EXHIBIT 15

Comments on the Whistling Ridge Wind Energy Power Project DEIS
Skamania County, Washington

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27 August 2010

Friends of the Columbia Gorge asked me to prepare an expert comment letter on the Whistling Ridge Wind Energy Project DEIS.[1] I reviewed this document and its appendices. My comments will mostly address the baseline data used to assess impacts and proposed mitigation measures. A summary of my comments appears on page 24.

I am an ecologist with 25 years of research and consulting experience on issues related to wildlife management and conservation problems. My qualifications for preparing this declaration are summarized in my curriculum vitae, which is attached. I received a Ph.D. degree in ecology from the University of California at Davis in 1990. Following four years of post-graduate research in the Agronomy and Range Science Department at UCD, I have worked for citizen groups, businesses, attorneys, and government agencies, largely on solving problems affecting wildlife, especially on special-status species.

I have eleven years of experience with the biological impacts caused by wind turbines. I performed multiple monitoring and research programs in the Altamont Pass Wind Resources Area (APWRA), and I senior authored many reports that followed, most of which were peer-reviewed. I consulted for the California Energy Commission on matters related to wind farm development. I also consulted to wind power companies, and helped project applicants obtain permits to repower a portion of the APWRA. My contribution to wind energy development has been to produce research-based solutions to avoiding, minimizing, and reducing bird collisions with wind turbines.[2]

ESTIMATES OF PROJECT IMPACTS – WIND TURBINE COLLISIONS

WEST, Inc. appeared to have relied on several types of empirical evidence to predict wind turbine-caused impacts at the proposed 75 MW Whistling Ridge wind energy project. These lines of evidence included a model based on fatality rates regressed on utilization rates, comparisons of exposure index values among species seen at the site, and a comparison of raptor nest density to nesting densities at other wind project sites. However, these approaches have consistently led to inaccurate predictions of project impacts at other locations (see below), and therefore should be examined carefully before relying on them yet again.

Predicted Collision Rates

Not only have most predictions of raptor fatality rates at wind projects been proven wrong after the project was developed and monitored for fatalities, but some of the wrong predictions have been very wrong (Table 1). Following construction and monitoring, raptor fatalities were estimated to be twice as high as predicted at Stateline, nearly 5 times higher than predicted at

Hopkins Ridge, 3 times higher than predicted at Wild Horse, 6.9 times higher than predicted at Shiloh I, at least 11 times higher than predicted at Klondike II, and about 14 times higher than predicted at Big Horn. Even in the scientific field of wildlife biology, prediction errors of these magnitudes would be considered gross failures. Prediction failures are caused by fundamental shortfalls in the assumptions and methodology used to make the predictions.[3] The repeat failures to predict wind project impacts should prompt the States of Washington and Oregon to demand a review of the methods used, and to require new standards, including consequences for wind projects exceeding predicted fatality levels by more than 50%.

Table 1. *Predictions of raptor fatality rates at proposed wind projects, and compared to estimated fatality rates following project development. Reported estimates were those appearing in fatality monitoring reports provided by consultants, and the Smallwood estimates were those made by me, using a common set of methods and assumptions, including search detection and scavenger removal rates reported in Smallwood (2007).*

	Raptor fatalities / MW / Year			**How fatality rates compared to predicted rates**
Project	**Predicted**	**Reported estimate**	**Smallwood estimate**	
Klondike I	0.029 - 0.044	0.000	0.000	Lower
Combine Hills	0.00-0.02	0.000	0.000	Accurate
Buena Vista[a]	0.331-0.581	0.605	0.544	Accurate
Klondike II	~0	0.11	0.062	≥11 times higher
Stateline	0.061	0.091	0.130	1.5 to 2.1 × higher
Big Horn	0.015 – 0.020	0.150	0.243	8.6 to 13.9 × higher
Shiloh I	0.109	0.820	0.756	6.9 to 7.5 × higher
Wild Horse	0.007-0.074	0.090	0.251	2.2 to 3.1 × higher
Hopkins Ridge	0.020-0.040	0.139	0.172	4.6 to 5.7 × higher

[a] I co-authored the report that presented the predicted fatality rates for Buena Vista.

Fatality rates regressed on utilization rates

WEST, Inc. relied on a regression relationship (*Figure 8* in App. C-4) that regularly appears in their environmental documentation in support of wind energy projects, and which I have commented on before (see Figure 1, below). Affirming its reliance on the WEST, Inc. approach to assessing potential project impacts, the DEIS (page 3-63) stated, "*Mean overall bird use in the study area was low compared to these other wind resource areas studied: ranking 19th compared to 24 other wind resource areas…*" and, "*Mean annual raptor use was 0.28 raptors per plot per 20-minute survey, which is a standardized way to measure use in order to compare results to avian use at other sites.*" However, this approach was inappropriate for use as a predictive tool due to multiple fundamental flaws, which are addressed in the following paragraphs.

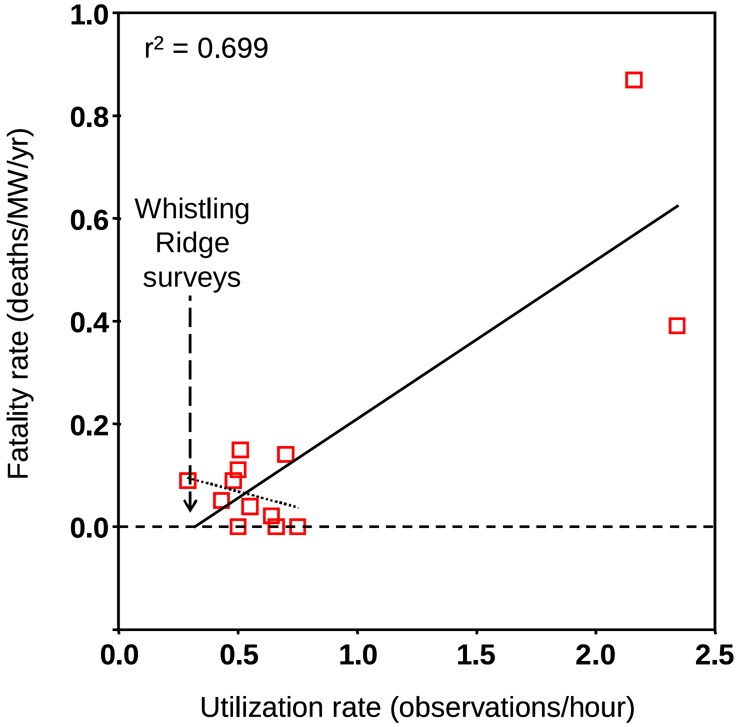

Figure 1. *Fatality rate as a function of utilization rate, according to WEST, Inc., Figure 8 in Appendix C-4. The dotted line fitting the clump of data points at the lower left represents an alternative regression relationship if data from the two California WRAs in the upper right aspect of the graph were omitted. The regression relationship was pseudoreplicated.*

Sufficiency of survey effort.—The vertical dashed arrow in Figure 1 represents the utilization rate that WEST, Inc. estimated for raptors at the Whistling Ridge project site. Although a non-biologist might be impressed with the number of bird surveys performed at the Whistling Ridge project site, totaling 261 surveys, biologists familiar with utilization surveys at wind project sites have cause for concern regarding conclusions drawn from the level of effort devoted to Whistling Ridge. The 261 surveys lasted 20 minutes each, so totaled 87 hours. Eighty-seven hours was insufficient time to detect multiple raptor species and many other bird species, especially considering the high levels of visual occlusion due to forest cover surrounding observation stations at Whistling Ridge, along with the large volumes of airspace that would have been occluded due to mountainous terrain and cloudiness.

Even the large amount of survey time invested in the Altamont Pass WRA -- where no forest occluded views -- failed to detect multiple species that are killed by APWRA wind turbines, including threatened and endangered species such as brown pelican and peregrine falcon, and many hours were needed to detect only one individual of many species. For example, 774 hours of survey at Vasco Caves Regional Preserve in the Altamont Pass WRA[4] failed to detect peregrine falcon even though this species was twice documented as killed by Altamont Pass wind turbines. At Vasco Caves, it took 387 hours per merlin observation, even though this species is killed by Altamont Pass wind turbines. It took all 774 hours to detect one red-shouldered hawk, and it took 70 hours per Cooper's hawk observation and 55 hours per Swainson's hawk observation, even though members of these species have been killed in the

Altamont Pass. Just because a species goes undetected in the minimal survey efforts that have been directed to birds at wind project sites does not mean that that species will avoid collisions with wind turbines.

An earlier study in a different part of the Altamont Pass WRA involved 980 hours of bird surveys.[5] In that study the number of hours required per observation was 490 for Cooper's hawk, 980 for white-tailed kite, 163 for rough-legged hawk, 7 for loggerhead shrike (a commonly killed species), 43 for cliff swallow (another commonly killed species), and 2 for golden eagle. Even though in the Altamont Pass we invested more than 11 times the hours committed to Whistling Ridge, we were unable to detect any significant relationships between fatality rates and utilization rates among rows or larger plots of wind turbines.[6] My colleagues and I concluded that not only were relatively small sample sizes an impediment to detecting a relationship between fatality rates and utilization rates, but there was the interference of a substantial bias caused by declining survey detection rates with increasing distance from the observer, especially for smaller-bodied bird species. The survey effort at Whistling Ridge was grossly insufficient for informing decision-makers about the impacts of the project that will be caused by wind turbine collisions with birds.

The surveys were diurnal.—The utilization surveys at Whistling Ridge did not record any birds flying at dawn, dusk, or at night, so they inadequately characterized the suite of bird species that uses the project area. (Utilization surveys are different from protocol-level call-back surveys used to detect northern spotted owls, and the data are recorded differently and used differently, including for wind turbine siting.) No nocturnal owl species would have been detected unless an owl flushed in daylight hours for some reason, and multiple other species would have been missed if they flew at night. This shortfall can be applied to most survey efforts that have been performed at wind project sites throughout the USA, so it was not unique to Whistling Ridge. This shortfall should be acknowledged and the level of uncertainty attributed to conclusions of impacts should be increased.

Variation in visibility of surveyed airspace.—Survey observation stations are typically located on prominent aspects of the study area so that the observers can scan for birds in as much of the airspace as possible. The surveyed airspace is that airspace between the observer and the maximum survey radius (a maximum distance from the observer), and between the ground and to whatever elevation above the ground (ceiling) the surveyor is scanning for birds. WEST, Inc. routinely uses an 800-m maximum survey radius. However, at least some of the airspace between the observer and the maximum survey radius is usually hidden from the observer, due to hills, the slope of the hill upon which the observer stands, trees, and the prevalence of fog or clouds. In hilly or mountainous terrain, observers stationed on prominent locations might be able to see a smaller proportion of the available airspace between 40 and 100 m away due to the slope dropping away from the observer. These observers might be able to survey a larger volume of airspace between 100 and 250 m away because those distances overlap canyon bottoms into which the observer might be able to see and over which there is more airspace due to a larger elevation range extending from below the observer (canyon bottom) to whatever elevation ceiling the observations might extend (assuming there is a ceiling). In other words, prominent locations tend to provide surveyors with variable volumes and proportions of volumes of airspace as functions of distance from the observer, due to the manner in which the ground surface slopes away from the observation station.

The ground surface area of a flat circle within 800 m of the observer at a single station equals 2.01 km^2. Assuming the WEST, Inc. survey team can see birds as high as they seem to think they can see them in distance, the volume of airspace surveyed on perfectly flat and unobstructed landscapes would be 1.61 km^3, which in my opinion is a huge volume of airspace in which to expect to see more than a small fraction of the available birds In the Altamont Pass my colleagues and I did not believe we could reliably detect most birds flying as high as 800 m, so we selected a ceiling of 140 m above the elevation of the observer, excluding birds above that ceiling from utilization rate estimates. This 140-m ceiling above flat terrain would have the surveyors searching 0.28 km^3, which is still a volume I consider unmanageable, but which is much smaller than within an 800-m ceiling.

However, flat ground is rarely where bird surveys are performed in WRAs, especially in the Pacific Northwest. From station to station, and from project site to project site across the US, the visible volume of airspace surveyed will vary greatly due to variability in topography and forest cover surrounding each station. To illustrate the influence of this variability, Lee Neher and I constructed a digital elevation model (DEM) of the Vasco Caves Regional Preserve in the Altamont Pass and we calculated the volume of airspace visible from each of 15 observation stations (Figure 2). Our results demonstrated that bird observations need to be related to visible volumes of airspace to avoid confounding any comparison that would be made of utilization rates among observation stations or wind project sites.

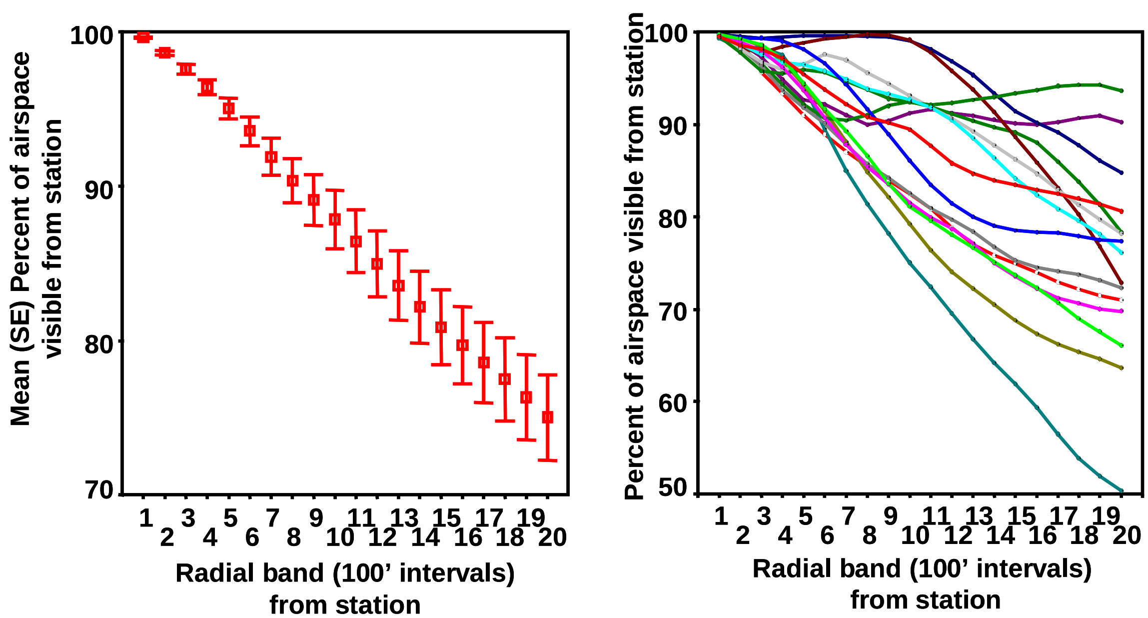

Figure 2. *Change in mean (left graph) and station-specific (right graph) percentage of visible volume of airspace within 140-m ceiling and within specific radial bands from the observer (x-axis) among 15 observation stations at Vasco Caves Regional Preserve in the Altamont Pass.*

Note that our maximum survey radius was 2009 feet, or 600 m, whereas WEST, Inc. uses a maximum survey radius of 800 m, including at Whistling Ridge. Projecting the trends in this Figure to 800 m, we might expect a mean of 60% of the airspace to be visible, ranging about 20% to 94% among the stations, and this variation did not include airspace hidden by forest surrounding observation stations at Whistling Ridge. Without accounting for this source of variation in utilization rates, comparing utilization among sites within a project area could be misleading, and comparing utilization rates among wind project sites across the US might qualify as very misleading.

800 m maximum survey radius was too far.--Lee Neher and I quantified the effect of variable distances of birds from the observer, using our DEM of a project area in the Altamont Pass (Figures 3 and 4). We calculated detection functions from the patterns depicted in Figures 3 and 4 (see Table 2), enabling me to project our detection rates to visible volumes of airspace within the maximum survey radii used by other investigators. Raptor utilization rates within an 800 m maximum survey radius would be reported at about 81% of the rate within a 600 m maximum survey radius, at 60% of the rate within a 400 m survey radius, and 22% of the rate within a 100 m survey radius. Without accounting for the effect of distance from the observer, utilization rates cannot be compared among wind projects, nor can utilization rates be compared appropriately among species.

Table 2. *First detections/hr/km^3 of visible airspace regressed on distance from observer within radial boundary increased from 30 m to 600 m at Vasco Caves Regional Preserve, California.*

		Model parameters				
Species/Group	**Model**	**a**	**b**	**r^2**	**SE**	**P**
Golden eagle	Power	12.6915	-0.7430	0.97	0.10	0.001
Red-tailed hawk	Power	90.0736	-0.6041	0.96	0.10	0.001
Turkey vulture	Power	66.4367	-0.7159	0.97	0.11	0.001
Northern harrier	Logarithmic	11.0526	-3.2695	0.95	0.63	0.001
Prairie falcon	Power	21.8581	-1.1817	0.98	0.14	0.001
American kestrel	Power	75.5038	-1.0143	0.94	0.21	0.001
Raptors	Power	281.1493	-0.7349	0.97	0.10	0.001
Common raven	Power	306.0222	-0.7777	0.97	0.12	0.001

Pseudoreplication.--The regression relationship in *Figure 8* of App. C-4 likely exemplifies psuedoreplication in correlation analysis, which is a fundamental experimental design flaw that is routinely warned against in statistics textbooks.[7] The regression is based on two clusters of data, one from wind projects located mostly in the Pacific Northwest and the other from two projects located nearby each other in California. If the variation in the graph was more representative of the two regions -- Washington/Oregon versus Central California – than of the individual project sites, then the sampling units were really the regions and not the project sites. In presenting their graph, Johnson and Erickson (2008, 2010) presented a value for the coefficient of determination, r^2, but they neglected to present an error term. Furthermore, they presented the relationship as significant, and the DEIS repeated that conclusion along with the prediction, based on the regression, that 0 raptors would be killed by Whistling Ridge wind turbines (page 3-79).

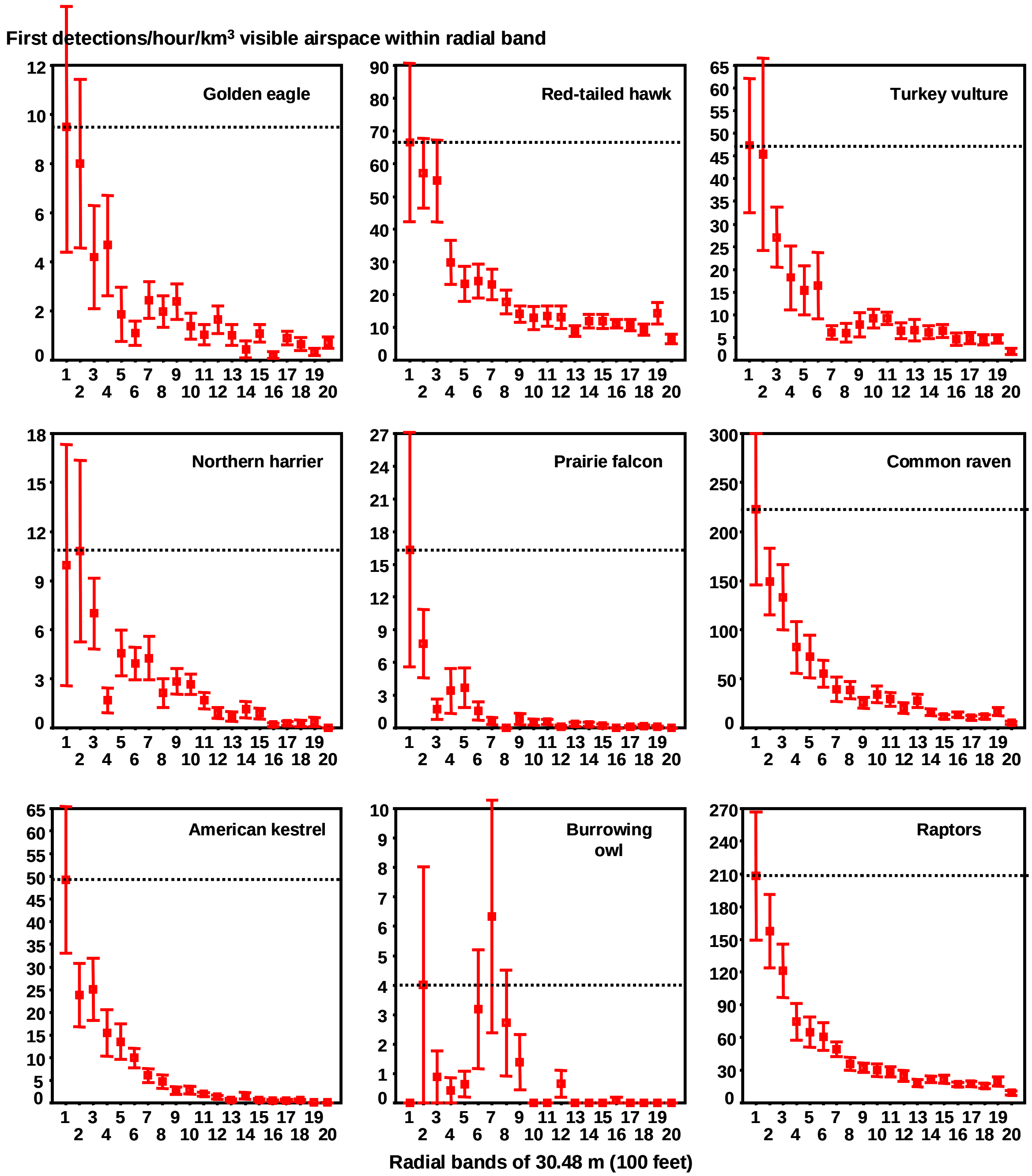

Figure 3. *Within specific 100-foot radial bands, mean first detections/hour/km^3 of visible airspace decreased with increasing distance from the observer for golden eagle, red-tailed hawk, turkey vulture, northern harrier, prairie falcon, common raven, American kestrel, burrowing owl, and all raptors as a group in Vasco Caves Regional Preserve, 2006-2007. Horizontal dashed lines represented detection rates expected of each species assuming spatial distributions were most accurate within the closest 100 or 200 feet to the observer.*

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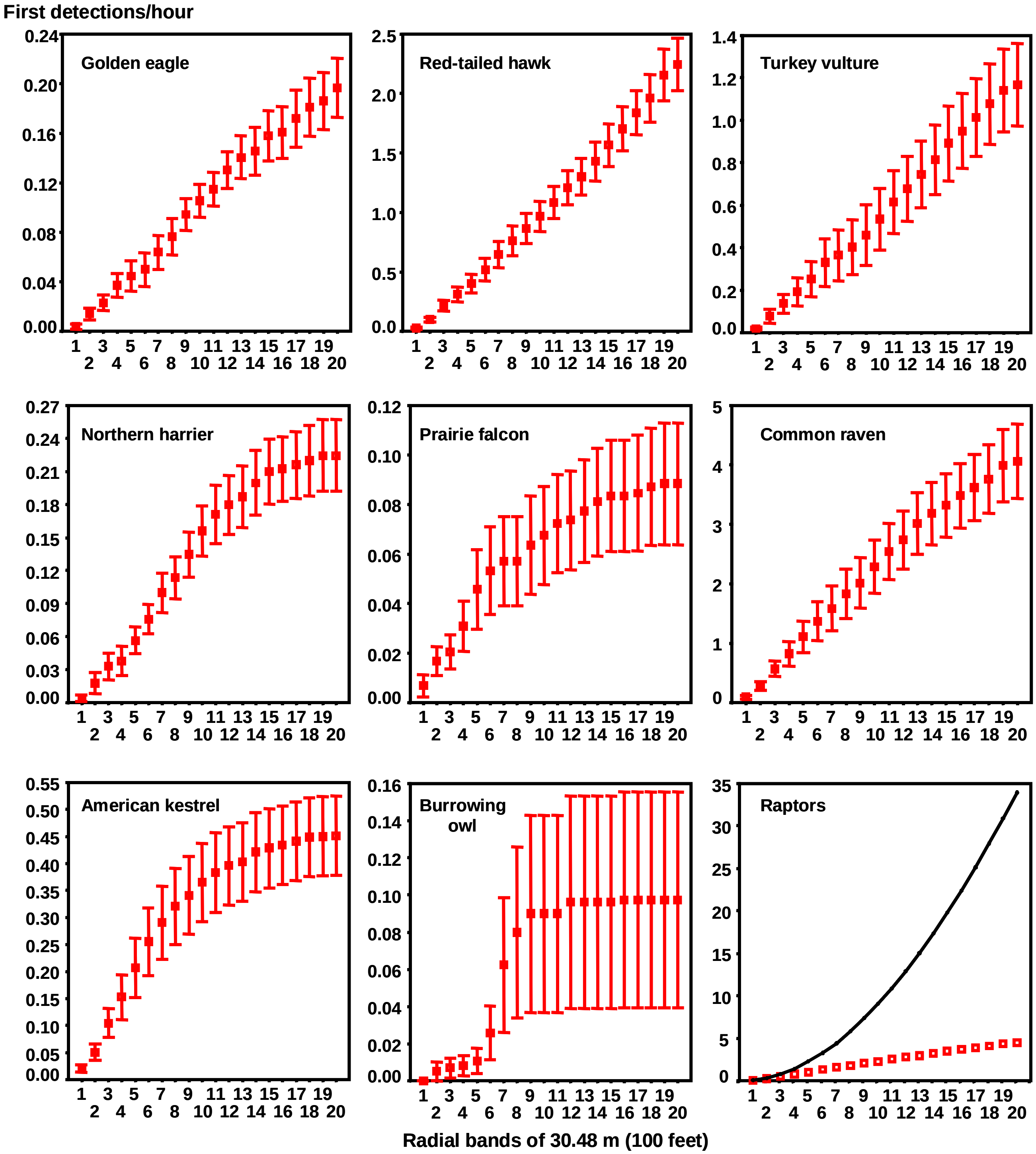

Figure 4. *Cumulative mean first detections/hour increased with increasing distance from the observer for golden eagle, red-tailed hawk, turkey vulture, northern harrier, prairie falcon, common raven, American kestrel, burrowing owl, and all raptors as a group in Vasco Caves Regional Preserve, 2006-2007. The solid line in the lower right graph depicts the exponential increase in cumulative detections of raptors, assuming the spatial distribution of raptors was unaffected by the locations of observation stations and detection rate was most accurate within the closest 100 feet.*

The coefficient of determination is an index of both response and precision, but the reader must be familiar with regression analysis to visually assess the degrees to which variability or precision contributed to r^2. A more direct measure of precision is the root mean square error (RMSE) of the regression, otherwise known as standard error. In my experience, RMSE can serve as a diagnostic tool for deciding whether r^2 was influenced more by leveraging from outliers or from psuedoreplication. Another diagnostic test is to omit data from one of the clusters to learn whether the regression slope would change significantly. In fact, omitting the two data points from Central California project sites converted a strongly positive slope to a negative slope (see dotted line in Figure 1), and the revised regression line was a better fit to the data, based on RMSE (RMSE = 0.0567, which was a third of the value for the pseudoreplicated regression slope). In cases like this, when two data points determine whether an estimated regression slope is strongly positive or negative, the analyst should not use the regression equation to make predictions. It was inappropriate for the DEIS to predict that 0 raptors would be killed by Whistling Ridge.

Accuracy of fatality rates.—Where able, and in the time I had before preparing this comment letter, I used data available in reports to independently estimate fatality rates at project sites across the western USA. My estimates averaged 2.44 times higher than reported for all birds as a group (N = 23 reports), 1.34 times higher for all raptors as a group (N = 23), and 2 times higher for all bats (N = 20). Probably the principal reason for my higher estimates was the difference in fatality estimator. Most of the monitoring reports I reviewed had utilized the following estimator of fatalities per MW per year, F_A:

$$F_A = \frac{F_U}{\left(\frac{\bar{t} \times p}{I}\right) \cdot \left(\frac{e^{I/\bar{t}} - 1}{e^{I/\bar{t}} - 1 + p}\right)}, \qquad \text{eqn. 1}$$

where F_U is unadjusted average number of carcasses observed per MW per year, $\bar{t}$ is mean number of days until carcass removal, and is estimated by scavenger removal trials, p is proportion of carcasses found by fatality searchers during searcher detection trials, and I is average search interval in days. The other estimator in use, and the one I use, is derived from the Horvitz and Thompson (1952)[8] estimator:

$$F_A = \frac{F_U}{R_C \times p}, \qquad \text{eqn. 2}$$

where R_C is the average proportion of carcasses remaining since the last fatality search and is estimated by scavenger removal trials. I assume carcasses are deposited at a steady rate from wind turbines, so I take the average proportion of carcasses remaining each sequential day between searches:

$$R_C = \frac{\sum_{i=1}^{I} R_i}{I}, \qquad \text{eqn. 3}$$

where R_i is proportion of carcasses remaining by the *i*th day following the initiation of a scavenger removal trial. Thus, the expected proportion of carcasses remaining by the next fatality search should be R_C corresponding with the fatality search interval, *I*.

A key difference between the two estimators is the use of $\bar{t}$ in eqn. 1 and the use of R_C in eqn. 2. The sample size of placed carcasses contributing to R_C never changes from start to finish of a removal trial, as none of the carcasses need to be censored. On the other hand, the sample size contributing to $\bar{t}$ starts small and increases quickly as the trial grows longer (Figure 5, left graph). If 10 carcasses were placed to obtain R_C, then 10 carcasses will contribute to R_C after 1 day, 10 days, or 30 days. If 10 carcasses are placed to obtain $\bar{t}$, then it may be that none of them will contribute to $\bar{t}$ after a day because none had been removed by then, and so all had to be censored from the calculation. If 4 carcasses were removed after 10 days, then only these 4 would contribute to the calculation of $\bar{t}$. If 7 carcasses were removed after 30 days, then only these 7 would contribute to the calculation of $\bar{t}$. Thus, $\bar{t}$ increases exponentially with the sample size used to calculate $\bar{t}$ because the increasingly large sample is also composed of carcasses that have persisted longer into the trial (Figure 5, right graph). Furthermore, $\bar{t}$ increases nonlinearly with number of days into a trial (Figure 6), indicating a bias. Perhaps the main bias, however, is the use of $\bar{t}$, which is derived from a time period that is necessarily much longer than the average search interval of the fatality monitoring (see text that follows).

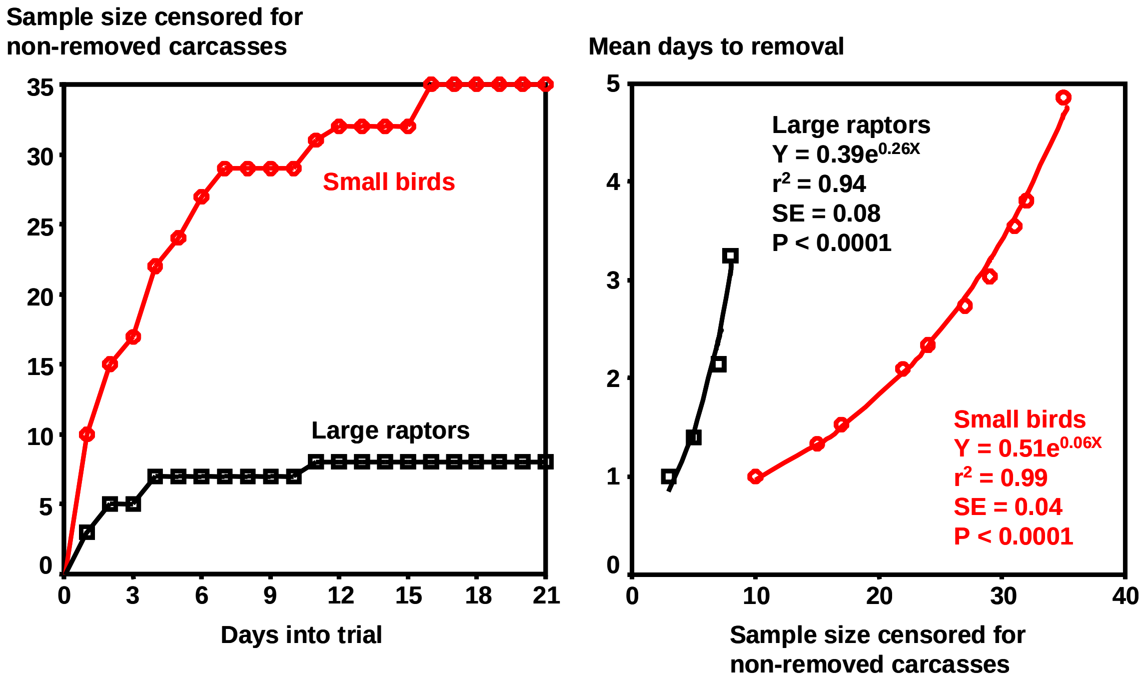

Figure 5. *Sample sizes used to calculate mean days to carcass removal decline with shorter trial duration (left graph), and mean days to removal increases exponentially with sample size (right graph) at Vasco Caves Regional Preserve, Altamont Pass, California.*

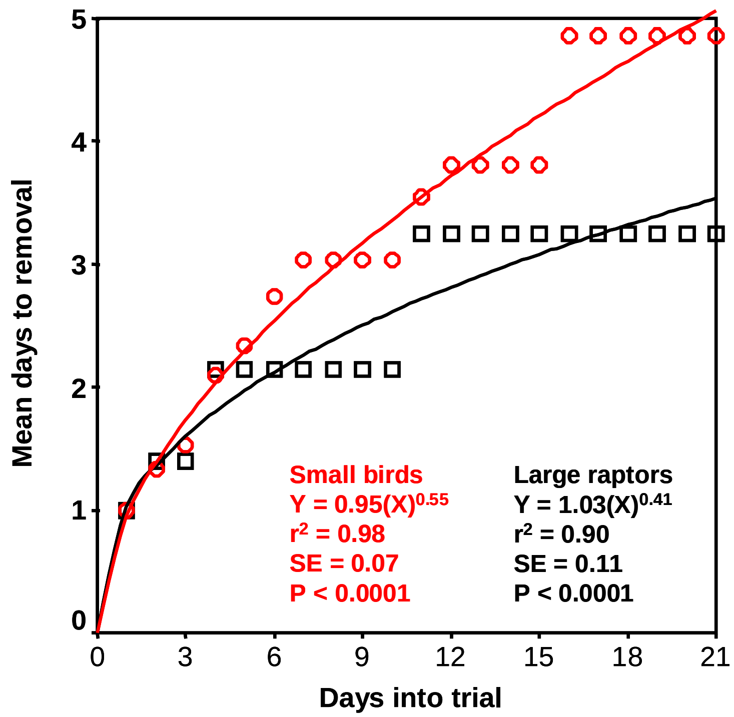

Figure 6. *Mean days to carcass removal increases with longer duration of the carcass removal trial at Vasco Caves Regional Preserve, Altamont Pass, California.*

When censoring remaining carcasses, $\bar{t}$ cannot be calculated unless at least one carcass has been removed. If no carcasses are removed during a trial, then $\bar{t}$ will be undefined, whereas R_C would equal 1 and the fatality rate could still be estimated. To prevent a trial result in which no carcasses are removed, and hence $\bar{t}$ cannot be calculated, investigators can place larger numbers of carcasses or they can perform longer trials. Placing larger numbers of carcasses can potentially swamp the vertebrate scavengers, thereby increasing mean days to removal. The option to perform longer trials might help explain why many of the trials intended to obtain $\bar{t}$ have been conducted for 40 to 64 days, or from nearly twice as long to more than four times longer than the average search interval used in the corresponding fatality monitoring. Values of $\bar{t}$ derived from such long trials will be larger than those derived from trials lasting no longer than the fatality search interval (Figure 5), and the fatality rates will be underestimated.

I must also point out that my estimates, relying on eqn. 1, remain conservative because I have yet to account for declining searcher detection rates as the search interval increases (searcher detection trials are based on a search interval of less or equal to one day). I also have not accounted for crippling bias – the non-detection of mortally wounded birds that leave the search area on their own volition before perishing – because there is no means to account for this bias. Underestimates of fatality rates in the Pacific Northwest might be partly caused by reliance on mean days to carcass removal as an adjustment for scavenger removal rates (Smallwood 2007), but some of the scavenger removal trials were sufficiently flawed that I had to replace their results with national averages in Smallwood (2007). Under-estimated fatality rates have been used to predict fatality rates of planned projects, which may be one reason why predicted fatality rates have so often been wrong (Table 1). The regression analysis appearing in *Figure 8* of App. C-4 was based on inaccurate fatality rate estimates.

Accounting for inter-annual variation.—The data presented in *Figure 8* of App. C-4 were derived mostly from one-year monitoring programs. However, inter-annual variation in fatality rates and utilization rates can be very high at a given project site. For example, fatality rates varied 5.7-fold from low to high over 8 years within a 10-year period in the Altamont Pass WRA (Figure 7). They varied nearly 2-fold over a 3-year period at Foote Creek Rim[9] and nearly 3-fold over a 4-year period at Buffalo Ridge.[10] Given this range of variation, single-year estimates are mere snapshots of fatality rates and unlikely to reveal meaningful relationships between fatality rates and utilization rates among wind projects.

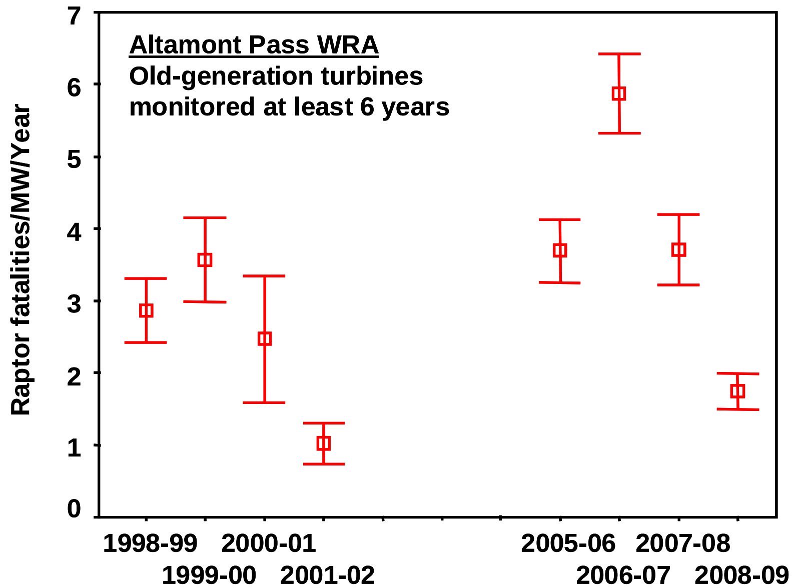

Figure 7. *Inter-annual estimates of raptor fatality rates in the Altamont Pass WRA.*

Regression relationship based on selective inclusion of data.—*Figure 8* of App. C-4 was based on only some of the wind projects for which there exists fatality rate and utilization rate estimates. Including more of the estimates available, the regression slope reported by Johnson et al. in the Whistling Ridge DEIS no longer applies (Figure 8).

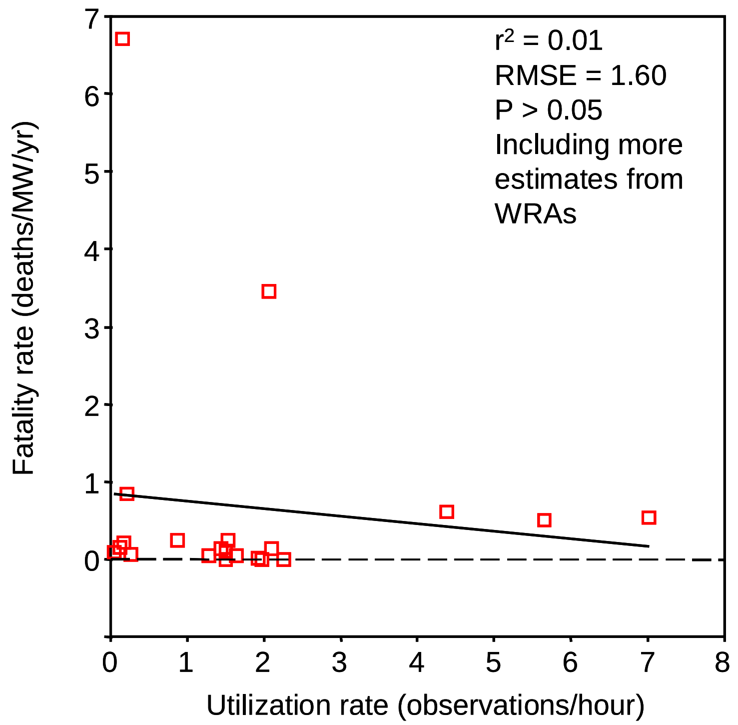

Figure 8. *Fatality rate estimates regressed on utilization rate estimates after including data from additional WRAs to those used by WEST, Inc.*

Consistency of regression relationship.—WEST, Inc. has been inconsistent in its utilization rates and fatality rates used to construct the regression model in *Figure 8* of App. C-4. For example, in the environmental review documents prepared for Windy Point, Windy Flats, and Hatchet Ridge, data representing the two extreme California wind projects (Diablo Winds and High Winds) indicated 30% higher utilization rates than depicted in the Whistling Ridge DEIS. Also, the fatality rate representing Diablo Winds was half as great in the Windy point, Windy Flats, and Hatchet Ridge documents compared to the Whistling Ridge DEIS. Compared to the regression model presented in the environmental review documents for Windy Point, Windy Flats, and Hatchet Ridge, the regression slope was more than twice as steep in the model presented for Whistling Ridge. These inconsistencies should be explained.

Fitted regression line intercepts 0 fatalities before it intercepts Y-axis.—The DEIS (page 3-79) predicted that Whistling Ridge will cause 0 raptor fatalities because its estimated utilization rate appeared to the left of the Y-axis 0-intercept in *Figure 8* of App. C-4. This prediction was unrealistic and inconsistent with the very data that contributed to the estimated regression line. In fact, one of the wind projects that contributed to Johnson et al.'s regression model also appeared to the left of the Y-axis 0-intercept, but it was represented as having killed 0.09 raptors/MW/year (my estimate of the fatality rate of this project was twice as high, however). In addition to this inconsistency in the use of the regression, omitting the two Central California wind projects from the analysis flips the regression slope from positive to negative, potentially leading to an opposite conclusion – that Whistling Ridge will kill more raptors than any other wind project in Washington or Oregon. However, for multiple reasons discussed below, I advise against using my revised regression line or the Johnson et al.'s regression line for predicting fatality rates.

***Calculation of utilization rates*.—**Utilization rates contributing to the regression model were often calculated as means among seasonal totals, rather than annual total observations per year or weighted averages. Weighted averages should be used if surveys were performed regularly across all seasons, where the weightings are based on duration of each season. Without weighting, simple averaging among seasonal total utilization rates likely under-represents the contributions of longer seasons with higher bird use.

Summary of fatality rates regressed on utilization rates

The consultants who prepared the supporting documents for the DEIS have been unable to accurately predict raptor fatality rates, as demonstrated above. In fact, their predictions have been much too low, and the same problem can be demonstrated for bats and other bird species. Upon examination, the methods used to predict fatality rates appear to be ineffective, as raptor fatality rates failed to correlate with nesting densities, utilization rates, and exposure index values. The methods used by the consultants simply do not work. The predictions of fatality rates in the Whistling Ridge DEIS cannot be relied upon.

Exposure index values

On page 3-77, the DEIS summarizes the calculation of the exposure index (also see App. C-4), which it said was used to assess the risk of collision of each bird species. In fact, on the same page and on subsequent pages the DEIS did just that – it offered conclusions about the likelihoods of collision-caused fatalities based on values of the exposure index. However, I have never seen a test of the relationship between fatality rates and exposure index. Based on my own experience attempting to relate fatality rates to variables similar to the exposure index, I am skeptical that WEST, Inc. has actually generated a hypothesis test result that would support the use of the exposure index as a predictive tool. Therefore, I tested for a relationship using data from the Big Horn and Wild Horse Wind Projects (Figure 7).

I found no hint that fatality rates could be predicted by the exposure index. Furthermore, between the two projects 27 species (23%) were not detected during utilization surveys at one or both project sites but were killed by wind turbines at the same project site. Of the 22 species that were detected during utilization surveys at one or both project sites and that were also killed by wind turbines, only 4 of them (18%) were given exposure index values >0. In other words, there was no correspondence between the exposure index and fatality rates. The exposure index appears to be completely ineffective as a predictor of fatality rates caused by wind projects.

Nesting densities

I collected reports of raptor nesting densities and raptor fatality rates from wind projects throughout the western states. I found no trend in the relationship between fatality rates and nesting density that would suggest that nesting density explains some of the variation in raptor fatality rates (Figure 8).

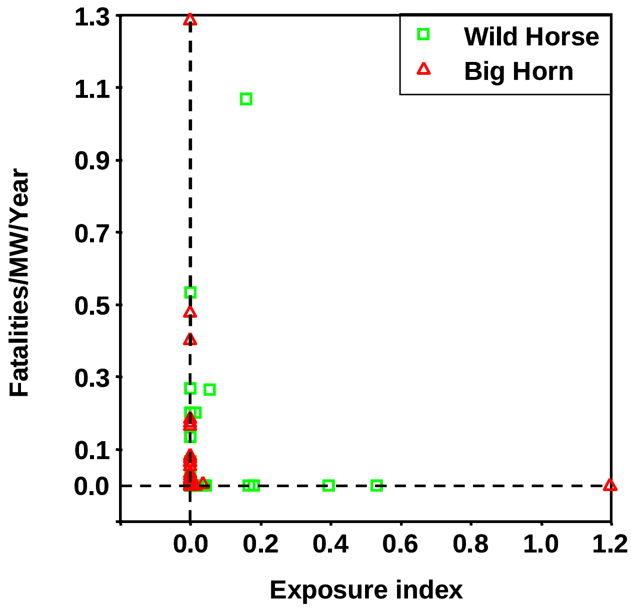

Figure 7. *Relationship between fatality rates and exposure index values for each bird species documented in utilization surveys and fatality searches at the Big Horn and Wild Horse Wind Energy projects. I omitted bats and unidentified birds such as sparrow, falcon, or passerine. I included only estimates for individual, named species, totaling 115 estimates between the project sites (some species appear twice, once for each project site).*

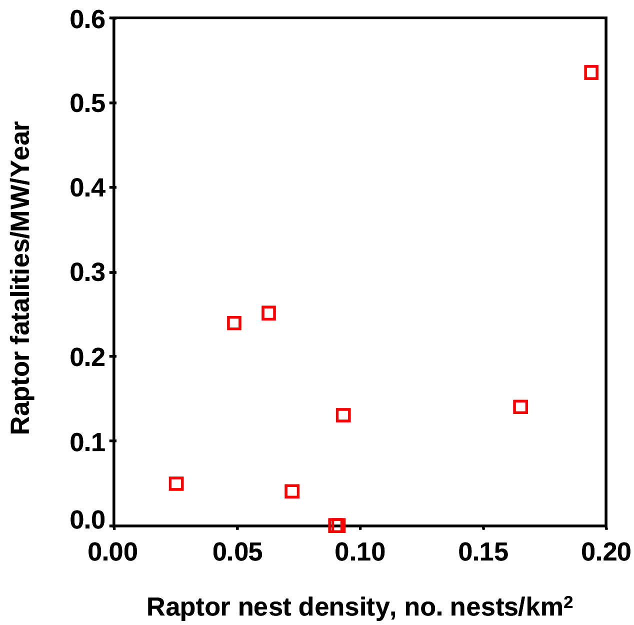

Figure 8. *Raptor fatality rates did not correlate significantly with raptor nest densities recorded on project sites and usually within a 2 mile buffer of the project boundaries. Raptor nesting density did not appear to predict raptor fatality rates at wind projects.*

ESTIMATES OF PROJECT IMPACTS – COLLISIONS

The DEIS predicted 0 raptors would be killed by the Whistling Ridge wind turbines, but this conclusion did not comport with the record of fatalities documented at existing wind energy projects (Table 3). There have been only two wind projects that documented 0 raptor fatalities, but those estimates were based on one year of monitoring, which was insufficient. Based on reports of fatality monitoring at 23 wind projects in Washington, Oregon and California, the average fatality rates projected to 75 MW of rated capacity would predict 33 raptor fatalities per year, 422 bird (including raptor) fatalities per year, and 86 bat fatalities per year (Table 3). However, the Whistling Ridge project site differs from all the others because it would be in a mountainous and forested environment that is also often enveloped by clouds. Given the absence of existing wind farms in these conditions in the Pacific Northwest, I cannot provide reliable estimates of collision rates at Whistling Ridge, but I caution that fatality rates could be much higher than listed in Table 3.

Furthermore, the fatality rate projections in Table 3 are interim rates before I update Smallwood (2007) to improve the adjustment factors for searcher detection error and scavenger removal rate. My 2007 paper was based on available searcher detection and scavenger removal trials available at the time, but hundreds of trials have been performed since then. I have integrated the data from these hundreds of trials, and I have observed much faster removal rates for most taxonomic groups, especially for bats, as well as lower searcher detection rates. I have not had time yet to finalize my analysis of these data from newer trials. I anticipate that my fatality rate estimates will be higher once I have updated Smallwood (2007).

Table 3. *Predicted wind turbine-caused annual fatalities based on projections of my independent estimates of collision deaths/MW/year among 23 modern wind farms in Washington, Oregon, and California. Note that these projections did not account for the unique environmental setting of Whistling Ridge, as none of the available fatality rate data were from forested landscapes. Fatality rates could be considerably higher at Whistling Ridge due to forest cover and due to occlusion of turbines caused by the area being frequently enveloped by clouds.*

	Collision deaths/MW/yr		Annual deaths
Group	Predicted in Whistling Ridge DEIS	Mean among 23 modern wind projects in western US	Projected to Whistling Ridge
All raptors	0	0.438	33
All birds	No prediction	5.623	422
All bats	“Some”	1.143	86

ESTIMATES OF PROJECT IMPACTS -- HABITAT

According to the DEIS (page 3-35), “*the project area includes no native habitat and is permanently committed to use by commercial forestry operations*…” and, due to frequent and repeated disturbances, “*the quality and value of the forest is generally considered low.*” These statements reveal a lack of understanding in the habitat concept, and are therefore inappropriate in a document intended to inform the public and decision-makers. Habitat is defined by the species' use of the environment,[11] so there is no such thing as "native habitat." The fact that many terrestrial vertebrate species continue to reside and use the project area, as documented by the utilization surveys,[12] is proof that the project site continues to serve as habitat for many species. Over 87 hours of surveys from fixed observation stations, WEST, Inc. detected 90 species of bird, which equals >1 species per hour detected. For comparison, 979 hours of survey at Altamont Pass detected 35 bird species, or 0.036 species per hour.[13] Bird species diversity is much greater at Whistling Ridge than at the Altamont Pass, where bird fatalities caused by wind turbines are notoriously high.

Ecological integrity is the degree to which the species assemblage is composed of native species that are supposed to occur in a particular environment. The degree to which a species list is composed of exotic species is a measure of site invisibility, which tends to increase with reduced ecological integrity.[14] Of the 90 bird species detected at Whistling Ridge, only wild turkey was exotic, and this species is quasi-exotic as it only spread its range from east of the Mississippi River. In my experience, Whistling Ridge exhibits a very high level of ecological integrity and a very low level of site invisibility for terrestrial vertebrates. The characterization of poor habitat and low value on Page 3-35 was misleading.

According to the DEIS (page 3-50), "*northern spotted owls will not be "taken" by the proposed project*." I disagree with the foundation for this conclusion. The argument was made that a US Fish and Wildlife Service protocol can be interpreted to conclude that northern spotted owls no longer occupy historical nest sites because owls were not detected at the sites in 6 to 8 years. Government protocols do not dictate biological reality. It has been well established that animal populations tend to be spatially dynamic, meaning that centers of activity shift periodically.[15] In most cases, the shifting of activity centers tend to shift locations every generation or so, and I would consider 6 to 8 years to be short of a northern spotted owl generation. Hypotheses for the spatial shifts have included: (1) escaping parasite or predator loads; (2) exhaustion of resources; (3) dispersal of progeny as the natal population senesces; and, (4) some combination of these hypothesized factors. Just because a species has not been detected for a while does not mean the species will never return, and I state this without implying that I believe northern spotted owls no longer occur at the site.

Some conclusions in the DEIS were inconsistent with earlier foundation statements. For example, on page 3-59, the DEIS stated, "*little is known about this species* [Keen's myotis]," and then a few sentences later it stated, "*the likelihood of occurrence on the site is considered low*." Similarly, on page 3-60, the DEIS stated, "*Based on lack of detailed information on this species* (Townsend's big-eared bat) *distribution and nature of the bat surveys conducted on the site, it is difficult to conclude with certainty the likelihood of Townsend's big-eared bats occurring on the project site. … the likelihood of occurrence on the site is considered to be low*." In both these cases, the conclusions of low likelihood of occurrence came immediately following admissions that the analysts knew very little about these species. These types of conclusions are inconsistent with the precautionary principle in risk assessment, which should be a principle applied to any DEIS.

CUMULATIVE IMPACTS ANALYSIS

On page 3-83, the DEIS stated, "*The proposed project would cause mortality to birds and bats through turbine collisions. However, the level of mortality is not anticipated to be sufficient to negatively affect the population viability of any single species*." This conclusion was offered in the absence of any population viability analyses (PVAs) or any other defensible risk assessments. There is no scientific basis for this conclusion. In the discussion that follows, I address the cumulative impacts analyses performed by WEST, Inc. and included in the DEIS as Appendices C-11 and C-12.

In Apps. C-11 and C-12, Johnson and Erickson (2008)[16] and Young and Poulton (2007)[17] performed what they termed cumulative effects analysis. In the case of Johnson and Erickson (2008), the cumulative effects analysis was of the wind industry's desired build-out of about 6,700 MW of wind energy capacity on the Columbia Plateau spanning eastern Washington and eastern Oregon. They averaged fatality rates from existing wind farms in the region and multiplied the average rate against the desired build-out capacity of 6,700 MW. They then compared their predicted annual fatalities to their estimates of regional population size, relying on a population estimator based on breeding bird survey (BBS) results from the 1990s and provided by the Partners in Flight North American Landbird Conservation Plan. However, these estimates were unsuitable for the use that Johnson and Erickson (2010) and Young and Poulton (2007) made of them, and I found several other problems with the analysis, discussed below.

Regional Population Estimates.--Johnson and Erickson (2010) neglected to mention that there exist relatively large standard errors associated with the mean detections per BBS route. I used the standard errors to calculate 95% confidence intervals, which yielded very large ranges of population size for each species addressed in Johnson and Erickson (2008). For example, the lower bound estimate for ferruginous hawk was less than 0, and the differences between one side of the confidence interval and the mean population estimate ranged 29% (American kestrel) to 65% (ferruginous hawk) of the magnitude of the mean. Without addressing the large error terms in the data, Johnson and Erickson (2008) inadequately informed the reader about the suitability of their population estimates for assessing biological significance of "cumulative impacts."

More importantly, Johnson and Erickson (2008) dismissed strong criticism of a review of the Partners in Flight approach. Thogmartin et al. (2006)[18] reviewed the population estimation approach of Partners in Flight, and found the approach to be an inappropriate use of BBS data. The BBS was designed for detecting long-term population trends, but not for estimating population size. Thogmartin et al. (2006) also pointed out several potential biases in the Partners in Flight use of BBS data. The most likely and most substantial bias is the extrapolation of detection rates from roadways across large expanses of potential habitat lacking roads. Having performed many years of bird surveys both along roadways and far from roads, I cannot agree more with Thogmartin et al.'s conclusion that this was a serious bias, and one that likely inflated population estimates of the species addressed in Johnson and Erickson (2008). American kestrels, red-tailed hawks, and ferruginous hawks congregate along roadways because utility poles occur along roadways and are used for perching, especially on agricultural and shrub-steppe landscapes lacking natural tall perch structures. Furthermore, on agricultural landscapes, foraging habitat often occurs as strips between roads and disked fields. Extrapolating densities from roadways will produce absurdly inflated numerical estimates of numerous bird species, especially for American kestrels because their densities were estimates only within 200 m of BBS routes (the usual radius used by Partners in Flight was 400 m). A later version of Johnson and Erickson's cumulative impacts analysis (Johnson and Erickson 2010), which was mysteriously not the analysis used in App. C11, dismissed Thogmartin et al.'s review because no other regional population estimates exist for the Columbia Plateau. This rationale was unscientific.[19]

Johnson and Erickson (2008) did not provide a Partners in Flight estimate of the population size for golden eagles on the Columbia Plateau Ecoregion within Washington and Oregon because golden eagle fatalities had yet to be documented among wind turbines on the Columbia Plateau. However, golden eagle fatalities were subsequently documented, so the 2010 version of Johnson and Erickson's cumulative impacts analysis included a golden eagle population estimate, which was 1,700. For this number of golden eagles to occur on the Columbia Plateau within Washington and Oregon, the population density would have to be nearly as high as recorded in the Altamont Pass, or nearly one nesting pair per 19 km^2.[20] The Altamont Pass golden eagle density was characterized by Hunt et al. as one of the highest ever recorded. Therefore, for the Johnson and Erickson estimate to be true, the Columbia Basin would require an Altamont-level density to extend across the entirety of the Plateau, which is highly unlikely based on my understanding of animal density and distribution. Furthermore, the baseline studies performed by Johnson and Erickson and their WEST, Inc. colleagues have universally reported much lower golden eagle observations per hour among project sites in the Columbia Plateau Ecoregion as compared to the utilization rates documented in the Altamont Pass. As examples, WEST, Inc. reported 0 golden eagle observations during baseline surveys at Big Horn, 0.07/hour after 90 hours at Wild Horse, 0.033/hour after 270 hours at Golden Hills, 0.024/hour after 126 hours at Hopkins Ridge. For comparison, representative observation rates from the Altamont Pass have been 0.278/hour and 0.314/hour. The golden eagle population on the Columbia Plateau cannot be just as dense as in the Altamont Pass while at the same time trained observers count them at rates that are 0%, 8%, and 24% of the rates observed in the Altamont Pass.

As for Swainson's hawk, Johnson and Erickson (2008) estimated 10,000 breeding Swainson's hawks reside on the Columbia Plateau within Washington and Oregon. My model of nesting density projected only 579 pairs, or 1,158 adults.[21] My projection was extended beyond all the population density estimates that were available to contribute to the model, so to be conservative I can rationalize doubling my estimate to 2,315, which is still a much smaller population size than estimated by Johnson and Erickson.

Johnson and Erickson estimated the breeding American kestrel population to be 170,000 on the Columbia Plateau within Washington and Oregon. This number would amount to 7% of the entire North American breeding population that was estimated 28 years ago, and it would be a much larger percentage of today's North American breeding population.[22] It would have me believe that at least 7% of North America's American kestrel population resides on 0.55% of North America's land mass, or nearly 13 times more densely other than expected in the Columbia Plateau Ecoregion. This regional population estimate also would have me believe there resides 1 breeding American kestrel for every 0.79 km^2, or one pair per 1.58 km^2. This density across such a large area would be highly unlikely. Furthermore, Johnson and Erickson

(2008) claimed that the level of mortality likely to be caused by wind turbines following desired build-out in the Columbia Plateau would be sustainable and therefore of no significant population impact. This conclusion was not supported by a scientifically acceptable analysis, and it was inconsistent with the overall declining trend of American kestrels across North American and within Washington, specifically.[23]

Fatality Rates.--Johnson and Erickson (2008, 2010) compared fatality rates among Oregon and Washington wind farms, and then extrapolated the mean fatality rates to the projected build-out of 6,700 MW of wind power capacity in the Columbia Plateau Ecoregion. The fatality rates in their Table 2 (Table 1 in the 2010 analysis) were too low (Table 4). For example, using the same data, I found their estimates to be low for Big Horn, Wild Horse, and Stateline. The raptor fatality rate reported for Big Horn was 0.15 deaths/MW/year, whereas I estimated the rate to be 60% higher.[24] The raptor fatality rate at Wild Horse was reported to be 0.09 deaths/MW/year, but I estimate the rate to be 178% higher. The raptor fatality rate at Stateline was reported to be 0.091 deaths/MW/year, but I estimated the rate to be 43% higher. Extrapolating my Wild Horse fatality rate estimates to 6,700 MW of cumulative capacity yielded 1,688 raptors per year and 27,230 total birds per year. Extrapolating my Big Horn fatality rate estimates to 6,700 MW of cumulative capacity yielded 1,625 raptors per year and 23,568 total birds per year. The average of the extrapolations from these two projects yielded 1,656 raptors per year and 25,399 total birds per year. These extrapolations are 3.2 times greater for all raptors and 1.4 times greater for all birds than forecast by Johnson and Erickson (2008, 2010), and I have yet to consider the confidence intervals around the fatality rate estimates, which are very large. As for American kestrel, Johnson and Erickson (2008, 2010) forecast 162 deaths/MW/year, but my average estimates between Wild Horse and Big Horn, extrapolated to 6,700 MW, indicates the cumulative toll will be 1,381 deaths/MW/year, or 8.5 times greater than forecast by Johnson and Erickson (2008, 2010).

I also compared cumulative annual fatalities predicted by WEST, Inc. (and included in the DEIS) to my predictions based on my independent estimates of fatality rates using data in the same reports (Table 4). Compared to the predictions made by WEST, Inc., my predicted cumulative annual fatalities caused by the projected build-out of wind energy facilities in the Columbia Basin Ecoregion were 6.3 times greater for raptors, 2.6 times greater for all birds as a group, and about the same for bats (Table 4). Most of the difference in predictions between those made by me and WEST, Inc. can be explained by the estimators used, and specifically whether scavenger removal rates of carcasses were characterized by mean days to removal or by proportion of carcasses remaining at the *i*th day into a removal trial (see earlier discussion).

Table 4. *Differences in predicted fatality rates across neighboring Klickitat County and across the Columbia Basin Ecoregion, where the predictions were made by WEST, Inc. and by my use of the same data in available reports. Note that Whistling Ridge is not part of the Columbia Basin Ecoregion, but the DEIS nevertheless relied on a cumulative impacts analysis directed toward wind projects in the Columbia Basin Ecoregion. In either case, the WEST, Inc. estimates of fatality rates were much lower than my estimates, based on the same data.*

	Annual deaths in 1,000 MW Klickitat County		Annual deaths in 6,700 MW Columbia Basin Ecoregion		My estimate as multiple of WEST, Inc. estimates	
Group	Predicted by WEST (2004)[25]	Projected by my mean estimate (N = 23)	Predicted by Johnson and Erickson (2008)	Projected by my mean estimate (N = 23)	Klickitat County	Columbia Basin Ecoregion
All raptors	33	438	469	2,935	13.3	6.3
All birds	1461	5,623	14,539	37,674	3.8	2.6
All bats	467-600	1,143	7,906	7,658	1.9-2.4	1.0

Avian Use Rates.--It was inappropriate to compare avian use rates among wind farms without accounting for differences in maximum survey distances from the observer and in volumes of visible airspace from observation stations. Topography varies from place to place, and so does the proportion of the survey area that is visible from the observation stations. Also, detection rates of birds decline rapidly with distance from the observer, more so for smaller-bodied birds, so comparing use rates between wind farms will be substantially biased when the maximum survey distance was 800 meters in one wind farm and only 400 meters in another, or when few birds of one species will be detected beyond 300 m whereas most birds of another species will be detectable to 800 m. Without accounting for species-specific detection functions and variation in visible airspace due to topographic occlusion, comparisons of use rates cannot be reliable.[26]

ADDITIONAL COMMENTS ON THE DEIS

Cumulative impacts analysis in App. C-12 (page 1) identified dryland agriculture, CRP, and rangeland to be more suitable for wind power development on the Columbia Plateau than the surrounding mountainous areas that are more forested. I agree with this assessment. While developing a screening tool for siting wind energy facilities in California, I discovered that forested sites pose greater hazards to more bird species, including special-status species.[27] It appeared that overall impacts of wind power projects on wildlife would likely be greater in forested environments.

According to the DEIS (page 3-46), "*Although* [golden eagles] *soar at high altitudes, they drop down to the ground to capture prey*." This characterization can be misleading. Golden eagles typically hunt while flying low to the ground, using a flight behavior termed 'contour flying.' In fact, the summary of the two golden eagles seen flying on the project site (same page, 3-46) indicated the eagles were at heights above ground typical of the heights used during contour flights. This contour flying appears to be a behavior that predisposes golden eagles to wind turbine collisions, and it is not a behavior that this species will change.

Table 2 in Young and Poulton (2007) summarized "Mean annual mortality" estimates from various wind power projects in the region. However, most of the cited estimates were for one year only and not multiple years as the heading, "Mean annual mortality," would lead readers to believe.

Making the argument that background mortality causes fatality rates to be over-estimated at wind project sites, Young and Poulton (2007: page 14) claimed they found 0.33 bird carcasses per turbine plot equivalent per year in background fatality monitoring at two wind project sites, one in Montana and one at Buffalo Ridge, Minnesota. However, Young and Poulton (2007) neglected to mention that background mortality searches have been performed at multiple wind project sites by multiple investigators over the past decade, and those searches turned up very few or zero naturally occurring bird carcasses (Table 5). The average among reported background mortality surveys (0.0108 dead birds per turbine plot-equivalent) was 32 times lower than claimed by Young and Poulton (2007). In the case of Buffalo Ridge, which was one of the two project sites cited by Young and Poulton (2007), another WEST, Inc. team (Johnson et al 2000)[28] conducted 2,482 searches in reference plots and found one naturally occurring fatality for every 78 person-hours spent searching. They concluded, "The amount of natural mortality occurring in the study area is so small that attempting to correct fatality estimates for natural mortality is not warranted."

Table 5. *Results of background mortality surveys in which fatality searches were performed in similar environments as occurred amongst the project's wind turbines, but where there were no wind turbines. The turbine plot equivalent was 0.5625 ha, or the area within a typical square search plot used at modern wind turbines of 75 m per side. Anderson et al. (2005)*[29] *also performed background mortality searches, but their searches were nearby the wind turbines of the Tehachapi Pass, and appeared to have likely included birds killed by the wind turbines.*

Source[30]	**Study site**	**No. sites**	**Ha per site**	**Searches per site**	**Ha search effort**	**Dead birds found**	**Deaths / turbine plot equivalent**
Nicholson 2003	Buffalo Mountain, TN	3	0.785	150	353.40	2	0.0101
Harmata et al. 1998					596.00	4	0.0119
Kerlinger et al. 2000	Ponnequin, CO		24.000	5	120.00	2	0.0296
Schmidt et al. 2003	National Wind Technology Center, CO	10	0.790	24	189.60	0	0.0000
Kerlinger et al. 2005	High Winds, CA	90	1.767	1	159.04	0	0.0000
Average							0.0103

MITIGATION MEASURES

The DEIS listed several wind turbine design features as mitigation measures, including:

- Use of tubular tower to minimize perching;
- Minimize use of turbines lighting to minimize the chance of disorienting birds and bats; and,
- Install newer generation up-wind turbines.

However, all three of these design features are pursued for economic reasons having nothing to do with mitigating wildlife impacts, and there is no empirical evidence that any of these features have anything to do with bird and bat fatalities. These design features do not in any way mitigate for the impacts of bird and bat collisions.

Conducting a raptor nest survey prior to construction would unlikely mitigate project impacts. How could it, other than influencing the timing of installation to minimize disturbance caused by construction activities? There is no established relationship between raptor nest density and wind turbine collision rates.

I concur with the need for post-construction fatality monitoring, but I would set the minimum to three years instead of two years, and I would require that all the turbines are searched for fatalities over the first three years and that a subset of the turbines be searched through the life of the project.

I agree that a Technical Advisory Committee (TAC) should be established, but EFSEC and BPA should impose minimum standards for TAC membership, including scientific credentials and experience with issues relevant to avian and bat impacts caused by wind projects. The TAC should be clearly authorized to select the fatality monitor, to require additional mitigation, and to change the monitoring. However, this measure should refrain from giving the impression that additional mitigation measures are readily available. In truth, there is little if anything that can be done to reduce bird and bat fatalities once the wind turbines are installed. There is no evidence that any measures have been implemented to reduce bird fatalities at modern wind energy projects, and so no evidence that any measures were effective.[31]

Unless the TAC is formed long before project construction, I do not believe mention should be made of adaptive management. To be true adaptive management, the measures would need to be formulated ahead of time, along with thresholds of success and alternative prescriptions. The TAC should work together with stakeholder groups to formulate an adaptive management plan, and the plan should be informed by adequate, directed pre-construction surveys. The currently available surveys are not adequate for informing adaptive management.

Recommended Mitigation Measures

Once the wind turbines are installed, there is little, if anything, that can be done to reduce fatality rates. Therefore, it is very important to carefully plan the installation of wind turbines, including tower height and wind turbine siting. Lee Neher and I have developed spatial models to predict hazard zones for specific species of raptor in the Altamont Pass, relying heavily on behavior and utilization surveys. Sufficient sample sizes of birds displaying specific flight behaviors, e.g., hovering, contouring, fly-catching, are needed to inform the models, which also rely on a resolute digital elevation model of the project area so that slope and wind conditions can be measured and related to bird flight patterns. Our models are being implemented in two repowering projects. Our approach or a similar approach should be utilized at Whistling Ridge, if the project is developed.

Once wind turbines are carefully sited, tower heights are decided upon to minimize encounters with birds, and the electrical distribution system is designed to minimize impacts, the wind turbine-caused fatalities should be low enough to establish a reasonable nexus between the project's impacts and the benefits gained through compensatory, offset mitigation.

Fatality monitoring and post-construction utilization monitoring should be performed for at least three years following project installation. The monitoring is needed to learn of successes and failures of the project planning so that the lessons can be applied to future wind energy projects. It is also needed to inform compensatory mitigation. All wind turbines should be included in the fatality monitoring to ensure adequate sample sizes are obtained. Fatality searches should be performed no less frequently than every two weeks, and two teams should perform searches independently of each other so that detection rates can be estimated without performing independent searcher detection and scavenger removal trials, which are fraught with biases and sources of uncertainty.[32]

SUMMARY

Collision Impacts

- The analysis of direct impacts caused by bird and bat collisions with wind turbines was incorrect and misleading. It relied on the same methodology that has most often resulted in predicted fatality rates being proven by post-construction monitoring to have been much too low. Measured raptor fatality rates have been up to 14 times higher than predicted fatalities.

- The impacts assessment relied on raptor fatality rates regressed on utilization rates, but this regression was fundamentally flawed in multiple ways.

    - The regression between fatality rates and utilization rates was pseudoreplicated, meaning the effective study units were not the study units implied in the graph – they were regions instead of wind projects. The positive regression slope was strongly leveraged by two California wind projects, the omission of which reverses the direction of the regression slope.

- The effort directed toward avian utilization surveys totaled 87 hours, which was grossly insufficient for characterizing utilization rates of many species, especially golden eagle and other raptors.

- The utilization surveys were diurnal, so were not designed to detect species active in the early morning, evening, or at night.

- The utilization surveys were extended to 800 m from the observer, which ensured that most flying birds would be undetected during each survey session, and no attempt was made to account for the proportion of the sky over the survey area that was occluded by terrain and forest. For these reasons, the utilization survey results were not comparable to other wind farms or among plots within the Whistling Ridge project site.

- The regression slope between fatality rates and utilization rates relied on fatality rates that were biased low in most of the available monitoring reports. Most of the fatality rates in the Pacific Northwest were derived from an estimator that relies on mean days to removal of placed carcasses in carcass removal trials, but carcasses in these trials must be censored from the calculation of the mean if the carcasses have not been removed by the end of the trial. This means the trials must extend for much longer periods than the average search interval of the fatality monitoring, and that mean days to removal is biased high and the resulting fatality estimates biased low.

- The regression between fatality rates and utilization rates was based mostly on monitoring that lasted only one year, but the inter-annual variation measured at other wind projects revealed up to nearly 6-fold differences in low to high fatality rates between years. This high inter-annual variation warrants a much larger sample size before any validity can be given to the regression used in this DEIS.

- The prediction of zero raptor fatalities at Whistling Ridge was fallacious because the prediction was based on the regression slope intercept being to the right of Whistling Ridge on the continuum of utilization rates among wind farms. In the very same graph, the slope intercept was also to the right of other wind farms where fatality rates were greater than zero.

- The DEIS also appeared to rely on an exposure index value to assess collision impacts of individual species. However, I tested the relationship between fatality rates and this exposure index at other wind farms, and found no relationship whatsoever.

- The DEIS appeared to rely on a comparison of raptor nesting densities among wind project sites, but I was unable to find a significant relationship between fatality rates and raptor nesting densities.

- Based on mean fatality rates estimated at other wind projects throughout Washington, Oregon and California, the minimum numbers of annual fatalities at Whistling Ridge would likely be 33 raptors, 422 birds (including raptors), and 86 bats, but actual rates would likely be much higher because unlike the other wind projects used to calculate the means, Whistling Ridge is located in a forested environment that is also frequently enveloped by clouds.

Other Impacts

- The impacts assessment directed to habitat fragmentation was also fallacious because the DEIS characterized the site as biologically impoverished, whereas the mere 87 hours of avian surveys there revealed a much higher avian species diversity than occurs in the Altamont Pass – the site of the most notoriously dangerous wind energy project on Earth to birds. Furthermore, all but one of 90 bird species were endemics, indicating a high level of ecological integrity at the site.

- Impacts to northern spotted owl were inappropriately dismissed, because this conclusion relied too much on interpreting US Fish and Wildlife Service protocols and not enough on wildlife biology and common sense.

Cumulative Impacts

- The cumulative impacts analysis in the DEIS was fundamentally flawed in several ways. First, the DEIS relied on a cumulative impacts analysis of the Columbia Basin Ecoregion, but Whistling Ridge occurs in a forested environment outside this Ecoregion. Second, the analysis relied on a Partners in Flight web site to estimate regional population sizes of bird species, but the Partners in Flight estimator did not pass scientific scrutiny in the scientific literature and the population estimates used in the DEIS were absurdly large. Third, reported avian fatality rates have been underestimated, so low fatality rates were compared to absurdly large population sizes to arrive at erroneous conclusions of no significant cumulative impacts. The cumulative impacts analysis cannot be taken seriously.

- Based on means from available reports of fatality monitoring at wind projects in the western US, build-out of 6,700 MW in the neighboring Columbia Basin Ecoregion could be expected to annually kill at least 2,935 raptors, 37,674 birds, and 7,658 bats, far exceeding the annual death toll at the notorious Altamont Pass.

- A new cumulative impacts analysis is needed for this project, and it needs to include the potentially unique impacts of siting wind turbines in the forested environment of Skamania County.

Mitigation Measures

- The DEIS listed several design features of the proposed wind turbines as preventive mitigation measures, but these features have not affected fatality rates and so are misleading.

- Post-construction monitoring should last at least 3 years for all turbines, and throughout the life of the project for a subset of turbines. Fatality searches should be no less frequent than twice per month.

- Minimum standards are needed for Technical Advisory Committee membership, and the TAC should be given authority to select the monitor, make changes to the monitoring program, and to require additional mitigation measures.

- Wind turbines should be carefully sited, and the siting should be based on adequate bird surveys, the results of which are related quantitatively to a resolute digital elevation model of the project site.

- Tower heights and the low and high reaches of the rotor plane should be based on an analysis of adequate avian survey data.

I recommend that the DEIS for Whistling Ridge be withdrawn, and that a new one be prepared. Much more effort should be directed toward pre-construction bird and bat surveys, and adequate analysis of the data should be performed. The methods used to predict impacts need to be replaced by scientifically defensible methods. The cumulative impacts analysis needs to be replaced, and the new one should include the impacts of siting wind turbines in the forested environments of Skamania County. The section on mitigation needs to be revised to avoid misleading readers about the effectives of turbine design features and adaptive management. The TAC needs to consist of qualified scientists, and the post-construction monitoring needs to be strengthened.

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[1] Bonneville Power Administration and Washington Energy Facility Site Evaluation Council. 2010. Whistling Ridge Energy Project Draft Environmental Impact Statement, DOE/EIS-0419.

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