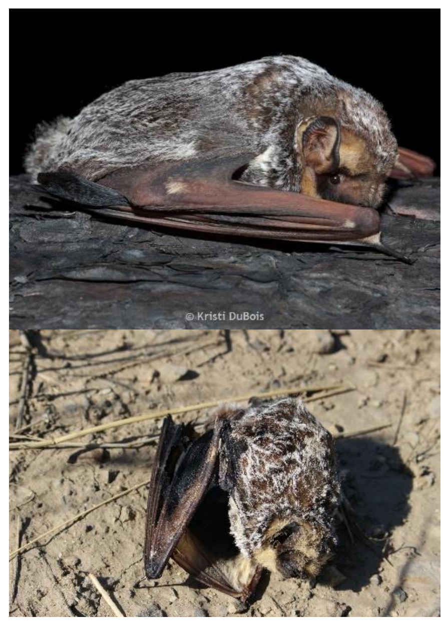
RECOMMENDATIONS TO REDUCE BAT FATALITIES AT WIND ENERGY FACILITIES IN MONTANA

Approved by the Montana Bat Working Group on February 4, 2020; presented to the Montana Fish & Wildlife Commission on December 10, 2020.

BACKGROUND & NEED

Montana Fish, Wildlife and Parks (MFWP) has prepared these recommendations to answer common questions on the potential impacts of wind energy facilities to bat populations, and to provide consistent recommendations on how to minimize this risk. MFWP biologists worked closely with biologists at the Montana Natural Heritage Program to include data on Montana bat populations and craft recommendations based on bat ecology. This document has been endorsed by the multi-agency Montana Bat Working Group. The recommendations in this document are based on the current best available science and may be subject to change as new research emerges. There is no regulatory authority to require these recommendations and implementation is voluntary.

Bats are long-lived species with low reproductive rates – most species produce one pup per year; this makes their populations especially vulnerable to threats that increase adult mortality. Bat populations in North America face many threats, including disease, loss of roost sites, reduced insect populations due to pesticides and drowning at unsafe drinking sites (e.g. stock tanks). The disease white-nose syndrome has devastated populations of some bat species in eastern North America. Wind energy facilities present yet another risk to bat populations.



Hoary bat roosting on a tree; same species found dead below a wind turbine.

Assessing the impact of bat fatalities at wind farms is difficult given the lack of information on the size and trends of regional bat populations, but there is widespread acknowledgement and concern over the potential impact of wind energy facilities on bat populations (Arnett et al. 2016, Baerwald et al. 2009, Cryan et al. 2014 and Kunz et al. 2007). Frick et al. (2017) suggest bat fatalities at wind farms may threaten the population viability of at least one bat species. Bat fatalities have been reported at most wind facilities nationwide. A recent analysis of data from 146 wind farms (AWWI 2018) found that bat fatality rates vary regionally; the median bat fatality estimate in USFWS Mountain-Prairie region, which includes Montana, is 2.3 bats/MW/year while in the adjacent Midwest region it is 6.2 bats/MW/year. Migratory tree-roosting bats account for a majority of fatalities – 70% in the Mountain-Prairie Region. Research using thermal imagery video suggest that bats may be attracted to wind turbines (Cryan & Barclay 2009; Horn et al. 2008); the reason for this behavior is an area of active research and hypotheses that include the inability to differentiate turbines from trees, attraction to lighting, mating behavior and increased feeding activity (Cryan 2008; Cryan et al. 2014; Reimer et al. 2018; Voigt et. al 2018).

DATA FROM MONTANA

Based on fatality data, the Montana bat species most vulnerable to collisions with wind turbines are hoary bat (Species of Concern in Montana) and silver-haired bat (Potential Species of Concern); both are migratory tree-roosting species. In post-construction monitoring at wind facilities in Montana these species accounted for 100% of bat fatalities at Spion Kop (MFWP 2019) and 97% of the bats identified at the Judith Gap Wind Facility (WEST 2010). Bat fatalities have been recorded from May – October at wind facilities in Montana, but at Spion Kop 87% of fatalities were found during the peak migration season, August 1 through September 30 (MFWP 2019). Fatality monitoring at Judith Gap in 2006 found 80% of fatalities occurred during this same time period, but in 2009 45% of fatalities were found in July. This suggests that the timing of migration varies spatially and/or annually in Montana. Bat fatality estimates at both wind farms are higher than the median estimate of 2.3 bats/MW/year at wind facilities in the Mountain-Prairie Region (n=27); mean bat fatality estimates from two years of fatality studies at each site were 4.1 bats/MW/year at Spion Kop and 6.9 bats/MW/year at Judith Gap.

Data from an array of acoustic bat detectors across Montana provides detailed information on when, where and the conditions in which bats are active (Bachen et al. 2018[b]). This information, in combination with acoustic data collected at Spion Kop Wind Farm (Bachen et al. 2018[a]), is useful for examining bat activity patterns and determining when bats are most susceptible to turbine strikes.

- Across Montana, bats are most active from May – September. At Spion Kop bat activity was low from October – April, suggesting wind turbines pose low risk to local populations during this time period.
- Bats are more active on warmer nights, and at Spion Kop, 90% of bat activity occurred at temperatures $\geq$ 50° F.
- Bats are more active at lower wind speeds. Across the statewide acoustic detector network, bat activity was greater than expected at random for wind speeds at 1 – 3 meters per second (m/s); 72% (statewide) and 75% (Spion Kop) of bat activity was at wind speeds $\leq$ 3 m/s. At Spion Kop, 90% of bat passes were recorded at or below 5 m/s and 95% of activity was at or below 6 m/s.
- Bats are more active during periods of falling barometric pressure associated with incoming storm systems.
- Bat activity decreases with precipitation events.

Post-construction monitoring at Spion Kop Wind Farm in Judith Basin County, MT.

RECOMMENDATIONS FOR PRE-CONSTRUCTION STUDIES & POST-CONSTRUCTION MONITORING

Formal pre-construction surveys and post-construction monitoring are important components of a system to evaluate and address the potential impacts of wind energy projects on birds, bats and other wildlife. The U.S. Fish and Wildlife Service's Land-Based Wind Energy Guidelines (WEG) (2012) is a voluntary set of guidelines that "provides a structured, scientific process for addressing wildlife conservation concerns at all stages of land-based wind energy development." This comprehensive document uses a "tiered approach" for assessing risk to species of concern and their habitats. The WEG recommends that studies are of sufficient duration to ensure adequate data are collected and recognizes studies may need to occur over multiple years. In Montana, biologists recommend two years of surveys. The guidelines below build on the WEG, are specific to bats, and tailor recommendations to Montana.

<u>Pre-construction surveys</u>

The goal of pre-construction bat surveys is to estimate the risk of bat fatalities at the proposed site.

1. Develop a pre-construction study plan with review and input from USFWS and MFWP.
2. Conduct acoustic surveys for two years using full spectrum detectors to document species present, species-specific seasonal occurrence and the conditions under which bats are most active (e.g., temperature, wind speed, etc.).
3. Plan the timing of acoustic surveys according to the following:
   - Year 1 of acoustic surveys should occur year-round because acoustic data in Montana reveal that some species show activity every month of the year (Bachen et al. 2018[b]).
   - Year 2 of acoustic surveys should occur during the active bat season in Montana, which is May – Sept (Bachen et al. 2018[b]).
4. Distribute acoustic detectors across the proposed project area at enough locations to characterize bat activity at the entire site.
   - At least one detector should be placed within the proposed turbine array.
   - Because bats use linear features such as river and stream corridors, ridgeline and tree-line detectors should be placed to monitor bat use of linear features and potential east-west and north-south fly ways (Lausen et. al 2010).
   - Because bat activity is highest at drinking sites, at least one detector should be placed at a water source, if it exists (USFWS 2012 – WEG, p. 31); this will improve the odds of documenting all species present.
5. Place detectors at the appropriate height to record bat activity:
   - Ideally, acoustic detectors are placed on existing MET towers at 30m (or as high as practical) to record bat activity at or near the rotor swept zone (USFWS 2012 – WEG, p. 31); studies also suggest that detection rates are significantly higher at this height (Lausen et al. 2010).
   - If sampling at MET towers does not adequately cover the study area, or provide sufficient replication, additional sampling stations can be established at lower positions (1.5 – 2m).

<u>Post-construction monitoring (PCM):</u>

The goal of post-construction monitoring is to estimate the number of fatalities attributable to collision with operating wind turbines. Below are some specific study design recommendations that target bats and are based on monitoring in the Mountain-Prairie Region:

1. Develop a post-construction monitoring (PCM) plan with review and input from USFWS and MFWP.
2. Conduct two years of post-construction fatality studies.

3. If bats are the primary taxa of interest, use the following search radius size around selected turbines: 50m – 80m radius circular plots (or 100x100m – 160x160m plots). Data from 23 PCM studies show that 88% of bat carcasses are found within 50m of a turbine and 98% are found within 76m of a turbine (AWWI 2018). Search transects within the plot should be 6m apart. Note that recommended search plot size to estimate bird fatalities may be larger (USFWS 2012).
4. Typically, searches for bird and bat fatalities are conducted between April/May – September. If bats are the primary taxa of interest searches could occur from July – September.
5. Use a design for searcher efficiency (SE) trials that achieves an SE rate ≥50%. SE can be improved by (1) increasing the number of trial carcasses, (2) conducting carcass checks in a way that gives searchers multiple chances to find a carcass and (3) restricting searches to areas with higher visibility or use mowing to increase visibility.
6. Conduct SE trials throughout the entirety of the search season, ideally concurrent with each search interval, to account for seasonal changes in visibility and carcass removal by scavengers. Trials should use tree-roosting bat carcasses when possible.
7. Conduct carcass persistence trials throughout the entirety of the search season to detect seasonal changes in carcass removal by scavengers. Trials should use tree-roosting bat carcasses when possible.
8. Use carcass persistence (CP) trial results to determine search interval; the length of the search interval should be ≤ to the number of days a carcass persists. PCM studies in Montana suggest that a search interval of 8 – 14 days may be adequate (MFWP 2019).

SPECIFIC RECOMMENDATIONS TO AVOID & MINIMIZE BAT FATALITIES

There are opportunities to minimize bat fatalities at both the construction phase, when selecting turbine locations, and once the facility becomes operational, by adopting an operational risk minimization strategy. Operational minimization, or curtailment, limits blade rotation at low wind speeds (when bats are most active) and is the most effective method of reducing bat fatalities at wind facilities. Research shows that small increases in cut-in speeds, i.e. the speed at which electricity starts to be generated from the turbine, can substantially lower bat fatality. Factory set cut-in speeds for wind turbines are typically 2 – 4 m/s. Studies show that increasing cut-in speeds to between 5 m/s – 6.5 m/s can lower bat fatality by 44 – 93% while the annual loss in power generation is minimal (Baerwald et al. 2009; Arnett et al. 2010; Arnett et al. 2011; Arnett et al. 2013). Curtailment need only be implemented for a fraction of the year, during the peak of fall migration.

As support for curtailment, data from both a statewide network of over 60 detectors in Montana (Bachen et al. 2020, Bachen et al. 2018[b]) and post-construction bat acoustic data at Spion Kop wind farm show that bat activity decreases as wind speed increases. At Spion Kop, bat activity data indicate that increasing the turbine cut-in speed to:

- 4 m/s would avoid 75% of bat activity
- 5 m/s would avoid 90% of bat activity
- 6 m/s would avoid 95% of bat activity

Siting wind turbines:

1. Avoid placing turbines near potential roost sites, including rock outcrops, cliffs and talus slopes. (Bachen et al. 2018 [a])
2. Place turbines at least 3.5 km away from forested areas that may be used as roosting or as swarming sites. This 3.5 km buffer is based on the distances traveled between roosts and foraging for tree roosting species (Barclay 1985, Campbell et al. 1996, Elmore et al. 2005, Hutchinson and Lacki 1991).

Operational risk minimization:

1. Prevent rotor blades from spinning at wind speeds below the cut-in speed, by feathering or locking the blades, during the active bat season (May 1 – September 30).
2. Set wind turbine cut-in speed at 5 – 6 m/s from August 1 – September 30 at night (from a half hour before sunset through a half hour after sunrise). Pre-construction activity data and/or post-construction fatality data may be useful for shifting, and potentially narrowing, the curtailment period.
3. Minimize lighting at operation and maintenance facilities according to Bat Conservation International's 2017 Best Management Practices for detailed recommendations (2.4.1 – 2.4.4).

Contribute data:

Consider submitting reports and data to the American Wind Wildlife Institute's documents library (https://awwic.nacse.org/), the most comprehensive database of post-construction monitoring data from wind energy facilities in the U.S.. The database incorporates both publicly available data and contributed data, that maintains confidentiality, to yield datasets in a format that can be analyzed to better understand how wildlife interacts with wind energy. Empirical data can lead to policy changes.

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