Overview of Montana Bat Conservation Issues and Data Needs

March 3rd, 2012, Lewis and Clark Caverns, Montana

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http://mtnhp.org
### Bats of Montana

- **6 Species of Concern**
- **3 Potential Species of Concern**

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White-Nose Syndrome

For Latest Info:  http://www.fws.gov/whitenosesyndrome/

• Has killed 5.7 to 6.7 million bats in N.A. since 2006 (USFWS January 17, 2012 news release)
• Caused by cold-adapted fungus: *Geomycetes destructans* (Lorch et al. 2011, Nature 480: 376-378)
• Predicted regional extinction of Little Brown Myotis by 2026 (Frick et al. 2010, Science 329: 679-682)

• *G. destructans* on bats across Europe, but no mass mortality there (Puechmaille et al. 2011, PLoS One 6(4)e19167)
Distribution of White-Nose Syndrome
- 16 States
- 4 Canadian Provinces


Occurrence of white-nose syndrome and/or *Geomyces destructans* in the United States (by county) and Canada (by county or district) from winter 2005–2006 through April 2011.
**G. destructans** growth and Hibernacula Temps

- Of 45 bat species in U.S., at least 6 of the 25 that hibernate have been documented with WNS

Temperature range of most bat hibernacula in North America is 2-14°C.

Colony expansion rates of *Geomycetes destructans* when grown on cornmeal agar at 3, 7, 14, and 20°C. The trend line estimates colony expansion rates at temperatures ranging from 3–20°C.

<table>
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<th>Wt</th>
<th>Hibernation Information</th>
<th>Mortality rate:</th>
</tr>
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<tr>
<td><strong>Mylu</strong></td>
<td>7-10 g</td>
<td>Prefers areas of high RH (&gt; 70%) and temperatures between 5 and 8 °C. Nearly always clusters in large groups (5-100s)</td>
<td>91%</td>
</tr>
<tr>
<td><strong>Myse</strong></td>
<td>5-9 g</td>
<td>Hibernate solitarily or in small clusters; May hibernate in deep crevices or move between hibernacula in the winter</td>
<td>98%</td>
</tr>
<tr>
<td><strong>Pesu</strong></td>
<td>4-8 g</td>
<td>Hibernates solitarily in deeper parts of caves with stable warmer temperatures (9-12 °C typical, but range 5 to 16 °C) and high RH (&gt; 80%); highest hibernacula site fidelity. First to enter hibernacula and last to leave.</td>
<td>75%</td>
</tr>
<tr>
<td><strong>Epfu</strong></td>
<td>11-23 g</td>
<td>Last to enter hibernacula and first to leave, prefers colder drier, more exposed locations with higher air flow within hibernacula than other species; nearly always solitarily.</td>
<td>41%</td>
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Wind Energy Development and Bats

- Of North America’s 45 bat species, mortalities of 11 have been detected at wind energy facilities (Kunz et al. 2007).

- 75% of documented mortalities have been of migratory foliage roosting species: Hoary Bat, Eastern Red Bat, and Silver-haired Bat (Kunz et al. 2007, Frontiers in Ecology and the Environment 5(6): 315-324).

- 7 Montana bat species have had documented mortalities at wind energy facilities in North America and at least 3 species have documented mortalities at Montana wind energy facilities (Kunz et al. 2007, Poulton and Erickson 2010, Judith Gap Final Report).

- Most bats are killed on nights with low wind speed (< 6 m/s where wind turbine cut-in speeds are typically 3.5 - 4.0 m/s) (Arnett et al. 2008, JWM 72(1): 61-78).

- Fatalities increase before or after storm fronts (Arnett et al. 2008, JWM 72(1): 61-78).


- Mortalities are often skewed toward males (Arnett et al. 2008, JWM 72(1): 61-78).
Direct Collision versus Barotrauma

- Direct contact with turbine blade in 50% of fatalities
- 90% of bat fatalities involve internal hemorrhaging
- Pressure drops of 5-10 kPa with tip speeds of 55-80 m/s

(Baerwald et al. 2008, Current Biology 18(16): R695-R696)

Wind Energy Development 101

Goal of 20% of U.S. energy from wind by 2030 (DOE 2008)

MT is 39% of western onshore potential

(Energy Strategies 2010)
Wind Energy Development and Bats

- Migratory pathways?
- Migration timing?

- 30 miles from transmission corridor is limit of economic viability

(Martin et al. 2009, TNC Report)

(Energy Strategies 2010)
Wind Energy Development Disturbed vs. Undisturbed Lands

<table>
<thead>
<tr>
<th>State</th>
<th>DOE (GW)</th>
<th>Total (GW)</th>
<th>Disturbed (GW)</th>
<th>% DOE goal on Disturbed Land</th>
<th>Averted Loss (KM²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AZ</td>
<td>2.72</td>
<td>27.37</td>
<td>0.36</td>
<td>13%</td>
<td>534</td>
</tr>
<tr>
<td>CA</td>
<td>15.82</td>
<td>108.22</td>
<td>6.18</td>
<td>39%</td>
<td>2719</td>
</tr>
<tr>
<td>CO</td>
<td>2.51</td>
<td>290.25</td>
<td>105.2</td>
<td>4197%</td>
<td>420</td>
</tr>
<tr>
<td>IA</td>
<td>19.91</td>
<td>490.62</td>
<td>450.56</td>
<td>2263%</td>
<td>0</td>
</tr>
<tr>
<td>ID</td>
<td>2.82</td>
<td>55.75</td>
<td>5.33</td>
<td>189%</td>
<td>496</td>
</tr>
<tr>
<td>IL</td>
<td>14.68</td>
<td>343.66</td>
<td>304.6</td>
<td>2075%</td>
<td>91</td>
</tr>
<tr>
<td>IN</td>
<td>6.77</td>
<td>16.46</td>
<td>16.15</td>
<td>238%</td>
<td>0</td>
</tr>
<tr>
<td>KS</td>
<td>7.16</td>
<td>838.21</td>
<td>518.7</td>
<td>7246%</td>
<td>16</td>
</tr>
<tr>
<td>MD</td>
<td>1.82</td>
<td>1.59</td>
<td>0.28</td>
<td>15%</td>
<td>297</td>
</tr>
<tr>
<td>ME</td>
<td>1.11</td>
<td>11.09</td>
<td>0.63</td>
<td>56%</td>
<td>194</td>
</tr>
<tr>
<td>MI</td>
<td>20.34</td>
<td>15.51</td>
<td>10.76</td>
<td>53%</td>
<td>1092</td>
</tr>
<tr>
<td>MN</td>
<td>9.94</td>
<td>195.31</td>
<td>173.69</td>
<td>1747%</td>
<td>110</td>
</tr>
<tr>
<td>MT</td>
<td>5.26</td>
<td>902.04</td>
<td>245.27</td>
<td>4662%</td>
<td>884</td>
</tr>
<tr>
<td>NC</td>
<td>1.89</td>
<td>5.35</td>
<td>0.82</td>
<td>44%</td>
<td>339</td>
</tr>
<tr>
<td>ND</td>
<td>2.26</td>
<td>724.14</td>
<td>457.19</td>
<td>20201%</td>
<td>126</td>
</tr>
<tr>
<td>NE</td>
<td>7.88</td>
<td>698.73</td>
<td>291.35</td>
<td>3697%</td>
<td>482</td>
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<tr>
<td>NM</td>
<td>6.45</td>
<td>297.29</td>
<td>25.68</td>
<td>398%</td>
<td>1193</td>
</tr>
<tr>
<td>NV</td>
<td>7.49</td>
<td>36.17</td>
<td>0.22</td>
<td>3%</td>
<td>1431</td>
</tr>
<tr>
<td>NY</td>
<td>2.19</td>
<td>48.52</td>
<td>25.64</td>
<td>1179%</td>
<td>381</td>
</tr>
<tr>
<td>OK</td>
<td>38.48</td>
<td>259.72</td>
<td>141.81</td>
<td>369%</td>
<td>3058</td>
</tr>
<tr>
<td>OR</td>
<td>7.92</td>
<td>70.04</td>
<td>8.1</td>
<td>100%</td>
<td>1297</td>
</tr>
<tr>
<td>PA</td>
<td>3.1</td>
<td>5.97</td>
<td>0.79</td>
<td>25%</td>
<td>579</td>
</tr>
<tr>
<td>SD</td>
<td>8.06</td>
<td>854.48</td>
<td>350.53</td>
<td>4349%</td>
<td>1163</td>
</tr>
<tr>
<td>TN</td>
<td>1.09</td>
<td>0.37</td>
<td>0.01</td>
<td>1%</td>
<td>78</td>
</tr>
<tr>
<td>TX</td>
<td>20.46</td>
<td>733.77</td>
<td>320.63</td>
<td>1567%</td>
<td>765</td>
</tr>
<tr>
<td>UT</td>
<td>2.45</td>
<td>26.61</td>
<td>0.33</td>
<td>14%</td>
<td>451</td>
</tr>
<tr>
<td>VA</td>
<td>1.78</td>
<td>5.63</td>
<td>0.57</td>
<td>32%</td>
<td>330</td>
</tr>
<tr>
<td>WA</td>
<td>9.87</td>
<td>58.14</td>
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<td>WV</td>
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<td>9.51</td>
<td>0.8</td>
<td>41%</td>
<td>347</td>
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<tr>
<td>WY</td>
<td>12.77</td>
<td>569.93</td>
<td>63.23</td>
<td>495%</td>
<td>2146</td>
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Figure 1. Map of continental U.S. with states where DOE targets can (blue) and cannot (red) be met on disturbed lands. We focused on the 31 states that comprise the majority of the DOE vision, excluding states (grey) with less than 1 GW of projected development [1]. Inset table with 31 focal states, their DOE projections (in GW), Total available wind energy (in GW), wind energy available on disturbed lands (in GW), percent of DOE vision that can be met on disturbed land and amount of undisturbed lands that a disturbance focused development scenario would avert (in KM²).
## Major Bat Conservation Issues

### Wind Turbine Impacts Documented

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Montana Bat Observations Through 2009

Total = 3,760 total observation records through 2009
Summer Acoustic and Mist Netting Data

*5,584 records between May 16 and September 30

*5,678 bat records as of 2/25/12

Large Red Dots = Acoustic Surveys
Large Purple Dots = Mistnet Surveys
Small Black Dots = Bat detections
Winter and Cave/Mine Data

*63 records between November 1 and March 31

Large Blue Squares = Known hibernacula (Red circle = newly identified)
Red Cross = Temp/Relative Humidity Data Logger Installed
Small Gray Dots = Caves
Small Pink Dots = Caves/Mines with bat activity recorded
Spring and Fall Bat Data

April to mid-May = 11 records

October = 20 records
Montana Bat Observations by Month

Total = 3,760 observation records
Montana Caves and Abandoned Lode Mines
Data Needs and Management Issues

- Timing and routes of migration in migratory species for mitigation of impacts from wind turbines: Hoary Bat, Eastern Red Bat, Silver-haired Bat in particular, but also Spotted Bat, Pallid Bat, and Fringed Myotis

- Focal studies at wind energy facilities

- Overwintering locations with information on temperature and relative humidity of roosting areas

- Winter activity levels within hibernacula and outside of hibernacula

- Roost locations during “active season”, particularly maternity roosts

- Spatial use of landscapes over the course of the year

- Data useful for monitoring status – site occupancy rates

- Investigation of possible alternative roost stru
Acoustic and Cave/Mine Baseline Surveys for White-Nose Syndrome and in Montana’s Bats

Large Blue Squares = Known hibernacula (+ = with data loggers)
Large Red Circles = SM2 detector installed
Large Purple Circles = SM2 detector installation planned
Large Orange Circles = Potential SM2 sites, funding pending
Small Gray Dots = Caves
Small Pink Dots = Caves/Mines with bat activity recorded
Example Output for SM2 Station
Total Number of Bat Call Sequences Summarized by Date
No. Bat Call Sequences Summarized by Tentative Species Identification
Number of Bat Call Sequences Summarized by Hour Across all Months of Deployment
Number of Bat Call Sequences Summarized by Date and Species Across Period of Deployment
Overview of Spatial and Temporal Distribution Information for Montana Bats
Rabies in Montana
(Source MT DPHHS)

**Bats:** 5-10% +
From 1996-1999: 901 tested with 67+ (7.5%)

**Skunks:** Frequent +
From 1996-1999: 304 tested with 122+ (40%)

**Raccoons:** Rare +
From 1996-1999: 134 tested with 0+
Pallid Bat
SOC, G5, S2

Relative Density

Recency

Submitted Observations by Month

Submitted Observations by Year

Elevation Profile (feet)

(Records associated with a range of dates are excluded from time charts)
Townsend’s Big-eared Bat
SOC, G4, S2

Relative Density

Recency

Submitted Observations by Month

Submitted Observations by Year

Elevation Profile (feet)

(Records associated with a range of dates are excluded from time charts)
Big Brown Bat
G5, S4

Relative Density

Recency

Submitted Observations by Month

Submitted Observations by Year

Elevation Profile (feet)

(Records associated with a range of dates are excluded from time charts)
Spotted Bat

SOC, G4, S2

Relative Density

Recency

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Elevation Profile (feet)

(Records associated with a range of dates are excluded from time charts)
Silver-haired Bat
PSOC, G5, S4

Relative Density

Recency

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Submitted Observations by Year

Elevation Profile (feet)

(Records associated with a range of dates are excluded from time charts)
Eastern Red Bat

SOC, G5, S2S3

Relative Density

Recency

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Elevation Profile (feet)

(Records associated with a range of dates are excluded from time charts)
Hoary Bat
SOC, G5, S3

Relative Density

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(Records associated with a range of dates are excluded from time charts)
California Myotis
G5, S4

Relative Density

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Submitted Observations by Year

Elevation Profile (feet)

(Records associated with a range of dates are excluded from time charts)
Western Small-footed Myotis
G5, S4

Relative Density

Recency

[Maps and graphs showing distribution and density]

Submitted Observations by Month

Submitted Observations by Year

Elevation Profile (feet)

(Records associated with a range of dates are excluded from time charts)
Long-eared Myotis
G5, S4

Relative Density

Recency

Submitted Observations by Month

Submitted Observations by Year

Elevation Profile (feet)

(Records associated with a range of dates are excluded from time charts)
Little Brown Myotis
G5, S4

Relative Density

Recency

Submitted Observations by Month

Submitted Observations by Year

Elevation Profile (feet)

(Records associated with a range of dates are excluded from time charts)
Northern Myotis

PSOC, G4, S24

Relative Density

Recency

Submitted Observations by Month

Submitted Observations by Year

Elevation Profile (feet)

(Records associated with a range of dates are excluded from time charts)
Fringed Myotis
SOC, G45, S3

Relative Density

Recency

Submitted Observations by Month

Submitted Observations by Year

Elevation Profile (feet)

(Records associated with a range of dates are excluded from time charts)
Long-legged Myotis G5, S4

Relative Density

Recency

Submitted Observations by Month

Submitted Observations by Year

Elevation Profile (feet)

(Records associated with a range of dates are excluded from time charts)
Yuma Myotis
PSOC, G5, S34