program, discuss available resources for NABat partners, and identify goals for NABat in 2018 and beyond. I will highlight early successes of the program and illustrate the utility of NABat for 'scaling up'—allowing NABat Partners to address local research questions while contributing to larger, landscape-scale efforts to improve our understanding of range-wide population trends and threats to North American Bats.

INTEGRATING MULTIPLE SURVEY TECHNIQUES DOCUMENT SHIFTING BAT COMMUNITIES IN THE WAKE OF WHITE-NOSE SYNDROME

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The long-term study of bat communities often reflects a diverse set of sampling methodologies that are difficult to integrate into a single measure of relative abundance. We developed a Bayesian state-space model to integrate such data into a common currency, captures per unit effort. We used acoustic monitoring and mist-net capture data over an eight year period (2006 – 2014) from a bat community in central New England to test the model. Integrating these data is critical to characterize changes in community structure or composition over time, such as one would expect following an emergent infectious disease such as White-nose Syndrome ('WNS'). The integrated data model shows a significant decline in the abundance of little brown myotis (*Myotis lucifugus*) since 2006, and an increase in abundance of the eastern small-footed myotis (*M. leibii*), the eastern red bat (*Lasiurus borealis*), and the big brown bat (*Eptesicus fuscus*). These results are consistent with our understanding of the impact of WNS on these species. The success of this model provides opportunities to quantify shifts in other communities where multiple sampling methodologies were employed with inconsistent sampling effort, and therefore provides natural resource managers quantitative data to inform conservation and management recommendations.

AUTUMN BEHAVIOR OF NORTHERN LONG-EARED BATS (*MYOTIS SEPTENTRIONALIS*) IN CENTRAL IOWA

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Recent threats to bats in the form of White-nose Syndrome (WNS) and interactions with wind facilities have sparked an impetus for filling life history gaps of previously common species in order to mitigate these threats. The objective of this study was to collect land use and behavior information on federally threatened northern long-eared bats (NLEB) during autumn near the western edge of the WNS Buffer Zone and within proximity of the state's wind facilities. A total of 230 bats of 8 species were caught at 18 sites during 148 net nights in Franklin and Hardin counties from 28 August – 1 October 2017, including 37 NLEB. Radio-tracking resulted in the location of 84 roosts which included live and dead trees, anthropogenic structures, and rock roosts, 1 of which was a talus slope hibernaculum. Thirty-nine nights of aerial telemetry resulted in 1,700 location points used to describe nocturnal behavior of 28 bats (27 NLEB and 1 little brown bat). Although located in a primarily agricultural landscape, bats utilized forested areas more heavily than other landcover types, although bats did forage over corn fields, and less often, soybean fields. Bat movement across the landscape (7 – 25 km) peaked in mid-September and males were still active on the landscape on 15 October. Several bats disappeared suddenly at night during aerial tracking, but were not found on the landscape that night or in subsequent days. Due to the ability of the plane to locate wayward bats up to 30 km away and the autumn time of year, we conclude that many of these bats may have chosen underground hibernacula but were not detectable from the surface. Roosting behavior, swarming areas, and potential hibernacula located and characterized by this study will aid in ongoing efforts to conserve this species and its habitats.

INDIANA BAT (*MYOTIS SODALIS*) MATERNITY ROOST HABITAT PREFERENCE WITHIN MIDWESTERN UNITED STATES UPLAND OAK-HICKORY (*QUERCUS-CARYA*) FORESTS

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The Indiana bat (*Myotis sodalis*) is a federally listed endangered species negatively impacted by human disturbance, habitat change, and disease. Habitat protection and management of summer roosting habitat and hibernacula are recommended for the recovery of this species. We studied roost tree and landscape characteristics of 19 known summer maternity roosts in Illinois and Iowa upland oak-hickory forests. Landscape variables can be highly correlated in fragmented forest habitats and not all the roost tree and landscape variables are relevant to roost tree selection. We employed an algorithm to approximate the data set by using singular value decomposition (SVD) to identify the primary factors governing the selection of maternity roosts. The proposed method (formally referred to as a feature selection algorithm) approximates the data by discarding highly correlated features and features that can be removed without incurring much loss of information. Results indicated that maternity roosts were trees closer to forest edge, larger in diameter and typically trees with crowns in the upper canopy of the forest. Although live or dead shagbark hickory (*Carya ovata*) were preferred as roosts, snags of other tree species common to Midwest upland oak-hickory forests were also used. There was sufficient evidence to infer that the chosen live trees were taller and in more favorable locations compared to the chosen snags. We further observe that the joint distribution for quantitative attributes among dead or

declining shagbark hickory was not significantly different compared to the other chosen tree species, indicating a lack of shagbark hickory may not limit the Indiana bat population. Knowledge of these complex relationships regarding maternity roost habitat preferences is useful for future management of the Indiana bat throughout Midwest oak-hickory forests.

BATS, BUZZES, AND DRINKING: A PILOT STUDY AND PHOTOGRAPHIC JOURNEY

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During fall of 2016 and 2017, Copperhead set manned camera traps at small water sources in forested landscapes in southeastern Kentucky in an attempt to capture high resolution photos of drinking bats. In 2016 it became clear that we could capture reasonably clear photos of drinking activity, with bats typically identifiable to species. During the 2017 efforts, AnaBat SD2 acoustic detectors (Titley Electronics) were set adjacent to the waterbodies to record approach echolocation calls that may be associated with drinking. Preliminary results found bats used a "buzz" type call similar to the more familiar "feeding buzz" to orient themselves during the approach for a drink. However, this type of call was not produced on every pass, suggesting bats may be using memory to navigate on subsequent drinking passes. Additionally, some species specific behaviors were observed that show how different species may approach the dilemma of drinking on the wing. While our sample size is too small to draw any firm conclusions at this time, we feel these initial findings are worth sharing and hope to continue to peruse this topic.

TORPOR PATTERNS AND HIBERNACULA CONDITIONS OF *PERIMYOTIS SUBFLAVUS* IN WHITE-NOSE POSTIVE AND NEGATIVE SITES

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Tri-colored bat (*Perimyotis subflavus*) populations have experienced >90% declines in the southeastern U.S. due to white-nose syndrome (WNS), despite milder and shorter winters. Data are lacking on *P. subflavus* response to WNS and hibernacula temperatures in the south; therefore, we conducted a study in the winters of 2015-16 and 2016-17 to compare torpor patterns and hibernacula conditions of *P. subflavus* in a WNS+ site in South Carolina and WNSsites in Florida and Mississippi. We used temperature sensitive radio transmitters and Lotek dataloggers to record individual skin temperatures (Tsk) and iButtons to record hibernacula temperatures (TH) and humidity. We collected data on 29 *P. subflavus* in SC, 12 in FL, and 8 in MS. Mean TH in SC ranged from 9.3°C to 12.1°C and mean TH was 13.6°C in FL. Bats in MS rarely went into deep torpor. Average torpor Tsk in SC (15.5°C) did not differ significantly from average torpor Tsk in FL (15.9°C) and Tsk in both sites was well within the optimal range for *Pd* growth. Torpor bout length ranged from 1 to 15 days and numbers of torpor bouts did not differ significantly between SC and FL ($P = 0.12$). Arousal length ranged from 30 to 593 minutes and arousal frequency did not differ between SC and FL ($P = 0.22$). Bats typically aroused during the evening 2-3 hours before sunset at all three sites. Based on similar torpor patterns in SC and FL we conclude that bats in the very southern part of the range that use caves with stable cold temperatures may be highly susceptible to WNS but bats that use other types of roosts such as culverts may be less susceptible.

WINTER ROOST SELECTION BY TRI-COLORED BATS AND SOUTHEASTERN MYOTIS IN FLORIDA CAVES

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In recent years, understanding how bats select cave hibernacula has become of greater importance as white-nose syndrome (WNS), caused by the fungus *Pseudogymnoascus destructans (Pd)*, has spread and led to large-scale mortality of wintering bats. Currently, *Pd* and WNS has not been detected in Florida. From 2015-2017, we conducted 399 surveys of 162 caves in Florida to develop pre-WNS baseline information on hibernacula use. We assessed the distribution, occupancy, and abundance of bats and determined cave features that were important for hibernacula. Across all three years, tri-colored bats *Perimyotis subflavus* were detected in 126 (77.8%) caves, southeastern myotis *Myotis austroriparius* were detected in 51 (31.5%) caves, and a Rafinesque's big-eared bat *Corynorhinus rafinesquii* was detected in only one cave. We modeled cave occupancy and abundance as a function of cave habitat variables for tri-colored bats and southeastern myotis. Tri-colored bat occupancy was positively influenced by water drips and disturbance and negatively influenced by temperature. Tri-colored bat abundance was greater in longer, cooler caves with pitting, solution holes, and multiple unobstructed entrances that were closer to a source of water. Southeastern myotis occupancy was greater in longer, domed caves with a large water source present that were closely associated with forested habitats and further from bodies of water. Factors affecting southeastern myotis abundance could not be evaluated due to extreme values in the data. Our results increase our understanding of winter distribution and abundance of these bat species and the effects of cave structure and surrounding habitat on their selection of hibernacula sites. This information is essential for more effective management, conservation, and monitoring strategies to address the expected impacts from WNS.

A POPULATION GENETICS ASSESSMENT OF THE NORTHERN LONG-EARED BAT

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Disease dynamics involve complex relationships between host, pathogen, and environment. One such interaction is the capacity for pathogens to exert powerful selection pressure for host populations to adapt. White Nose Syndrome, a fungal infection causing high levels of mortality in several species of North American bats, has provided a unique opportunity to investigate selection pressure and resultant changes in population genetic structure for one such species, the northern long eared bat (*Myotis septentrionalis*). Using a RAD-Seq approach, this population genetics study aims to investigate the status of this endangered species with the goal of determining whether there is evidence for adaptation at the molecular level in response to the causative agent of White Nose Syndrome, *Pseudogymnoascus destructans*, as well as significant changes in the effective population size.

SMARTER CURTAILMENT FOR BATS

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Wind energy fatalities may pose a serious risk to bat populations (Frick et al. 2017). Low blade rotation (2 to 3 RPM) rates greatly reduce fatalities (Fieldler 2004). Achieving such low RPMs requires pitching the blades out of the wind (curtailing) which precludes energy generation. The loss of energy yield and revenue is cited by wind farm operators as the primary reason for not implementing standard curtailment regimes. Standard curtailment regimes rely primarily upon wind speed which results in a high false positive rate; turbines are curtailed when wind speed are low but bats are absent from the rotor swept zone and the risk of fatality is zero. Curtailing during false positive events reduces energy yield, increases the cost of curtailment for wind farm operators, and has zero conservation benefit. Eliminating false positive events minimizes the financial impacts of curtailment while still achieving the conservation objective (e.g., % reduction in fatalities, avoidance of take of endangered species) and should make curtailment acceptable to a wider range of wind farm operators. The most direct method to eliminate false positives is to monitor bat exposure within the rotor swept zone and curtail only when bats are present and wind speeds are low. This approach reduced fatalities of all species significantly (83%, Sutter et al. 2017) and reduced the impact on energy yield by ~40%. This strategy of real-time risk-based curtailment provides the optimum balance between conservation and energy production. Site suitability for using this risk-based curtailment approach can be assessed using pre- and/or post-construction nacelle-height acoustic data in combination with meteorological data. These datasets are used to model various curtailment scenarios and estimate conservation benefits (reduced fatality rate) and the economic benefit (increased energy yield) of each scenario to determine if a site would benefit from this smart curtailment approach or not.

COMPARISON OF PASSIVE AND ACTIVE ACOUSTIC SAMPLING IN A BAT COMMUNITY IN SOUTH-CENTRAL SOUTH CAROLINA

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Acoustic monitoring techniques have become more heavily relied on in bat population monitoring studies over the past two decades. There are two broad categories of acoustic monitoring in use today: active and passive. While both methods have advantages, a direct comparison between the two methods has not been conducted in the southeastern United States. Our objective was to compare passive and active acoustic sampling designs. We hypothesized that (1) average number of calls collected by each method would be significantly different and (2) method, amount of clutter at a point, precipitation (mm), temperature (°F), and basal area (m2/ha) would have an effect on detection probabilities of bats. In summer 2017 we used Anabat Express detectors to record bat calls both actively (20 minutes) and passively (20 minutes and all night) at the Savannah River Site. We collected 113 calls through active sampling and 75 calls were collected through simultaneous passive sampling during the same 20-min time period. We collected 3899 passively when detectors were active the entire night. Calls were grouped into five species groups according to call frequencies. Using the Kruskal-Wallis test we found that the average number of calls per 20 minutes was significantly higher for passive sampling all night than for active sampling for each species group. Using multi-covariate detection models, we found that the global model was the top predictive model for each species group, with results indicating that we were more likely to detect each species group in low clutter, as temperature increased, and when using passive sampling all night and less likely to detect bats in high clutter, using active sampling or sampling passively for 20 minutes. We conclude that passively sampling throughout the night is the best method to use when surveying for bats.

UNDERSTANDING THE ECOLOGICAL IMPACTS OF TIMBER HARVEST TECHNIQUES ON THE BAT COMMUNITY IN A MIDWESTERN HARDWOOD FOREST

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Timber harvesting is an essential tool for habitat management of several wildlife species present in Indiana State forests, especially bats. Despite a long history of timber harvesting and forest management in the Midwest, there is a paucity of information regarding the immediate and long-term effects of these practices on forest dwelling bat species. Considering recent population declines of several cave dwelling bat species due to White-nose Syndrome that have been observed across the eastern U.S., understanding community wide bat response to habitat management practices are of immense importance. To fully elucidate the ecological consequences of harvesting practices on the bat community, we acoustically surveyed 132 sites across the Morgan-Monroe and Yellowwood state forests in southern Indiana during the 2016- 2017 summer seasons (May-August). As a part of the Hardwood Ecosystem Experiment, a longterm (100 yr.) ecological study, we used paired random sampling techniques to survey bat occupancy in four different harvest treatment types including clear-cuts, shelter wood cuts, single-tree selection cuts, and recently unharvested forests. Echolocation calls were recorded using Wildlife Acoustics SM2+ echolocation detectors and calls were identified using Bat Call ID v.2.7D (BCID), and Echoclass v.3.1. Over 55,000 call files were recorded over the course of the study. We constructed species specific detection histories and modeled false-positive occupancy for both seasons. Results will be discussed in full following complete analyses.

EXAMINING TEMPORAL TRENDS OF NATIVE BATS IN NORTHWEST OHIO THROUGH CITIZEN SCIENCE

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Citizen science is becoming an important tool for mass data collection, and can be critical in engaging the public in both local scientific research and in species that can be misunderstood, such as bats. We examined species diversity and activity over three natural parks in the Oak Openings Region of northwest Ohio, a major biodiversity hotspot. Native bats in this region face numerous threats, from habitat loss due to anthropogenic pressures to the fungal disease White Nose Syndrome (WNS). This long-term study began in 2011, one year after the first detection WNS in Ohio and has continued through 2017. Using non-invasive acoustic monitors, multiple trails were sampled in each of three parks (Oak Openings, Secor, and Wildwood) on consecutive nights in June, July, and August. Walking transects were conducted by citizen scientist volunteers after being instructed on the project details and use of the monitors. We recorded 458 calls over 9 recording nights in this year's study. The number of identified species decreased in two of the three parks between 2011 and 2017 (from 8 species to 6 in Oak Openings and 8 to 5 in Secor). Wildwood, the smallest park and closest to an urban center, recorded 7-8 distinct species every year and exhibited the highest species diversity (Simpson's Diversity = 0.791 versus 0.318 in Oak Openings and 0.464 in Secor). This could be a result of the higher density of forest habitat in that park. It is also possible that this park is acting as an urban refugia for native bats. Total amount of calls decreased continually in all parks through the study, suggesting a decrease in total activity over time. Citizen science has shown to be a valuable tool for studying these temporal trends and creating a long term data set.

ESTIMATING POPULATION SIZES OF *MYOTIS LUCIFUGUS* THROUGH NOVEL METHODS AND ANALYSES

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There is an urgent need to better understand the population ecology of bats throughout North America given the precipitous population decreases that have resulted from white-nose syndrome. To better conserve bat species believed to be at risk of extinction or extirpation, novel and efficient tools are required to assess current population statuses and improve surveillance for potential future population declines. Although numerous field methods and analytical tools are available for gathering and evaluating population-level data, there have been relatively few attempts to do so in North American myotis species. Here, we present a novel approach by using high-frequency radio-frequency identification (HF-RFID) technology, in combination with an analytical approach unused by bat ecologists. For use with these techniques, 218 female little brown myotis (*Myotis lucifugus*) in Yellowstone National Park have been implanted with HFRFID tags. Three buildings across 39 km of Yellowstone's northern range, which are used by little brown myotis as seasonal maternity roosts, have been collectively equipped with 6 continually operating HF-RFID readers and 42 antennas. We also performed 26 emergence counts outside of monitored roosts throughout the 2017 season. Since 6/19/2017, 1,854,619 detections of tagged bats have been recorded, detecting 59.6% (130/218) of total tagged bats. Of bats captured at these monitored buildings, we detected 44.1% (15/34) of bats tagged in 2015, 52.3% (34/65) of bats tagged in 2016, and 91.3% (63/69) of bats tagged in 2017. Using markresight models in program MARK, we estimated pre-partition population highs at two colonies to be 746.1 (95% CI = 518.4 – 1073.6) and 201.5 (95% CI = 123.4 – 329.2). With the birth of juvenile bats (increase in unmarked individuals) and the emigration of marked adults, the estimated post-partition population highs at the same two colonies are 1488.6 (95% CI = 881.8 – 2512.9), and 559.6 (95% CI = 368.0 – 851.0). In addition to population

estimates, we will also present data on individual roost fidelity, connectivity between roosts, and seasonal arrivals and departures from summer roosts. Through continuously tracking detections of tagged bats, a dataset has been started that will provide biologists with a tool that can track long-term population trends. These data provided by this monitoring system and mark-resight analyses will allow for estimates of local population sizes to be made and uncover aspects of little brown myotis ecology that will be essential for managing bats populations in Yellowstone.

DEVELOPMENT OF CONSERVATION AREAS FOR ENDANGERED/THREATENED BATS IN WEST VIRGINIA: WHAT WORKS AND WHAT DOESN'T

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Since 2015, AllStar Ecology, LLC (ASE) has applied various methods to select locations for conservation and to enhance and restore bat habitat for Indiana and northern long-eared bats (NLEBs) in West Virginia. To identify potential conservation sites, ASE has utilized multiple approaches including landscape modeling, known presence records, and presence/absence sampling. To restore and enhance summer roosting habitat on conservation and impact sites, we have utilized various methods including reforestation, creating potential roost trees through girdling and creation of tree cavities, and installing artificial roosts. We have attempted to create and improve foraging areas through the construction of vernal pools, permanent wetlands, and stream bank stabilization efforts. We have found varying degrees of success with different methods and approaches and have examined the effectiveness of practices and overall conservation values achieved to help drive and refine our efforts. We have had success in locating areas with both Indiana and NLEB presence and have had the successful use of artificial roosts by maternity colonies of NLEBs. Continued monitoring and evaluation of applied methods is underway to further our understanding and improve our conservation efforts.

HABITAT PREFERENCE AND MOVEMENT PATTERNS OF FLORIDA BONNETED BATS (*EUMOPS FLORIDANUS)*

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The Florida bonneted bat is an endangered species endemic to Florida. Little is known about its basic ecology, including habitat preferences and foraging behavior; acquiring this information is vital to the development of effective management strategies for the species. We conducted this study to determine seasonal and sexual differences in movement patterns and habitat preference of adult, non-reproductive individuals. We attached GPS collars to 37 individuals at Babcock-Webb Wildlife Management Area in Punta Gorda, Florida in April, August, and December 2015-2016. Altitude values were obtained for a subset of individuals. We found that Florida bonneted bats are capable of flying long distances and flying at high altitudes. Bats were detected a maximum distance of 40km from their roosts, with females traveling a greater maximum distance from their roost than males. Nightly path lengths ranged from 1.3km to 90.6km, and females traveled a greater nightly path length ($\tilde{x}$ = 36.3 ± 23.4km than males ($\tilde{x}$ = 20.3 ± 15.1km Maximum distance from the roost was significantly greater in December than in August, and total nightly path lengths were significantly greater in December than in August or April. The highest altitude recorded was 604m. Florida bonneted bats have the ability to travel long distances from their day-roosts, highlighting the need for management strategies far from known roost locations. Florida bonneted bats require landscape-level consideration for the most impactful conservation.

BAT SURVEY HAZARDS: RISK REDUCTION AND AVOIDANCE

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Three bat biologists have died while conducting bat-related field work in the last six years. Tragedies and minor injuries can be avoided by identifying the hazards and setting controls to eliminate or reduce the risks. We assessed the potential hazards and consequences associated with mist net, acoustic, habitat, and ground telemetry surveys. The unique survey techniques, supplies, and circumstances associated with bat surveys call for specific controls to be implemented. These controls can reduce the risks of a variety of incidents including electrocution, hand injuries, falls, damages to equipment, and injuries related to exhaustion. We aim to help bat biologists understand the importance of developing a safety and communication plan as well as how to complete a thorough job hazard analysis. Implementing these essential safety methods will decrease the likelihood of an incident. By stressing the importance of safety in the bat biologist community, we can reduce injuries and save lives.

ARCHIVING ACOUSTIC DATA TO MONITOR BATS OVER THEIR FULL ANNUAL CYCLE

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Providing for effective conservation of North American bat populations requires an understanding of their population status and stressors throughout their full annual cycle. The North American Bat Monitoring Program (NABat) provides an efficient and statistically-robust framework to monitor the population status of most species during the summer active season using echolocation monitoring. However, the use of acoustic monitoring has grown explosively in recent years and is employed throughout the year to determine species presence and activity patterns to address a multitude of local research and conservation concerns. The Bat Acoustic Monitoring Portal (BatAMP; http://batamp.databasin.org/) is an existing, open access, web-based tool that enables upload and display of echolocation monitoring data. BatAMP allows results from local echolocation monitoring or research efforts to be dual-purposed to help understand regional- or continental-scale phenomena such as migratory connectivity or foci of winter activity. As such, it has utility as a source of data to help address pressing conservation issues such as White-nose Syndrome and wind energy development that arise over multiple years and wide geographic scales. Results from over 100,000 detector-nights across 16 states and 1 province have been uploaded to BatAMP, dwarfing all previous compilations of bat species occurrence. However, results compiled to date are strongly biased to locations in the western United States. I will demonstrate the capabilities of BatAMP for visualizing patterns of bat activity that occur at large spatial scales and over multiple seasons--making the case for increased participation from the eastern half of North America. In addition, I will address developing synergies between BatAMP and NABat leading to a more comprehensive ability to monitor bat populations of North America throughout their full annual cycle.

BAT HIBERNACULA PRESENCE ABSENCE SURVEY USING ACOUSTIC DETECTORS

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During pre-construction surveys for the Transcontinental Gas Pipe Line Company, LLC (Transco) natural gas pipeline project in Pennsylvania (Atlantic Sunrise Project), potential bat hibernacula portals were discovered, which necessitated spring presence/absence surveys. While United States Fish and Wildlife Service (USFWS) guidelines do allow spring trapping surveys, Pennsylvania Game Commission (PGC) guidelines do not. Therefore, acoustic surveys were conducted from mid-March through May 1, 2017, using Anabat SD1 and SD2 detectors in 15 potential portals. To minimize false positives, microphones were placed between 10 and 50 feet into the portals. Recorded files were reviewed using standard filter parameters and USFWSapproved auto-classifier programs. Zero bat calls were identified. However, raw unfiltered files were manually vetted and numerous potential bat call files were identified. After consultation with Anabat inventor Chris Corbin, it was determined that the call files were likely produced by bats exiting the portals. As a result, Transco assumed the presence of the federally endangered Indiana bat (*Myotis sodalis*) and adopted several conservation measures into the project design to avoid impacts on both the hibernacula and hibernating bats. Trapping surveys were conducted prior to construction for a total of 20 consecutive nights between September 15 and October 4, 2017, at all portals where bat passes were identified during the spring acoustic survey. During fall trapping surveys, several tri-colored bats (*Perimyotis subflavus*), eastern small-footed bats (*Myotis leibii*), and one little brown bat (*Myotis lucifugus*) were captured, which confirmed the presence of bats detected with Anabat detectors and manual vetting. This offered a unique opportunity to compare spring acoustic survey results with fall trapping surveys.

POSTER PRESENTATION ABSTRACTS

Listed in order of presenter's last name.

BAT ACTIVITY FOLLOWING REPEATED PRESCRIBED FIRE IN THE CENTRAL APPLALACHIANS

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To restore and manage fire-adapted forest communities in the central Appalachians, land managers are now prioritizing use of prescribed fire. However, it is unclear how the bat community will respond the re-introduction of fire assemblages after long periods of fire suppression and mesophytic closed canopy forest development. Additionally the WNS-induced changes in cave-hibernating bat abundance and changes in bat niche partitioning during this period add an interesting ecologicaly component to the response. Accordingly, we monitored and compared bat activity in burned and unburned habitat across a temporal gradient in the mountains of western Virginia on the George Washington National Forest and Shenandoah National Park. We observed evidence for slightly positive fire effects on the northern long-eared bat (*Myotis septentrionalis*), Indiana bat (*Myotis sodalis*), little brown bat (*Myotis lucifugus*), big brown bat (*Eptesicus fuscus*)/silver-haired bat (*Lasionycteris noctivagans*) group, high frequency bats combined, and total activity. We observed temporal effects only for the big brown bat, with a negative relationship between activity and time since fire.

PRESCRIBED FIRE EFFECTS ON SNAGS IN THE SOUTHERN APPALACHIAN MOUNTAINS

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Snags, or standing dead trees, are an influential part of forest ecosystems and provide habitat for many species of birds and bats. Alabama alone is within the ranges of 45 species of birds and 8 species of bats which utilize snags at some point in their life histories. Alabama is also within the historical range of longleaf pine (*Pinus palustris*) which requires frequent, low intensity fires to maintain its open-canopy structure. Current restoration efforts in the southeastern U.S. employ mechanical thinning and prescribed fire to promote longleaf pine and its associated species. The effect on snags preferred by wildlife within a prescribed fire regime has not been well documented. Our objective is to evaluate how different burn intervals, or times between fire events, affect the density and characteristics of snags. The study area is located in the Talladega National Forest in northeastern Alabama. We will use belt transects on ridgetops, mid-slopes, and drainages to assess the density, size, and condition of snags within stands of varying management intensities. Preliminary results from circular habitat plots show that snag density increases as the burn interval increases. Heavily managed stands also proportionally produced more mid-sized snags preferred by wildlife, but less pine snags. These early results indicate that prescribed fire may reduce overall snag density, but provide snag characteristics preferred by wildlife. This emphasizes the benefit of a landscape with stands varying in management intensities. A subsequent study will be done to assess more detailed characteristics of snags and snag density under varying management and fire intensities.

DETECTION EFFICIENCY OF THE ALLEGHENY WOODRAT *(NEOTOMA MAGISTER)* IN VIRGINIA

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The Allegheny woodrat (*Neotoma magister*) has shown significant decline in population size and narrowed population distribution since 1928. Declines have been attributed to constrained habitat requirements specific to high elevation rocky outcrops. The rough terrain limits the ability of researchers to access these isolated habitat fragments, resulting in low detection rates and high costs of effort. We launched a collaborative effort between Radford University, Virginia Department of Game and Inland Fisheries and the USGS Virginia Cooperative Fish and Wildlife Research Unit Cooperative Unit in an effort to gather data at new and historical woodrat sites across Virginia. Collectively, we paired remote-sensing cameras and tomahawk traps at 31 sites from May through October of 2017. We estimated probability of detection and site occupancy using package *unmarked* in Program R. The aim of this study was to compare detection efficiency between trapping methods to determine the most efficient method of detection for the species in challenging research environments. Results will be presented in light of recent analyses.

THE INFLUENCE OF HABITAT AND WEATHER PARAMETERS ON BATS IN NORTHERN INDIANA

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Many different species of Chiroptera forage all over the United States, but only 11 species have been documented in Indiana, and 9 in Northern Indiana, which includes a common endangered species, *Myotis sodalis*. However, acoustic surveys, besides studies on the *Myotis sodalis*, are lacking for Northern Indiana. Our study focuses on species specifically in South Bend, Indiana, and the effect of habitat type and weather on species variation and detection. In the spring, late summer, and early fall of 2017, two SM3BAT devices were set up on Saint Mary's College campus: one in an open area by a campus pond and one in a forested nature area. The device was activated at sunset and recorded only when bat calls were detected. Weather parameters including temperature, precipitation, humidity, and moon phase were also documented. Data from the SM3BAT devices were processed in Kaleidoscope and analyzed using R studio. Automatic species classification indicated we found 9 species across our two recording locations, but differences in bat species between habitat site. Additionally, habitat affected the total number of detected calls, with more detected calls in the forested area compared to the open area. We also investigated the effect of weather parameters on acoustic activity. Our results provide baseline information on bat activity in Northern Indiana, and we will continue to acoustically monitor for subsequent years to determine how long-term weather and climate affect bat activity in our region.

EFFECTS OF THE AMOUNT OF AGRICULTURE IN A FOREST MATRIX ON MEDIUM AND LARGE-SIZED MAMMALS IN SOUTHWEST VIRGINIA

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Researchers and managers alike are interested in mammal diversity in human-dominated landscapes. Communities of medium and large-sized mammals can drive food web dynamics in eastern forests and elsewhere. The effects of human-dominated landscapes on mammal communities is not clear cut. On one hand, mammalian carnivores and omnivores may be at increased risk of death and injury when they use human-dominated areas. Alternatively, human dominated landscapes can provide food resources which increase abundances of these mammals. We used wildlife cameras to census medium and large-sized mammals (opossum, striped skunk, raccoon, fox, bobcat, coyote, black bear, and domesticated/feral dog) in forest landscapes that varied in the amount of adjacent agricultural area: Havens Wildlife Management Area (10% agriculture to 90% forest) and Buzzard Rock (20% agriculture to 80% forest). We censused the two sites for six weeks each during January – May 2017 and six-weeks each during December – March 2018. We used four Reconyx Rapid Fire 800 Cameras giving us 686 trap nights. Each week, we baited two cameras and put the other two cameras on a game trail and moved cameras every two weeks. Raccoons, coyotes, and black bears accounted for 76 to 86% of all captures. The Buzzard Rock site (more agriculture) had more than three times as many captures (0.32 animals/trap night) compared Havens WMA (less agriculture; 0.09 animals/trap night). The increased number of medium to large-sized mammals in area with more agriculture increases the opportunity for conflicts with humans. Our work suggests that the benefit of the increase in food resources available on agricultural lands outweighs the increased risk that these mammals face from conflicts with humans.

BABY IT'S COLD OUTSIDE: FALL 2017 AND WINTER 2018 BAT ACTIVITY ON THE COASTAL PLAINS OF NORTH CAROLINA

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Previous research on the northern long-eared bat (*Myotis septentrionalis*) has documented them overwintering in caves, but recent range expansions into coastal plain regions prompted many questions including habitat use and activity patterns during fall and winter. In North Carolina, temperatures in the coastal plains differ from other regions in the state and may have an effect on the behavior of coastal bat species. As part of a programmatic agreement between the North Carolina Department of Transportation, Federal Highway Administration, United States Army Corps of Engineers, and the United States Fish and Wildlife Service, focused research continues to investigate the northern long-eared bat's distribution, habitat use, and fall and winter activity in eastern NC. In 2017, during the months of November and December, and January – March in 2018, under contract with Ecological Engineering, Ecological Solutions conducted mist net surveys in the Croatan National Forest where temperatures at the time of capture and roost emergence were surprisingly low with averages between 11°C to ±3°C. The lowest temperature documented at a time of capture was 3°C for a *Perimyotis subflavus* and a *Nycticeius humeralis*. Based on the data collected during this research, coastal bat species may adjust their behavior (activity, roost selection, and torpor bouts) and remain active for winter months due to the temperate temperatures of coastal plain regions. Ongoing research will help us understand how different bat species are using varied climate regions, and research in these more temperate areas will contribute an understanding of how species may behave in a changing climate.

HABITAT OCCUPANCY AND DETECTION RATES OF NORTHERN FLYING SQUIRRELS IN PENNSYLVANIA USING ULTRASONIC ACOUSTICS

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The northern flying squirrel (NFS, *Glaucomys sabrinus*) is listed as State Endangered in Pennsylvania. Within the Appalachians, northern flying squirrels can be difficult to detect using traditional methods (live trapping, nest boxes). Flying squirrels produce ultrasonic calls that can be detected using acoustic bat detectors. Within Pennsylvania, NFS are sympatric with southern flying squirrels (SFS, *G. volans*). These species can be differentiated using ultrasonic acoustics, making this technique appropriate where both species co-occur. We surveyed 6 sites in the Pocono Mountains in Pennsylvania during June 2017. We considered 3 sites high occupancy ("high") and 3 site low occupancy ("low") sites for NFS. We surveyed sites for 9 nights using Pettersson D500x ultrasonic detectors (N=108 detector survey nights). We estimated probability of detection (POD) and latency to detection (LTD; i.e., number of survey nights until the initial detection) between high and low sites. We obtained 478 flying squirrel calls: 384 NFS, 58 SFS, and 48 unknown flying squirrel species calls. We recorded NFS at 4 sites (3 high, 1 low) and SFS at all 6 sites. For NFS, POD between the high and low sites were 0.28±0.06 and 0.09±0.7, respectively. LTD for NFS were 2.7±0.8 nights at high sites and 7.83±1.5 nights at low sites. For SFS, POD was 0.13±0.05 and 0.17±0.05 at high and low sites, respectively. LTD was 5±1.6 nights at high and 3.8±1.5 days at low sites. This study highlights the effectiveness of acoustic monitoring for rare NFS that are sympatric with SFS.

AN ASSESSMENT OF GENETIC STRUCTURE IN THE FLORIDA MOUSE (*PODOMYS FLORIDANUS*)

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The Florida mouse (*Podomys floridanus*) is endemic to Florida and considered a Species of Greatest Conservation Need. Florida mice occupy xeric, upland sandhill and scrub habitats. Those xeric communities are distributed as discrete patches that typically occur on or are associated with geologic ridges, which vary in size and in the distance separating them from other patches of similar habitat. Florida mice are believed to have limited ability or propensity to move among suitable habitat patches. We examined the amount of gene flow, or connectivity, among populations across the range of the Florida mouse. We obtained tissue samples from and genotyped 1001 *Podomys*. Of those, we were able to retain 994 for microsatellite analysis and successfully sequenced the cytochrome *b* mitochondrial gene (cyt *b*) for 263 individuals. Sequence data from cyt *b* revealed a high level of haplotype variation overall, with 47 unique haplotypes detected range-wide, and little haplotype sharing across ridge (geographic) groups. Phylogenetic divergence among haplotypes was shallow, with no monophyletic phylogenetic structuring among ridges. The Lake Wales ridge system and Atlantic Coastal ridge system represent regions of relatively high mtDNA diversity. Microsatellite variation, like mtDNA, also fit a model of a primarily ridge-based genetic structure. Multiple lines of evidence suggest that the Atlantic Coastal ridge populations have had the most stable demographic history and have apparently been isolated from populations on ridges to the west for a considerable period of time. The apparent reduced gene flow among *Podomys* from sites across the Lake Wales ridge system suggests those populations are experiencing negative impacts from reduced habitat connectivity at the landscape scale. The high level of microsatellite structuring and evidence for non-existent gene flow between isolated regional groups justifies not moving *Podomys* beyond short (tens of kms) distances or across major potential barriers such as rivers.

LAND MAMMALS OF THE VIRGINIA BARRIER ISLANDS

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The Virginia barrier islands are a dynamic natural laboratory for the study of ecological and evolutionary patterns and processes. We have studied the ecology, distribution, and genetics of non-volant mammals on these islands since the mid-1970s. We have trapped, tracked, and observed mammals on 30 barrier and marsh islands and at more than 25 locations on the adjacent mainland in Accomack and Northampton counties, Virginia. We also have assembled published and unpublished reports from other researchers who have studied mammals on the islands and the Delmarva Peninsula, which is made up of the state of Delaware and parts of Maryland and Virginia. In this report, we identify 34 species of land mammals that are native to this region. Of those, 20 species have been observed on at least one island. In addition, we identify 4 nondomesticated, exotic, species that have been observed on at least one island.

THE MICROBIOLOGY OF FRESH, SURFACE, AND DEEP BAT GUANO SAMPLES, INCLUDING DETECTION OF POSSIBLE PATHOGENS

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Bat guano plays an integral role in the ecological balance of the cave environment. In addition, guano serves as a food source for microorganisms such as bacteria, potentially including zoonotic pathogens. Past studies on the microbiological populations of guano were limited to isolated pellets or guano from the surface of a pile. Here, we present the first comparison of bacterial populations cultured from fresh, surface, and deep (~ 2m) guano samples from a large maternal colony of Brazilian free-tailed bats (*Tadarida brasiliensis*) in Sierra County, New Mexico. We cultured and isolated bacteria on three types of nutrient agar: tryptic soy agar, blood agar, and a special recipe consistent with the composition of bat guano ("bat guano medium"). Using 16s rDNA PCR and genetic sequencing technology, we identified 15 species of bacteria including one possible new species. Further research determined that a number of these species that were cultured and sequenced have been present in clinical samples and designated as pathogenic and threatening to cave visitors. The data collected in this research can be utilized to supplement the microbiological knowledge concerning the cave environment and guano as well as to elucidate the health risks involved in cave dwellings.

ARTIFICIAL ROOST USE BY NORTHERN LONG-EARED BATS IN WEST VIRGINIA FROM 2016-2017

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Forest loss has been a contributing factor in the decline of Myotine bat species in West Virginia (WV). In order to supplement natural roosts following forest disturbance, the United States Fish and Wildlife Service (USFWS) West Virginia Field Office (WVFO) has required conservation measures in the form of artificial roosts. AllStar Ecology, LLC (ASE) has designed and manufactured artificial roosting structures in the form of two-chambered rockets, four-chambered nursery boxes, and artificial bark while using the Myotine Suitable Habitat Assessment Model (MSHAM) to aid in placement. ASE installed a total of 490 artificial roosts (380 two-chambered rocket boxes, 53 four-chambered nursery boxes, and 57 artificial barks) within WV and monitored them for bat occupancy and species composition from 2016-2017. Site occupancy across all 59 sites averaged 72.9% for both years of monitoring. Occupancy rate rose by 24.64% for boxes in their 2nd year on the landscape compared to the same boxes in their 1st year. In 2016, eight Northern Long-eared Bat maternity colonies were discovered in the artificial roosts with the number of maternity colonies increasing to 14 in 2017. Site fidelity was witnessed at 5 of 59 sites. Out of bats caught emerging from artificial roosts from 2016-2017, 359 (98.36%) were northern long-eared bats. The more suitable a habitat class, according to MSHAM, the higher the occupancy rating—adding credence to the model. Based on the data set, northern long-eared bats use artificial roosts as part of their roosting network and will use artificial roosts for reproduction, showing that artificial roosts may serve as viable conservation measures after tree clearing.

BAT ACTIVITY SURROUNDING THE SILVER MOUNTAIN HIBERNACULUM DURING SPRING EMERGENCE AND FALL SWARM

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To explore bat activity patterns and habitat use around a hibernaculum during spring emergence and fall swarm, we deployed 12 SM3Bat detectors across a 4 km2 landscape centered on the cave entrance in 2016-17. Within this landscape, twelve 0.5 km2 sites were sampled by placing a detector at the center of each site in 2016, and in 2017, by placing detectors > 100 m away in a random direction. Detectors were deployed on average 35 days each season coinciding with beginning and end of hibernation. Using SonoBat V4.2.2 autoclassifier, there was an unexpected 130% increase in calls (passes) in 2017 compared to 2016 given White-Nose Syndrome was first detected at the mine winter of 2015-16. However, the percentage of High Frequency calls during spring emergence declined by 78% in 2017 compared to 2016. We used N-mixture models within R package 'unmarked' and a model selection framework to explore the relationship between bat activity to local-scale (detector) and site-scale covariates. In general, bat activity patterns were associated more with site-scale covariates rather than local-scale covariates during both seasons. Call frequency of Myotis lucifugus increased with the length of stream within the sampling site (0.5 km2) during the spring season, and during fall swarm, amount of wetland and open habitat in addition to length of stream influenced activity levels. Call frequency of Eptesicus fuscus increased to these same covariates and also greater topography (i.e., terrain ruggedness) at the site-scale. Our initial analysis shows landscape features such as stream length (corridors), topography, and amount of open and aquatic habitats in the surrounding landscape were more important than distance to mine, most likely reflecting spatial differentiation based on foraging and moving behavior. Further refinement and sampling within landscapes surrounding other caves will be required to determine the applicability of our results to other landscapes.

ACOUSTIC SCANNING BEHAVIOR IN THE NORTHERN LONG-TAILED SHREW

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Shrews are some of the smallest mammals on the earth. They are a diverse group that have adapted to many habitats all over the world. Shrews have poor eyesight and acute hearing, so they may have the potential to echolocate. A few studies have explored this possibility and found that some shrew species echolocate while exhibiting scanning behavior. In this study, we investigated the link between scanning behavior and acoustic signals in the Northern Short-tailed shrew (*Blarina brevicauda*). A shrew was captured from the Saint Mary's College nature area and recorded in the laboratory with a GoPro video camera and a Wildlife Acoustics SM3Bat acoustic recorder. From our recordings we identified portions of scanning behavior from the video and extracted the corresponding audio file. We extracted 10 selections of scanning behavior and 168 calls. We used Audacity to calculate call duration, frequency range, and inter call interval (ICI). Call duration ranged from 4 to 15 ms, with energy between 3 to 48 kilohertz, and the ICI ranged from 49 to 393 ms. Our results indicate that Blarina brevicauda may use echolocation to sense their environment. Future work can identify scanning behavior and changes in acoustic signals in different environments.

COMPARISON OF AUTOMATED BAT CALL CLASSIFICATION SOFTWARE VERSIONS: WHEN TO UPGRADE?

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Many bat researchers rely heavily on commercially available automated software programs to aid in identifying bat calls to species. However, the software can be expensive and data processing time can be significant. For those working with large datasets or long-term monitoring, the frequent release of software upgrades can be problematic because it is not clear whether purchasing the new version will be worth the time and expense required to re-analyze all data in the latest version. It is also unclear how comparable the different versions are in terms of autoclassifier results. To address these questions, we analyze a single dataset using two versions of each of two widely used software programs: Kaleidoscope Pro and Sonobat. Our dataset consists of full spectrum acoustic files that were collected through passive recording of bats at two national parks in the Upper Midwest during the period June-August 2016. We compare the software outputs in terms of species classifications and potential biases towards or against certain species. Note that because we are not using a known dataset, this study will not directly address questions of software accuracy. Our results will help bat researchers understand what differences to expect among software versions and provide insight on decisions of if and when to upgrade software.

EFFECTS OF VARIATIONS IN FOREST CANOPY OPENNESS, PREY ABUNDANCE, AND ABIOTIC FACTORS ON BAT ACTIVITY IN THE NANTAHALA NATIONAL FOREST

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Disturbed and open sites with early successional vegetation provide foraging habitat for bats. As part of a larger study to examine early successional habitat created by logging, we compared activity of open- and clutter-adapted bats within and among canopy openings of varying aggregation and size within mixed hardwood forest of the Nantahala National Forest, North Carolina. We asked if 1) open-adapted bats are more active within openings, while clutter adapted bats are more active in forest corridors and 2) open-adapted bats are more active above the canopy, while clutter-adapted bats are more active below the canopy. Preliminary results suggest bats are more active a) in dispersed openings, b) within openings than in the forest corridors between them, and c) below the canopy than above; activity was not affected by opening size. These results suggest logging that creates dispersed early successional patches would provide foraging habitat for both open-adapted and clutter-adapted bat species.

NORTHERN LONG-EARED BAT MATERNITY COLONY ROOST TREE CHARACTERISTICS IN THE CENTRAL APPALACHIANS: HAS WHITE NOSE SYNDROME CHANGED ROOST SELECTION?

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Most extant northern long-eared bat maternity colony day-roost data was gathered prior to the onset of white-nose syndrome (WNS). Despite the informational need with listed status, the difficulty in catching northern long-eared bats has meant that locating and describing post-WNS day-roost characteristics to compare to pre-WNS is limited. Post-WNS (5+ years), we were able capture and radio-track pregnant or lactating female northern long-eared bats to day-roosts in the summers of 2015 and 2016, in the central Appalachians of Bath County, Virginia. We compared recorded day-roost characteristics to those recorded pre-WNS at Fernow Experimental Forest, Tucker County, WV, and Westvaco Wildlife and Ecosystem Research Forest, Randolph County, WV within similar vegetation types and elevations. We found significant differences for some day-roost characteristics including tree/snag height, roost height, and roost DBH; with post-WNS day roosts being smaller. However, we found no significant differences for canopy closure, surrounding forest basal area, and day-roost condition between pre- and post-WNS day-roosts.

Changes in day roost characteristics may not be due to true behavioral changes, but perhaps instead caused by changes in population sizes and resulting smaller maternity colony sizes or more incidences of single females. Care should be taken when incorporating pre-WNS findings in assessment and management of northern long-eared bat day-roost habitat in the central Appalachians, however meaningful stand-level characteristics appear to be similar.

POTENTIAL BENEFITS OF REFORESTED AGRICULTURAL RIPARIAN ZONES FOR BAT COMMUNITIES

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Bat conservation must occur in multiple habitats beyond national parks and protected forests if the ecosystem services bats provide are to be protected. This project contributes to our understanding of the efficacy of current conservation practices in mitigating bat habitat loss within agricultural settings. Current research suggests that restored riparian forests within an agricultural matrix provide bat species with improved feeding opportunities and act as covered corridors between habitats. Our findings will help inform stakeholders and government agencies as to the value of riparian forests established through the Conservation Reserve Enhancement Program (CREP) for promoting bats. Pettersson acoustic detectors were used to determine if CREP riparian zones (compared to control sites with denuded riparian areas) promote increased bat diversity within the Shenandoah Valley of Virginia. The species richness and diversity of recorded bats were analyzed across treatments. Flying insects were collected throughout the field season using combined malaise and pan traps deployed simultaneously with the bat detectors. Insects were identified to Order with Coleoptera and Lepidoptera being identified to Family when possible. Transects, 100m x 20m, were established at each site and were surveyed for tree diversity, canopy cover, snag count, and DBH. Results were analyzed using statistics packages in 'R' to determine significance of different CREP characteristics. By analyzing multiple aspects of these riparian forests, we hope to better evaluate specific characteristics of CREP sites correlated with increased bat activity and help inform land managers and government agencies involved with CREP and other riparian projects.

CHANGES IN BAT CAPTURE RATES AND COMMUNITY COMPOSITION AT FORT INDIANTOWN GAP, PENNSYLVANIA

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Populations of many North American bat species are in decline as the result of numerous threats, most notably White-nose Syndrome (WNS). WNS has caused severe regional-scale declines of several cave-hibernating bat species, however, the community-level impacts of the disease remain poorly studied. Resource managers will need to understand how bat communities have changed over time when making current and future management decisions. The objective of our study, therefore, was to compare species-specific capture rates and bat community composition during summer mist-netting surveys conducted at 12 sites in 2004 and 2017 at Fort Indiantown Gap (FIG), a military training site in south-central Pennsylvania. Given species-specific responses to WNS, we hypothesized that capture rates of Myotis species would decline between 2004 and 2017, while capture rates of *Eptesicus fuscus* and *Lasiurus borealis* would remain stable or increase. Moreover, we predicted there to be a dramatic shift in the overall composition and abundance of the bat community between years. In 2004, *Myotis septentrionalis* (n = 98 captures) and *M. lucifigus* (n = 31) were relatively common, however, in 2017, we failed to catch a single individual of either species, suggesting a significant decline (-100%) in both species. Capture rates (bats/unit of net effort) of *E. fuscus* have increased significantly (+300%) over this time period, while capture rates of *L. borealis* did not change. A PERMANOVA also revealed a significant difference (P = <0.001) in the overall structure of the bat community between 2004 and 2017. These results are consistent with a WNS -driven decline in Myotis species that were previously abundant at the site, and suggest that *E. fuscus* populations at FIG could be expanding in the absence of competition from these species. Together, these changes have led to a community-level shift among bats, with important implications for their arthropod prey.

OPTIMIZATION OF CAMERA TRAPPING METHODS FOR SURVEYING MESOPREDATORS IN THE APPALACHIAN FOOTHILLS

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The global decline of apex predators has allowed mesopredator populations to increase, a phenomenon described by the mesopredator release hypothesis (MRH). However, some mesopredator species are of conservation concern, such as the eastern spotted skunk (Spilogale putorius), whose populations have noticeably declined in the past 40 years despite an ability to inhabit human altered habitats. Mesopredators generally prefer edges and corridors, landscape features that are increasingly common throughout the forests of eastern North America. We tested deployment strategies for surveying mesopredators using baited camera traps in Kentucky, a state for which systematic methodological data is lacking. We surveyed 72 sites across 10 counties over more than 1,100 trap nights from May 2017 to February 2018, focusing on features associated with mesopredator presence such as corridors, edges, and trails. Cameras were deployed on tree trunks ca. 0.5 m off the ground facing a bait station that was 2-3 m away. Our 2×2 design allowing for the evaluation of bait type (sardines only or sardines + fatty acid scent tablet) and

deployment duration (2 weeks or 4 weeks). To date, opossums (*Didelphis virginiana*) and raccoons (*Procyon lotor*) comprise over 90% of recorded mesopredator species. Other mesopredators recorded include striped skunks (*Mephitis mephitis*), bobcats (Lynx rufus), and coyotes (*Canis latrans*). These data are being used to inform ongoing camera trapping efforts in the Appalachian region of Kentucky. In addition to diversity indices, species accumulation curves will be created and factors of alpha-biodiversity of sites will be explored. Ultimately, mesopredator habitat selection will be assessed using ArcGIS data layers to determine preferred site characteristics, thus allowing targeted, more efficient camera trapping efforts in the future.

REACHING OUT TO NEW AUDIENCES FOR BAT CONSERVATION

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Most recreational cavers and cave researchers are aware of risks of spreading Pseudogymnoascus destructans (Pd), the fungus that causes white-nose syndrome disease of hibernating bats, and protocols to reduce those risks. Several types of outdoor recreationists however, may not be aware that they might enter areas where the fungus occurs. These user groups pose a lower, but real risk of spreading Pd. The White-nose Syndrome Communications and Outreach Working Group created postcards for climbers and infrequent cave explorers to encourage them to take simple measures to reduce their risk of spreading Pd: check, scrape, wash, and protect. The group distributed the postcards, also available at www.whitenosesyndrome.org in several languages, to show caves. Stop by the poster and learn about this effort and other recent activity of the working group.

HOME RANGE DYNAMICS AND HABITAT SELECTION OF THE EASTERN SPOTTED SKUNK IN THE OZARKS

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The eastern spotted skunk (*Spilogale putorius*) is a small, once common mesopredator and member of the Mephitidae family. Beginning in the 1940s, it declined across its range, which includes the Ozark Ecoregion. Reasons for the range-wide decline are still unknown, but currently the species is considered threatened, rare, or of conservation concern by many states within its range and one subspecies has been petitioned for listing under the U.S. Endangered Species Act. Despite several new studies aiming to understand the basic ecology of the species, few efforts have focused in the Ozarks. Thus, we developed a project to assess home range dynamics and habitat selection of the eastern spotted skunk in north-central Arkansas. Beginning in March 2017 and continuing presently, we deployed camera traps across a large-scale grid in Ozark National Forest and Gene Rush Wildlife Management Area to assess landscape-level habitat selection. We confirmed the presence of eastern spotted skunks in the Arkansas Ozarks at three camera trap sites. Efforts to live-trap and radio-tag skunks to determine home range dynamics began in winter 2017 and will continue into 2018. This project will shed light on the effects of common habitat management actions like prescribed burns and timber harvest on movement patterns of eastern spotted skunks. It will provide guiding information for eastern spotted skunk managers across the Ozark region.

FALL BEHAVIOR OF MYOTIS SEPTENTRIONALIS ON ISLANDS

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From late summer to early fall, Myotis species in North America exhibit swarming behavior near mines and caves. This fall swarm serves important functions; mating has been observed, and it is believed that young-of-the-year may be introduced to hibernation sites. Understanding how threatened species interact during this time is critical for conservation. Myotis septentrionalis populations have declined drastically since the onset of white-nose syndrome. In New York, winter counts show a 99% decline, with extirpation from many hibernacula. One source of hope lies in coastal populations inhabiting New York and New England, which appear to support a relative abundance of this threatened species. However, these coastal areas seem to be devoid of natural hibernacula, creating uncertainty as to where these individuals swarm and hibernate. M. septentrionalis have recently been found in human structures during the hibernation season on Long Island, NY; Martha's Vineyard, MA; and Nantucket, MA, with activity stretching into the traditional hibernation period. We propose that previously undocumented hibernation behaviors have reduced disease severity and/or exposure, leading to higher host survival. To assess hibernation behavior and timing, we radio-tracked individuals throughout late fall to document roosts, assess movement, and identify potential hibernacula. Netting occurred mid-October through early November at sites with previous net captures or recent acoustic activity. Five M. septentrionalis were tracked over three weeks on both Long Island and Nantucket. We tracked four individuals to human structures, confirming at least one hibernacula. The farthest distance traveled between roosts was 10.5 km, with most individuals remaining local to capture locations. Acoustic detections on the landscape continued into mid-December. This pilot study will be expanded next fall to support greater netting and tracking effort, as our preliminary results indicate the potential to learn vital information about the behavior of this species.

EASTERN SMALL-FOOTED MYOTIS (MYOTIS LEIBII) HABITAT ON THE NIAGARA ESCARPMENT

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Eastern Small-footed Myotis was listed as Endangered in Ontario in 2014, and recovery efforts in the province to date have primarily focused on understanding more about the specific summer habitat types used by the species in Ontario, as well as its distribution and abundance. In 2017 we carried out a study to improve our understanding of both the distribution and roosting habits of Eastern Small-footed Myotis (*Myotis leibii*) on the Niagara Escarpment in Ontario. Focusing on rocky habitats associated with the limestone escarpment, we examined 4 sites containing open, south-facing talus slopes adjacent to cliffs and forests. We mist netted directly in open or semi-open talus habitats, or on forest trails near open talus between late May and September 2017. Eastern Small-footed Myotis captured during mist netting were radio-tracked to identify specific roost sites. We also conducted ground-based visual searches of accessible rock habitats at each study site, as well as nearby roadside rock-cuts. Visual searches were ineffective at identifying roosts for any species of bat. As a result of mist net surveys, Eastern Small-footed Myotis were captured on just over half of all survey nights, represented 43% of bats captured, and were captured at 3 of 4 study sites. Roosts were located for 6 of 11 tracked bats. These were found primarily in crevices in cliffs adjacent to the capture locations, but one juvenile male was also confirmed to roost in the crevice of a large talus boulder in August. Our results confirm that cliff crevices in the Niagara Escarpment provide roosting habitat for adult and juvenile Eastern Small-footed Myotis, including maternity roosting habitat. They also suggest that visual searches are not an effective way to identify roosts of Eastern Small-footed Myotis in the cliff and talus habitats of the Niagara Escarpment.

TWENTY YEARS OF MIST-NETTING IN WV: BAT POPULATION AND COMMUNITY CHANGES

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The Monongahela National Forest (MNF) has been conducting bat mist-netting since 1997, with over 12,000 bats captured and many tracked to roosting locations. Long-term sites have been resurveyed multiple times since 2003 using standardized methodology and level of effort, which allows for tracking of general trends in those locations. The West Virginia Division of Natural Resources (WVDNR) has been collecting state-wide mist-net data and conducting hibernacula surveys for over 30 years. The combined efforts of the MNF and WVDNR have resulted in a long-term data set that provides a unique resource for assessing changes in bat populations and communities across a broad area before and after the onset of White-nose Syndrome in West Virginia in 2009. Our analyses indicate dramatic declines among WNS-affected species (e.g., *Myotis septentrionalis*, *M. lucifugus*, and *Perimyotis subflavus*) similar to those seen in other parts of eastern North America, though the rate and extent of decline in WV does appear to differ for some species. Concurrent increases in local populations of other bat species not affected by WNS also have been observed. Additionally, our long-term data allow for an assessment of changes in local distribution of summer populations across the million acres of habitat on the MNF. A better understanding of both species status and spatial distribution of surviving populations can allow us to better manage the landscape to ensure persistence of these declining species and hopefully enhance recovery of local populations post-WNS.

BAT ROOSTS IN BRIDGES: ASSESSING ILLINOIS BRIDGES FOR BAT USE

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The Illinois Natural History Survey (INHS) works with the Illinois Department of Transportation to conduct bat presence/absence surveys in compliance with the Endangered Species Act. In 2017, INHS conducted 173 structure assessments on bridges and culverts in 58 counties throughout the state following protocols from the Indiana Bat and Northern Long-eared Bat Section 7 Consultation and Conservation Strategy for the Federal Highway Administration, Federal Railroad Administration and Federal Transit Administration. All bridges were checked during the daytime, using high powered headlamps to illuminate crevices and expansion joints. Binoculars were used to assess portions of bridges that were inaccessible due to water depth or height of the structure. We found evidence (guano or staining) of bats roosting in 32 of 173 structures surveyed (18.5%) and we observed bats present in 10 structures (8 bridges, 2 culverts; 5.7%).

THE EFFECT OF ALTITUDE ON FREQUENCY, DURATION, AND BANDWIDTH OF ECHOLOCATION CALLS OF TADARIDA BRASILIENSIS RECORDED WITH AN UNMANNED AERIAL VEHICLE

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Tadarida brasiliensis emit acoustic signals in the form of echolocation calls to locate prey and orient themselves with their environment. Additionally, these bats are able to navigate in darkness back to their roost from high flight altitudes at high speeds. Little is known about how these bats echolocate at altitude during re-entry. To examine the calls made in close proximity to the roost during the re-entry period, an airborne radio-controlled drone was used to determine if echolocation calls vary at different

flight altitudes. For this study, a drone was piloted and hovered at increments between five and forty meters during the re-entry period. Calls recorded from different heights were extracted and analyzed to determine if start frequency, end frequency, and duration varied depending on altitude. There was no significant effect of altitude on start frequency, end frequency, or duration. This indicates that echolocation calls from *Tadarida brasiliensis* are not altered at heights of 40 meters or less when returning to the roost.

IMPROVING CAPTURE METHODS TO INCREASE CAPTURE SUCCESS RATE AND REDUCE HANDLING TIME AND POTENTIAL STRESS LEVELS OF BATS IN ARTIFICAL STRUCTURES.

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As the need for bat habitat conservation measures increase due to growing industry, artificial roosting structures such as rocket boxes have been implemented in an attempt to mitigate the effects of habitat loss and potential natural roosts. Our goal in implementing these artificial structures is to provide roosting structures for threatened and endangered species such as Indiana bats (*Myotis sodalis*), and Northern long-eared bats (*Myotis septentrionalis*), and promote sustainability. In order to monitor success, all structures were checked for presence/absence at two intervals, once in the early season when maternity colonies would be formed and potentially birthing, and once in the later season when pups would be Volant. Species data was collected via trapping individuals during emergence. In the previous year, mist-nets were used in close proximity around the roost structure in order to capture emerging bats. This method worked, however it proved to be inadequate in which bats escaped, thus not providing total accuracy of individuals present. The following season, a new trap was developed specifically to meet the needs of acquiring absolute data in the form of 100% capture rate. This trap was also developed with the intent to minimize handling time in order to quickly process bats and reduce stress amongst individuals, primarily when monitoring a maternity colony. Lastly, the trap was designed to increase monitoring productivity. Results clearly showed an increase in capture rate, however some individuals still escaped and corresponding data is limited due to overall duration of study and scope of project since capture rate comparison was not the focus. Further monitoring efforts will incorporate capture success rate and potentially stress rate.

BASAL HOLLOW MATERNITY ROOSTS OF SOUTHEASTERN MYOTIS IN ALABAMA

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Southeastern myotis (*Myotis austroriparius*) is an insectivorous bat that occurs in bottomland hardwood forest along the coastal plain and Mississippi River from southern Illinois to Florida. Female southeastern myotis form large maternity roosts containing several hundred to 90,000 individuals during the spring and summer months. These maternity roosts are primarily located in caves, but have also been found in tree cavities. In Alabama, only two known maternity roosts for southeastern myotis exist and both are located in caves along the coastal plain. Southeastern myotis are considered a species of highest conservation concern in Alabama and little is known about their distribution and natural history in the state. We discovered three maternity roosts of southeastern myotis in the southern Appalachians of northeastern Alabama over a hundred miles outside the known range of this species. Over three years of netting at our study site, we captured 47 adult and juvenile southeastern myotis. We radio tagged nine females and tracked their day roost usage. All bats exclusively used one of the three basal hollow roosts. The maternity roosts were located in basal cavities of two tulip popular (*Liriodendron tulipifera*) and a blackgum (*Nyssa sylvatica*) in upland riparian forest habitat. Emergence observations revealed several hundred bats were using these roosts during the breeding season. Due to the lack of ecological knowledge of this species, we cannot conclude if their range has extended or has previously been undetected in the area.

EFFECT OF OMNIDIRECTIONAL MICROPHONE HEIGHT AND DISTANCE FROM EDGE ON PROBABILITY OF DETECTING BATS IN KENTUCKY

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Due to declines of many North American bat species from white-nose syndrome (WNS) and difficulties capturing them in mist-nets, acoustic methods are an increasingly important survey method. Many factors affect the probability of detecting bats acoustically including microphone type, height, and orientation; atmospheric conditions; the surrounding environment; and bat behavior. Recently, the U.S. Fish and Wildlife Service approved the use of omnidirectional microphones for Indiana bat (*Myotis sodalis*) and northern long-eared bat (*M. septentrionalis*) summer surveys. However, little is known about the effect of omnidirectional microphone placement on detection probabilities of these species or others affected by WNS (i.e., little brown bats, *M. lucifugus*, and tri-colored bats, *Perimyotis subflavus*). Our objective was to determine the best height and distance from clutter required to achieve high detection of WNS affected species with omnidirectional microphones. We set up 9x9 arrays of Anabat Express and Wildlife Acoustics SM4BAT FS detectors with omnidirectional microphones near Indiana bat colonies at two sites in Kentucky

during July and August 2016. Detectors were set in open areas 1.5, 5, and 9 m from the ground and 1, 3, and 5 m from the nearest edge for 3-6 nights each month. We used Program Presence to estimate probability of detection and included height, distance from clutter, height X distance, and several environmental variables as covariates. Probability of detecting Indiana bats and tri-colored bats were not affected by height, distance, or their interaction. However, the probability of detecting little brown bats increased with detector height 1 m from clutter but decreased with height 5 m from clutter. This interaction was also important for other species suggesting that survey design may need to vary depending on the target species.

UPDATE ON THE DEVELOPMENT OF THE U.S. FISH AND WILDLIFE SERVICE ELECTRONIC BAT DATABASE.

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In 2015 Region 3 (Midwest) of the Fish and Wildlife Service (Service) developed a spreadsheet for submitting data collected during bat surveys. The goal of creating this spreadsheet was to standardize the data submitted to the Service, while reducing redundancy, increasing efficiency of data submittal, and minimizing errors. This format was quickly adopted by three other Regions of the Fish and Wildlife Service (Regions 4-6). Now submittal of this spreadsheet is a condition of surveyors' section 10(a)1(A) permits for those that work within the Indiana bats (Myotis sodalis) range. After the 2016 field season approximately 117 completed spreadsheets were submitted to the Service. The purpose of collecting this data is to facilitate section 7 and 10 consultations for listed species, and assessing bat populations for listed and non-listed species.

A MULTI-YEAR WHITE-NOSE SYNDROME TREATMENT AT BLACK DIAMOND TUNNEL

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In an effort to mitigate precipitous declines in bat populations due to white-nose syndrome (WNS), a multi-year treatment strategy has been implemented at Black Diamond Tunnel (BDT) in Clayton, Georgia. Ideal hibernation conditions made BDT the largest known tri-colored bat population in Georgia. However, since the detection of Pseudogymnoascus destructans, the causative agent of WNS, in 2013, BDT has seen a 95% decline in tri-colored bats. Treatment involves utilizing gaseous antifungal volatile organic compounds (VOCs) that have demonstrated an in vitro ability to inhibit P. destructans growth. The compounds being evaluated are associated with a naturally-occurring, plant-associated microbe and are generally recognized as safe (GRAS) by the FDA. Antifungal compounds are dispersed in gaseous a form throughout the tunnel at even intervals. Treatment is carried out three times per hibernation season. Bat population surveys are performed before and after the hibernation season to gauge potential impact. The first treatment applications occurred the first week of November and December of 2016 and January of 2017. Bat population surveys pre- and post-treatment have been both surprising and positive.

ESTABLISHMENT OF THE CHARITON HILLS BAT CONSERVATION BANK IN NORTHEAST MISSOURI

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Approximately one-third of the known Indiana bat population hibernates in a single site in northeast Missouri. Upon emergence from the hibernaculum in the spring, female Indiana bats establish summer maternity colonies in suitable habitat throughout northern Missouri, southern Iowa and western Illinois. The concentration of Indiana bats in this tri-state area presents significant opportunities to benefit the species within its entire range through summer maternity habitat preservation and long-term management. Accordingly, Burns & McDonnell is establishing the Chariton Hills Conservation Bank (CHCB) in northeast Missouri. The CHCB will protect and manage over 1,300 acres of summer maternity habitat in Schuyler and Adair Counties, and will provide mitigation credits to offset impacts to Indiana bat and northern long-eared bat habitat in Missouri. We worked closely with state and federal agencies to select CHCB sites using landscape ecology principles. Our site-specific analyses included historical record searches to confirm occurrences of the Indiana bat, detailed habitat assessments, and mist-net surveys to document presence of the species. We used a comparison to county-wide data and established habitat parameters from the Indiana bat recovery plan to determine habitat quality and likelihood of occupancy. Our analysis indicated that two potential properties met or exceeded most of the important summer habitat variables outlined in the Indiana bat recovery plan, and that they could be maintained or improved through adaptive management. Management actions on the properties will be directed toward maintaining the quality of the habitat and improving any habitat that does not meet values outlined in the Indiana bat recovery plan and other literature. These may include thinning, girdling, prescribed burning, and tree planting. When finalized, this will be the first conservation bank approved by Region 3 of the U.S. Fish & Wildlife Service and will protect a substantial amount of Indiana bat maternity habitat in perpetuity.

WELCOME HOME: BRAZILIAN FREE-TAILED BATS ADJUST THEIR ECHOLOCATION CALLS TO DETECT CAVE OPENING

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Bats use different types of signals to sense their environment. Brazilian free-tailed bats (*Tadarida brasiliensis*) adjust their call structure based upon their environment, producing lower bandwidth, constant-frequency (CF) calls in open environments, and higher-bandwidth, frequency-modulated (FM) calls in cluttered environments. In this study, we examined how Brazilian free-tailed bats change the bandwidth of calls when locating the cave opening in a flat, non-cluttered environment. We extracted individual echolocation calls from two locations around the cave, one away from the cave opening and one next to edge of the cave opening, with the only distinctive difference in the environment of the locations being the presence of the cave edge. For each echolocation call, we calculated the starting frequency and stopping frequency, and compared bandwidths between the two locations. The results indicated a significant difference in the starting and stopping frequencies between the two locations, and demonstrated an increased bandwidth for the location next to the cave opening. This higher bandwidth suggests the bats may rely on edge detection to locate the cave opening, and change the bandwidth of their signals to improve target resolution when returning to the roost.

THE MAMMAL COLLECTION AT EASTERN KENTUCKY UNIVERSITY: A RESOURCE FOR NATURAL HISTORY EDUCATION AND CONSERVATION

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Natural history collections are often underutilized resources, yet contain a multitude of valuable information. Specimens and their collection data can be used to reveal biogeographical patterns, species richness in a study area, and historic occurrences that allow evaluation of extinction and extirpations. Additionally, collections now serve as repositories for genetic material. Recently collections have been used to investigate biogeographic shifts in response to our increasingly altered world. Eastern Kentucky University (EKU), located in Madison County, houses five unique natural history collections: plants, invertebrates, birds, fish, and mammals. Recently, these collections have been relocated to new facilities and, in doing so, the mammal collection has been assessed and re-catalogued. The mammal collection at EKU holds over 1,000 specimens, primarily comprised of dry preserved skins and skeletal materials. While the majority of specimens were collected within the Commonwealth of Kentucky, many other Midwestern and southeastern states are represented, such as Illinois, Indiana, Ohio, West Virginia, and Virginia. There are also specimens from all three North American countries. Distributions of Kentucky's mesopredators will be presented at the county level using our specimen records. While the mammal collection at EKU has been predominately used for teaching, community outreach events, and student research opportunities, this poster serves as a first step towards exploring the biogeographic data within the collection for research purposes.

BASELINE DATA ON OVERWINTERING BATS AND HIBERNACULA IN TEXAS

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White-nose syndrome (WNS) has led to precipitous declines in population size of cave-dwelling bat species in eastern Unites States. Of the 33 species documented in Texas, five species have known susceptibility to the fungus. Based on current rates of expansion, we expected that the fungus and potentially WNS could be documented in Texas within the 2016-2019 period. To understand the potential threat of WNS to bats in Texas, we monitored for the fungus and signs of WNS, as well as collected data on bat species distribution, abundance, and environmental characteristics at 20 sites from January-March 2016, and 207 sites for the 2016-2017 winter season. We submitted 142 swabs from bats for testing of P. destructans using real-time PCR in the 2016 winter season. All swabs were negative for the fungus. Additionally, we submitted 163 samples for testing between January and March 2017. Of the 10 sites swabbed, 5 produced positive results for P. destructans DNA. Throughout our surveys, we documented baseline data for winter roost sites of seven bat species and obtained winter distribution information for one species (*Nycticeius humeralis*). These baseline data will play a critical role in developing management plans prior to the arrival of WNS, and provide guidance on how to proceed should it arrive.

SURVIVAL AND RECRUITMENT OF A PERSISTING COLONY OF LITTLE BROWN MYOTIS IN SOUTHERN ONTARIO

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The precipitous decline of bats in response to White-nose Syndrome (WNS) in eastern North America has heightened the need to gain a better understanding of their ecology. The behavior, diet, fecundity, philopatry, adult survival and juvenile recruitment of affected bats are critically important to the conservation and recovery of populations. Through four years of study, the Sandilands Roost has a sustained colony of Little Brown Myotis (*Myotis lucifugus*), despite WNS infection.

Bats were captured in mist nets and harp traps, banded, PIT tagged, tested for WNS and radio-tracked to other roosts. The roost is part of a network of at least nine roosts, which bats move among and there are trends in association patterns of individual bats. Significant differences were observed between 9 mm and 12 mm PIT tag retention. Acoustic activity at the roost varied between and within years, but adult and juvenile capture rates in July were relatively constant 2015-2017, with return of some juvenile bats to the natal roost and reproduction in their first year. WNS was identified on bats in May, but not in July, and all showed minimal signs of skin or wing damage. Molecular sequencing of guano revealed that Ephemeroptera were most abundant in the diet followed by Trichoptera. This colony indicates that some Little Brown Myotis, including juveniles, are surviving the effects of WNS and still reproducing. Although the reproductive rate of this species is low, this colony could serve as a source for the rebound of Little Brown Myotis in Southern Ontario.

MOBILE ACOUSTIC SURVEY DURATION, SEASONALITY, AND REPETITION INFLUENCE INFERENCES ON BAT ACTIVITY AND SPECIES RICHNESS

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Mobile acoustic surveys are commonly used to monitor trends in bat occurrence and activity over time. We set up an experiment to investigate 4 issues that may cause biases in data collected at a local scale through this survey approach: survey duration, season, starting location, and repetition. Our objectives were to determine for our study area whether inferences on bat activity and species richness would vary according to the duration of our mobile surveys, the time of year we conducted them, the starting location, or the number of repeat mobile surveys we conducted. We used Anabat II echolocation detectors coupled with ZCAIMs to record bat activity, with high mount microphones attached to the roofs of two vehicles. Each survey night, both vehicles surveyed the same 60 mile circular route, beginning simultaneously from one of two locations along the route (i.e., one vehicle always began the route at mile marker 0 and the other at mile marker 30). Both vehicles simultaneously surveyed the circular transect 3 nights/week in April, June, and August, which corresponds to peaks of pregnancy, lactation, and volant young in the area. We then used Kaleidoscope Pro software to objectively classify each high quality sequence of recorded echolocation calls to species. We detected most species expected in the region: EPFU, LABO/LASE, LACI, LAIN, NYHU, PESU, and TABR. Activity levels of each species peaked at different times of night and varied among seasons. Number of species detected varied according to number of nights surveyed as well as survey starting location. Overall, results suggest that survey duration, season, starting point, and repetition strongly influence inferences drawn from mobile acoustic surveys at the local scale, and highlight the importance of careful advance planning when designing long-term monitoring protocols that expect to reliably estimate bat occurrence and activity through mobile surveys.

COMMON MANUAL VETTING MISTAKES EVERY NOVICE MAKES

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Acoustic detection surveys are a powerful survey tool for bats. However, they remain a tool that is dependent on an experienced vetter to review calls and interpret results. Although there are myriad talking points and discussion topics regarding a successful acoustic analysis, our experience has shown that misunderstandings and misinterpretations most often fall into three categories. The first broad category is failing to properly contextualize the files that are being analyzed. A manual vetter should have a basic knowledge of how the detector was deployed, with information on clutter, nearby roosts, and feeding areas being factors that may change interpretation of files. Furthermore, locational data is critical to interpreting what species may truly be present in an area and what species are unlikely or highly unlikely. The second category includes is a lack of understanding of acoustic software, including the importance of call libraries and understanding how the Maximum Likelihood Estimator (MLE) works. The third category of common vetting mistakes is perhaps the most common and is simply the tendency of new vetters to attempt to identify low quality calls, including quiet calls and non-search phase behavior. We present these common pitfalls not only to point out difficulties inherent to acoustic analysis, but also to suggest some of the practices we've implemented to face these challenges. Although nothing can replace supervised practice to improve one's vetting skills, it is our hope that an awareness of the most common problems may assist those new to the field and open a dialogue about how to improve analyses for novices and experts alike.

"CRASH INTO ME:" HOW BRAZILIAN FREE-TAILED BATS AVOID COLLISIONS DURING CAVE EXODUS

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In nature, many animals form concerted groups. Animal groupings are formed based on different attractive and repulsive forces. Attractive forces provide benefits for an individual to be close to others in a group such as safety from predators, whereas repulsive forces maintain a distance between individuals so that individuals do not collide with one another. The balance of these separate forces is what drives the individual to form a group structure. *Tadarida brasiliensis*, or Brazilian free-tailed bats, fly in large groups with complex three-dimensional dynamics. Every night, these bats exit the cave flying in groups and fast speeds to travel

to foraging locations. Therefore, in the formation of these groups, what forces dictate bat grouping behavior? We predicted that bats will alter their individual flight path in the presence of conspecifics, based on either repulsive or attractive forces. Specifically, we hypothesized that an individual bat would alter its flight path and trajectory to either avoid a physical collision with a bat (if repulsive forces dominate), or to become closer to another bat (if attractive forces dominate). We analyzed thermal imagery of paired bats in flight during cave exodus using a toolbox in MATLAB. We found no significant change in bearing angle, distance between each bat, nor deviation relative to original flight path as two bats flew together over time. These results suggest that bats do not change their flight trajectory in the presence of other bats, which may be due in part to the equaling out and balancing of attractive and repulsive forces.

ACTIVITY PATTERNS AT GRAY BAT (MYOTIS GRISESCENS) SUMMER CAVE ROOSTS IN THE UPPER TENNESSEE RIVER BASIN, SOUTHWESTERN VIRGINIA: PRELIMINARY RESULTS USING THE BAT CALL DATA RECORDER (BCDR)

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At least seven caves along rivers in the Upper Tennessee River basin in Virginia serve as summer Gray bat (Myotis grisescens) bachelor roosts with over a thousand individuals, with smaller numbers observed at additional sites. To assess bat activity while evaluating the instrument's potential for roost monitoring, Bat Call Data Recorders (BCDR) were deployed from March through October at three sites: Bacon Cave (Powell River, Lee County); Big Entrance Crawl (BEC) Cave (Clinch River, Scott County); and Grigsby Cave (Copper Creek, a Clinch tributary, Scott County.) The BCDR records the number of sonic events in the frequency range used by bats, and does not distinguish between species or call type. Summer use at the sites is >99% gray bats, so species identification is not required. Results were encouraging, revealing complex, systematic patterns of activity. Data were recorded at 10 minute intervals from 7 p.m. to 6 a.m., with data gaps (Bacon: March 18 thru May 4; BEC: April 19-May 3, June 9-27) due to battery issues. Data were split nightly into emergence (7-11 pm) and post-emergence (11 pm to 7 am) bins, with emergence used to assess relative occupancy. Bats arrived at sites the last week of March, activity increasing through early April. Bat activity at roosts ceased by mid-October. Activity varied more early in the season, with vacancies of several days common through mid-July. Typically more activity was associated with emergence, but each site exhibited intervals mid-season when post emergence dominated, possibly reflecting use of the cave as night roost by bats foraging in the area but not using the cave as a day roost. Late season activity patterns were more consistent at all sites, with emergence activity much greater than post-emergence. Data suggest male Gray bats use multiple roost sites for a variety of functions over the season.

SPECIES-SPECIFIC PROBABILITY OF WINTER ACTIVITY ACROSS A TEMPERATURE GRADIENT IN BATS

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Low winter-temperatures drive hibernation and migration in temperate region bats which in turn can influence mortality via white-nose syndrome (WNS) and wind turbine interactions. However, the low-temperatures at which bats are able to be active remains unknown. The goal of this study was to describe the species-specific winter low-temperature thresholds (TLT) for bat activity across the state of North Carolina (NC), USA. NC has 3 regions, with a wide range of winter climates and is well situated latitudinally to study TLT. We defined the TLT as the mean daily temperature at which there was a 50% probability of activity. We had 2 hypotheses: 1.) different species of bats would have different TLT 2.) for each species, TLT will vary by regional climate. For the first hypothesis, we predicted larger species would have lower TLT due to their smaller surface area to volume ratio. For the second hypothesis, we predicted that TLT would be lower in cooler regions than in warmer regions. We acoustically monitored winter bat activity from sunset to sunrise nightly from December to February at 11 sites across a large temperature gradient (-10 °C to 25 °C). We recorded bat activity in at least one site every night of winter (927 recording nights total). Silver-haired bats (*Lasionycteris noctivagans*) had lower TLT than big brown bats (*Eptesicus fuscus*), and tri-colored bats (*Perimyotis subflavus*) had higher TLT than big brown bats. We found that big brown bats and Silver-haired bats had lower TLT in cooler regions. However, tri-colored bats showed no difference in TLT between regions. We found lower TLT in species less affected by WNS, suggesting that behavioral adaptations to winter temperatures affect WNS susceptibility. Our results can be used to model winter bat activity in the southeastern USA where WNS affected species may be active in winter.

BAT UTILIZATION OF FORESTED HABITAT ON THE CUMBERLAND PLATEAU, TENNESSEE.

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Previous work has found that forest management, including the use of prescribed fire and thinning, increases bat activity for some species by altering forest structure. Therefore, developing an understanding of the bat habitat associations and responses to management are critical to making informed management decisions. The objectives of our study were to 1) compare bat activity and diversity among forest types, including managed and untreated upland areas of the Southern Cumberland Plateau; 2) evaluate the effects of forest clutter on bat activity and diversity among the forest habitat types; and 3) compare bat activity and diversity on upland sites with lower elevation and untreated areas. In Summer 2017, we used acoustic recording of bat echolocation call sequences (Wildlife Acoustics SM4BAT ZC) to compare bat activity in 4 forest types including closed canopy, recently thinned, >1 yr post thinning with burning regime, and cove habitat. All monitors were placed at each sites for equal time periods. We recorded 150,989 calls, of these 11,766 were No ID and 103,650 were Noise, and we recorded a total of 12 species. Species with similar call characteristics were combined to minimize error and included: LABO/NYHU (eastern red bat [*Lasiurus borealis*] and evening bat [*Nycticeius humeralis*]), EPFU/LANO (big brown bat [*Eptesicus fuscus*] and silver-haired bat [*Lasionycteris noctivagans*], LACI- hoary bat (*Lasiurus cinereus*), PESU - tri-colored bat (*Perimyotis subflavus*), CORA- Rafinesque's big-eared bat (*Corynorhinus rafinesquii*), and MYOT (*Myotis spp.*). Preliminary data from these sites indicated that unmanaged upland forest habitat had the least amount of bat activity and diversity with 1,515 calls recorded over the survey period. Upland sites that were thinned to 50ft2/acre and burned three times had the most calls (17,456). Data collection and analysis is ongoing and when complete, management recommendations will focus on forestry practices to enhance bat habitat in select areas of Sewanee's forested property.

CITY BAT LIFE

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Bats in North America are under grave threat by White Nose Syndrome (WNS), caused by the fungus Pseudogymnoascus destructans (Pd). Since Pd requires cold and humid environments to survive, urbanization's "heat island effect" may alter Pd's impact on bat populations. The "heat island effect" results from urbanization's impervious surfaces and manmade structures creating warmer and drier climates. These structures, planted trees, artificial lights, and additional water sources may inadvertently offer bats roosting, commuting, and foraging habitat. Therefore, I hypothesize that, with the appropriate combination of landscape features, urban areas within a WNS-positive region could serve as habitat for WNS-sensitive bats. To test this overarching hypothesis, I deployed bat acoustic detectors, insect traps, light loggers, and sound meters every week from March through October from 2015-2017 among three urbanization levels in Mid-Atlantic States. To date, almost 300,000 echolocation calls were recorded over 1,100 nights. There were significantly more total bat calls in highly urbanized sites. Interesting, there was a positive relationship in highly urban areas between total bat calls and precipitation and a negative relationship between total bat calls and canopy cover. Therefore, management recommendations for heavily urbanized areas in this region will likely include forestry practices. Next steps include conversion of all echolocation calls to presence/absence for WNS-sensitive species followed by Generalized Linear Mixed Modeling (GLMM) and Linear Regression to determine important habitat features associated with WNS sensitive presence locations.

ACOUSTIC MONITORING OF GRAY BAT SUMMER COLONIES IN SOUTHWESTERN VIRGINIA

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The gray bat (Myotis grisescens) is a federally-endangered species whose summer range is restricted to far southwestern Virginia. Given the advance of White-nose Syndrome into the Commonwealth in recent years, we began a long-term effort to monitor bat acoustic activity at eight caves and one long-box culvert known to house gray bat colonies in summer months. We deployed 10 detectors (1 per cave; 2 at either end of long-box culvert) from mid-July until early November, 2017. Analyses using automated identification software, Kaleidoscope 4.3 (294,841 files identified as non-noise bat calls) and EchoClass 3.1 (479,899 files identified as nonnoise bat calls), revealed mixed results with identification of gray bat calls – even at sites known to exclusively house gray bats. This issue with auto-identification is likely due to detector placement and call plasticity in cave-emerging gray bats. Given issues with reliable identification to genus or even large-bodied versus small-bodied bats, we present our results as average number of bat calls per site per night across the survey period. We compare daily activity patterns between programs, and discuss general trends in activity between sites. This acoustics project will resume in late spring to detect and monitor gray bats as they return to these summer sites.

COYOTE BEHAVIOR AND INTERACTION WITH MESOPREDATORS IN A FOREST/AGRICULTUREAL LANDSCAPE IN ROANOKE VALLEY, VA

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Mammalian carnivores have strong top-down effects in food webs in eastern deciduous forests. Historically, wolves and mountain lions were apex predators and controlled mesopredators in this region. With their extirpation of these species and the range expansion of coyotes in recent decades, we explored whether coyotes are acting as top predators or mesopredators in the region. Additionally, we are interested in how coyote behavior is affected by human-dominated landscapes. We addressed these ideas using four trail cameras from December 2016 to March 2018 (960+ total trap nights) at three sites in the Roanoke Valley. Within sites, we located cameras along a gradient from interior forest to the edge of agricultural land and other development. We had a coyote capture rate of 0.05 captures/trap night. Raccoons and opossums did not avoid areas with coyotes. Coyotes were photographed 89% of the time at night/dusk/dawn suggesting that their behavior allows them to avoid humans. Coyotes were lured to the bait but never took the bait suggesting a high level of neophobia. Taken together, our results show that coyotes are likely on the same trophic level as mesopredators and not acting as apex predators. Further, their wary-of-humans behavior likely reduces some direct conflict with humans. Understanding the behavior and niches of coyotes gives managers interested in the conservation of mammals useful information.

SUMMER FORAGING RESOURCE SELECTION OF LOCAL BATS

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Conservation of bats requires detailed knowledge of their habitat use. Bat populations in Dayton, OH have been monitored by environmental consulting groups and the US Fish and Wildlife Service for decades. In 2000, two female Indiana bats (Myotis sodalis) were radio-tagged to a maternal roost in Wright State University's (WSU) campus woods post-capture. This 82ha wooded property consists of 58% primary forest and 42% secondary forest. Since Indiana bats were recorded on the property and are known to be selective when choosing optimal summer habitats, we determined the property would be sustainable for many Ohio bat species in summer months. Additionally, each bat species in Ohio is state and/or federally listed; thus, surveying all bat activity is critical for determining baseline habitat use and furthermore establishing conservation management strategies for the WSU campus woods. We hypothesized that bats would select primary forests over other habitats for foraging based on Ohio bat anecdotal natural history. We also predicted greater habitat selection in riparian areas than in interior or edge habitats because of the importance of hydric habitat proximity to foraging habitat selection. In Summer 2017, 10 walking bat acoustic routes with georeferenced detections were completed. Echolocation calls were recorded with a Wildlife Acoustic's Echo Meter Touch microphone and Echo Meter Touch app for iOS on an Apple iPad Air. We created a generalized linear model and determined probabilities of occupancy for different foraging habitats. We found the greatest probabilities of occupancy were in riparian habitats of both primary (0.71 probability) and secondary (1.00 probability) forests. Our model provides predictions for areas where bat activity is the greatest during summer months for use in conservation management strategies. Further analysis with acoustic classification and species models may also provide predictions for species specific management practices.

USE OF LONG TERM MONITORING TO STUDY IN-FLIGHT SOCIAL CALLS OF NORTH CAROLINA BATS

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Bat species exhibit a high diversity of social group size, ranging from one to over one million individuals. Within gregarious bats there is also a broad range in the complexity of interactions; such as simple congregations, fission fusion dynamics, and reciprocal altruism. Their diversity in sociality makes bats a potentially useful model for understanding how the social environment shapes communication behavior. However, as bats are nocturnal, volant, often small, and produce predominantly ultrasonic vocalizations the existing literature focuses mostly on social calls in roost or laboratory settings. With the increase in long term bat monitoring projects for conservation purposes, it may be possible to obtain sufficiently sized samples of in flight social calls. The objective of this study is to investigate in flight social calls using data from large scale bat monitoring projects in North Carolina. We hypothesized that bat social call characteristics (shape, frequency, duration, etc.) differed by species. We used data from bat monitoring projects in North Carolina to identify social calls. Manually identified social calls were then used as training data for machine learning. We analyzed if the differences in call characteristics between species were greater than within species. We were able to identify several distinct types of social calls produced by different species of bat. These preliminary results demonstrate the viability of using monitoring data to study bat social communication.

HIBERNACULA COUNTS REVEAL MAJOR DECLINES IN MARYLAND CAVE BATS

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North American populations of cave-hibernating bats are experiencing devastating declines caused by white-nose syndrome (WNS), a disease caused by the fungus Pseudogymnoascus destructans. Since its initial detection in western Maryland in 2010, white-nose syndrome has affected cave bat populations throughout the western region of the state, and acoustic and capture surveys suggest negative effects on bat populations statewide. To quantitatively assess changes in bat populations following the emergence of WNS, we used hibernacula counts collected over a 31-year period in 12 western Maryland hibernacula. We estimated percent decline between pre- and post-WNS years and used localized regression to visualize count trends over the study period. From 1977 – 2017, we counted 9,621 bats of 5 species including tri-colored (*Perimyotis subflavus*), little brown (*Myotis lucifugus*), eastern small-footed (*Myotis leibii*), northern long-eared (*Myotis septentrionalis*), and big brown (*Eptesicus fuscus*) bats. Total bat counts declined by 85% following the detection of WNS. Tri-colored, little brown, and northern long-eared bats exhibited significant declines of 92–93%, though big brown bat counts increased by 58% following the emergence of WNS. Similarly, visual assessment of trends using localized regression showed declines in tri-colored, little brown, and northern long-eared bats following the emergence of WNS, but suggested a slight increase in counts of big brown bats. Our findings demonstrate that WNS has caused major declines in populations of several Maryland cave bat species.

NORTHERN LONG-EARED BAT MATERNITY ROOST SELECTION IN MINNESOTA

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The northern long-eared bat (*Myotis septentrionalis*; NLEB) was listed as a threatened species under the Endangered Species Act (ESA) in 2015, mainly due to the impacts of white-nose syndrome (WNS). Mortalities from WNS were first observed in Minnesota in winter 2015/2016. Under the ESA, NLEB maternity roost trees are protected from harvest during June and July, when bat pups are non-volant. Little information is available on NLEB roosting habitats and reproductive timing in the upper Midwest. We captured bats throughout the forested region of Minnesota during the summers of 2015-2017. Pregnant and lactating NLEB were given radiotransmitters and were tracked to their maternity roost sites. We tracked 84 female NLEB to 237 roosts, 233 of which were in trees. These roosts were located in at least 22 different species of trees of varying diameter, height, and decay stage. Roost trees were, on average, larger and more decayed than random trees. Bats spent an average of 1.3 days in each roost, and moved an average of 278 m (range 2 – 2083 m) between consecutive roosts. Our results suggest that female NLEB prefer larger more decayed trees as maternity roosts, but have flexible roosting habits and may therefore not be limited by roost availability. Parturition may occur as late as the third week of July in Minnesota, meaning some pups may still not be able to fly during the first weeks of August. These results can be applied to future management actions to assist recovery of NLEB in Minnesota.

INFLUENCE OF OFF-ROAD VEHICLE TRAILS ON SMALL MAMMAL COMMUNITY STRUCTURE AND BAT ACTIVITY IN WESTERN MARYLAND

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Anthropogenic habitat disturbance is recognized as a primary contributor to loss of biodiversity and overall degradation of natural landscapes. Roadways that divide forest ecosystems reduce habitat connectivity and disrupt wildlife behavior. Most research to date has focused on major roadways with high traffic volume with less focus on smaller roads and trails. Policy changes regarding off-road vehicle (ORV) use on public lands has concentrated environmental impacts in specific areas. The first objective of this study was to provide the first comprehensive survey of small mammal population distributions and abundances along St. John's Rock ORV trail in Savage River State Forest. We hypothesized that small mammal abundances would be greater near the trail, whereas species richness and diversity would be greater further from the ORV trail. Transects established along the trail were trapped to quantify small mammal community structure and distribution. The second objective of this study was to further our understanding of the impacts of forest trails on bat activity. We hypothesized that bat activity would be greater along the ORV trail compared to locations further from the trail. Acoustic bat detectors were deployed within 5m and 250m from the trail to quantify bat activity and occupancy. We observed ten small mammal species across all sampling locations, with Peromyscus spp. being the most abundant. We detected at least 6 bat species across all locations, with Lasiurus borealis and Eptesicus fuscus being the most abundant. Preliminary results indicate that small mammal abundances and bat activity were greater near the ORV trail. Modeling small mammal abundances and detection probabilities with microhabitat characteristics will provide an understanding of distributions and activity levels. The results of this study can be used to determine the extent to which anthropogenic recreation and small mammals can coexist in a multiuse natural landscape.

CHANGES IN SUMMER BAT CAPTURE RATES AT MAMMOTH CAVE NATIONAL PARK: PRE/POST WHITE-NOSE SYNDROME ARIVAL

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Thirteen species of bats have been documented during summer capture surveys at Mammoth Cave National Park, Kentucky. White-nose syndrome (WNS) was first confirmed in the park in early January 2013. This disease has been confirmed in seven bat species on the park, and the fungus which causes the disease has been found on three park species, but without confirmation of the disease. Biennial winter bat counts from 2007 to 2017 in selected park caves showed increasing numbers for the gray bat (*Myotis grisescens*), big brown bat (*Eptesicus fuscus*) and Rafinesque's big-eared bat (*Corynorhinus rafinesquii*), and decreasing numbers for the little brown bat (*M. lucifugus*), the tri-colored bat (*Perimyotis subflavus*) and the Indiana bat (*M. sodalis*) over the 11-year period. Capture data from summer bat inventory efforts on the park prior to the arrival of WNS (2004-05) and after the arrival of WNS (2017) were used to examine changes in capture rates among bat species between the two time periods. Several species showed declines, a few species showed increases, and several species showed little or no changes in capture rates. Results from summer capture studies were similar to changes observed during the winter bat counts. These findings are similar to results reported elsewhere following the arrival of WNS.

A MULTIVARIATE ANALYSIS OF COMPLEX RELATIONSHIPS BETWEEN DEN SELECTION BY EASTERN SPOTTED SKUNKS (SPILOGALE PUTORIUS) AND ENVIRONMENTAL VARIATION

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Eastern spotted skunk (*Spilogale putorius*) populations have been in decline since the 1940's. The cause of this decline is thought to have been a combination of several factors including increased competition with sympatric carnivore species, spread of introduced diseases, and habitat loss and fragmentation. In Virginia, ideal spotted skunk habitat occurs in small, disjunct patches throughout the Appalachian and Blue Ridge Mountains. Management recommendations include the use of prescribed burning and other disturbance based management to increase habitat connectivity and maintain areas of current spotted skunk habitat. However, to construct and implement effective wildlife habitat management plans, it is critical to understand microhabitat use and resource selection by the species in need of management. We tracked 19 radio-collared spotted skunks from January 2016 through November 2017 at three sites throughout the George Washington and National Forests. Our aim was to investigate the complicated relationships among characteristics of dens selected by spotted skunks. We conducted a redundancy analysis (RDA) to extract and summarize the variation in den selection that can be explained by site specific environmental variables, variation in weather conditions, and reproduction condition. We hypothesized spotted skunks would select den types and locations that offer protection from predation and exposure to inclement weather. We predicted that these relationships would be strongest during times of higher vulnerability, i.e. during mating season in late winter and kit rearing in late summer. We expect our results to influence the selection and timing of management methods and implementation in respect to eastern spotted skunk habitat restoration and management.

INTERACTIONS BETWEEN IMPREILED BAT SPECIES AND A FIRE DEPENDENT ECOSYSTEM IN THE SOUTHERN APPALACHIANS

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Longleaf pine (*Pinus palustris*) ecosystems of the southeastern U.S. require low-intensity fire to maintain their open-canopy forest structure. Efforts to restore this once widespread ecosystem are being implemented by use of prescribed fire and forest thinning. These restoration efforts may, however, have negative impacts on the threatened northern myotis (*Myotis septentrionalis*) and the endangered Indiana myotis (*Myotis sodalis*), which are declining due to white-nose syndrome. Our objective is to examine roost site selection and foraging patterns of northern myotis and Indiana myotis across prescribed fire regimes. The study area is located in the Shoal Creek Ranger District of the Talladega National Forest in northeastern Alabama. We mist netted for and radio tagged northern myotis and Indiana myotis during the summer of 2016 and 2017. We tracked tagged individuals daily to find day roosts, and we obtained foraging points nightly. We measured habitat characteristics for each day roost and nearby random tree. Our preliminary results suggest that northern myotis and Indiana myotis had a greater proportional home range use in areas with more frequent prescribed fire. Indiana myotis roosted in tall pine snags with high DBH, whereas northern myotis roosted in a variety of living and dead pine and hardwood trees with a lower DBH. These early results suggest that extensive prescribed fire management associated with longleaf pine ecosystem restoration is compatible with the habitat needs of the northern myotis and Indiana myotis.

ARTIFICIAL ROOST STRUCTURES AS A SURROGATE FOR NATURAL ROOSTS IN THE EASTERN SMALL-FOOTED MYOTIS, MYOTIS LEIBII

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The focus of this project is the development of artificial roosts for *Myotis leibii*. This species roosts in rock crevices, so the conservation application is limited, although rock roosts may occasionally collapse. If the bats use these structures, we will manipulate the structures by changing variables (e.g. crevice width, angle of exposure to the sun, height, and crevice temperature) to test hypotheses about roost preferences of this species. In the spring of 2017, we placed 8 roost boxes, approximately 1 m2 each, at locations on Surry Mountain Dam. The boxes are placed in pairs, anchored to the slope, and face southeast. We monitored the boxes weekly during the summer, and also successfully netted Myotis leibii to confirm their presence in the area. Bats often require time to find and utilize artificial roosts, so we will continue monitoring the boxes for at least two additional years. Because no bats used the boxes in summer 2017, we have modified the roosts in anticipation of the 2018 bat season. Specifically, we lowered one of each pair of boxes so that the bats might locate it more easily, and we painted the lowered box interior black. We hope this will better simulate the rock crevices this species prefers. In addition, the boxes will be available earlier this year, because they are set up and waiting through the winter months. This may mean that bats will locate the roosts earlier in the spring, and then adopt them for the summer 2018 season. We will be able to record the dates of bats returning to roost in the area, and also data about whether roosts are preferred lower to the ground.

BATS IN BRIDGES: SEARCHING FOR SUITABLE ACOUSTIC METHODS AND ANALYSIS

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Many bats, including several species listed as threatened or endangered, rely on highway bridges as both day and night roosts, and even as maternity colony sites. Bridges are regularly inspected for signs of bat use, and must be checked before any maintenance or construction activities that might disturb roosting bats. But it can be difficult to determine exactly which bat species may be present in the structure. Roosting sites may be inaccessible and capture techniques can be challenging and dangerous in proximity to busy highways. Acoustic detectors and analysis software can be used to identify free-flying bats, but species recorded foraging or passing through the area may or may not actually be using the structure. We used several acoustic detectors in different configurations to look for differences in call quality and activity patterns at a bridge known to house roosting bats in Wythe County, VA, and consider statistical analysis to compare classification data as initial steps in developing a strategy to differentiate between bat species roosting in the bridge from those just using the area around it. Lack of replication is a current constraint, but results can be enhanced and techniques refined as we incorporate additional sampling sites.

BAT TRACKING AND COUNTING WITH LOW-COST THERMAL CAMERAS

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Obtaining accurate counts of bats is important for population monitoring and species management. High-end thermal cameras have been used for counting bats, but they are expensive for an individual or non-profit organization. There are lower-cost thermal cameras available, but the low resolution can make accurate counting difficult due to high background noise. In this paper, we designed a new algorithm for bat tracking, and tested our algorithm across a range of bat caves under different environmental conditions. We use energy distribution of the bat body in our algorithm to obtain a robust tracking and counting method for low-cost cameras and tested the performance with different levels of background noise. Our recursive algorithm has low computation complexity in both counting accuracy and speed, is open-source, and is easy to use. We assessed the counting accuracy of our algorithm from 4 different caves and different weather conditions. The average performance accuracy was 87%, with a maximum accuracy of 97%. This new counting algorithm can be helpful for users desiring a low-cost, user friendly bat counting method.