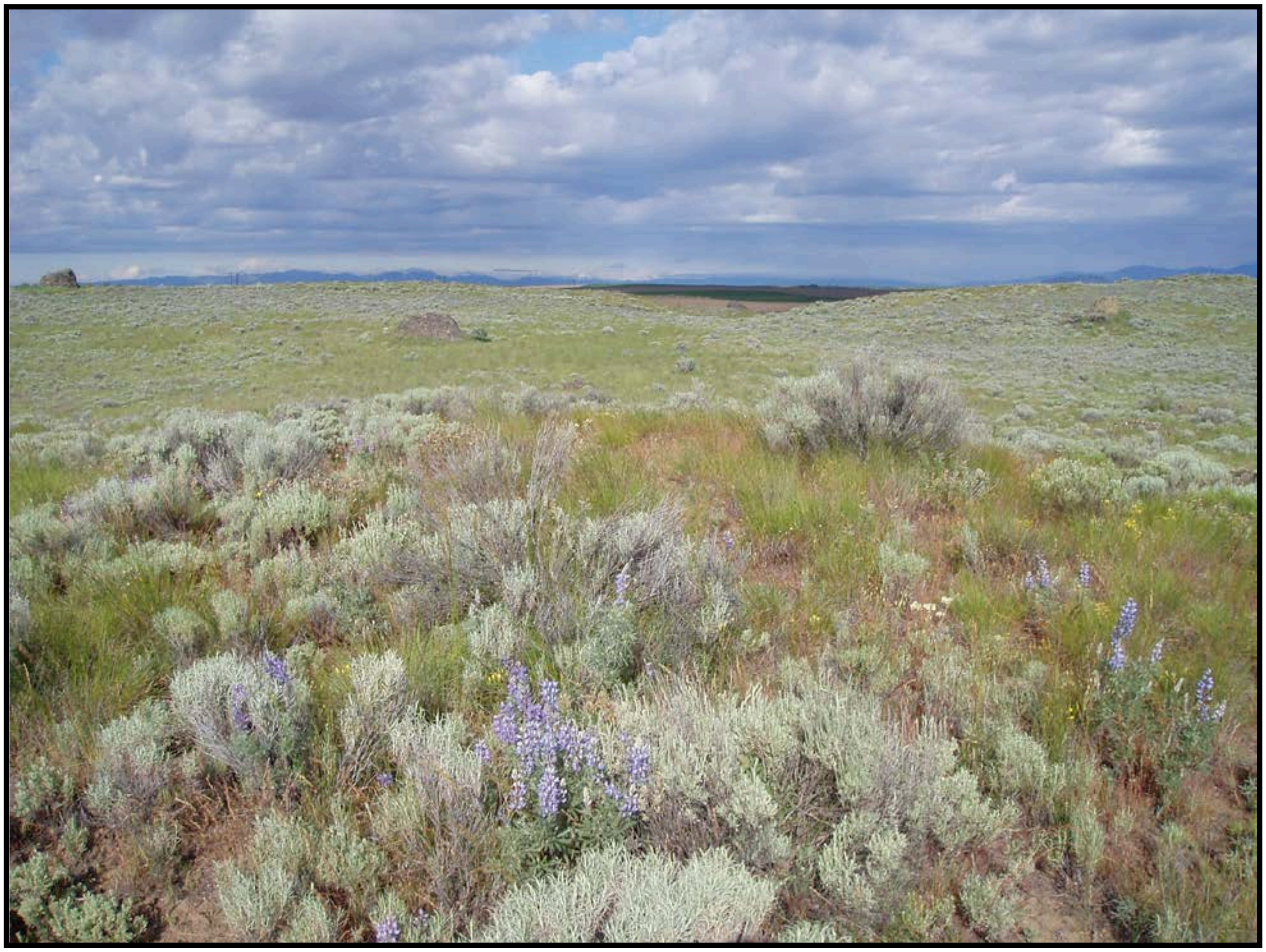
State of Washington May 2014

Monitoring of Greater Sage-Grouse and other Breeding Birds on the Withrow Wind Power Project Site: Final Report



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Washington Department of
Fish and Wildlife
Wildlife Program
Science Division

Monitoring of Greater Sage-Grouse and other Breeding Birds on the Withrow Wind Power Project Site: Final Report

Final report to
Douglas County PUD

May 2014

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Recommended Citation:

Schroeder, M. A., and W. M. Vander Haegen. 2014. Monitoring of greater sage-grouse and other breeding birds on the Winthrow Wind Power Project Site. Final Report. Washington Department of Fish and Wildlife, Olympia, WA.

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ABSTRACT

In 2010 and 2011 we documented the abundance of greater sage-grouse (*Centrocercus urophasianus*) and other breeding birds in an area proposed for wind power development in Douglas County, Washington State. The original project goal was to document wildlife use of the site before and after wind power development. However, because the construction project did not proceed, this report summarizes the data collected during the planned "pre-construction" phase of the project. We also present the results of some preliminary analyses on wildlife use of the area relative to existing habitat and landscape variation (both natural and anthropogenic) and recommendations for post-construction sampling and analysis. Specific objectives of the research were to assess the effects of wind turbines and related infrastructure on 1) occurrence and relative abundance of passerine birds, 2) attendance at leks by greater sage-grouse, and 3) use of habitats by greater sage-grouse on and near the project area. We detected 8937 individuals of 37 species during breeding bird surveys in 2010–2011. The most common bird species documented on point-count bird surveys were Brewer's sparrow (*Spizella breweri*), vesper sparrow (*Pooecetes gramineus*), and western meadowlark (*Sturnella neglecta*). Modeling in Program Distance indicated that probability of detection for most species was influenced by observer whereas habitat type had little effect on detectability**.** A total of 15,078 sage-grouse pellets were identified during pellet count surveys. The presence of existing transmission lines was negatively correlated with the distribution of sage-grouse pellets. No male greater sage-grouse were detected on lek counts on the project site (n = 2 leks); 4 leks were monitored within 10 km of the nearest proposed turbine with an average attendance of about 26 males/lek. Point-counts, pellet counts, and lek counts conducted post-construction should provide sufficient data to examine response of breeding birds to wind power construction on this site. Distance sampling should be used for analysis of point count data and models should test for effects of observer and distance on detectability. Distance to transmission lines should be included in models examining effects of wind power projects on use of habitats by greater sage-grouse.

ACKNOWLEDGEMENTS

This project was funded by the Douglas County Public Utilities District (PUD). We thank B. Patterson (PUD) for coordinating funding and for access to digital data layers of the proposed wind power project. We received a great deal of cooperation from many landowners in the region who graciously permitted access to their lands. This project would not have been possible without field assistance from Rose Winchell, Rebecca Cahall, Quick Yeates, and Jill Harper. In addition, countless biologists have collected data on greater sage-grouse in the area for many years including E. Anderson, D. Antoine, P. J. Bartels, D. E. Baughman, E. Braaten, G. L. Brady, L. Cooke, S. F. DeGrood, F. C. Dobler, R. C. Friesz, J. Gallie, M. Hallet, G. J. Hickman, S. Johnston, D. Larson, L. Lillquist, M. F. Livingston, T. C. McCall, J. L. Musser, B. Patterson, W. T. Pedersen, D. J. Peterson, J. W. Scolville, J. E. Tabor, T. Thompsen, D. Volsen, L. Wadkins, and D. L. Zeigler. We thank G. Olson for review and comments on the Distance analysis, I. Keren for comments on the pellet count analysis, and L. A. Robb for editorial comments. Substantial financial support for lek surveys was provided by the Washington Department of Fish and Wildlife through the Federal Aid in Wildlife Restoration Project W-96-R.

INTRODUCTION

Shrubsteppe historically was the dominant habitat in eastern Washington (Daubenmire 1970). Daubenmire described shrubsteppe as vegetative communities consisting of one or more layers of perennial grass with a conspicuous but discontinuous overstory layer of shrubs, usually big sagebrush (*Artemisia tridentata*). The quantity, quality, and configuration of shrubsteppe have been adversely affected by habitat conversion for crop production (Buss and Dziedzic 1955, Vander Haegen et al. 2000) and hydropower (Howerton 1986); a differentially high loss of deep-soil communities (Dobler et al. 1996, Vander Haegen et al. 2000); fragmentation through habitat conversion, roads, power lines, and fences (Vander Haegen et al. 2000); and alteration of the vegetation through over-grazing, invasion by exotic plants, and changes in fire frequency (Yensen et al. 1992, Pashley et al. 2000, Vander Haegen et al. 2000). Today, less than 40% of the shrubsteppe remains, and much of it is degraded, fragmented, and/or isolated from other similar habitats (Jacobson and Snyder 2000). Shrubsteppe is considered a priority habitat within the state of Washington (Washington Department of Fish and Wildlife 2001) that warrants special management considerations due to threats from human-associated causes.

Loss and degradation of extensive shrubsteppe communities has greatly reduced the habitat available to a wide range of shrubsteppe-associated wildlife including several bird species restricted to this community type (Quigley and Arbelbide 1997, Saab and Rich 1997, Vander Haegen et al. 2000). Sagebrush sparrow (*Artemisiospiza nevadensis*), Brewer's sparrow, sage thrasher (*Oreoscoptes montanus*), and greater sage-grouse are considered shrubsteppe obligates and numerous other species are associated primarily with shrubsteppe at a regional scale. In an analysis of birds at risk within the interior Columbia River Basin, most species with "high management concern" were shrubsteppe species. Moreover, according to the Breeding Bird Survey, half these species have experienced long-term declines in their populations (Saab and Rich 1997). In Washington, greater sage-grouse, sharp-tailed grouse (*Tympanuchus phasianellus*), and ferruginous hawk (*Buteo regalis*) are listed as state threatened, and sagebrush sparrow, sage thrasher, loggerhead shrike (*Lanius ludovicianus*), and golden eagle (*Aquila chrysaetos*) are listed as state candidate species.

One potential threat to shrubsteppe-associated wildlife and the habitats upon which they depend is wind-power generation facilities. Wind-generated electricity is increasingly recognized as an important option for addressing energy needs within the state of Washington. In addition to augmenting energy needs, wind power is considered renewable and is encouraged by law. Because shrubsteppe is often the dominant habitat in areas with the best wind resources, there is potential for conflict between the needs for wind power and the needs for shrubsteppe and shrubsteppe-associated wildlife. This potential conflict can be attributed to the physical footprint of the wind power facility (amount of shrubsteppe permanently converted), the ecological footprint (e.g., displacement of shrubsteppe-associated wildlife, increase in noxious weeds, etc.), and direct mortality due to wind turbines and activities associated with power generation and transmission. Although the mortality effects of wind turbines on wildlife (impact mortality) have been examined, the potential effects on populations are largely un-explored.

The purpose of this research was to examine the potential impacts of the Withrow Wind Power Project (WWPP) in shrubsteppe-dominated habitat north of Withrow, Washington.

Because construction of the WWPP had not begun, there was ample opportunity to obtain pre-construction data on both the project site and on nearby control sites not slated for development. Although the original plan for this research was to examine wildlife before construction of the wind power facilities and post construction, postponement of the project eliminated the second portion of this research. Regardless, we retained the original objectives as written in the project proposal and as carried out in the first two "pre-treatment" years of the project. The three primary objectives of this research were as follows:

1) Assess the effects of wind turbines and related infrastructure on occurrence and relative abundance of passerine birds breeding on and near the project area.

2) Assess the effects of wind turbines and related infrastructure on attendance at leks by greater sage-grouse at points relatively near (< 10 km) and far (>10 km) from the project area.

3) Assess the effects of wind turbines and related infrastructure on use of habitats by greater sage-grouse on and near the project area.

STUDY AREA AND METHODS

Study area

The WWPP is centered approximately 8 km NNW of Withrow and 15 km WSW of Mansfield, Douglas County, Washington State. The project area straddles the terminal moraine of the Okanogan Lobe of the Cordilleran ice sheet. The area was historically shrubsteppe, but is now a mix of extant shrubsteppe (~25%), wheat (~50%), and agricultural lands enrolled in the Conservation Reserve Program (CRP, ~25%). The current habitats of the area are intermixed as relatively small patches, largely due to the rocky substrate of the glacial moraine and the area north of the moraine.

Habitat and wildlife data were collected in reference to pre-determined plots on the WWPP site, and on adjacent control sites. In 2010, a grid containing approximately 700 plots spaced at 300 m intervals was designed to encompass the WWPP site and adjacent shrubsteppe and/or CRP habitat (outward approximately 5 km from the WWPP site). We established and marked 298 study plots on this grid (Fig. 1); many plots were rejected because the habitat was dominated by wheat and thus not favorable for wildlife. Locations of individual study plots were "adjusted" up to 50 m in the field to improve visibility for data collection while maintaining a distance of at least 250 m between adjacent plots. Each selected plot was marked in the center with a fiberglass stake and points were marked at 50 and 100 m outward from the center stake in each cardinal direction with a bamboo stake; all stakes were flagged to increase their visibility.

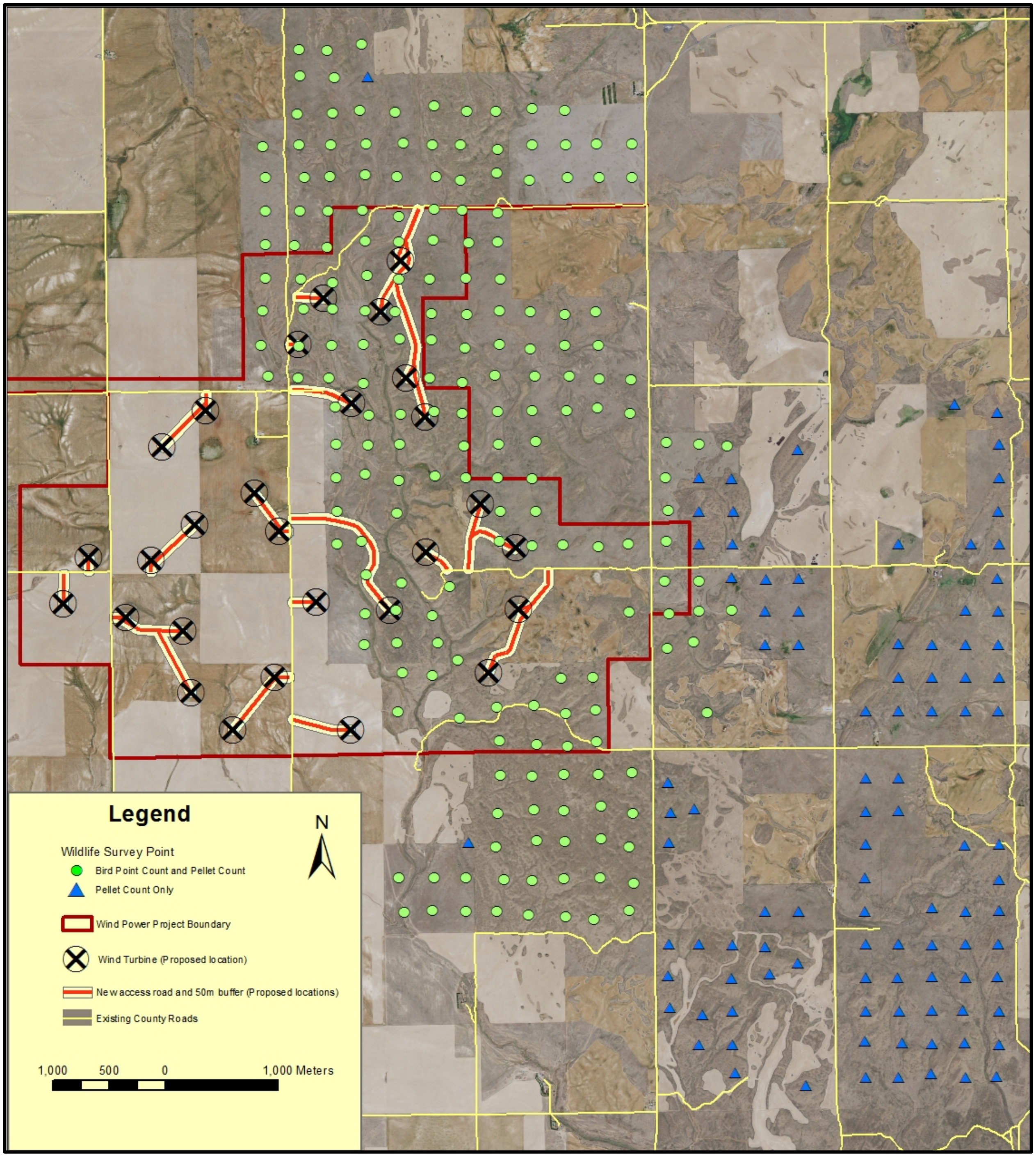

Fig 1. Configuration of survey points relative to the proposed Withrow Wind Power Project approximately 15 km WSW of Mansfield, Washington. Landcover in the project area to the west of the survey point grid was predominantly cultivated land planted to winter wheat.

Vegetation sampling

Within each 100 m-radius study plot we estimated the proportion of the circle occupied by native shrubsteppe and by CRP. Where >1 habitat type occurred within the circle we randomly sampled each habitat. We characterized vegetation at each point using 15 x 6.67 m (100 m^2) rectangular plots randomly located and oriented within each habitat type. Colored flags were placed at set distances along the plot boundary to create "subplots" and assist with cover estimation. We visually estimated percent cover of shrubs, perennial grasses, and forbs as one of nine categories: (1) ≤1%, (2) >1–5%, (3) >5–15%, (4) >15–25%, (5) >25–35%, (6) >35–50%, (7) >50–75%, (8) >75–95%, and (9) >95%. We also estimated percent cover of each shrub species and recorded the grass species dominant on the plot. All vegetation sampling was conducted during July and August of 2011. We also took digital photographs in the 4 cardinal directions from each of the 289 survey points to document the vegetation structure.

Bird surveys

Breeding bird surveys were conducted at 199 of the 298 established plots that were on, or within 1.5 km of the WWPP site (Fig. 1). Surveys were conducted between 20 minutes before sunrise to 0800; most days we completed surveys by 0700. All birds detected during a 5-minute survey period were recorded along with their sex (if known), age (adult/juvenile), activity (singing, calling, visual-only), and distance from the center of the plot (Ralph et al. 1993). Detections were binned into 6 distance categories (0–25, 25–50, 50–75, 77–100, 100–150, and >150m). We estimated distances with the aid of a laser range finder and with marker flags placed at 50 m and 100 m intervals in the 4 cardinal directions from the center of the plot (See Appendix A). In 2010, surveys were conducted during three separate periods: 26 April–12 May; 17 May–3 June; and 7 June–22 June. During 2011, the number of surveys was reduced to two (4 May–20 May and 3 June–29 June).

We used program DISTANCE (Buckland et al. 2001) to estimate bird densities and to evaluate potential effects of observer and habitat on probability of detecting individual species. We used all observations including visual, singing, and calling. Observations in the field were made while standing at the center point and attributing each observation to 6 distance bins. We retained these groupings for the analysis, truncating observations at 150 m (excluding the outermost distance bin) to improve model fit near zero (Buckland et al. 2001). We used the Hazard-rate model with cosine adjustment because of its simplicity and our limited number of distance categories (Thompson and Sorte 2008).

Because the study site was comprised of two primary habitat types (CRP and native shrubsteppe) we used a subset of points to test for differences in detection probably that might influence density estimates. We used survey points where the 100 m-radius circle was ≥90% in a single habitat type (75% of the 199 points) in this analysis. For each species, we ran 3 models: an observer model that allowed detection to vary among observers, a habitat model that allowed detection to vary between habitats, and a "dot" model that assumed no variation in detection rate. We used post-stratification for the observer and habitat models. When the observer model performed better than the dot model (delta AICc >2) we tested a second habitat model based on data from the observer with the greatest number of observations and used AICc to compare the observer-specific habitat model to the dot model for that observer. We then used the full data set (all 199 points) to estimate density for each of the 7 species.

Pellet counts

Greater sage-grouse pellets were identified (Schroeder et al. 1999, Fig. 2), counted, and removed within circular 200 m^2 plots centered on all eight of the 50 m and 100 m bamboo stakes radiating outward from each of the 298 established points (including 99 points that were not used for

Fig. 2. Sample pellets for grouse in the proposed Withrow Wind Power Project (approximately 15 km WSW of Mansfield, Washington). The upper left photo is an example of sage-grouse pellets that are a few months old, the upper right photo shows fresh sage-grouse pellets adjacent to a caecal dropping (dark greenish brown when fresh, black when older), the lower left photo is a sage-grouse clocker pellet (large group of compacted pellets deposited by incubating female), and the lower right photo shows sharp-tailed grouse pellets (Tympanuchus phasianellus; pellets are smaller than sage-grouse and usually found in grassier habitat).

breeding bird surveys, Fig. 1, Appendix B). Although 200 m^2 is a fairly large area to survey, the surveys were conducted as 4 concentric 2-m wide belts around the center stake. Sage-grouse deposit pellets throughout the year, but the vast majority of detectable pellets are deposited in autumn, winter, and early spring when the sage-grouse diet is primarily sagebrush. Pellets deposited during late spring and summer tend to be less persistent because of the relatively moist diet of sage-grouse during this time of year (Schroeder et al. 1999). The majority of observed pellets likely represent distinct seasons; the fresh pellets (light brown with a hint of dull yellow) from the recent autumn-spring period and the old pellets (grayish-brown) from previous autumn-spring periods. In addition to sage-grouse pellets, pellets for mule deer (*Odocoileus hemionus*, Fig. 3), jackrabbit (*Lepus* spp., likely white-tailed jackrabbit—*Lepus townsendii*, Fig. 3), Washington ground squirrel (*Spermophilus washingtoni*), porcupine (*Erethizon dorsatum*), cottontail (*Sylvilagus* spp., Fig. 3), gray partridge (Fig. 3, *Perdix perdix*), and ring-necked pheasant (*Phasianus colchicus*) were also identified, but not removed.

Fig. 3. Sample pellets in the proposed Withrow Wind Power Project (approximately 15 km WSW of Mansfield, Washington). The upper left photo is an example of white-tailed jackrabbit pellets, the upper right photo shows cottontail pellets, the lower left photo shows a gray partridge pellet, and the lower right is a photo is of mule deer pellets.

Lek counts

The greater sage-grouse population was monitored on and near the project area by recording the maximum number of males detected on traditional breeding sites (leks, Schroeder et al. 2000). We monitored 4 leks within 10 km of the project boundary 13 leks 10–30 km from the project boundary. Annual instantaneous rates of change were determined between 2002 and 2012 for 10 annual intervals. Rates of change were estimated as the natural logs of the total males counted on a group of leks (on project area, or off project area) in 1 year divided by the total males counted on the same leks the previous year (Garten et al. 2011). Rates of change were then used to back-estimate population size for each of the 11 years. This technique to monitoring leks has been used since 1955 and has been shown to effectively document population responses to management practices such as the CRP (Connelly et al. 2004, Schroeder and Vander Haegen 2011). We separated leks into two groups for analysis, those within 10 km of the project boundary and leks farther than 10 km from the project boundary. To limit the scope of the analysis, only leks north of U.S. Highway 2 and east and south of Washington Highway 17 were included. This eliminated from consideration leks that were more than about 30 km from the project area boundary.

RESULTS

Study plots relative to proposed tower locations

Study plots were established on a grid to provide a suitable sampling frame relative to the proposed tower locations as provide by the PUD in 2010 (Fig. 1). Assessment of the distribution of plots relative the nearest proposed wind turbine showed that plots were well represented at distances out to 2000m (Fig. 4).

Vegetation sampling

The 3.1ha circular plots (100 m radius) surrounding each of the 297 sampling points were dominated by either native shrubsteppe or CRP fields in approximately equal proportion (51 vs. 49%, respectively). Wheat made up a very small portion of the sites due to the avoidance of wheat when setting up the plots. We sampled a total of 215 vegetation plots in shrubsteppe and 183 plots in CRP. The dominant grass on shrubsteppe plots was bluebunch wheatgrass (*Pseudoroegneria spicata*, 74% of sites), followed by Idaho fescue (*Festuca idahoensis*) and Sandberg's bluegrass (*Poa secunda*, each at 8%). Dominant grasses in CRP were crested wheatgrass (61%), bluebunch wheatgrass (13%), intermediate wheatgrass (*Thinopyrum intermedium*, 11%), and a cultivar of Sandberg's bluegrass, Sherman big blue (20%). Other grasses on the site included needle and thread grass (*Hesperostipa comata*), prairie junegrass (*Koeleria macrantha*), and smooth brome (*Bromus inermis*). Shrub cover on shrubsteppe sites averaged 22% with most sites (94%) dominated by sagebrush (big sagebrush or three-tip sagebrush, *Artemisia tripartita*) (Table 1). Shrub cover on CRP sites averaged 14% with most sites dominated by sagebrush; 34% of sites were dominated by rabbitbrush (*Chrysothamnus viscidiflorus* and *Ericameria nauseosa*). Other shrubs on the site included stiff sage (*A. rigida*), antelope bitterbrush (*Pursia tridentata*), horsebrush (*Tetradymia canescens*), wax current (*Ribes cereum*), and Ponderosa pine (*Pinus ponderosa*). Forb cover averaged 17% throughout the area, regardless of whether the site was dominated by CRP or shrubsteppe. Forbs were not identified to species.

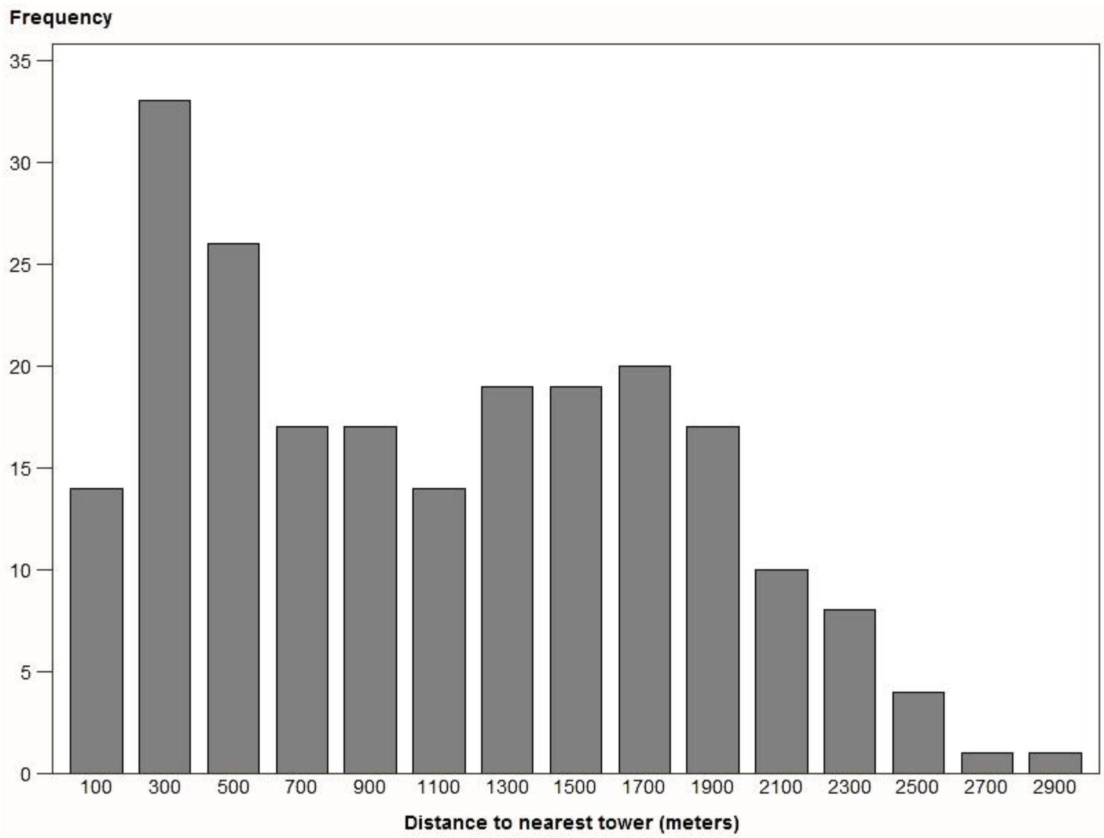

Fig. 4. Frequency of sampling points as a function of distance to nearest proposed turbine location. Bars represent the mid-point of 200m distance bins out to 3000 m. Each sampling point is represented only once.

Table 1. Vegetation measurements on 298 plots in shrubsteppe and CRP habitats within 100 m radius survey circles surrounding sampling points on the Withrow Wind Power Project study area, 2011.

	Shrubsteppe (*n*=215)				CRP (*n*=183)			
Parameter	Average	SD	Min	Max	Average	SD	Min	Max
Shrub cover	21.64	10.76	2	70	14.33	11.73	0	60
Sagebrush cover	10.49	11.02	0	60	7.95	10.12	0	54
Grass cover	53.52	11.84	20	78	63.35	15.67	15	91

Bird surveys

We detected 8937 individuals of 37 species during breeding bird surveys in 2010–2011. Brewer's sparrow, vesper sparrow, western meadowlark, horned lark, and grasshopper sparrow were detected most frequently (Table 2). An additional 7 species were observed on the site, but were either not detected during breeding bird surveys or were far (> 150 m) from the survey point (Table 3). We modeled detectability of the 7 species with >100 detections, excluding white-crowned sparrow because this species was migrating through the site and is not known to nest in the area.

Modeling in Program Distance indicated that probability of detection for most species was influenced by observer, indicating that observers varied in their ability to see and/or hear particular species (Table 4). Observer effects were not apparent for grasshopper sparrow and sage thrasher. Models with a parameter for habitat had lower AICc values than dot models only for Brewer's sparrow indicating that detectability was influenced by habitat type only for this species. However, the observer model was the stronger model for Brewer's sparrow indicating that habitat effects could be confounded with observer effects. Where observer effects were apparent and sample size adequate we created additional models constrained by observer and modeled the effects of habitat using the observer with the most detections for that species. In all cases (including Brewer's sparrow) there was no indication that habitat affected detectability; AICc values for models with Habitat were greater than that of the DOT models (Table 4).

Sample size was sufficient to estimate probability of detection and detection radius by habitat type for 5 species (Table 4). Both probability of detection and estimated detection radius for grasshopper sparrow, horned lark, vesper sparrow and western meadowlark were similar in CRP and shrubsteppe; for Brewer's sparrow these parameters were slightly lower in shrubsteppe compared to CRP (Table 4). We were able to estimate density for 7 species from survey data (Table 5). Because detection distance varied by observer and observers were unique within years, we used Program Distance to generate pooled estimates for each year. Brewer's sparrow and vesper sparrow occurred at the highest densities; density of several species varied considerably between years (Table 5).

Table 2. Species and total number of individuals counted on breeding bird surveys, Withrow Wind Power Project study area, 2010–2011; includes only species detected within 150 m of the plot center.

Common name	Scientific name	2010	2011	Total
Brewer's sparrow	*Spizella breweri*	1513	1006	2519
Vesper sparrow	*Pooecetes gramineus*	977	442	1420
Western meadowlark	*Sturnella neglecta*	434	599	1033
Horned lark	*Eremophila alpestris*	441	360	801
Grasshopper sparrow	*Ammodramus savannarum*	391	274	665
White-crowned sparrow	*Zonotrichia leucophrys*	349	68	417
Sage thrasher	*Oreoscoptes montanus*	209	170	379
Savannah sparrow	*Passerculus sandwichensis*	71	86	157
Mourning dove	*Zenaida macroura*	5	16	21
Say's phoebe	*Sayornis saya*	12	8	20
Brown-headed cowbird	*Molothrus ater*	5	13	18
Gray partridge	*Perdix perdix*	13	3	16
Loggerhead shrike	*Lanius ludovicianus*	8	3	11
Greater sage-grouse	*Centrocercus urophasianus*	7	3	10
Common raven	*Corvus corax*	2	8	10
Western kingbird	*Tyrannus verticalis*	1	9	10
Brewer's blackbird	*Euphagus cyanocephalus*	9	0	9
Northern harrier	*Circus cyaneus*	4	5	9
American kestrel	*Falco sparverius*	4	4	8
Rock wren	*Salpinctes obsoletus*	2	5	7
California quail	*Callipepla californica*	4	2	6
European starling	*Sturnus vulgaris*	4	1	5
Rock pigeon	*Columba livia*	4	0	4
Mountain bluebird	*Sialia currucoides*	0	4	4
Swanson's hawk	*Buteo swainsoni*	0	4	4
Barn swallow	*Hirundo rustica*	3	0	3
Merlin	*Falco columbarius*	0	3	3
Western wood-pewee	*Contopus sordidulus*	2	0	2
Eastern kingbird	*Tyrannus tyrannus*	0	2	2
Great horned owl	*Bubo virginianus*	1	0	1
Red-tailed hawk	*Buteo jamaicensis*	1	0	1
Red-winged blackbird	*Agelaius phoeniceus*	1	0	1
Lark sparrow	*Chondestes grammacus*	0	1	1
Lewis' woodpecker	*Melanerpes lewis*	0	1	1
Prairie falcon	*Falco mexicanus*	0	1	1
Short-eared owl	*Asio flameus*	0	1	1
Spotted towhee	*Pipilo maculatus*	0	1	1

Table 3. Species observed during field work on Withrow Wind Power Project study area, 2010– 2011, but not detected within 150 m of plot center during breeding bird surveys.

Common name	Scientific name
American robin	*Turdus migratorius*
Black-billed magpie	*Pica hudsonia*
Chipping sparrow	*Spizella passerine*
Dusky flycatcher	*Empidonax oberholseri*
Northern flicker	*Colaptes auratus*
Ring-necked pheasant	*Phasianus colchicus*
Warbling vireo	*Vireo gilvus*

Incidental observations of mammals were also common and included mule deer, coyote (*Canis latrans*), cottontail, chipmunk (*Tamias minimus*), porcupine, long-tailed weasel (*Mustela frenata*), and American badger (*Taxidea taxus*). Incidental observations of reptiles included pygmy short-horned lizard (*Phrynosoma douglassii*), yellow-bellied racer (*Coluber constrictor*), and Pacific gophersnake (*Pituophis catenifer*).

Pellet counts

We detected pellets from at least 11 species in 2,384 pellet counts (8 pellet counts for each of 298 plots). Greater sage-grouse pellets were detected on 608 (25.5%) of the 2,384 plots (Table 6). Pellets from mule deer and cottontail were the most common, but pellets were also detected for relatively uncommon species. For example, pellets that resembled those of Washington ground squirrels were detected on 13 of 2,384 counts. Five of these 13 observations were on the WWPP site and the others were east of Highway 172. All of these observations were in patches of native habitat; none were in CRP. Although we could not be certain that these pellets were from Washington ground squirrels, the locations are precise enough to be examined more closely at a later date.

Pellets from sage-grouse were collected from 2-m wide concentric circles around a survey stake. Because the amount of area contained in each concentric circle increases with distance from the stake, the number of pellets detected should also be higher in the outer concentric circles (Fig. 5). The number of pellets declined from 10,696 in 2010 to 4,383 in 2011. Because pellets were removed from plots in 2010, the decline was expected. This also occurred because pellets typically last for more than 1 year (Fig. 6). The ratio of pellets in 2010 to pellets in 2011 was 2.44, which suggests that pellets likely last for at least 2 years on average. Although the decline in pellets between 2010 and 2011 for sage-grouse was expected, the decline for other species was not (Table 6). It is not clear why the pellets for other species declined from one year to the next, but little is known about the persistence of fecal pellets in these habitat types.

Table 4. Models comparing effects of observer and habitat (Conservation Reserve Program fields [CRP] and shrubsteppe [SS]) on detection probability (dp) and effective detection radius (EDR) of breeding birds in point count surveys, eastern Washington, 2010-2011. Akaike's Information Criterion (AICc) was used to compare models. Only survey points (n = 149) where the dominant habitat composed ≥90% of the 100-m radius point-count circle were included. n = sample size in bird detections.

Species	Model[a]	Constraints[b]	AICc	Δ AICc	dp	EDR	n
Brewer's sparrow	dot		5847	133	0.30	82	1910
	Observer		5714	0			1910
	Habitat		5836	122			1910
		CRP			0.36	89	606
		SS			0.22	70	1304
	dot	Observer1	1575	1			530
	Habitat	Observer1	1574	0			530
		Observer1,CRP			0.47	103	151
		Observer1,SS			0.35	88	379
Grasshopper	dot		1284	1			471
	Observer		1283	0			471
	Habitat		1290	7			471
		CRP			0.38	92	344
		SS			0.33	86	127
Horned lark	dot		1774	87			630
	Observer		1687	0			630
	Habitat		1780	93			630
	dot	Observer1	448	0			165
	Habitat	Observer1	454	6			165
		Observer1,CRP			0.66	122	122
		Observer1, SS			0.62	118	43
Sage thrasher	dot		698	2	0.98	149	288
	Observer		696	0			288
	Habitat		700	4			288
Savannah sparrow	dot				0.28	79	136
Vesper sparrow	dot		3101	30	0.47	103	1056
	Observer		3071	0			1056
	Habitat		3107	36			1056
		CRP			0.50	107	423
		SS			0.44	100	633
	dot	Observer1	1283	0			455
	Habitat	Observer1	1296	13			455
		Observer1,CRP			0.59	116	170
		Observer1,SS			0.63	119	285

Table 4. Continued							
Species	Model[a]	Constraints[b]	AICc	Δ AICc	dp	EDR	n
W. Meadowlark	dot		1682	35			760
	Observer		1647	0			760
	Habitat		1684	37			760
	dot	Observer2	435	0			154
	Habitat	Observer2	442	7			154
		Observer2,CRP			0.39	93	60
		Observer2,SS			0.47	103	94

[a]Dot models assumed no effect of observer or habitat on detectability; Observer models include the effect of the 4 different observers; Habitat models included the effect of 2 habitats.

[b]When the Observer model outperformed the dot model ($\Delta AIC_c > 2$) we created additional models constrained to include only the observer with the largest number of observations (where sample size allowed) for subsequent examination of potential habitat effects.

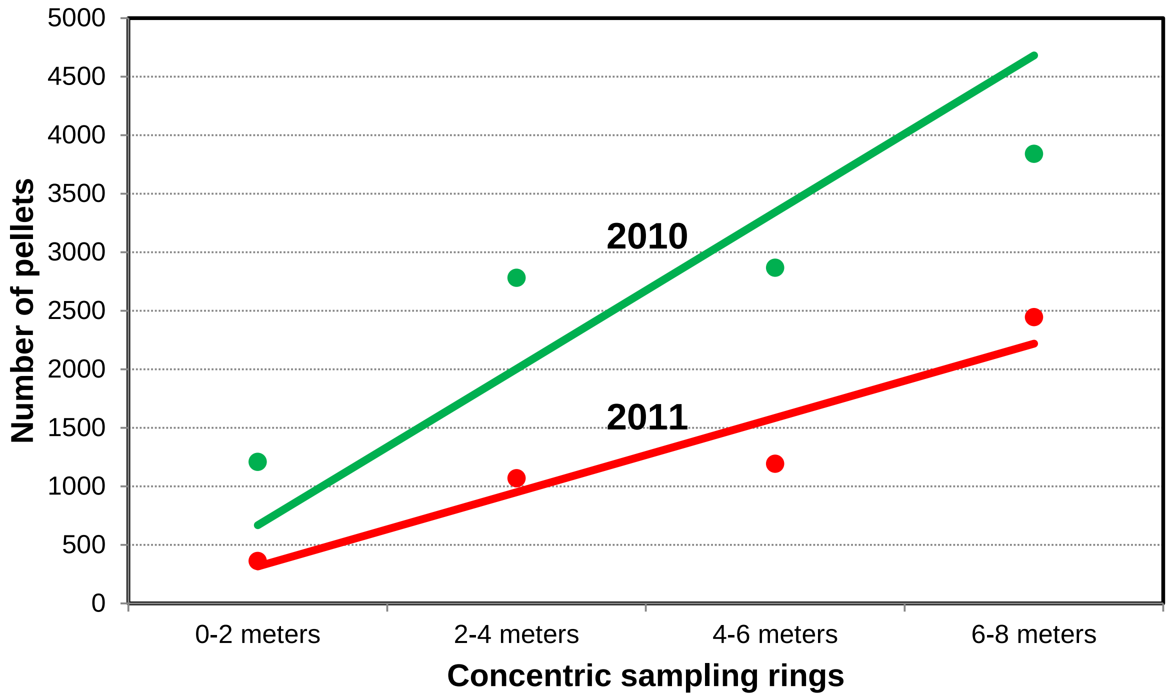

Fig. 5. Abundance of greater sage-grouse pellets within 4 concentric sampling rings at 2,384 points associated with 298 plots on and near the Withrow Wind Power Project. The lines represent the expected observations based on the amount of area in each concentric ring. The higher number of pellets detected in 2010 was due to the persistence of pellets (longer than a year) and the removal of pellets in 2010.

Table 5. Density (individuals/hectare) and projected 95% confidence intervals for species detected on breeding bird surveys, Withrow Wind Power Project study area, 2010-2011.

Common name	2010		2011	
	Estimate	CI	Estimate	CI
Brewer's sparrow	0.47	0.34-0.66	1.02	0.85-1.23
Grasshopper sparrow	0.16	0.09-0.29	0.25	0.11-0.56
Horned lark	0.07	0.04-0.13	0.16	0.09-0.29
Sage thrasher	0.05	0.04-0.06	0.07	0.06-0.10
Savannah sparrow	0.05	0.04-0.07	0.11	0.04-0.27
Vesper sparrow	0.34	0.26-0.44	0.16	0.10-0.26
Western meadowlark	0.05	0.04-0.06	0.14	0.09-0.26

Table 6. Abundance and presence of pellets from counts on and near the Withrow Wind Power Project study area, 2010. Percent is from a total of 2384 points associated with 298 study plots (8 points per plot).

Species	Abundance (pellets)		Occurrence at 2,384 Points (%)			Occurrence on 298 Plots (%)		
	2010	2011	2010	2011	Combined	2010	2011	Combined
Greater sage-grouse[a]	10,696	5,071	18.9	10.5	25.5	57.7	41.9	71.8
Sharp-tailed grouse[a]	2	221	0.0	0.5	0.6	0.3	4.0	4.4
Mule deer			76.6	58.9	85.7	99.0	92.6	99.3
Cottontail			28.3	21.4	36.1	57.7	48.7	68.1
Jackrabbit			18.5	8.6	23.0	48.0	29.2	54.4
Cow			17.2	13.8	18.2	24.8	17.1	25.5
Gray partridge			15.0	2.7	17.1	57.4	16.8	63.1
Coyote			6.1	3.2	8.4	35.9	19.5	44.6
Owl			2.7	0.8	3.4	17.4	6.7	22.5
Porcupine			0.3	0.0	0.3	2.0	0.3	2.3
Washington ground squirrel			0.2	0.0	0.2	1.7	0.0	1.7

[a]The greater sage-grouse and sharp-tailed grouse sampling was done with removal of pellets in 2010; pellets for other species were not removed. Abundance of pellets was counted only for grouse.

The distribution and abundance of sage-grouse pellets was examined relative to key features of the habitat and landscape including percent of native habitat on the plot, shrub cover, big sagebrush cover (subset of shrub cover), grass cover, forb cover, noxious weed cover, bare ground cover, distance to the nearest lek, distance to Washington Highway 172, and distance to the nearest transmission line (Table 7). The only factor that was consistently significant was distance to the nearest transmission line (Fig. 7). The transmission lines considered in this analysis were the 220 kV line bisecting the study area (originally planned for use with the WWPP) and the larger kV lines transferring power from Chief Joseph Dam to the north-northeast. The negative effect of the transmission lines appears to extend outward approximately 1 km; plots closer to the line had significantly fewer pellets (Fig. 8).

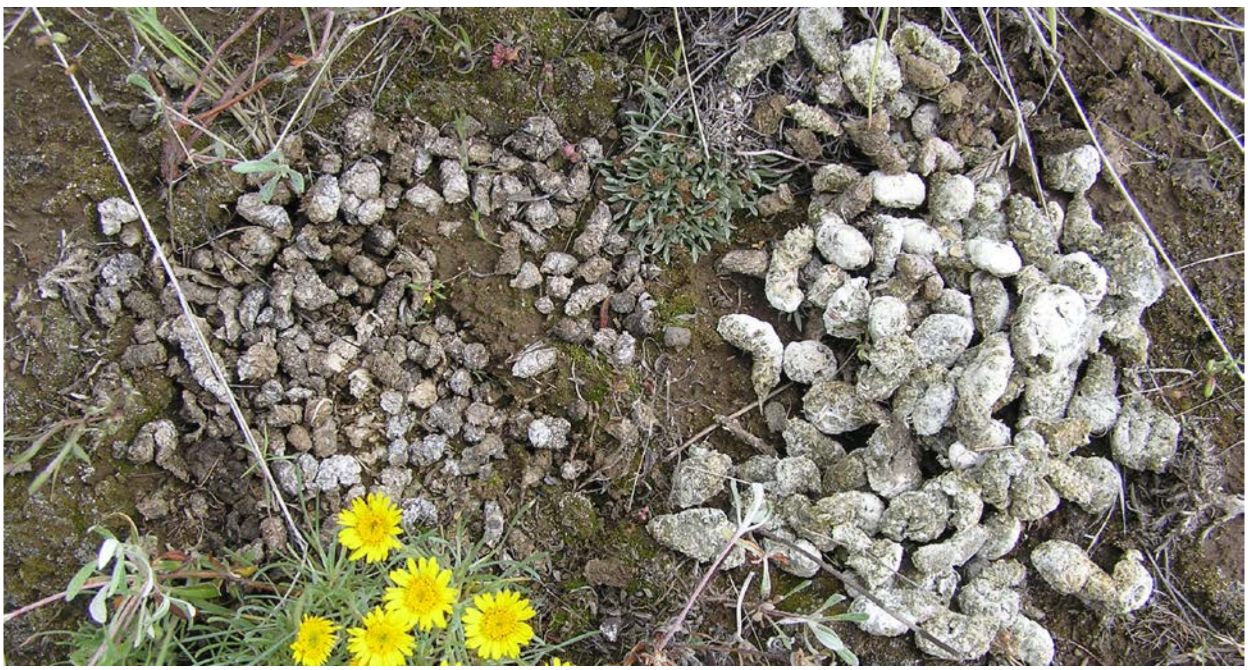

Fig. 6. Photo taken on 9 June 2011 showing greater sage-grouse pellets identified in 2010 on the left and pellets from the current year on the right. The size difference can be due to age of the pellet and sex and age of the bird; pellets from males are larger.

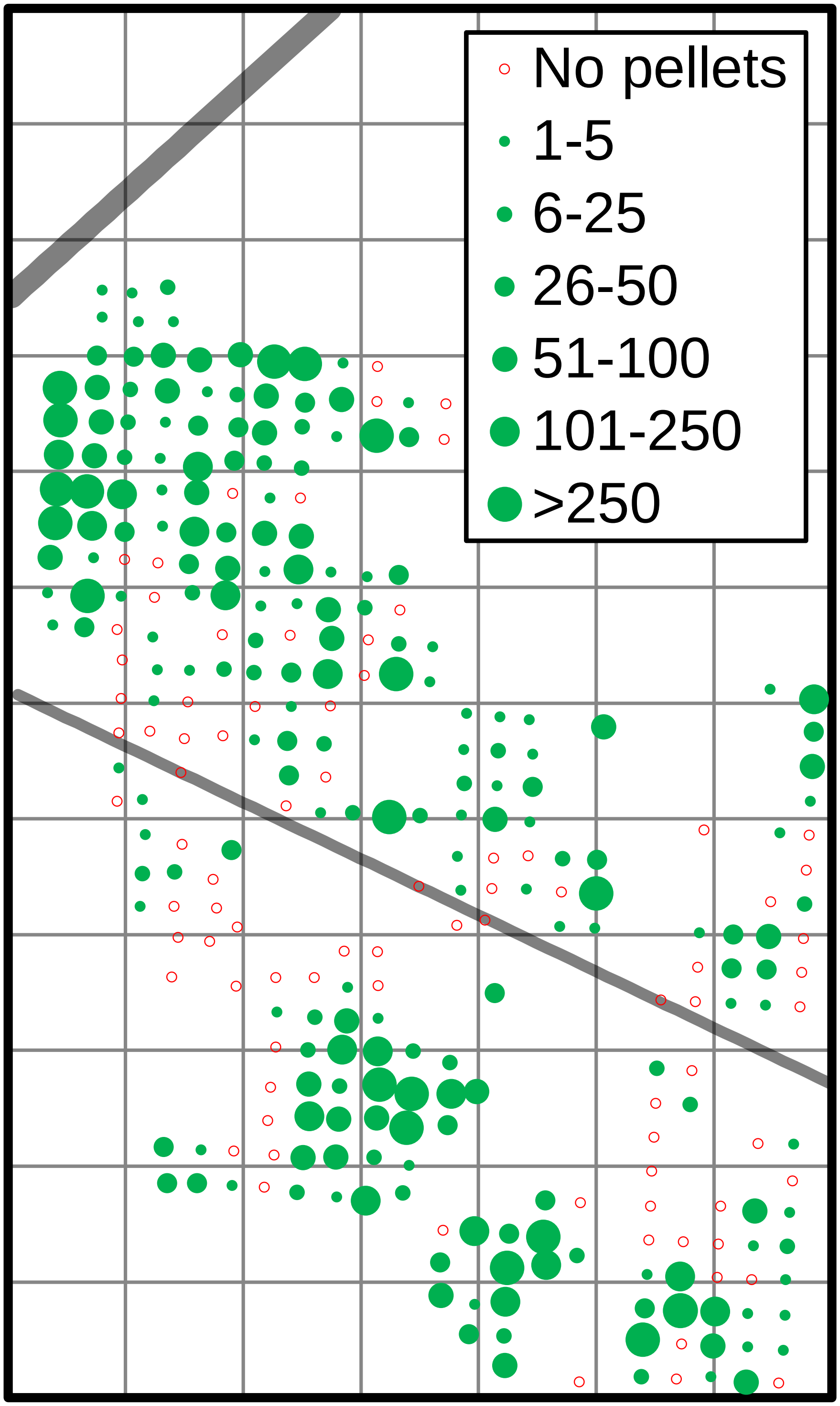

Fig. 7. Distribution of sage-grouse pellets detected on 298 study plots on and near the Withrow Wind Power Project (WWPP). The transmission lines are represented by dark gray diagonal lines (narrower line is the 220 kV line through the WWPP area and the wider line comes from the Chief Joseph Dam). Each grid cell is 1 km².

Table 7. Analysis of greater sage-grouse pellet counts (abundance and presence) relative to habitat and landscape features on and near the Withrow Wind Power Project, 2010-2011. Pellet data was combined for each of 8 pellet counts for each of 298 survey plots (roughly 1,600 m^2 of survey area per plot).

Parameter	Abundance[a]		Presence-absence[a]	
	F	P	Chi-square	P
Proportion of native habitat in plot	0.42	0.5161	0.63	0.4291
Shrub cover	2.20	0.1391	2.39	0.1224
Big sagebrush cover	0.24	0.6240	2.93	0.0868
Grass cover	0.09	0.7650	0.86	0.3526
Forb cover	0.06	0.8139	0.00	0.9863
Noxious weed cover	0.04	0.8429	0.34	0.5600
Bare ground cover	0.48	0.4874	0.66	0.4165
Distance to the nearest lek	3.24	0.0728	0.01	0.9112
Distance to Washington Highway 172	0.13	0.7172	0.04	0.8505
Distance to nearest transmission line	3.98	0.0471	13.02	0.0003

[a]The assessment of abundance was conducted with a general linear model and the assessment of presence-absence was conducted with a logistic regression.

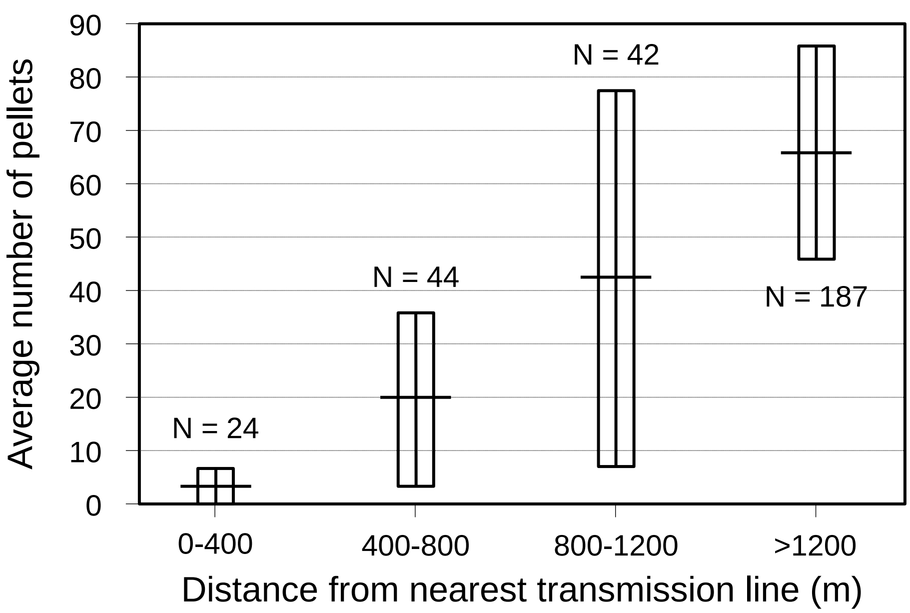

Fig. 8. Average number of greater sage-grouse pellets on 298 survey plots relative to distance to the nearest transmission line on and near the Withrow Wind Power Project (WWPP), WSW of Mansfield, Washington, 2010–2011.

Lek counts

Counts of male sage-grouse on leks in Douglas County indicated that no males were detected on the WWPP site during the breeding season. These data were consistent with data obtained prior to 2010. Four leks were monitored within 10 km of the nearest proposed turbine with a maximum male attendance of 11 (5 km), 46 (7 km), 36 (9 km), and 20 (10 km); average of about 26 males/lek. Thirteen additional leks 10–30 km from the WWPP site (total of 299 males with an average of 28 males/lek) were monitored in Douglas County. Sage-grouse abundance was variable between 2002 and 2012 (Fig. 9), but showed slight declines (0.83% decline among 13 leks in the control area [10–30 km from project area] and 2.67% decline among the 4 leks in the treatment area [<10 km from project area]). The declines did not appear to be significant.

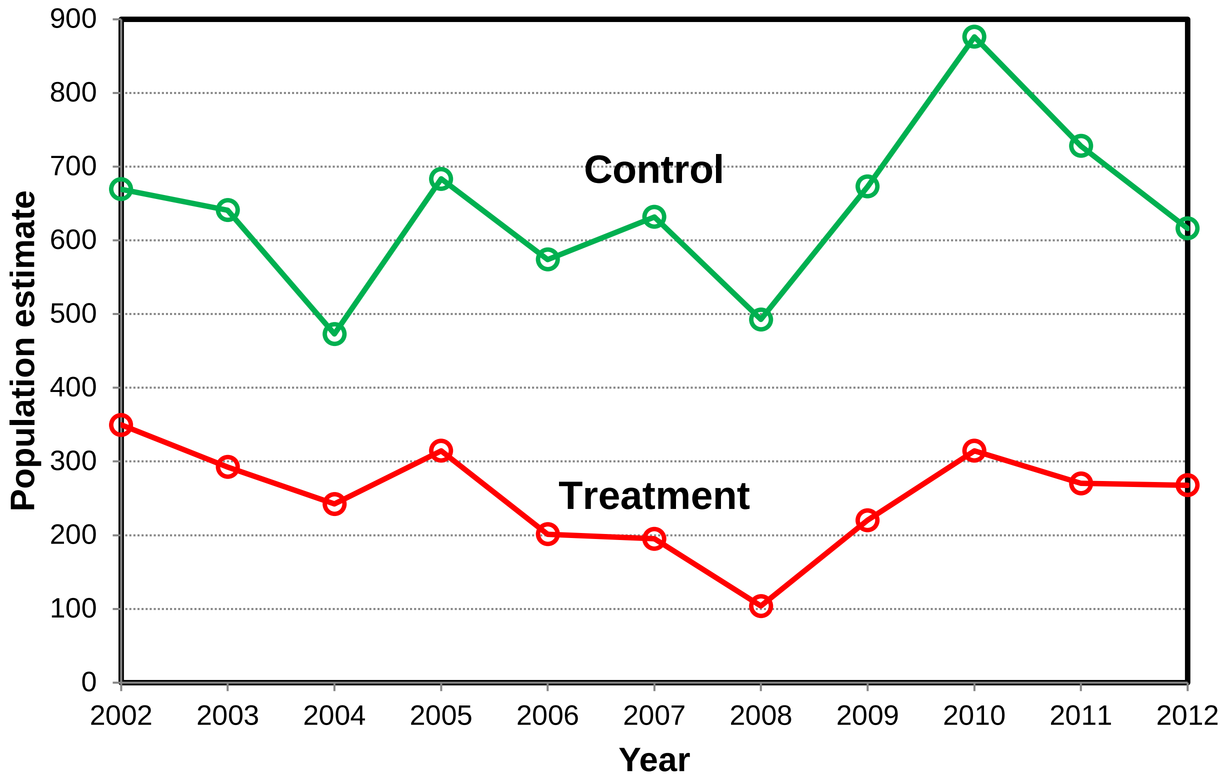

Fig. 9. Estimated greater sage-grouse population <10 km from the proposed Withrow Wind Power Project (4 treatment leks) or 10–30 km from the Withrow Wind Power Project (13 control leks) between 2002 and 2012.

CONCLUSIONS

We collected data during “pre-treatment” years for the WWPP site (2010 and 2011); however, construction of the wind power project has been postponed indefinitely (B. Patterson, PUD, personal communication). Our surveys documented that several species of conservation concern occur on the project area including: greater sage-grouse (state threatened), sharp-tailed grouse (state threatened), sage thrasher (state candidate), loggerhead shrike (state candidate), and white-tailed jackrabbit (state candidate). The Brewer’s sparrow was the most numerous bird species documented on point-counts with an estimated density of 0.75 individuals per hectare (Table 3). The abundance of Brewer’s sparrow was further illustrated by the incidental discovery of 37 nests; 20 vesper sparrow and 6 sage thrasher nests also were found during fieldwork on the site.

The abundance of sage-grouse pellets, anecdotal observations of sage-grouse, and lek count surveys demonstrated that sage-grouse are currently using the WWPP site and adjacent areas. Our observations also indicated that greater sage-grouse may be affected by certain types of development already present on the site. The observed relationship between transmission lines and presence of greater sage-grouse, based on pellet counts, was consistent with observations from other research on sage-grouse in Washington (Schroeder et al. 2012, 2014). These observations suggests the need to include distance to transmission lines in models assessing potential effects of wind power projects.

Recommendations for post-building sampling and analysis

In the event that wind turbines are constructed on the site as originally planned, we have the following recommendations for continued monitoring and analysis to evaluate potential effects.

1. Repeat point-count sampling annually for a minimum of 3 years post-construction using the protocols outlined here. Sampling should not begin until the spring following the year that construction was completed but need not begin immediately following construction. Sampling should encompass at least 3 years in order to capture the variability inherent in bird populations, especially for migrant species.

2. Survey points where the habitat in the surrounding 100-m radius circle has been converted from CRP back to cultivated farmland (e.g., wheat) should be excluded from point-count sampling, particularly sites where CRP composed >25% of the plot. Direct alteration of habitat immediately surrounding the survey point could affect bird counts independent from proximity to other features such as turbines.

3. Distance sampling should be used for analysis of point count data and models should test for effects of observer and distance on detectability. Using multiple models with different detection functions and employing multiple-covariate distance sampling (Marques et al. 2007) will improve the reliability of the estimates. This approach should prove effective in testing for effects of wind turbines and related development on abundance of breeding birds using covariates such as distance to nearest turbine and number of turbines within a set radius of the survey point.

4. Repeat pellet counts to assess habitat use by greater sage-grouse for 3 years post-

construction. All grouse pellets should be removed from survey plots as soon as practicable following completion of the construction project. Sampling should not begin until the spring following the year that plots were cleared of pellets to ensure that only pellets deposited by grouse using the site post-construction are detected. Analysis of pellet counts pre- and post-construction should include modeling for detection probability to adjust zero-counts for less than perfect detection.

5. Lek counts are conducted annually by WDFW as part of recovery efforts for greater sage-grouse. Counts for leks included in this project (<10km and >10km from the project boundary) should be used to generate instantaneous rates of change for at least 3 years post-construction. These data can be compared between distance groups to detect change in lek attendance following construction.

6. Distance to transmission lines should be included in models examining effects of wind power projects on greater sage-grouse.

DATA PROVIDED WITH THIS REPORT

The following data are provided in digital format as part of this job completion report.

1. Microsoft Excel database with the following tables:
    a. Results of point-count surveys of breeding birds for 2010 and 2011.
    b. Results of pellet-count surveys for greater sage-grouse and other wildlife for 2010 and 2011.
    c. Results of lek counts on sage grouse leks within the study area.
    d. Results of vegetation sampling of sample points.
2. ArcGIS shapefiles describing the following features:
    a. Sample point locations on the study area.
    b. Location of other significant features and/or observations on the study area.
3. Digital photographs:
    a. Photographs of sample point locations on the study area.
    b. Photographs of other significant features, plants, and/or wildlife.

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APPENDIX A. Point-count data form

Withrow Wind Power Project – Breeding Bird Point Count Form

Area number:		Observer(s):	
Date (day/month/year):		Time start:	Time end:

Wind: 0) none; 1) light; 2) moderate **Clouds**: 0) <33%; 1) 33-66%; 2) >66% **Rain**: 0) none; 1) drizzle; 2) light rain

#	Time	Species	Sex	Obs	Dist	Flock	Comments
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
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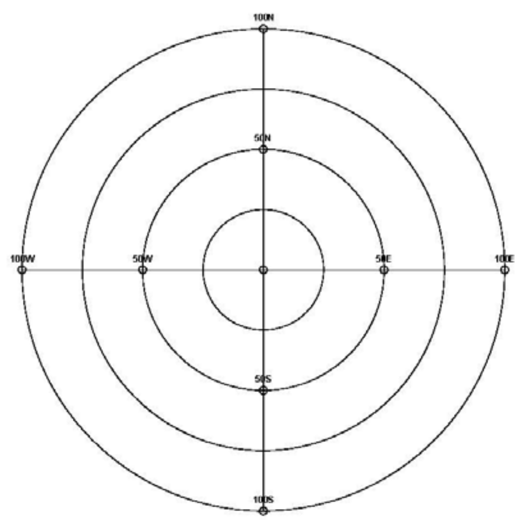
20							

Species: GRSP, SAVS, VESP, BRSP, SAGS, WEME, HOLA, RNEP, MODO, NOHA, RTHA, SEOW, LOSH, SATH, GRSG, etc.

Sex: M) male; F) female; & U) unknown **Obs**: V) visual; S) song; C) call; SV) song & visual; CV) call & visual **Flock**: Y) yes or N) no

Distance code: 1) <25m; 2) 25 - <50m; 3) 50 - <75m; 4) 75 - <100m; 5) 100 - <150m; 6) ≥150m; and 7) fly over.



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APPENDIX B. Pellet-count data form

PELLET COUNT DATA – Michael A. Schroeder, WDFW, P.O. Box 1077, Bridgeport WA 98813

Area #: Date (D/M/Y): Time: Observer(s):

Plot		Greater sage-grouse pellets (circle numbers for sharp-tailed grouse)							Presence noted (check if present)								Comment(s)
		# groups	# winter in groups	# summer in groups	# winter scattered	# summer scattered	# caecal	# clocker	P/C/B	GRPA	Deer	Jack	Cotton	Other 1	Other 2	Shrub	
100N	0-2																
	2-4																
	4-6																
	6-8																
50N	0-2																
	2-4																
	4-6																
	6-8																
100E	0-2																
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50W	0-2																
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