

Bat Activity on High Elevation Reforested Coal Mines in the Monongahela National Forest, West Virginia Briana Snyder¹ Christopher Barton^{1,2} Michael Lacki² Steven Price² Zachary Hackworth²

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Background	Objective	Methods	Results	Conclusion
Basic Bat	Facts	<u>Clutte</u>	e <u>r-</u> Physical complex	kity of an airspace
		High cl	utter	Low clutter

Photo credits: Green Forests Work

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Photo Credits: Kent Mason (frog, newt, deer, rabbit), Vermont Reptile & Amphibian Atlas (yellow-spotted salamander), Ohio Wildlife Center (mouse)



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Background Objective Methods Results Conclusion



Land Classifications

- 1-year old FRA legacy mined land: FRA1
- 8-year old FRA legacy mined land: FRA8
- Traditionally reclaimed mined land: REGEN
- Mature forest not previously mined: MAT

• 4 per category = 16 total sites





Ultrasonic monitoring

Insect Surveys

Habitat Assessment









Ultrasonic monitoring







Bat activity:

- Recordings
- Feeding buzzes



Ultrasonic monitoring

Insect Surveys







Insect Surveys





Lepid. Number Lepid. Mass

Counts Biomass

Tot. Insect Number Tot. Insect Mass







Insect Surveys

Habitat Assessment











Wetland pool characteristics

- Area of pool surface
- Percent cover of water surface
- Volume of woody debris

Terrestrial characteristics

- Distance to nearest road
- Distance to nearest forest

Habitat Assessment





Models: WATER, LAND, INSECT, LAND+WATER, & GLOBAL



Silver-haired bat

Indiana bat



- FRA8 = 112
- REGEN = 1,098
- MAT = 223
- REGEN had significantly more feeding buzzes than all other land classes (p<0.05)











Model Parameters

- LAND
 - Distance to nearest road
 - Distance to nearest forest
- WATER
 - Area of pool surface
 - % cover of water surface
 - Volume of woody debris
- INSECT
 - Lepidoperta mass
 - Lepidoperta count
 - Total insect mass
 - Total insect count

Recordings

- Best
 - LAND
- Supported
 - All INSECT models
 - WATER
- Significant
 - Pool cover

Feeding Buzzes

- Best
 - LAND
- Supported
 - INSECT-Lepidoptera number
 - INSECT-Total insect biomass
 - INSECT-Total insect number
- Significant
 - Proximity to forest
 - Total insect biomass

WATER: As pool cover increased \rightarrow recordings decreased LAND: As forest proximity decreased \rightarrow feeding buzzes increased INSECT: As insect variables decreased \rightarrow feeding buzzes increased



Question 1: Do bats use FRA restored lands as foraging habitat?

YES!



Question 2:

How does the bat activity at wetlands in FRA restored lands compare to wetlands in naturally regenerating mined land and mature forest? • FRA1



• Overall, REGEN had the greatest activity levels

Background

Results

Conclusion

Question 2:

How does the bat activity at wetlands in FRA restored lands compare to wetlands in naturally regenerating mined land and mature forest?





Summary of Pool and Terrestrial Characteristics

Habitat variable	FRA1	FRA8	REGEN	MAT
Distance to nearest forest (m)				•
Range	28.00 - 94.00	95.00 - 131.00	4.00 - 13.00	2.00 - 56.00
Mean	59.00	110.75	9.25	18.25
Distance to nearest road (m)				
Range	38.00 - 473.00	90.00 - 179.00	355.00 - 504.00	53.00 - 384.00
Mean	251.25	144.50	428.50	223.75
Pool surface area (m²)				
Range	0.69 - 100.49	6.83 - 63.36	6.57 - 72.19	8.50 - 200.20
Mean	43.71	39.10	39.93	66.73
Percent cover of pool (%)				
Range	23.00 - 48.00	55.00 - 75.00	0 - 62.00	8.00 - 75.00
Mean	26.50	64.00	27.63	38.25
Woody debris volume (m ³)				
Range	0 - 0.46	0 - 0.22	0 - 0.0005	0 - 2.10
Mean	0.19	0.10	0.00	0.54

Question 2:

How does the bat activity at wetlands in FRA restored lands compare to wetlands in naturally regenerating mined land and mature forest?



FRA 8 wetland

Summary of Pool and Terrestrial Characteristics

Habitat variable	FRA1	FRAS	REGEN	AA AT
	TINAT	TINAO	REGEN	////~\ I
Distance to nearest forest (m)				
Range	28.00 - 94.00	95.00 - 131.00	4.00 - 13.00	2.00 - 56.00
Mean	59.00	110.75	9.25	18.25
Distance to nearest road (m)				
Range	38.00 - 473.00	90.00 - 179.00	355.00 - 504.00	53.00 - 384.00
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Woody debris volume (m ³)				
Range	0 - 0.46	0 - 0.22	0 - 0.0005	0 - 2.10
Mean	0.19	0.10	0.00	0.54

Background

Objective



Prey base establishment

Question 3:

What can be done to help foster bat activity in FRA restored lands?

Wetland establishment







Vegetation management



Kentucky Bat Data



- 3 land classes; 4 sites per
 - Mature forest
 - Young FRA 2 years post restoration
 - Old FRA 8-15 years post restoration

- 3 nights of recording
- Total recordings: 8,319

Recording Summary				
	Young FRA	Old FRA	Mature Forest	
Total	3162	3563	1594	
Range	53-692	46-597	2-279	
Mean	263.5	296.9	132.8	
SD	181.5	179.5	100	

Feeding Buzz Summary

	Young FRA	Old FRA	Mature Forest
Total	296	606	200
Range	0-66	3-188	0-37
Mean	24.7	50.5	16.7
SD	23.2	48.8	14.2

Species ID'd:

- Big brown bat
- Red bat
- Hoary bat
- Myotis spp.
 - Gray bat
 - Small-footed Myotis
 - Little brown bat

- Northern long-eared bat
- Indiana bat
- Tricolored bat
- Silver haired bat
- Virginia big-eared bat

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Questions?

Want to know more? Find our publication in Ecological Restoration, Volume 42 - Number 2

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Ultrasonic Monitoring -Species ID

- 6,282 sequences were identified to species
- Proportion ID'd
 - FRA1: 57%
 - FRA8: 53%
 - REGEN: 51%
 - MAT: 43%



Species detected:

- Red bat (*Lasiurus borealis*)
- Big brown bat (*Eptesicus fuscus*)
- Hoary bat (*Lasiurus cinereus*)
- Tri-colored bat (Perimyotis subflavus)
- Silver-haired bat (Lasionycteris noctivagans)
- Myotis spp Small-footed myotis (Myotis leibii)
 Little brown bat (Myotis lucifugus)
 Northern long-eared bat (Myotis septentrionalis)
 Indiana bat (Myotis sodalis)















FRA8







MAT





REGEN

