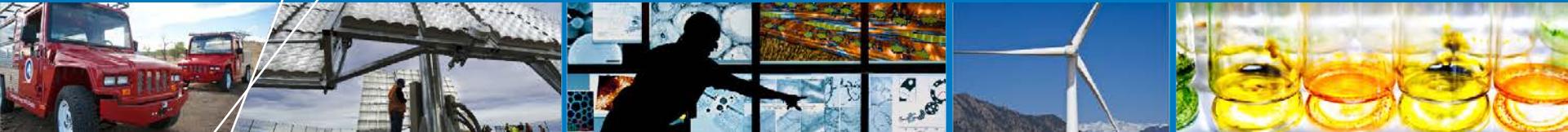


# Historical Challenges of Wind Energy/Wildlife Interactions: How This May Affect Distributed Wind



**ASES Wind Division Webinar Series**

**Karin Sinclair**

**August 12, 2014**

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NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

# Presentation Outline

- Historical overview
- Statutory authority
- Challenges
- Key species habitat distribution
- Research
- Collaboratives
- Distributed wind definition
- Conclusions



Entegrity EW50, 50-kilowatt (kW) turbine,  
Kittery, Maine  
*Photo by Donald Doval, NREL 28427*

# Overview: Concern for Impacts to Wildlife

**Issue: Wind turbines may impact wildlife (especially birds and bats) and habitats**

- **The discussion of wind's impact on wildlife began in Altamont Wind Resource Area, California, in the late 1980s and early 1990s**



Junction Hill Top Wind Farm, Iowa. Five GE 1.6-megawatt (MW) turbines. *Photo by Tom Wind, NREL 26494*



Bergey Excel 10. 10-kW wind turbines; Oak Hills, California. *Photo by Karin Sinclair, NREL 14986*

- **Small and distributed projects often face challenges on this issue as well.**

# Overview: U.S. Department of Energy Wind Program's Mission

- Reduce challenges to project development to accelerate deployment of appropriate wind energy
- Support the 20% wind energy by 2030 initiative (Advanced Energy Initiative)
- Accelerate wind energy capacity growth/development of domestic energy options (Energy Policy Act of 2005).



Northwind 100, 100-kW wind turbine;  
Hempstead, New York. Photo by Town  
of Hempstead, NREL 28963

# Overview: Main Points

- Real or perceived wildlife impacts can be a challenge for development
- Misinformation on potential of impacts is rampant
- Impacts are species- and habitat-specific
- Impacts are site-specific; micrositing is critical to reducing these impacts
- Potential impacts at a large wind farm will likely be different than at a single small wind turbine
- Developers of distributed projects must still be aware of potential issues.



Bergey Excel 10, 10-kW wind turbine; Oak Hills, California.  
Photo by Karin Sinclair, NREL 14983



Eight Nordex N60, 1300-kW wind turbines;  
Garrett, Pennsylvania.  
Photo by Green Mountain Energy Company, NREL 09699

Figure 2: Summary of All Bird Mortality Rates at Various Wind Energy Facilities\*

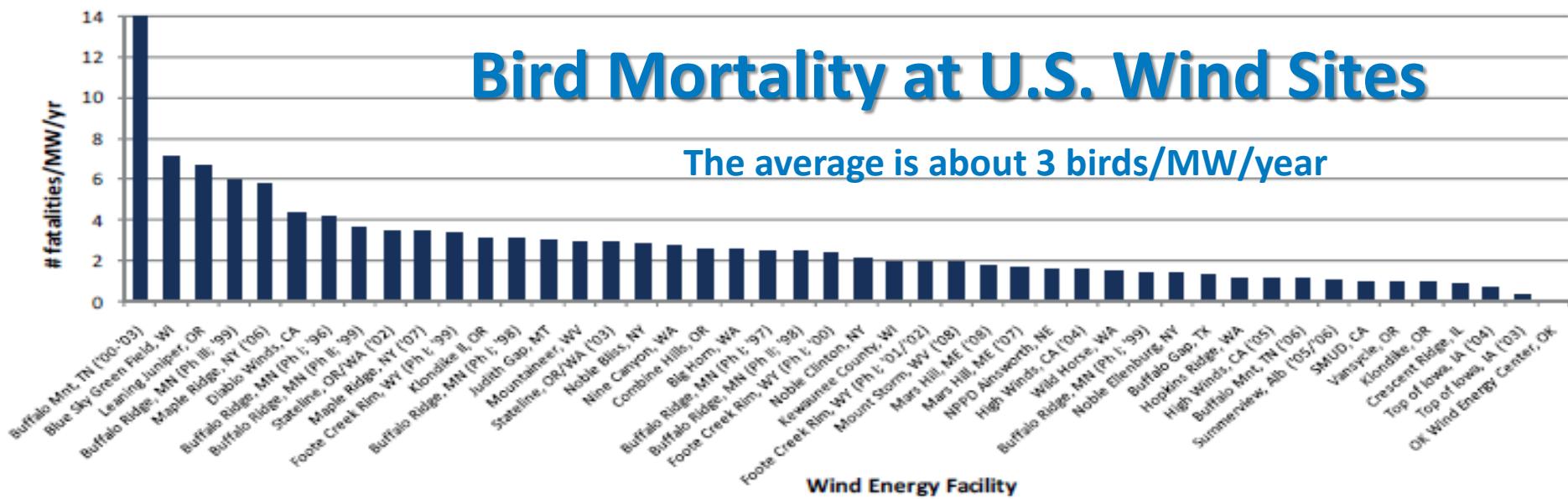
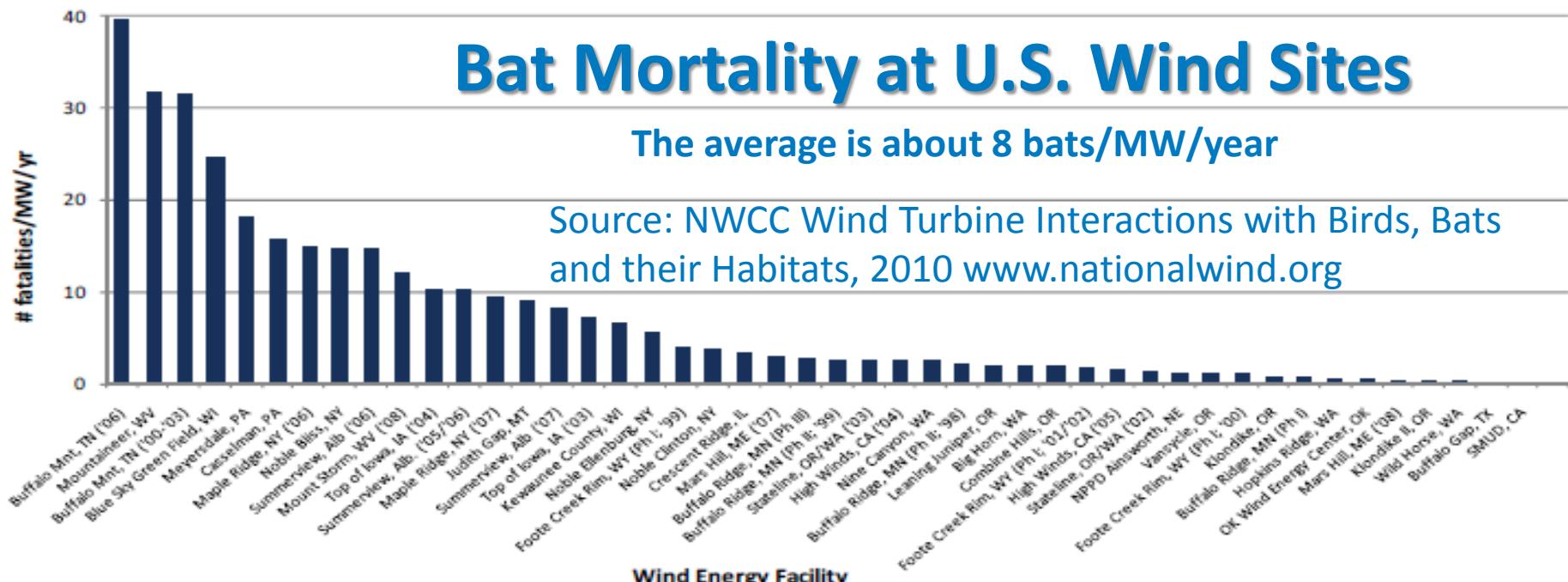


Figure 3: Summary of Bat Mortality Rates at Various Wind Energy Facilities\*



Source: NWCC Wind Turbine Interactions with Birds, Bats and their Habitats, 2010 [www.nationalwind.org](http://www.nationalwind.org)

# U.S. Fish and Wildlife Service (USFWS) Statutory Authority for Wind Permitting Guidelines

- **Endangered Species Act:**
  - Directs service to identify and protect threatened and endangered (T&E) species and their critical habitat
  - Must provide a means to protect T&E species ecosystems.
- **Migratory Bird Treaty Act:**
  - Based on a strict liability statute
  - Proof of intent, knowledge, or negligence is not an element of a Migratory Bird Treaty Act violation
  - Actions resulting in the ‘taking’ or possession of a protected species, in the absence of a service permit or regulatory authorization, is a violation.
- **Bald and Golden Eagle Protection Act:**
  - Bald and golden eagles are afforded additional legal protection.

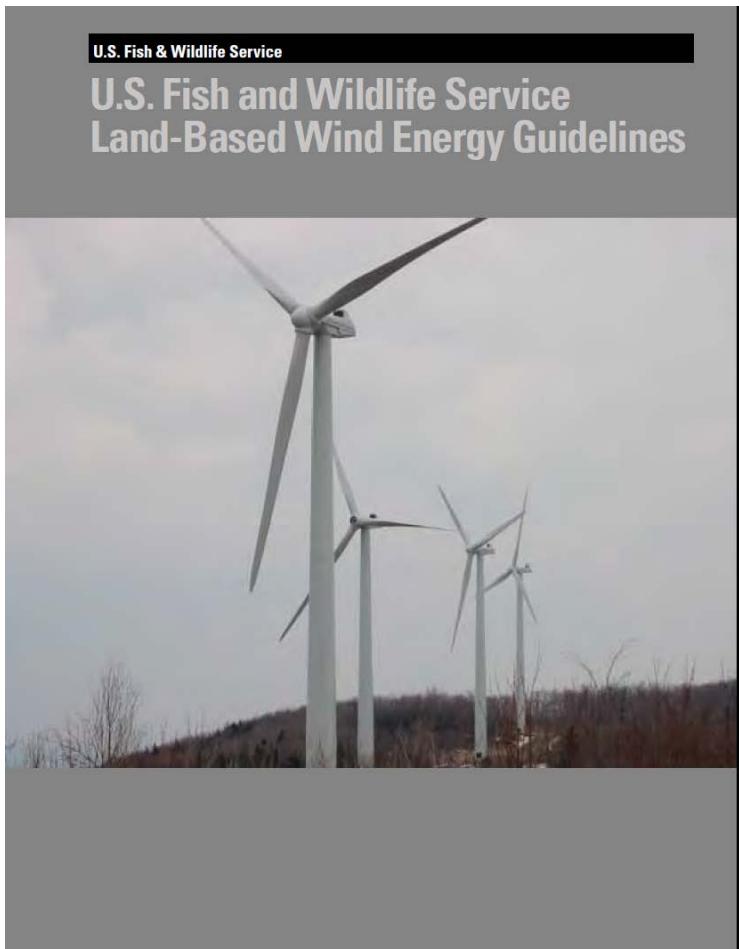


Whooping Crane. Photo by Karin Sinclair, NREL 27961



Bald Eagle. NREL 01101

# The USFWS Wind Energy Wildlife Guidelines



Released March 2012

## A Tiered Approach:

- Tier 1 – Preliminary site evaluation (landscape-scale screening of possible project sites)
- Tier 2 – Site characterization (broad characterization of one or more potential project sites)
- Tier 3 – Field studies to document site wildlife and habitat and predict project impacts
- Tier 4 – Post-construction studies to estimate impacts
- Tier 5 – Other post-construction studies and research.

# USFWS Guidelines: Developer and Service Roles

<i>TIER</i>	<i>Project Developer/Operator Role</i>	<i>Service Role</i>
Tier 1: Preliminary site evaluation	<ul style="list-style-type: none"><li>• Landscape level assessment of habitat for species of concern</li><li>• Request data sources for existing information and literature</li></ul>	<ul style="list-style-type: none"><li>• Provide lists of data sources and references, if requested</li></ul>
Tier 2: Site characterization	<ul style="list-style-type: none"><li>• Assess potential presence of species of concern, including species of habitat fragmentation concern, likely to be on site</li><li>• Assess potential presence of plant communities present on site that may provide habitat for species of concern</li><li>• Assess potential presence of critical congregation areas for species of concern</li><li>• One or more reconnaissance level site visit by biologist</li><li>• Communicate results of site visits and other assessments with the Service</li><li>• Provide general information about the size and location of the project to the Service</li></ul>	<ul style="list-style-type: none"><li>• Provide species lists, for species of concern, including species of habitat fragmentation concern, for general area, if available</li><li>• Provide information regarding plant communities of concern, if available</li><li>• Respond to information provided about findings of biologist from site visit</li><li>• Identify initial concerns about site(s) based on available information</li><li>• Inform lead federal agencies of communications with wind project developers</li></ul>
Tier 3: Field studies and impact prediction	<ul style="list-style-type: none"><li>• Discuss extent and design of field studies to conduct with the Service</li><li>• Conduct biological studies</li><li>• Communicate results of all studies to Service field office in a timely manner</li><li>• Evaluate risk to species of concern from project construction and operation</li><li>• Identify ways to mitigate potential direct and indirect impacts of building and operating the project</li></ul>	<ul style="list-style-type: none"><li>• Respond to requests to discuss field studies</li><li>• Advise project proponent about studies to conduct and methods for conducting them</li><li>• Communicate with project proponent(s) about results of field studies and risk assessments</li><li>• Communicate with project proponents(s) ways to mitigate potential impacts of building and operating the project</li><li>• Inform lead federal agencies of communications with wind project developers</li></ul>
Tier 4: Post construction studies to estimate impacts	<ul style="list-style-type: none"><li>• Discuss extent and design of post-construction studies to conduct with the Service</li><li>• Conduct post-construction studies to assess fatalities and habitat-related impacts</li><li>• Communicate results of all studies to Service field office in a timely manner</li><li>• If necessary, discuss potential mitigation strategies with Service</li><li>• Maintain appropriate records of data collected from studies</li></ul>	<ul style="list-style-type: none"><li>• Advise project operator on study design, including duration of studies to collect adequate information</li><li>• Communicate with project operator about results of studies</li><li>• Advise project operator of potential mitigation strategies, when appropriate</li></ul>

# Challenges

- Habitat and species likely to be impacted vary by climate, topography, and location
- No single solution
- Impacts expected to increase as more turbines are installed across the country—but these can be managed.

## Addressing the Challenges:

- Identification of near-term research needs
- Multipronged approach
- Multistakeholder involvement
- Support for collaborative field research, methods/metrics refinement, tools, mitigation strategies, deterrent development/testing
- Information dissemination.

# Challenges: Key Issues Being Addressed

## Impacts of wind turbines on wildlife:

- Bats (mortality)
- Raptors (mortality)
- Nocturnal migration (mortality)
- Prairie birds (habitat – displacement; genetic diversity)
- Cumulative (population impacts).

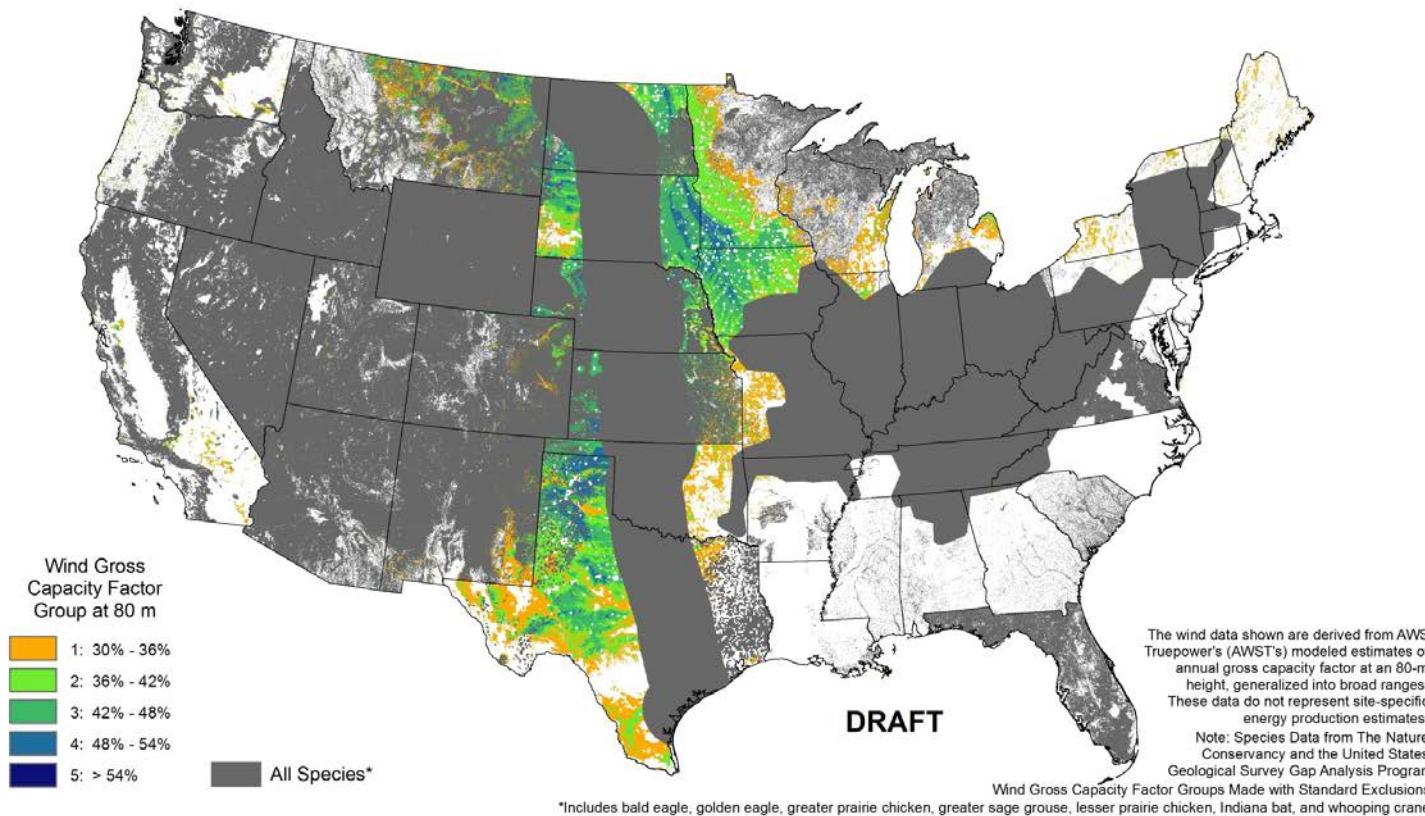
## Tools to avoid problematic sites:

- Federal and state guidelines
- Pre versus post construction validation
- Mapping of migratory pathways
- Pre-siting assessments
- Risk assessments
- Literature archive
- Peer review.



Sage Grouse. NREL 20649

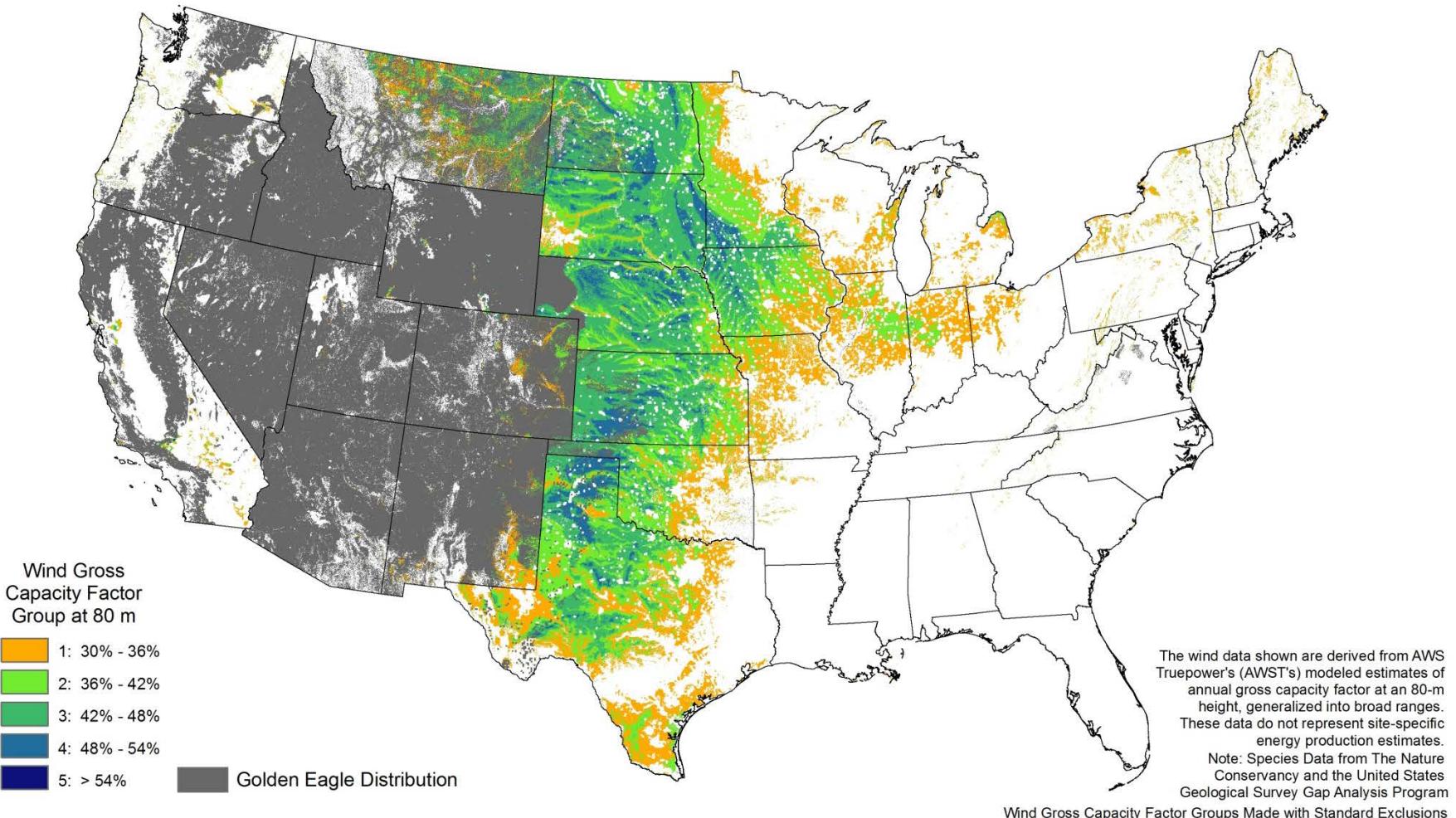
# Key Species Habitat Distribution



Areas in grey indicate where wildlife species live, breed, and migrate. These areas are *not* no-build zones, but are of special concern for developers that could increase costs and time, or lead to project delays or cancellation.

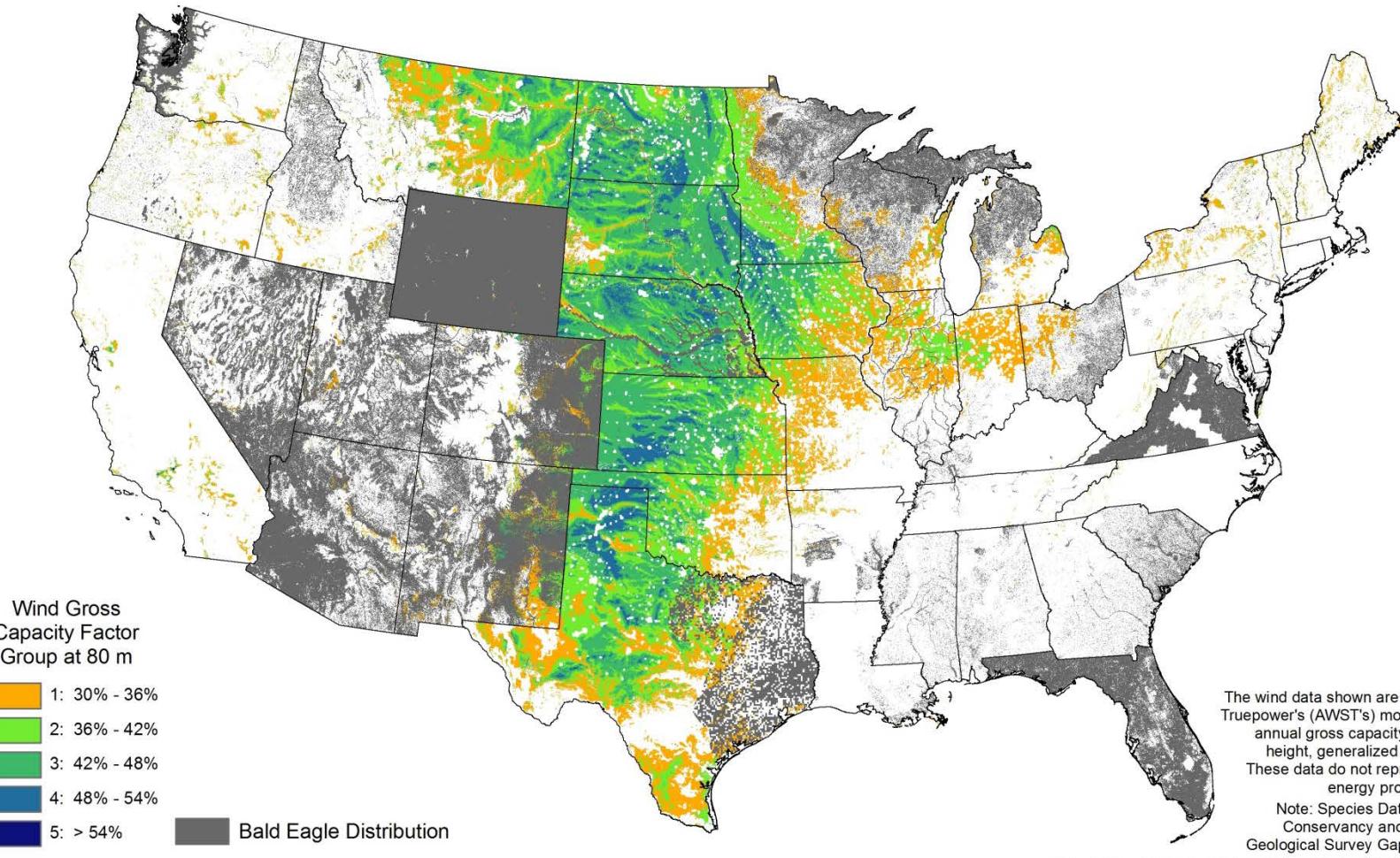
Wildlife distribution can impact local areas very differently. On a national scale, 44%–53% of land could be affected.

# Key Species Habitat Distribution



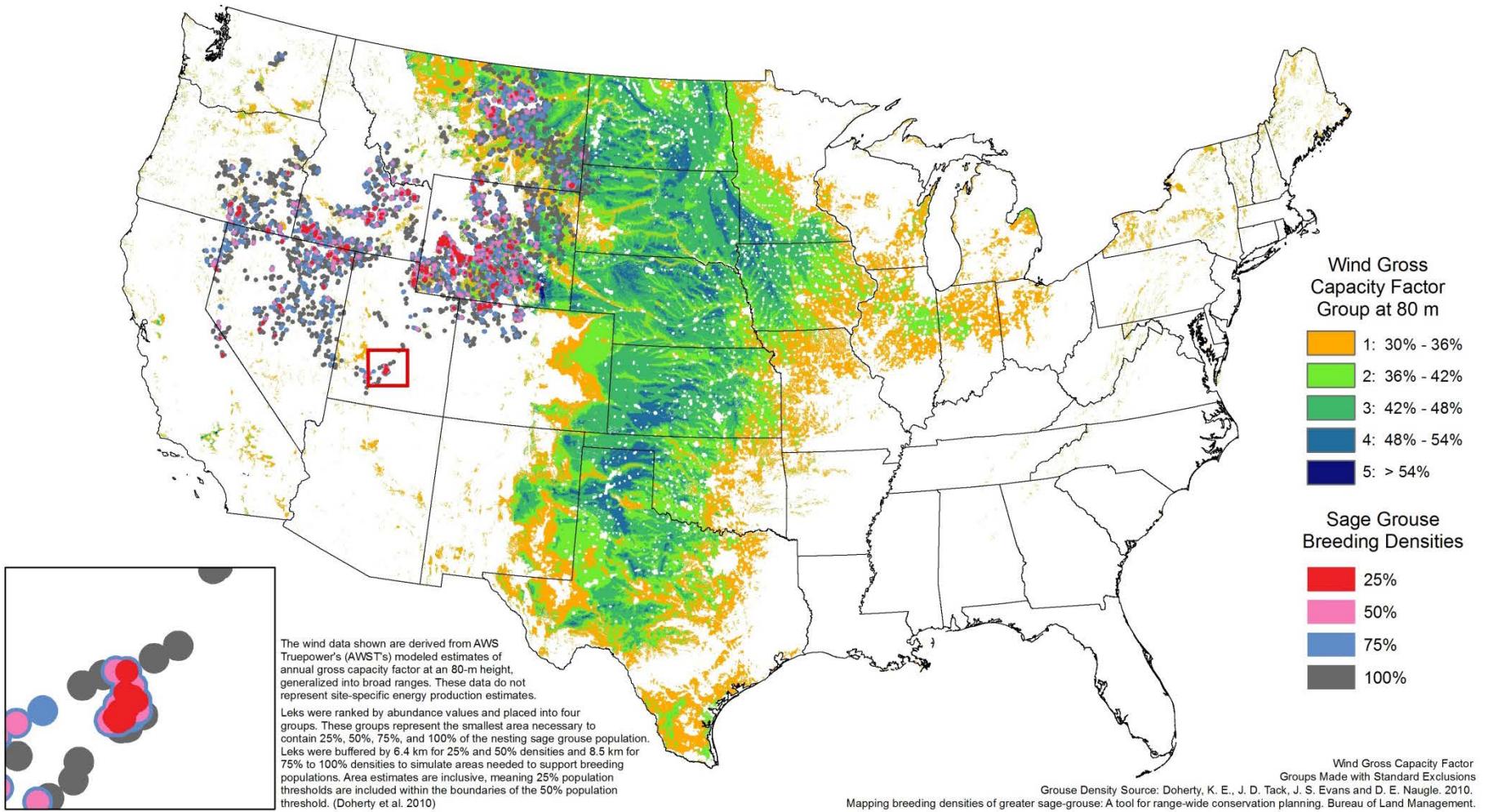
**Golden eagle habitat: areas requiring additional consideration**

# Key Species Habitat Distribution



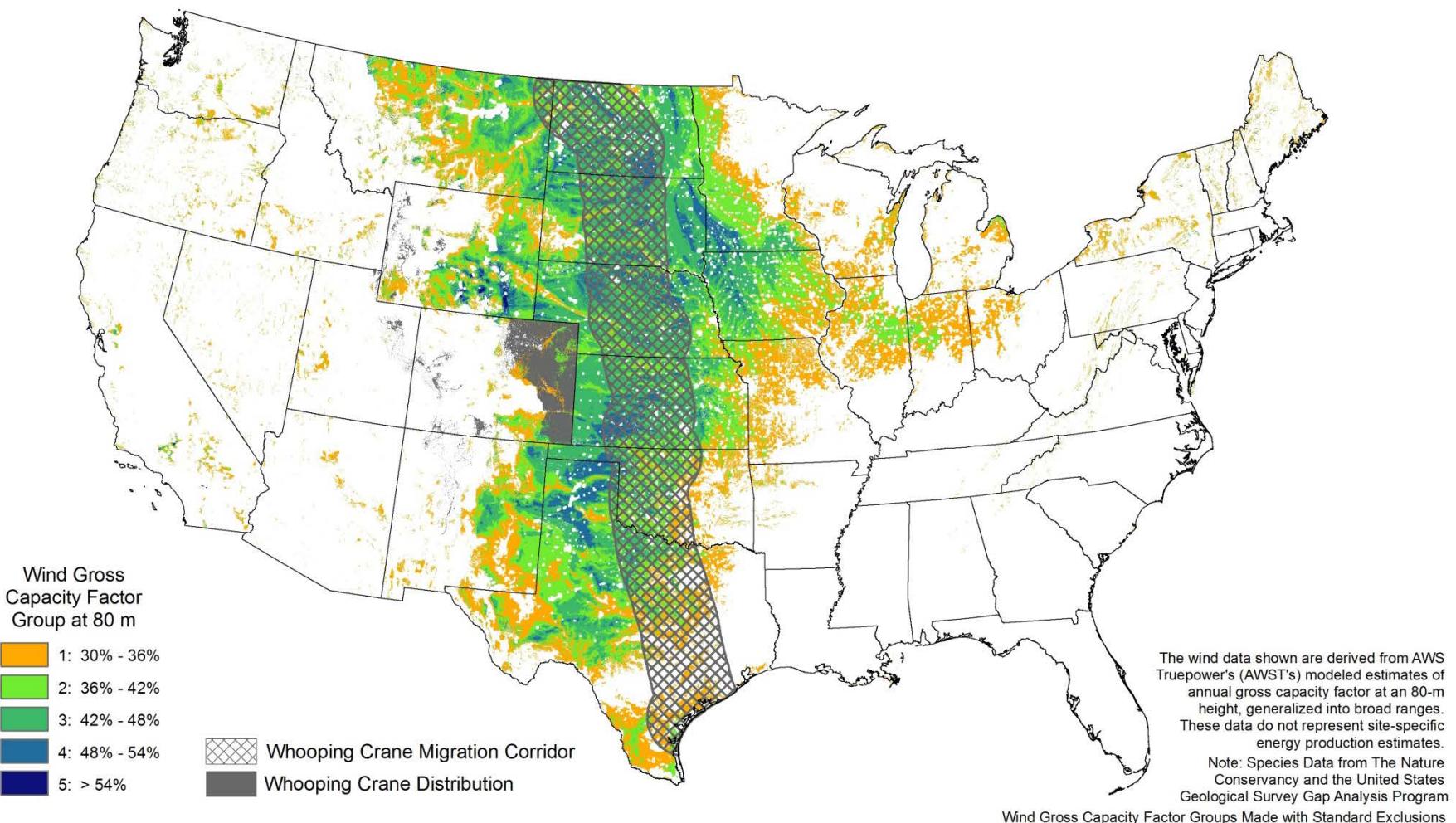
**Bald eagle habitat: areas requiring additional consideration**

# Key Species Habitat Distribution



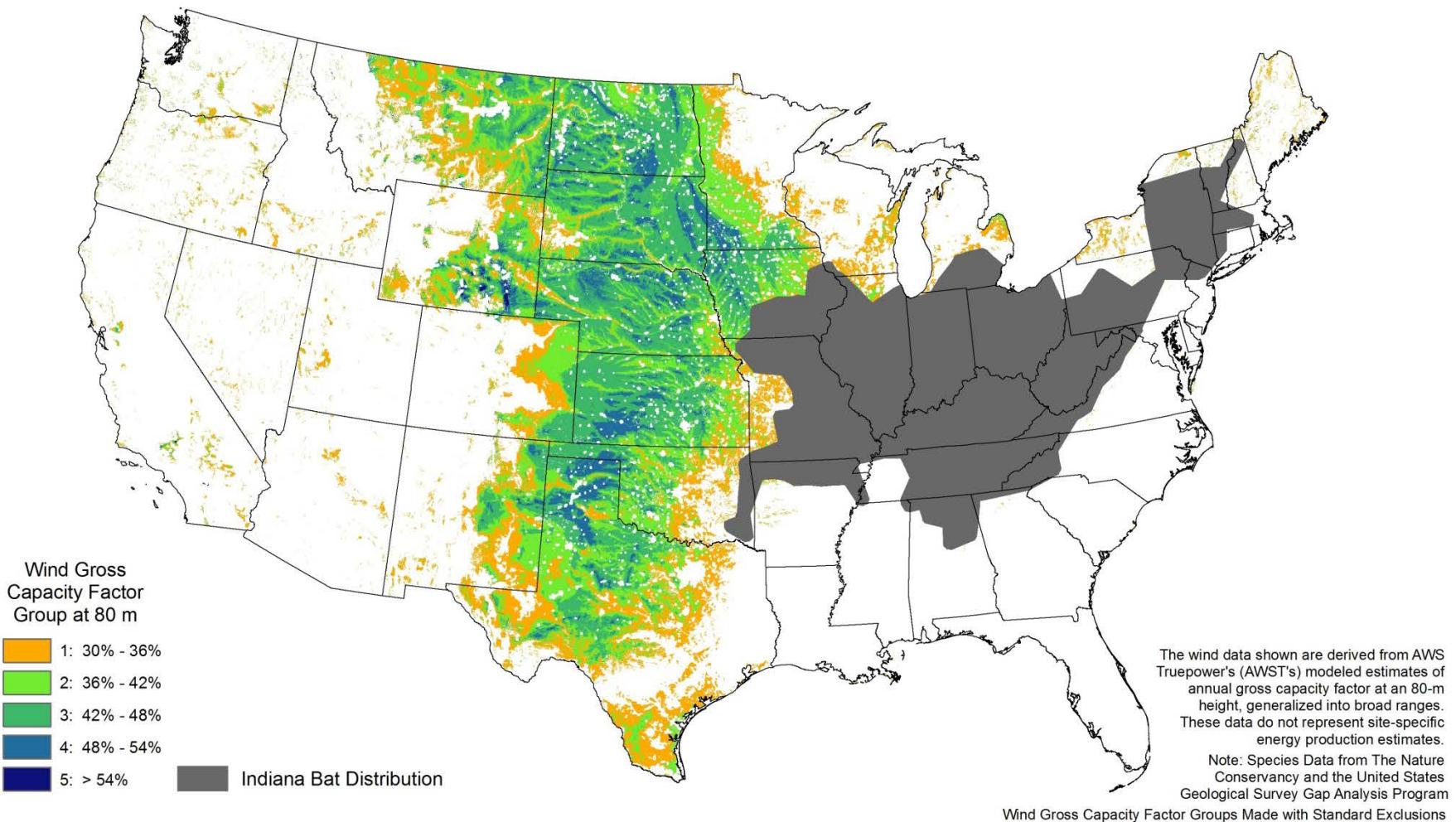
**Sage grouse habitat and breeding sites: areas requiring additional consideration**

# Key Species Habitat Distribution



**Whooping crane habitat and migratory corridor: areas requiring additional consideration**

# Key Species Habitat Distribution



**Indiana bat habitat distribution: areas requiring additional consideration**

# Cumulative Impacts

In the Mid-Atlantic Highlands, cumulative impacts to bats under two modeling scenarios are estimated as follows:

Estimate (based on NREL WindDS model):

- 2,158 MW by year 2020
- 33,000–62,000 bats/year

Estimate (based on PJM grid model):

- 3,856 MW by year 2020
- 59,000–111,000 bats/year

The crucial issue is whether these impacts affect whole populations of certain species. Commonly found bats at wind facilities could experience the following cumulative impacts in the Mid-Atlantic Highlands:

- 9,500–32,000 hoary bats/year
- 11,500–38,000 eastern red bats/year
- 1,500–6,000 silver-haired bats/year

Kunz et al. 2007. Frontiers in Ecology and the Environment 5:315-324

# Mitigation Research

**Mitigation research focuses on:**

- Deterrent development
- Correlating wind speed to utilization
- Correlating weather patterns to fatality patterns
- Offsite compensation
- Micrositing
- Turbine size
- Blade visibility
- Seasonal shutdowns
- Habitat manipulation
- Artificial roosts.



Greater Prairie Chicken. *Photo by Mark Herse, Kansas State University, NREL 27970.*

# Technology/Model Research

Technology/modeling research  
is focused on:

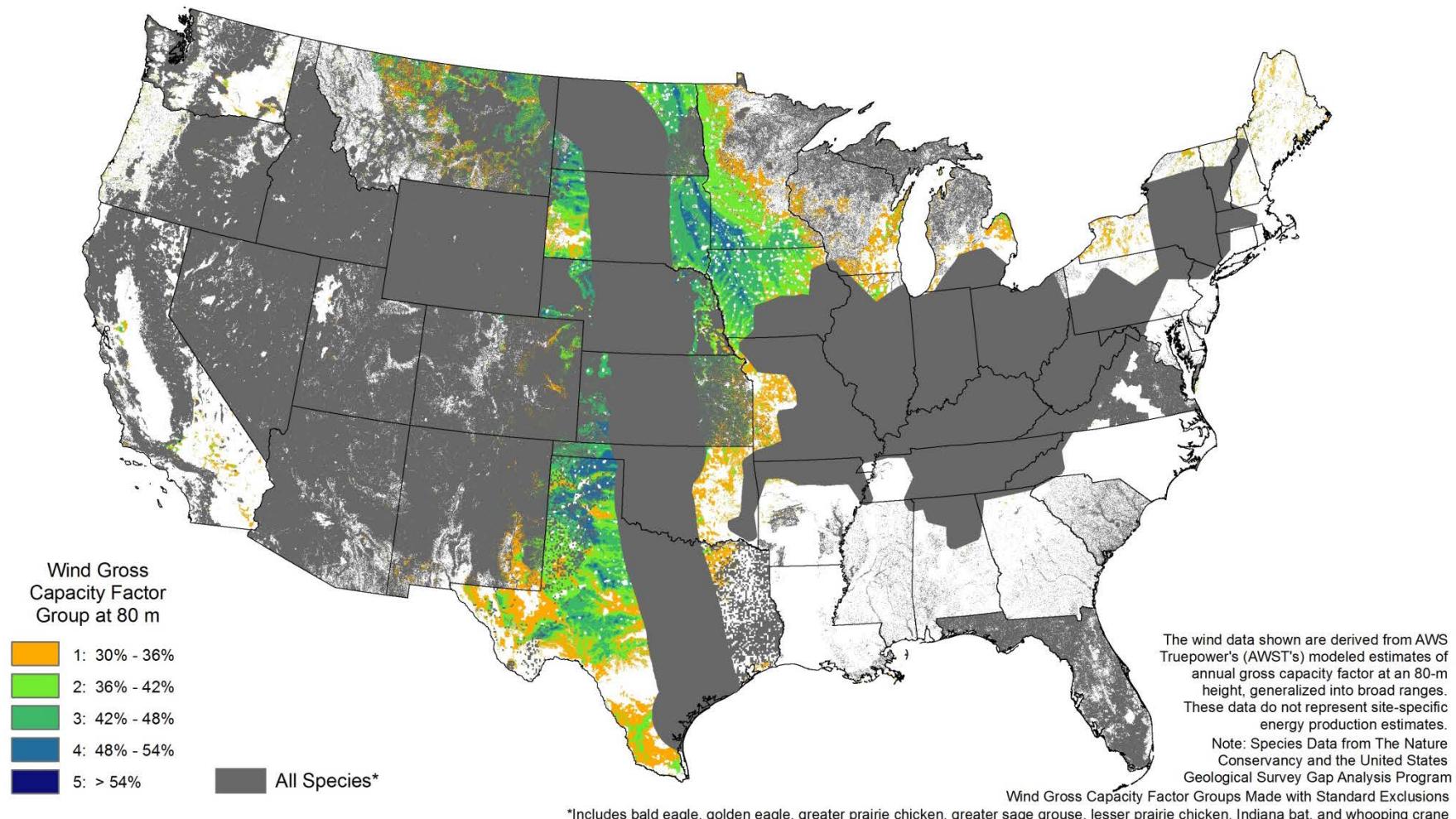
- Radar validation
- Thermal imaging cameras
- Near-infrared cameras
- Indirect fatality indicators
- Stable isotopes
- Predictive models.



Infrared camera.

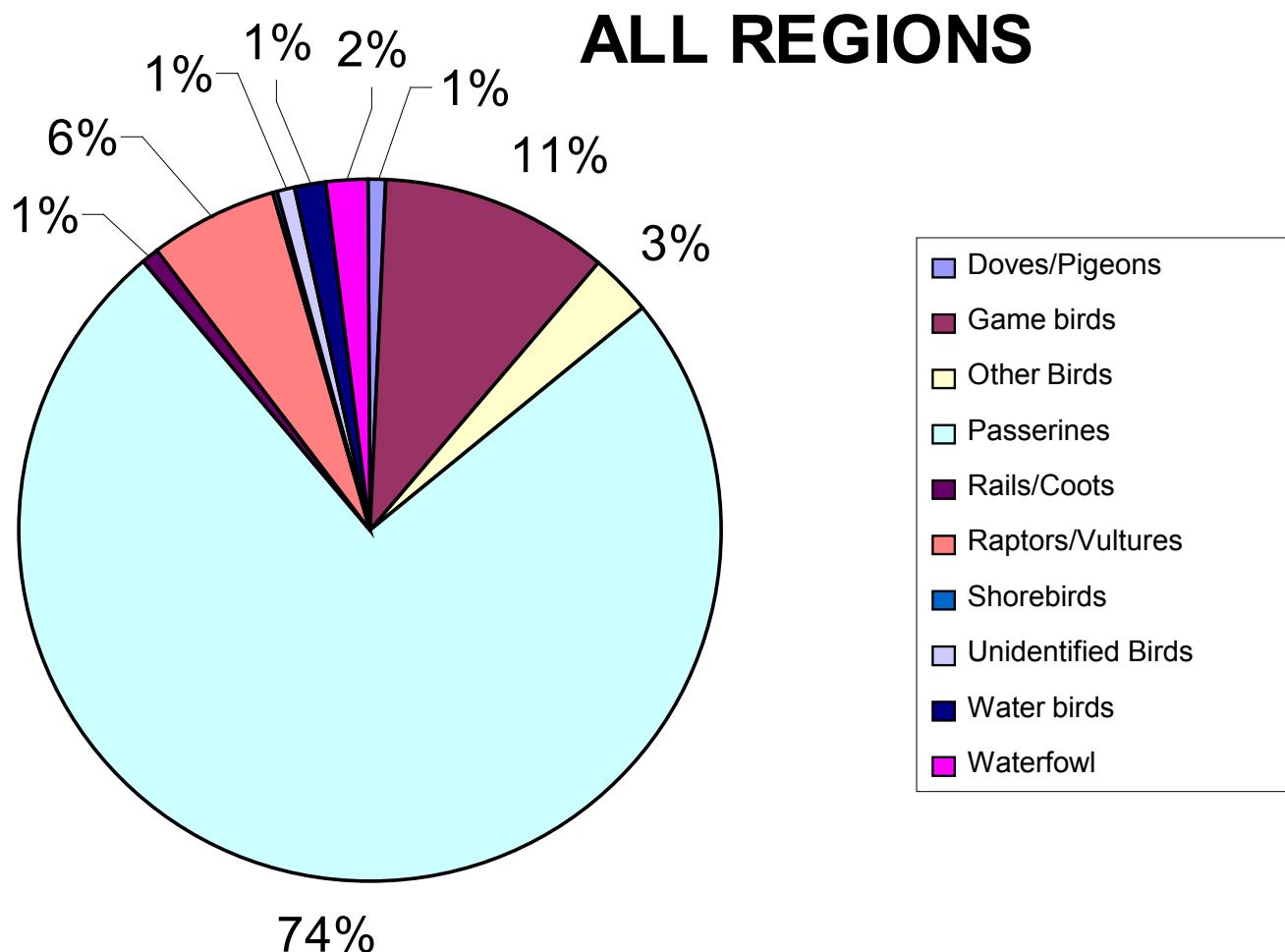
*Photo by Dennis Schroeder, NREL 20338.*

# Key Species Habitat Distribution



**Combined wildlife impacts: areas requiring additional consideration**

# Research: Species Composition of Bird Fatalities



Proportion of fatalities at sites reporting fatalities by species, for all regions where studies have been conducted (the Pacific Northwest, Midwest, Rocky Mountains, and East).

Source: Strickland and Morrison, February 26, 2008.

[http://www.fws.gov/habitatconservation/windpower/Past\\_Meeting\\_Presentations/Morrison\\_Strickland.pdf](http://www.fws.gov/habitatconservation/windpower/Past_Meeting_Presentations/Morrison_Strickland.pdf)

# Collaboratives

## Current collaboratives include:

- National Wind Coordinating Collaborative – Federal, state, utilities, nongovernmental organizations (NGOs), and wind industry
- Grassland Shrub Steppe Species Collaborative (G3SC) – Federal, state, NGOs, and wind industry
- Sage Grouse Collaborative – Federal, state, NGOs, and wind industry
- Bats and Wind Energy Cooperative (BWEC) – Federal, state, NGOs, and wind industry
- American Wind Wildlife Institute (AWWI) – Industry and NGOs
- International Energy Agency (IEA) Wind Task 34 – Numerous countries; early stages of organization.

# Distributed Wind Definition

- Based on where the project is located and how the power is used; the distributed wind market includes wind turbines and projects of many sizes.
  - Is defined in terms of technology application based on a wind project's location relative to end-use and power-distribution infrastructure, rather than on technology size or project size
  - Is the use of wind turbines at homes, farms and ranches, businesses, public and industrial facilities, and off-grid locations to offset all or a portion of local energy consumption or systems directly connected to the local grid to support local loads
  - Can range in size from a 1-kW or smaller off-grid wind turbine at a remote cabin to a 10-kW turbine at a home or farm to several multimegawatt wind turbines at a university campus, manufacturing facility, or any large facility.



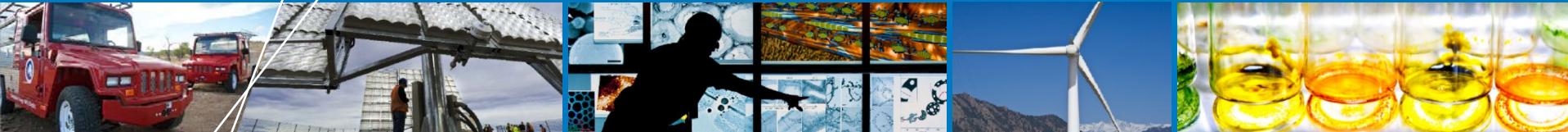
Bergey Excel 10, 10-kW turbine,  
Klickitat County, Washington  
Photo by Gwen Bassetti, NREL 26429

# Conclusions

- Wind-wildlife impact concerns are complicated.
- Micrositing is key to avoiding, minimizing, and mitigating impacts. However, some locations may not be appropriate for wind development.
- Research and development of tools is continuing.
- USFWS Wind Energy Guidelines include distributed wind; conducting Tier 1 and Tier 2 evaluations are likely sufficient.



Endurance E3120 turbine; 50-kW turbine;  
Appleton, Wisconsin. Photo by Kettle View  
Renewable Energy, LLC, NREL 28428.



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