# Bat Evaluation Monitoring Studies at the Fowler Ridge Wind Farm Benton County, Indiana

## August 1 – October 15, 2012

**Prepared for:**

**Fowler Ridge Wind Farm**


**Prepared by:**

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**NATURAL RESOURCES ◆ SCIENTIFIC SOLUTIONS**

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## EXECUTIVE SUMMARY

The Fowler Ridge Wind Farm (FRWF) is collectively owned by BP Wind Energy, Sempra US Gas & Power, and Dominion Energy. The project currently consists of 355 wind turbines in three phases in Benton County, Indiana. A post-construction casualty study of bats was conducted by Western EcoSystems Technology, Inc. (WEST) within Phases I and III in 2009, and within Phases I, II, and III in 2010 and 2011. A total of two Indiana bat (*Myotis sodalis*) carcasses were found, one in the fall of 2009 and one in the fall of 2010. The results of research at the FRWF in 2010 and 2011 completed under Scientific Research and Recovery Permits (TE15075A-0 and TE15075A-2) were used by the FRWF to design an operational monitoring strategy designed to reduce Indiana bat casualty rates. The operational monitoring strategy was implemented at all but nine turbines at the FRWF in the fall of 2012, and included feathering turbines below a cut-in speed of 5.0 meters per second (m/s; 16 feet per second [ft/s]) from August 1 to October 15. The nine turbines not included in the operational monitoring strategy were part of a separate research project conducted by the US Geological Survey (USGS) and Bat Conservation International (BCI).

The primary objective of the 2012 research was to conduct monitoring that provided an accurate estimate of all bat mortality that can be used to reliably determine if a 50% reduction in mortality from control turbines in 2010 has been achieved. The 2012 casualty study occurred during the fall (August 1 – October 15) migration period for Indiana bats. Casualty searches were completed weekly on roads and turbine gravel pads of 118 turbines from August 1 – October 11, 2012. Personnel trained in proper search techniques conducted the carcass searches. Searches occurred along transects within each search plot. Searchers walked at a rate of approximately 45 to 60 m per minute (about 148 to 197 ft per minute) along each transect looking for bat carcasses. Transects were spaced at approximately 5-m (16-ft) intervals on road and pads, and searchers scanned the area on both sides out to approximately 2.5 m (about eight ft) for casualties as they walked each transect. Bias trials of searcher efficiency and carcass removal rates were conducted.

Similar to 2010 and 2011 data, the most commonly found bat species were eastern red bat (49 fatalities, 60.5% of fatalities), followed by hoary bat (14 fatalities, 17.3%), silver haired bat (12 fatalities, 14.8%), and big brown bat (three fatalities, 3.7%). Unlike 2009 and 2010 studies, no Indiana bat carcasses or other *Myotis* species were found in 2012.

The results of monitoring during 2012 provide evidence that operational strategies exceeded the objective of reducing bat casualty rates by 50% compared to casualty estimates of turbines in normal operation modes in 2010. Road and pad searches completed in 2010 at turbines in normal operation modes provide the most direct comparison of casualty estimates to the 2012 estimate. Data collected in 2010 provide a baseline from which future casualty estimates can be compared. During 2010, 31.23 bat casualties/turbine (90% confidence interval [CI] 18.77 – 48.94) were estimated from road and pad searches of 100 turbines in normal operation mode. 2012 casualty point estimates from turbines feathered until wind speeds reached 5.0 m/s were

84% lower than casualty point estimates at turbines operating normally in 2010, with an estimated 5.00 bat casualties/turbine (90% CI 3.51 – 6.78).

A secondary objective of the 2012 research was to detect changing trends in bat mortality over time, including analysis of casualty patterns in relation to temperature and wind conditions. Power analyses based on previous research at FRWF show that monitoring 118 turbines by searching roads and pads will result in adequate power to detect a 30% decrease in bat casualty rates between years. The sample sizes and search frequencies used to monitor turbines at FRWF in 2012 provided more than adequate power to determine if objective one was met, and provided sufficient power to detect changing trends in bat mortality over time. The monitoring in 2012 also provided a mechanism for tracking observed casualty rates on a weekly basis, which gave the FRWF and the US Fish and Wildlife Service (USFWS) the ability to determine if in-season adjustments to the operational strategy were needed in order to meet objective one. Observed bat casualty rates were consistently less than 50% of rates observed for casualties in 2010, and no adjustments to operational strategies were required in 2012.

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## INTRODUCTION AND BACKGROUND

The Fowler Ridge Wind Farm (FRWF) is collectively owned by BP Wind Energy, Sempra US Gas & Power, and Dominion Energy. The project currently consists of 355 wind turbines in three phases in Benton County, Indiana (Figure 1). A post-construction casualty study of bats was conducted by Western EcoSystems Technology, Inc. (WEST) within Phases I and III in 2009, and within Phases I, II, and III in 2010 and 2011 (see Johnson et al. 2010a, 2010b; Good et al. 2011, 2012). A total of two Indiana bat (*Myotis sodalis*) carcasses were found, one in the fall of 2009 and one in the fall of 2010. The results of research at the FRWF in 2010 and 2011 completed under Scientific Research and Recovery Permits (TE15075A-0 and TE15075A-2) were used by the FRWF to design an operational monitoring strategy designed to reduce Indiana bat casualty rates. The operational monitoring strategy was implemented at all but nine turbines at the FRWF in the fall of 2012, and included feathering turbines below a cut-in speed of 5.0 meters per second (m/s; 16 feet per second [ft/s]) from August 1 to October 15. The nine turbines not included in the operational monitoring strategy were part of a separate research project conducted by the US Geological Survey (USGS) and Bat Conservation International (BCI).

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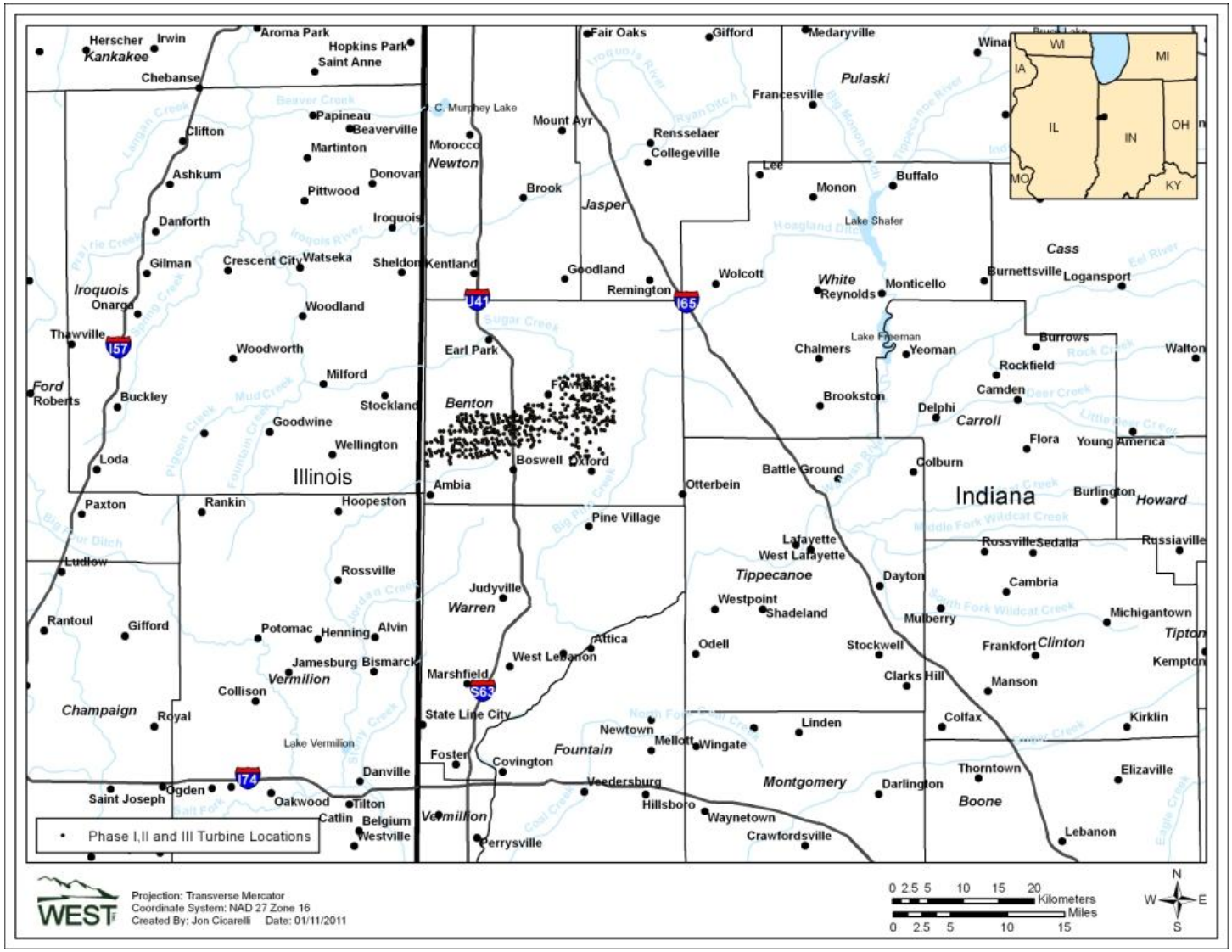


**Figure 1. Location of the Fowler Ridge Wind Farm, Phases I, II and III.**

## STUDY AREA

The FRWF currently has a total energy capacity of 600 megawatts (MW). Phase I consists of 122 Vestas V82 1.65-MW turbines and 40 Clipper C96 2.5-MW turbines for a total of 301 MW of energy capacity. Phase II consists of 133 1.5-MW General Electric (GE) SLE turbines with a total capacity of 199.5 MW. Phase III consists of 60 Vestas V82 1.65-MW turbines (99 total MW of capacity). The three turbine types varied in size (Table 1).

**Table 1. Turbine characteristics at the Fowler Ridge Wind Farm.**

| Turbine Model | MW | Turbine Height (meters) | Rotor Diameter (meters) | Standard cut-in speed (meters/second) |
|---|---|---|---|---|
| GE SLE | 1.5 | 80 | 77 | 3.5 |
| Vestas V82 | 1.65 | 80 | 82 | 3.5 |
| Clipper C96 | 2.5 | 80 | 96 | 3.5 |

Phases I and III were constructed in 2008 and became operational during January of 2009. Phase II was constructed in 2009 and became operational by December 31, 2009.

The FRWF is located in western Indiana in Benton County (Figure 1). The wind energy facility lies within the Tipton Tall Plain physiographic region that includes much of central Indiana and lies within the Grand Prairie Natural Region that includes a small section of north central Indiana (Whitaker and Mumford 2009). The topography of the FRWF is mostly flat to slightly rolling and there are no hills, ridges, or other areas of starkly elevated topography (Figure 2). Elevations in the project area range from approximately 700-800 feet (ft; 213-244 meters [m]). The area averages 40 inches (102 centimeters [cm]) of precipitation per year and average temperatures range from 19 to 45 °F (-7.2 to 7.3 °C) in January to 65 to 86 °F (18 to 30 °C) in July. Soils in the FRWF are various combinations of silt loam, clay loam, loam, silty clay loam, sandy loams and sandy clays (US Department of Agriculture Natural Resources Conservation Service [USDA-NRCS] 2006). Much of the area is classified as prime farmland based on soil type. The FRWF is dominated by tilled agriculture with corn (*Zea mays*) and soybeans (*Glycine max*) being the dominant crops. Of the roughly 59,000 acres (about 92 square miles [$mi^2$]) within one half-mile (0.80 kilometers [km]) of turbine locations, row crops comprise about 93% of the land use for the study area (Homer et al. 2004; Table 2). After tilled agriculture, the next most common land uses within the FRWF are developed areas (e.g., houses and buildings), which compose 5.3% of the total, and pastures/hayfields, which compose 1.7% of the total area. There are 23.9 acres (0.04 $mi^2$) of grasslands, which compose less than 0.1% of the FRWF. Grasslands in the study area are limited primarily to strips along drainages, railroad rights-of-way (ROWs), and ROWs along county and state roads. There are also a few grass-lined waterways within cultivated fields in the study area. Trees in the study area occur at homesteads, along some of the drainages and fencerows, and within some small, isolated woodlots. Forested areas are rare within the study area based on 2001 data (Homer et al. 2004), and the 291.11 acres (0.45 $mi^2$) of forest compose 0.5% of the total area. Small amounts of barren ground, open water, and woody wetlands are also present.

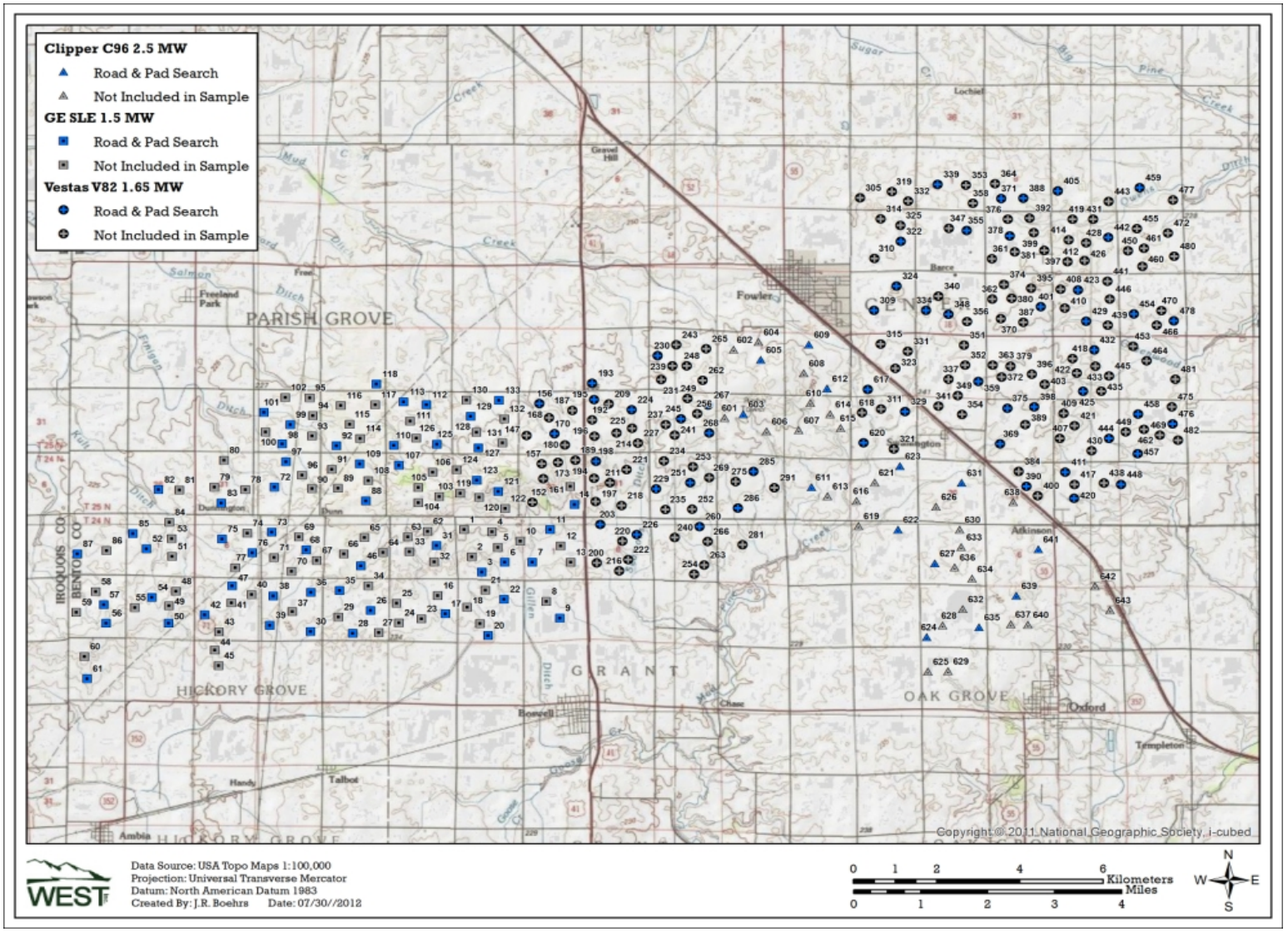


**Figure 2. Elevation and topography of the Fowler Ridge Wind Farm.**

**Table 2. Land cover data within a half-mile of turbine locations within the Fowler Ridge Wind Farm (Homer et al. 2004).**

| Habitat Type | Acres | Percent Composition |
|---|---|---|
| Crops | 54,611.24 | 92.5 |
| Developed, Low Intensity | 1,682.37 | 2.9 |
| Developed, Open Space | 1,347.93 | 2.3 |
| Pasture/Hay | 978.15 | 1.7 |
| Deciduous Forest | 291.90 | 0.5 |
| Developed; Medium Intensity | 53.65 | 0.1 |
| Grassland | 23.90 | <0.1 |
| Open Water | 18.25 | <0.1 |
| Developed, High Intensity | 16.40 | <0.1 |
| Barren | 10.02 | <0.1 |
| Woody Wetlands | 1.23 | <0.1 |
| **Total** | **59,035.05** | **100** |

# METHODS

## Season

The 2012 casualty study occurred during the fall from August 1 – October 15, which encompasses the fall migration period for Indiana bats, as outlined in the Draft Indiana Bat Recovery Plan (US Fish and Wildlife Service [USFWS] 2007), the period of highest bat mortality at the FRWF during 2009 to 2011 (Good et al. 2011, 2012), and the period in which previous Indiana bat fatalities occurred at the FRWF.

## Search Plot and Sample Size

The FRWF is comprised of 355 turbines. One-hundred-eighteen turbines (about 33%) were sampled during the study (Figure 2). To minimize potential for bias due to search location, efforts were made to ensure sampling locations were representative of the entire FRWF and were relatively equally distributed throughout the FRWF and among turbines types. Search turbines were distributed among turbine types in proportion to their relative occurrence in the FRWF.

Carcass searches at 118 turbines were conducted along access roads and turbine pads within 80 m (262 ft) of the turbine. The results of the 2010 FRWF study supported the use of road and pad searches for generating comparable and unbiased overall bat casualty estimates (Good et al. 2011).

## Search Frequency

Turbines were searched weekly (i.e., each turbine was searched once per week). The search interval was based on mean carcass removal times of 9.93, 10.34, and 13.02 days observed during monitoring at FRWF in 2009, 2010, and 2011, respectively (WEST unpublished data, Good et al. 2011, 2012).

## Turbine Operation Schedule

The 118 turbines searched weekly during the fall were programmed to operate at a cut-in speed of 5.0 m/s with blades feathered below 5.0 m/s for the duration of the study. The treatment was applied from sunset to sunrise each night of the study session form August 1 – October 15.

## Field Methods

*Casualty Searches*

Observers trained in proper search techniques conducted the carcass searches. Searches occurred along transects on roads and pads within each search plot within 80 m of turbines. Searchers walked at a rate of approximately 45 to 60 m per minute (about 148 to 197 ft per minute) along each transect looking for bat carcasses. Transects were spaced at approximately 5-m (16-ft) intervals, and searchers scanned the area on both side sides out to approximately 2.5 m (about eight ft) for casualties as they walked each transect. All bat carcasses were recorded and collected. Bird carcasses were recorded, but left in the field. Searches began after 0700 hours (H) each morning, and were completed by sunset, with most searches completed by early afternoon.

The condition of each carcass found was recorded using the following categories:

- Live/Injured – a live or injured bat or bird.
- Intact - a carcass that was completely intact, was not badly decomposed, and showed no sign of being fed upon by a predator or scavenger.
- Scavenged - an entire carcass, which showed signs of being fed upon by a predator or scavenger, or a portion(s) of a carcass in one location (e.g., wings, skeletal remains, portion of a carcass, etc.), or a carcass that was heavily infested by insects.
- Feather Spot (for bird carcasses only) – 10 or more body feathers and/or at least two primary feathers, which indicated predation or scavenging.

Tissue and hair samples were collected from all dead bats and delivered to the USFWS Bloomington Field Office. A copy of the data sheet for each carcass was maintained, bagged, and kept with the carcass at all times. For all casualties found, data recorded included: species, sex and age when possible, turbine identification number, date and time collected, global positioning system (GPS) location, condition (live, intact, scavenged, feather spot), and distance from turbine, as well as any comments that may indicate cause of death. All bird and bat carcasses located were photographed as found and plotted on a detailed map of the study area, showing the location of the wind turbines and associated facilities. Estimated time since death for bats was also recorded. Criteria used to determine time since death can be found in Appendix A.

Casualties found outside the formal search area by observers or by FRWF personnel were treated following the above protocol as closely as possible. Casualties found in non-search

areas (e.g., near a turbine not included in the sample of search area) were coded as incidental discoveries, collected, and documented in a similar fashion as those found during standard searches. In addition to carcasses, all injured bats and birds observed in search plots were recorded and treated as a casualty for the purpose of the analyses.

*Field Bias Trials*

Searcher efficiency and removal of carcasses by scavengers was quantified to adjust the estimate of total bat fatalities for detection bias. Bias trials were conducted throughout the entire study period. Only freshly killed bats conclusively identified as non-*Myotis* or non- *Nicticeius humeralis* were used for searcher efficiency and carcass removal trials. Due to the lack of freshly killed (intact) bats available for the trial effort, trial bat carcasses were supplemented by frozen non-*Myotis* bat carcasses supplied by Indiana State University. Trial bats were placed throughout the study session by a biologist not involved in the carcass search effort within any given turbine's searchable area. Searchers had no knowledge of the number, placement, or timing of carcasses at turbines. Data recorded for each trial carcass prior to placement included date of placement, species, turbine number, and the distance to and direction from the turbine. Carcasses were identified as bias trial carcasses through the placement of small, indistinct black zip ties on the bats' wings. Bat carcasses were placed at varying intervals before scheduled searches on plots (i.e., a carcass may have been placed at a plot not scheduled to be searched for three days). Carcasses were left in the field for up to 24 days, resulting in searchers having three to four chances of finding a carcass that lasted the full 24 days. The first day the carcass was discovered by the searcher was recorded to estimate the overall probability that a carcass was available and detected. The carcass was then left in the field and checked on days one, two, four, six, eight, 10, 12, 18, and 24.

## Statistical Analysis

*Bat Mortality Estimation*

Estimates of facility-related bat mortality were calculated based on:

1) Observed number of bat carcasses found during standardized searches during the monitoring period;
2) Non-removal rates combined with searcher efficiency, expressed as the estimated average probability a bat carcass is expected to remain in search areas and be available for detection and was detected by the observers during combined bias trials; and
3) The area adjustment factor for bat carcasses landing outside of searched roads and pads.

Carcasses found on a scheduled search plot were included in the casualty analysis, regardless of whether they were found during a scheduled search or incidentally at some other time. It is assumed that all carcasses found incidentally on scheduled search plots would have been found at the next search if they had not been found incidentally. Those carcasses found during searches but not within the search area were not included in casualty estimates.

The probability of carcass availability and detection ($\hat{\pi}$) was calculated based on the results of combined bias trials. Carcasses were placed in the field and left until they were either found by searchers or removed by some means such as scavenging. The ratio of the number found to the number placed was then calculated and used as an empirical estimate of the probability of availability and detection. This method was used during previous study years at the FRWF and was used to provide a comparable casualty estimate.

A correction factor (r) of 6.56 was used to adjust for fatalities that likely occurred outside of searched roads and pads, to determine total estimated bat mortality during the fall migration period. This area adjustment factor was an average of the road and pad correction factors from 2010 and 2011 at the FRWF (Good et al. 2011, 2012). In each year, the area adjustment factor for roads and pads was estimated from the ratio of bat casualty in a set of control plots that were cleared of vegetation, to the bat casualty on the roads and pads of the same plots. This same correction factor will be used in subsequent years of study.

The adjusted estimate for the number of fatalities per turbine was calculated as follows:

$$m = \frac{(observed\ fatalities)}{(number\ of\ search\ plots) * \hat{\pi}} * r$$

*Between Years Comparisons*

Percent change in casualty rates between 2012 and the baseline year (2010) was calculated and compared to the anticipated 50% reduction in casualty rates due to applied minimization measures. Observed casualty rates were tested using a chi-squared test to determine statistical significance of the changes.

*Weather Analysis*

The goal of the weather analyses was to determine variation in mortality with respect to weather characteristics such as wind speed, temperature, barometric pressure, and humidity. Since turbines were searched weekly, analysis of weather patterns in relation to casualty rates was limited to analysis of summarized weekly weather conditions, and/or conditions on the night preceding documentation of bat carcasses estimated to have been killed during the previous night.

*Quality Assurance/Quality Control*

Quality assurance and quality control (QA/QC) measures were implemented at all stages of the study, including in the field, during data entry and analysis, and report writing. Following field surveys, observers were responsible for reviewing date for completeness, accuracy, and legibility. A sample of records from an electronic database was compared to the raw data forms and any errors detected were corrected. Irregular codes or data suspected as questionable were discussed with the observer and/or project manager. Errors, omissions, or problems identified in later stages of analysis were traced back to the original data entry, and appropriate changes in all steps were made. A Microsoft® ACCESS database was developed to store, organize, and retrieve survey data. Data were keyed into the electronic database using a pre-

defined format to facilitate subsequent QA/QC and data analysis. All data forms, field notebooks, and electronic data files were retained for reference.

# RESULTS

The following sections contain the results of studies conducted under permit TE73598A. Per the requirements of this permit, information regarding the date, locations, and species of bats encountered can be found in Appendix B. Other information required under permit TE735598A can be found below.

## Bat and Bird Fatalities

A total of 1,286 weekly surveys were conducted on roads and pads across 118 turbines from August 1 – October 11, 2012. Overall, 81 bat carcasses were found, with 70 carcasses found during scheduled searches and an additional five bat carcasses found incidentally at turbines. The remaining six bat carcasses were not found on scheduled search turbines and were not included in the casualty estimates (Table 3; Appendix B).

Overall, nine bird carcasses were found during the study period, with seven carcasses found during scheduled searches and two incidental finds, one found incidentally at a turbine and the other not found on a scheduled search turbine (Table 3).

### *Species Composition*

Similar to 2010 and 2011, the most commonly found bat species were eastern red bat (*Lasiurus borealis*; 49 fatalities, 60.5% of fatalities), followed by hoary bat (*Lasiurus cinereus*; 14 fatalities, 17.3%), silver haired bat (*Lasionycteris noctivagans;* 12 fatalities, 14.8%), and big brown bat (*Eptesicus fuscus*; three fatalities, 3.7%). Similar to 2011, two less common species were found as casualties, Seminole bat (*Lasiurus seminolus*) and evening bat (*Nicticeius humeralis*; two and one fatalities, respectively). The evening bat is listed as endangered by the State of Indiana, but is not protected under the federal endangered species act. No Indiana bat carcasses or *Myotis* carcasses were found during the 2012 study (Table 3).

**Table 3. Total number of bird and bat casualties and the percent composition of casualties found during post-construction casualty monitoring at the Fowler Ridge Wind Farm from August 1 to October 11, 2012.**

| | Fatalities during Scheduled Searches | | Incidental Fatalities at Search Plots* | | Other Incidentals** | | Total | |
|---|---|---|---|---|---|---|---|---|
| Species | Total | % Comp. | Total | % Comp. | Total | % Comp. | Total | % Comp. |
| **Birds** | | | | | | | | |
| American robin | 1 | 14.3 | 0 | 0 | 0 | 0 | 1 | 11.1 |
| marsh wren | 1 | 14.3 | 0 | 0 | 0 | 0 | 1 | 11.1 |
| mourning dove | 1 | 14.3 | 0 | 0 | 0 | 0 | 1 | 11.1 |
| Nashville warbler | 1 | 14.3 | 0 | 0 | 0 | 0 | 1 | 11.1 |
| red-eyed vireo | 1 | 14.3 | 0 | 0 | 0 | 0 | 1 | 11.1 |
| ruby-throated hummingbird | 1 | 14.3 | 0 | 0 | 0 | 0 | 1 | 11.1 |
| tree swallow | 1 | 14.3 | 0 | 0 | 0 | 0 | 1 | 11.1 |
| horned lark | 0 | 0 | 1 | 100 | 0 | 0 | 1 | 11.1 |
| cliff swallow | 0 | 0 | 0 | 0 | 1 | 100 | 1 | 11.1 |
| **Bird Total** | **7** | **100** | **1** | **100** | **1** | **100** | **9** | **100** |
| **Bats** | | | | | | | | |
| eastern red bat | 44 | 62.9 | 2 | 40.0 | 3 | 50 | 49 | 60.5 |
| hoary bat | 12 | 17.1 | 2 | 40.0 | 0 | 0 | 14 | 17.3 |
| silver-haired bat | 9 | 12.9 | 0 | 0 | 3 | 50 | 12 | 14.8 |
| big brown bat | 3 | 4.3 | 0 | 0 | 0 | 0 | 3 | 3.7 |
| Seminole bat | 2 | 2.9 | 0 | 0 | 0 | 0 | 2 | 2.5 |
| evening bat | 0 | 0 | 1 | 20.0 | 0 | 0 | 1 | 1.2 |
| **Bat Total** | **70** | **100** | **5** | **100** | **6** | **100** | **81** | **100** |

*Fatalities found incidentally on turbine search plots were included in analyses.
**Fatalities found that were estimated to have been killed prior to the start of the study, or carcasses that were found outside of plot boundaries.

The proportion of eastern red bat fatalities (60.5% of total bat fatalities) was comparable to data in 2010 and 2011 (63.7% and 53.2% of the total, respectively; Good et al. 2011, 2012), and a higher percentage compared to 2009 (35.9%, Johnson et al. 2010). Hoary bats composed a similar percentage of bat fatalities in 2012 (17.3%) compared to data collected in 2010 but lower than 2011 (18.1% and 27.8%, respectively). Silver-haired bats composed a similar percentage of bat fatalities in 2012 (14.8%) compared to results in 2010 and 2011 (13.7% and 14.1%, respectively). Hoary and silver-haired bats composed similar percentage of the overall fatalities in 2011 compared to 2009 (30.8% and 26.9%, respectively; Johnson et al. 2010)).

The nine bird carcasses found during the survey represent nine individual bird species (Table 3). No bird species listed as threatened or endangered under the State of Indiana (Indiana Natural Heritage Data Center [INHDC] 2010) or federal endangered species acts (Endangered Species Act [ESA] 1973, USFWS 2012) were found. No large bird species carcasses were found during the survey effort.

*Estimated Time since Death*

Most bat casualties were estimated to have been killed two to three days before the scheduled search (30.7%), followed by four to seven days (29.3%; Table 4). Bat casualties estimated from the previous night included 25.3% of all bat casualties found (Table 4).

Most bird casualties were estimated to have been killed the previous night (37.5%) or two to three days before scheduled search (37.5%; Table 4).

**Table 4. Estimated time since death of bird and bat fatalities at the Fowler Ridge Wind Farm from August 1 to October 11, 2012.**

| Estimated Time Since Death | Number of Fatalities | Percent Composition |
|---|---|---|
| **Birds** | | |
| last night | 3 | 37.5 |
| 2-3 days | 3 | 37.5 |
| 4-7 days | 2 | 25.0 |
| 7-14 days | 0 | 0 |
| >2 weeks | 0 | 0 |
| >month | 0 | 0 |
| Unknown | 0 | 0 |
| **Bats** | | |
| last night | 19 | 25.3 |
| 2-3 days | 23 | 30.7 |
| 4-7 days | 22 | 29.3 |
| 7-14 days | 7 | 9.3 |
| >2 weeks | 3 | 4.0 |
| >month | 0 | 0 |
| Unknown | 1 | 1.3 |

[a] Estimated time since death criteria described in Appendix A.

## Timing of Bat Fatalities

Bat casualties occurred throughout the study period (Figure 3). The majority of bat causalities were found in August, followed by another spike at the beginning of October.

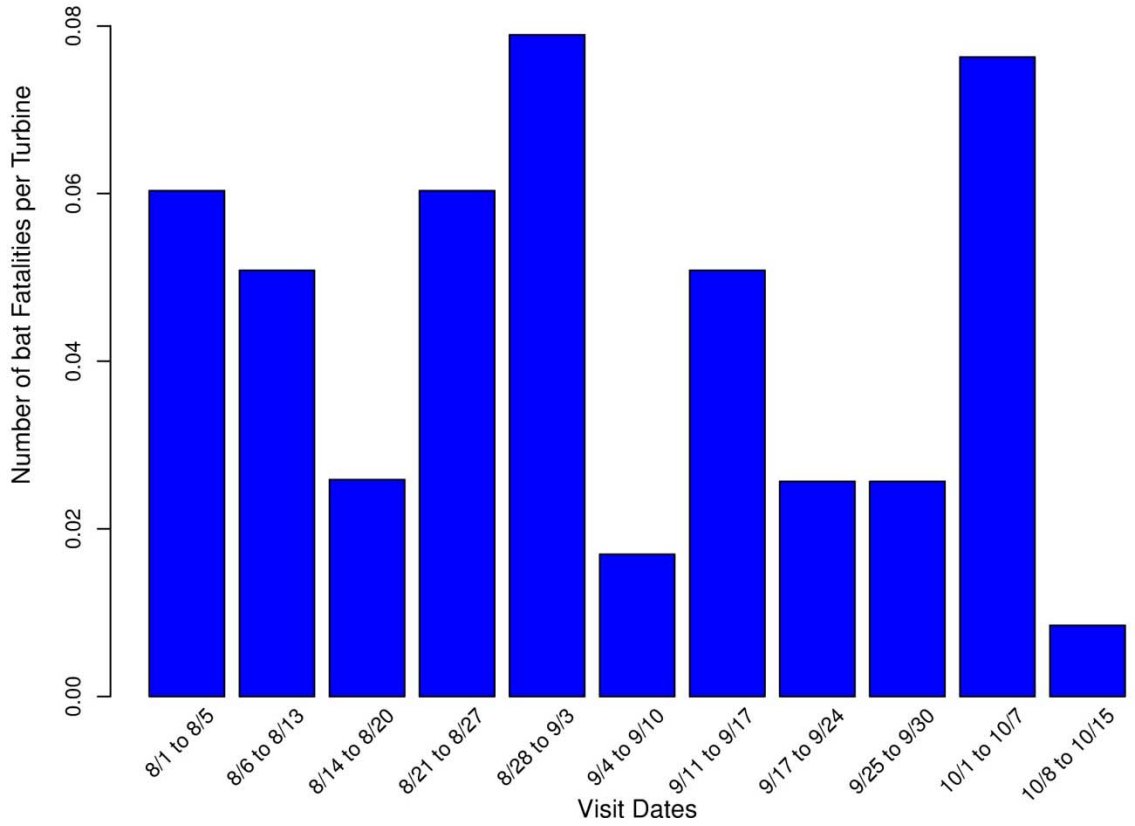


**Figure 3. Timing of bat fatalities per turbine found during scheduled searches or incidentally on turbine search plots at the Fowler Ridge Wind Farm from August 1 to October 15, 2012.**

## Distribution of Bat and Bird Casualties

A total of 98.7% of bat carcasses were found within 60 m (197 ft) of turbines, with the highest percentage (38.7%) of carcasses found between 0 – 10 m (0 – 33 ft), followed by 25.3% of bat carcasses found between 10 – 20 m (33 – 66 ft) from turbines (Table 5, Figure 4). This was a function of the amount of searchable area present within varying distances of turbines; road and pad comprise a higher percentage of area in each distance band closer to turbines. There were no bat fatalities recorded beyond a distance of 70 m (231 ft) from the turbines (Table 5, Figure 4).

Fifty percent of all bird carcasses were found within 1 – 10 m (0 – 33 ft), followed by 37.5% of bird carcasses found between 20 – 30 m (66 – 99 ft) from turbines (Table 5). No bird carcasses were found beyond a distance of 30 m from the turbine.

**Table 5. Distribution of distances from turbines of bird and bat casualties found during scheduled searches or incidentally on turbine search plots at the Fowler Ridge Wind Farm from August 1 to October 11, 2012.**

| Distance to Turbine (m) | % Bird Casualties | % Bat Casualties |
|---|---|---|
| 0 to 10 | 50.0 | 38.7 |
| 10 to 20 | 12.5 | 25.3 |
| 20 to 30 | 37.5 | 17.3 |
| 30 to 40 | 0 | 8.0 |
| 40 to 50 | 0 | 6.7 |
| 50 to 60 | 0 | 2.7 |
| 60 to 70 | 0 | 1.3 |
| 70 to 80 | 0 | 0 |
| >80 | 0 | 0 |

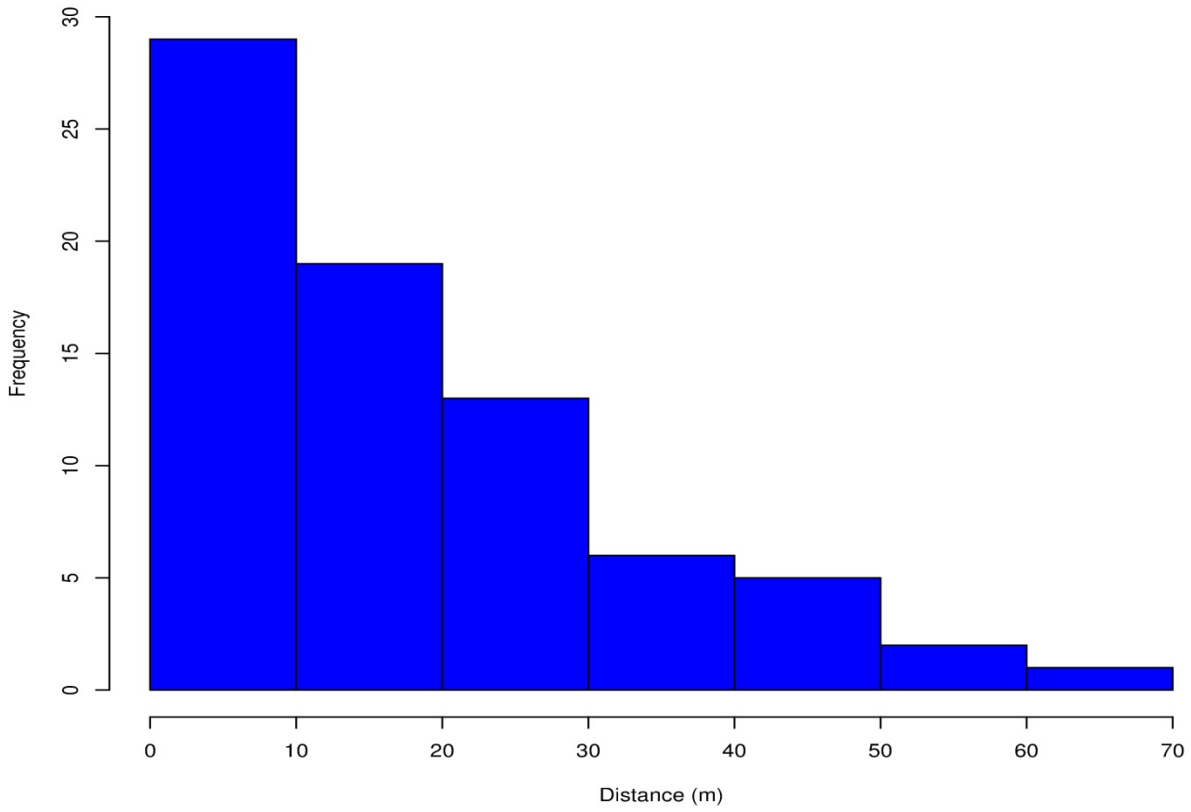


**Figure 4. Distance of bat fatalities from the turbine found during scheduled searches or incidentally on turbine search plots at the Fowler Ridge Wind Farm from August 1 to October 11, 2012.**

### Bat Fatalities by Turbine Location

The turbines with the highest densities of bat casualties include turbine number 224 (Vestas), and 230 (Vestas) both of which had three bat casualties each (Figures 2, 5, and 6). Bat fatalities appeared to occur more frequently throughout the central and eastern portions of the FRWF (Vestas and Clipper turbines), with the majority of casualties being found at Vestas turbine

locations (Figure 6). The highest density for observed fatality rates occurred at the Clipper turbines with 14 fatalities on 15 searched turbines, for a rate of 0.93 observed bat fatalities per turbine. Vestas turbines had a rate of 0.50 observed bat fatalities per turbine, with 25 fatalities on 50 searched turbines. The lowest observed fatality rate was at the GE turbines with 0.23 bat fatalities per turbine (12 carcasses on 53 search plots).

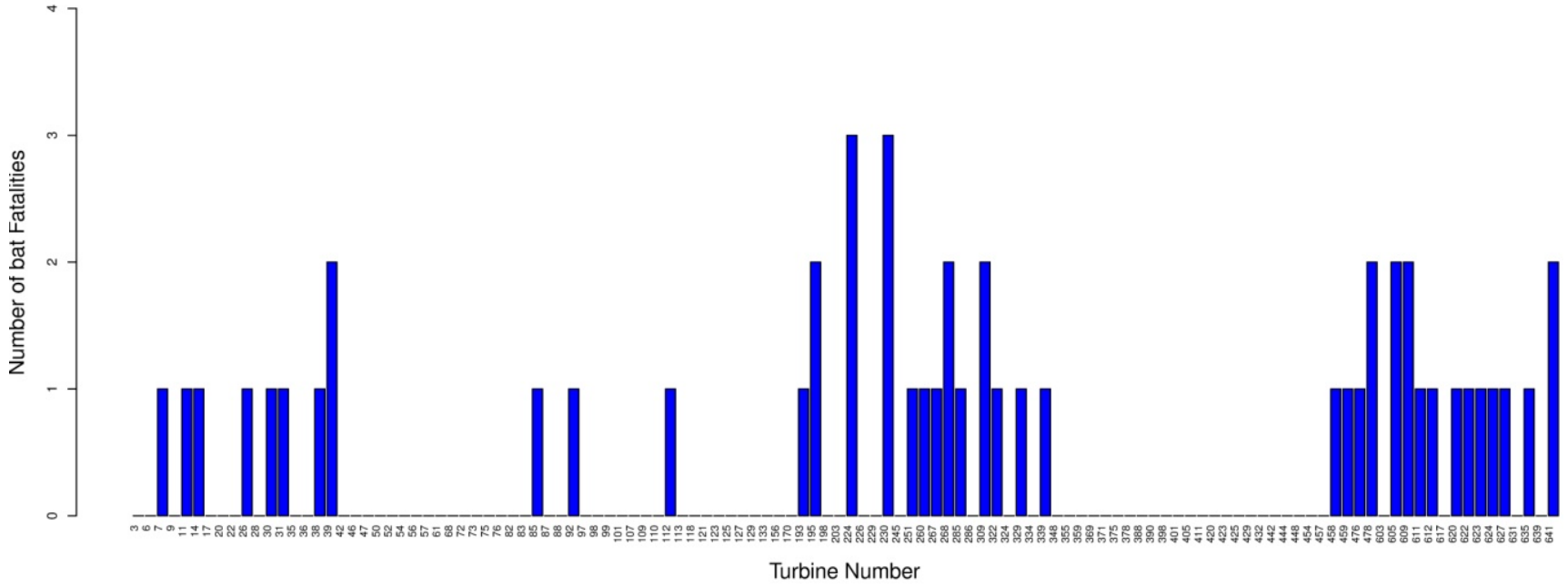


**Figure 5. Number of bat fatalities by turbine found during scheduled searches or incidentally on turbine search plots at the Fowler Ridge Wind Farm from August 1 to October 11, 2012.**

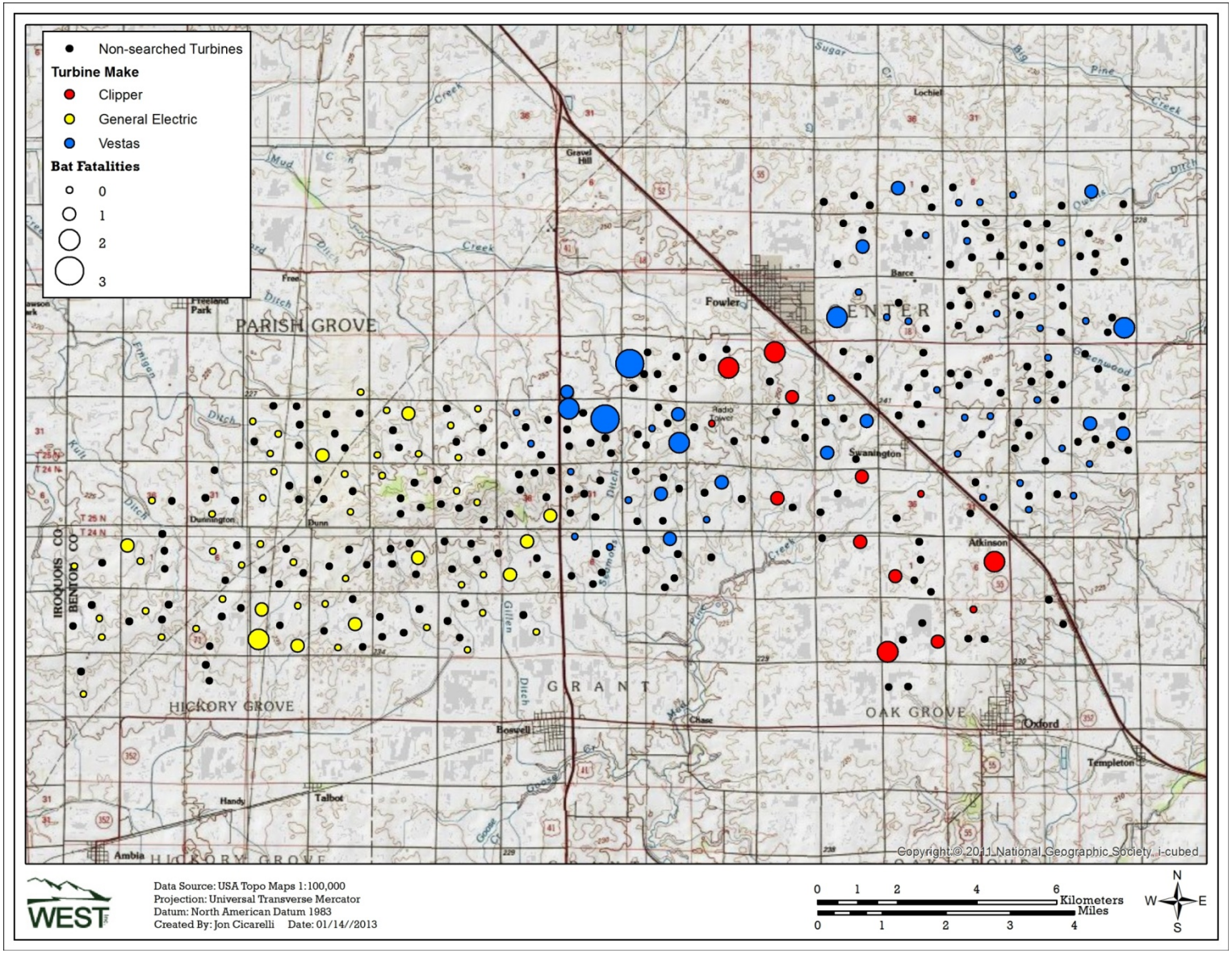


**Figure 6. Location of all bat casualties found at the Fowler Ridge Wind Farm.**

## Bias Trials

Bias trials were conducted throughout the study period at four placement intervals. A total of 60 bat carcasses were placed at a varied number of days prior to a scheduled search ranging from zero to seven days prior to searches (Table 6). Of the 60 trial carcasses placed, 34 were found at the next scheduled search, with three of the four found (75%) that were placed the day of a scheduled search and 11 of the 14 found (78.6%) that were placed the day prior to a scheduled search. Percent found of carcasses placed six and seven days prior to scheduled search were significantly lower at 30% and 10%, respectively (Table 6). Overall, the probability of available and detected (56.7%) carcasses in 2012 was similar to bias trials completed in 2010 at roads and pads (39 of 77 found; 51%).

**Table 6. Searcher efficiency based on empirical pi by time since death methodology for post-construction casualty monitoring at the Fowler Ridge Wind Farm from August 1 to October 11, 2012.**

| Number of Days Prior to Search | Number Placed | Number Found at Next Search | Percent Found |
|---|---|---|---|
| 0 | 4 | 3 | 75.0 |
| 1 | 14 | 11 | 78.6 |
| 2 | 12 | 8 | 66.7 |
| 3 | 5 | 5 | 100 |
| 5 | 5 | 3 | 60.0 |
| 6 | 10 | 3 | 30.0 |
| 7 | 10 | 1 | 10.0 |
| **Total** | **60** | **34** | **56.7** |

## Weather Conditions and Bat Fatalities

Since searches were completed on a weekly basis, weather analyses were limited to summarizing conditions on nights preceding searches when fresh fatalities were found, and comparison of weather conditions between nights. A total of 51 bats were included in casualty analyses, of which 17 were fresh carcasses deemed to have died the night before the search during which they were found. Of the 17 fresh bats found, 76.5% (13 individuals) were found following nights when the temperature was greater than 15.5˚ C (Table 7). The average temperature was less than 15.5˚ C 27.8% of the time during this 2012 study. In previous years of study, the proportion of fresh bat fatalities that occurred when average nightly temperatures were above 15.5 ˚C was 96.4% (242 fatalities out of 251) in 2010, and 90.1% (200 fatalities out of 222) in 2011. Average nightly temperatures that were below 15.5˚ C occurred about 16% and 22.6% of the time in 2010 and 2011, respectively.

**Table 7. Weather conditions and bat fatalities during post-construction casualty monitoring at Fowler Ridge Wind Farm from August 1 to October 11, 2012 for nights preceding the search dat.**

| Search Date | Average Wind Speed | Average Temperature | Average Relative Humidity | Average Barometric Pressure | Number of Bats | Number of Fresh Bats |
|---|---|---|---|---|---|---|
| 8/3/2012 | 4.9 | 26.1 | 64.6 | 974.7 | 2 | 2 |
| 8/9/2012 | 4.1 | 21.9 | 88.4 | 976.9 | 3 | 2 |
| 8/22/2012 | 5.1 | 21.8 | 47.7 | 982.4 | 2 | 1 |
| 8/23/2012 | 6.0 | 24.2 | 43.4 | 982.0 | 3 | 2 |
| 8/29/2012 | 4.7 | 23.1 | 56.9 | 981.5 | 5 | 1 |
| 9/4/2012 | 3.8 | 25.5 | 84.6 | 925.5 | 1 | 1 |
| 9/19/2012 | 4.4 | 13.0 | 42.9 | 927.6 | 1 | 1 |
| 9/20/2012 | 9.5 | 15.6 | 56.4 | 924.2 | 2 | 1 |
| 9/25/2012 | 7.5 | 15.2 | 52.6 | 926.6 | 1 | 1 |
| 9/27/2012 | 6.6 | 14.4 | 77.5 | 930.2 | 2 | 2 |
| 10/4/2012 | 6.3 | 17.0 | 71.3 | 928.8 | 3 | 3 |
| **Total Bats** | | | | | **25** | **17** |

Fresh bat fatalities were fairly evenly distributed throughout the study (Figure 7). No apparent trends appear in the data relating temperature patterns to the number of fresh bat fatalities. The search date with the greatest number of fresh bat fatalities found was October 4, 2012, with three fresh bat fatalities. In relation to other nights, the average temperature and average barometric pressure were comparatively low on this night (17.0˚ C and 928.8 millibars [mb], respectively), while the average wind speed and average relative humidity were comparatively high (6.3 m/s [20.7 ft/s] and 71.3%, respectively; Figure 8). None of the values were outside of the 1st and 3rd quartiles, suggesting that these weather patterns were fairly typical for this fall season at the FRWF.

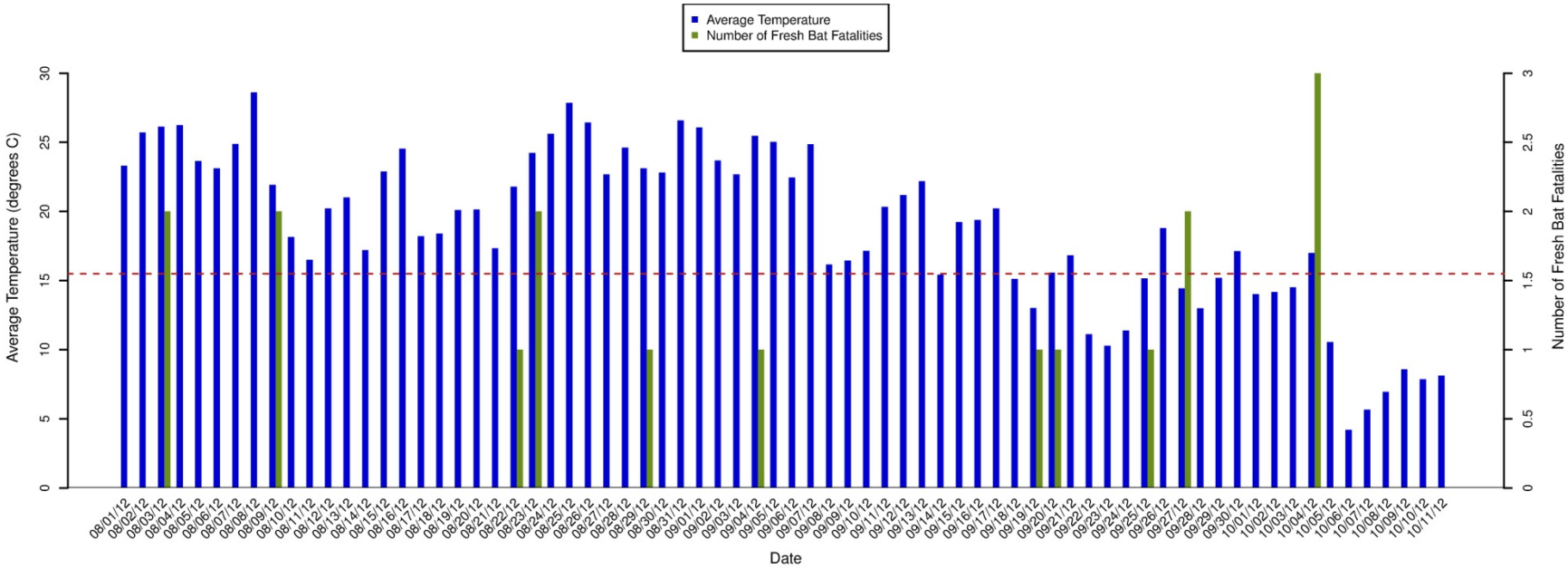


**Figure 7. Counts of fresh bat fatalities compared to average temperature (˚C) at the Fowler Ridge Wind Farm, Fall 2012.**

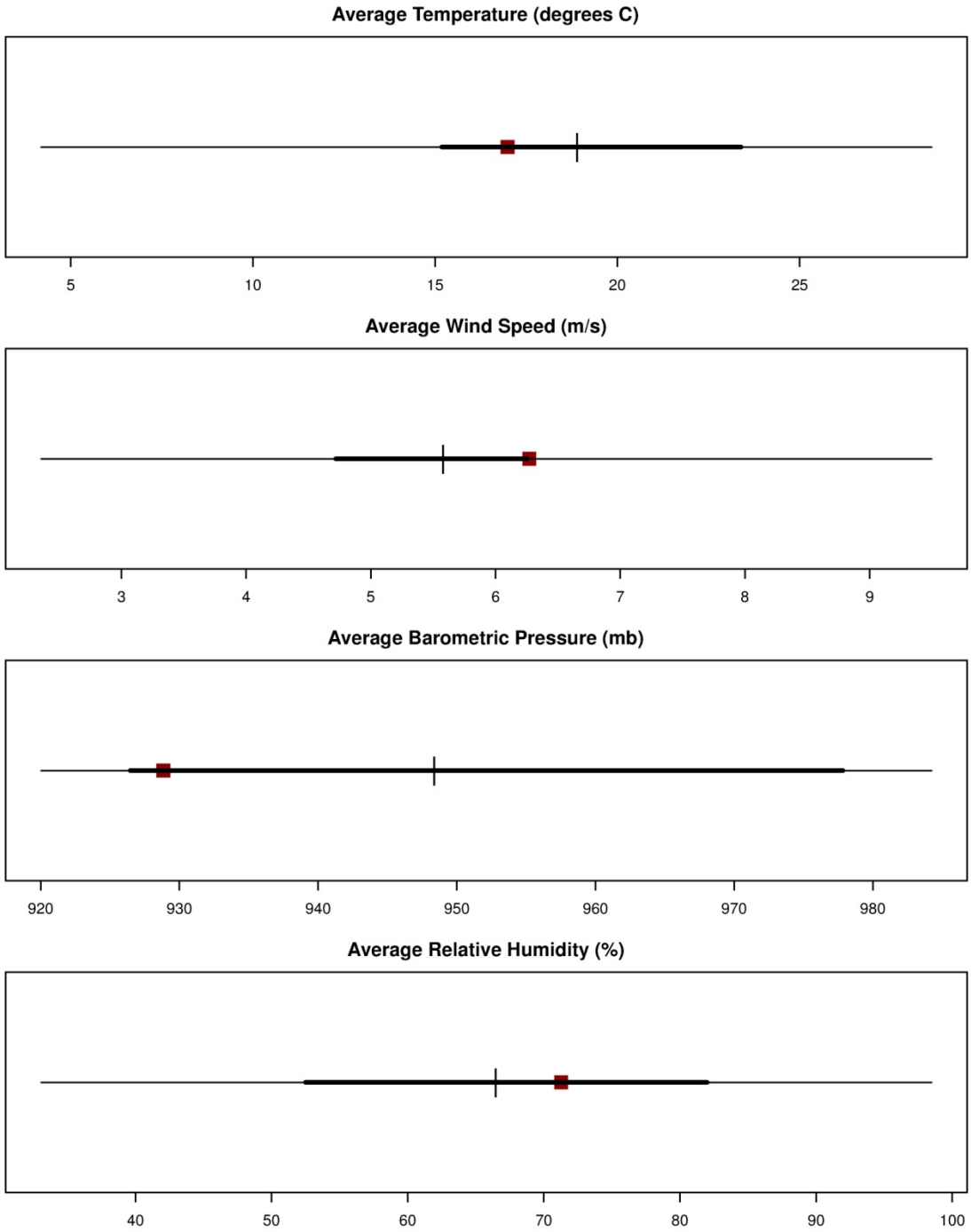


**Figure 8. Average climate conditions on the night preceding October 4, 2012, the night prior to the date when the highest number of bat casualties were found.**

## Adjusted Casualty Estimates

Eighteen bat casualties were found on August 1, 2, and 3, but were not included in the casualty estimate because the estimated time of death occurred prior to July 31, 2012. One additional

bat casualty was found on August 9, and was determined to be more than two weeks old. This casualty was also excluded from the analysis, as its estimated time of death was prior to the beginning of the study. Eleven bat casualties found after August 3 were not included in analyses because carcasses were found outside of search plots (Appendix B). Of the remaining casualties, 51 were included in the casualty estimate, resulting in an observed casualty rate of 0.43 bats per turbine. The observed fatality rate was then divided by the empirical probability of availability and detection (0.57). Finally, this value was multiplied by the road and pad correction factor (6.56) to obtain the per turbine adjusted fatality estimate. The adjusted casualty estimate for the 2012 study was 5.00 bat fatalities/turbine/year, or 2.96 bat fatalities/MW/year (Table 8).

**Table 8. Number of bat fatalities per turbine per year for the Fowler Ridge Wind Farm from August 1 to October 11, 2012.**

| Estimator | Point Estimate | Mean | Standard Deviation | 90% Confidence Interval | |
|---|---|---|---|---|---|
| | | | | Lower Limit | Upper Limit |
| Casualties per turbine | 0.43 | 0.43 | 0.06 | 0.33 | 0.53 |
| Empirical pi | 0.57 | 0.57 | 0.06 | 0.47 | 0.68 |
| **Adjusted number of fatalities per turbine** | **5.00** | **5.01** | **0.97** | **3.51** | **6.78** |

*Comparison to 2010 Casualty Estimates*

Road and pad searches completed in 2010 at turbines in normal operation modes provide the most direct comparison of casualty estimates to the 2012 estimate. Data collected in 2010 provide a baseline from which future casualty estimates can be compared. During 2010, 31.23 bat casualties/turbine/study period (90% confidence interval [CI] 18.77 – 48.94) were estimated from road and pad searches of 100 turbines in normal operation mode, after adjusting for bats falling outside of 40 m (Good et al. 2012). Point estimates of 2012 casualty estimates from turbines feathered until wind speeds reached 5.0 m/s were 84% lower than casualty estimates at turbines operating normally in 2010, with an estimated 5.00 bat casualties/turbine/study period (90% CI 3.51 – 6.78).

Bat casualty rates are estimates, and uncertainty surrounding estimates was measured using 90% confidence intervals. The upper end of the 2012 estimate (6.78 bats/turbine/study period) was 64% lower than the lower end of the 2010 estimate (18.77 bats/turbine/study/period). The confidence intervals of estimates from 2010 and 2012 do not overlap, providing additional evidence that reductions in bat casualty rates were realized and were not the result of random chance.

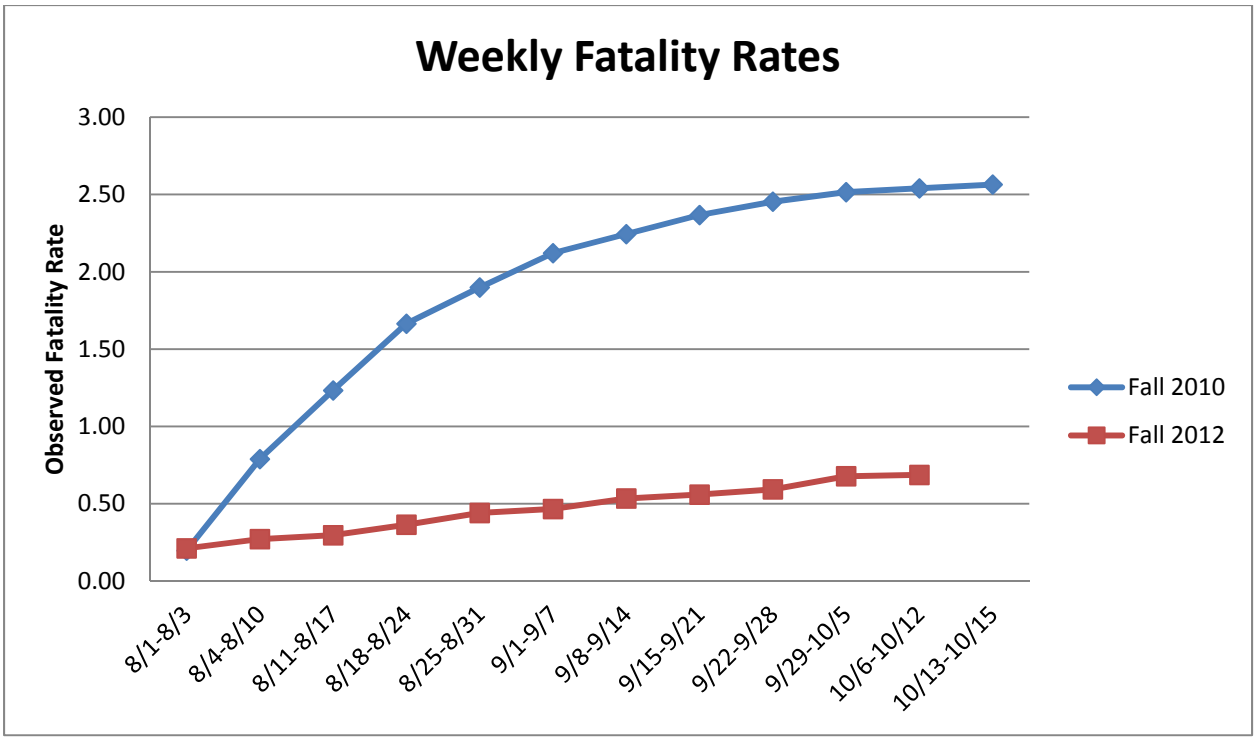


**Figure 9. Weekly fatality rates at the Fowler Ridge Wind Farm.**

## DISCUSSION

The primary objective of the 2012 research was to conduct monitoring that provided an accurate estimate of all bat mortality that can be used to reliably determine if a 50% reduction in mortality from control turbines in 2010 has been achieved between August 1 – October 15. The results of monitoring during 2012 provided evidence that operation strategies exceeded the objective of reducing bat casualty rates by 50% compared to casualty estimates of turbines in normal operation modes in 2010. Previous research at the FRWF in 2010 and 2011 (Good et al. 2011, 2012), as well as sites in Pennsylvania (Arnett et al. 2010a), West Virginia (Young et al. 2011b), and Canada (Baerwald et al. 2009) have shown that feathering blades or raising cut-in speeds is an effective measure for reducing bat casualties at wind-energy facilities.

The 84% reduction in point estimates of overall bat casualty rates observed in 2012 compared to 2010 exceeded reductions observed at Fowler and were similar to Casselman (Table 9). Previous research at Fowler and other wind-energy facilities has shown reductions in bat casualty rates ranging from 50 % at FRWF (Good et al. 2011) to 77.5% at Casselman (Arnett et al. 2010) when cut-in speeds were raised or blades feathered at 5.0 m/s. Turbines operating at baseline cut-in speeds were not monitored in 2012 as part of this study, limiting our ability to empirically test the reasons for the increased reduction. The most likely explanation for the difference was the extreme drought and warm temperatures recorded in the Midwest in 2012. Sheeringa and Hudson (2012) of the Indiana Climate Office characterized July weather as

"extreme", with July 2012 ranking as the "third warmest July in Indiana since 1895, behind second place 1901 (80.6°F) and first place holder 1936 (80.9°F)." Indiana also experienced extreme drought conditions in June and July of 2012, with over one half of the state qualifying as a federal drought disaster area (Sheeringa and Hudson 2012). Bat biologists conducting mist-net surveys in the Midwest noted that bats were volant approximately 1 – 2 weeks earlier than during previous years (K. Murray, WEST, pers. comm., T. Elliot, Missouri Department of Conservation, pers. comm.). It is not known if early volancy led to earlier migration or post-whelping movements by eastern red bats and silver-haired bats. Bat Conservation International (BCI) and the U.S. Geological Survey (USGS) completed a concurrent research study of bat casualty rates at Fowler during 2012, from July 14 – October 1. BCI and USGS found 28 of 82 bat casualties (34%) between July 10 – August 1. During 2011, 98 of 571 (17%) bat carcasses found by WEST in 2011 between July 14 – October 1 were recorded prior to August 1, which suggests the extreme heat and drought conditions of 2012 may have influenced the timing of bat casualties.

**Table 9. Comparison of available data on effectiveness of changing turbine cut-in speeds or blade feathering on reducing bat mortality**

| Location | Turbine type | Treatment | Reduction in Bat Casualty (Percent) | Reference |
|---|---|---|---|---|
| Casselman, PA | GE 1.5-MW | 5.0 m/s<br>6.5 m/s | 77.5<br>75.0 | Arnett et al. 2010 |
| Alberta, Canada | Vestas V80 1.8-MW | 5.5 m/s<br>idled during low wind speeds | 60.0<br>57.4 | Baerwald et al. 2009 |
| Mount Storm, WV | | 4.0 m/s | 22-47%<br>2nd half vs 1st half of the night | Young et al. 2011a |
| Fowler Ridge, IN 2011 | Vestas V82 1.65-MW<br>Clipper C96 2.5-MW<br>GE SLE 1.5-MW | 3.5 m/s<br>4.5 m/s<br>5.5 m/s | 36.3<br>56.7<br>73.3 | Good et al. 2012 |
| Fowler Ridge, IN 2010 | Vestas V82 1.65-MW<br>Clipper C96 2.5-MW<br>GE SLE 1.5-MW | 5.0 m/s<br>6.5 m/s | 50<br>78 | Good et al. 2011 |
| Germany | Unknown | 5.5 m/s | ~50 | O. Behr, unpubl. data |

A secondary objective of the 2012 research was to detect changing trends in bat mortality over time. Power analyses based on previous research at the FRWF show that monitoring 118 turbines by searching roads and pads will result in adequate power to detect a 30% decrease in bat casualty rates between years during equal periods of study. The sample sizes and search frequencies used to monitor turbines at the FRWF in 2012 provided more than adequate power to determine if reductions in bat casualty rates exceeded 50% between August 1 – October 15, and provided sufficient power to detect changing trends in bat mortality over time. The monitoring in 2012 also provided a mechanism for tracking observed casualty rates on a weekly basis (Figure 9), which gave the FRWF and the USFWS the ability to determine if in-season adjustments to the operational strategy were needed in order to meet objective one. 2012 observed bat casualty rates were consistently less than 50% of observed casualty rates

observed casualties in 2010 during equal periods of study, and no adjustments to operational strategies were required in 2012.

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## Appendix A. Estimated Time of Death Information Sheet

## Appendix A. Estimated Time of Death Information Sheet

**Last Night**

- Eyes will be round and fluid filled or slightly dehydrated
- No decomposition
- No infestations other than flies and eggs
- Body may be more flexible

**2 – 3 Days**

- Eyes will be sunken or missing
- May be infested with maggots, beetles, flies, and ants
- Flesh and internal organs will begin to be scavenged by insects

**4 – 7 Days**

- Eyes will be completely gone
- Most internal organs will be missing
- Bat may look like a hollow shell
- Fur may begin to fall off the skin and bat may look like it expanded in size
- Few maggots may be present but not prevalent

**7 – 14 Days**

- There is almost no meat left on body
- Skin has conformed to the skeletal system
- Body cavity should be devoid of insects

**> 2 Weeks to > 1 Month**

- Wing membrane is either gone or deteriorating
- Exposed bones are bleached in appearance

## Appendix B. Complete Casualty Listing for the 2012 Casualty Monitoring at the Fowler Ridge Wind Farm

**Appendix B. Complete casualty listing for the 2012 casualty monitoring at the Fowler Ridge Wind Farm.**

| Date | Common Name | Location | Distance from Turbine | Type of Find | Search Type | Condition |
|---|---|---|---|---|---|---|
| 8/1/2012 | eastern red bat | 339 | 32 | Scheduled Search | road/pad | Intact |
| 8/1/2012 | eastern red bat | 359 | 22 | Scheduled Search | road/pad | Dismembered |
| 8/1/2012 | eastern red bat | 371 | 31 | Scheduled Search | road/pad | Scavenged |
| 8/1/2012 | eastern red bat | 371 | 9 | Scheduled Search | road/pad | Scavenged |
| 8/1/2012 | eastern red bat | 388 | 27 | Scheduled Search | road/pad | Scavenged |
| 8/1/2012 | eastern red bat | 398 | 43 | Scheduled Search | road/pad | Scavenged |
| 8/1/2012 | eastern red bat | 420 | 26 | Scheduled Search | road/pad | Scavenged |
| 8/1/2012 | eastern red bat | 425 | 26 | Scheduled Search | road/pad | Scavenged |
| 8/1/2012 | eastern red bat | 432 | 3 | Scheduled Search | road/pad | Scavenged |
| 8/1/2012 | eastern red bat | 444 | 7 | Scheduled Search | road/pad | Scavenged |
| 8/1/2012 | eastern red bat | 444 | 27 | Scheduled Search | road/pad | Scavenged |
| 8/1/2012 | eastern red bat | 459 | 12 | Incidental Find | road/pad | Scavenged |
| 8/1/2012 | eastern red bat | 624 | 22 | Scheduled Search | road/pad | Scavenged |
| 8/1/2012 | eastern red bat | 639 | 44 | Scheduled Search | road/pad | Dismembered |
| 8/1/2012 | hoary bat | 635 | 18 | Scheduled Search | road/pad | Scavenged |
| 8/1/2012 | hoary bat | 641 | 9 | Scheduled Search | road/pad | Scavenged |
| 8/2/2012 | big brown bat | 195 | 7 | Scheduled Search | road/pad | Scavenged |
| 8/2/2012 | big brown bat | 609 | 7 | Scheduled Search | road/pad | Scavenged |
| 8/2/2012 | eastern red bat | 195 | 6 | Scheduled Search | road/pad | Scavenged |
| 8/2/2012 | eastern red bat | 260 | 18 | Scheduled Search | road/pad | Scavenged |
| 8/2/2012 | eastern red bat | 617 | 30 | Scheduled Search | road/pad | Scavenged |
| 8/3/2012 | eastern red bat | 26 | 40 | Scheduled Search | road/pad | Scavenged |
| 8/3/2012 | eastern red bat | 98 | 7 | Scheduled Search | road/pad | Scavenged |
| 8/3/2012 | hoary bat | 85 | 21 | Scheduled Search | road/pad | Scavenged |
| 8/3/2012 | hoary bat | 268 | 29 | Incidental Find | road/pad | Scavenged |
| 8/6/2012 | eastern red bat | 224 | 23 | Scheduled Search | road/pad | Scavenged |
| 8/6/2012 | eastern red bat | 251 | 1 | Scheduled Search | road/pad | Scavenged |
| 8/6/2012 | eastern red bat | 609 | 3 | Scheduled Search | road/pad | Scavenged |
| 8/9/2012 | big brown bat | 478 | 18 | Scheduled Search | road/pad | Intact |
| 8/9/2012 | eastern red bat | 329 | 10 | Scheduled Search | road/pad | Scavenged |
| 8/9/2012 | eastern red bat | 390 | 13 | Scheduled Search | road/pad | Scavenged |
| 8/9/2012 | eastern red bat | 478 | 2 | Scheduled Search | road/pad | Intact |
| 8/16/2012 | eastern red bat | 605 | 6 | Scheduled Search | road/pad | Scavenged |
| 8/16/2012 | hoary bat | 267 | 70 | Scheduled Search | road/pad | Scavenged |
| 8/16/2012 | hoary bat | 605 | 1 | Scheduled Search | road/pad | Scavenged |
| 8/16/2012 | horned lark | 611 | 26 | Incidental Find | road/pad | Scavenged |
| 8/17/2012 | tree swallow | 193 | 29 | Scheduled Search | road/pad | Scavenged |
| 8/21/2012 | hoary bat | 38 | 4 | Scheduled Search | road/pad | Scavenged |
| 8/21/2012 | hoary bat | 39 | 3 | Scheduled Search | road/pad | Scavenged |
| 8/22/2012 | cliff swallow | 417 | 29 | Incidental Find | | Scavenged |
| 8/22/2012 | eastern red bat | 627 | 32 | Scheduled Search | road/pad | Intact |
| 8/22/2012 | eastern red bat | 635 | 24 | Scheduled Search | road/pad | Scavenged |
| 8/23/2012 | eastern red bat | 230 | 13 | Scheduled Search | road/pad | Scavenged |
| 8/23/2012 | eastern red bat | 625 | 5 | Incidental Find | | Scavenged |
| 8/23/2012 | hoary bat | 11 | 29 | Scheduled Search | road/pad | Intact |
| 8/23/2012 | hoary bat | 268 | 2 | Scheduled Search | road/pad | Intact |
| 8/28/2012 | hoary bat | 30 | 1 | Scheduled Search | road/pad | Scavenged |
| 8/29/2012 | eastern red bat | 309 | 8 | Incidental Find | road/pad | Scavenged |
| 8/29/2012 | eastern red bat | 339 | 49 | Scheduled Search | road/pad | Intact |
| 8/29/2012 | eastern red bat | 388 | 0 | Scheduled Search | road/pad | Scavenged |
| 8/29/2012 | eastern red bat | 459 | 7 | Scheduled Search | road/pad | Scavenged |
| 8/29/2012 | eastern red bat | 641 | 11 | Scheduled Search | road/pad | Scavenged |
| 8/29/2012 | hoary bat | 309 | 5 | Scheduled Search | road/pad | Scavenged |
| 8/29/2012 | Seminole bat | 322 | 8 | Scheduled Search | road/pad | Scavenged |
| 8/30/2012 | eastern red bat | 14 | 20 | Scheduled Search | road/pad | Scavenged |
| 8/30/2012 | mourning dove | 170 | 1 | Scheduled Search | road/pad | Intact |
| 9/4/2012 | hoary bat | 112 | 1 | Scheduled Search | road/pad | Scavenged |
| 9/5/2012 | eastern red bat | 622 | 31 | Scheduled Search | road/pad | Scavenged |
| 9/6/2012 | American robin | 286 | 6 | Scheduled Search | road/pad | Feather Spot |
| 9/12/2012 | red-eyed vireo | 371 | 13 | Scheduled Search | road/pad | Scavenged |
| 9/12/2012 | silver-haired bat | 641 | 13 | Scheduled Search | road/pad | Scavenged |
| 9/13/2012 | eastern red bat | 7 | 20 | Scheduled Search | road/pad | Scavenged |
| 9/13/2012 | eastern red bat | 623 | 4 | Scheduled Search | road/pad | Scavenged |
| 9/13/2012 | silver-haired bat | 604 | 27 | Incidental Find | | Scavenged |
| 9/13/2012 | silver-haired bat | 604 | 30 | Incidental Find | | Scavenged |
| 9/13/2012 | silver-haired bat | 611 | 20 | Scheduled Search | road/pad | Scavenged |
| 9/13/2012 | silver-haired bat | 612 | 16 | Scheduled Search | road/pad | Scavenged |
| 9/13/2012 | silver-haired bat | 620 | 18 | Scheduled Search | road/pad | Scavenged |
| 9/18/2012 | eastern red bat | 60 | 23 | Incidental Find | | Scavenged |

**Appendix B. Complete casualty listing for the 2012 casualty monitoring at the Fowler Ridge Wind Farm.**

| Date | Common Name | Location | Distance from Turbine | Type of Find | Search Type | Condition |
|---|---|---|---|---|---|---|
| 9/19/2012 | eastern red bat | 309 | 18 | Scheduled Search | road/pad | Intact |
| 9/19/2012 | marsh wren | 444 | 26 | Scheduled Search | road/pad | Intact |
| 9/20/2012 | Nashville warbler | 195 | 7 | Scheduled Search | road/pad | Intact |
| 9/20/2012 | silver-haired bat | 193 | 50 | Scheduled Search | road/pad | Scavenged |
| 9/20/2012 | silver-haired bat | 224 | 21 | Scheduled Search | road/pad | Scavenged |
| 9/23/2012 | silver-haired bat | 625 | 12 | Incidental Find | | Scavenged |
| 9/25/2012 | ruby-throated hummingbird | 26 | 0 | Scheduled Search | road/pad | Scavenged |
| 9/25/2012 | silver-haired bat | 85 | 15 | Scheduled Search | road/pad | Scavenged |
| 9/27/2012 | eastern red bat | 285 | 4 | Scheduled Search | road/pad | Intact |
| 9/27/2012 | Seminole bat | 31 | 35 | Scheduled Search | road/pad | Intact |
| 10/1/2012 | eastern red bat | 92 | 4 | Scheduled Search | road/pad | Scavenged |
| 10/1/2012 | evening bat | 230 | 19 | Incidental Find | road/pad | Intact |
| 10/1/2012 | hoary bat | 99 | 9 | Incidental Find | road/pad | Scavenged |
| 10/3/2012 | eastern red bat | 458 | 46 | Scheduled Search | road/pad | Scavenged |
| 10/3/2012 | eastern red bat | 604 | 3 | Incidental Find | | Scavenged |
| 10/3/2012 | eastern red bat | 624 | 55 | Scheduled Search | road/pad | Scavenged |
| 10/3/2012 | silver-haired bat | 476 | 17 | Scheduled Search | road/pad | Intact |
| 10/4/2012 | eastern red bat | 224 | 13 | Scheduled Search | road/pad | Intact |
| 10/4/2012 | eastern red bat | 230 | 56 | Scheduled Search | road/pad | Intact |
| 10/4/2012 | eastern red bat | 260 | 16 | Scheduled Search | road/pad | Intact |
| 10/9/2012 | silver-haired bat | 39 | 5 | Scheduled Search | road/pad | Intact |