

Biology, Ecology and Natural History of T & E Bats in Kentucky

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Overview of Kentucky Bats

- 15 species occur in the state during one or more seasons of the year
- 27% have some level of federal protective status
- All species belong to the taxonomic family Vespertilionidae and represent 7 genera: *Myotis*, *Lasiurus*, *Lasionycteris*, *Perimyotis*, *Eptesicus*, *Nycticeius*, and *Corynorhinus*
- One genera, *Tadarida*, is extirpated
- All species are insectivorous



Protected Bat Species in Kentucky

Cave-obligate species:

- Gray bat (*Myotis grisescens*) – **Endangered** (1976)
- Virginia big-eared bat (*Corynorhinus townsendii virginianus*) – **Endangered** (1979)



Forest-obligate species:

- Indiana bat (*Myotis sodalis*) – **Endangered** (1967)
- Northern long-eared bat (*Myotis septentrionalis*) - **Threatened** (2015)

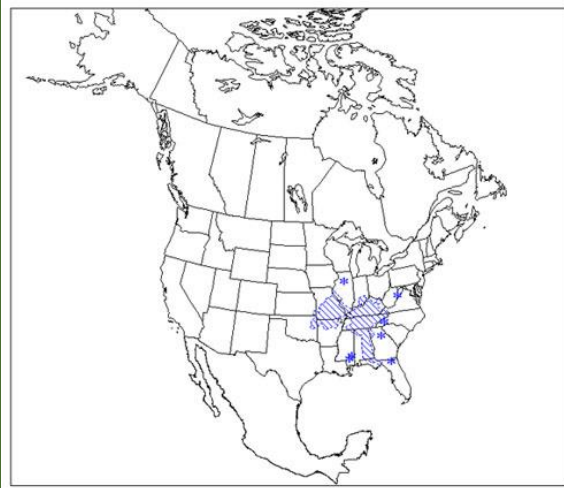


Gray Bat

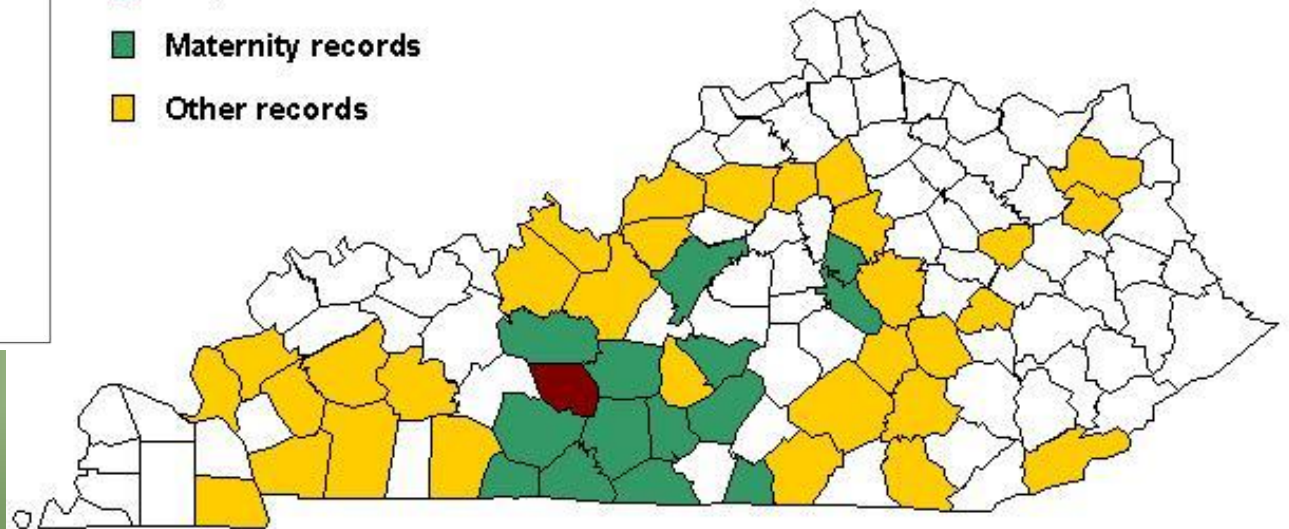
Myotis grisescens



Kentucky Distribution of Gray bat (*Myotis grisescens*) by county



- Major hibernaculum records
- Maternity records
- Other records



Morphology & Identification

Body Mass: 7 – 16 grams

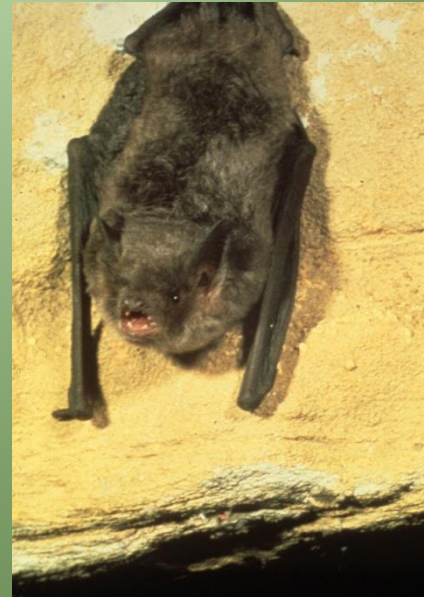
Body Length: 97 – 106 mm

Wingspan: 275 – 300 mm

Pelage Color: Light to dark gray; can be brownish in color during summer

Diagnostic Feature(s):

Dorsal fur uniform tip to base
wing attached to foot at ankle



Roosting Requirements

- Winter roosts:

- Typically in deep vertical caves
 - Predominantly in limestone karst



- Summer roosts:

- Typically in caves along rivers
 - Form maternity colonies in caves closer to entrances
 - Give birth to single pup in May/early June



Foraging Habitat Needs

- Travel long distances up to several kilometers to foraging areas
- Strongly associated with riverine and riparian ecosystems
- Will forage in forested habitats along and near water (SMZs)



Diet

- Can be quite varied and shifts with seasonal changes in insect availability
- Heavy reliance on insects with aquatic larval stages
- Captures insects in flight: aerial hawking
- Predominant taxonomic Orders include:

Diptera



Chironomid midge

Coleoptera



Spotted cucumber
beetle

Ephemeroptera



Mayfly

Trichoptera



Caddisfly

Virginia Big-eared Bat

Corynorhinus townsendii virginianus





C. townsendii complex

Morphology & Identification

Body Mass: 7 – 12 grams

Body Length: 101 – 116 mm

Wingspan: 297 – 324 mm

Pelage Color: Uniform color (tan to brown);
Ventral fur not white

Diagnostic Feature(s):

Ears 33 – 38 mm in length

Globular-shaped muzzle

First upper incisor unicuspid



Roosting Requirements

➤ Winter roosts:

In caves and sinkholes in karst regions
Majority of population in Kentucky hibernates
in a single cave



➤ Summer roosts:

Typically in caves and rockshelters
Prefer well ventilated areas near entrances
Maternity colonies often roost in domed ceilings
that serve as warm air traps
Very sensitive to disturbance
Give birth to single pup in May/early June



Foraging Habitat Needs

- Forage in forests along clifflines
- Use rockshelters as feeding roosts
- Will also use clearings in forests
- Can travel several km to reach feeding areas



Diet

- Diet specialist
- Heavy reliance on Lepidoptera (moths)
- Captures insects by gleaning off surfaces via relatively inaudible echolocation calls and a slow agile flight
- Predominant taxonomic Families include:

Geometridae



Lesser maple
spanworm

Noctuidae



Unspotted looper

Notodontidae



White-dotted
prominent

Sphingidae



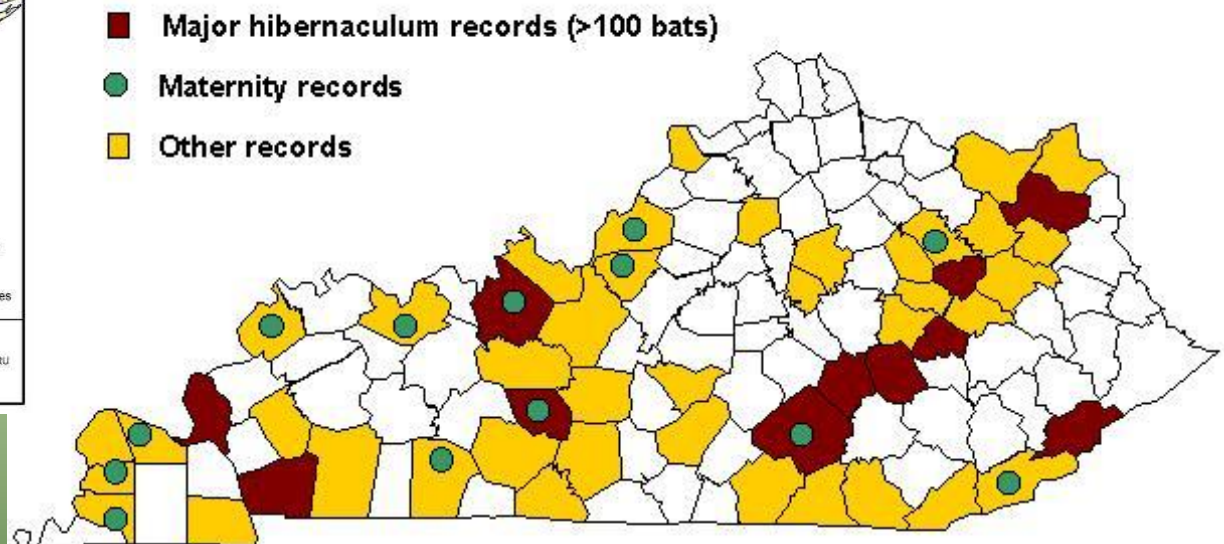
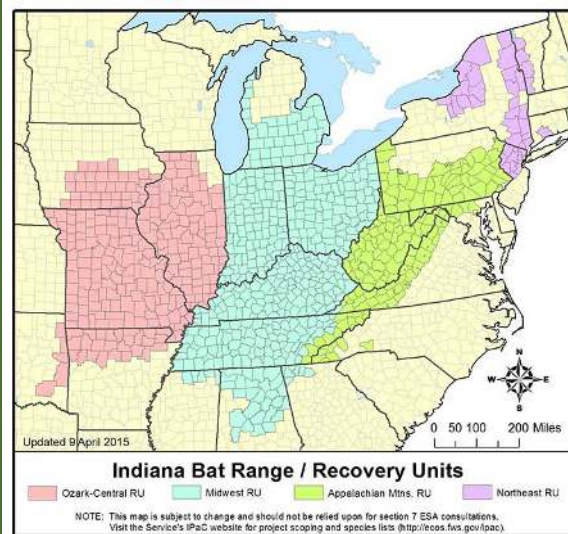
Lettered sphinx

Indiana Bat

Myotis sodalis



Kentucky Distribution of Indiana bat (*Myotis sodalis*) by county



Morphology & Identification

Body Mass: 5 – 11 grams

Body Length: 86 – 94 mm

Wingspan: 240 – 267 mm

Pelage Color: Dark brown with dull,
nonglossy fur

Diagnostic Feature(s):

- keeled calcar

- short toe hairs do not extend beyond
tip of claws

- relatively small feet

- snub-nosed face



Roosting Requirements

➤ Winter roosts:

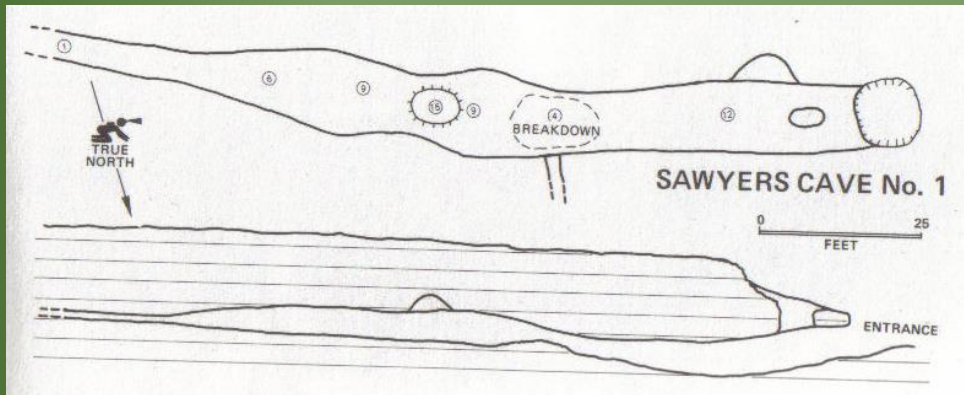
In caves and sinkholes in karst regions

Require cool, humid caves

Hibernates at temperature $< 10^{\circ}\text{C}$ (50°F) but above freezing

Highly vulnerable to WNS infection from *Pseudogymnoascus destructans*

Form extremely dense clusters when hibernating



Roosting Requirements

➤ Summer roosts:

Use both live and dead trees in upland forests, woodlands, riparian forests and swamp forests

Often select roost trees in canopy gaps where bole of tree or snag is exposed to direct sunlight during part of the day

Form maternity colonies beneath exfoliating bark and inside crevices and cavities

Likely exhibit fission/fusion behavior requiring multiple roost trees per colony

Give birth to single pup in May/early June



Foraging Habitat Needs

- Forage along streams and in upland forests
- Often captured over woodland ponds and along forest corridors
- Typically forage higher in the canopy or above canopy
- Can travel several km to reach feeding areas but often feed relatively close to roosting sites



Diet

- Diet varies geographically and seasonally but usually is comprised of smaller insect prey
- Heavy reliance on upland forest insects, although aquatic insects are eaten
- Captures insects by aerial hawking but are also capable of gleaning
- Predominant taxonomic Orders include:

Lepidoptera



Coleoptera



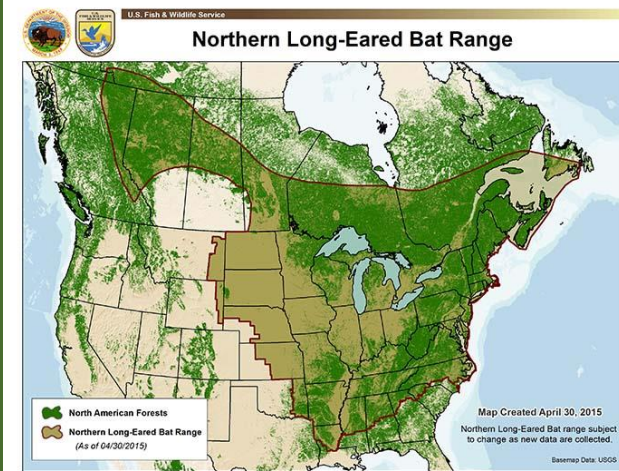
Diptera



Northern Long-eared Bat

Myotis septentrionalis

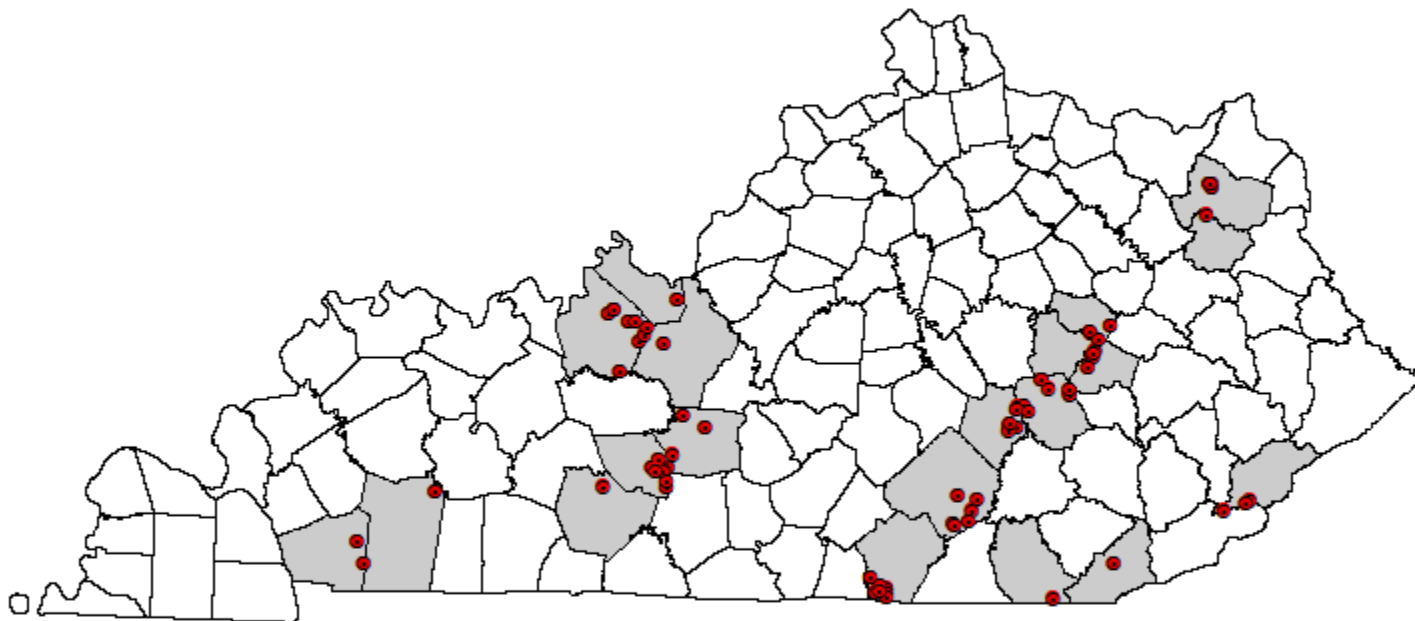




WNS Sites in Kentucky



- WNS Caves
- WNS Counties



0 25 50 75 100 Miles
1:2,700,000

Traci Hemberger
4/22/2014
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Morphology & Identification

Body Mass: 5 – 10 grams

Body Length: 86 – 98 mm

Wingspan: 228 – 258 mm

Pelage Color: medium to dark brown with
dull, nonglossy fur

Diagnostic Feature(s):

- long ears (17 – 19 mm)

- long, narrow pointed tragus

- no keel on calcar



Roosting Requirements

➤ Winter roosts:

- In caves and mines

- Roost singly or in small numbers, often in inaccessible places

- Prior to WNS was commonly found but never abundant, rendering current population trajectories difficult to assess



Roosting Requirements

➤ Summer roosts:

Use both live and dead trees in upland forests, woodlands, riparian forests and swamp forests

Also roosts in buildings

Less specific in selection of roost trees than Indiana bats, choosing trees of a wider range in diameter size, height and species (including pines)

Selects trees in canopy gaps, but also beneath closed canopy forest

Forms maternity colonies more frequently in crevices and cavities than Indiana bats

Exhibits fission/fusion behavior requiring multiple trees per colony

Give birth to single pup in May/early June



Foraging Habitat Needs

- Clutter-adapted, forage along woodland trails and within the mid-and upper canopy layers
- Less frequently captured over streams
- Often captured over woodland ponds and along forest corridors
- Believed to forage lower in the canopy than Indiana bats
- Can travel several km to reach feeding areas but often feed relatively close to roosting sites



Diet

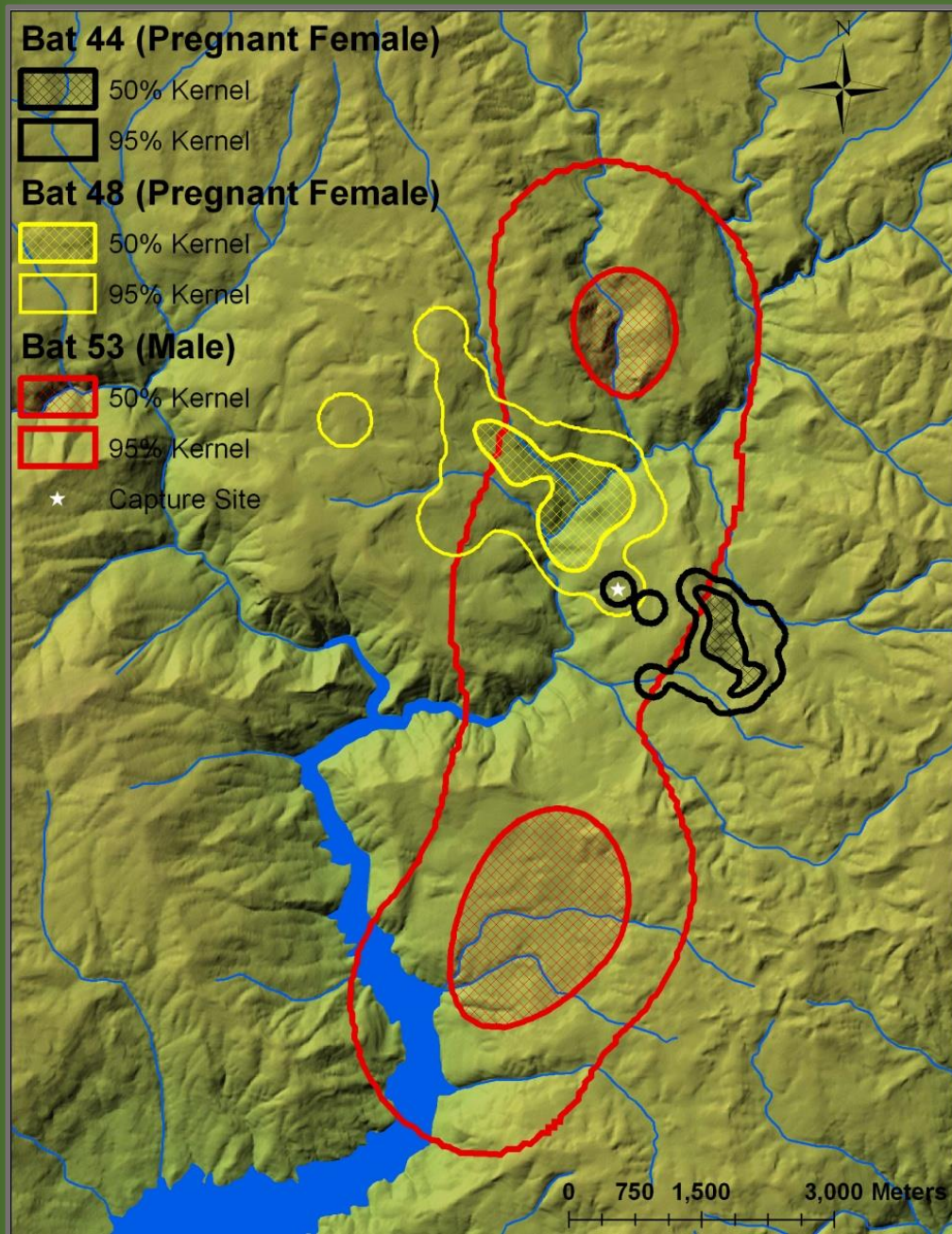
- At the Ordinal level diet is similar geographically
- Heavy reliance on Lepidopterans and Coleopterans
- Use of molecular techniques demonstrated selection for smaller-sized moths (micro-lepidopterans) than other sympatric bat species, including moths that are forest pests in the larval stage (Dodd et al. 2012)
- Captures insects by gleaning and aerial hawking
- Echolocates at frequencies inaudible to many moth species
- Also capable of using passive listening to locate stationary prey

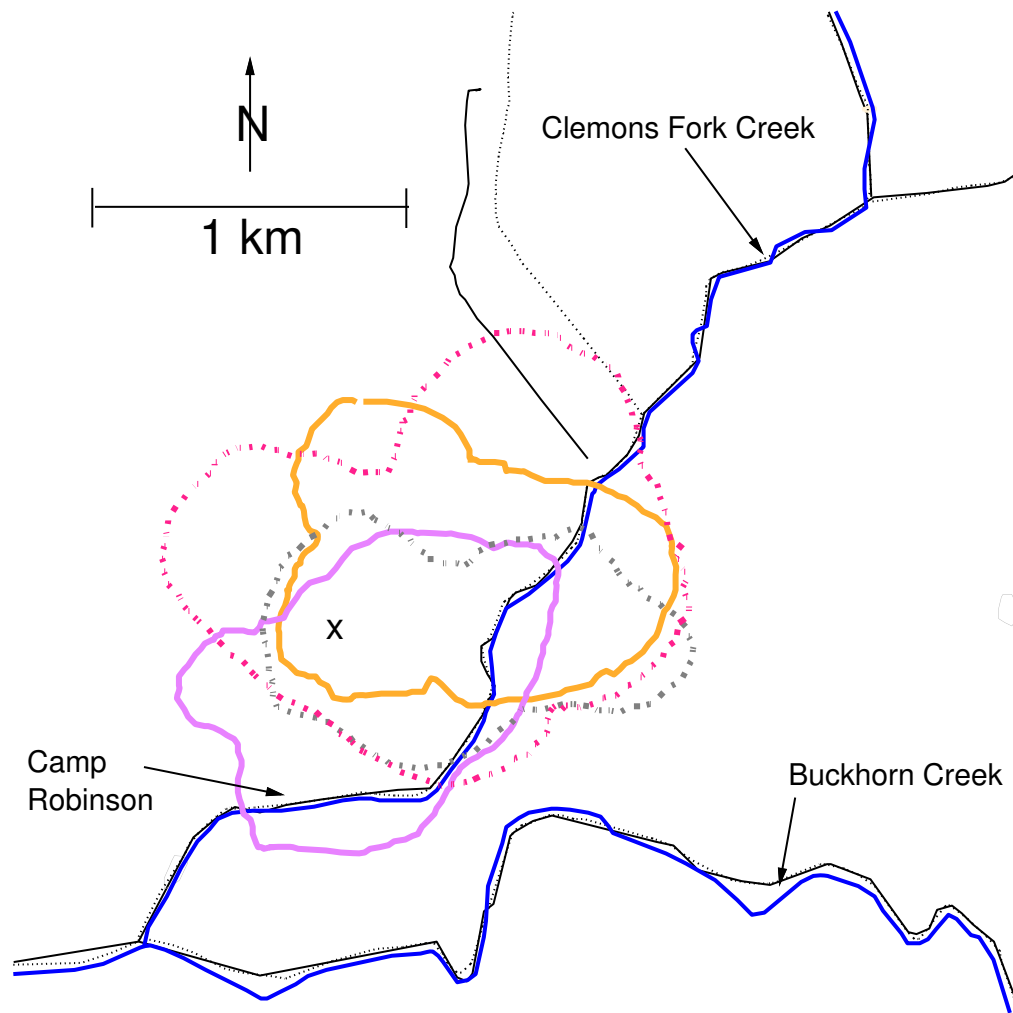


Malacosoma americanum – Eastern tent caterpillar moth

Habitat Needs of Forest Bats







HABITAT TYPE

- Forest
- Non-Forest
- Aquatic

FORAGING AREA

- #883 (m)
134 ha
- #944 (f)
116 ha
- #963 (f)
113 ha
- #984 (f)
192 ha



Forest Management and Bats

Based on ecomorphology and acoustic call signatures:

- (1) ***closed-space species***: are slow flying and highly maneuverable bats that can forage close to vegetation (call frequency at >34 KHz)
- (2) ***edge-space species***: exploit edge habitat and other linear features
- (3) ***open-space species***: have lower maneuverability and fly faster above the forest canopy or within gaps in the forest (call frequency at ≤ 34 KHz)

(Law et al. 2016)

Stand-level Prescriptions



Even-aged Management

Treatment	Condition	Bat response (activity)	Source
Clearcut harvest	Not defined	Mixed	Hart et al. 1993
Deferment and clearcut harvests	6 -10 m ² /ha residual	Increase	Owen et al. 2004
Shelterwood harvests	30-50% reduction	Increase	Titchenell et al. 2011
Seed tree and shelterwood harvests	7.7 - 18 m ² /ha residual	Increase	Dodd et al. 2012

Uneven-aged Management

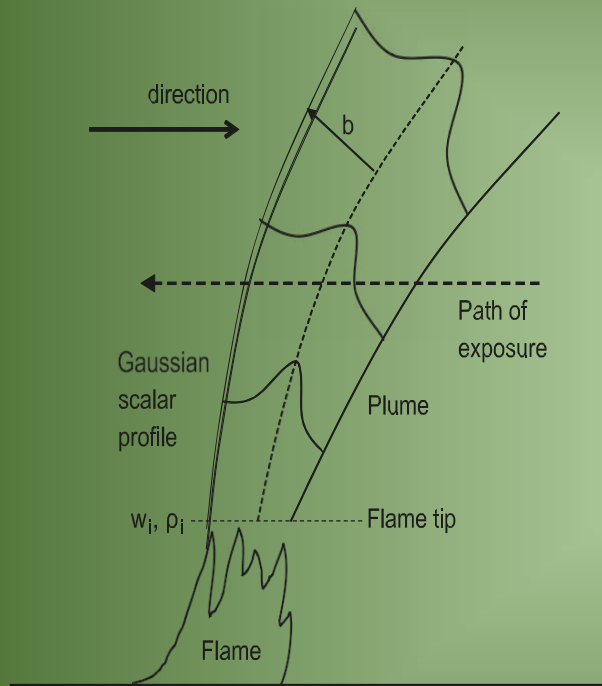
Treatment	Condition	Bat response (activity)	Source
Group selection cuts	0.1 - 0.8 ha in size	Increase	Krusic et al. 1996
Group selection cuts	60% decline in volume	Increase	Perdue and Steventon 1996
Group selection cuts	0.02 - 0.5 ha in size	Increase	Menzel et al. 2002
Canopy gaps	16 - 33.5 m wide	Mixed	Ford et al. 2005
Thinning	45% decline in density	None	Tibbels and Kurta 2003
Thinning	18 m ² /ha residual	Mixed	Loeb and Waldrop 2008

Prescribed Fire

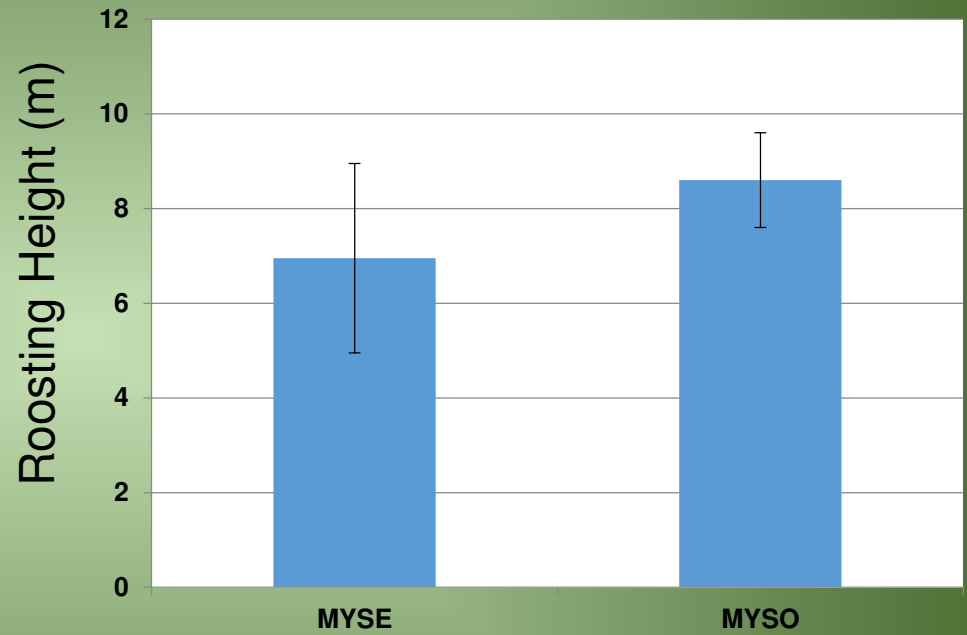
Prescribed fire has similar effects in reducing vegetation clutter:

Most change occurs in the mid- and understory layers and not to the canopy, especially during cool burns





(Dickinson et al. 2010)



Management of Riparian Zones (SMZs)

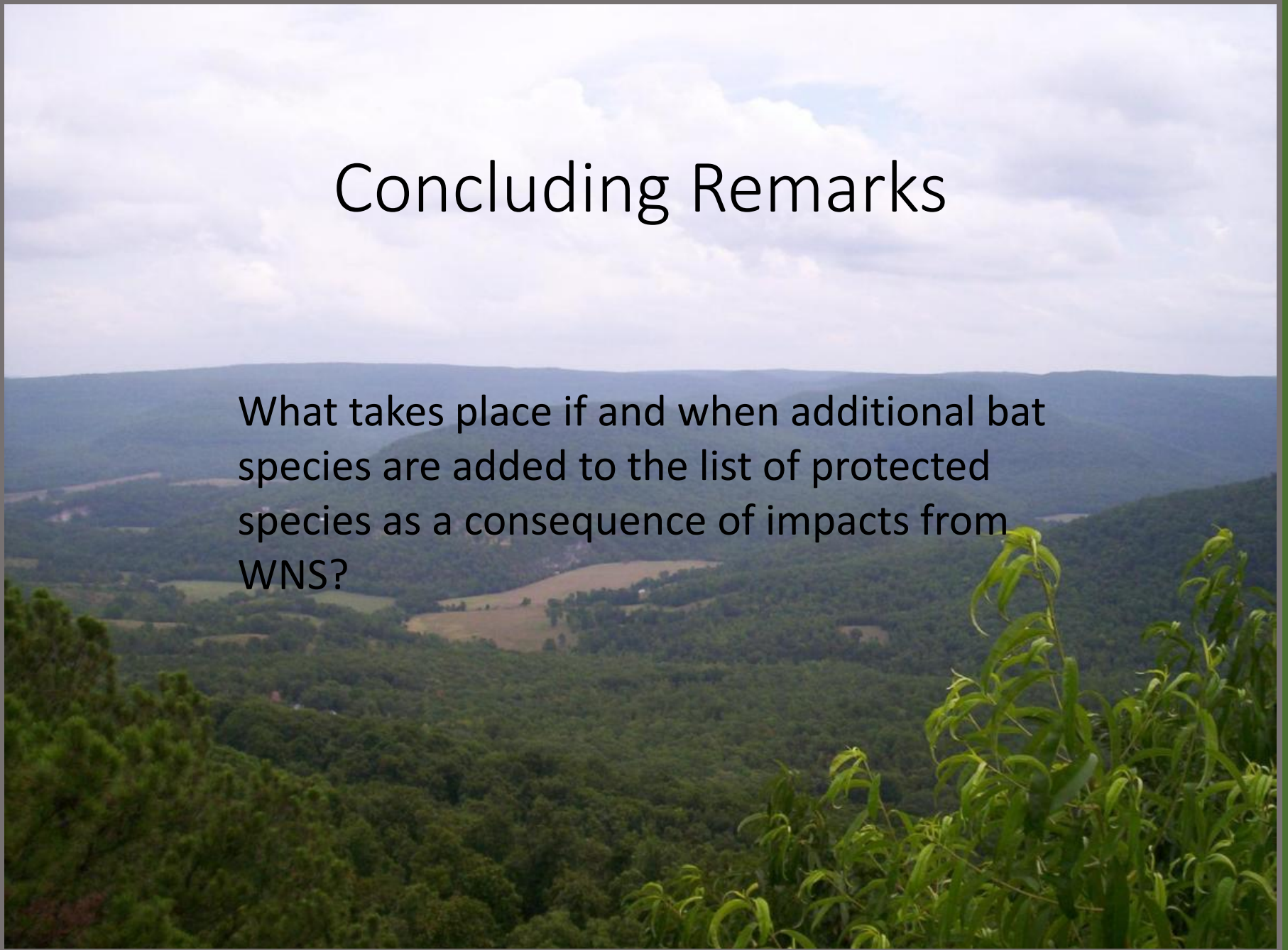


Landscape-level Considerations



Concluding Remarks

What takes place if and when additional bat species are added to the list of protected species as a consequence of impacts from WNS?



Acknowledgements

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