

# Status of Bats in the Midwest: Implications for Energy Projects



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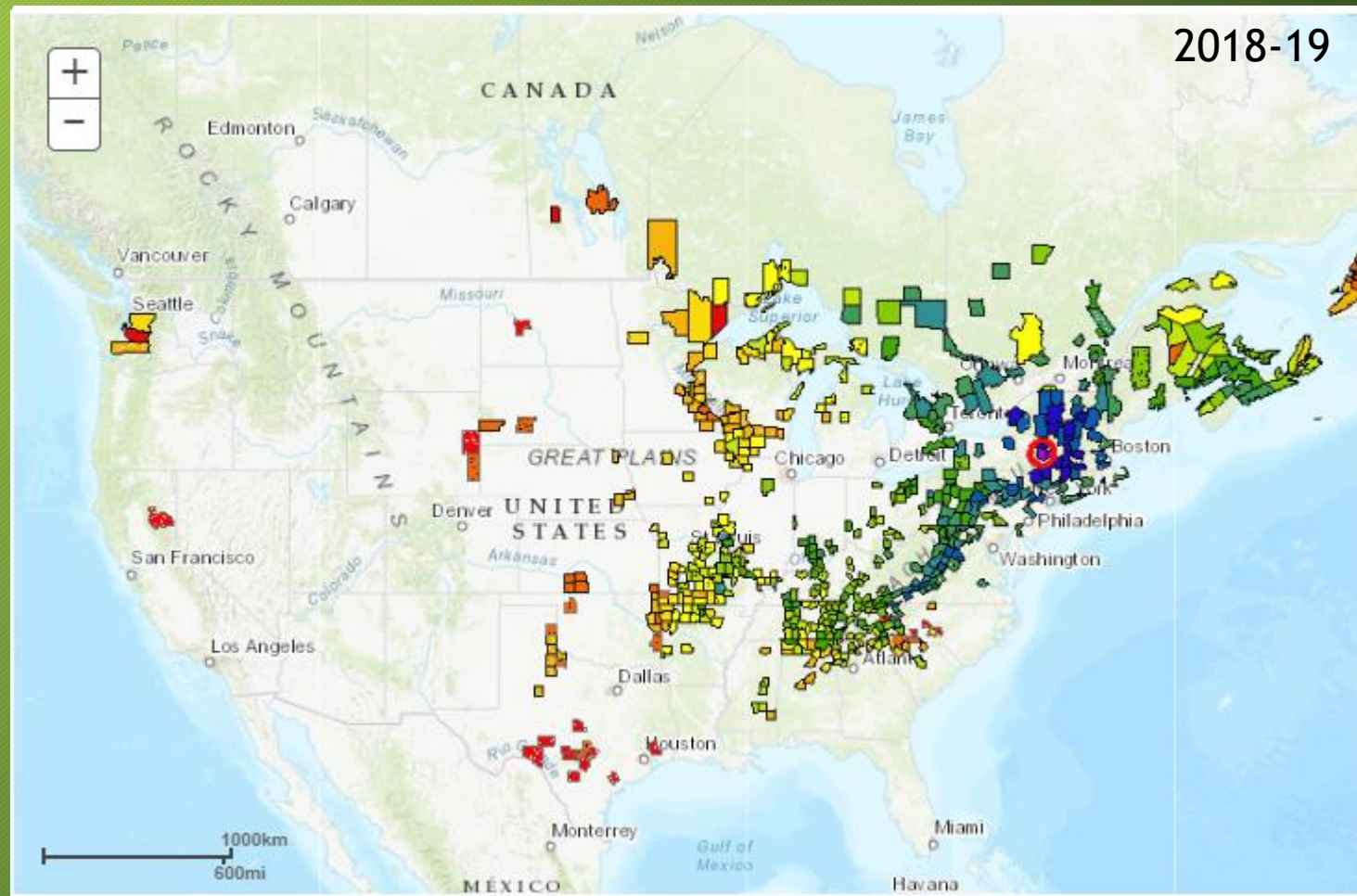
# Overview & Purpose



- White-nose syndrome update
- Bat population status update
  - Listed species
  - WNS-affected species
- Implications
  - Stable vs. declining populations
- Bats and wind HCPs in Missouri
  - Pre-construction surveys
  - Siting and operations
  - Post-construction monitoring

How status and trends in bat populations relate to and inform project consultation, impacts assessments, and mitigation

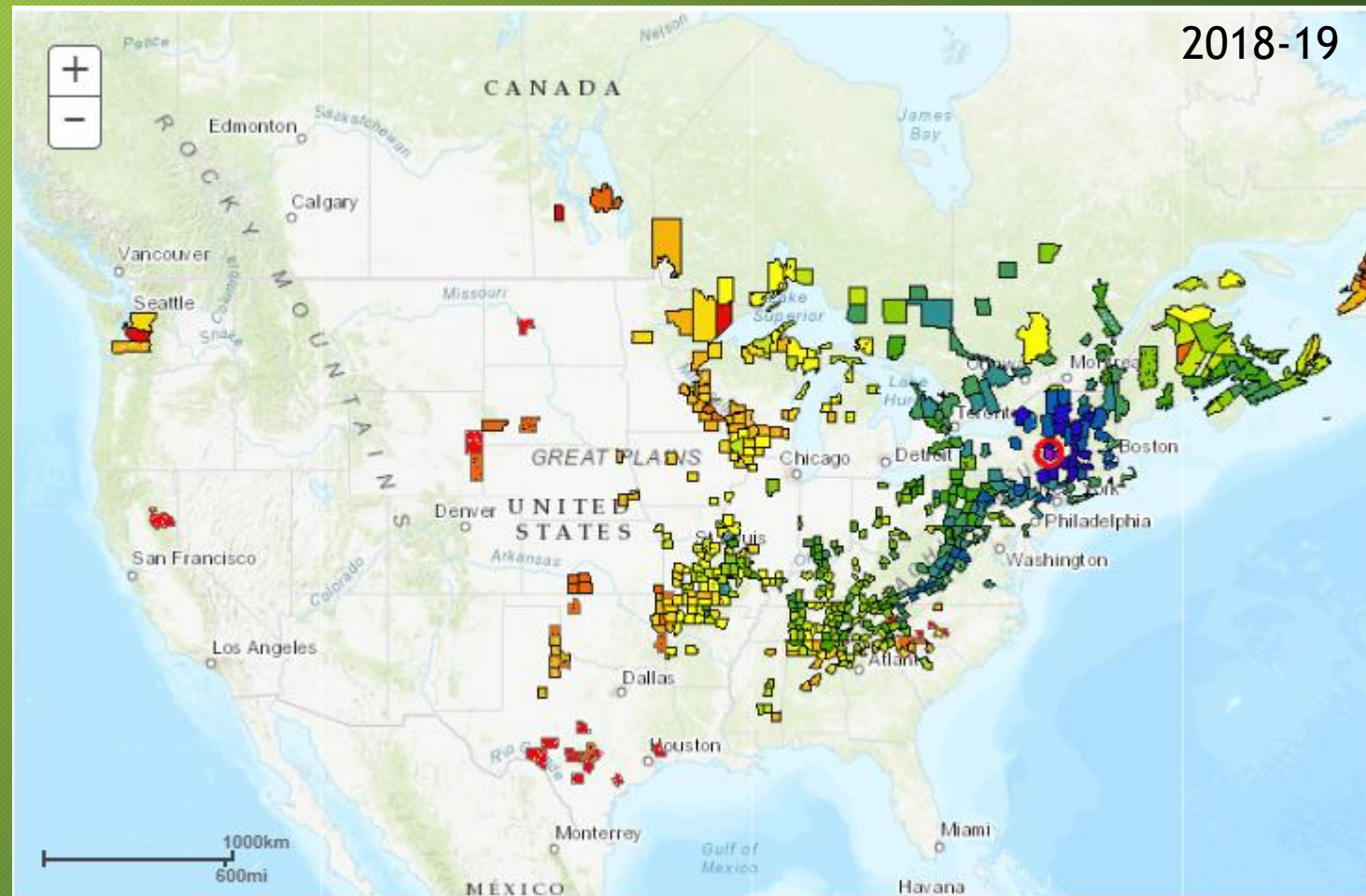
# White-nose Syndrome Progression 2007-2019



# White-nose Syndrome Progression



Of the 47 species of bats in the U.S. more than half rely on hibernation



12 species confirmed with WNS

8 species Pd positive

# White-nose Affected Bat Species

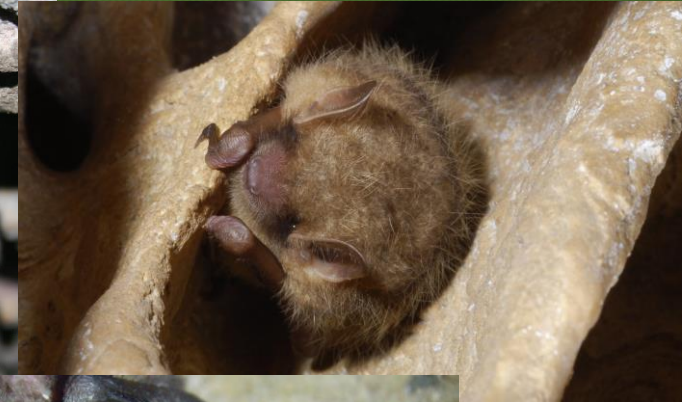


- Big brown bat (*Eptesicus fuscus*)
- Cave bat (*Myotis velifer*)
- Eastern small-footed bat (*Myotis leibii*)
- Gray bat (*Myotis grisescens*) \*endangered
- Indiana bat (*Myotis sodalis*) \*endangered
- Little brown bat (*Myotis lucifugus*)
- Long-legged bat (*Myotis volans*)
- Northern long-eared bat (*Myotis septentrionalis*) \*threatened
- Western long-eared bat (*Myotis evotis*)
- Southeastern bat (*Myotis austroriparius*)
- Tricolored bat (*Perimyotis subflavus*)
- Yuma bat (*Myotis yumanensis*)

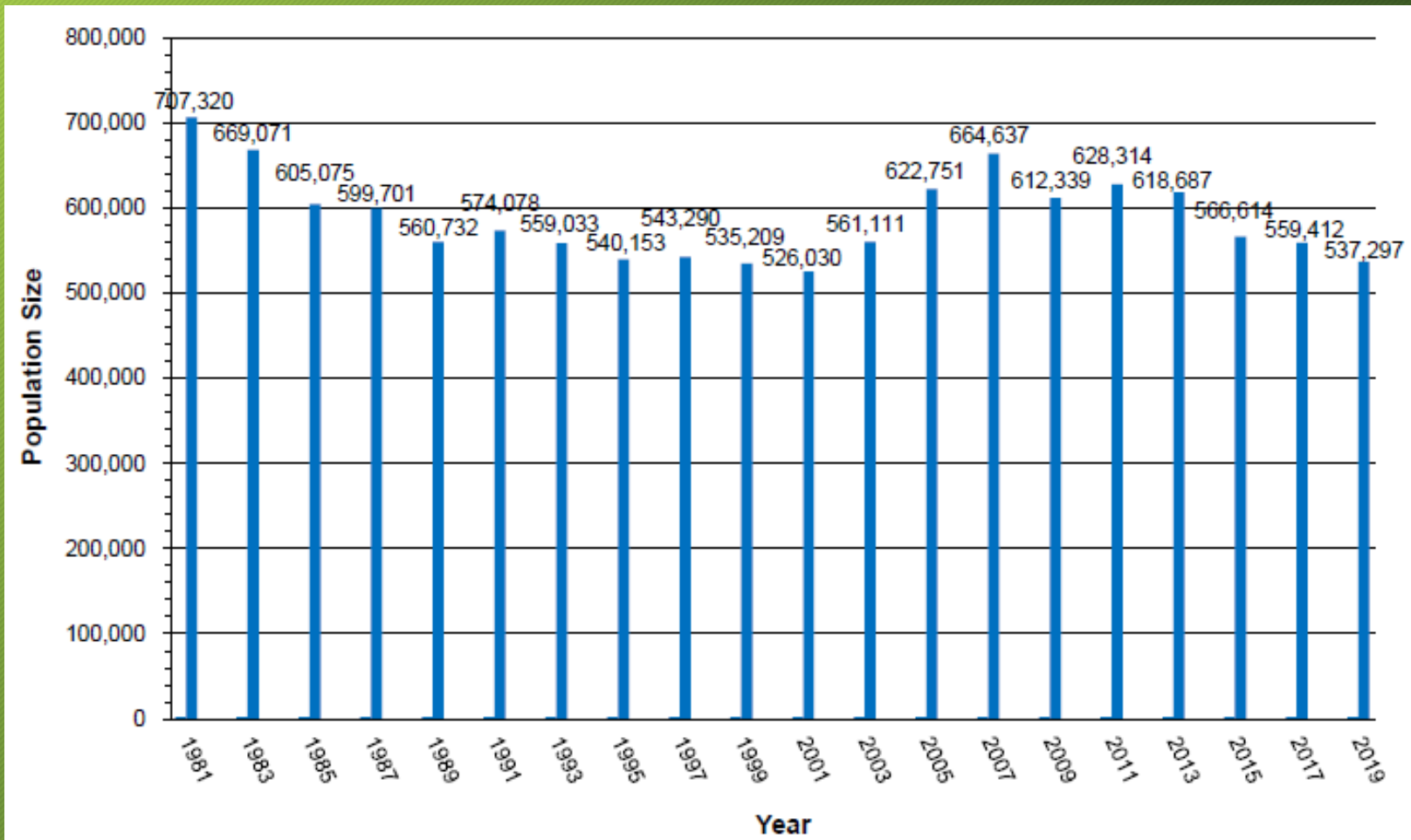
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# Indiana Bat Rangewide Population 1981-2019



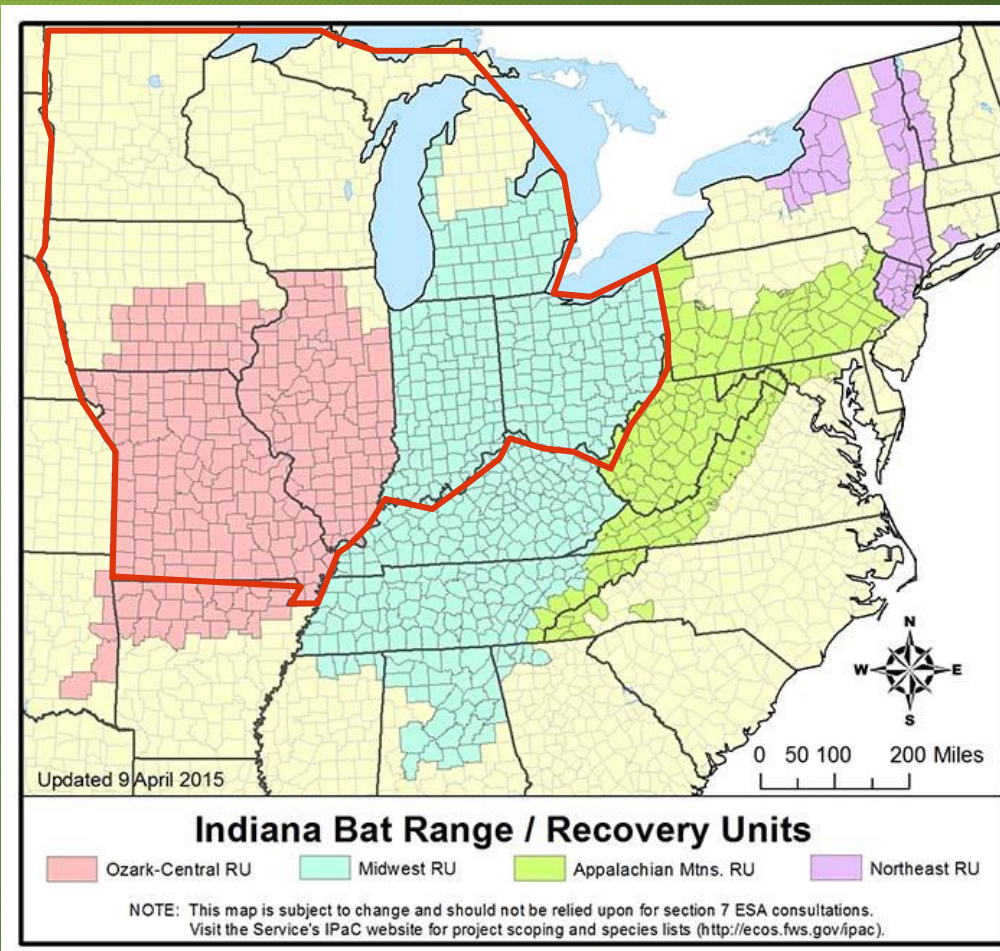
2019  
537,297

-19.2%  
since  
2007

# Indiana Bat Recovery Units



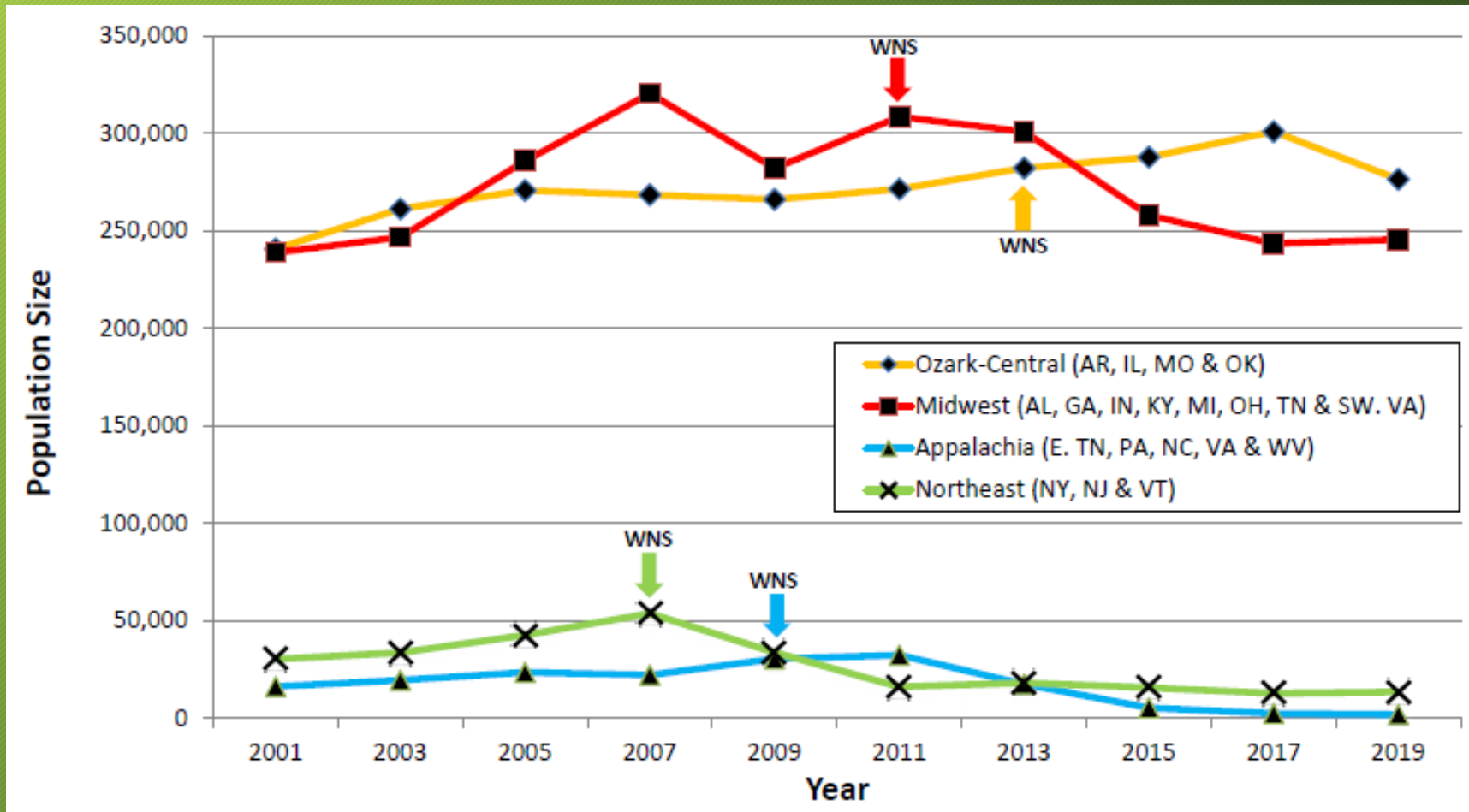
Ozark-Central  
Midwest



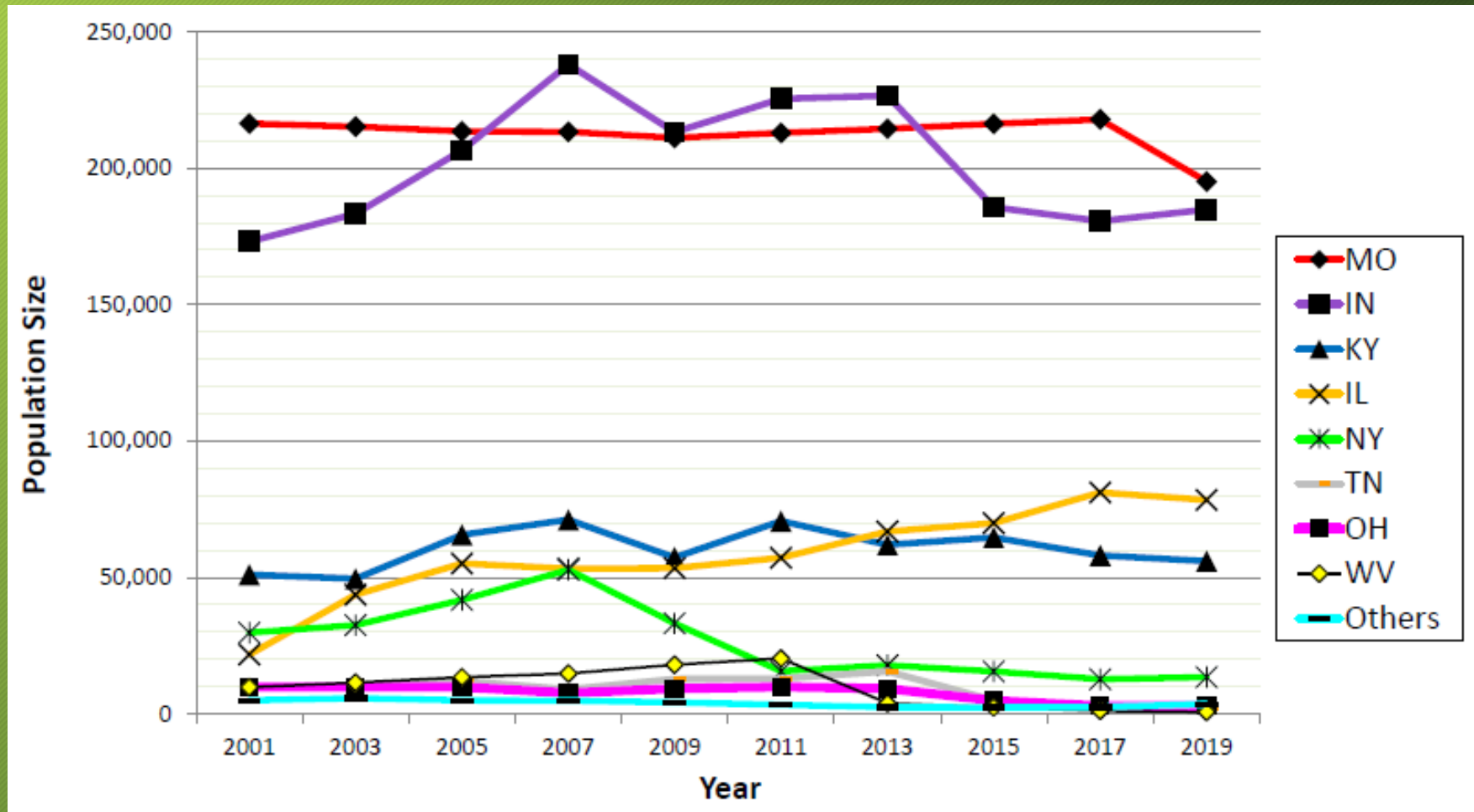
Appalachian  
Northeast



# Indiana Bat Population by Recovery Unit



# Indiana Bat Population by State



# Indiana Bat Population by State



## States with Largest Net Loss of Indiana Bats since 2007 (% decline since 2007):

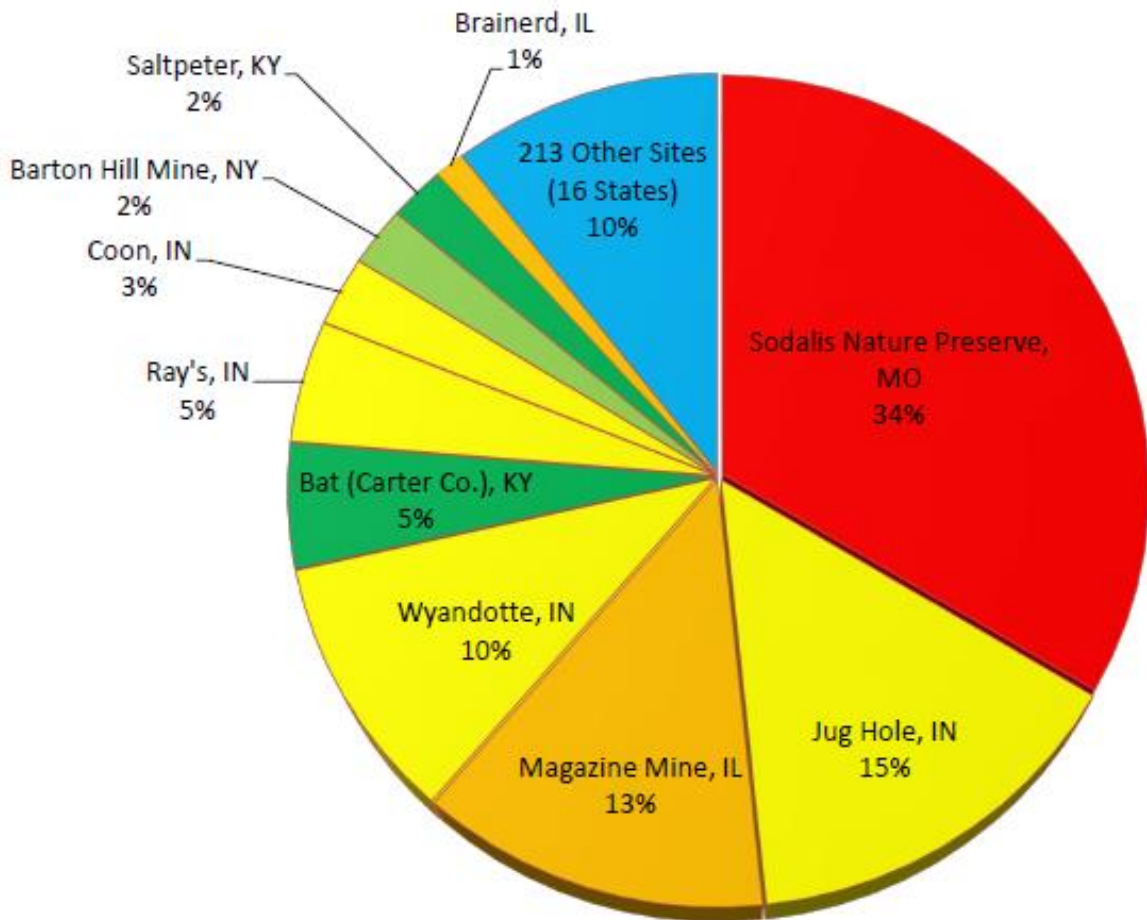
1. Indiana:	-53,220	(-22%)	5. West Virginia:	-14,125	(-96%)
2. New York:	-39,367	(-75%)	6. Tennessee:	-6,509	(-73%)
3. Missouri:	-18,157	(-9%)	7. Ohio:	-4,739	(-62%)
4. Kentucky:	-15,220	(-21%)	8. Pennsylvania:	-1,027	(-99%)

USFWS Region	State	2011	2013	2015	2017	2019	% Change from 2017	% of 2019 Total
Region 3	Missouri	212,942	214,453	216,289	217,884	195,157	-10.4%	36.3%
	Indiana	225,477	226,572	185,720	180,611	184,848	2.3%	34.4%
	Illinois	57,212	66,817	69,924	81,143	78,403	-3.4%	14.6%
	Ohio	9,870	9,259	4,809	2,890	2,890	0.0%	0.5%
	Michigan	20	20	20	20	20	0.0%	0.0%
	<b>Total</b>		<b>505,521</b>	<b>517,121</b>	<b>476,762</b>	<b>482,548</b>	<b>461,318</b>	<b>-4.4%</b>

# Sodalis Nature Preserve Survey 2019

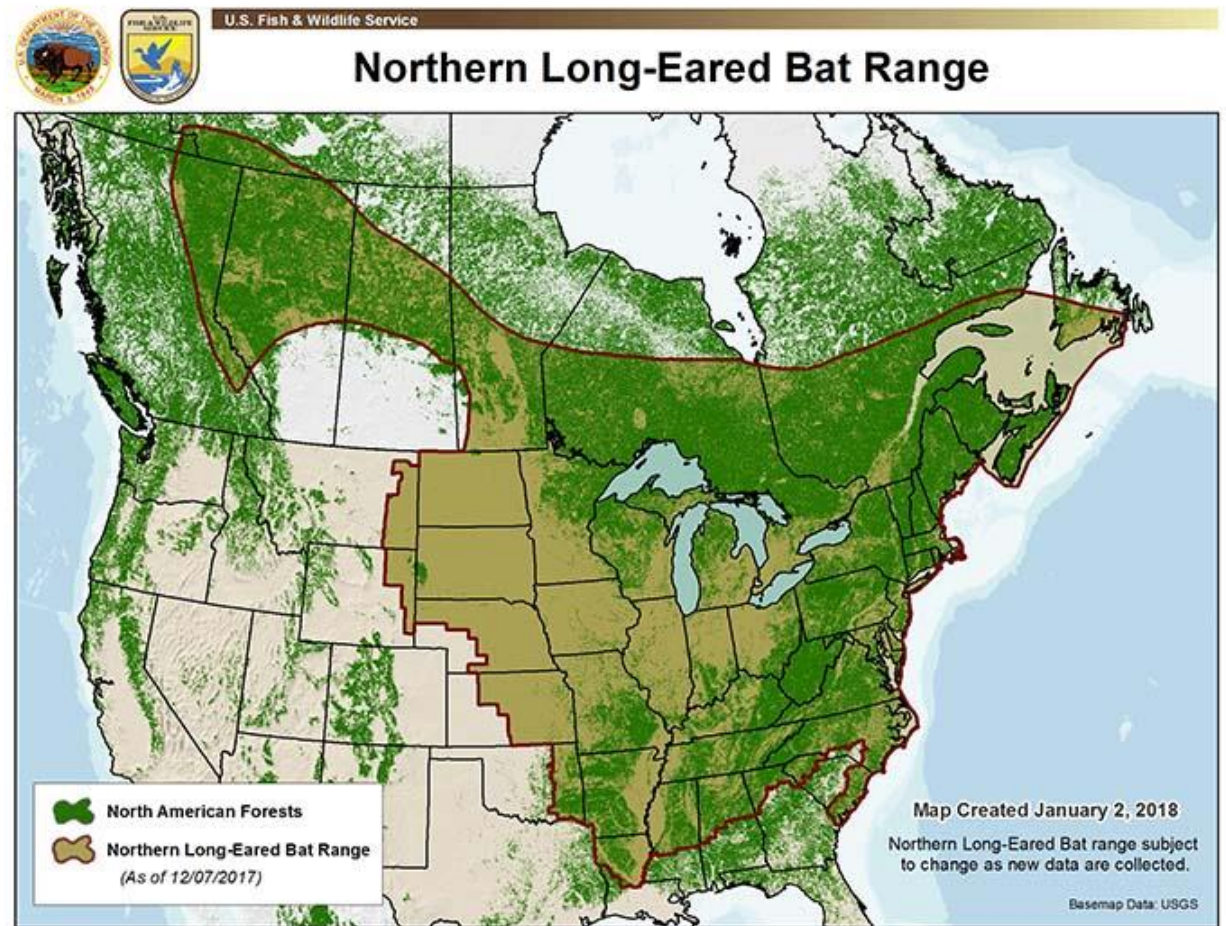
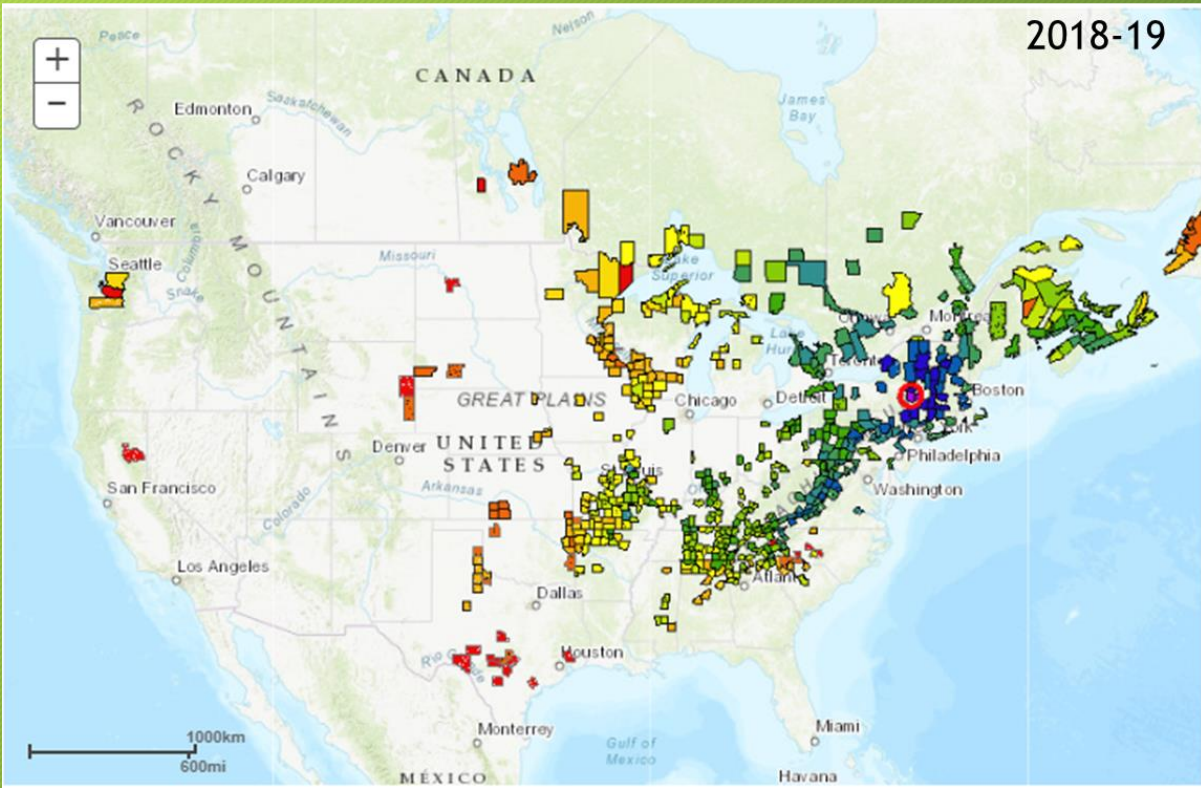


# Sodalis Nature Preserve

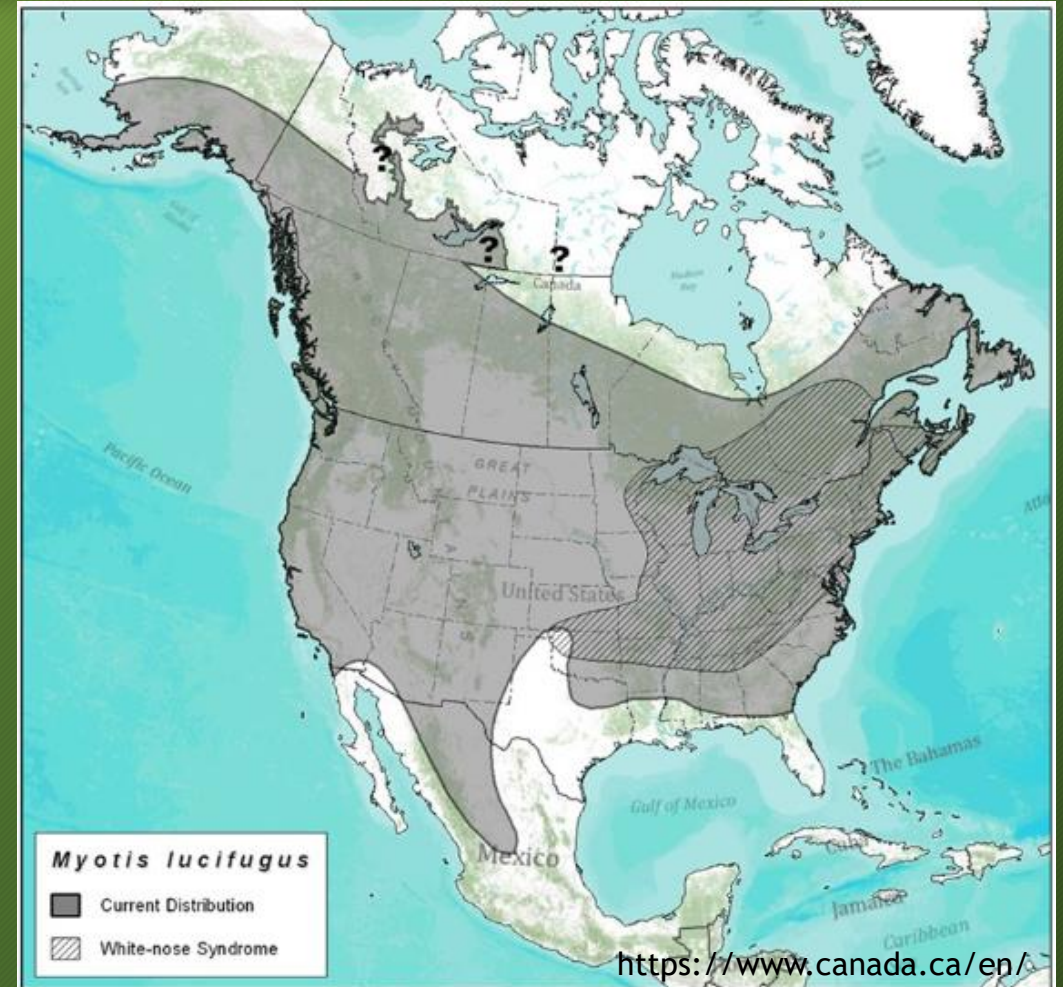
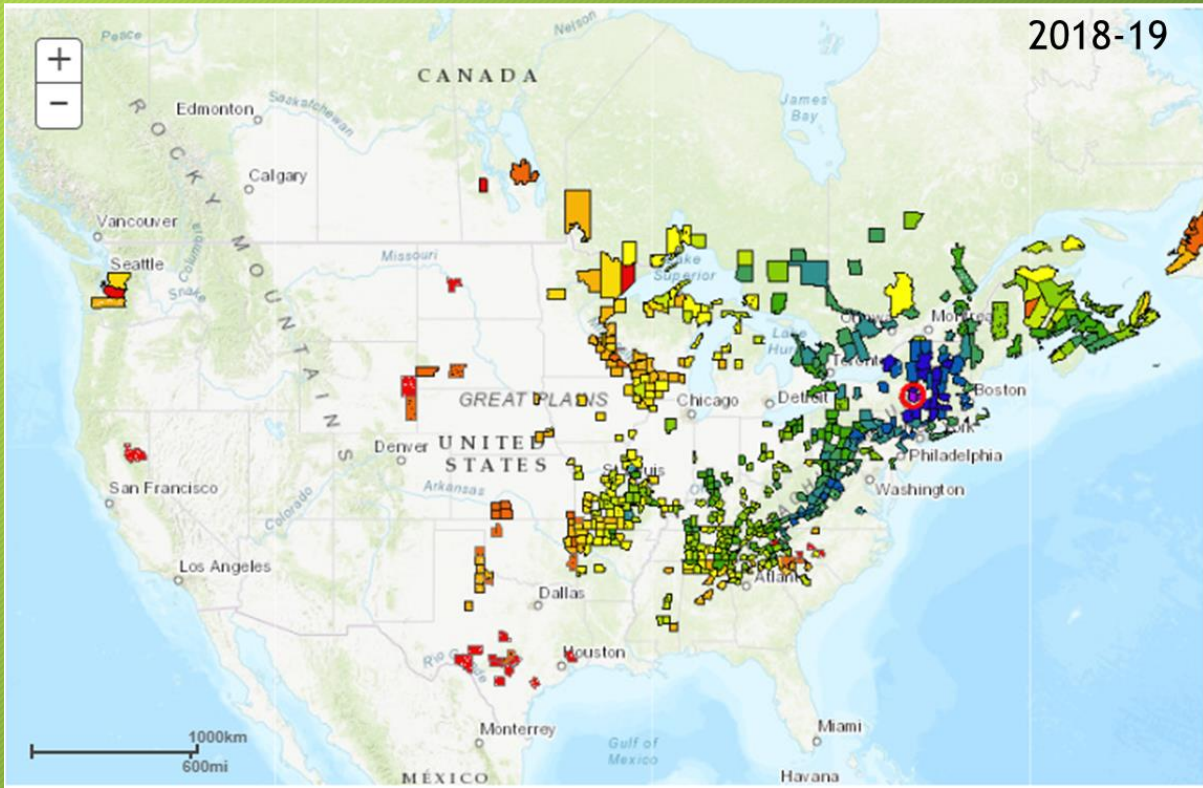


Hibernaculum Name	State	2019 Pop. Size	% of 2019 Overall Pop.	%Change From 2017 Pop.
1. Sodalis Nature Preserve	MO	180,801	34%	-8%
2. Jug Hole	IN	79,358	15%	+16%
3. Magazine Mine	IL	69,090	13%	0%
4. Wyandotte	IN	55,095	10%	+9%
5. Bat (Carter Caves SRP)	KY	26,237	5%	+3%
6. Ray's	IN	25,693	5%	-18%
7. Coon	IN	14,728	3%	-23%
8. Barton Hill Mine	NY	12,570	2%	+13%
9. Saltpeter	KY	11,806	2%	-20%
10. Brainerd	IL	5,900	1%	0%
All Others Combined (n=213)	Multiple	56,721	10%	-14%
<b>Totals</b>		<b>537,297</b>	<b>100%</b>	

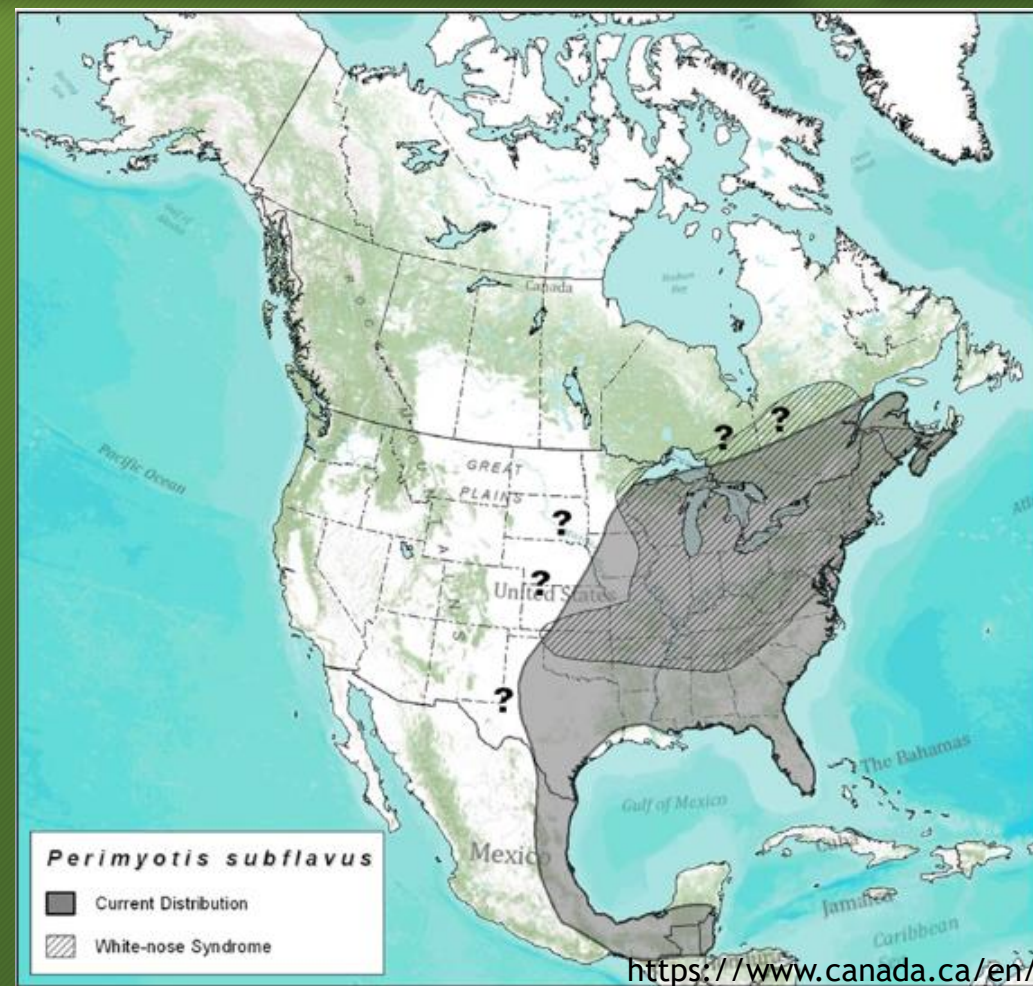
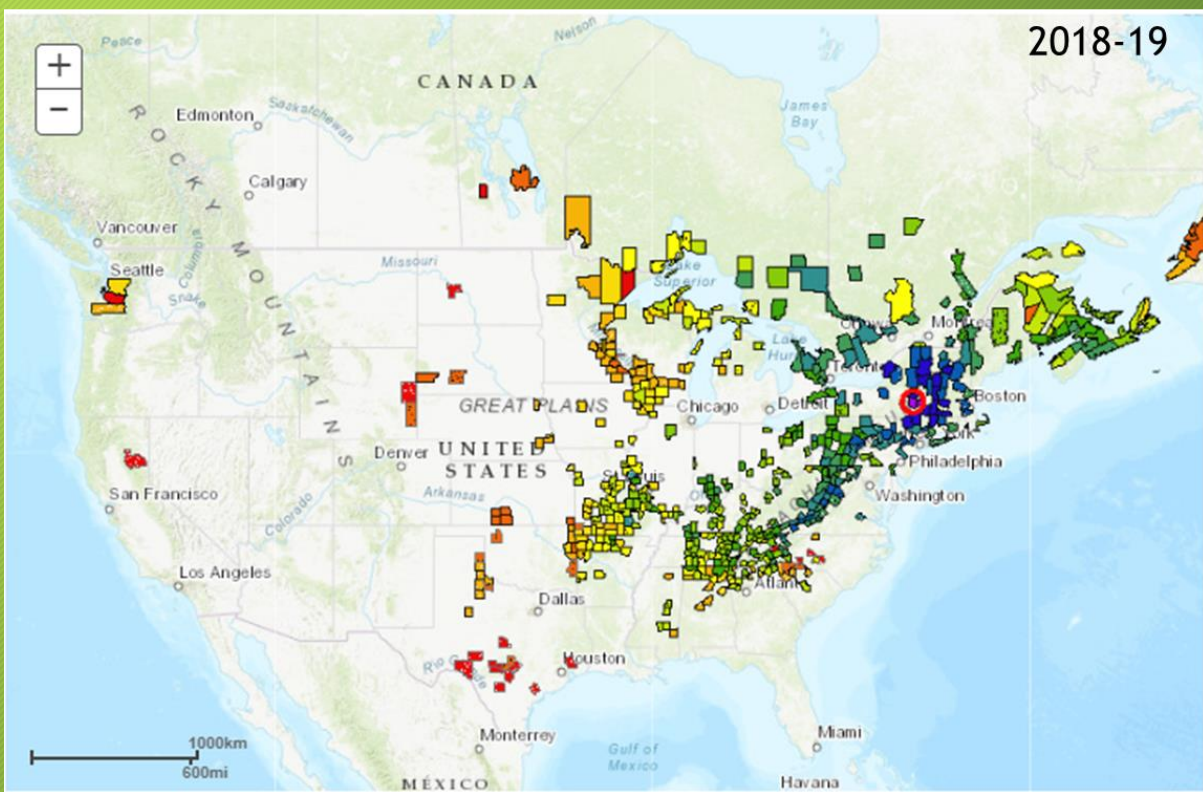
# Northern long-eared bat



# Little brown bat

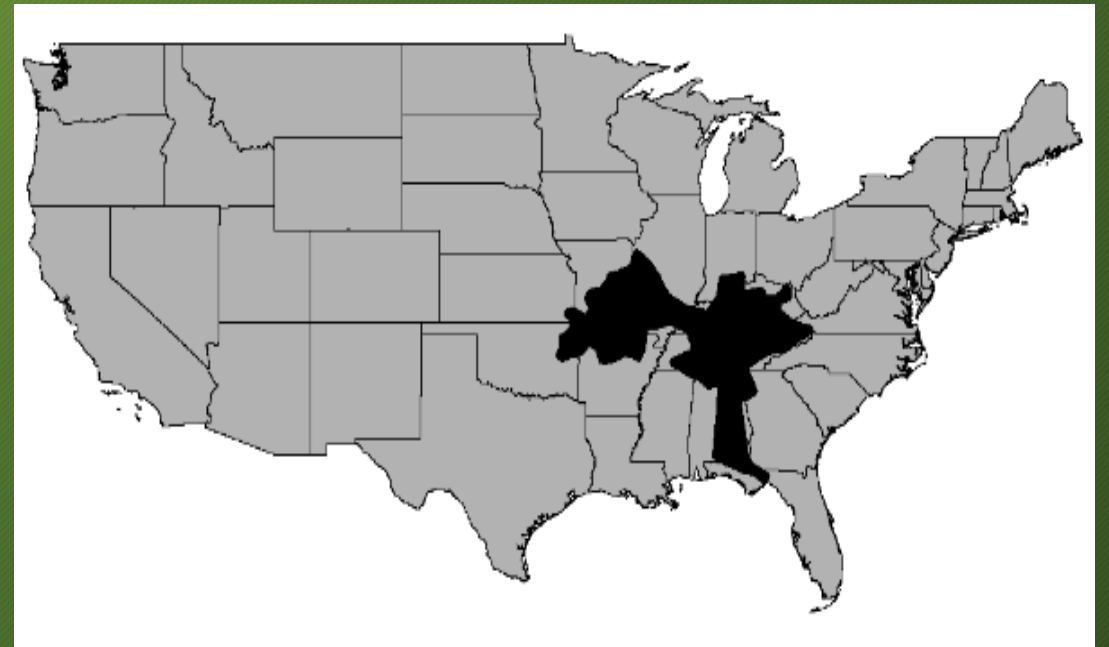
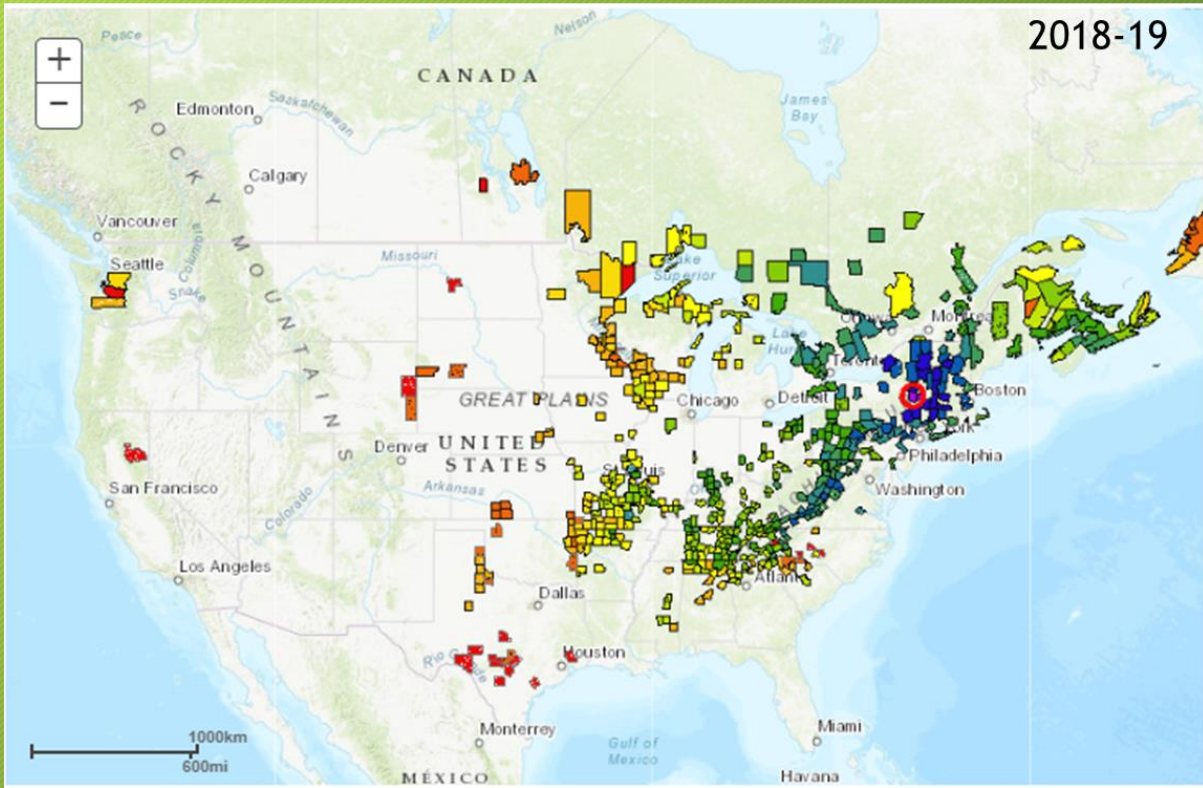


# Tricolored bat





# Gray bat



TN Bat Working Group

# Implications of a changing bat landscape



How status and trends in bat populations relate to and inform project consultation, impacts assessments, and mitigation

# Stable vs. Declining Population



- Indiana bat presence/absence surveys: Level of Effort (LOE)
    - Triggers to increase LOE from 9 to 42 net nights/123 acres for mist-netting
      - Niver *et al.* 2014. Methods to evaluate and develop minimum recommended summer survey effort for Indiana bats: white paper.
      - Range-wide Indiana Bat Survey Guidelines
    - If winter counts document  $\geq 50\%$  of Priority 1 and 2 hibernacula within a Recovery Unit (RU) decline by  $\geq 30\%$  from their most recent pre-WNS population estimates
- OR
- The total RU declines by  $\geq 30\%$ , then that RU should be considered WNS-impacted
- Northeast and Appalachian RUs are WNS-impacted
  - Midwest and Ozark-Central RUs are not WNS-impacted...

...but they  
are close

# Stable vs. Declining Population



- Resource Equivalency Analysis (REA)
  - Compare resources lost through impacts and gained through compensation
  - For wind HCPs primary interest is reproductive services of female Indiana bats
  - When an adult female is killed, she and her future reproductive potential are lost
- Growth Rate ( $\lambda$ ) for a Recovery Unit in a REA
  - Population Growth Rate moves from Stationary -> Declining

# REA Inputs - Injury



Input Parameters		
Permit start year:	2020	2050
Injured Adult Females Annually:	5	
Permitted take years	30	years to 2050
Lambda condition	Stationary	
Adult Female Breeding Rate	0.601	pups/female/year = AP*AB
Adult F-F Breeding Rate	0.301	female pups/female/year
Juvenile Female Breeding Rate	0.143	pups/female/year
Juvenile F-F Breeding Rate	0.071	female pups/female/year
Pup Survival to juvenile	0.636	rate
Juvenile Annual Survival	0.697	rate
Adult Annual Survival	0.873	rate

# REA Mitigation - Summer Habitat Protection



Summer habitat protection			
<b>Project Details:</b>			
Project start year	2020		
Project end year (include 10 years beyond last monitoring year)	2060		
Habitat function served by the "to be protected" habitat	Roosting & Foraging	1.00	
Acres "to be protected" of occupied forest block/at terminus 1	495	Qualifying acreage	495
Acres of "to be protected" corridor habitat	90	10	
Acres of "to be protected" forest at terminus 2	46	46	
<b>Required Conditions:</b>		1.00	implies 46 acres/bat
Is the "to be protected" roosting and foraging habitat $\geq 5$ acres?	Yes	1.00	
Are the termini blocks $> 500$ ft apart?	Yes	1.00	
Are the occupied termini blocks $\geq 5$ acres?	Yes	1.00	
Will or are both termini forest blocks protected?	Yes	1.00	
<b>Level of threat</b>	<b>Habitat threatened</b>	1.00	
<b>Expected female gain</b>	<b>10.76</b>	Expected K	####

# Stationary Lambda



Input Parameters		
Permit start year:	2020	2050
Injured Adult Females Annually:	5	
Permitted take years	30	years to 2050
Lambda condition	Stationary	
Adult Female Breeding Rate	0.601	pups/female/year = AP*AB
Adult F-F Breeding Rate	0.301	female pups/female/year
Juvenile Female Breeding Rate	0.143	pups/female/year
Juvenile F-F Breeding Rate	0.071	female pups/female/year
Pup Survival to juvenile	0.636	rate
Juvenile Annual Survival	0.697	rate
Adult Annual Survival	0.873	rate

Output		
<b>Debit Accrued</b>		
Undiscounted		
Direct take	150	female adults
Total lost reproduction	285	female pups
<b>Total Lost</b>	<b>435</b>	
<b>Mitigation Credit Accrued</b>		
Undiscounted		
Direct females added by project	129	female adults
Summer habitat protection	129	female adults
Hibernaculum protection	-	female adults
Maternity habitat restoration	-	female adults
Total reproduction gained	306	female pups
<b>Total Gain</b>	<b>435</b>	<b>females</b>
<b>Mitigation Credit Due</b>		
Net gained	0	
Total qualifying mitigation acres	495	must be >46 acres

# Declining Lambda



Input Parameters		
Permit start year:	2020	2050
Injured Adult Females Annually:	5	
Permitted take years	30	years to 2050
Lambda condition	Declining	
Adult Female Breeding Rate	0.562	pups/female/year = AP*AB
Adult F-F Breeding Rate	0.281	female pups/female/year
Juvenile Female Breeding Rate	0.130	pups/female/year
Juvenile F-F Breeding Rate	0.065	female pups/female/year
Pup Survival to juvenile	0.585	rate
Juvenile Annual Survival	0.674	rate
Adult Annual Survival	0.857	rate

Output		
<b>Debit Accrued</b>		
Undiscounted		
Direct take	150	female adults
Total lost reproduction	239	female pups
<b>Total Lost</b>	<b>389</b>	
<b>Mitigation Credit Accrued</b>		
Undiscounted		
Direct females added by project	121	female adults
Summer habitat protection	121	female adults
Hibernaculum protection	-	female adults
Maternity habitat restoration	-	female adults
Total reproduction gained	237	female pups
<b>Total Gain</b>	<b>358</b>	<b>females</b>
<b>Mitigation Credit Due</b>		
Net gained	-31	
Total qualifying mitigation acres	495	must be >46 acres



# Keys to Facilitate Wind HCP Coordination



- Point of contact - Marquardt is new wind energy lead
- Conservation measures:
  - Tree removal
    - Winter clearing - November 1 through March 31
    - Habitat replacement
  - Pre-construction surveys
  - Siting and operations
  - Post-construction monitoring

# Pre-construction surveys



- Federally listed: Indiana bat, northern long-eared bat, gray bat
- Conservation concern: Little brown bat, tricolored bat
- Acoustic, mist-net, and/or telemetry surveys
  - Inform analysis for collision risk during summer and migration
  - Determine summer presence or probable absence in suitable habitat near the project to inform summer risk
    - Estimate number of maternity colonies impacted
  - Identify high-risk or sensitive areas that could be protected via turbine siting
- Timing and specific recommendations are based on location and species of concern
  - E.g. gray bat vs. Indiana bat summer and migration evaluations

# Siting and Operations



- Site turbines  $\geq 1000$  feet from suitable forest habitat
- Cut-in speeds
  - All turbines should be feathered below a minimum of 3.0 m/s for the entire bat active season - March 15 - November 15
  - Turbines with fall migration-only risk should also be feathered below 5.0 m/s from August 1 through October 15 (fall migration season)
  - Turbines at risk of taking listed species during the summer should be feathered below 5.0 m/s April 1 through October 15

# Post-construction monitoring - Compliance



- Includes a combination of searches on roads/pads and mowed plots to achieve the desired detection probability (g-level)
  - Target g-level of 0.20
  - Short-term, low effect scenario - three years  $g \geq 0.20$ , followed by  $g \geq 0.08$
  - Long-term scenario - project specific, use models of other HCPs in Region 3
- Evidence of Absence (EoA) framework
  - Model used to evaluate compliance with Incidental Take Permits (ITPs) associated with Habitat Conservation Plans (HCPs)
  - Estimates “rare event” fatalities by establishing plausible upper and lower bounds
  - Inform post-construction monitoring plans to increase the likelihood of detecting a rare event
    - Proportion of roads/pads to plots
    - Use of trained search dogs

# Post-construction monitoring - Bat Populations



- Maternity colony monitoring for covered species
  - If applicable
  - Especially relevant in short-term HCP situations to inform long-term HCPs
  - Persistence of colonies in the Plan Area
  - Include emergence counts at occupied roost trees
    - Acoustic presence/absence alone is not sufficient



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