

# Deerfield Wind Black Bear Study Update

August, 2015 Interim Report



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## ABSTRACT

This is an interim report of the Deerfield Wind Bear Study. The research is the result of a condition that the VT Public Service Board imposed on Iberdrola, Inc as part of their final permit for the construction and operation of the Deerfield Wind Energy Project (DWEP) in Searsburg and Readsboro Vermont. The objective of the study is to evaluate potential impacts of the DWEP on the area's black bear population, specifically changes in beechnut foraging behaviors. Black bear movement, habitat use, and behavior data are to be collected during pre-construction, construction, and post construction phases of the DWEP. Initially, field work for the study was scheduled to end in 2017, but due to an appeal of the USFS Environmental Impact Statement construction has been delayed by at least four years. Currently the study is still within the pre-construction phase. The study is nearing the completion of its fifth year (fall 2011 – fall 2015) collecting data from GPS collared bears. To date 26 bears have been collared (18 males, 8 females) and over 35,000 GPS locations of study animal movements collected. The data collected has provided insight into important food sources and availability, habitat features, movement corridors, and feeding behavior.

## Overview

Wind energy development is an increasingly popular source for non-fossil fuel energy and in New England these projects typically occur on high elevation ridges. In Vermont, like much of northern New England, these ridges often contain stands of American beech (*Fagus grandifolia*), which provide an important fall and spring food source for black bear (*Ursus americanus*). Beech mast is widely recognized as providing significant resources for not only black bear, but also white-tailed deer, American marten (Jakubas et. al. 2005), fisher (Brown and Will 1979), wild turkey, ruffed grouse, and many small mammal and passerine species. Beechnuts have about the same protein content as corn but five times the fat content (Elowe and Dodge 1989). Compared to acorns, beechnuts have nearly twice as much crude protein (dry weight), twice the fat of white oak acorns and about the same fat content as red oak acorns as reported by Serveillo and Kirkpatrick (1989). The special importance of beech mast for black bear reproduction has been well documented. "In northern Maine, 22% of the female black bears that were reproductively available reproduced following falls when beechnut production was poor. The proportion of reproducing females increased ( $P < 0.001$ ) to 80% following falls when beechnut production was high." (Jakubas et. al. 2005) This effect is most pronounced in areas where beechnuts constitute a large proportion of the fall diet and alternate food sources are scarce. In the Green Mountain National Forest and north half of Vermont, beech is the predominant mast species, and the only source of hard mast in the northeastern region of the state. Black bears exhibit fidelity to beech mast production areas, feeding in them year after year when mast is abundant. Clusters of mast bearing beech which are remote from human developments are particularly important feeding areas, so maintaining connectivity to such areas is a vital element of maintaining habitat for a viable black bear population. Clusters of beech exhibiting significant levels of bear feeding activity are afforded legal protections under Act 250 and Act 248 in Vermont.

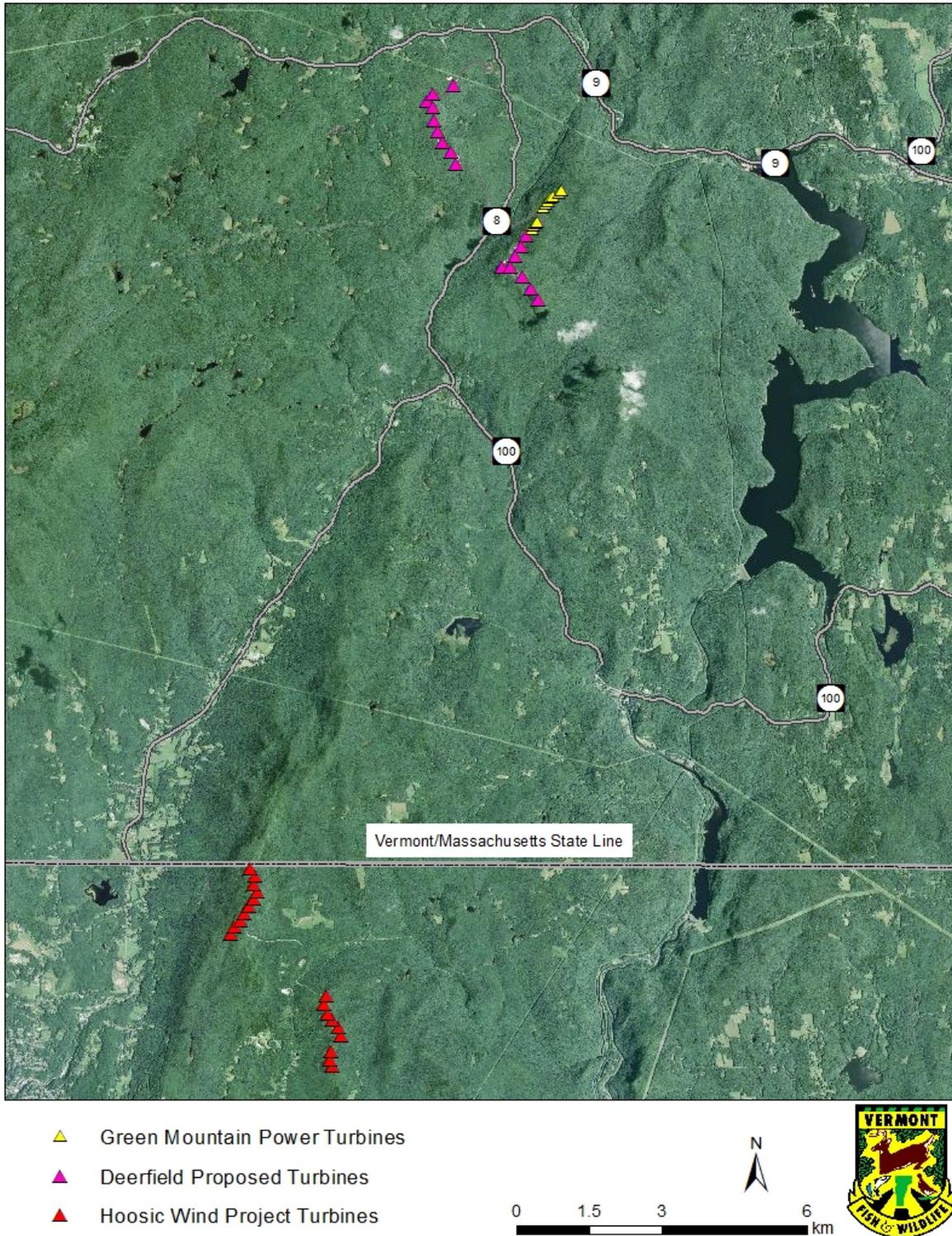


Figure 1. The location of the proposed Deerfield Wind Energy Project turbines (pink triangles) and the existing Green Mountain Power turbines (yellow triangles) and the Hoosic Wind Project turbines (red triangles).

Impacts on raptors, migratory birds, and bats have been investigated in relation to wind energy development, but potential impacts on large mammals such as black bears have not yet been explored. Of particular concern to wildlife managers in Vermont is the disturbance to beech stands on remote ridges that have a history of bear use. Bear use is identified by scarring on the trunks of beech trees as a result of repeated climbing by bears to access beech nuts; these stands are referred to as bear scarred beech (BSB). Currently it is unknown if wind turbine development within these stands will displace black bears from foraging within beech stands adjacent to areas cleared for wind energy projects.

A wind energy project, referred to as the Deerfield Wind Energy Project (DWEP), is proposed for development on two separate ridges within the Manchester Ranger District of the Green Mountain National Forest in the towns of Searsburg and Readsboro Vermont. BSB stands exist on both ridges and dominate the northwestern ridge. These stands constitute significant fall feeding habitat for bears in the region. This proposed wind project will consist of fifteen 2.0-megawatt turbines with eight turbines placed on the western ridge and seven turbines on the eastern ridge just south of the existing Green Mountain Power (GMP) Searsburg Wind Facility (Figure 1). The Searsburg Wind Facility consists of eleven 550 kilowatt turbines and went into operation in 1997 after being sited on private land to avoid impacts to bears and the beech stands. Additionally there is a nineteen turbine 1.5 mega-watt wind energy facility approximately 13 kilometers south of the DWEP in Florida and Monroe, MA. This wind facility, referred to as the Hoosic Wind Project, has been in operation since 2012.

In 2011, the Vermont Fish & Wildlife Department (VFWD) contracted with Western EcoSystems Technology, Inc. (WEST) to initiate a study of black bear response to the construction and operation of the DWEP. The primary objective of the study is to determine if bears respond to the various potential disturbances associated with construction and operation of the DWEP and to document any changes in responses over time. Field work for the study was initially expected to last through 2017 and include pre-construction, construction, and post-construction phases. An appeal of the USFS Environmental Impact Statement has delayed construction of the project and so extended the duration of the study by as much as five years. Due to the delay in project construction and to the resulting budget shortfall, the contract with WEST was terminated and the study is being continued by the VFWD.

The results of a study evaluating the impacts of ski resort development on black bears (Hammond 2002) led to a prototype of ski resort master plans allowing other ski resorts to effectively plan and implement development while minimizing impacts to black bears. A goal of this study is to better understand how future wind projects can be planned and implemented to minimize impacts to black bears. The specific study objectives of the Deerfield Wind Black Bear Study are:

**Objectives:**

1. Evaluate the movements and habitat use of black bears in response to the construction and operation of the Deerfield Wind Energy Project
  - a. Determine the extent of indirect effects resulting from the project and quantify displacement distances if possible;

2. Evaluate the relationship between hard mast availability and human-bear conflicts
  - a. Determine if study animals using bear scarred beech (BSB) habitat for extended periods of time are more or less likely to be involved with bear-human conflicts than bears not using BSB habitat; and
3. Evaluate the behavioral response of black bears to the wind turbines during days that the turbines are operating or feathered or shut down completely

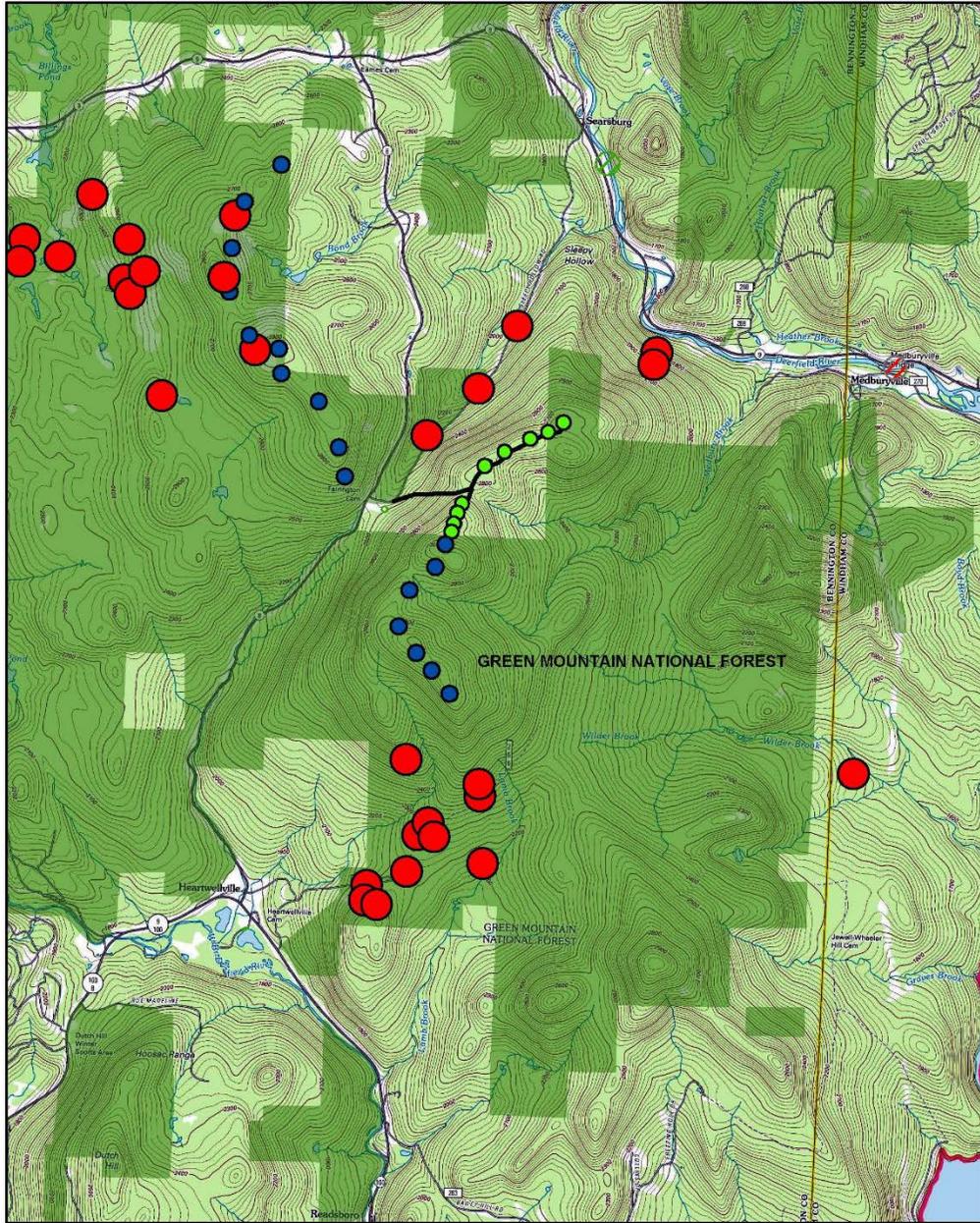
## **CURRENT STATUS**

### **Capture of Study Animals**

In order to achieve the project objectives a target number of 12 black bears are being monitored through the use of GPS radio collars. Priority is given to collaring adult males and females along with subadult females. Male bears estimated to be younger than three years of age are not collared. Bears are primarily captured with the use of cable restraints (Aldrich Humane Foot Snare design and bucket traps), but trained bear hounds, and barrel/culvert traps have also been used. Collared bears will be maintained during at least one good beech nut production season during post construction. Efforts are made to maintain the same study animals through the life of the project; however, new animals are captured when necessary.



Initial capture of F206 using Aldrich Humane Foot Snare design (5/7/2012).



Locations of black bears captured in 2011, 2012 and 2013 ● (N=29)  
 Existing Searsburg Facility ●  
 Proposed Turbine Locations ●



Figure 2. Deerfield Wind Bear Study capture locations, 2011, 2012, 2013.

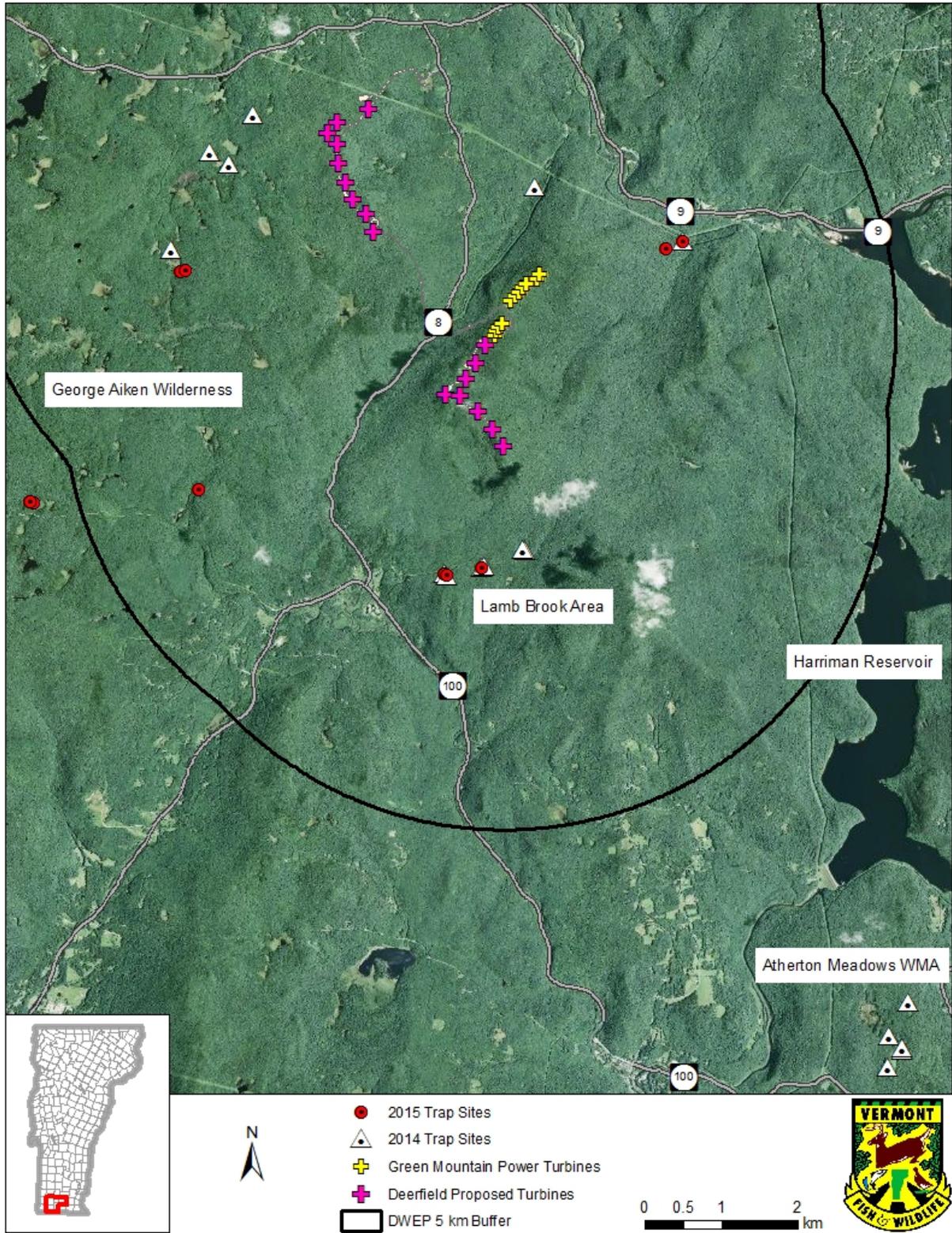


Figure 3. Deerfield Wind Bear Study trap sites for the 2014 (white triangles) and 2015 (red circles) capture seasons. Some trap sites were used during both seasons.

Researchers began capturing animals in October, 2011 and additional capture efforts have been made during the spring and summer months of 2012, 2013, 2014, and 2015 in an effort to maintain collars on 12 study animals. Capture efforts have been primarily focused within a 5 km radius of the proposed Deerfield Wind Project sites (Figure 2 and Figure 3). Some traps targeting specific bears were set beyond the 5 km radius in 2014 and 2015 (Figure 3).



Jaclyn Comeau (VFWD) with M28, captured in an Aldrich Humane Foot Snare.

One bear was collared in the fall of 2011, but shed his collar in the spring of 2012. Seven new bears were collared in 2012, however, all shed their collar by the spring of 2013. In 2013 12 bears were collared, including two that had been collared during 2012. Nine of these animals were still collared during the 2013/2014 denning season. Unfortunately collar caused neck wounds required the removal of collars from four bears leaving five study animals. An additional nine bears were collared during 2014, including the recapture of one female whose collar had been removed in the den. Due to dropped collars, collar malfunction, and human caused mortality only five bears had collars changed during the 2014/2015 denning season. In 2015 five additional bears were collared including three that had been collared in previous years (Table 1).

In total, 50 bears have been captured (including recaptures) and 26 different bears have been fit with GPS collars as study animals. Of those collared, 18 have been males, eight have been females and of these 11 have been collared in multiple years (Table 1). Due to study animals shedding their collars prematurely (12), researchers removing collars due to collar caused neck wounds (4), collar malfunctions (4), mortality from hunting (2), and mortality from human-bear conflicts (2) the target number of 12 study animals collared at one time has only been achieved briefly during the 2013 and 2014 seasons. However, due to attrition caused by the previously listed reasons the sample size dropped from a high of 12 in 2013 to five by the spring of 2014 and a high of 13 in 2014 to eight in the spring of 2015 (Table 2). Due to collar malfunctions and budget constraints only 10 study animals are being monitored during the 2015 season.

Table 1. Deerfield Wind Bear Study capture results 2011-2015.

	2011	2012	2013	2014	2015	Total
<b>Total Captures</b>	3	9	15	17	6	<b>50</b>
<b>Capture Sex Ratio (M:F)</b>	3:0	6:3	12:3	13:4	3:3	<b>37:13</b>
<b>Within Season Recaptures</b>	0	0	0	3	0	<b>3</b>
<b>Total Project Recaptures</b>	0	0	3	6	5	<b>14</b>
<b>Bears Collared</b>	1	7	12	9	6	<b>35</b>
<b>Captured Bears Collared Sex Ratio (M:F)</b>	1:0	4:3	9:3	5:4	3:3	<b>22:13</b>
<b>Unique Bears Collared Sex Ratio (M:F)</b>	1:0	4:3	8:2	3:3	2:0	<b>18:8</b>
<b>% Captured Bears Collared</b>	33	78	80	53	100	<b>70</b>



Mary Beth Adler (VFWD) checks the gender of one of F031's two male cubs, 3/11/15. These cubs were believed to be F031's first litter and were undersized (photo credit Lisa Bent).

Table 2. Deerfield Wind Bear Study seasonal summary of collared bears from fall 2011-summer 2015. Season dates are based on observed foraging behaviors of study animals (Fall = September 1-December 15, Winter = December 16-March 14, Spring = March 15-May 31, Summer = June 1-August 31).

		<b>Collared Bears</b>	<b>Sex Ratio (M:F)</b>	<b>GPS Points Collected</b>	<b>% GPS Fix Success Average</b>
<b>2011</b>	*Fall	1	1:0	441	-
	Winter	1	1:0	n/a	-
	<b>2011 Total</b>	<b>1</b>	<b>1:0</b>	<b>441</b>	-
<b>2012</b>	*Spring	4	3:1	1330	84
	Summer	7	4:3	2487	87
	Fall	1	0:1	317	87
	Winter	1	0:1	n/a	-
	<b>2012 Total</b>	<b>8</b>	<b>5:3</b>	<b>4134</b>	<b>86</b>
		Spring	2	2:0	161
<b>2013</b>	Summer	11	9:2	6401	85
	*Fall	11	9:2	6496	90
	Winter	9	6:3	n/a	-
	<b>2013 Total</b>	<b>12</b>	<b>9:3</b>	<b>13058</b>	<b>89</b>
		*Spring	5	4:1	2405
<b>2014</b>	Summer	12	7:5	5414	90
	Fall	9	5:4	3823	88
	Winter	8	4:4	n/a	-
	<b>2014 Total</b>	<b>13</b>	<b>8:5</b>	<b>11642</b>	<b>88</b>
		Spring	5	1:4	2498
<b>2015</b>	Summer	9	4:5	4762	89
	<b>2015 Total</b>	<b>10</b>	<b>4:6</b>	<b>7260</b>	<b>84</b>

\* Good beechnut availability.

### Den Data

There have been a total of 13 different study animals during the four denning seasons (2011-2015). Of these 13, five have been collared during multiple denning seasons. Data was recorded as to den location, date of den entrance and emergence, reproduction, offspring survival, and den site characteristics including the distance to existing turbines.

At this time all known locations of the dens of study animals have been in Vermont despite many bears having left the study area during summer or fall months to seek food sources in Massachusetts and New York. Collar data has not been fully analyzed, but results of initial analysis are interesting. The average den entrance date during a good beech nut year (2013) was December 8, 2013 (n=8, 6M:2F). This is almost a month later than the average den entrance date, November 11, 2014, during poor beech nut production the following year, 2014 (n=6, 2M:4F). The difference in sex ratios between seasons may contribute to this difference. Additional data will help to better explain any relationships between mast production and denning behavior.

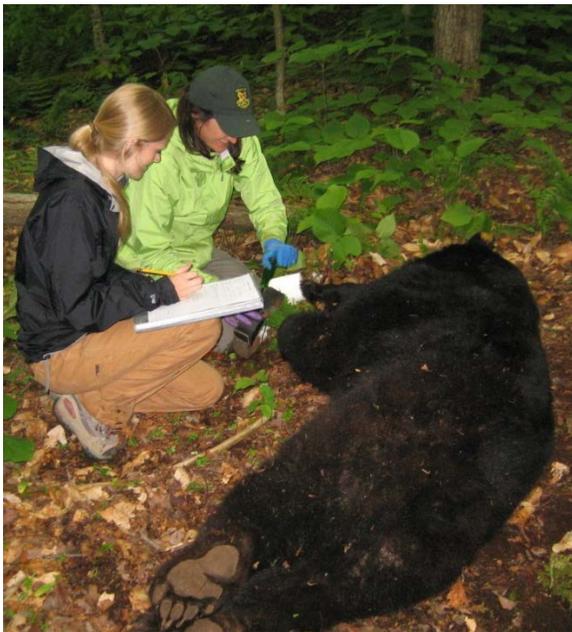
Reproduction data has been collected on six female study animals; three during the 2013/2014 denning season and three during the 2014/2015 season. Female F206, six years of age, produced three cubs; one female and two males. Female F224 produced two male cubs, and female F288 produced one male cub in what is believed to be her first litter. Cub survival data was only collected for F206 and F288. Although F206's collar was pulled during the March 2014 den visit due to a neck abrasion, data collected from game cameras during the 2015 capture season showed 100% cub survival. Bear F288 also had 100% survival, as her single male offspring was found in the den with her in March 2015. Bear F224's den during the 2014/2015 den season was inaccessible so litter survival was not confirmed. A game camera was placed outside her den in attempt to collect survival data when they emerged. At least one offspring was photographed emerging from the den with her, but it was not possible to determine if both yearlings were present.

Two new females, F031 and F230, were visited in their dens during the 2014/2015 den season. Both females turned four years of age while in the den. F031 only weighed 90 lbs, but had two male cubs; both cubs were smaller than would be expected. F230 did not have any cubs and although it wasn't possible to weigh her she appeared to be similar in weight to F031.



Ryan Smith (VFWD) holding F288's single male cub in March 2014 and March 2015.

A large number of cooperators and volunteers have helped with spring capture work as well as with den visits (Appendix A). Their involvement has helped reduce overall labor costs of the field work. Several cooperators and volunteers have given large amounts of their time and by doing so have become valuable field technicians for the study. Most importantly have been Scott Wixom (USFS), Fred Pogmore (USDA Wildlife Services), Richard Watkin (VFWD, Game Warden), Travis Buttle (VFWD, Game Warden), John Ogorzalek, Mike and David Senecal, Dan Luke, Courtney Lockerby, and Caitlin Drasher. Mrs. Murphy's Donuts (Manchester, VT) and The Crazy Russian Girls Neighborhood Bakery (Bennington, VT) have also been instrumental in providing bait to assist with the capture of study animals.



Jaclyn Comeau (VFWD) and Caitlin Drasher adjust M215's GPS collar.



Scott Wixsom (USFS) takes morphological measurements from F31.

### **Hard Mast Availability**

Beechnut and acorn production has been evaluated in stands throughout the study area. Surveys are conducted during September and October each year to quantify the availability of hard mast. A sample of 10 mature ( $\geq 6$ " DBH) beech or oak trees are selected in each surveyed stand. Under each tree viable beech nuts are counted in two randomly selected one meter sites. Bear scarring and beech bark disease are also assessed for each tree. This data has yet to be analyzed, but preliminary assessments show that poor beechnut crops existed in 2012 and 2014. Good beechnut crops existed in 2011 and 2013 and from preliminary reports it is anticipated that 2015 will provide another good beechnut crop.

## Movements and Behavior

Thirteen Iridium satellite collars manufactured by Lotek were purchased for the initial phase of the study (2011-2015). Global Positioning Satellite (GPS) collars are programmed to collect a location approximately every three hours between March 15 – December 15. Collars are programmed to collect a location every 35 hours between December 16 – March 16 to conserve the battery while bears are in dens. Additionally, the collars collect activity data that can be used to help evaluate behaviors associated with the location data. Collars are programmed to transmit GPS locations through satellites to a website maintained by the manufacturer after 12 locations have been successfully collected by the collar.

To date, more than 35,000 GPS locations have been collected from 26 study animals. A total of 1,631 location points (n=21, range=1-395, mean=78) have been collected within a one kilometer radius of the DWEP (Figure 4). This represents 4.5% of the total points collected thus far. Of those locations within one kilometer of the DWEP approximately 32% were collected during the fall and spring months when bears were likely foraging for beechnuts. Of the 21 bears that spent time within one kilometer of the DWEP 19 spent time there during the beechnut foraging season, but only 10 were collared for at least one complete fall or spring season and only eight during a fall and/or spring with good beechnut production.

Additionally monitoring the daily movements of the study animals has allowed documentation of the use of different seasonal feeding habitats, travel corridors and road crossing areas associated with Routes 8, 9 and 100. Further, these movements have provided insight into a number of human-bear conflicts including the locations of intentional feeding sites by some members of the public. Interesting observations include study animal use of the Atherton Meadows WMA; the heavy use of power line corridors and a tornado damaged swath of forest in the George Aiken Wilderness by bears seeking soft mast in July, August, and September; movements away from the study area during the fall of 2012 and 2014 when natural foods were scarce; and the early spring use of beech stands following years of beech nut abundance. In some cases researchers were able to locate previously unknown beech stands by visiting areas where study animals had spent considerable amounts of time during the month of April. Study animals that left the study area were documented traveling long distances including to beech stands previously conserved as a result of mitigation associated with the Haystack and Stratton ski resorts. Three male study animals made long distance movements into New York (one as far as Salem, NY) while most of the study animals travels have included excursions into Massachusetts. Most bears travelling into MA followed the Deerfield River drainage and did not cross Route 2. Male bears have also travelled west to the farm lands of Pownal and Bennington to feed in cornfields. Additionally, due to the movement of many of the study animals into MA, data is also being collected in relation to the Hoosic Wind Project in Florida and Monroe, MA.

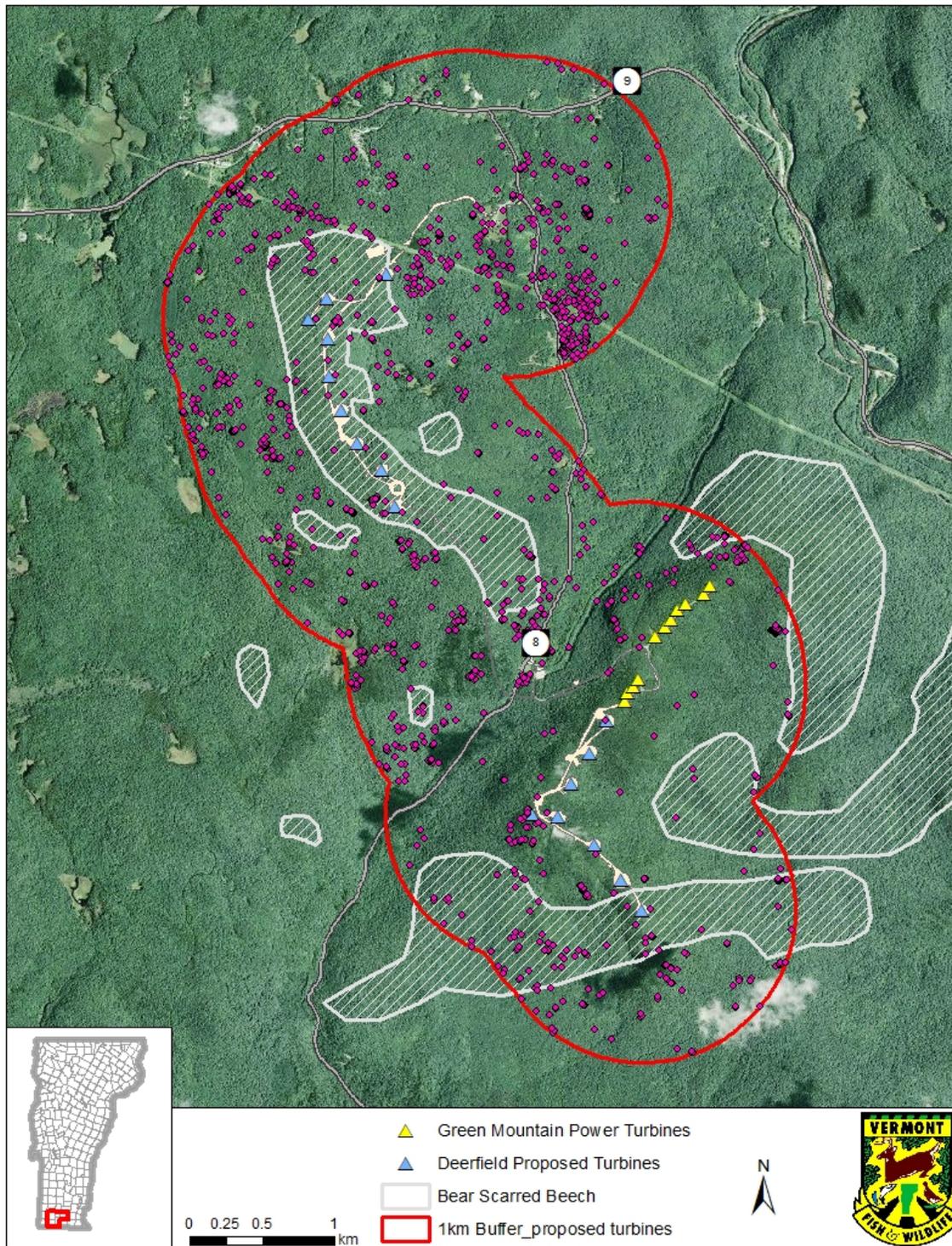


Figure 4. Bear locations (pink circles) within 1 kilometer of the DWEP (blue triangles) equal 1,631 (n=21), October 2011 – December 2014. Mapped bear scarred beech stands surrounding the DWEP are represented by white polygons.

## **PLANNED SCHEDULE OF WORK**

### **Habitat Mapping**

Bear scarred beech stands within the study area have been mapped and further field work to refine the boundaries of the stands will be done during the 2015/2016 winter season. Known BSB stands within the impact zone of the wind turbines will be re-evaluated and the maps improved. A substantial amount of the mature beech trees within these stands show signs of advanced beech bark disease or have already fallen in the years since the initial mapping was done by Iberdrola, Inc. and the USFS. It may be necessary to re-evaluate the boundaries of these stands. Additionally, other stands of BSB and oak that have been found throughout the study area will be mapped to determine their boundaries and overall size. Existing stand data provided by the U.S. Forest Service will be reviewed and incorporated into habitat mapping within the study area. This information will be used to help direct future mast surveys and to evaluate the relationship of black bears with hard mast sources within the study area.

### **Monitoring Study Animals**

It has been a challenge to capture and maintain collars on 12 study animals due to the difficulty in capturing the black bears within the study area, keeping the collars on them, and the problems associated with collar malfunctions. After five years of effort the problems associated with capturing and maintaining collars on the study animals have been mostly resolved. At this time we are actively researching other GPS collar manufacturing companies for a more reliable product and a company having better customer service. To increase the number and quality of study animal locations within the area of the proposed wind project we are also considering switching from Satellite collars to GPS collars having Store-On-Board (SOB) or Virtual Fence capabilities.

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## **Appendix A.**

People who have assisted with field work related to the Deerfield Wind Bear Study.

Abrams, Robert	Luke, Dan
Acabbo, Robert	Markowski, Adam
Adler, Mary Beth	McDonald, Trent
Agdere, Lena	Mewes, Dennis
Austin, Jake	Montgomery, Owen
Austin, John	Morton, Erin
Bennett, Alyssa	Morton, Tim
Bent, Lisa	Ogorzalek, John
Bernier, Chris	Phalen, Carey
Bernier, Olivia	Pogmore, Fred
Blodgett, Doug	Pyne, Lawrence
Buttle, Travis	Rhode, Galen
Comeau, Nancy	Rogers, Tom
Costello, Cecily	Sausville, Dave
Cottrell, Walt	Schiller, Amie
Darling, Ryan	Senecal, Dave
Darling, Scott	Senecal, Mike
Diego, Mary	Smith, Peter
Disorda, Jeff	Smith, Ryan
Disorda, Kerigan	Stratton, Elizabeth
Dobert, Ted	Tidhar, David
Drasher, Caitlin	Watkin, Rich
Drury, Charlee	Wixsom, Scott
Elizondo, Greg	
Fleming, Jill	
Garrison, Bill	
Gaudreau, Paul	
Habig, Chase	
Habig, Neil	
Harrington, Emma	
Hurst, Aaron	
Jackman, Mitchell	
Kulis, Richard	
LaPlante, Jessica	
LeQuier, Stephanie	
Lindholm, Jane	
Lockerby, Courtney	
Lockerby, David	