White-Nose Syndrome:
Current Status of the Disease and the Collaborative Response

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US Fish and Wildlife Service

New England Chapter of The Wildlife Society
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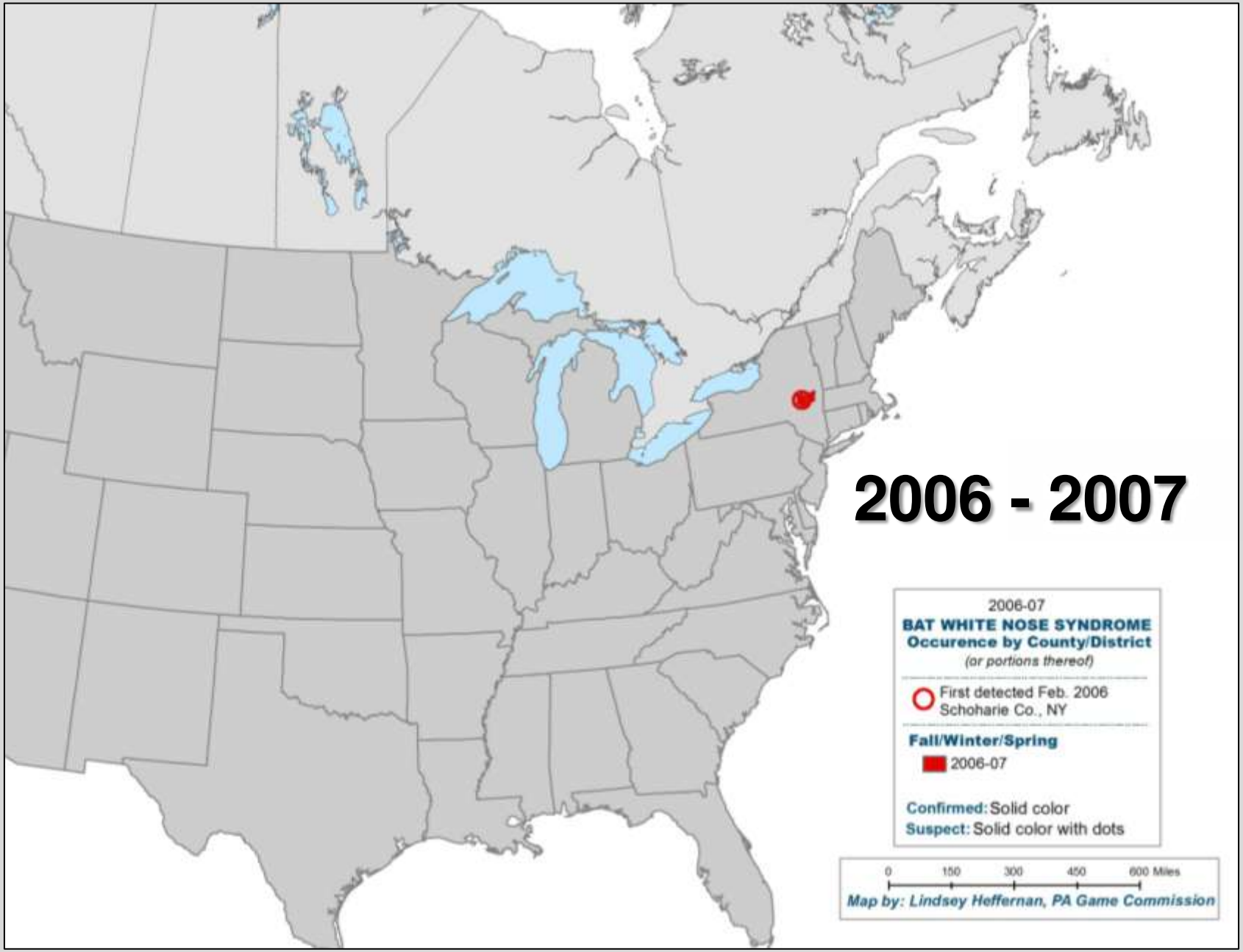
Pete Pattavina

Overview of WNS

- **A fungal disease of hibernating bats that continues to spread through North America**
  - 26 states and 5 provinces confirmed
  - Evidence of causative fungus found in 2 additional states
- **Disease caused by fungus *Pseudogymnoascus destructans* (*Pd*)**
  - Grows at cold temperatures
  - Invasive pathogen, likely of foreign origin
- **Mortality exceeds 90% for many sites and species**
- **Research continues to drive response**
- **Management:**
  - Actions focused on containment and conservation
  - Multiple treatment options under investigation

Current Spread – 26 states, 5 Canadian Provinces



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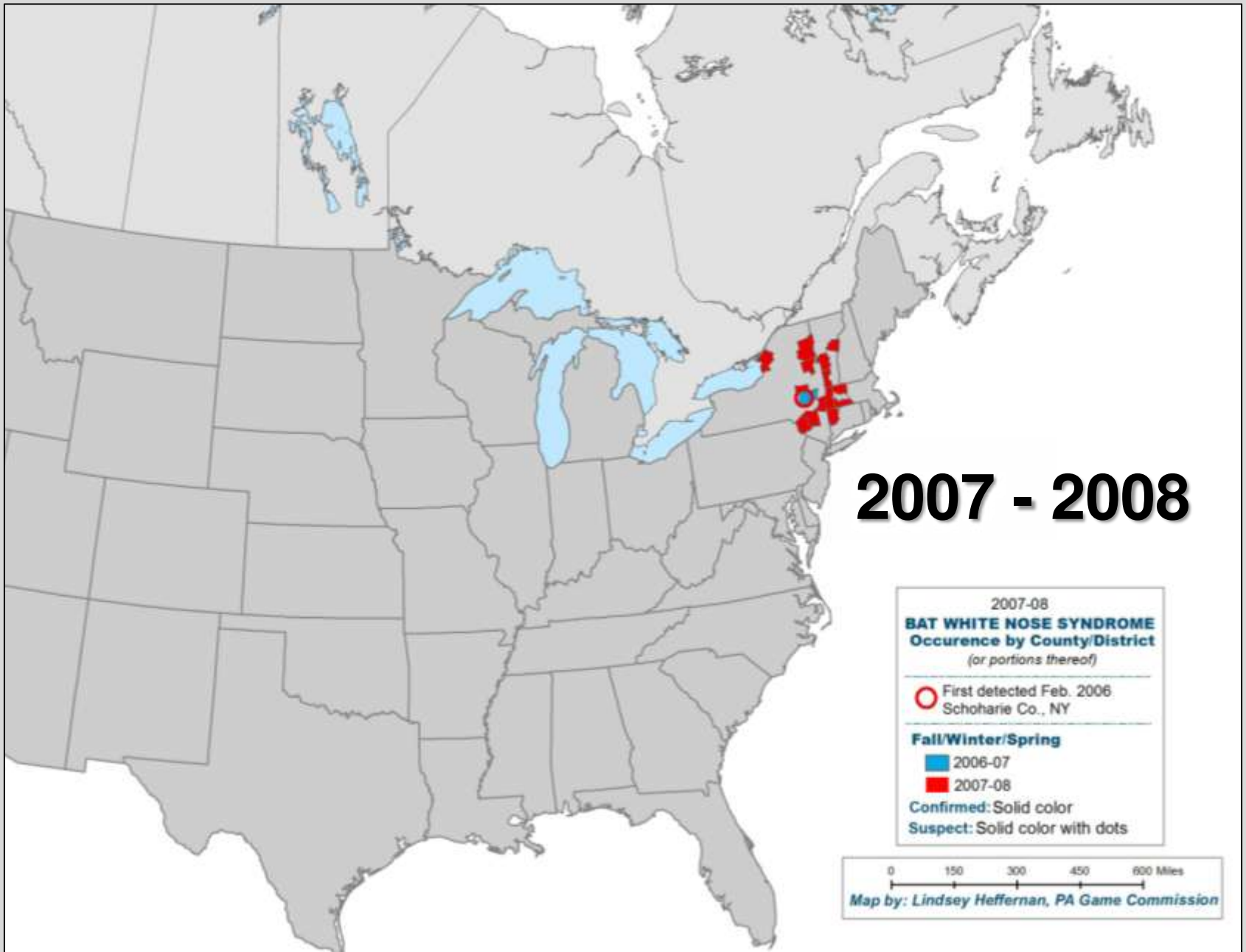

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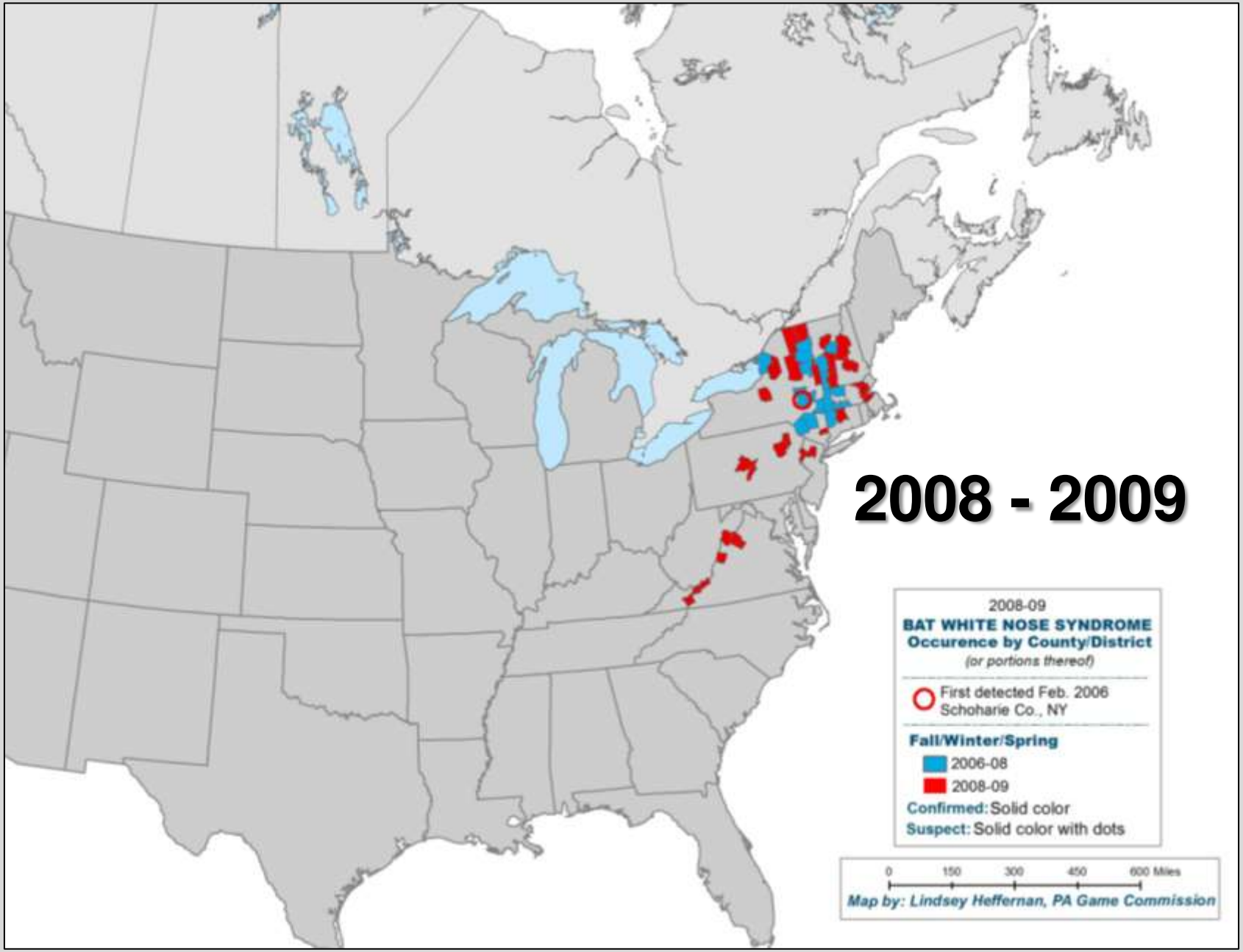

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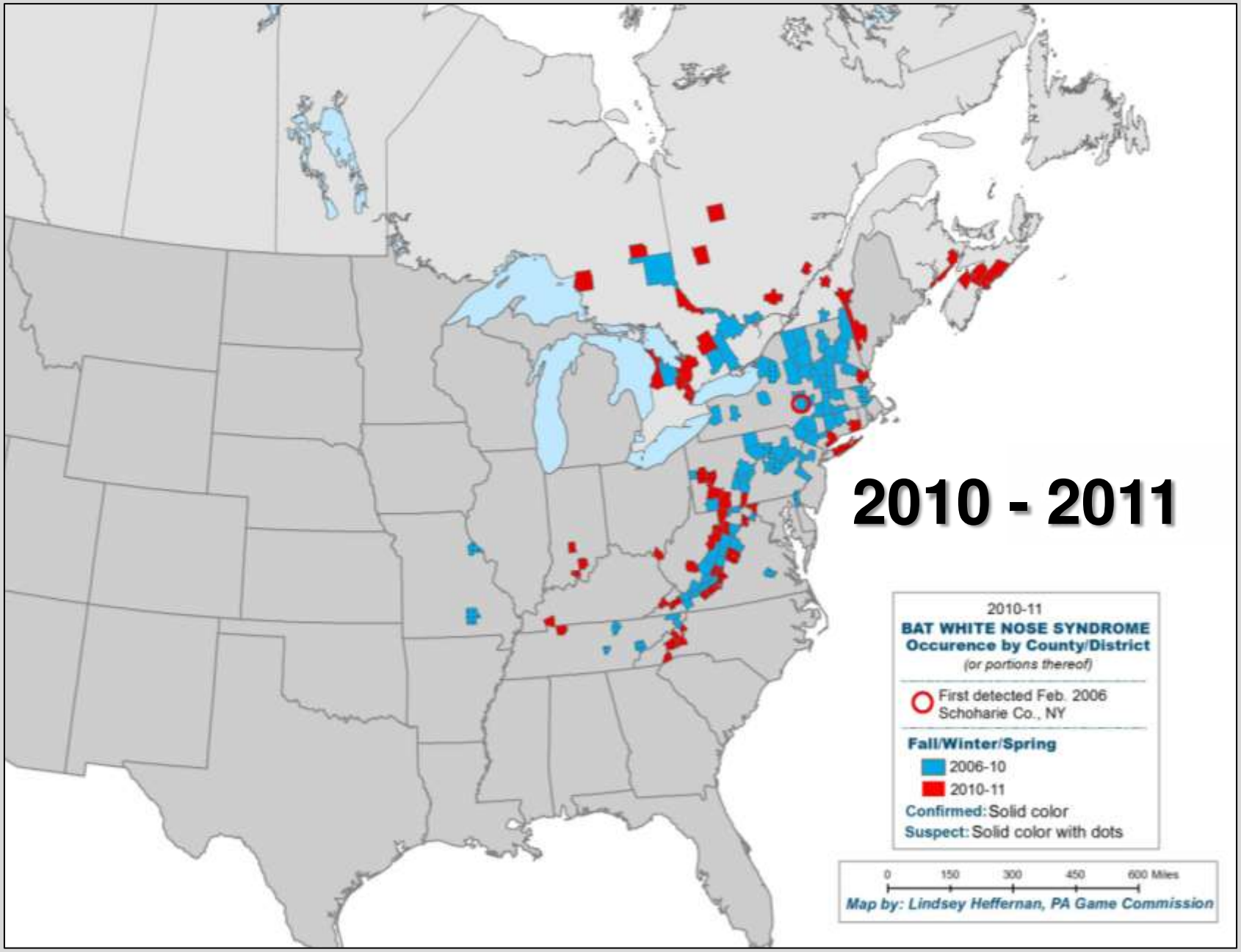

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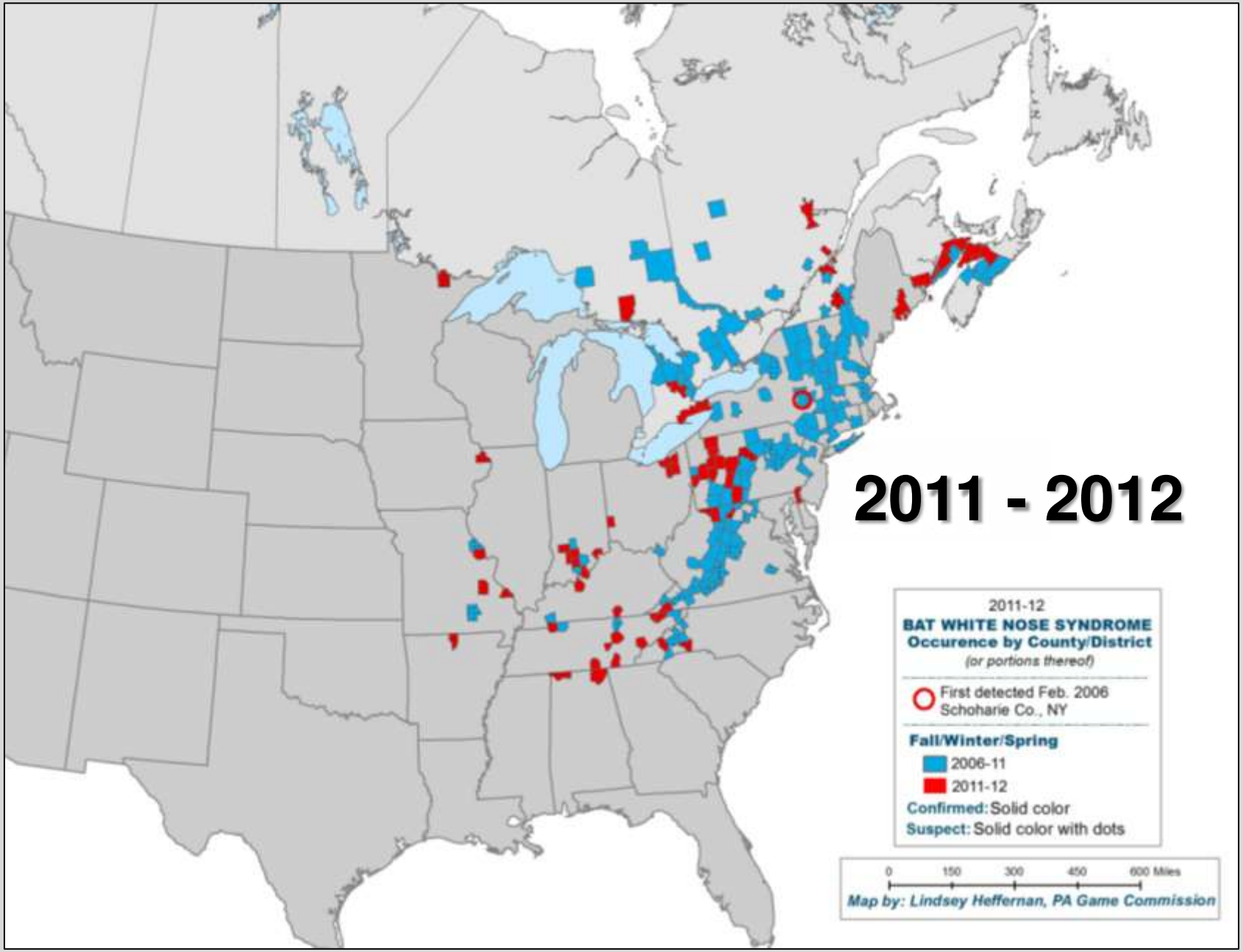

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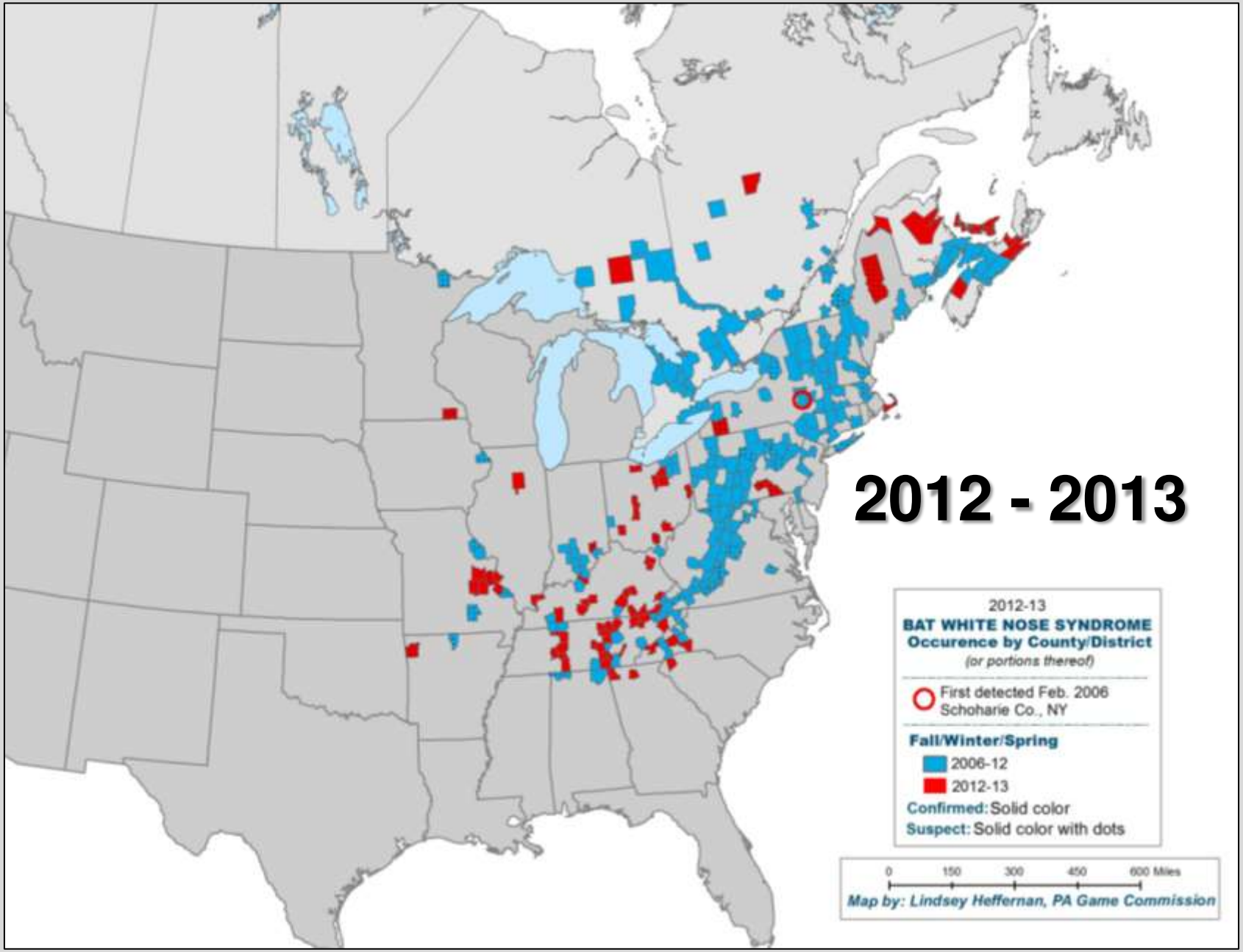

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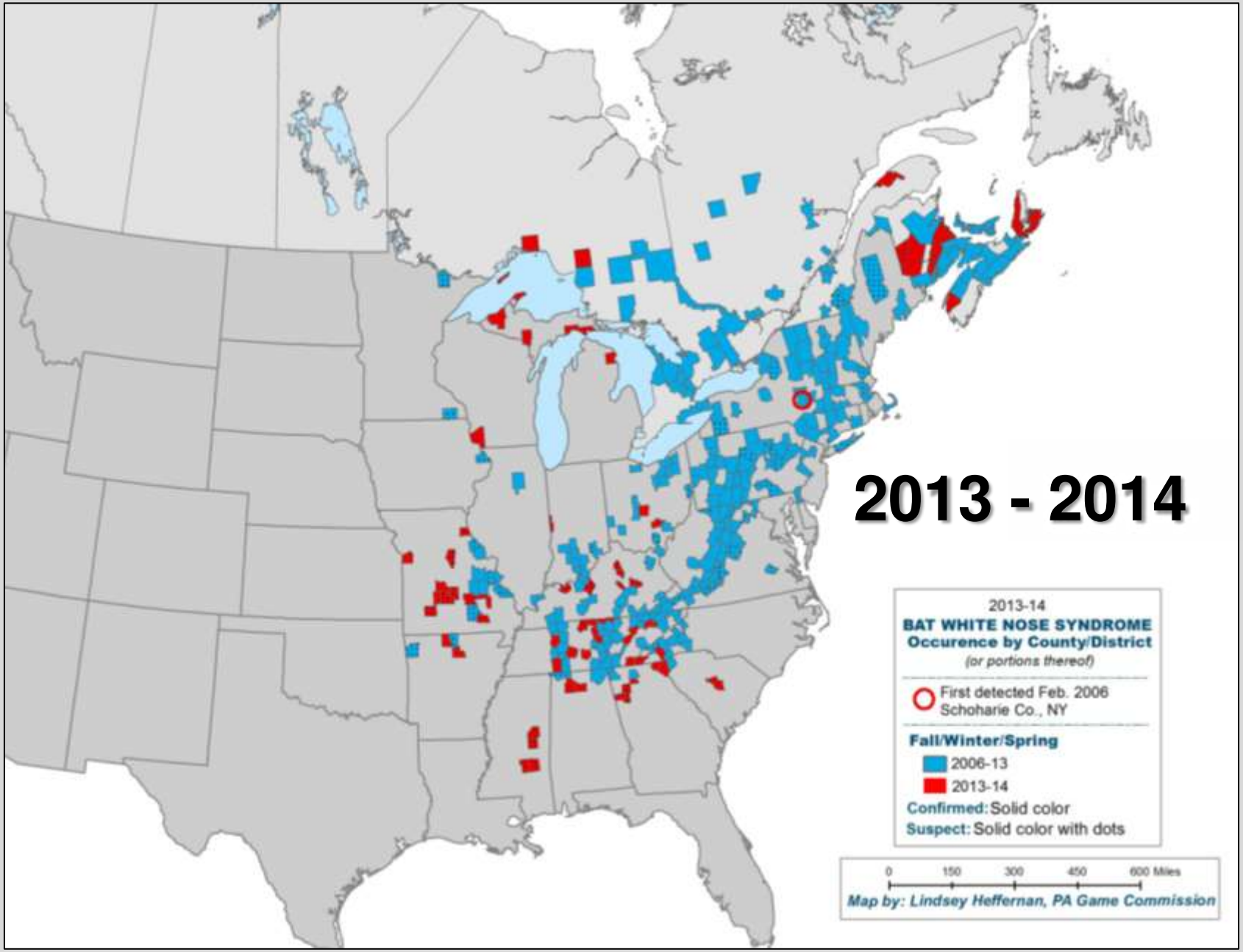

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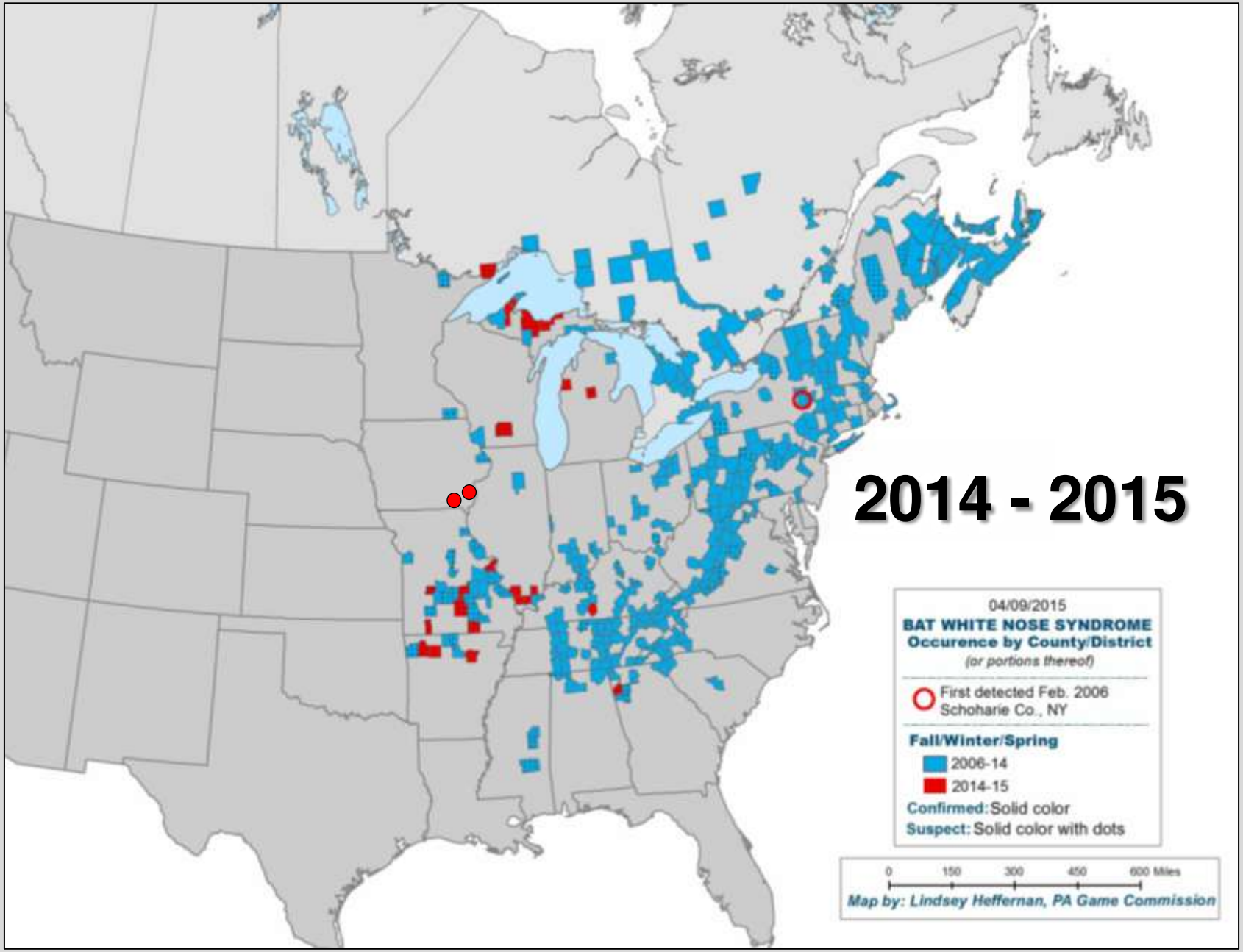


Seven Species Confirmed with WNS

(In North America)

Little brown bat
(*Myotis lucifugus*)
MYLU

Northern long-eared bat
(*Myotis septentrionalis*)
MYSE

Tri-colored bat
(*Perimyotis subflavus*)
PESU

Indiana bat *
(*Myotis sodalis*)
MYSO

Eastern small-footed bat
(*Myotis leibii*)
MYLE

Big brown bat
(*Eptesicus fuscus*)
EPFU

Gray bat *
(*Myotis grisescens*)
MYGR

Photos: Merlin Tuttle, Bat Conservation International

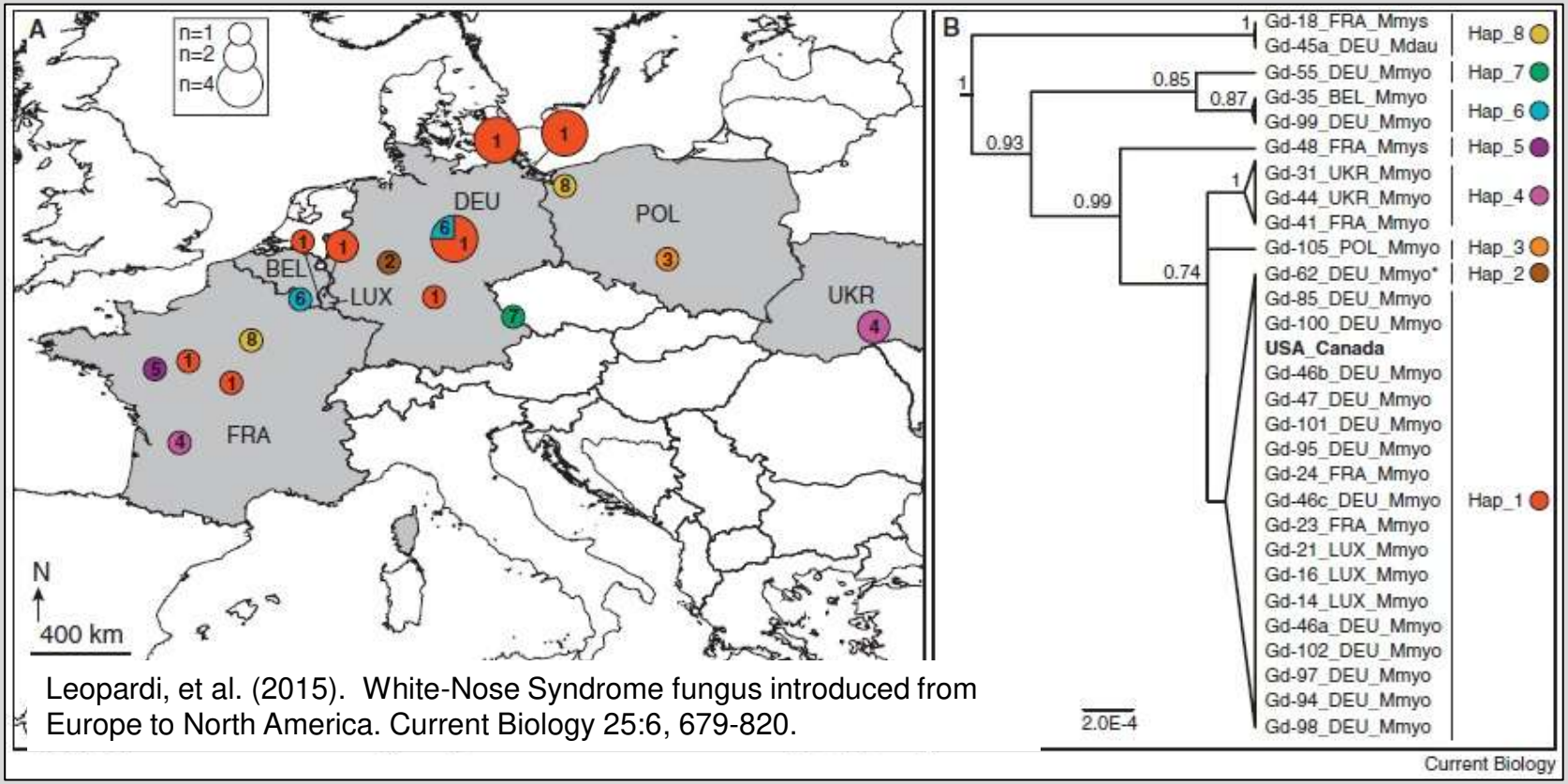
Additional species on which *Pd* has been detected

(In North America)

- **Southeastern bat**
  (Myotis austroriparius)
- **Virginia big-eared bat***
  (Corynorhinus townsendii virginianus)
- **Rafinesque's big-eared bat**
  (Corynorhinus rafinesquii)
- **Silver-haired bat**
  (Lasionycteris noctivagans)
- **Eastern red bat**
  (Lasiurus borealis)

WNS in Europe

- 13 species confirmed with the disease
- No mass mortality documented
- Long-term presence
- Considerable genetic variation
- North American Pd may have originated in western Europe



Leopardi, et al. (2015). White-Nose Syndrome fungus introduced from Europe to North America. Current Biology 25:6, 679-820.

Bat Populations in

NY, PA, VT, VA, WV

from 42 hibernacula w/ 2+ yrs of mortality/WNS

Species	Total change 2011 (Turner et al.)
Little brown	-91%
Northern	-98%
Tricolored	-75%
Indiana	-72%
Small-footed	-12%
Big brown	-41%
Total	-88%

Bat Populations in

NY, PA, VT, VA, WV, CT, MA, MD, NC, NH, NJ, QC

from 42/149 hibernacula w/ 2+ yrs of mortality/WNS

Species	Total change 2011 (Turner et al.)	Sum Pre-WNS	Sum Post-WNS	Total change 2014
Little brown	-91%	600,595	76,968	-87%
Northern	-98%	4,412	196	-96%
Tricolored	-75%	16,826	4,224	-75%
Indiana	-72%	51,744	34,951	-32%
Small-footed	-12%	3,087	4,359**	+41%
Big brown	-41%	5,012	3,745	-25%
Total	-88%	681,677	124,442	-82%

**increase of ~1,300 small-footed at a single site in NY

Bat Populations in the Midwest

from hibernacula w/ 3 yrs of mortality/WNS*

Species	Ohio (36,541 bats, 2 sites)	Indiana (100,766 bats, 15 sites)
Little brown	**-97%**	**-80%**
PESU	**-98%**	**-45%**
MYSE	**-90%**	**-60%**
MYSO	**-49%**	**-16%****
EPFU	**-41%**	**+4%**

Winter of 2013-2014, preliminary analyses

Data Courtesy: ODOW & IDNR, Jennifer Norris & Scott Johnson

*** Decline estimated from winter of first WNS confirmation to most recent population count in sites with ≥3 years of WNS**

**** Biennial population census of larger caves not conducted in winter 2013 – 2014.**

A Glimmer of Hope?

MYLU Recaptures in MA, NH, and VT

Number of winters survived	Summer in which the bat was last recovered					
	2009	2010	2011	2012	2013	Total
1	34 (3)	-	-	21 (2)	7 (1)	62 (6)
2	-	-	9* (2)	-	6 (2)	15 (4)
3	-	-	3** (3)	13 (1)	-	16 (4)
4	2	-	-	14 (1)	-	16 (1)
5	-	-	-	-	2	2
6	-	-	-	2	-	2

*Includes 1 adult male recaptured in Framingham, MA, on 12 July 2011.
**Includes 1 adult male recaptured in Milford, NH, on 17 July 2012.

Condition	Number of winters survived						
	1	2	3	4	5	6	Total
Pregnant	15 (2)	3 (3)	1 (1)	2	1	-	22 (6)
Lactating	9 (2)	1	5	5	1	-	21 (2)
Postlactating	3	-	2	7 (1)	-	2	14 (1)

Reichard, J., et al. 2014. Northeastern Naturalist Notes: Interannual Survival of Myotis lucifugus (Chiroptera: Vespertilionidae)n near the Epicenter of White-Nose Syndrome. Northeastern Naturalist, Issue 21/4.

New Research

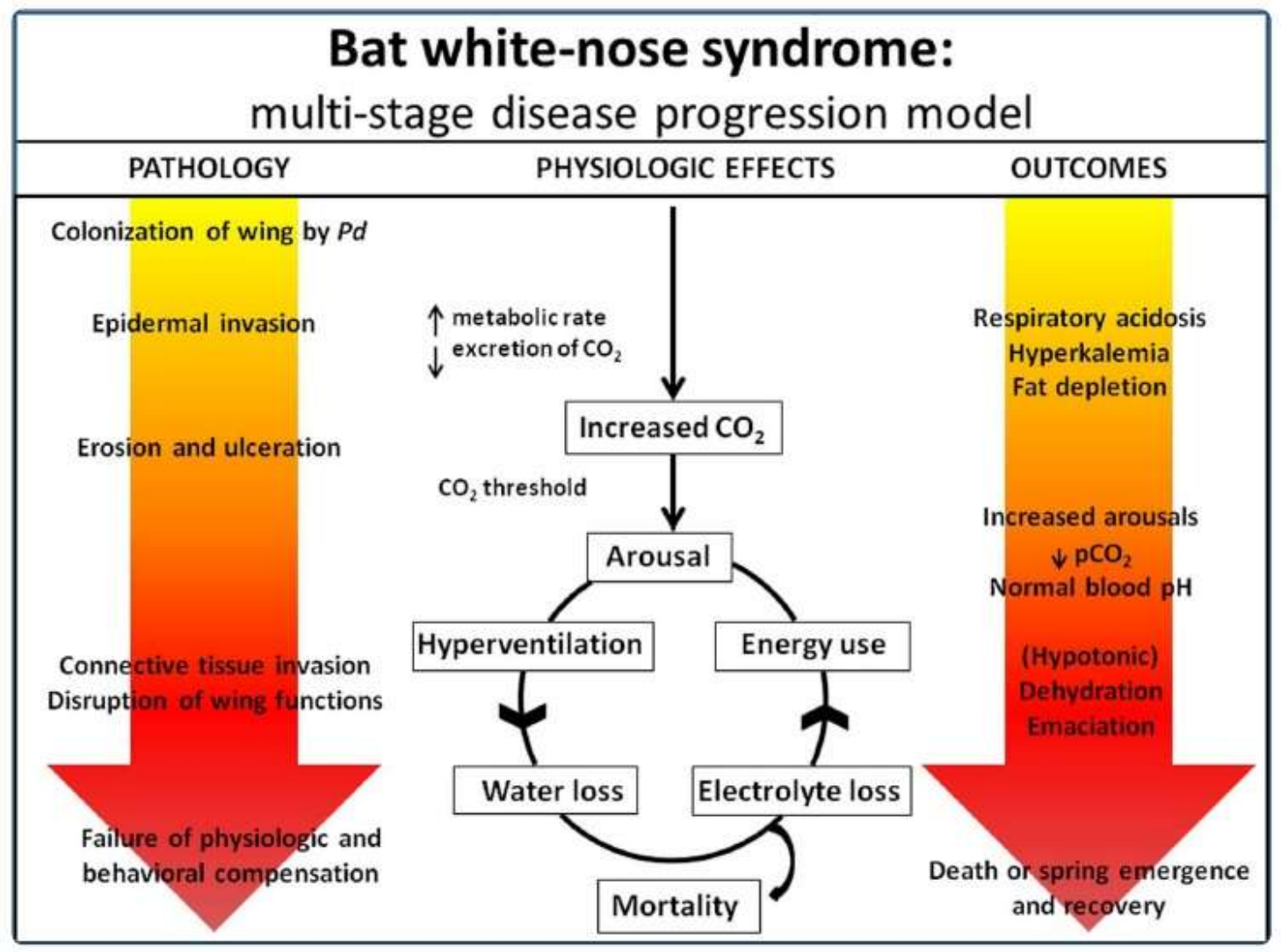
Dynamics of fungal infection and transmission

- 6 bat species, 30 sites
- Peak transmission in the fall
- Peak fungal loads at end winter
- Infection cleared in the summer

- Management Implications – best time to apply a treatment is in early winter, when transmission rates are the highest

Langwig, K. et al. 2014. Host and pathogen ecology drive the seasonal dynamics of a fungal disease, white-nose syndrome. Proceedings of the Royal Society B. DOI: 10.1098/rspb.2014.2335

New Research



Verant, M., et al. 2014. WNS initiates a cascade of physiologic disturbances in the hibernating bat host. BMC Physiology 14:10.

Treatments and Other Conservation Measures

Treatment and preventions under investigation:

- Probiotics
- Microbial derived compounds
- Mycovirus
- Vaccine development
- Other fungicides…

WNS Treatment Strategy Workshop – 2015

Other Conservation Measures:

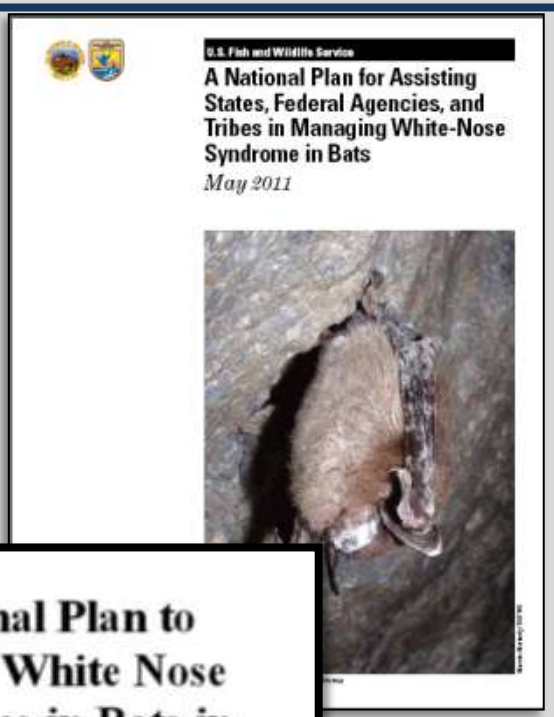
- Cave advisory & Decontamination guidance
- Guidance Documents
  - NWCO, Rehab, Forest Management, & Bats and Bridges guidance documents
  - Captive management recommendations
- NABat report & implementation - baseline in non-WNS areas, trends over time in WNS areas

Managing WNS: A Tale of Two Plans

US National Plan

Purpose:

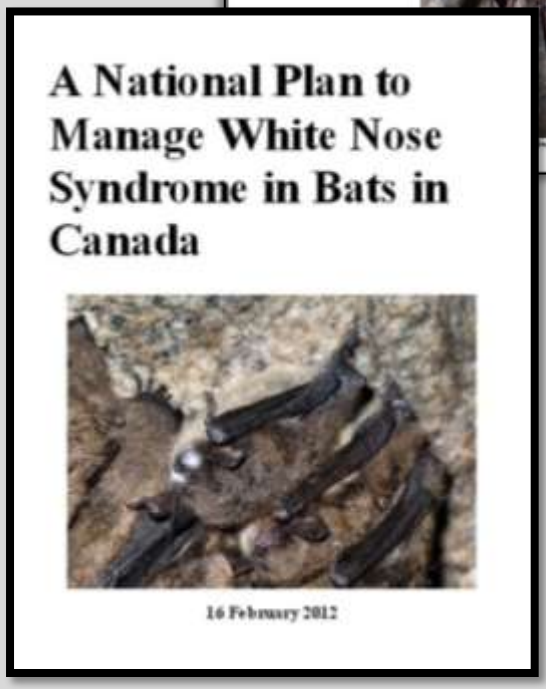
To guide the response of Federal, State, and Tribal agencies, and partners to WNS



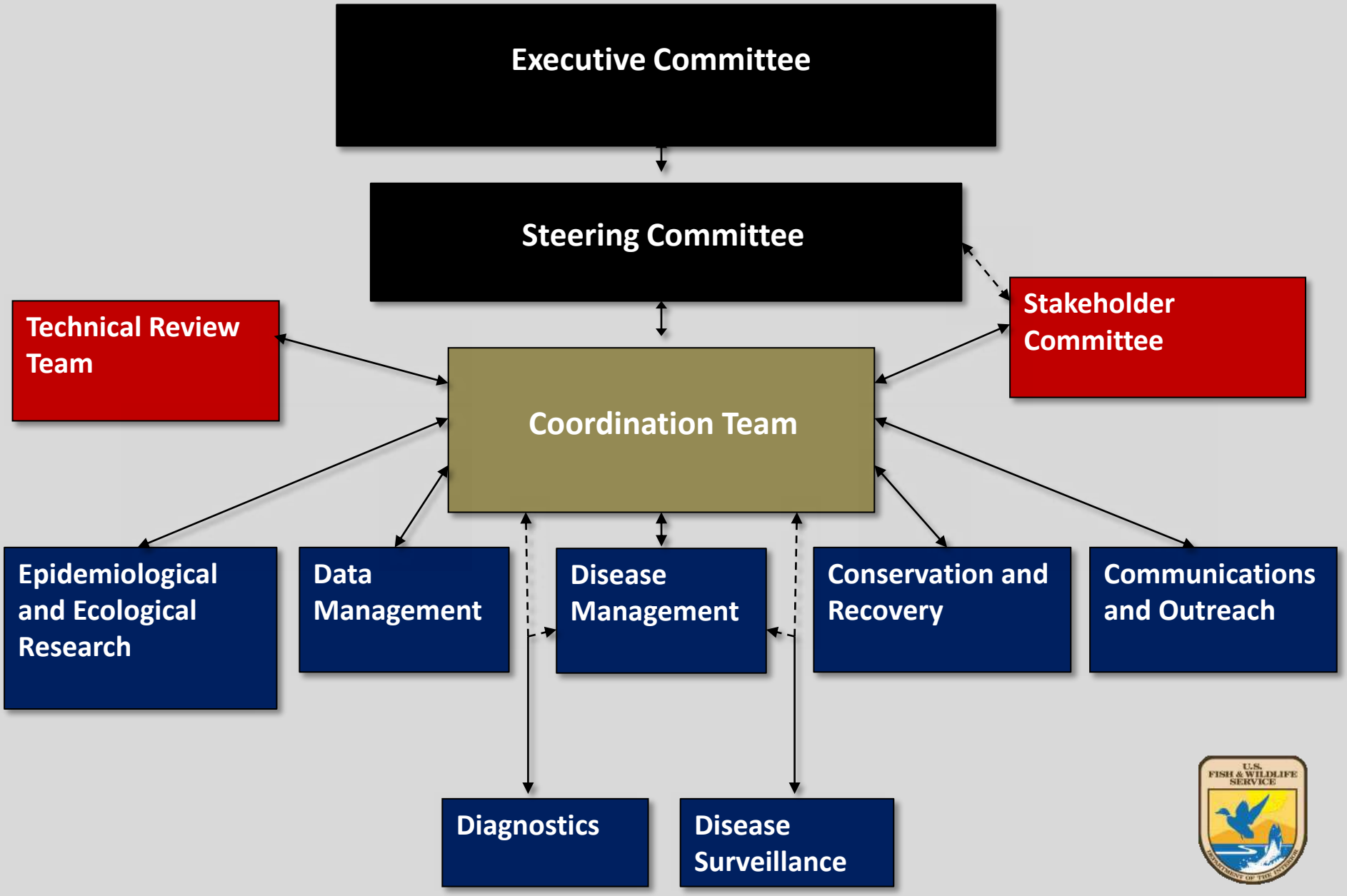
Canadian National Plan

Purpose:

To organize Canada's response to WNS, in collaboration with the US plan



US WNS Organization Structure



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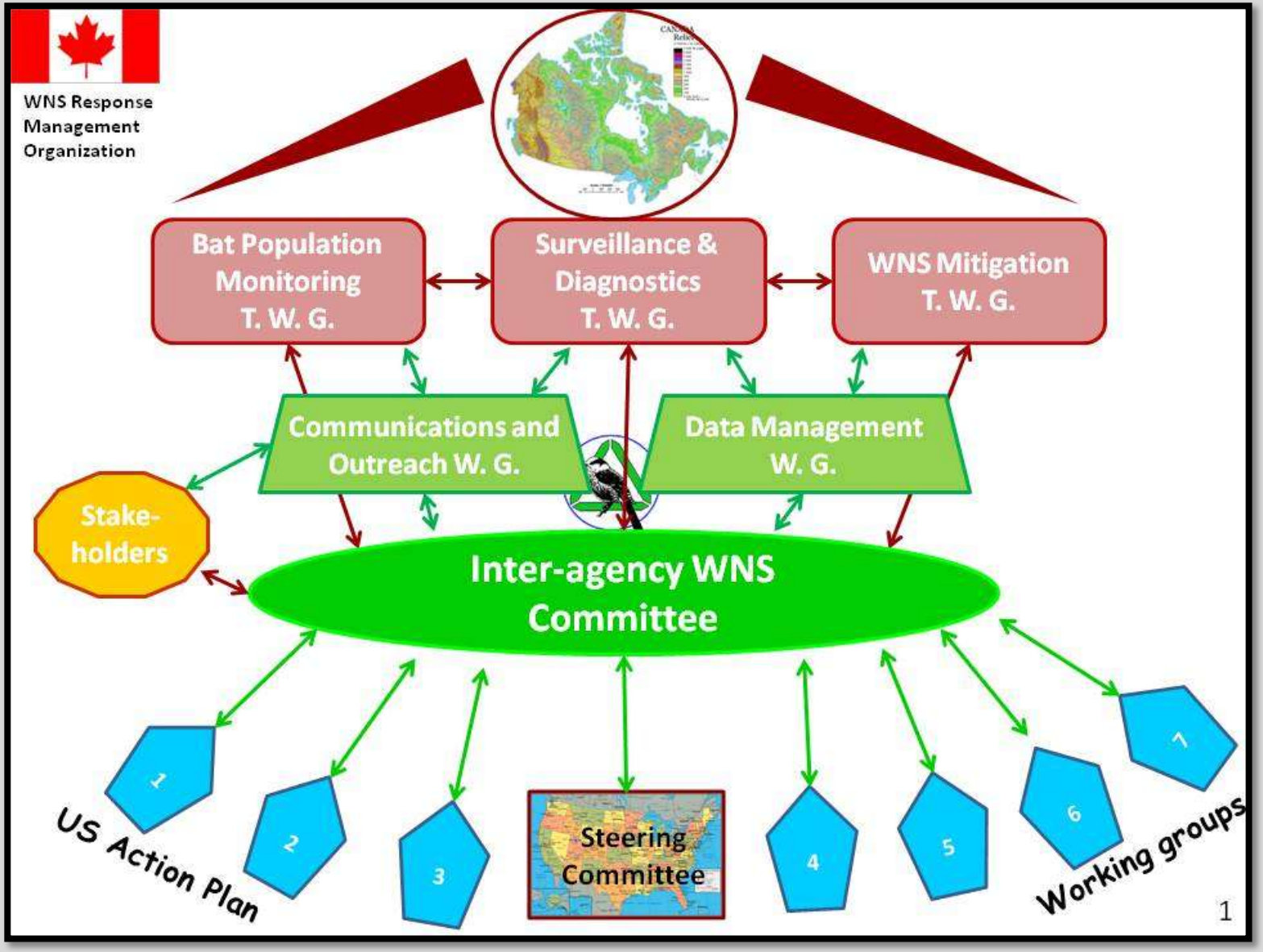


US Working Groups

Diagnostics – Anne Ballmann, USGS NWHC

- Diagnostics protocols & case definitions

Disease Surveillance – Eric Britzke, DoD

- National Surveillance Plan

Communications and Outreach - Catherine Hibbard, USFWS

- National Communications Plan, Outreach, EduBat

Data and Technical Information Management – Laura Ellison, USGS FORT

- Bat Population Database, Disease Tracking Database

Disease Management – Jonathan Reichard, USFWS *(interim)*

- Decontamination, Cave Management Guidance, Treatment/Control

Etiological and Epidemiological Research – Sybill Amelon, USFS, NRS

- Environmental Manipulations

Conservation and Recovery – Robyn Niver, USFWS

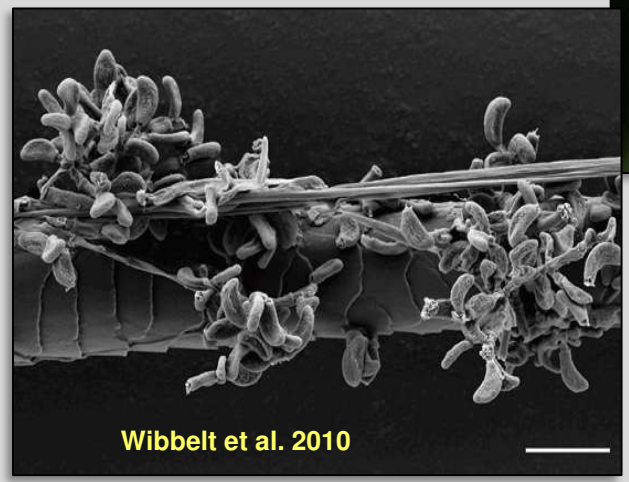
- NaBat, Species and Habitat Recovery, Captive Management

Budget for WNS

- Agency spending, FY07-13: ~$40 million
  (USFWS, USGS, NPS, BLM, USFS, APHIS, DoD, ~40 states)

- USFWS total allocation, FY07-14: ~$27 million
  - USFWS grants through FY14: >$20 million

- USFWS research and state support in FY2015
  - $3.4 million
  - 4 grant opportunities



USFWS Funding & Support – FY2014

- $1.6 million for 8 Federal agency research projects
  Matched with $1.6 million by USGS, USFS, & NPS
- $1.9 million for 9 Research projects
- $1.3 million to 30 states for WNS capacity

Research targets:

- *Pd* surveillance
- Treatment and control of *Pd*
- Understanding bat populations, pre- and post-WNS
- Bat physiology and immunology
- *Pd* genetics, ecology, and pathogenicity
- Population monitoring, NABat
- Ecological Impacts
- Communications and Outreach

ESA-Related Actions

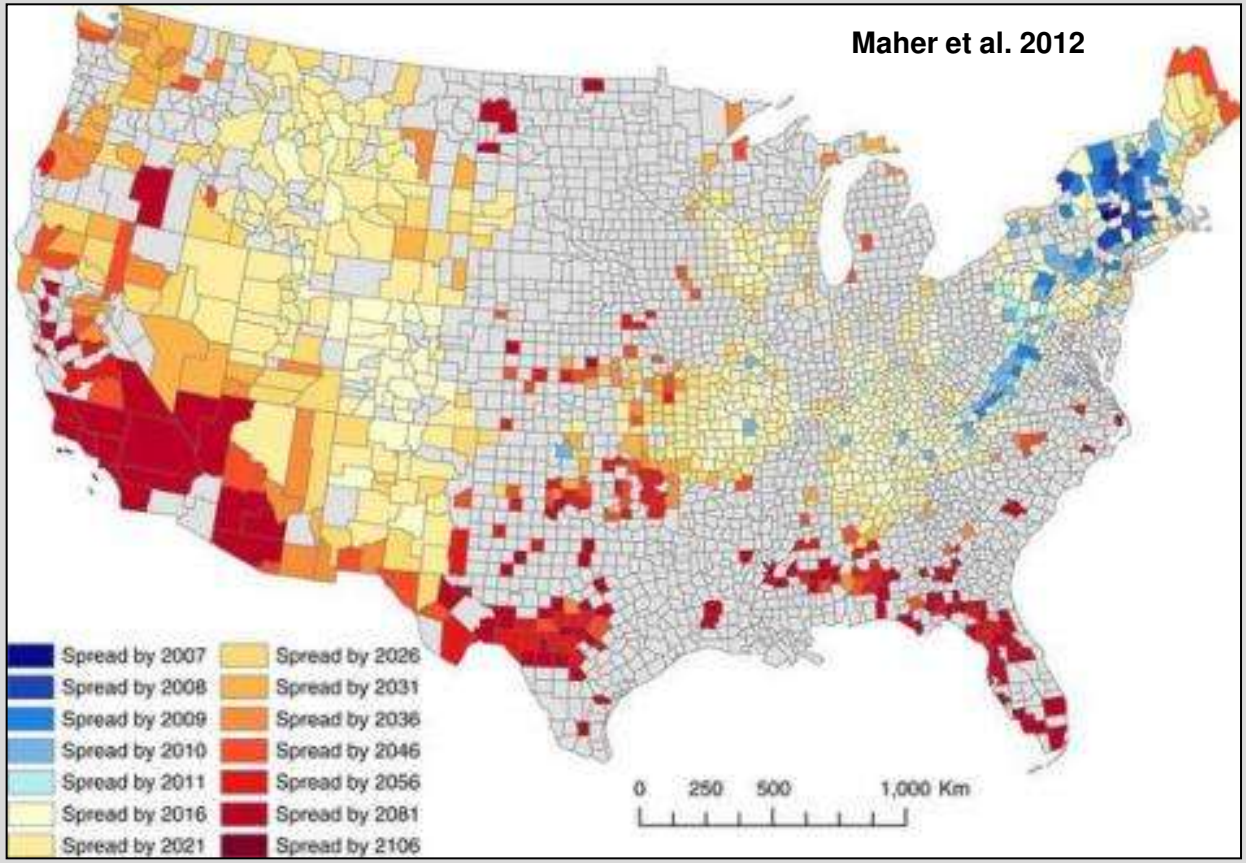
Assessment status:

1. Eastern small-footed bat
   - Petition 2010, not warranted
2. Northern long-eared bat
   - Threatened, 2015
3. Little brown bat - under assessment
4. Tri-colored bat - under assessment

COSEWIC emergency listed 3 species in Canada

Future of WNS?

- Models predict continued spread
- All hibernating bat species potentially at risk
- Long-term impacts to bat population dynamics uncertain



Multi-Partner Collaboration

Thank You!

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