

Mammoth Cave International Center for Science and Learning

Mammoth Cave National Park

Western Kentucky University



White-nose Syndrome in Bats -- Causes, Responses, and Consequences

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Presentation topics and goals

What is WNS?

Extent and species affected

Impacts on Bats

What is the NPS doing?

Questions and concerns



White-nose Syndrome (WNS)

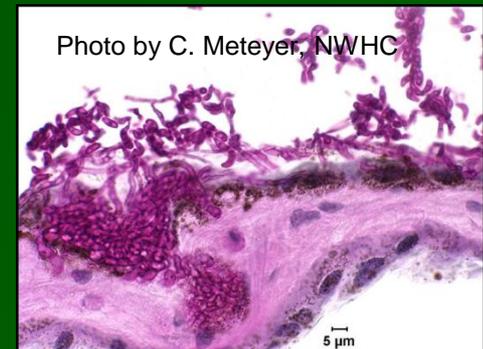
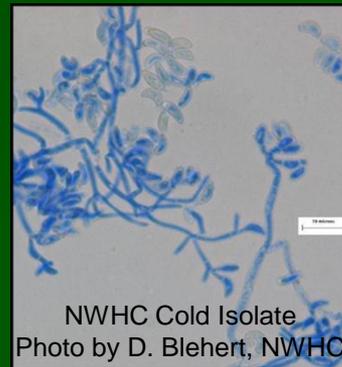
- Disease in bats
- First identified in winter 2006
- First identified in caves and mines in New York
- Has killed over 7,000,000 bats
- Has expanded geographically since 2006
- Kills bats mainly at hibernation sites
- Caused by a fungus *Pseudogymnoascus destructans* (Pd)





Pseudogymnoascus destructans

- Psychrophilic fungus
- Grows below 20°C
- Maximum growth between 12°C and 13°C
- Invades skin and hair follicles on lightly-haired areas of bats (snout, ears, wings, tail membrane)





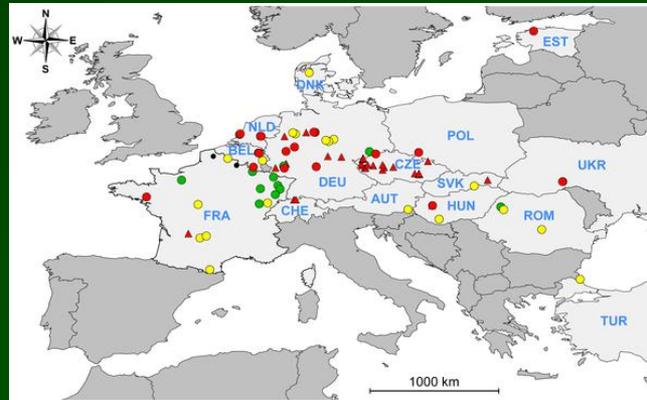
Some preferred hibernation temperatures

- Indiana Bats – 3 - 7.5°C
- Little Brown Bats – 3 - 10°C
- Northern Long-eared Bats – 0 - 9°C
- Gray Bats – 6 - 10°C
- Big Brown Bats – 0 - 9°C
- Tricolored Bats – 5 - 16°C



Pseudogymnoascus destructans

- Same genetically as fungus found throughout Europe
- Causes apparently non-lethal infection in European bats
- Invasive exotic



figures from
Puechmaille, et al. 2012)





White-nose Syndrome (WNS)

What happens

- Dead bats in caves and mines
- Bats at cave and mine entrances
- Bats flying around in cold weather and during day
- White fungus on lightly-haired regions



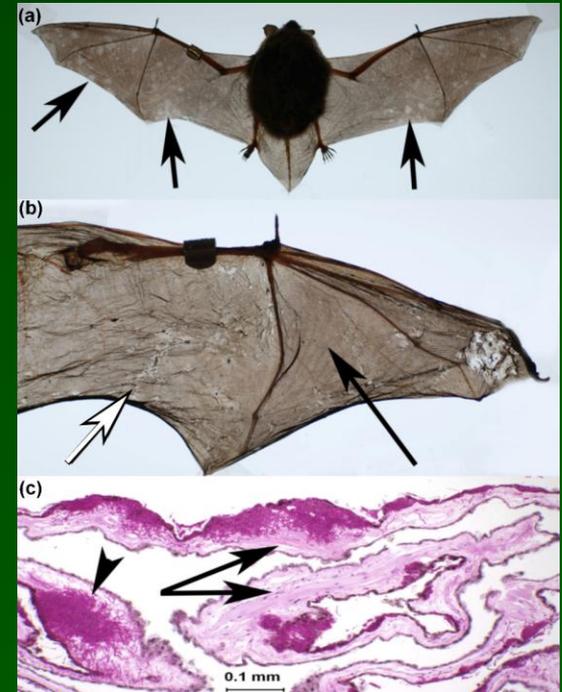
Photo Credit - Alan Hicks



White-nose Syndrome (WNS)

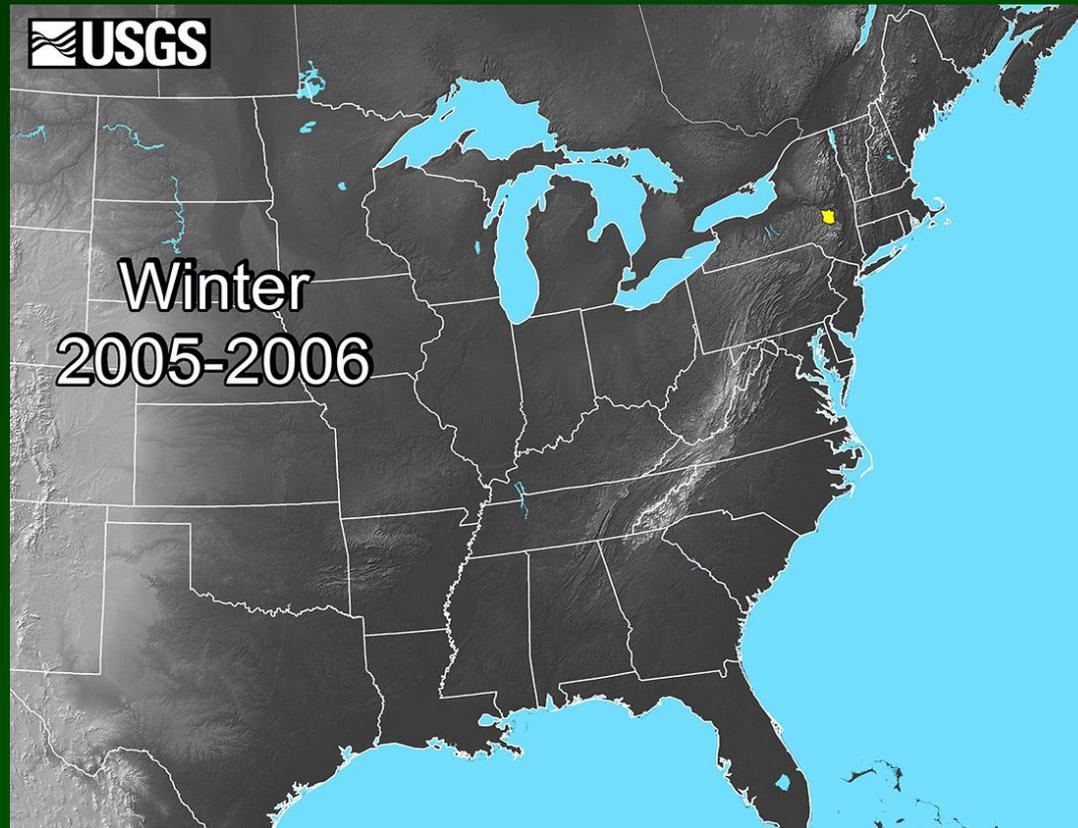
What happens

- Wing damage and scarring (winter, spring, early summer)
- Reduced bat numbers in summer
- Populations reductions potentially warranting T&E listing
- Potential species extinctions



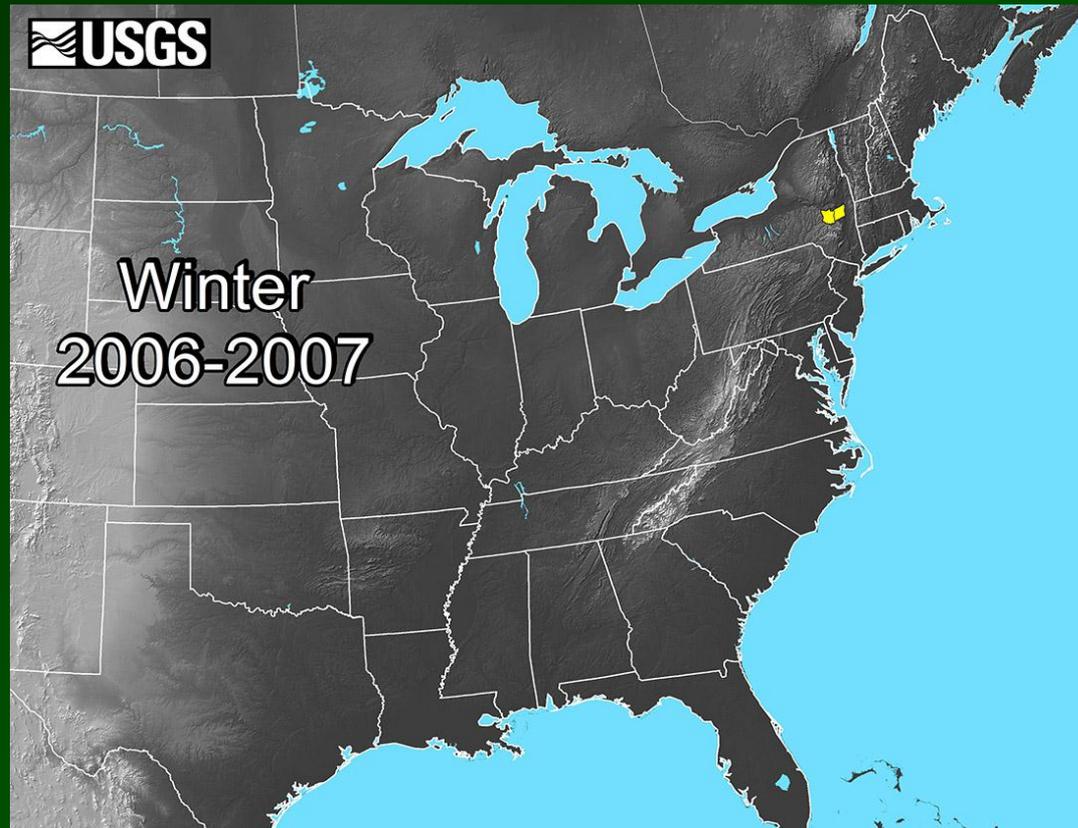


Geographic Spread



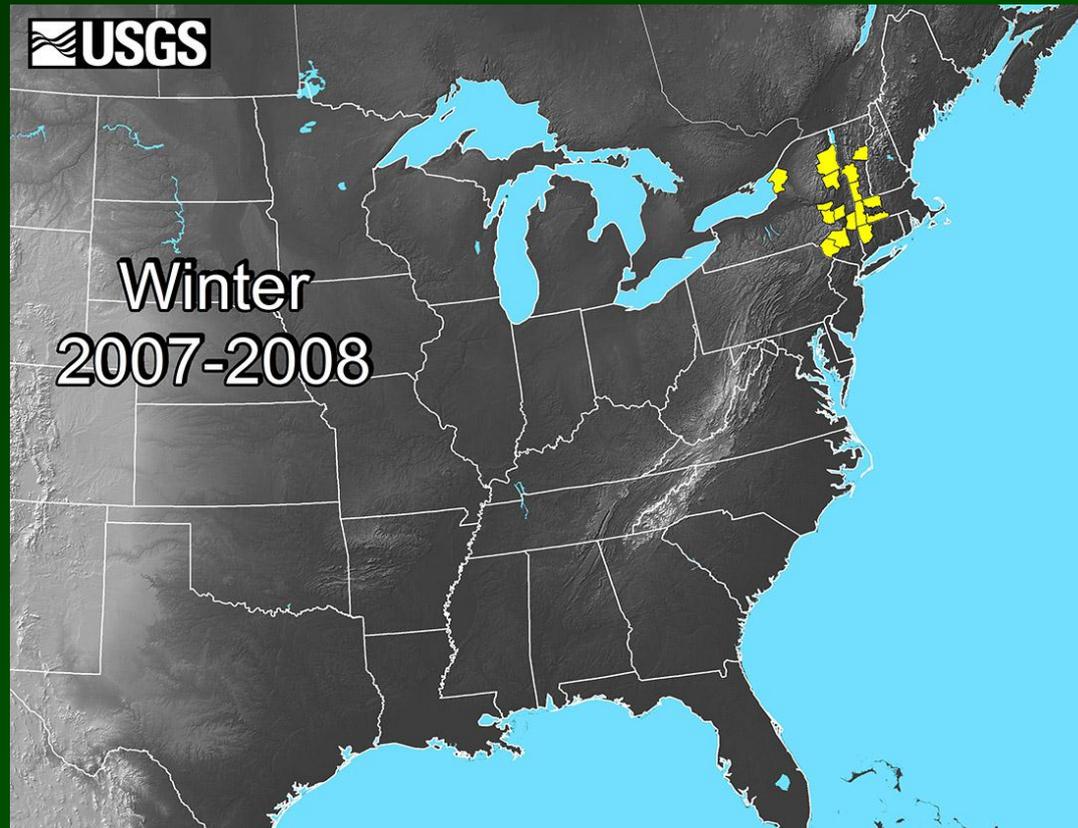


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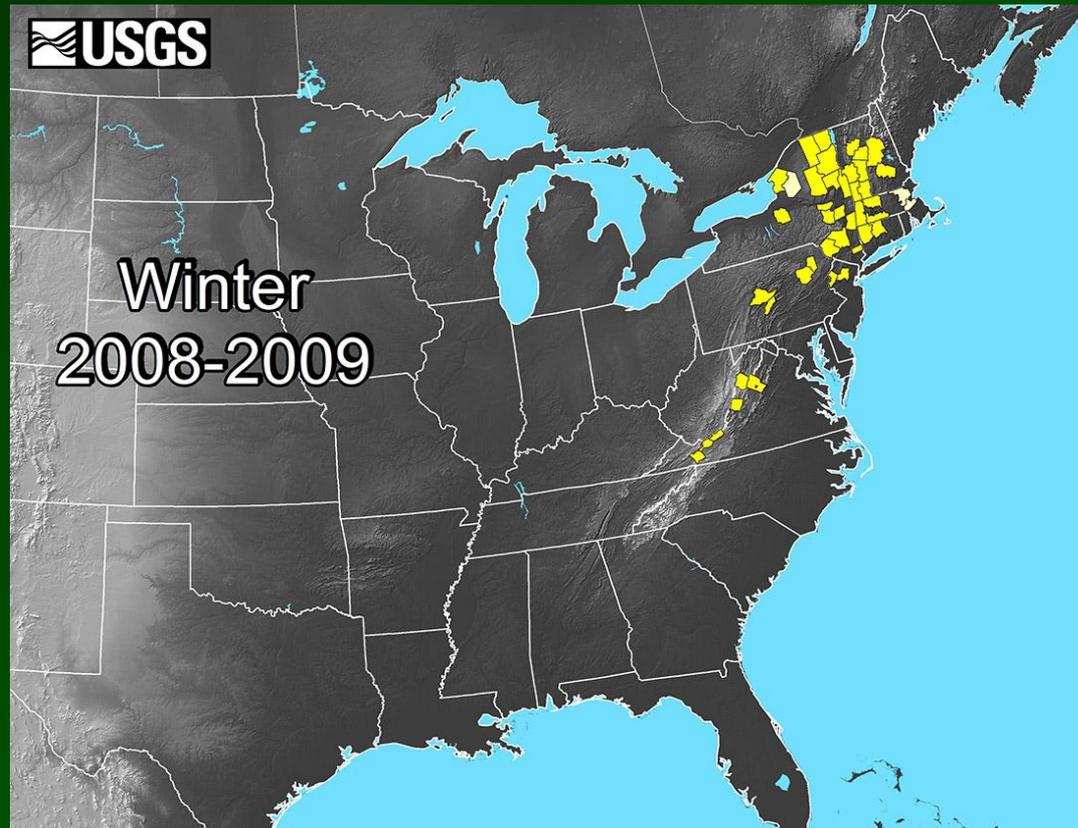


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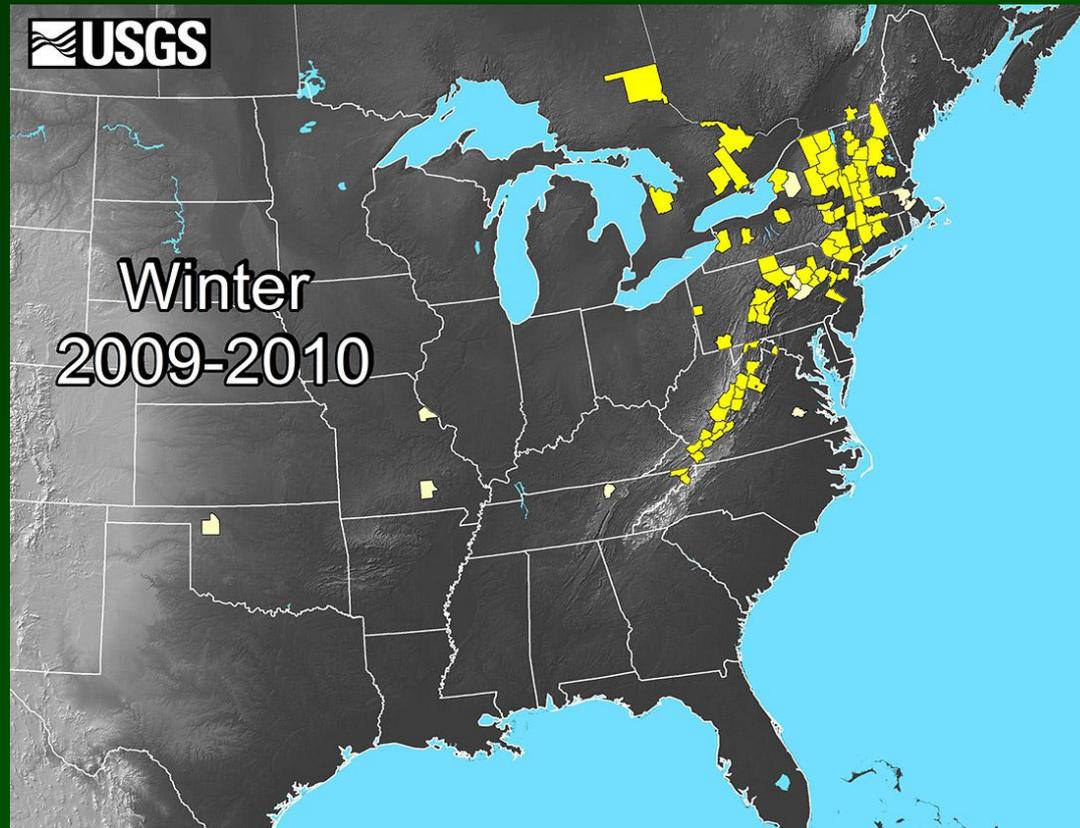


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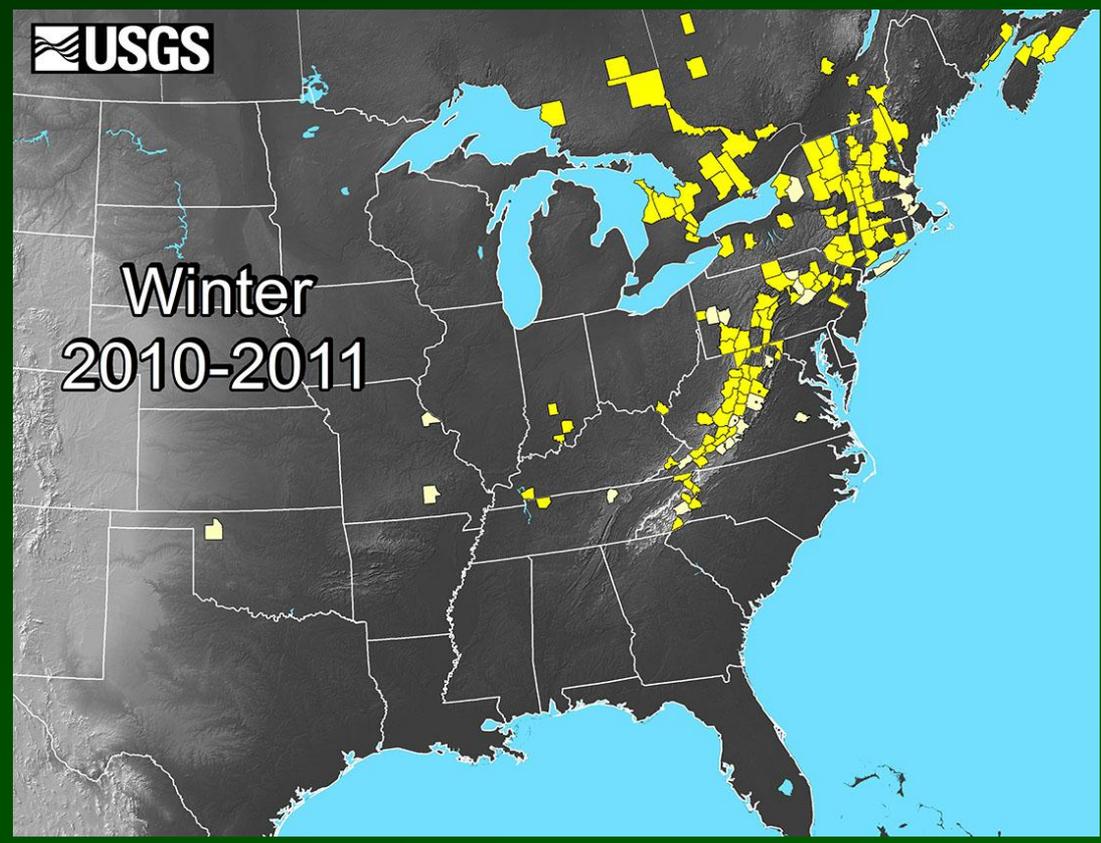


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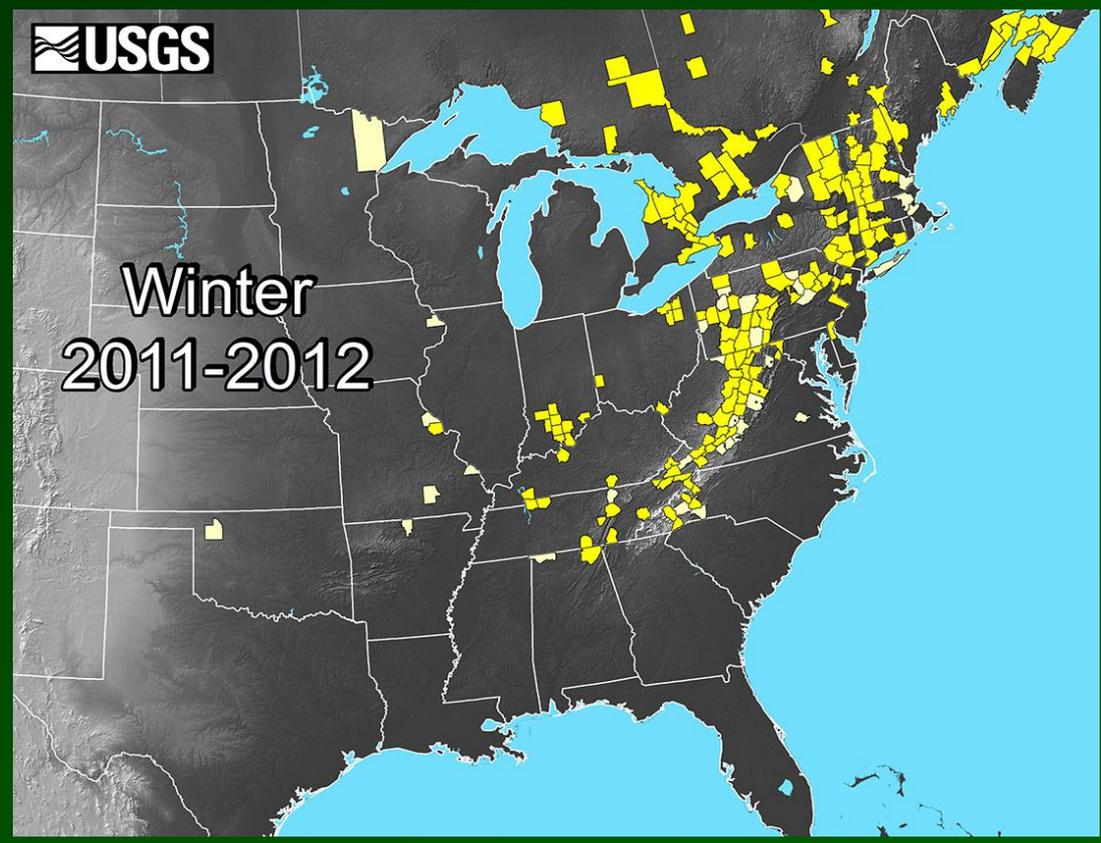


Geographic Spread



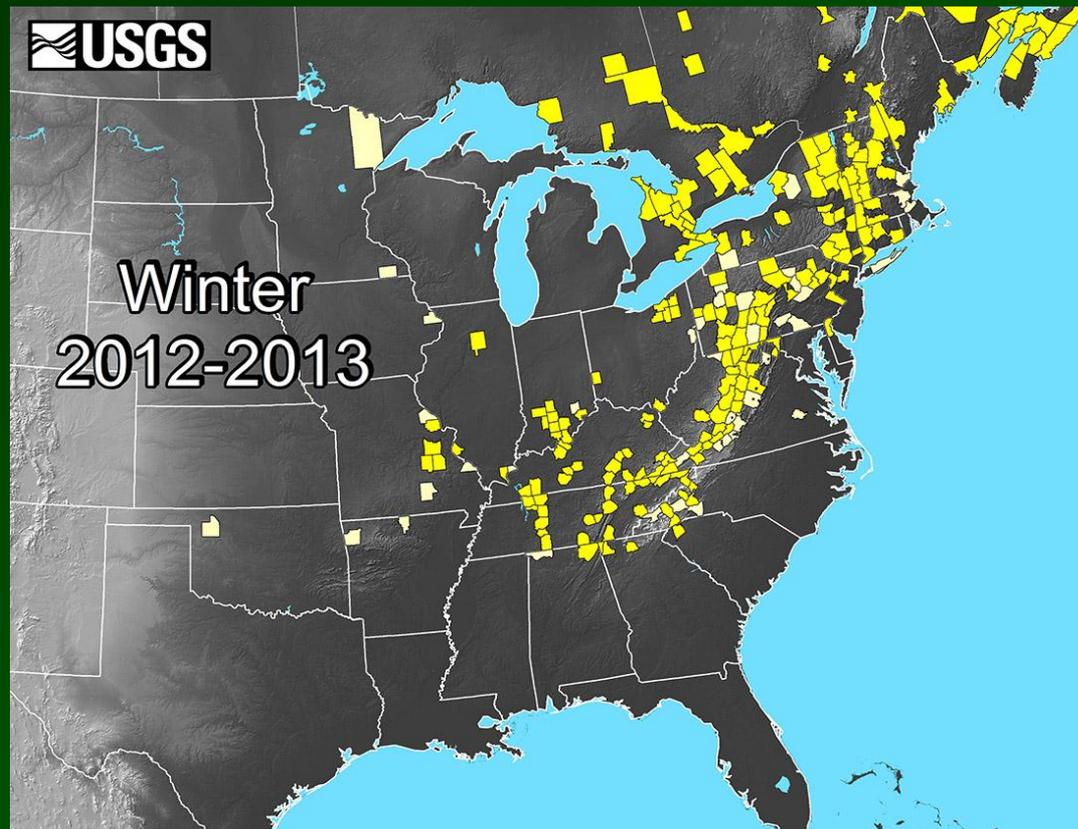


Geographic Spread



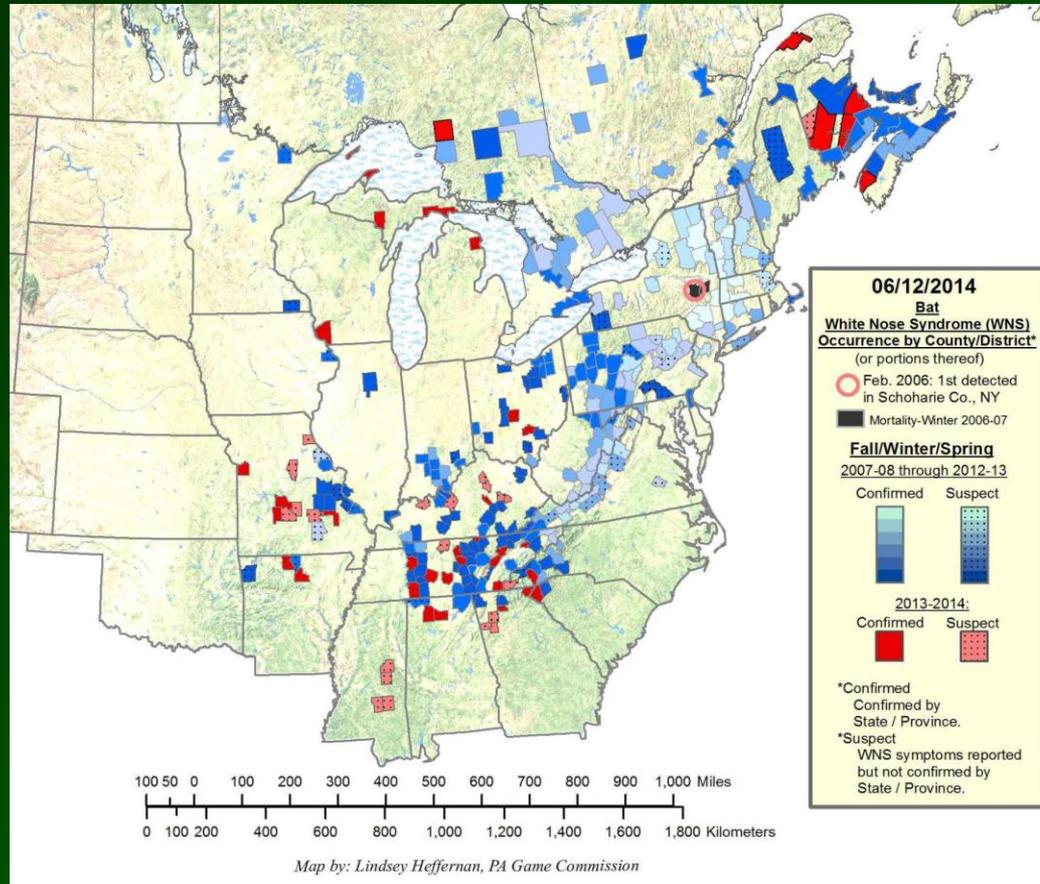


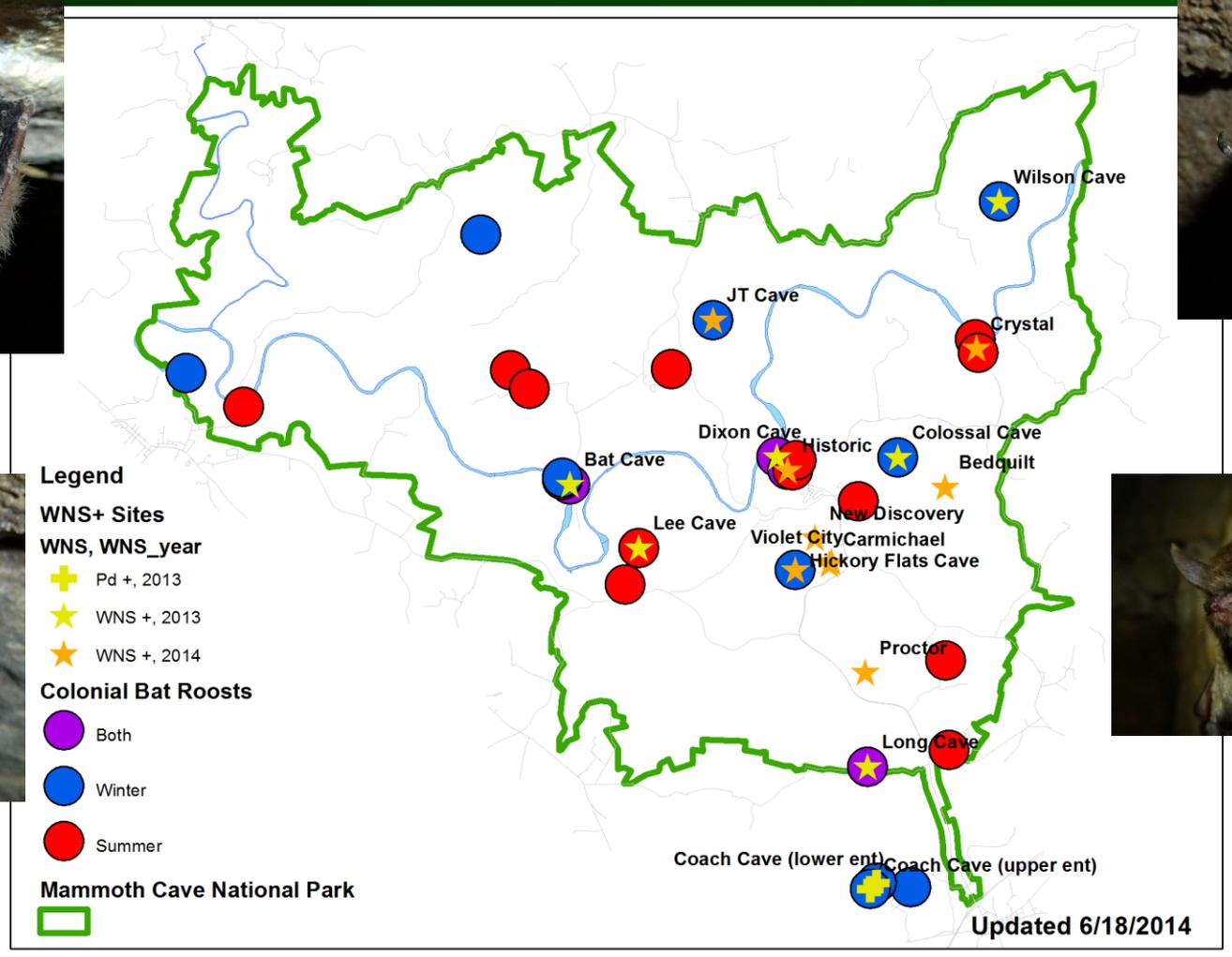
Geographic Spread





Geographic Spread







Species Affected by WNS

Myotis grisescens – gray bat

Myotis lucifugus – little brown bat

Myotis leibii – eastern small-footed bat

Myotis septentrionalis – northern long-eared bat

Myotis sodalis – Indiana bat

Perimyotis subflavus – tricolored bat

Eptesicus fuscus – big brown bat



Additional species with *P. destructans*

(may not show disease, we do not know yet)

Myotis austroriparius – SE myotis

Corynorhinus townsendi virginianus – Virginia big-eared

Lasionycteris noctivagans – Silver-haired bat



Graphite Mine, NY – March 2008



Reduced ~50%
from pre-WNS

Photo by Al Hicks, NYSDEC





Graphite Mine, NY – April 2009

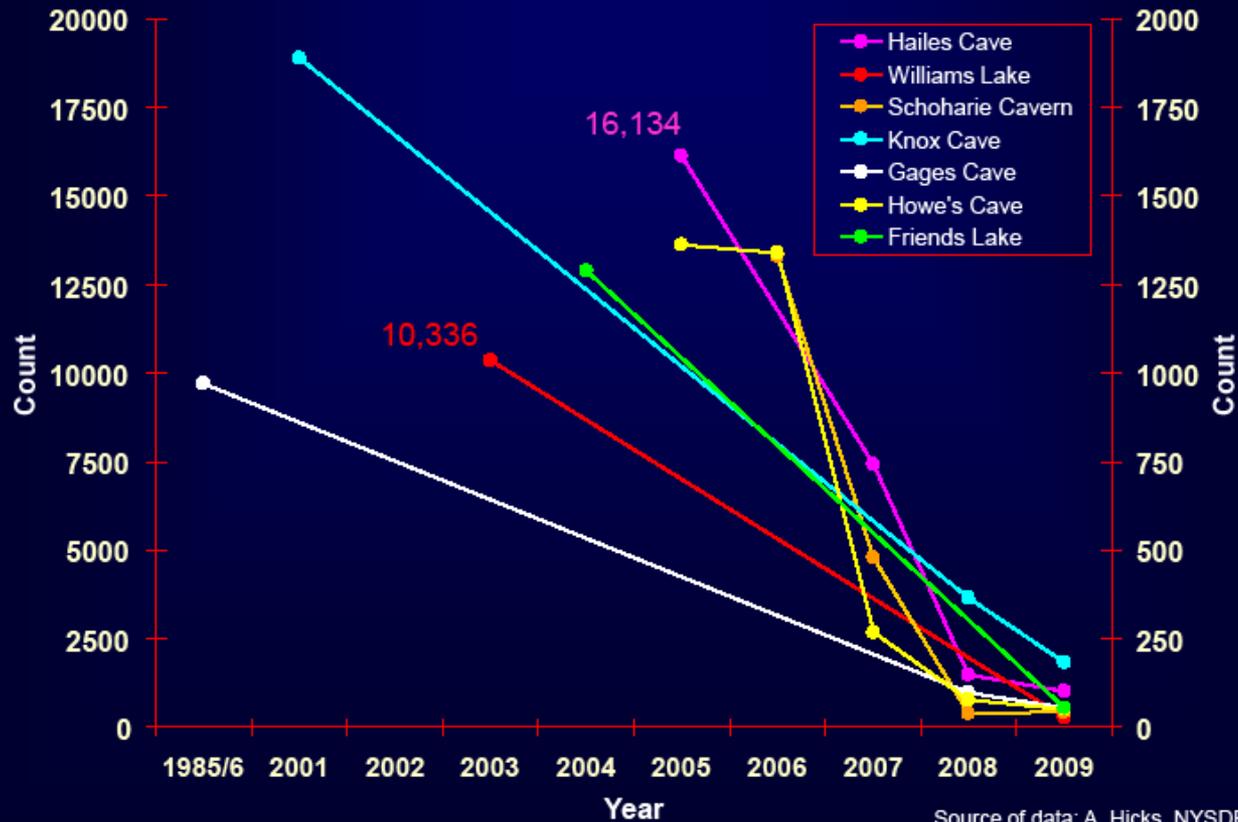
	2000	2010
Little brown myotis	183,542	2,049
Northern myotis	440	0
Indiana myotis	104	0
Tri-colored bat	194	2
E. small-footed myotis	721	485
Big brown bat	18	9



Photo and data: Alan Hicks, NYSDEC



New York Sites - Complete Counts



Source of data: A. Hicks, NYSDEC



Population decline in the Northeast (NY, NH, VT, CT, MA, part of PA)

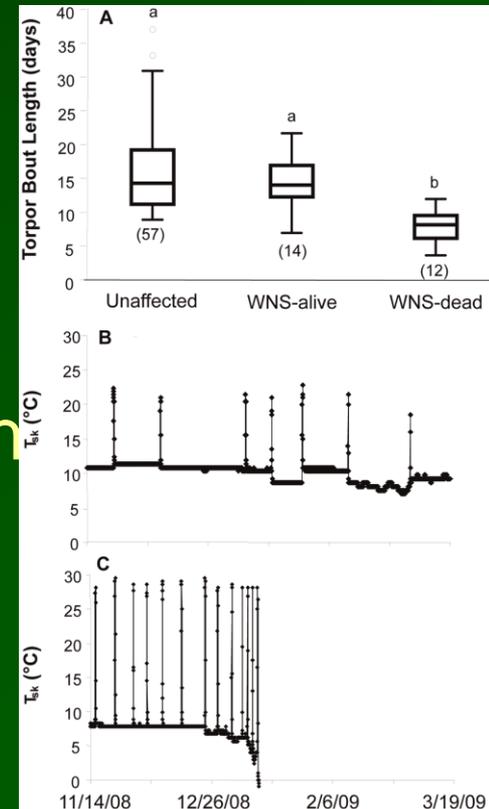
Species	Sites	Pre-	Post-	% decline
Little Brown	50	~385,000	~51,000	87%
Northern Myotis	37	~2000	~300	85%
Pipistrelle	39	~1600	~250	85%
Indiana bat	11	~53,000	~21,000	61%
Small-footed	25	~1250	1125	11%
Big Brown	33	2823	1616	43%

These numbers are older and are now considered low for several species



How does it kill bats?

- Disturbance of torpor via irritation
- Increased fat usage and starvation
- Dehydration
- Damage to wings causing dehydration and electrolyte imbalance (like burn victims)
- Immune Reconstitution Inflammatory Syndrome (IRIS)
- Respiratory acidosis

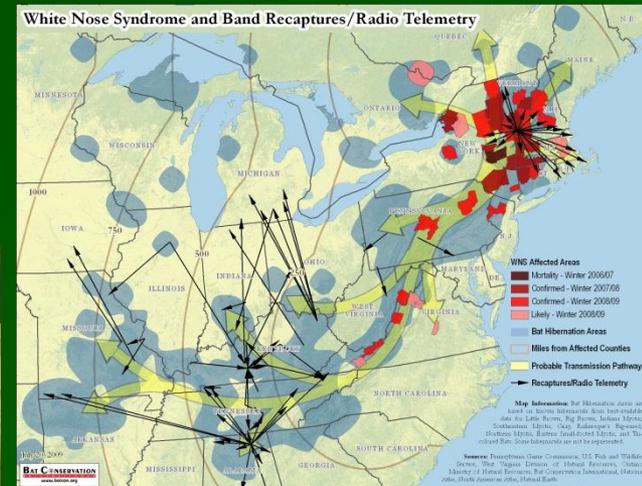




How does it spread?

Possible Routes

- Bat to Bat
- Bat to Cave/Mine
- Cave to Bat
- Cave to People
- People to Cave





What is the National Park Service doing?

- Visitor Screening and Intervention
- Access Restriction
- Research Requirements
- Education
- Population and WNS Monitoring
- Research



Visitor Screening and Intervention



Attention!
Help protect our bats

You can help us slow or stop the advance of White-Nose Syndrome, a disease deadly to bats, by following the simple flowchart below.

Have you been in caves or mines at any time since 2005, for work or for recreation?

No → Enjoy your cave tour!

Yes → Are you wearing or carrying with you any article you took into the caves or mines you visited?
(Clothing, footwear, jewelry, watches, flashlights, cameras, cell phones, etc.)

No → Enjoy your cave tour!

Yes → Visit the White-Nose Syndrome Station → Then → Enjoy your cave tour!



Access Restrictions



Appendix B

WNS Cave Access Table
 Mammoth Cave National Park

Cave Area Classes	Activity Categories													
	On-Trail Tours and Education ¹	"Wild" Cave Tours and Education ²	Off-Trail Non-Caving Groups ³	Off-Trail Education: Caving Groups ⁴	Off-Trail Education: Facility Maintenance, Construction ⁵	Research and Allied Activities ⁶	Search and Allied Emergency ⁷	WNS and Bat Research ⁸	Entrance Only ⁹					
	Pre-WNS	Post-WNS	Pre-WNS	Post-WNS	Pre-WNS	Post-WNS	Pre-WNS	Post-WNS	Pre-WNS	Post-WNS	Pre-WNS	Post-WNS	Pre-WNS	Post-WNS
Current Developed Trails ^a	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Current "Wild" Cave Trails ^b	White	White	White	White	White	White	White	White	White	White	White	White	White	White
Former Tour Trails ^c	White	White	White	White	White	White	White	White	White	White	White	White	White	White
Off-Trail in Mammoth Cave System and Caves Without Colonial Bats ^d	White	White	White	White	White	White	White	White	White	White	White	White	White	White
Cave Areas With Colonial Bats ^e	White	White	White	White	White	White	White	White	White	White	White	White	White	White

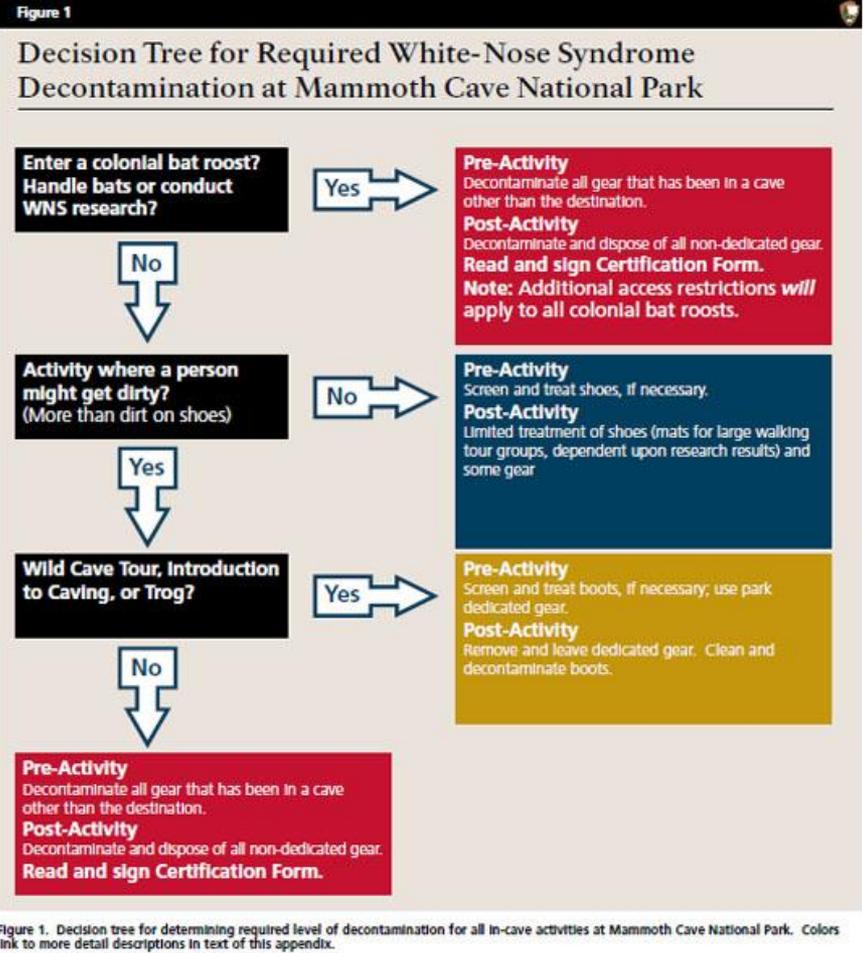
Access Restrictions: ■ = Activity allowed in this class of cave area ■ = Activity may be allowed in this class of cave area on a case-by-case basis ■ = Prohibited Activity ■ = Activity generally does not occur in this class of cave area

Note: For activities in the ■ and ■ categories, see Appendix C, Figure 1 for decontamination requirements for access.





Research Requirements





Education



Bats Matter!

Bats are an essential, beneficial part of ecosystems. The loss of our bat populations could cause an ecological ripple effect with potentially far-reaching consequences.

Bats play critical roles in insect control, plant pollination, seed dissemination, and cave ecosystems. They are also food for other animals, including hawks, raccoons, skunks, and owls.



Bats and You

Consuming over half their body weight in insects each night, bats are primary predators of night-flying insects including many crop and forest pests. Bats in the U.S. eat thousands of tons of insects nightly. A recent study concluded that losing our bats could result in billions of dollars in increased pesticide costs and agricultural damages each year!

The droppings of cave-roosting bats provide vital nutrients for cave ecosystems and are often the basis of a cave's food chain. This guano is used by microorganisms and invertebrates, which become food for fish, salamanders, frogs, and other larger animals.

Bats also play a significant role in science and medicine. Research conducted on bats has led to advancements in sonar, vaccine development, blood anti-coagulation, and more.

**WNS not only affects bats,
it impacts entire ecosystems.**

Research is Critical

Scientists around the world are urgently studying WNS. Many field and laboratory projects are underway as scientists try to discover how WNS is killing our bats, what we can do to fight it, and how to protect surviving bats.

Your Help is Needed!

- Stay out of caves and mines where bats are hibernating.
- Honor cave closures. Check with your state and federal agencies or a local chapter of the National Speleological Society for the status of caves and caving in your area.
- Follow the National WNS Decontamination Protocol to clean and disinfect clothes, footwear, and equipment used in caves or mines.
- Report bats showing signs of WNS, and bats that are dead, dying, or appear diseased, to your state wildlife agency.
- Help spread the word about WNS and the value of our bats.

More Information

For more information on WNS, including decontamination procedures, visit the national response website: www.WhiteNoseSyndrome.org



- For more information on bats and caves, visit:
 - Bat Conservation International: www.batscon.org
 - National Speleological Society: www.caves.org
 - BatsLIVE: <http://batslive.pwnet.org>

This brochure was produced in partnership by:



Battle for Bats The WNS Tragedy

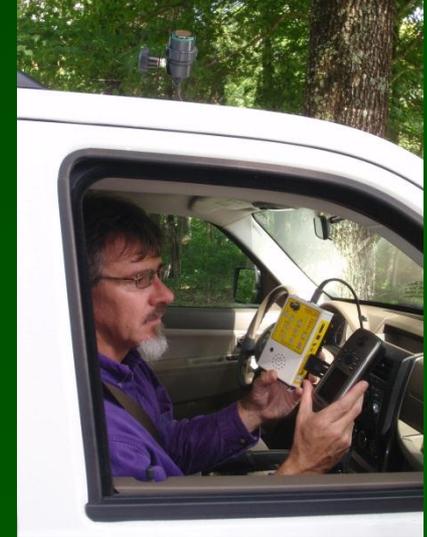


White-Nose Syndrome (WNS)

has caused catastrophic declines in hibernating bats in the United States and Canada. This previously unknown disease has spread very quickly among bats since it was first discovered in 2007 and it poses a considerable threat to millions of bats and entire ecosystems.

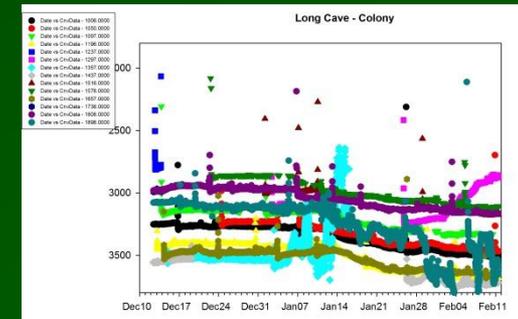
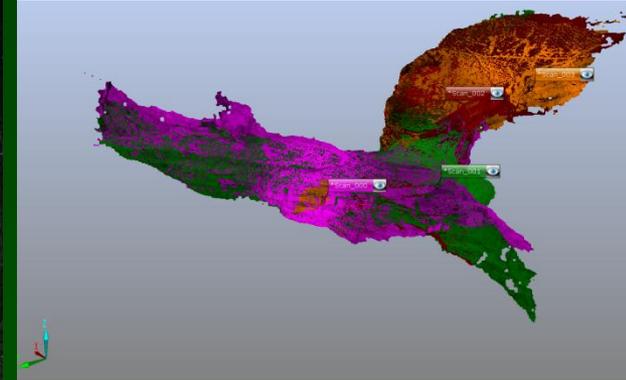


Population and WNS Monitoring





Research



6/24/2014

Toomey, WNS INDU

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What next? Where do we go from here?

- Extinctions ?
 - Models suggest Indiana bats will go at least regionally extinct
 - Northern long-eared bat proposed for federal endangered listing
 - Little brown bat being evaluated for federal T&E and models suggest at least regional extinction
- Treatments / Mitigation?
 - Antifungals
 - Antagonists
 - Probiotics
 - Artificial roosts
- Evolution of reduced virulence (fungus)
- Evolution of increased resistance (bats)
- Behavior changes



Questions and Comments