

Deerfield Wind Black Bear Study: Understanding black bear habitat use, movements, and behaviors in response to the construction and operation of the Deerfield Wind Energy Project.

Background

Developing renewable energy sources is an important component of Vermont's efforts to reduce carbon emissions and combat climate change. Vermont's topography has been described as well suited for wind power generation (Vermont Department of Public Service 2002); however, Vermont has a strong tradition of balancing the needs of human development with the needs of the State's wildlife species. The effects of wind energy development on migratory birds and bats have been documented, but potential impacts on large mammals such as black bears have not yet been explored. While it is unknown to what extent the operation of wind energy facilities will disrupt black bear movements, foraging behaviors, and use of nearby habitats earlier research looking at the effects of other types of development and human activity suggest that this is a concern. Previous research on the effects of development on black bear behavior and habitat use has served as the basis for the VFWD's positions in other cases to protect important feeding and travel habitat.

The Deerfield Wind Energy Project (DWEF) is a 30.0-megawatt wind facility within the Manchester Ranger District of the Green Mountain National Forest and was the first commercial wind project built on a National Forest in the United States. It consists of 15 turbines and spans four miles across two ridgelines in the towns of Searsburg and Readsboro Vermont. Of concern to wildlife managers are the large concentrations of bear scarred American beech within and adjacent to the DWEF facility. Beechnuts support a wide suite of Vermont's wildlife species and are a particularly important food source for black bears (McLaughlin et al 1994, Hammond 2002, Jakabas et al 2005). It has been shown that beechnuts have approximately the same protein content as corn but five times the fat content and have nearly twice the protein of acorns (Elowe and Dodge 1989, Serveillo and Kirkpatrick 1989). Beech trees scarred by bears climbing to forage for nuts are significant indicators of site use by bears (Wolfson 1992). For these reasons, the Vermont Fish and Wildlife Department (VFWD) considers concentrations of bear scarred beech as necessary habitat for black bears and attempts to identify and protect these habitats throughout the State.

In Vermont, precedent has been set to afford bear scarred beech concentrations legal protections under Vermont's Act 250 and 248 (Hammond, F.M., J.M. Austin. 2011. Black Bears and Wind Energy – A case for including bear habitat requirements in wind energy project planning in Vermont. Proceedings of the Northeast Black Bear Working Group). Through the 248-review process, the VFWD argued the location of DWEF would have a negative impact on the regional black bear population due to removal of bear scarred beech trees and displacing bears from the remaining beech; therefore, the VFWD recommended that the VT Public Service Commission not grant Avangrid Renewables a permit for the wind facility at this location. However, counter arguments were made that bears would quickly acclimate to DWEF infrastructure, and an adequate beechnut source would remain for black bears. Because no research had evaluated the impacts of black bear habitat use and foraging behaviors in proximity to commercial wind development the VT Public Service Commission required a study to evaluate the potential impacts DWEF has on the black bear population in this area.

Study Design and Approach:

The Deerfield Wind Black Bear Study (DWBBS) was designed to evaluate the effects of the DWEP on black bear movements, habitat use and foraging behaviors. The study was structured around three phases: pre-construction (fall 2011 – summer 2015), construction (fall 2016 – winter 2017), and post operation (spring 2018 – spring 2021, Figure 1). A total of 45 bears (30 males, 15 females) were fit with GPS Iridium collars with an average of 10 bears collared each year of the study (Table 1). Collars were programmed with a virtual fence containing the DWEP area, associated bear scarred beech concentrations and other nearby habitats beginning in 2015. Within the virtual fence collars collected 1 location every 20 minutes, while outside of the fence a location was collected every 2 hours 50 minutes – prior to 2015 collars collected locations at the latter interval rate throughout the study area. Over 230,000 bear locations were collected. Beechnut productivity was surveyed annually, and abundant beechnut crops occurred at least once during each phase of the study (2013, 2015, 2017 and 2019).

In addition to telemetry data from collared bears, 40 camera traps were used to document the presence and behaviors of bears within the DWEP area. Camera traps were deployed across four sampling plots beginning the fall of 2015 through the spring of 2021. Camera traps collected over 4,000 bear detections which were categorized into the following behavior types: foraging (>1,400 photographs), relaxed (>1,500 photographs), traveling (>1,200 photographs) and other (>30 photographs).

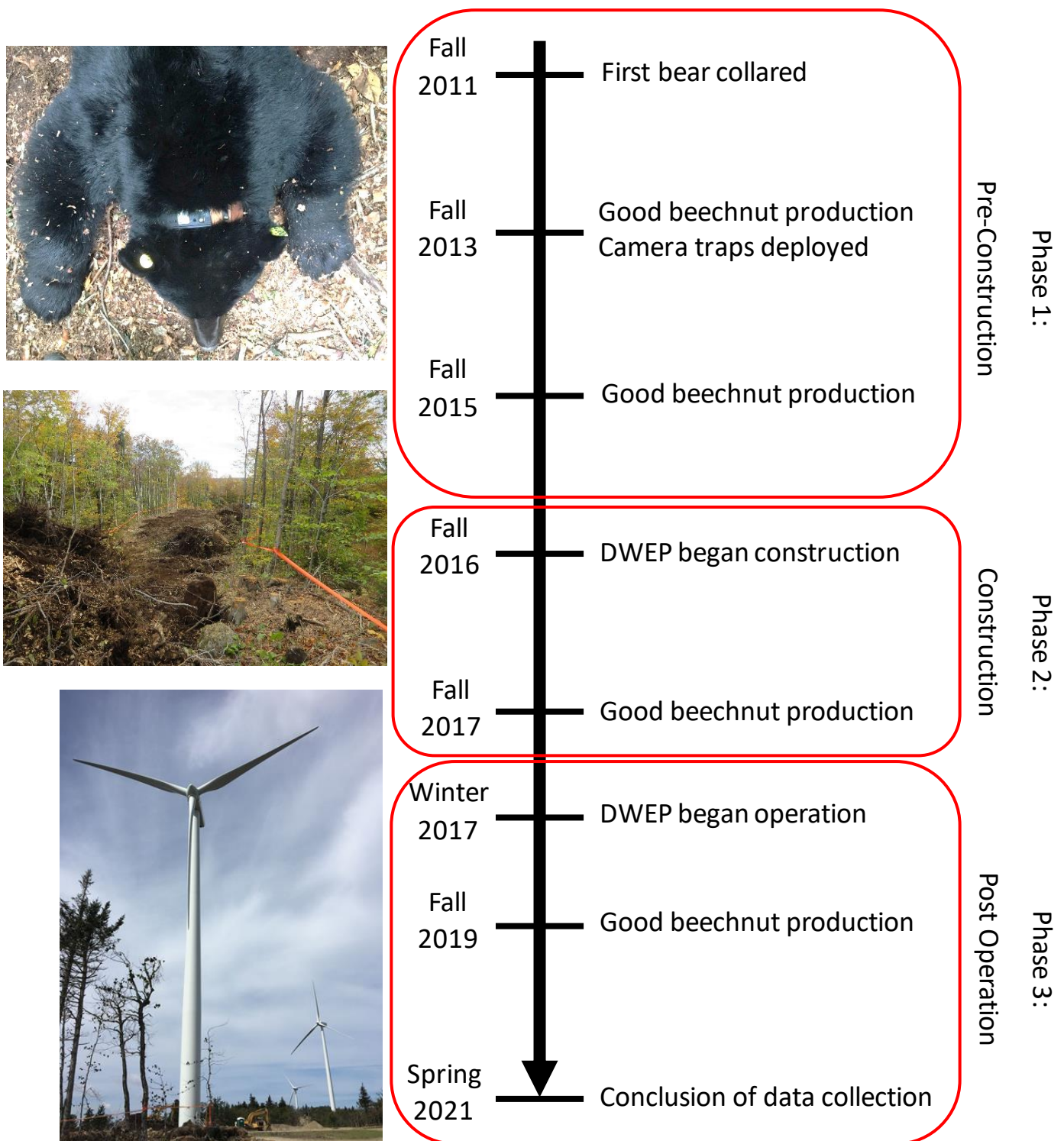


Figure 1. Deerfield Wind Black Bear Study timeline. The study consists of three stages: pre-construction of the DWEP, construction of the DWEP, and post operation of the DWEP. Telemetry, camera trap, and mast production data will be collected during all three phases. At least one good beechnut production season must occur in each phase of the study. Black bear habitat use, movement and behaviors will be

compared across all three phases of the study to determine the impacts of construction and operation of DWEP on black bears

Table 1. Deerfield Wind Black Bear Study annual capture results.

	2011	2012	2013	2014	2015	2016	2017	2018	2019
CAPTURES	3	9	15	17	6	15	13	13	9
CAPTURE SEX RATIO(M:F)	3:0	6:3	12:3	13:4	3:3	12:3	10:3	9:4	4:5
BEARS COLLARED	1	7	12	9	6	8	5	9	5
COLLARED SEX RATIO (M:F)	1:0	4:3	9:3	5:4	3:3	7:1	3:2	6:3	2:3
FIRST TIME COLLARED	1	7	9	6	2	7	5	5	3
TOTAL BEARS COLLARED	1	8	11	12	10	14	14	13	11

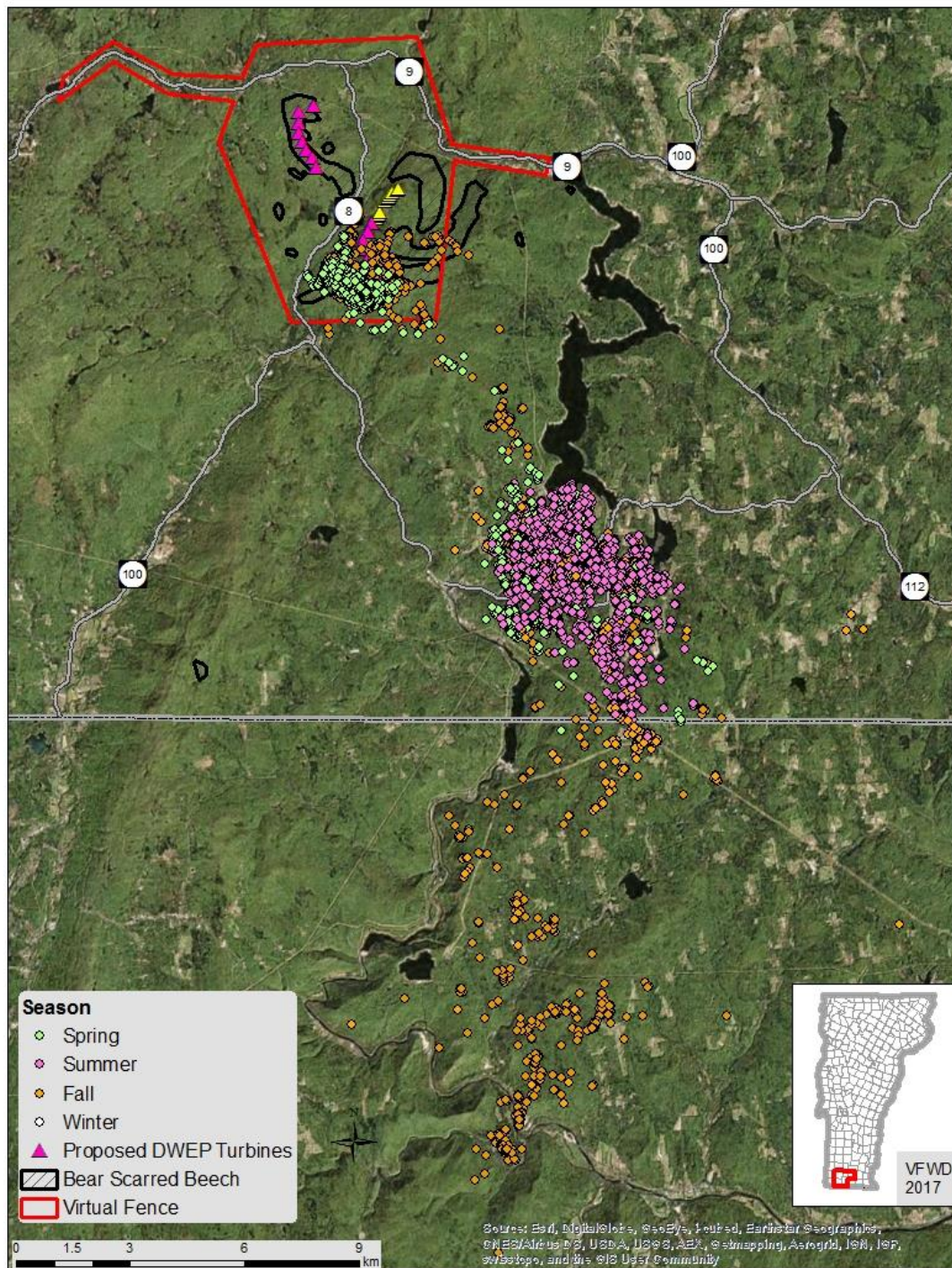


Figure 2. The locations of black bear #F32, summer 2014 through fall 2016 – pre-construction phase. Green circles represent spring-time locations, pink circles represent summer-time locations, and orange circles represent fall-time locations. During the fall of 2015 and spring 2016 when beechnut availability was good, F32 traveled northwest to the bear scarred beech concentrations on the east ridge of the future DWEP. In years when beechnut availability was poor she traveled south during the fall to areas where acorns were more plentiful.

Status of Project Analysis:

VFWD wildlife scientists have been working on organizing and analyzing the enormous volume of data collected through this rigorous, long-term investigation. Due to the volume of data and complexity of analysis in addition to limited staff capacity to focus specifically on this analysis, final results and conclusions are not yet available. Given the implications of the results from this research project, VFWD is hesitant to offer any preliminary thoughts regarding what the data might suggest regarding the effects of the wind energy project on black bear behavior and habitat use. Instead, VFWD is finalizing a request for proposals from qualified researchers to help with data analysis and development of a final report (see scope of work below). We anticipate having a final report available to share with the Vermont Public Utility Commission by 2024.

ATTACHMENT A: STATEMENT OF WORK

Deerfield Wind Black Bear Study: Data Analysis Request For Proposals

The vendor will conduct a statistical data analysis of black bear habitat selection to address objectives laid out in the Deerfield Wind Black Bear Study project proposal using the latest advancements in statistical modelling theory and applications.

Scope of Work

The Vermont Fish and Wildlife Department is seeking a researcher to analyze previously collected black bear telemetry location data to understand movement and habitat use associated with the DWEP. This researcher should have prior experience developing habitat use availability models, ideally for bears or other large carnivores. Because habitat availability varies over time and space, preference will be given to researchers with experience developing integrated step selection functions. Analysis will address previously developed objectives of the DWBBS. Those objectives and corresponding hypotheses are as follows:

1. Evaluate the movements and habitat use of black bears in response to the construction and operation of the DWEP. Determine the extent of indirect effects resulting from the project and quantify displacement distances if possible.

Hypotheses:

- a. Disturbance caused by the construction and operation of the DWEP will Cause black bears to use high-quality foraging habitat (bear-scarred beech concentrations) in and around wind turbines less than expected given beech mast production (relative categorizations of high, medium, or low) in any given year.
 - b. Disturbance caused by the construction and operation of the DWEP will shift bear movements to surrounding lesser quality food sources or high-quality foraging habitat (bear-scarred beech concentrations) farther away given beech mast production in any given year.
2. Evaluate the relationship between hard mast availability and human-bear conflicts.

Hypotheses:

- a. Bears will use areas in and around human development and potential anthropogenic food sources such as apple orchards, corn fields, housing, and business developments more often than in years of lower mast production (i.e., specifically beechnuts).
 - b. Disturbance caused by the construction and operation of the DWEP will cause shifts in this relationship where bears will use areas in and around human development and anthropogenic food sources even in years of higher beechnut production.
 - c. Acorn production will have a modulating effect on this relationship, as black bears will also seek oak stands as a natural food source even though acorns contain lower quality caloric energy compared to beechnuts and often require longer distance movements for bears in this study area.
3. Evaluate the behavioral response of black bears to wind turbine activity levels.

Hypothesis:

- a. Wind turbine operation levels will have different effects on the surrounding environment (light and sound scapes) and thus influence black bear use of the DWEP area differently depending on the operation level. This hypothesis will be explored to the extent the data allow; data points may not be refined enough to elucidate nuanced black bear habitat use differences tied to specific operating levels of turbines.

The researcher will need to explore all objectives across different black bear sex and age classes, in individuals, and to the extent possible, extend findings to the population level. Alterations can be made to the hypotheses and research questions, but only after receiving approval from VFWD.

The dataset for this analysis spans a lengthy amount of time and include an extensive number of sample points, thus they provide for consideration of further questions as time and budget allow. These further questions could include:

- Are black bears more active at night than daylight closer to the DWEP during construction and post operation compared to pre-development?
- Do black bears with more of their core home range overlapping the DWEP have lower survival rates than bears with core home ranges farther from the DWEP?
- Do black bears den further from the operating turbines compared to pre-development?

Further questions may also be explored associated with landscape connectivity for bears, human-bear conflicts, and black bear use of habitats beyond bear scarred beech concentrations. The researcher will work with VFWD to develop these secondary objectives. Of particular interest to VFWD are questions where data gaps exist that could help address the state's overall habitat management goals:

- Identify anthropogenic features that create habitat fragmentation for bears and explore how bears interact with these fragmentation features.
 - Identify features that facilitate bear road crossings and develop a model to identify road crossing areas throughout the Vermont.
- Develop models to predict black bear travel corridors.

- Compare bear movement data to recently developed expert opinion-based landscape connectivity models.
- Evaluate seasonal habitat selection by bears, specifically use of wetland habitats.
- Explore movements associated with anthropogenic landscape features as it relates to human-bear conflicts.

Literature

Vermont Department of Public Service, October 2002. Wind Energy Planning Resources for Utility-Scale Systems in Vermont.

Elowe, K.D. and W.E. Dodge. 1989. Factors affecting black bear reproductive success and cub survival. *Journal of Wildlife Management* 53: 962-968.

Hammond, F.M. 2002. The Effects of Resort and Residential Development on Black Bears in Vermont. Final Report. Vermont Agency of Natural Resources, Department of Fish and Wildlife.

Hammond, F.M., J.M. Austin. 2011. Black Bears and Wind Energy – A case for including bear habitat requirements in wind energy project planning in Vermont. *Proceedings of the Northeast Black Bear Working Group*.

Jakubas, W.J.; C.R. McLaughlin; P.G. Jenson; S.A. McNulty. 2005. Alternate Year Beechnut Production and its Influence on Bear and Marten Populations, in: *Beech Bark Disease: Proceedings of the Beech Bark Disease Symposium*. C.A. Evans, J.A. Lucas, M.J. Twery, eds. US For. Serv. Gen. Tech. Rep. NE-331, pp. 79-97.

McLaughlin, C.R.; G.J. Matula Jr.; and R.J. O'Connor. 1994. Synchronous reproduction by Maine black bears. *Int. Conf. Bear Res. And Management*. 9(1):471-479.

Serveillo, F.A., R.L. Kirkpatrick. 1989. Nutritional value of acorns for ruffed grouse. *Journal of Wildlife Management* 53: 26-29.

Vermont Department of Public Service. 2002. Wind Energy Planning Resources for Utility-Scale Systems in Vermont.

https://publicservice.vermont.gov/sites/dps/files/documents/Renewable_Energy/Resources/Wind/PLANINGPACKET.pdf.

Wolfson, D.L. 1992. Development of a quantitative procedure to assign a value rating to beech stands as black bear habitat. Unpublish. M.S. Thesis. Antioch College, Keene, NH.