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California Energy Commission
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Re: DRECP NEPA/CEQA: Comments of San Bernardino Valley Audubon Society, San Diego Audubon Society, San Fernando Valley Audubon Society, and Audubon California

Dear Commissioners,

Thank you for this opportunity to comment on the draft Desert Renewable Energy Conservation Plan and Environmental Impact Report/Environmental Impact Statement prepared by the California Energy Commission and the Bureau of Land Management. San Bernardino Valley Audubon Society, San Diego Audubon Society, San Fernando Valley Audubon Society, and Audubon California (collectively "Audubon") appreciate the drafters acknowledgment of Audubon's ongoing efforts to identify Important Bird Areas in California. However, the following comments are informed by a serious concern that, although acknowledging the scientific validity of Audubon's IBAs, each of the DRECP's alternatives proposes to focus utility-scale solar, solar thermal, wind, and geothermal within important IBAs identified within the project area. Of the 20 IBAs located within the Project area, three are of particular significance to the DRECP proposal – the 623,000-acre Imperial Valley IBA south of the Salton Sea (DEIS/DEIR, Table III.7-24 ["Important Bird Areas within the Imperial Borrego Valley Ecoregion Subarea of the DRECP"] (p. III.7-109); the Antelope Valley IBA to the north of Lancaster (DEIS/DEIR, Table III.7-32 ["Important Bird Areas within the West Mojave and Eastern Slopes Ecoregion Subarea of the DRECP"], p. III.7-117, and the 34,000-acre Lower Colorado River Valley IBA near Blythe, California (DEIS/DEIR, Table III.7-23 ["Important Bird Areas within the Cadiz Valley and Chocolate Mountains Ecoregion Subarea of the DRECP'] (p. III.7-109). *See* DEIS/DEIR, p. III.7-108 – III.7-117. Even Alternative 1, which purports to be the more conservation-oriented alternative, proposes to construct vast areas of utility-scale renewable energy projects covering vast swaths of these three IBAs.

Although Audubon supports the Commission's and other agencies' efforts to facilitate the siting of renewable, particularly solar, energy projects through comprehensive planning, one of the most significant disadvantages of utility-scale renewable energy projects is the disproportionate impact the projects are having on sensitive bird populations, especially in southern California's desert areas. Although wind and thermal solar utilities have the most impact on birds flying into their vicinity, even PV solar facilities are detrimental to many bird species as a result of collisions

and destruction of ever diminishing foraging habitat. For these reasons, it is incumbent upon the CEC and BLM to expand the project definition and alternatives to include at least three additional alternatives – 1. An alternative that reorients the Development Focus Areas to not only reduce their scope, as is proposed by Alternative 1, but also avoids significantly greater portions of the IBAs identified above, which Alternative 1 does not do; 2. An alternative that reduces by a third the overall megawatts of renewable energy within the DRECP area which would allow the project to avoid IBAs and other sensitive habitats; and, 3. A reduced megawatts and acreage version that places greater emphasis on distributed generation.

In addition, the DEIS/DEIR significantly plays down the adverse impacts the current alternatives will have on burrowing owls, Swainson's hawks, and other bird species, relying on vague and unproven mitigation measures as the rationale for concluding no significant impacts will result to these Covered Species. There can be no doubt that, despite many decades of projects implementing mitigations for burrowing owls, the species is in a steep decline. Cumulative impacts to burrowing owls are plainly evident throughout its range. The DRECP now proposes to drastically reduce the burrowing owls' last and best habitat in both the Imperial Valley south of the Salton Sea and in the areas around Lancaster. Yet the very mitigations that have failed to stem the cumulative demise of burrowing owls is purported by the DEIS/DEIR to prevent further cumulative impacts to this species.

The DEIS/DEIR also takes an overly optimistic view of utility developers' ability to mitigate impacts to migratory and other birds from large wind farms and thermal solar facilities. Once constructed, any wind farm will pose a lethal obstacle, throughout the entire turbine field and rotor swept zones, to every bird that ventures into its spinning blades. No mitigation measures will remove these impacts. The same is true for the unwary birds that fly into the beams of a solar thermal plant. Nor are the reasons for amplified bird and bat collisions with photovoltaic solar facilities yet understood, nevermind means to effectively mitigate these impacts. There are no mitigations that avoid these technologies' lethal effects on birds. However, reading the DEIS/DEIR, one gets the impression that mitigations are available to render each of these technologies benign to birds. No such certainty exists in reality. These and other comments are more fully set forth below.

Audubon has retained renowned expert Dr. Shawn Smallwood, Ph.D., who has conducted groundbreaking research on the impacts to birds from wind turbines and has substantial experience reviewing avian impacts from solar utilities. Dr. Smallwood has prepared expert comments on the DRECP and EIS/EIR which are attached and hereby incorporated by reference and partially summarized below. Please respond to Dr. Smallwood's comments separately from these comments.

A. The Range of Alternatives Analyzed in the EIS/EIR is Insufficient.

The EIS/EIR stacks the deck in favor of the Preferred Alternative by failing to consider any alternatives that would further reduce the impacts of the DRECP. Even Alternative 1, the purportedly conservation-oriented alternative, increases impacts to a number of covered species, in particular burrowing owls, Swainson's hawks, greater sandhill crane, Tricolored blackbird, and

mountain plover. Looking at each of the alternatives, there is little variation and, relative to the Preferred Alternative, the options only get worse for avian species.

For example, Alternative 1 has 148,000 acres of permanent disturbance from renewable energy development compared to 145,000 acres of permanent disturbance for the Preferred Alternative. DEIS/DEIR, Table IV.27-1. The disturbed acreage increases from there for Alternatives 3 and 4. Although increasing the disturbed area, Alternative 1 proposes significantly less DFAs. In effect, all Alternative 1 does is limit the possible areas the energy projects will be rewarded with streamlining by the DRECP while not reducing the actual impacts at all as compared to the Preferred Alternative.

There is little difference between the five alternatives' impacts to "agricultural land-related covered species," *i.e.* burrowing owls, Swainson's hawks, greater sandhill crane, and mountain plover. For example, Alternative 1, the conservation alternative, increases impacts to these species as compared to the Preferred Alternative from 53,000 acres to 68,000 acres. DEIS/DEIR, p. IV.27-11. Alternative 1's impacts to these species are greater than the other three alternatives as well. *Id*. For burrowing owls, Alternative 1 also has the greatest acreage impacts -137,000 acres vs. 123,000 acres of impacts for the Preferred Alternative. DEIS/DEIR, p. IV.27-13. The same is true for Swainson's hawks – Alternative 1 with 52,000 acres of impacts compared to the preferred Alternative's 46,000 acres of impacts to Swainson's hawk's habitat. *Id*.

Similarly, in terms of migratory birds, the comparison of alternatives is useless. The DEIS/DEIR's table repeats the same generic language for all of the alternatives. DEIS/DEIR, p. IV.27-12, Table IV.27-3. The DEIS/DEIR also claims generically that impacts would be project specific, making no effort to distinguish additional impacts from greater reliance on wind and thermal solar. *Id*. *See also* p. IV.27-27 (Table IV.27-7) (BLM lands); p. IV.27-31 & 32 (GCP (NCCP) project). *See* Smallwood Comments.

"The purpose of an EIR is ***not*** to identify alleged alternatives that meet few if any of the project's objectives so that these alleged alternatives may be readily eliminated." *Watsonville Pilots Assn. v. City of Watsonville* (2010) 183 Cal.App.4th 1059, 1089 (emphasis supplied). "Since the purpose of an alternatives analysis is to allow the decision maker to determine whether there is an environmentally superior alternative that will meet most of the project's objectives, the key to the selection of the range of alternatives is to identify alternatives that meet most of the project's objectives but have a reduced level of environmental impacts." *Id*. In *Watsonville Pilots*, the Court of Appeal made clear that it was incumbent under CEQA for the agency:

> to include within its alternatives analysis a reduced development alternative that would have satisfied the 10 objectives of the project that did not require the level of development contemplated by the project. Analysis of such an alternative would have provided the decision makers with information about how most of the project's objectives could be satisfied without the level of environmental impacts that would flow from the project.

Id. The lack of any alternatives that would be better protective of all of the covered species, including burrowing owls, Swainson's hawks, greater sandhill crane, and mountain plover,

stems from the assumptions applied to developing the Reserve Design. Although the EIS/EIR makes much of the IBAs in its discussion of the Project's environmental setting, the process for developing the Reserve Design components makes no mention of the IBAs. Instead, the criteria for selecting the Reserve Design components treats all farmland as disturbed. As the EIS/EIR states, "[t]he reserve design was the single most important factor affecting the likely distribution of DFAs." DEIS/DEIR, p. F1-3. "Disturbed lands and areas of low terrestrial intactness were considered lower biological conflict for renewable energy siting and are not important for inclusion in the reserve design." DEIS/DEIR, App. D, p. D-17. To the extent the reserves exclude "disturbed lands," that means they likely will end up in the DFAs. This is certainly the case for the large area south of the Salton Sea that includes many agricultural fields. This agricultural area is the location of the greatest concentration of burrowing owls remaining in California. In 2007, the Imperial Valley was home to 71% of the estimated breeding population in California (DeSante et al. 2007). Wilkerson & Siegel (2010). The Antelope Valley IBA and Lower Colorado River Valley IBA also appear to be the other most significant development areas proposed for the Plan. The preferred alternative plan for all three of these areas appears to leave little if any of these areas as conservation areas.

1. The DEIS/DEIR's project definition improperly narrows the scope of the project to a single megawatt production goal.

The CEC has selected a single 20,0000 megawatt goal applicable to every alternative that opts to include all of the projected energy generation assigned to the DRECP area. This overly narrow objective precludes the consideration of a reasonable range of alternatives in the DEIS/DEIR. As stated in the DEIS/DEIR, the CEC's goal includes to "[c]ontribute to California's Renewables Portfolio Standard and the state's greenhouse gas reduction mandates and goals by planning for approximately 20,000 MWs of renewable energy generation and associated transmission capacity in the Plan Area by 2040." DEIS/DEIR, p. I.1-9. This is equivalent to the federal government's entire 2020 public lands goal nationwide. *Id*., p. I.1-1. The CEC's fixed 20,000 MW goal is derived from its staff's DRECP Acreage Calculator, described in Appendix F3 of the DEIS/DEIR. The Acreage Calculator "estimates [] how many MW of renewables and subsequent acreage *might* be needed [within the DRECP] given different assumptions about the future of electricity demand growth, GHG emission reduction goals, and low-carbon/renewable technologies." App. F3, p.1. "The Acreage Calculator is **not** a prediction of the future; it is a reflection of what many different possible futures could be given the different series of assumptions described above." *Id* (emphasis in original). The Acreage Calculator nevertheless is a conservative projection of market-driven renewable power needs. To that extent, by including all of the power needs and acreage estimated by the model in the project objectives and thus every single alternative, the DRECP proposes to incentivize and streamline projects achieving all of that projected market driven demand. Audubon does not believe adhering to a single projection from a tool purportedly designed to project many different possible futures comes close to complying with CEQA's mandate for agencies to adopt a reasonable project objective that facilitates consideration of a range of alternatives.

The last page of Appendix F3 acknowledges the fact that less than 20,000 MW of renewable energy may be either necessary or ultimately built in the DRECP area:

> The technology type and amount of generation built in the DRECP area will remain market-driven. There is **no guarantee** that the acreage associated with 20,000 MW will *all* be built: *ideally, it would not*. The DRECP's twin goals do not only include planning renewable energy facilities. It is *central* to the DRECP to minimize the environmental impacts of desert renewables to the greatest extent possible. However, the collective agencies felt it was important, necessary, and beneficial to incorporate the additional MW of planning capacity to account for inherent uncertainties in the 2040 planning process. That way, *if* the capacity *is* needed, it will be covered by the DRECP, especially given many of the conservative inputs and assumptions that have been fed into the Acreage Calculator by CEC staff.

App. F3, p. 24 (emphases in original). If the ideal situation is something less than 20,000 MW of new renewable energy utilities in the DRECP (indeed, the DRECP Acreage Calculator actually projects 17,000 MW), alternatives reflecting more ideal outcomes should be considered. The DRECP is only a mechanism to streamline, incentivize, and direct proposed renewable energy projects to certain locations. It is not reasonable for every alternative to incentivize damaging renewable energy projects in the desert – an area already bearing more than its fair share of development burdens from such facilities – going well beyond the ideal level of development that may be necessary. A project objective that is responsive to CEQA's goal of protecting the environment would be flexible enough to encompass a range of energy production including not just the market driven project but also as important the ideal build-out that could very well play out. The CEC and the public should have an opportunity to consider and debate not only the locations and types of renewable energy projects that will be incentivized and facilitated by the DRECP but also how many projects and MWs should be entitled to streamlining.

A project's objectives are part of the mandatory project description required by CEQA. "A clearly written statement of objectives will help the lead agency develop a reasonable range of alternatives to evaluate in the EIR and will aid the decision makers in preparing findings or a statement of overriding considerations, if necessary." 14 Cal. Code of Regulations §15124(b). "The process of selecting the alternatives to be included in the EIR begins with the establishment of project objectives by the lead agency." *In re Bay-Delta* (2008) 43 Cal.4th 1143, 1163. "[A] lead agency may not give a project's purpose an artificially narrow definition…." *Id*. at 1166. When project objectives are defined too narrowly, the EIR's alternatives analysis may be inadequate. *City of Santee v. San Diego* (1989) 214 CA3d 1438; *Preservation Action Council v. San Jose* (2006) 141 Cal.App.4th 1336. The EIR must state project objectives broadly enough to leave room for consideration of alternatives that reduce environmental impacts.

By limiting the DRECP project's objectives to planning for and incentivizing a single 20,000 MW objective, the DEIS/DEIR improperly constrains the alternatives and impacts considered.

2. The DEIS/DEIR must consider an alternative that avoids more of the areas included in Audubon's IBAs.

An alternative with significantly less development in Audubon's IBAs must be included. "A potentially feasible alternative that might avoid a significant impact must be discussed and

analyzed in an EIR so as to provide information to the decision makers about the alternative's potential for reducing environmental impacts." *Habitat & Watershed Caretakers v. City of Santa Cruz* (2013) 213 Cal. App. 4th 1277, 1304. As the DEIS/DEIR acknowledges, Audubon's IBAs "provide a useful framework for helping guide efforts to conserve birds statewide…." DEIS/DEIR, p. III.7-108. Despite that acknowledgement, each of the alternatives proposes to fragment and destroy large swaths of three of the most important IBAs with renewable energy development. It is particularly frustrating to Audubon that the alternative held out as avoiding conflicts with biological resources actually significantly increases conflicts with covered bird species, including the burrowing owl and Swainson's hawk. *See* DEIS/DEIR, p. II.1-2 ("Alternative 1 includes a DFA configuration that includes only the lowest biological resource conflict areas"). Alternative 1 has the greatest impact on "agricultural land-related covered species." DEIS/DEIR, p. IV.27-11, IV.27-13. This is because the criteria for establishing DFAs excludes farmland, even if it is important habitat for burrowing owls, Swainson's hawks, and other bird species. *See* DEIS/EIR, App. D, p. D-17 ("Disturbed lands and areas of low terrestrial intactness were considered lower biological conflict for renewable energy siting and are not important for inclusion in the reserve design … [T]he DRECP disturbed lands mapping identified aggregations of disturbed and agricultural lands"). There is no alternative that lays out a configuration of DFAs that significantly reduces the siting of renewable energy projects within Audubon's IBAs, in particular the three IBAs near the Salton Sea, Lancaster and Blythe.

3. The DEIS/DEIR must consider a reduced size alternative that does not locate all projects meeting the projected demand in the desert.

As discussed above, the 20,000 MW objective set forth by the CEC is not the only conceivable demand for renewable power production within the DRECP nor is it even the ideal outcome. *See* App. F3, p. 24. Accordingly, the DEIS/DEIR should evaluate an alternative that reflects the preferred scenario that Appendix F hints at but does not disclose. Audubon suggests a range of alternatives generating 5,000, 10,000 to 15,000 MW with the appropriate mitigation for each would provide the CEC, BLM and the public with a clear picture of the relative impacts of the current Preferred Alternative while still making a serious stride toward either California's renewable energy goals or the federal government's nationwide 20,000 MW goal for public lands.

4. The DEIS/DEIR must consider an alternative including significantly more distributed generation in the mix of power sources.

A distributed generation alternative should have been selected for detailed analysis in this DEIS/DEIR. There is little doubt that a distributed generation alternative "would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen [some] of the significant effects of the project," consistent with the guidance of CEQA Guidelines § 15126.6(a). The DEIS/DEIR rejects considering an alternative based on achieving the project objectives entirely through distributed generation. DEIS/DEIR, p. II.8-9 ("Under the Distributed Generation Alternative, the DRECP would not plan for the development of utility-scale renewable energy facilities larger than 20 MW, but instead assume that future greenhouse gas and emission reduction goals will be achieved exclusively through distributed generation"). Audubon believes that rejecting a 100 percent distributed generation alternative does not relieve the CEC and BLM of considering a feasible alternative that would rely to a substantially greater extent on achieving the

project's power generation goals through distributed generation but not eliminate all utility-scale renewable energy sources. Nor does factoring in a mere 1,700 MW of distributed generation that is predicted to occur in any event within the DRECP area an alternative that allows the public and decision-makers to weigh the pros and cons of relying more on distributed renewable power generation. *See* DEIS/DEIR, p. II.8-8 - 8-9. Audubon believes that an alternative relying on at least half of the renewable energy power coming from distributed generation sources both within the DRECP and west of the DRECP area within the developed areas of Southern California must be analyzed in the DEIS/DEIR. Such an alternative would not suffer from the concerns expressed in the DEIS/DEIR rejecting the exclusive distributed generation alternative.

As the DEIS/DEIR acknowledges, there are a number of distinct advantages to a project designed to promote more distributed generation systems, including protecting sensitive desert habitats by avoiding the disturbances created by large, utility-scale solar facilities. *See* DEIS/DEIR, pp. II-8-6, II.8-9. In the case of solar PV technologies, these technologies enjoy frequent efficiency upgrades. Distributed systems are more capable of adapting quickly to such upgrades, whereas the panels that are utilized in large-scale solar "farms" may not be capable of being replaced with more efficient units as quickly for a variety of reasons, not the least of which would be a significant investment commitment in the current level of efficiency. Today's large-scale solar "farm" can quickly become a "dinosaur" compared with the distributed systems that can quickly absorb the new technology about to come online.

In addition, to reducing the number of habitat destroying large-scale projects, increased reliance on distributed generation would reduce aesthetics impacts compared to utility-scale projects, blending into existing buildings, parking lots and other developed areas.

Similarly, impacts on air quality are among the highest impacts of constructing large, utility-scale projects, and the distributed generation alternative would lessen this impact. None of the dust and particulate matter emissions that result from constructing massive energy projects are associated with distributed generation. Even at the current rate of solar development in the desert counties, air quality is a significant problem.

Lastly, relying on a significant amount of distributed energy generation will meet most of the project objectives. The only objective that may be compromised is the one improper objective requiring 20,000 MW to be generated within the DRECP area. As discussed above, that objective is improperly narrow and should be changed to allow additional feasible alternatives to be considered, including an alternative relying more on distributed generation that will reduce the project's environmental impacts. This alternative would still allow BLM and USFWS to consider public lands for large-scale utility projects, though not as many would be required. It would not preclude BLM from identifying and incorporating public lands managed for conservation purposes within the CDCA. Nor, as described above, would this option be inconsistent with California's policy goals and any efforts to reserve lands for environmental protection in the California desert. Because an alternative with a greater mix of distributed generation would meet all the appropriate project objectives, a recirculated DEIS/DEIR is required to fully analyze this alternative.

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B. The DEIS/DEIR Must Include Wind Power's Rotor Swept Areas In The Comparison Of Alternatives In Order To Provide An Accurate Comparison.

The biggest threat to avian species from wind power is the spinning blades within a project's rotor swept area ("RSA"). Although the alternatives provide a calculation in acres of the rotor swept areas proposed under each alternative, the comparison of alternatives fails to include those critical figures in its analysis and tables. *Compare, e.g.* Tables II.3-24 & Table II.4-8 with Tables IV.27-1, IV.27-3, IV.27-7 & IV.27-10. *See* DEIS/DEIR, p. II.3-185 ("Unlike solar, not all the land within the boundary of a wind project was assumed to be permanently disturbed by project activities. For the purpose of analysis, estimates of disturbed acreage were the sum of the estimated acreage required for turbine pads, roads, ancillary facilities, and supporting infrastructure."). The CEQA Guidelines require that "[t]he EIR shall include sufficient information about each alternative to allow meaningful evaluation, analysis, and comparison with the Proposed Project." 14 CCR § 15126.6(d). The Guidelines suggest, and the DEIS/DEIR utilizes, "[a] matrix displaying the major characteristics and significant environmental effects of each alternative may be used to summarize the comparison." *Id*. By leaving out the rotor swept area from the comparison of alternatives, the DEIS/DEIR omits an important component to the impacts of each alternative. For those alternatives with larger areas of wind power, omitting the rotor swept area component underestimates its impact to avian species. For example, the DEIS/DEIR estimates that the Preferred Alternative's wind component will result in 9,000 acres of permanent on-the-ground disturbance and another 5,000 acres of rotor swept area. DEIS/DEIR, Table II.3-24. It further estimates that Alternative 1 will result in 2,000 acres of permanent disturbance from wind and 2,000 acres of rotor swept area. DEIS/DEIR, Table II.4-8. As it stands now in the comparison of alternatives, the Preferred Alternative will permanently disturb 145,000 acres through the DRECP area while Alternative 1 will disturb 148,000 acres. *Id*., Table IV.27-1. Accounting for the additional 4,000 acres of rotor swept area included in the Preferred Alternative when compared to Alternative 1 results in the total acres disturbed being effectively the same. Given how similar these two alternatives are in the first place, this would have a substantial effect on the current finding in the DEIS/DEIR that the Preferred Alternative is the environmentally superior alternative. *See* DEIS/DEIR, p. IV.27-4. Audubon believes that any of the three alternatives described above that should be added to the EIS/EIR's discussion would easily qualify as environmentally superior to either the Preferred Alternative or Alternative 1.

C. The DEIS/DEIR Fails To Address Adequately The Large-Scale Displacement And Destruction Of Foraging And Nesting Habitat Of Covered Species Associated With Agricultural Habitats.

The comments of Dr. Smallwood discusses the extreme consequences that the DRECP preferred alternative would have on burrowing owls and the lack of adequate monitoring and mitigation necessary to protect numerous other avian species, including Swainson's hawks and Golden eagles. The following highlights the inadequacies of the DEIS/DEIR from a non-expert reader's perspective.

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1. The DEIS/DEIR fails to address adequately the large-scale displacement and destruction of burrowing owl habitat that will result from the Alternatives' Location of DFAs within Audubon IBAs.

The EIR/EIS must provide a much more robust impact analysis on the Plan's impact to regional and statewide populations, and even the continued viability, of burrowing owls given the concentrations of development proposed within the main population centers of the owl in the DRECP area, especially within the Imperial Valley IBA. There is no doubt that the burrowing owl habitat in the Imperial Valley is critical to the viability of owl. DEIS/DEIR, p. III.7-102 ("The canals and drainage ditches in the Imperial Valley also provide extremely important habitat for the burrowing owl, which supports the largest breeding population of that species in California"); Biological Baseline, p. 5-29 – 30 ("About 69% of California's [burrowing owl] population was found to be concentrated in agricultural areas of the Imperial Valley"); *Id*. (the Western Mojave and area around Blythe make up another 8 percent of the total California population). *See* Figure 3.7-17. *See also* Wilkerson & Siegel (2010) (in 2007, the Imperial Valley was home to 71% of the estimated breeding population in California (DeSante et al. 2007)). The owl also depends on extensive habitat within the IBA around Blythe and in the West Mojave. *See* Figures 3.7-16 & 3.7-25. Nor is there any dispute that the owl's population is in a steep decline in California. *Id*., p. III.7-102. Despite these concentrations of owls and their ongoing population decline, the DRECP proceeds to treat the preferred habitats of 77 percent of the State's burrowing owl population as generally disturbed and focuses the primary DFAs in each of the alternatives coincidentally with the burrowing owl's preferred habitat.

Given these facts, one would expect a robust analysis of the clear impacts to burrowing owls of expanding development in their preferred habitat. Unfortunately, the DEIS/DEIR spends little effort in describing the implications of accelerated development in the proposed DFAs on the burrowing owl. The sum total of the discussion of the Preferred Alternative's impact on the burrowing owl includes the almost identical generic sentence for both the West Mojave and the Imperial Valley, lumping the owl in with a number of other species, and stating:

> Suitable habitat for several bird Covered Species in the West Mojave and Eastern Slopes subarea would be impacted, including Bendire's thrasher, burrowing owl, California condor, golden eagle, least Bell's vireo, mountain plover, southwestern willow flycatcher, Swainson's hawk, and tricolored blackbird.

DEIS/DEIR, p. IV.7-233 (West Mojave). The discussion for Imperial Valley states, "Impacts would occur to suitable habitat for the following covered bird species in this subarea: Bendire's thrasher, burrowing owl, California black rail, Gila woodpecker, golden eagle, greater sandhill crane, least Bell's vireo, mountain plover, southwestern willow flycatcher, Swainson's hawk, tricolored blackbird, and Yuma clapper rail." *Id*., IV.7-235 (Imperial Valley). The DEIS/DEIR does note the connection between burrowing owls and agricultural lands, but still falls far short of an adequate discussion of impacts to the burrowing owl:

> Covered Species associated with agricultural lands include burrowing owl, greater sandhill crane, mountain plover, Swainson's hawk, and desert pupfish. As shown in Table IV.7-47, impacts to Covered Species associated with agricultural lands would

> occur, primarily in the Imperial Valley, Palo Verde Valley, and Antelope Valley. Specific surveys, setbacks, and other CMAs have been developed to avoid and minimize impacts of Covered Activities on these species (AM-DFA-AG-1 through 7). Compensation CMAs would offset habitat loss for these species.

DEIS/DEIR, p. IV.7-244 – 245. The exact same language is used for Alternative 1 despite its dramatic increase in impacts to burrowing owl habitat. *Id*., p. IV.7-521. These general statements appear at various other points in the discussion. *See Id*., p. IV.7-274 (discussing the Preferred Alternative) ("Given the expected concentration of development on disturbed and agricultural land, species associated with these habitats such as mountain plover, burrowing owl and Swainson's hawk are likely to be more susceptible to injury and mortality factors than other Covered Species"); *Id*., p. IV.7-276 ("Based on the location of DFAs and MW distribution, it is expected that take of Covered Species associated with Agricultural habitats would be particularly affected, which would include Covered Species such as burrowing owl, Swainson's hawk, greater sandhill crane and mountain plover"); *Id*., p. 4.7-545 (discussing Alternative 1) ("species, like burrowing owl are less regionally specific and would be affected in subareas with significant quantities of open agriculture lands. They would especially be affected by development in Imperial Borrego Valley, which contains the largest population of burrowing owls in California, and in the West Mojave and Eastern Slopes subarea, in the open agricultural lands around Lancaster and Palmdale"). None of these cursory statements provides the reader or decision-makers with any information about the actual impacts of the Preferred Alternative on the burrowing owl, especially the cumulative impacts, that one could compare to any other alternative.

The DEIS/DEIR's discussion of cumulative impacts to the owl is equally as cursory as the earlier references. The entire cumulative impact analysis consists of the following:

> Solar DFAs and transmission corridors, primarily in the West Mojave and Eastern Slopes subarea and on disturbed and agricultural lands, contain large areas of modeled habitat for burrowing owl. CMAs and species-specific survey and setback requirements would site solar facilities in areas that would limit burrowing owl exposure. For some alternatives that have reduced DFA footprints, the richest burrowing owl habitats would be avoided. CMA avoidance and setback provisions for managed wetlands and agricultural drains would also avoid or minimize impacts. CMAs require habitat assessments and/or pre-construction surveys. Operational impacts would be monitored and project-specific mitigation would be implemented if needed. Compensation CMAs would offset habitat loss. The contribution of the Preferred Alternative, Alternatives 1, 3, and 4 would be reduced with implementation of reserve design and CMAs.

DEIS/DEIR, p. iv.25-60. "The cumulative impact from several projects is the change in the environment which results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable probable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time." *Communities for a Better Environment v. Cal. Resources Agency ("CBE v. CRA")*, (2002) 103 Cal.App.4th 98, 117. A legally adequate

cumulative impacts analysis views a particular project over time and in conjunction with other related past, present, and reasonably foreseeable probable future projects whose impacts might compound or interrelate with those of the project at hand. "Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time." 14 CCR § 15355(b). There is no effort to quantify any cumulative impacts to burrowing owls, for example, by estimating the effects of the DRECP build-out on the current population trend of the burrowing owl. Given that trend, there is simply no legitimate scientific perspective that could conclude that the construction of the renewable energy facilities contemplated by the DRECP will not contribute to the ongoing cumulative decline of the burrowing owl. *See* Smallwood Comments, pp. 5-7.

The DEIS/DEIR also misleads the public and decisionmakers by overestimating the available habitat acreage for burrowing owls throughout the DRECP area. The DEIS/DEIR claims that 5,269,000 acres of viable burrowing owl habitat exist within the DRECP area – fully a quarter of the total DRECP area. DEIS/DEIR, p. IV.7-236 (Table IV.7-47). The DEIS/DEIR then uses that expansive number to compare the relatively modest areas proposed for development under the DRECP. *Id*. (identifying impact area to burrowing owl of Preferred Alternative at 123,000 acres). The DEIS/DEIR uses its inflated habitat number to downplay the project's cumulative impacts to the owl as well. *See* Table IV.25-5 ("2% of habitat in DFAs"); *Id*. ("44% of habitat in reserve designs"). But, as Dr. Smallwood explains, the overall habitat claim is entirely unrealistic, failing to acknowledge the difference in quality of any such habitat and the absence of burrowing owls in vast stretches of the purported existing habitat. *See* Smallwood Comments, pp. 5-6.

Dr. Smallwood, using the burrowing owl habitat figures as an example, explains how the acreage figures are not supported by substantial evidence:

> In the comments that follow, I will use the burrowing owl as an example of how the DRECP treats the impact assessments of special-status species. Available habitat areas and impact areas were provided per species in Table IV.7-47. According to this table, 5,269,000 acres are available for burrowing owl out of 19,040,000 acres in the DRECP area. But this acreage appears to have been derived from a geographic range map, and included no information about the actual distribution of burrowing owls within this acreage. If there was a model of burrowing owl distribution within the DRECP, I did not see it or how it was developed. Anyhow, geographic range maps always include large areas that are not really used by the species, so the actual acres of available habitat will be smaller.

Smallwood Comments, p. 5. Thus, in addition to improperly watering down the Project's impacts on Covered Species of birds, the acreage figures are exaggerated.

The DEIS/DEIR's tactic of using an overall habitat number to water down the incremental harm to a relatively small amount of habitat has been roundly rejected by the courts. *See Kings County Farm Bureau v. City of Hanford* (1990) 221 Cal.App.3d 692, 718. Likewise, given the decreasing population trend of burrowing owls, the question is whether any additional loss of habitat can stem the cumulative impacts, despite the theoretical possibility of less preferred or unoccupied habitat. *See also Los Angeles Unified v. City of Los Angeles* (1997) 58 Cal.App.4th

1019, 1024-1026 ("ratio theory" trivialized the project's noise impact by focusing on individual inputs rather than their collective significance).

The DEIS/DEIR relies on its conclusion that the Conservation and Management Actions for the burrowing owl that will be employed by each project pursuant to the DRECP will mitigate any impacts, including cumulative impacts, to the owl. Presumably, that assertion is the reason the DEIS/DEIR does not bother to describe the impacts in any detail. However, that assertion cannot be accurate. These same general CMAs applicable to burrowing owls have been being applied on a project-by-project basis for decades and yet the burrowing owl continues to lose ground, both in habitat and population. In addition, the DEIS/DEIR fails to address the impacts of translocating burrowing owls, one of the mitigation measures authorized by the DRECP. DEIS/DEIR, pp. II.3-56 – II.3-58. *See* Smallwood Comments, p. 23. As Dr. Smallwood explains:

> Passive location will be ineffective in the Imperial Valley because the solar projects will cover too much of the habitat and the remainder of the habitat will be occupied by burrowing owls and will not be able to crowd in more owls. This same limitation will occur in other DFAs where siting of large solar projects will conflict with burrowing owl habitat preferences. As for translocation, it is well known by now that this method is ineffective, and too often leads to conflict with burrowing owls in the receiving areas and net negative impacts.

Smallwood Comments, p. 23.

The DRECP's treatment of agricultural areas, and thus burrowing owl habitat, as disturbed threatens extreme harm to burrowing owls. Dr. Smallwood has estimated the number of owls that would be taken by the proposal:

> Had this been done, the summary in Table 1 would have been included. Based on the average nesting density in the DRECP area, the loss of 123,000 acres (49,777 ha, or 497.8 km^2) of habitat would likely result in the destruction of 4,216 pairs of burrowing owls. ***This number of pairs would mean that the DRECP would take more than half of California's remaining burrow owls***.

Smallwood Comments, p. 6. For this Covered Species, the DRECP fails to meet its conservation objective and instead accelerates the burrowing owl toward threatened or endangered status.

2. The DEIS/DEIR also fails to adequately describe the impacts to Swainson's hawks foraging habitat, especially in the Imperial and Lancaster areas.

As with the DEIS/DEIR's handling of impacts to burrowing owls, the same vague statements mentioning Swainson's hawks also are not sufficient to disclose the project's potential impacts to those birds. Swainson's hawks are listed as a threatened species by California because of habitat loss and reduced numbers. Swainson's hawks nest and forage in agricultural fields, particularly within the Antelope Valley. *See* DEIS, p. III.7-102. "Rodents, including ground

squirrels and pocket gophers (Thomomys bottae), and large invertebrates may be abundant on agricultural lands and attract foraging raptors." *Id*. *See also id*., p. III.7-156.

The CMA's inclusion of a measure to avoid Swainson's hawks nests does not cure the DEIS/DEIR's failure to define the project's impacts to the hawks' foraging habitat. *See* DEIS/DEIR, p. IV.7-233; *Id*., p. IV.7-233 ; *Id.*, p. IV.7-235. And, as is the case with the handling of burrowing owls, mitigation measures like compensatory habitat and avoiding nests that have not stemmed the cumulative decline of Swainson's hawks, will also not achieve that objective if, moving forward, more and more habitat is lost.

Also like the burrowing owl discussion, the DEIS/DEIR's discussion of cumulative impacts to Swainson's hawk does not add anything to understanding the actual impacts to the hawks.

> Impacts to Swainson's hawk may occur within the West Mojave and Eastern Slopes, Imperial Borrego Valley, and associated agricultural lands, primarily in the Imperial Valley, Palo Verde Valley, and Antelope Valley. CMAs require avoidance of Swainson's hawk nests with setbacks within DFAs. CMA avoidance and setback provisions for managed wetlands and agricultural drains would avoid or minimize impacts. Compensation CMAs would offset habitat loss. Operational impacts would be monitored and project-specific mitigation would be implemented as needed. CMAs require habitat assessments and/or pre-construction surveys. The contribution of the Preferred Alternative, Alternatives 1, 3, and 4 would be reduced with implementation of reserve design and CMAs.

DEIS/DEIR, IV.25-64. None of these general observations allow one to understand the actual impact to Swainson's hawks of focusing renewable energy development in agricultural area's in the Lancaster area that are crucial to Swainson's hawks. Given the hawk's threatened status, and the DEIS/DEIR's reliance on commonly applied mitigation measures that, to date, have been unsuccessful at stopping the hawk's slide toward extirpation in California and the loss of a unique population in the Antelope Valley, the absence of any quantitative discussion of the project's actual cumulative impacts to the hawk does not satisfy CEQA's requirements. It is vital that an agency assess "'the environmental damage [that] often occurs incrementally from a variety of small sources . . .'" *Bakersfield Citizens For Local Control v. City of Bakersfield* (2004) 124 Cal.App.4th 1184, 1214.

Also like the DEIS/DEIR's burrowing owl discussion, the DEIS/DEIR again seeks to downplay cumulative impacts to Swainson's hawks by highlighting the relative percentage of habitat located in DFAs to a modeled habitat amount claimed by the DEIS/DEIR. *See* CITE; *Id*., p. IV.25-64 (Table IV.25-5) (suggesting no cumulative impact because 46,000 acres of Swainson's hawk habitat to be destroyed amounts to 3% of total claimed habitat of hawk). CEQA does not condone a drop-in-the-bucket analysis. *Friends of Oroville, et al. v. City of Oroville, et al.* ("*Friends of Oroville*") (2013) 218 Cal.App.4th 1352.

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D. The DEIS/DEIR's Failure to Estimate Bird Collisions With Solar Facilities for Each of the Alternatives or Otherwise Disclose the Extent of This Serious Impact Precludes Reasoned Decision-Making.

The DEIS/DEIR acknowledges that "[c]ollision with power towers, heliostats, solar arrays, and injury or mortality from exposure to concentrated solar flux, are all known impacts of solar generation facilities." DEIS/DEIR, p. IV.7-273-75. The DEIS/DEIR then asserts that, based on the proportionate increase in solar facilities under the DRECP from the existing number of facilities, "plan-wide solar development would result in a four-fold increase in collision risks relative to baseline…." *Id*. This exercise provides no useful information to the reader or decision-maker. The DEIS/DEIR does not estimate the existing number of avian and bat collisions that are occurring at existing facilities. DEIS/DEIR, Chapter 3.7. Thus, the "baseline" to which it refers is not provided in the DEIS/DEIR. The DEIS/DEIR essentially asks the reader to multiply four times nothing (which amounts to zero) and expect him/her to appreciate some increased risk from that exercise. The absence of collision estimates is despite the feasibility of providing an estimate and range of such baseline collisions. Smallwood Comments, pp. 8-16. Without providing the referenced baseline against which to compare the various alternatives collision impacts with solar facilities, the DEIS/DEIR fails to comply with CEQA. 14 CCR § 15125(a). *See, Save Our Peninsula Committee v. County of Monterey* (2001) 87 Cal.App.4th 99, 124-125. Of particular concern are the lethal effects of solar thermal facilities. Expert estimates of bird and bat deaths associated with this technology at Brightsource's Ivanpah site as well as the smaller Solar One project near Joshua Tree National Park are available and should be disclosed. Dr. Smallwood demonstrates in his comments the methodology for estimating bird collisions for solar facilities. Smallwood Comments, pp. 8-16. Comparing such numeric estimates to the existing baseline is essential to give the public and decisionmakers information by which they could compare the relative impacts to avian and bat species of each alternative.

The number of bird fatalities that may occur from the DRECP's preferred alternative is shocking and the DEIS/DEIR's failure to provide the public and decision-makers a frank assessment of the avian fatalty risks is a serious shortcoming in the document. As Dr. Smallwood explains, the bird fatalities for the overall DRECP project would be devastating to birds. Smallwood Comments, pp. 15-16.

The few vague assertions that siting and monitoring will somehow eliminate the collision risks is not supported by substantial evidence. As Dr. Smallwood notes, none of these measures has been demonstrated to reduce avian or bat collisions. *See* Smallwood Comments, pp. 18-23. There is no effort in the DEIS/DEIR to explain how the development of future plans for specific projects will reduce collisions. The fact is, once built, there is no known way to prevent bird collisions with any solar facility and, in particular, a solar thermal facility. For the majority of Covered Species, many of which like Swainson's hawks and burrowing owls, are deemed covered because existing cumulative impacts have put their population numbers in steep decline, the creation of guaranteed lethal obstacles over large swaths of their habitat for which no known, effective mitigation has yet to be devised, cannot be brushed aside by the DEIS/DEIR as a less than significant impact. *See* Executive Summary, p. 48 (Impact BR-9). Ultimately, the DEIS/DEIR rests almost entirely on the proposed reserve components as its justification that the many bird collisions that will result will be rendered less than significant. Birds currently in the

areas proposed as reserves are not being killed by collisions with turbine blades or inviting arrays of panels nor are they being obliterated by energy beams. How maintaining that status quo in those areas can be claimed to replace tens of thousands of dead birds or more and hundreds of thousands of dead bats amounts to no significant impact is not supported either by logic or substantial evidence.

E. The DEIS Discussion of Avian and Bat Collisions With Wind Facilities Also Lacks a Proper Baseline and Fails to Provide Sufficient Resolution for a Reader to Understand the Resulting Impacts.

The DEIS/DEIR's discussion of avian and bat collisions with the project's proposed wind development also suffers from an absence of any baseline figures setting forth the current estimates of collision numbers at existing wind facilities. DEIS/DEIR, p. IV.7-271-273. Without those baselines, it is impossible for a reader to appreciate the relative increase in collisions of the proposed project. The DEIS/DEIR does at least provide some ranges of numbers estimating overall avian and bat collisions with wind projects constructed pursuant to the DRECP. *Id*., p. IV.7-273 (Table IV.7-53). However, there is no information provided for the relevant covered species that would allow a reader to understand or appreciate whether killing, on the estimated high end, 39,000 birds per year, year in and year out, into the future, could not have any direct or cumulative impacts on species that already are fighting for survival. Common sense as well as Dr. Smallwood says this is not only unexplained but without any scientific basis. *See* Smallwood Comments, pp. 7-8.

The DEIS/DEIR's estimates of bird collisions from wind projects also are not based on any identified methodology and do not appear to be based on substantial evidence. DEIS/DEIR, pp. IV.7-272, IV.7-341, IV.7-428. As Dr. Smallwood explains, using defensible national averages of collisions at wind facilities for the preferred alternative, "[t]he empirically supported predictions of annual bird fatalities are 3.5 times greater than what appeared in the EIR/EIS, and up to 4 times greater at the upper end of the confidence range." Smallwood Comments, p. 8.

Comparing the estimated collision numbers for wind alone, with the estimated level of take for covered species that would require habitat compensation, underscores how illogical the DEIS/DEIR's discussion of collision impacts appears to a reader. On the one hand, wind alone will kill potentially upwards of 39,000 birds every year, yet it is estimated that only 740 individuals within the Covered Species will be deemed acceptable without payment into a habitat compensation system by the wildlife agencies. DEIS/DEIR, pp. IV.7-273 (Table IV.7-53), IV.7-276 (Table IV.7-54). *See* EIS/EIR, p. IV.7-272 ("the Preferred Alternative would result in a median of approximately 10,000 collisions per year for birds and approximately 47,000 collisions for bats across the Plan Area"); DEIS/DEIR, Table IV.7-69, pp. IV.7-341 - IV.7-343. The sheer number of possible bird kills would make it impossible for the built out projects to achieve the estimated take limits. And given that simply reserving existing undeveloped lands that presumably already provide whatever benefits they may provide to the covered species, it is clear that compensation preserving such lands will not bring back any killed covered specie individuals. *See* Smallwood Comments, pp. 20-21. At a minimum, the DEIS/DEIR should provide an estimate of collisions by each covered species in order for a reader to gauge whether there is any correlation

between the resulting contributions to the reserve system and the individual and population impacts of the estimated collisions.

F. Avian Deaths Associated with Transmission and Electric Distribution Lines and Fencing are not Adequately Addressed.

The DEIS/DEIR does not provide a reasonable discussion of the serious impacts that the transmission, distribution, and fencing components of the proposed development will have on avian species. Our review could not locate information about the length of transmission lines needed to support the DRECP. Extrapolating from the 33,000 acreage figure provided, Dr. Smallwood estimates that the preferred alternative will need about 6,526 miles of new transmission line. Smallwood Comments, p. 17 ("The EIR/EIS documents were vague about the length of transmission line needed to support the DRECP, but an acreage value was provided. A habitat disturbance total of 33,000 acres was attributed to the DRECP. Assuming the average transmission tower pad requires 61 x 61 m, and 5.5 transmission towers per mile of circuit, then 33,000 acres would equal about 6,526 miles of new transmission line."). Extrapolating from actual field studies, Dr. Smallwood quantifies the vast number of bird deaths that could result from the DRECP developments' transmission lines:

> If this transmission line were to kill birds at only 1% of the rate documented over hay fields at Mare Island (Hartman et al. 1992), then the DRECP's transmission lines would kill 962,455 birds per year. To err on the side of caution, consistent with risk assessment of rare resources in the face of high uncertainty (National Research Council 1986, O-Brien 2000, Shrader-Frechette and McCoy 1992), it is worth considering fatality rates at 5% and 10% of what was estimated at Mare Island, which would be annual collision fatalities of 4.8 million birds to 9.6 million birds. The added transmission capacity, which would be necessary for the DRECP due to the development of renewable energy in remote portions of California, would cause many thousands or even millions of collision fatalities among birds. The EIR/EIS should address this impact, and some effort ought to be directed toward estimating the magnitude of the impact.

Smallwood Comments, p. 17.

Likewise, Dr. Smallwood's review of the DEIS/DEIR did not disclose any substantial discussion of the impacts of the projects' electrical distribution lines on wildlife. Smallwood Comments, p. 17. As Dr. Smallwood describes the electrocution problem associated with electrical distribution lines:

> Renewable energy generated at projects is typically collected via riser elements on electric distribution poles. Riser elements are particularly dangerous to raptors and other birds, and lightning arrestors, which often accompany riser elements or other equipment on distribution poles are also particularly dangerous. Both riser elements and lightning arrestors are associated with raptor electrocutions 16 times other than expected (Smallwood and Karas, largely unpublished data, but also some reporting in BioResource Consultants 2009). Riser elements are difficult to insulate and to

> maintain the insulation. Insulators installed on riser elements in the Altamont Pass Wind Resource Area lasted no more than three years before insects, birds, and the weather caused warping and gapping, and raptor electrocutions have since been common.

Id. The DCEIS/DEIR again shies away from fully disclosing the potential impacts of electrocutions on avian species:

> I did not see any substantial discussion in the DRECP about the impacts of electric distribution lines on wildlife. There was a brief discussion on EIR/EIS pages IV.7-275 and IV.7-276, but the discussion did not even identify the types of equipment that cause the disproportionate numbers of electrocutions. It also made vague assurances such as collector lines will be buried wherever feasible. There was no estimate of the length of the collector lines or transmission lines, nor was there any attempt to predict fatality rates.

Id.

Lastly, the other common obstacle associated with renewable energy facilities that is deadly to birds is the fencing of the sites. Dr. Smallwood's review of the DEIS/DEIR indicates that the discussion does not attempt to quantify or describe the extent of bird collisions with projects' fencing. Smallwood Comments, p. 18. The existing Ivanpah thermal solar facility already is killing about 107 birds a year that collide with that project's fencing. *Id*. The overall cumulative impact of project fencing must be disclosed and discussed in the DEIS/DEIR.

G. The DEIS/DEIR Conclusion That Collision Impacts can be Mitigated is not Supported by Substantial Evidence.

The DEIS/DEIR purports to list a series of measures that it implies will prevent collisions by birds and bats with wind and solar projects. *See* DEIS/DEIR, pp. II.3-41 – II.3-45. These include surveying and monitoring applying the most current survey methods and best procedures available at the time, utilizing project designs and project operations that minimize the reflectivity (acoustic and visual/polarizing) and exposure duration of reflective surfaces to avian species, radar detection systems and associated temporary wind turbine shutdown, and wind turbine cut-in speed restrictions. *Id*. Additional vague measures for IBAs include "'[u]se techniques that would minimize attraction of birds to hazardous situations that are mistaken to be or simulate natural habitats (e.g., bodies of water)" and "[i]mplement operational management techniques that minimize impacts to migratory birds during diurnal and seasonal cycles (e.g., positioning of heliostats to decrease surface area exposed to avian species)." *Id*. To start, unidentified "techniques that would minimize attraction of birds" and "operational management techniques" does a great disservice to reviewers of the DEIS/DEIR, suggesting that such techniques actually exist or, even if they have been tried, that they in fact work. No discussion of what these techniques may be, with the exception of perhaps positioning mirrors purportedly to reduce surface areas exposed to birds, is provided. The DEIS/DEIR makes no effort to describe whether the undisclosed techniques or any mirror positioning significantly reduce risks of or actual collisions.

As Dr. Smallwood explains, no effective measures yet exist to prevent collisions once a facility is built:

> Having worked on these issues since 1999, I know from ample experience that this paragraph is misleading, and that there are no deterrents to prevent birds from flying through the rotor planes of wind turbines or over solar projects. This paragraph suggests that passive deterrents "may" be configured to break up light-polarizing surfaces and to minimize recognition of collision conflicts, but this is nothing but hopeful speculation. ***No proven deterrents exist***.

Smallwood Comments, p. 19 (emphasis in original).

Dr. Smallwood goes through each of the purported mitigations for bird collisions with each of the utility scale technologies. The DEIS/DEIR consistently suggests effective mitigations exist on a site specific basis when, in fact, there are none. Dr. Smallwood questioned the measure in M-29 calling for "*Siting and designing Covered Activities to avoid high bird and bat movement areas that will separate birds and bats from their common nesting and roosting sites, feeding areas, or lakes and rivers*." Smallwood Comments, p. 19. Dr. Smallwood has extensive experience in these efforts for the wind projects in the Altamont Pass area and, as he notes, only by conducting "at least a year of behavior surveys designed to understand how birds are using the airspace over the landscape at issue" can a qualified biologist develop the necessary predictive models to implement this mitigation. Generally, behavioral studies have not been made prerequisites of renewable energy projects in the DRECP area. *See id*. ("Such siting would take serious research efforts, which seem counter to the intent of the DRECP to expedite the development of renewable energy").

"Implementing a robust monitoring program to regularly check for wildlife carcasses, document cause of mortality, and promptly remove them" will not prevent collisions, but as Dr. Smallwood notes, it is important to determine the number of fatalities occurring at a site Dr. Smallwood provides lengthy comments explaining the necessary elements of a monitoring program for bird collisions and carcasses. Smallwood Comments, p. 19. He also explains why removing carcasses as part of monitoring activities results in underestimates of bird fatalities. *Id*.

Similarly, Dr. Smallwood has serious concerns about the ongoing reliance of projects on bird and bat use surveys rather without complimentary behavioral surveys. Thus, M-29's measures that, "*During project siting and design, monitoring of bird and bat presence and use of the project site, using the most current survey methods and best procedures available at the time. This pre-project and pre-operations information will serve as the baseline from which to monitor and measure project operations in the future*" and "*Incorporating a bird and bat use and mortality monitoring program during operations, using current protocols and best procedures available at time of monitoring. This monitoring program will ensure that the information collected during operations is reported to the DRECP Coordination Group in a way that is compatible for use in the MAMP*" have not proven effective in the past. "[T]hese measures have been performed at many wind projects across the US, and have repeatedly failed to accurately predict fatality rates or to understand collision mechanisms." Smallwood Comments, p. 20. "It is important that these measures be more carefully written to specify that behavioral ecologists will perform behavior

surveys to document how birds are using the airspace, and that appropriate point counts will be used to document presence and relative abundance for use as baselines. Use surveys are not the way to go." *Id*.

Dr. Smallwood questions the efficacy of the M-29 mitigation, "*Installation of flight diverters on transmission lines according to the most current Wildlife Agencies guidelines, as described in CMA AM-TRANS-2 in Volume II.3.1.2.5 (Biological Conservation and Management Actions).*" Although Dr. Smallwood concurs that this is a worthwhile effort, it has not yet ddevleoped beyong an experimental stage:

> I concur with this action, but I must add that little is known about the effectiveness of the various flight diverters that are available. This measure should be augmented to include scientific fatality monitoring under transmission lines so that transmission lines impacts can be estimated and flight diverters tested. Initial monitoring of flight diverters should be implemented in an experimental design so that the effects of different flight diverters can be compared.

Smallwood Comment, p. 20.

Dr. Smallwood rejects the notion that there currently exist effective mitigations to minimize reflectivity or exposure duration of reflective surfaces. As he explains:

> Whereas this measure might look good to someone inexperienced with collision issues, the truth is that little is known about the mechanisms of collisions at solar projects, and whether nighttime alignments will make any difference to avian collisions. It remains unknown whether minimizing reflectivity or exposure duration will matter at all to collision rates. Speculated notions of why collisions are happening should not serve as the basis for wholesale adoption of mitigation measures at renewable energy facilities, as such measures can waste the project-owners' money while accomplishing no reductions in wildlife fatalities. This type of measure should not be proposed without implementation as part of a controlled experiment, preferably a before-after, control-impact (BACI) design.

Smallwood Comments, p. 20.

Similarly, the DEIS/DEIR at M-30 lists several mitigations that it implies are effective at protecting birds and bats from collisions, including "*Implementing project-specific avoidance and minimization actions that reduce the level of operational impacts to the populations of bird and bat species. Potential actions may include: ● Radar systems associated with wind turbine shutdown. ● Wind turbine cut-in speed restrictions. ● Night-time solar panel positioning to decrease surface areas exposed to avian species.*" Dr. Smallwood explains that none of these measures have proven effective at preventing bird collisions:

> However, there is no evidence that any of these measures have been effective. I have yet to read or review a single scientific report on integrated radar systems proving effective at reducing bird and bat collisions. Cut-in speeds appear to be effective for

> bats, but not for birds, and no wind company appears to be willing to increase cut-in speeds at commercial wind projects. Nor is there any evidence that night-time solar panel positioning reduces collision fatalities. These measures should not be listed as if there is any reason to believe that they have been effective, because doing so is misleading and potentially damaging to wildlife when projects are built and these measures are implemented. If any of these measures are implemented, they should be implemented in an experimental design and with sufficient scale to obtain meaningful measures of effect.

Smallwood Comments, p. 21. Overall, the DEIS/DEIR is highly misleading, implying or suggesting that numerous mitigations are available that reduce the dramatic impacts to avian species and bats that result from renewable energy facilities when in fact no such evidence exists. To be consistent with CEQA, the DEIS/DEIR must acknowledge that the DRECP's impacts to avian species will be significant.

H. As Currently Crafted, the DRECP Facilitates Perpetual Violations of F&G Code 3503.5.

The EIR/EIS does not give effect to the clear language of F&G Code 3503.5. The EIR/EIS notes that "California Fish and Game Code Section 3503.5 states that 'it is unlawful to take, possess, or destroy any birds of prey or to take, possess, or destroy the nest or eggs of any such bird' unless otherwise authorized by the California Fish and Game Code or Title 14 of the California Code Regulations." EIR/EIS, p. III.7-6. What the DEIS/DEIR does not mention is that there is no other take of many birds of prey in the orders *Falconiformes* and *Strigiformes* (including among other species, red-tailed hawks, golden eagles, Swainson's hawks, burrowing owls, and prairie falcons) authorized either in the Fish & Game Code or the regulations unless the specific species is also listed as threatened or endangered. Of these examples, only Swainson's hawks, as a listed species under CESA, may be taken pursuant to an incidental take permit under CESA for scientific study. F&G Code 2061(a). Even that limited incidental take could not apply to incidental take resulting from operating a utility-scale wind farm or solar energy facility. Despite this blanket prohibition on take of these bird species, the only aspect of F&G Code 3503.5 addressed by the EIS/EIR is its prohibition on destroying nests of the identified bird orders. *See* DEIS/DEIR, p. IV.7-263 ("Impact BR-5: Siting, construction, decommissioning, and operational activities could result in loss of nesting birds (violation of the federal Migratory Bird Treaty Act and California Fish and Game Code Sections 3503, 3503.5, 3511, and 3513)"); p. IV.7-336 ("Impact BR-5: Siting, construction, decommissioning, and operational activities could result in loss of nesting birds (violation of the federal Migratory Bird Treaty Act and California Fish and Game Code Sections 3503, 3503.5, 3511, and 3513)"). By ignoring half of Section 3503.5's take prohibitions – the prohibition on taking any birds of prey, not just their nests – the DEIS/DEIR's regulatory setting discussion is misleading and the impact discussion is deficient.

There is no exception to Section 3503.5's long-standing prohibition on taking any birds of prey included in the State's Natural Community Conservation Planning Act. Although the statute plainly provides for take authority for fully-protected species, which include a number of specific bird species including golden eagle, California condor, peregrine falcon, and several others, that exception does not include species that are not deemed fully protected but otherwise protected

from any take whatsoever by Section 3503.5. On its face, the NCCPA does not override F&G Code § 3503.5. *See* F&G Code 2835;[1] 2805(e).[2] Because the well-established rule of statutory construction precludes an agency or a court from implying exceptions to a rule especially where the legislature has provided express exceptions, the CEC has no authority to authorize take of Swainson's hawks and burrowing owls as is proposed by the DEIS/DEIR. *See* EIS/EIR, p. IV.7-276, Table IV.7-54; p. IV.7-346, Table IV.7-70.

I. The Monitoring Requirements Outlined in the DEIS/DEIR Will Not Be Sufficient To Conduct Effective Adaptive Management or Track Complaince With the Mitigation Measures.

Dr. Smallwood provides substantial evidence of the minimum levels of use and behavioral surveys necessary for the DRECP to assure that utility-scale renewable energy projects are sited in a manner that will reduce some of the impacts to avian and bat species, assure the accurate evaluation of the project's actual impacts to those species, and to have a shot at mounting an effective adaptive management program. Smallwood Comments, pp. 21-39. The DEIS/DEIR must require projects under the DRECP to incorporate Dr. Smallwood's monitoring recommendations in order to substantiate that all possible mitigations have been implemented to reduce the project's significant adverse effects.

J. Decisions and Recommendations of the DRECP Coordination Group Should be Informed by Public Comments Before They are Made.

The DEIS/DEIR contemplates an important prescreening role to be played by the DRECP Coordination Group. The intent of this prescreening is to implement the streamlining goals of the DRECP. *See* EIS/EIR, p. II.3-228 ("To facilitate streamlining under the DRECP, applicants may submit a Project Proposal to the DRECP Coordination Group for an early, informal review for consistency with DRECP requirements"). As far as Audubon can tell from the materials, there is no provision for public input into any decisions either preliminarily approving or recommending a project. It is not apparent from the DEIS/DEIR which specific agencies may be represented within the DRECP Coordination Group. It appears certain to include over time state and local agencies, including cities or counties, that may be independently reviewing a specific project for approval. DEIS/DEIR, p. II.3-213. Given the DRECP Coordination Group's oversized role in implementing the DRECP and specific project's, there is a clear risk that its early review and tacit approval of a

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[1] Section 2835 provides, in pertinent part, "At the time of plan approval, the department may authorize by permit the taking of any covered species, including species designated as fully protected species pursuant to Sections 3511, 4700, 5050, or 5515, whose conservation and management is provided for in a natural community conservation plan approved by the department."

[2] Section 2805(e) provides, "'Covered species' means those species, both listed pursuant to Chapter 1.5 (commencing with Section 2050) and nonlisted, conserved and managed under an approved natural community conservation plan and that ***may be authorized for take***. Notwithstanding ***Sections 3511, 4700, 5050, or 5515***, fully protected species may be covered species pursuant to this subdivision, and taking of fully protected species may be authorized pursuant to Section 2835 for any fully protected species conserved and managed as a covered species under an approved natural community conservation plan." (emphasis added).

project will provide momentum to projects even prior to any public participation and which many persons may believe are unwarranted projects. Audubon proposes that at least for the prescreening process identified in the DEIS/DEIR, that the DRECP Coordination Group be required to provide public notice and an opportunity to comment for at least 30 days in order for the Coordination Group to have the benefit of public comments on a particular project prior to recommending it be approved. Audubon also believes that any meetings on a prescreening decision be open to the interested public.

CONCLUSION

Audubon requests that the CEC and BLM prepare a revised DEIS/DEIR addressing the above concerns and recirculate it for public review and comment. Thank you for this opportunity to comment on the DRECP DEIS/DEIR.

Sincerely,

Michael R. Lozeau
Lozeau Drury LLP
On behalf of San Bernardino Valley Audubon Society, San Diego Audubon Society, San Fernando Valley Audubon Society, and Audubon California

Attachment

ATTACHMENT

Shawn Smallwood, PhD
3108 Finch Street
Davis, CA 95616

Chris Beale, DRECP Acting Executive Director
California Energy Commission
Dockets Office, MS-4
Docket No. 09-RENEW EO-01
1516 Ninth Street
Sacramento, CA 95814-5512

23 February 2015

Dear Mr. Beale,

I write to comment on the Draft Desert Renewable Energy Conservation Plan (DRECP) and Environmental Impact Report/Environmental Impact Statement. I reviewed the DEIR/DEIS and associated appendices and other documents.

My qualifications for preparing expert comments are the following. I earned a Ph.D. degree in Ecology from the University of California at Davis in 1990, where I subsequently worked for four years as a post-graduate researcher in the Department of Agronomy and Range Sciences. My research has been on animal density and distribution, habitat selection, habitat restoration, interactions between wildlife and human infrastructure and activities, conservation of rare and endangered species, and on the ecology of invading species. I have authored numerous papers on special-status species issues, including "Using the best scientific data for endangered species conservation," published in Environmental Management (Smallwood et al. 1999), and "Suggested standards for science applied to conservation issues" published in the Transactions of the Western Section of The Wildlife Society (Smallwood et al. 2001). I served as Chair of the Conservation Affairs Committee for The Wildlife Society – Western Section. I am a member of The Wildlife Society and the Raptor Research Foundation, and I've been a part-time lecturer at California State University, Sacramento. I was also Associate Editor of wildlife biology's premier scientific journal, The Journal of Wildlife Management, as well as of Biological Conservation, and I was on the Editorial Board of Environmental Management.

I have performed avian surveys in California for twenty-five years (Smallwood et al. 1996, Smallwood and Nakamoto 2009). Over these years, I studied the impacts of human activities and human infrastructure on birds and other animals, including on golden eagle, Swainson's hawk, burrowing owl, and other species. I studied fossorial animals (i.e., animals that burrow into soil, where they live much of their lives), including pocket gophers, ground squirrels, kangaroo rats, voles, harvester ants, and many other functionally similar groups. I performed focused studies of how wildlife interact with agricultural fields and associated cultural practices, especially with alfalfa production. I have also performed wildlife surveys at many proposed project sites, including at a proposed large solar thermal project in the Mojave Desert. I performed mountain lion track surveys throughout the DRECP area since 1985. Finally, I have

performed research and monitoring on renewable energy projects for sixteen years, and I have authored many peer-reviewed reports, papers, and book chapters on fatality monitoring, fatality rate estimation, mitigation, and other issues related to biological impacts of renewable energy generation. I have also reviewed many reports, served for five years on the Alameda County Scientific Review Committee that was charged with overseeing the fatality monitoring and mitigation measures in the Altamont Pass Wind Resource Area, and prepared many comment letters on proposed renewable energy projects. I also collaborate with colleagues worldwide on the underlying science and policy issues related to renewable energy impacts on wildlife.

My CV is attached.

DESIGN FEATURES

The PEIS Design Features in Appendix W lacked any requirement to make public the results of preconstruction surveys or the monitoring of project impacts. All methods and results of preconstruction baseline monitoring and post-construction impact monitoring should be made available to the public, and it should be made easy for members of the public to access this information. I saw no assurances that any of this information would be made available to the public.

Important Bird Areas ("IBAs") did not appear to factor into conservation planning. IBAs appeared as polygons on maps, but no use of these polygons was made other than their depiction. A great deal of time and consideration was devoted to the establishment of IBAs, and difficult decisions were made to limit the designated extents of IBAs so that their importance would stand out. The DRECP should make use of all that time and effort, and of all the experience of naturalists and scientists in the field, by incorporating IBAs into the planning process. Impacts should be minimized in IBAs and mitigation should be directed to augment the existing value of IBAs through habitat protection, enhancements, and restoration as needed.

In the rush to prepare the environmental review of DRECP, it was likely that other identified sensitive areas were also omitted from serious consideration in the DRECP. The DRECP planning area includes many unique biological resources, but not all of these resources are well known to the public. For example, it was only recently learned that a population of white bighorn sheep exists in the Clark Mountains (Photo 1). More time and effort should be devoted to the DRECP, so that scientists and naturalists can have the opportunity to share their experience with the planners of the DRECP and a more comprehensive effort can be made to protect unique biological resources and the habitat and landscape features that support them. The extent of renewable energy development under the DRECP would be so great, and the biological impacts potentially so large, that extra time for planning would be prudent.

This last comment brings me back to the first comment about the need for public availability of monitoring results. The public and the regulatory agencies need to be engaged in the monitoring related to the DRECP, and thresholds of action need to be

established based on monitoring results. These thresholds need to feed back to decisions on whether or how to proceed with future phases of development under the DRECP, and yes, the development should be phased and the phases linked firmly to monitoring. This process, of course, is central to adaptive management, although there is more to adaptive management than just this core process. The monitoring needed for true adaptive management needs more development time, and it needs to be developed to slow down rather than expedite renewable energy development under the DRECP so that adaptive management can be effective.

***Photo 1**. White (not albino) bighorn sheep in the Clark Mountains in 1985. After this initial sighting, it became known that a local population of white bighorn reside in the Clark Mountains. Photos by Rob Gross.*

The fast-track nature of the DRECP, including its No Surprises assurance from the US Fish and Wildlife Service, is liable to turn into a much larger example of how the Altamont Pass Wind Resource Area (APWRA) was developed so quickly, so extensively, and so dangerously to wildlife. The APWRA's wind turbines were installed over every available ridgeline and slope face suitable to wind energy generation, including across landscape features that were heavily trafficked by birds. The result was an annual death toll that gained notoriety worldwide (Orloff and Flannery 1992; Smallwood and Thelander 2004, 2005, 2008; Smallwood and Karas 2009). In effect, a No Surprises assurance was implemented in the APWRA, even though the lack of enforcement was not named "No Surprises." But the effect was the same as the effect that the No Surprises assurance will have on wildlife under the DRECP should surprises emerge to the detriment of special-status species. Without enforcement of environmental laws, there was little incentive to mitigate the impacts of the AWPRA's wind turbines (Smallwood 2008). None of the wind companies were fined, and none had their permits withdrawn or suspended. As a result, thousands of birds, including about 60 to 70 golden eagles, were killed every year since the early 1980s. The toll on wildlife continued unabated until the originally installed wind turbines declined to the degree that seasonal shutdowns and select turbine removals became tolerable to the wind companies. Now most of the APWRA is undergoing repowering, but only after the old wind turbines operated beyond their original permit periods. Birds killed in the APWRA over recent years were often killed by wind turbines operating at capacity factors of only 3% to 5%, or sometimes not operating at all (birds often collide with non-operating wind turbines). The DRECP should learn from past mistakes such as the

APWRA, and should ensure that fast-tracking the development of renewable energy does not come at great cost to our biological resources in the future. There also needs to be room to respond to wildlife impacts that were under-predicted or not predicted at all.

I have yet to see any evidence that the No Surprises rule has benefitted any wildlife in the United States. Nor am I aware that Congress has allocated funding to support actions by the federal government to mitigate for surprising impacts that emerged since any Habitat Conservation Plans were certified along with the No Surprises assurance. Given my experience in the APWRA, I am skeptical that the No Surprises assurance would benefit wildlife under the DRECP. And, as implied earlier, our understanding of wildlife impacts caused by renewable energy projects is still developing, as has been obvious at the Ivanpah Solar Electric Generating System. The No Surprises assurance should not be provided for an industrial use in the face of such high uncertainty about the magnitude and mechanisms of project-related fatalities.

Also as implied earlier, the design of the DRECP should also consider hazards to wildlife posed by renewable energy facilities as the capacity factors of these facilities decline through time. At what point has the capacity factor of a facility declined to the degree that its toll on wildlife is no longer tolerable? Injuring and killing wildlife is inevitable when renewable energy is developed, and efforts should be made to minimize these impacts, but as renewable energy facilities decline, their toll on wildlife do not necessarily decline and in some cases the toll might increase. It is one thing for a wind turbine operating at 38% capacity factor to kill a golden eagle, but it is another thing for this same turbine, years later, to kill another golden eagle while operating at 10% capacity factor. The DRECP should be developed further to come up with reasonable expectations on capacity factors associated with renewable energy facilities, as well as requirements for repowering or decommissioning once those capacity factors decline to the point of causing wildlife injuries that cannot be justified by the reduced renewable energy being delivered to ratepayers. To this end, not only should biological monitoring data be made available to the public, but so too should adequate data on energy generation. The public should be allowed to know when and where renewable energy facilities are not performing to expectations, and whether the wildlife impacts warrant another strategy related to those facilities.

IMPACT ASSESSMENT

Habitat Loss

There are tables of habitat capacities in terms of acres available to each of the special-status species in the plan area. It was unclear how these acreages were calculated because the models did not appear to be shared with the public (I could not find them in the EIR/EIS), and some of the values seemed optimistic. These capacity values can be used to minimize predictions of impacts to species by giving the false impression that ample habitat remains available after projects remove habitat. Species of wildlife rarely use all of the suitable habitat available to them at any given time, as wildlife populations are clustered and their aggregations typically shift locations every generation or so

(Taylor and Taylor 1979). Some portions of the habitat that humans like to map as GIS coverages are more important than other portions. For example, using the crude approach that was applied to assigning habitat acreages in the DRECP planning area, one would identify the entirety of the Altamont Pass Wind Resource Area as burrowing owl habitat, or 17,500 ha. However, after years of studying burrowing owls in the APWRA, I know that whereas all of the 17,500 ha of the APWRA are used at various points in time by burrowing owls, only a small fraction of this area is used intensively for nesting and foraging (Smallwood et al. 2009, 2013b). Burrowing owls congregate on the lower reaches of slopes, usually on slopes facing south (Smallwood et al. 2009; Smallwood and Neher 2010, 2011; Smallwood and Neher unpublished data), or in other words, on the same slope conditions generally preferred by industrial solar developers in California. Installing 10 ha of PV panels on the lower half of a south-facing slope in the APWRA could take out an entire breeding population of burrowing owls, and not just 10 ha of "habitat."

In the comments that follow, I will use the burrowing owl as an example of how the DRECP treats the impact assessments of special-status species. Available habitat areas and impact areas were provided per species in Table IV.7-47. According to this table, 5,269,000 acres are available for burrowing owl out of 19,040,000 acres in the DRECP area. But this acreage appears to have been derived from a geographic range map, and included no information about the actual distribution of burrowing owls within this acreage. If there was a model of burrowing owl distribution within the DRECP, I did not see it or how it was developed. Anyhow, geographic range maps always include large areas that are not really used by the species, so the actual acres of available habitat will be smaller.

According to the DRECP (Table IV.7-47), burrowing owl habitat covers 27.7% of the DRECP planning area. Of apparently little concern in the DRECP was the fact that 71% of California's entire burrowing owl population now resides within the Imperial Valley, after the species has declined greatly throughout the rest of its range in California (DeSante et al. 2007, Shuford and Gardali 2008). (According to the EIR/EIS (B-17), "*Imperial Valley contains most of remaining population*." However, this recognition of the importance of the Imperial Valley did not appear to matter to any planning or mitigation decisions in the rest of the EIR/EIS.) A DFA covers the very portion of the Imperial Valley where burrowing owls form their largest aggregation in California, and where the population is estimated at 5,600 pairs (DeSante et al. 2007). Converting the Imperial Valley's burrowing owl habitat to solar and geothermal uses would devastate the burrowing owl population in California. Passive relocation is not going to mitigate the impacts of massive conversions of burrowing owl habitat to solar projects in the Imperial Valley. A reduced acreage alternative or a distributed generation alternative would be necessary to prevent a catastrophe for this species in California.

Table IV.7-47 estimated the acres of habitat likely to be converted to renewable energy projects and supporting infrastructure. For example, 123,000 acres was estimated as the habitat loss to burrowing owls. However, the EIR/EIS did not attempt to translate these acreage values in terms of numerical impacts to the species. What does 123,000 acres of habitat loss mean to a species such as burrowing owl? The EIR/EIS could have

addressed this question by reviewing the burrowing owl survey sites performed over the last several years at proposed renewable energy projects throughout the DRECP area. Had this been done, the summary in Table 1 would have been included. Based on the average nesting density in the DRECP area, the loss of 123,000 acres (49,777 ha, or 497.8 km^2) of habitat would likely result in the destruction of 4,216 pairs of burrowing owls. ***This number of pairs would mean that the DRECP would take more than half of California's remaining burrow owls***.

The next question to ask is whether the habitat that would be lost to the DRECP would consist of the quality of habitat that led to the nesting densities in Table 1. The answer would likely be "yes," because these nesting densities were derived from surveys performed for solar projects proposed within the DRECP area. I did not attempt to select only those project sites where burrowing owls were detected – I used all that were readily available to me at the time I prepared this table. It just so happens that the best solar project sites correspond with conditions that are favored by burrowing owls – relatively low on generally south-facing slopes. Additionally, 71,000 acres (287.3 km^2) of predicted terrestrial impacts from the DRECP will be in the Imperial Valley (EIR/EIS Table IV.7-46), where the largest aggregation of burrowing owls occurs in California. This level of habitat loss in the Imperial Valley alone will result in the loss of 2,434 pairs of burrowing owls, or 43% of the Imperial Valley population.

Table 1. *Nesting densities of burrowing owls at proposed project sites within the DRECP.*

Source	**Site**	**Ha**	**Pairs**	**Nest density, pairs/km^2**
Cornett 2012	Imperial Valley Solar Company 2	64	4	6.25
Ecology and Environment 2012	Hudson Ranch Power II Geothermal Project	99	13	13.13
Ecology and Environment 2012	McDonald Road portion of Hudson Ranch	78	13	16.67
HDR 2011	Mt. Signal	1,711	72	4.21
BLM 2012	Ocotillo Sol	46	5	8.58
Imperial County 2012	Solar Gen II	813	56	5.61
Heritage Environmental Consultants, LLC. 2012a	Campo Verde	1,338	65	4.86
Average				8.47

The habitat Table IV.7-47 identified 33,000 of lost golden eagle foraging habitat as a result of the DRECP. I question this number, because golden eagles forage over large areas. Golden eagles hunt burrowing owls and the mammals that construct burrowing owl burrows, so I would expect golden eagle foraging habitat to include at least the same 123,000 acres that the EIR/EIS predicted will be lost to burrowing owls. In fact, the

known locations of golden eagle in the DRECP area are distributed all over the maps in EIR/EIS Figures III.7-16 to III.7-25. With such a wide distribution of known golden eagle locations, it seems incredible that the species' foraging habitat would be limited to 33,000 acres.

Similarly, I would expect more than 46,000 acres to be taken from Swainson's hawk.

According to the EIR/EIS (IV.7-233), the habitat impact estimates in Table IV.7-47 were calculated from the "*overlap of the DFAs and the modeled Covered Species habitat times the proportion of the impacts from Covered Activity development anticipated with the DFA*." Without commenting specifically on the modeled Covered Species habitat, this approach seems too crude. For example, it fails to consider the impacts of how the overlap occurs, and whether and how the overlap might contribute to habitat fragmentation. Habitat fragmentation is a process that has been recognized as the greatest threat to species' persistence in the wild (Wilcox and Murphy 1985). Habitat fragmentation results in the reduction of a net larger habitat area than can be measured by summing the remaining, apparent habitat patches (Wilcox and Murphy 1985, Saunders et al. 1991, Hall et al. 1997). Habitat fragmentation results in a reduced numerical capacity of the species in the region (Smallwood 2015). Despite the importance of habitat fragmentation, I did not see any analysis of habitat fragmentation impacts caused by DFA overlap with "modeled Covered Species habitat," whatever that was (again, I have yet to find these models or any explanation of how they were developed).

Collision Risk at Wind Energy Projects

Predicted fatality rates caused by wind turbines appear to be unfounded and unrealistic. Across the plan-wide area, CEC et al. (2014:IV.7-272) concluded, "*Overall, the Preferred Alternative would result in a median of approximately 10,000 collisions per year for birds and approximately 47,000 collisions for bats across the Plan Area*." Across the BLM LUPA area, the CEC et al. (2014:IV.7-341) concluded, "*Overall, the Preferred Alternative would result in a median of 4,000 collisions per year for birds and 19,000 collisions for bats across the Plan Area*." Across the GCP area the CEC et al. (2014:IV.7-428) concluded, "*Overall, the Preferred Alternative would result in a median of 6,000 collisions per year for birds and 28,000 collisions for bats in DFAs on nonfederal lands*." The DRECP referenced no source and provided no description of methodology for predicting collision impacts. Furthermore, the predictions lacked any sort of uncertainty statement or error term, the omission of which was inconsistent with first principles of scientific prediction and estimation as part of risk assessment.

Basing fatality rate projections on national averages (Smallwood 2013), bat fatalities per MW/year would be predicted at 17.2 (90% CI = 7.45 – 26.95). These rates applied to 3,070 MW in the preferred alternative of the DRECP would translate to 52,804 bats per year (90% CI = 22,871 - 82,736). Basing fatality rate projections on national averages (Smallwood 2013), bird fatalities per MW/year would be predicted at 11.1 (90% CI = 9.05 – 13.15). These rates applied to 3,070 MW in the preferred alternative of the DRECP would translate to 34,077 birds per year (90% CI = 27,774 – 40,397). The

empirically supported predictions of annual bird fatalities are 3.5 times greater than what appeared in the EIR/EIS, and up to 4 times greater at the upper end of the confidence range. The empirically supported predictions of annual bat fatalities is 12% higher than predicted in the EIR/EIS, but the upper end of the uncertainty range would be nearly twice as high. In my opinion, the bat fatality rates will be even higher than I predicted based on national averages because the national averages were biased low due to search intervals being too long for effective use with bats. The true annual fatality rates for bats could be four times higher than what I reported in Smallwood (2013).

Collision Risk at Solar Thermal Projects

No attempt was made to predict fatality rates caused by solar thermal projects, even though fatality rates should now be available. The omission of fatality rate predictions at solar thermal projects was especially troubling due to the emerging fatality rate estimates at Ivanpah, which have been alarmingly high. In the following section, I will estimate the fatality rates at the Ivanpah Solar Electric Generating System, which is a 270 MW project with thousands of heliostat mirrors on 939 acres concentrating reflected sunlight onto three power towers.

Routine fatality monitoring began at Ivanpah on 23 March 2014, and reporting is now available on this monitoring through 17 August 2014 (H. T. Harvey & Associates 2014a,b). Features of the monitoring are summarized in Table 2. Note that the transect width varied, and this variation likely resulted in some variation in fatality detection probabilities between project features, but there is no way to account for this variation. My fatality rates will be based on the assumption that detection probabilities were equal despite variation in transect width.

Table 2. *Fatality monitoring attributes at Ivanpah Solar Electric Generating System.*

Project area	Acres searched	Proportion of project area	Coverage of specific area (proportion)	Transect width (m)
Tower area	154	0.048	1.000	10
Heliostat area	720	0.224	0.241	10
Fence	39	0.012	1.000	6
Collector line	26	0.008	1.000	30
Total	939	0.292	0.292	

The number of fatalities found during monitoring must be adjusted for the proportion of fatalities not found. The proportion of fatalities not found is largely influenced by the average search interval (time between searches), body sizes and conspicuousness of the carcasses deposited within the search areas, and ground cover. The longer the search interval, the more carcasses will have been removed by scavengers or diminished in conspicuousness by exposure to sun, wind, and rain. The shorter the search interval, and the more often searchers will have an opportunity to find available carcasses. During spring, i.e., 23 March through 22 May, the fatality search interval averaged 7.2

days, but in summer, i.e., 23 May through 17 August, the search interval averaged 21 days.

Commonly used estimators of fatality rates were derived from Horvitz and Thompson (1952), and the version I typically have used is the following:

$$F_A = \frac{F_U}{R_C \times p},$$

where F_U was the unadjusted number of fatalities/MW/year (the found carcasses), and F_A was the fatality rate adjusted for the proportion of carcasses found amongst those that were available to be found, p, and by the average proportion of carcasses remaining since the last fatality search, R_C. The adjustments for p and R_C are typically estimated from separate trials for searcher detection and scavenger removal. I assume carcasses were deposited at a steady rate from heliostat mirrors and power towers, so I take the average proportion of carcasses remaining each sequential day between searches:

$$R_C = \frac{\sum_{i=1}^{I} R_i}{I},$$

where R_i is proportion of carcasses remaining by the ith day following the initiation of a scavenger removal trial.

H.T. Harvey & Associates (2014a,b) used the Huso (2010) version of the Horvitz-Thompson estimate:

$$F_A = \frac{F_U}{r \times p \times v}$$

$$r = \frac{t \times (1 - e^{-\min(I_e, I)/t})}{(\min(I_e, I)}, \quad I_e = \log(0.01) \times \bar{t}, \text{ and } v = \min(1, \frac{I_e}{I}).$$

The term I_e is referred to as the effective interval, and applies to species whose carcasses are not expected to persist on site throughout the periodic fatality search interval, and $\bar{t}$ is mean days to carcass removal of carcasses placed in removal trials:

$$\bar{t} = \frac{\sum_{S=1}^{c} t_i}{S - S_c}.$$

I have criticized the use of mean days to removal in the fatality estimator because it is unrealistic and results in estimates that are biased low (Smallwood et al. 2013). However, a factor that is more important than which estimator is used, or how it is formulated, is how the detection trials are implemented. Searcher detection trials typically involve placements of fresh carcasses that the searchers have only one opportunity to find, but this type of trial unrealistically simulates carcass detection

probabilities during routine fatality monitoring. Carcass persistence trials typically swamp scavengers by placing too many carcasses at once, and placing carcasses of species that do not represent the species being killed at the project (Smallwood 2007, Smallwood et al. 2013). Figure 1 illustrates this latter problem at Ivanpah.

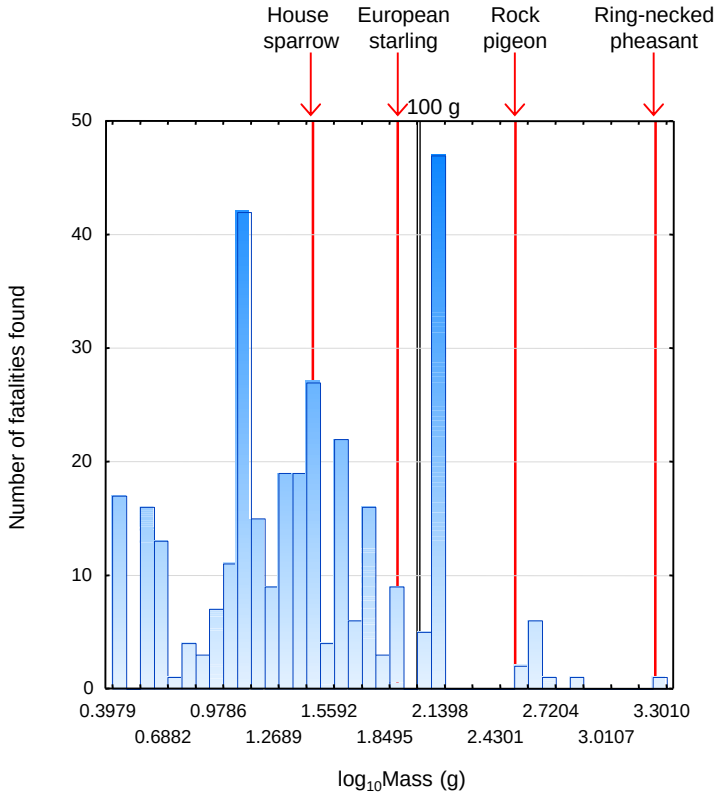

Figure 1*. Species used in carcass persistence trials – house sparrow and European starling representing small birds (birds <100 g), and rock pigeon and ring-necked pheasant representing large birds (birds >100 g) – were larger than the majority of birds they were intended to represent, resulting in fatality rate estimates that were biased low.*

H.T. Harvey & Associates placed carcasses of four species to calculate mean time to removal as a measure of carcass persistence. The house sparrow (*Passer domesticus*), which was intended to represent small birds, was larger than 69% of the small birds found during monitoring (Figure 1). The European starling (*Sturnus vulgaris*), which was the other species intended to represent small birds, was larger than 97% of the small birds found during monitoring. The rock pigeon (*Columba livia*), which was the smallest species intended to represent large birds, was larger than 83% of the large birds found during monitoring. The ring-necked pheasant (*Phasianus colchicus*), which was the other species intended to represent large birds, was larger than 98% of the large birds found during monitoring. These misrepresentations of the distribution of body sizes of species found dead at Ivanpah resulted in fatality rate estimates that were biased low, because in general the larger the bird the longer the carcass persistence and the less adjustment there will be in the calculation of the fatality rate. I cannot recommend relying on the detection trials performed at Ivanpah. A new approach is needed.

A superior method for estimating the proportion of carcasses not found is to integrate an overall detection trial into routine monitoring. Placing carcasses of species typically killed at the project, and at a rate that simulates the typical carcass deposition rate, will more realistically simulate both carcass persistence and searcher detection of those carcasses, especially if all carcasses are left in place indefinitely, including the carcasses that were not placed in trials. After all, the point of the trials is to simulate the conditions under which carcasses end up in the search area and are encountered by the searchers. In the Altamont Pass Wind Resource Area I implemented just such an integrated trial at two different projects over 2.5 years. In each project, I placed carcasses of many species across a broad size range at random places and random days of the week, averaging <1 g/acre/year. I estimated the overall detection rate, meaning that I did not care whether carcasses that were undetected had been removed or were available but missed by the searchers. The integrated trials also provided searchers with multiple opportunities to find placed birds, similar to detection probabilities associated with routine fatality monitoring.

The integrated trial data were applied to the following model:

$$F_A = \frac{F_U}{D},$$

where D was the proportion of placed carcasses that was detected by searchers performing periodic fatality searches throughout the duration of monitoring. The conditions in the Altamont Pass differed from the Ivanpah environment, but it remains unknown to what degree detection rates might differ between Altamont Pass and the Mojave Desert. Based on my experience, however, I would expect detection rates to be fairly robust between places because, for a given mean search interval, most of the variation in D can be explained by body mass (Figure 2). In Figure 3, I projected the model fits to all North American bird species for average search intervals of 4.5, 7, and 28 days.

During the first two months of monitoring at Ivanpah, the search interval averaged 7.2 days, so I simply applied the model from the 7-day interval in the Altamont Pass to the fatality data collected at Ivanpah. However, the search interval averaged 21 days during the summer months, but I lacked an integrated trial from a search interval of 21 days. Therefore, I extrapolated between the models derived from average search intervals of 7 days and 28 days: $D_{21} = (D_7 - D_{28}) \times 0.3333 + D_{28}$. This extrapolation was crude, but it should suffice given that each model explained almost all the variation in D. The projected detection rates applied to the Ivanpah data appear in Figure 4.

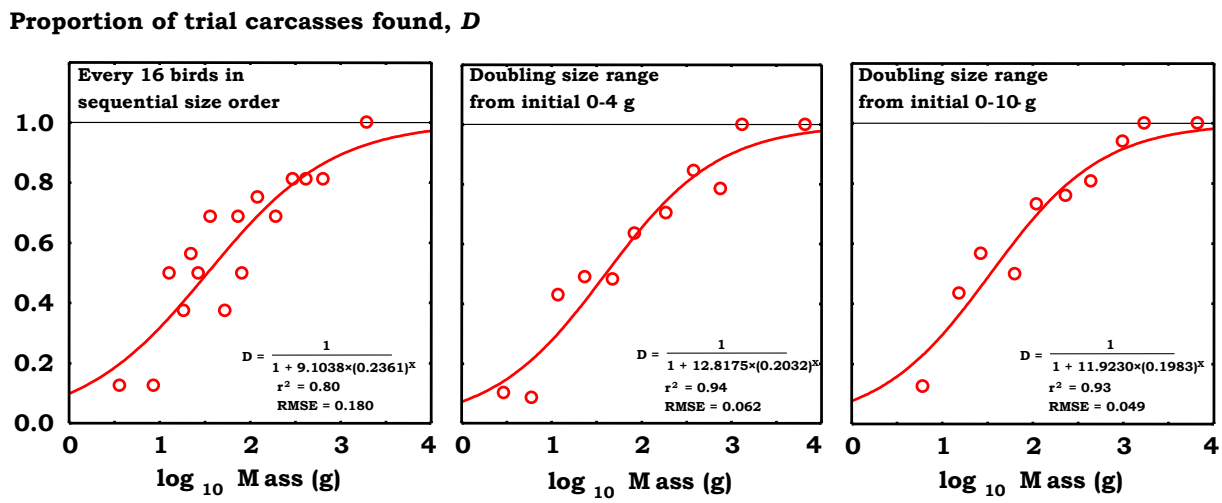

Figure 2. *No matter how species are binned by body mass, most of the variation in detection rates can be explained by variation in body mass. Data were from an integrated detection trial with a mean 4.5 day search interval in the Altamont Pass Wind Resource Area.*

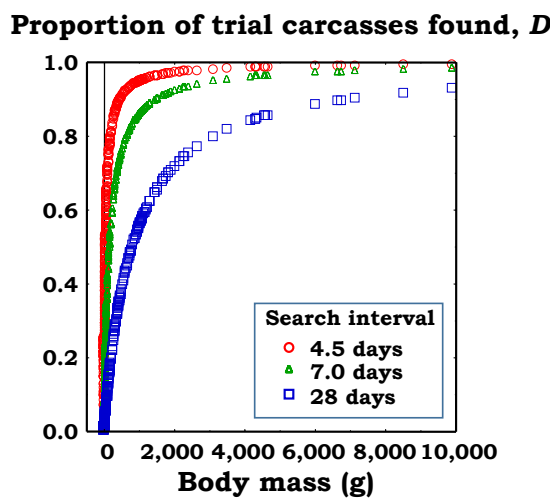

Figure 3. *Models of overall detection rates as functions of body mass projected to all avian species in North America for mean search intervals of 4.5, 7, and 28 days. Underlying data were from integrated trials in the Altamont Pass Wind Resource Area.*

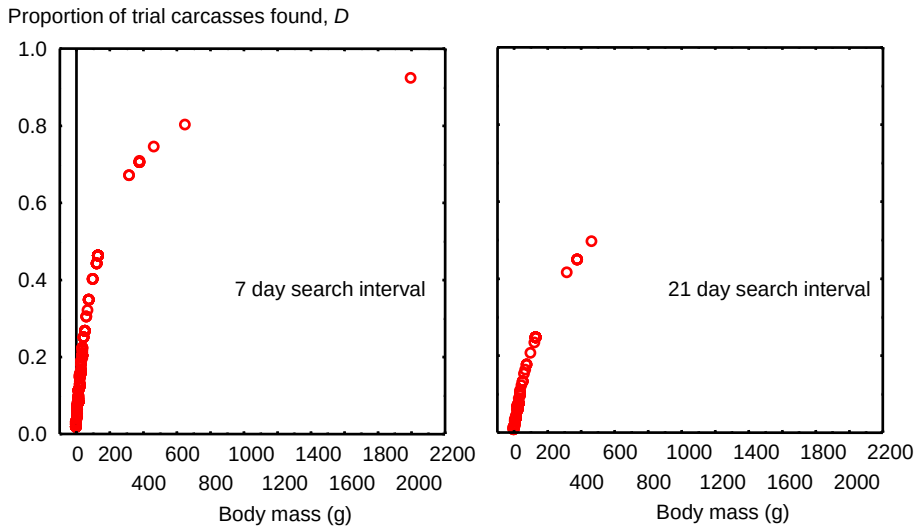

Figure 4*. Projections of the detection rate models onto the species of birds found dead at Ivanpah from 23 March through 17 August 2014.*

To estimate fatality rates at Ivanpah, I divided each fatality found within the search areas by the appropriate value of *D*, depending on the typical body mass of the species and the average search interval in use when the fatality was discovered. I also divided the fatalities found among the outer heliostat mirror arrays by 0.242 to account for the proportion of the fatalities not found because they occurred within the project area not surveyed. I added these adjusted fatalities to the fatality estimates from the power blocks (100% search areas around the towers, including the ACC buildings), and to those from the fence. I also adjusted the fatality estimates for the proportion of a year corresponding with the duration of monitoring, and I assumed that fatality rates would be constant throughout the year (this assumptions is most likely incorrect, but will have to do until a full year of data have been collected). Table 3 summarizes the results. Please be aware, however, that due to time constraints, I did not calculate confidence ranges. The lower and upper bounds of a 90% confidence interval would likely deviate greatly from the mean values in Table 3.

It should be obvious from Table 3 that the avian impacts of the Ivanpah Solar Electric Generating System are substantial, so far amounting to nearly 20,000 birds per year. Table 3 also reveals trends in the impacts, which can help predict impacts at other types of solar thermal projects, and perhaps can predict certain impacts at PV projects. For example, 5,687 (75%) of the 7,572 per-annum hummingbird deaths are occurring within the power block, indicating they are being destroyed as they fly through the zone of heat flux. On the other hand, most mourning doves, American kestrels, lesser nighthawks, ash-throated flycatchers, horned larks, cactus wrens, loggerhead shrikes, black-throated sparrows, Brewer's sparrows, white-crowned sparrows, and brown-headed cowbirds are being found amongst the outer heliostat mirrors, where collisions are the most likely cause of death. We can predict that these species will be vulnerable to collisions with parabolic mirror arrays and any other solar reflective technologies, as these species are vulnerable to attacking their own images on mirrored surfaces (Photo 2).

***Table 3**. Point estimates of annual fatalities at the Ivanpah Solar Electric Generation System, 23 March through 17 August 2014.*

Species	Fatalities/year			
	Power block	**Outer heliostats**	**Along fence**	**Project-wide**
Eared grebe	5	0	0	5
American coot	0	13	0	13
Wilson's phalarope	60	0	0	60
Turkey vulture	0	11	0	11
American kestrel	22	47	0	69
Mourning dove	117	617	10	744
Rock pigeon	10	0	0	10
Greater roadrunner	6	23	17	45
Lesser nighthawk	35	146	0	182
Swift spp.	47	0	0	47
Vaux's swift	22	0	0	22
White-throated swift	28	0	0	28
Hummingbird spp.	1005	0	0	1005
Anna's hummingbird	856	0	0	856
Broad-tailed hummingbird	101	0	0	101
Calliope hummingbird	732	0	0	732
Costa's hummingbird	2058	1885	0	3943
Rufous hummingbird	935	0	0	935
Ash-throated flycatcher	0	62	0	62
Olive-sided flycatcher	28	0	0	28
Horned lark	101	522	26	649
Swallow spp.	182	0	0	182
Bank swallow	142	0	0	142
Barn swallow	110	92	0	202
Cliff swallow	209	0	0	209
Northern rough-winged swallow	241	0	0	241
Tree swallow	383	0	0	383
Townsend's warbler	269	0	0	269
Verdin	252	0	0	252
Bewick's wren	84	0	0	84
Cactus wren	0	103	0	103
Blue-gray gnatcatcher	136	0	0	136
Loggerhead shrike	0	237	0	237
Phainopepla	0	164	0	164
Warbler spp.	32	0	0	32
Hermit warbler	112	0	0	112
Nashville warbler	120	0	0	120
Wilson's warbler	149	0	0	149
Yellow warbler	122	0	0	122

Yellow-breasted chat	0	67	0	67
Yellow-rumped warbler	908	258	0	1167
Sparrow spp.	0	180	0	180
Black-headed grosbeak	0	47	0	47
Black-throated sparrow	228	1890	0	2118
Brewer's sparrow	0	435	0	435
Chipping sparrow	64	0	0	64
Lapland longspur	33	0	0	33
Lazuli bunting	108	0	0	108
Lincoln's sparrow	45	0	0	45
White-crowned sparrow	51	280	33	363
Brewer's blackbird	25	34	0	59
Brown-headed cowbird	0	99	0	99
Scott's oriole	0	110	0	110
Western meadowlark	19	50	6	75
Yellow-headed blackbird	0	0	15	15
House finch	252	0	0	252
Lesser goldfinch	26	0	0	26
Pine siskin	58	0	0	58
Eurasian collared-dove	5	22	0	28
Bird spp.	112	235	0	347
Passerine (small)	148	1377	0	1526
All birds	10,792	9003	107	19,902

Photo 2. *A male brown-headed cowbird, encouraged by its female companion, repeatedly attacks its own image in the mirror of my truck, each time slamming head-first into the mirror.*

Assuming that the Ivanpah fatality rates remain stable through the remainder of the first monitoring year, then extending these rates to the 2,528 MW of solar thermal capacity planned in the preferred alternative of the DRECP would yield 186,342 avian

fatalities per year. If these rates were extended to all of the planned 12,036 MW of solar capacity, then the DRECP could result in the deaths of 887,187 avian fatalities per year (19,902 fatalities at Ivanpah ÷ 270 MW and multiplied by 12,036 MW of solar planned in the DRECP), not counting the range of possibilities between this number and a 90% upper bound of an estimated confidence range (not done yet). Hummingbirds alone would amount to 70,896 fatalities per year at the solar thermal planned in the preferred alternative, and to 337,543 fatalities per year should all solar consist of solar thermal. In either event, the impact of this toll on flowering plants would be potentially devastating.

Given this potential number of annual fatalities, it would be prudent to incentivize PV over solar thermal, to plan solar thermal very carefully, and to phase any development of solar thermal in order to limit development should avian fatalities be found to be excessive.

Collision Risk at Photovoltaic Projects

No attempt was made to predict fatality rates caused by PV solar projects, even though fatality rates should now be available. Across the plan-wide area, CEC et al. (2014:IV.7-272) provided no impact predictions for birds and bats due to solar, except for a table including covered species (page IV.7-277). However, this table of predicted impacts lacked a basis. It was unclear how these impact predictions were made.

Transmission lines

Transmission line impacts were insufficiently reviewed. Avian collisions with transmission lines are very common, and cause much greater overall mortality than does wind energy generation or solar energy generation alone. Some collision rates have been reported and should be used.

Photo 3. *A great blue heron hangs from the top wire of a transmission line in the Altamont Pass Wind Resource Area.*

Hartman et al. (1992) provided an empirical basis for estimating fatality rates of birds caused by collisions with transmission lines. Hartman et al. monitored bird collisions with a transmission line strung across Mare Island, California. Hartman et al. reported 85.3 bird fatalities per mile of transect per year along the portion of the circuit overlying

hayfields. This estimate translates to 28.4 bird fatalities per mile of circuit line per year, because there were 3 phase lines on this transect. Bird mortality was eleven times greater along that portion of the circuit overlying salt ponds, so transmission lines crossing wetland areas posed a much greater hazard to birds than lines crossing upland areas on Mare Island.

The EIR/EIS documents were vague about the length of transmission line needed to support the DRECP, but an acreage value was provided. A habitat disturbance total of 33,000 acres was attributed to the DRECP. Assuming the average transmission tower pad requires 61 x 61 m, and 5.5 transmission towers per mile of circuit, then 33,000 acres would equal about 6,526 miles of new transmission line. If this transmission line were to kill birds at only 1% of the rate documented over hay fields at Mare Island (Hartman et al. 1992), then the DRECP's transmission lines would kill 962,455 birds per year. To err on the side of caution, consistent with risk assessment of rare resources in the face of high uncertainty (National Research Council 1986, O-Brien 2000, Shrader-Frechette and McCoy 1992), it is worth considering fatality rates at 5% and 10% of what was estimated at Mare Island, which would be annual collision fatalities of 4.8 million birds to 9.6 million birds. The added transmission capacity, which would be necessary for the DRECP due to the development of renewable energy in remote portions of California, would cause many thousands or even millions of collision fatalities among birds. The EIR/EIS should address this impact, and some effort ought to be directed toward estimating the magnitude of the impact.

Electric Distribution Lines

I did not see any substantial discussion in the DRECP about the impacts of electric distribution lines on wildlife. There was a brief discussion on EIR/EIS pages IV.7-275 and IV.7-276, but the discussion did not even identify the types of equipment that cause the disproportionate numbers of electrocutions. It also made vague assurances such as collector lines will be buried wherever feasible. There was no estimate of the length of the collector lines or transmission lines, nor was there any attempt to predict fatality rates.

Renewable energy generated at projects is typically collected via riser elements on electric distribution poles. Riser elements are particularly dangerous to raptors and other birds, and lightning arrestors, which often accompany riser elements or other equipment on distribution poles are also particularly dangerous. Both riser elements and lightning arrestors are associated with raptor electrocutions 16 times other than expected (Smallwood and Karas, largely unpublished data, but also some reporting in BioResource Consultants 2009). Riser elements are difficult to insulate and to maintain the insulation. Insulators installed on riser elements in the Altamont Pass Wind Resource Area lasted no more than three years before insects, birds, and the weather caused warping and gapping, and raptor electrocutions have since been common.

Fencing

Many of the projects will include fencing, and fencing does injure and kill birds (Photo 4). The fencing needs to be further reviewed. For example, at Ivanpah, the fencing has so far been associated with 107 avian deaths per year (Table 3). For all projects including fencing, the FEIR/FEIS should include estimates of annual fatalities due to the fencing.

Photo 4. *A great-horned owl died after becoming entangled on the razor wire placed on top of this cyclone fence. Photo by Joanne Mount*.

Wildlife Movement and Stop-over Habitat

I saw little meaningful discussion of impacts on migratory birds. A discussion appeared on EIR/EIS pages IV.7-266 to IV.7-68, but it did not include an analysis, and its conclusions were baseless and vague. For example, it was stated, "*The goal of the project-specific Bird and Bat Covered Species Operational Actions would be to avoid and minimize direct mortality of birds and bats from the operation of the specific wind, solar and geothermal projects*." Whereas this would be a laudable goal, there was no discussion of how this goal would be achieved. What operational actions will avoid and minimize direct mortality of birds and bats? I have been performing research on bird and bat impacts caused by renewable energy since 1999, and have yet to see a single operational action that avoided or minimized impacts to birds or bats (Smallwood 2009).

MITIGATION MEASURES

Under section 7.6.3.2.1 Guidance for Preparing a Project-Specific BBCS, the EIR/EIS (M-28) stated, "*measures that may be incorporated or appropriately adapted for a project-specific BBCS include: Evaluation and installation of the best bird and bat detection and deterrent system available at the time of construction. For solar projects, these detection and deterrent systems will be configured to prevent bird species from flying over the site by day, and especially from flying into the project's concentrating radiant flux zone. Passive deterrents may be configured to break up light-polarizing*

surfaces to minimize avian recognition and collision conflicts. For wind projects, a detection and deterrent system will be configured to prevent bird and bat species from flying into the project's rotor-swept area." Having worked on these issues since 1999, I know from ample experience that this paragraph is misleading, and that there are no deterrents to prevent birds from flying through the rotor planes of wind turbines or over solar projects. This paragraph suggests that passive deterrents "may" be configured to break up light-polarizing surfaces and to minimize recognition of collision conflicts, but this is nothing but hopeful speculation. ***No proven deterrents exist***.

The EIR/EIS went on to promise that projects will be "*Utilizing unguyed monopole towers or tubular towers to reduce Common Raven perches as well as bird and bat collisions*." However, I have seen many common raven perches on monopole towers, and anyway neither guyed towers nor lattice towers have been used to support wind turbines in decades.

Another measure (M-29) would be "*Siting and designing Covered Activities to avoid high bird and bat movement areas that will separate birds and bats from their common nesting and roosting sites, feeding areas, or lakes and rivers*." This is something I have been doing in the APWRA since 2010, but only for four species of raptor. It takes me and my GIS analyst months to develop predictive models to accomplish this task, and this is following at least a year of behavior surveys designed to understand how birds are using the airspace over the landscape at issue. For bats, other methods would be needed, such as use of thermal imagery during nocturnal surveys. The EIR/EIS did not give me the impression that this much effort would be directed to siting solar and wind projects. I question how or even whether covered activities would be sited to avoid high bird and bat movement areas. Such siting would take serious research efforts, which seem counter to the intent of the DRECP to expedite the development of renewable energy.

M-29 also includes this measure, "*When fencing is necessary, using bird and bat compatible design standards*." I would support the implementation of bird and bat compatible design standards, but I wonder what they are. Fences are usually designed to be incompatible to wildlife, consistent with the goal of excluding wildlife. However, fences often entrap or entangle wildlife, so if there are design features to minimize entanglements, then I would support their use. It might help if the EIR/EIS would provide examples of such standards.

Also on page M-29, another measure would consist of "*Implementing a robust monitoring program to regularly check for wildlife carcasses, document cause of mortality, and promptly remove them*." I support the implementation of a monitoring program for carcasses. However, I recommend leaving found carcasses in place. Removing carcasses changes the interactions between scavengers and carcass persistence, and will affect carcass persistence and searcher detection rates used for adjusting fatality rate estimates. For the past three years I have been asking my fatality searchers to record carcass locations using GPS and to take notes on carcass status. With this information I have no problem tracking carcasses so that I know when a new one has appeared. Using this approach, my monitoring is more accurate.

Another measure on page M-29 reads, "*Installation of flight diverters on transmission lines according to the most current Wildlife Agencies guidelines, as described in CMA AM-TRANS-2 in Volume II.3.1.2.5 (Biological Conservation and Management Actions).*" I concur with this action, but I must add that little is known about the effectiveness of the various flight diverters that are available. This measure should be augmented to include scientific fatality monitoring under transmission lines so that transmission lines impacts can be estimated and flight diverters tested. Initial monitoring of flight diverters should be implemented in an experimental design so that the effects of different flight diverters can be compared.

According to M-29, "*During project siting and design, monitoring of bird and bat presence and use of the project site, using the most current survey methods and best procedures available at the time. This pre-project and pre-operations information will serve as the baseline from which to monitor and measure project operations in the future.*" Later on page M-29, the EIS/EIR added, "*Incorporating a bird and bat use and mortality monitoring program during operations, using current protocols and best procedures available at time of monitoring. This monitoring program will ensure that the information collected during operations is reported to the DRECP Coordination Group in a way that is compatible for use in the MAMP.*" However, these measures have been performed at many wind projects across the US, and have repeatedly failed to accurately predict fatality rates or to understand collision mechanisms. Under the subheading "Pre-construction Surveys to Predict and Mitigate Impacts," below, I will address these measures further. It is important that these measures be more carefully written to specify that behavioral ecologists will perform behavior surveys to document how birds are using the airspace, and that appropriate point counts will be used to document presence and relative abundance for use as baselines. Use surveys are not the way to go.

On page M-29, the EIR/EIS lists another measure as "*Utilizing project designs and project operations that minimize the reflectivity (acoustic and visual/polarizing) and exposure duration of reflective surfaces to avian species (e.g., vertically aligning solar panels during the night, using reduced reflectivity in material choices or applications).*" Whereas this measure might look good to someone inexperienced with collision issues, the truth is that little is known about the mechanisms of collisions at solar projects, and whether nighttime alignments will make any difference to avian collisions. It remains unknown whether minimizing reflectivity or exposure duration will matter at all to collision rates. Speculated notions of why collisions are happening should not serve as the basis for wholesale adoption of mitigation measures at renewable energy facilities, as such measures can waste the project-owners' money while accomplishing no reductions in wildlife fatalities. This type of measure should not be proposed without implementation as part of a controlled experiment, preferably a before-after, control-impact (BACI) design.

Also on page M-29, "*Restoring or enhancing habitat in conserved areas that benefit (through increased carrying capacity or fecundity) the populations of impacted bird and bat species. Potential actions may include nest site/roost enhancement, nest*

site/roost creation, and foraging habitat restoration/enhancement." Whereas I always support habitat restoration or enhancement where it is needed, based on my experience I cannot support such actions where restoration or enhancement is not needed. Too often these types of actions cause more harm than good by destroying habitat in order to restore it. If the goal is to increase the capacity of a habitat for a particular species, then it is likely that individuals of the species already occur in the target habitat; otherwise, it might be imprudent to target the particular habitat for restoration. This measure should be written to more clearly identify the situations where habitat restoration or enhancement would be appropriate. Also, to truly qualify as habitat restoration, the effectiveness of the restoration would need to be monitored and quantified with respect to the species' capacity in the area.

At the bottom of M-29, another measure reads, "*Reducing threats by actions that benefit the populations of impacted bird and bat species. Potential actions include: … Buying wind rights at existing operational facilities*." However, perhaps this measure would be counter-productive if the existing wind rights are located where birds or bats were and continue to be highly vulnerable to wind turbine collisions. Not all existing wind rights are safer than potential new locations for wind power. In my experience, many of the established locations have been extremely hazardous to birds and bats, and should be permanently decommissioned. In fact, this is happening in the Altamont Pass Wind Resource Area. It should be allowed to happen in the DRECP area as well.

And on M-30, … "*Reducing other forms of impacts to birds (e.g., fencing to exclude feral and outdoor cats)*." This measure might be of some benefit to birds, so long as it is remembered that not all other forms of impacts are equal among birds. Feral cats are bad for sparrows, but are food for golden eagles. Fencing can be dangerous to great-horned owls, but are of great benefit to loggerhead shrikes.

Also on page M-30, "*Implementing project-specific avoidance and minimization actions that reduce the level of operational impacts to the populations of bird and bat species. Potential actions may include:*

- *o Radar systems associated with wind turbine shutdown.*
- *o Wind turbine cut-in speed restrictions.*
- *o Night-time solar panel positioning to decrease surface areas exposed to avian species.*"

However, there is no evidence that any of these measures have been effective. I have yet to read or review a single scientific report on integrated radar systems proving effective at reducing bird and bat collisions. Cut-in speeds appear to be effective for bats, but not for birds, and no wind company appears to be willing to increase cut-in speeds at commercial wind projects. Nor is there any evidence that night-time solar panel positioning reduces collision fatalities. These measures should not be listed as if there is any reason to believe that they have been effective, because doing so is misleading and potentially damaging to wildlife when projects are built and these measures are implemented. If any of these measures are implemented, they should be implemented in an experimental design and with sufficient scale to obtain meaningful measures of effect.

In the Solar Design PEIS document (page W-24), one of the measures was "*Considering recommendations contained in Interim Golden Eagle Technical Guidance: Inventory and Monitoring Protocol and Other Recommendations in Support of Golden Eagle Management and Permit Issuance*." And, "*Adhering to instruction Memorandum 2010-156, the Bald and Golden Eagle Protection Act—Golden Eagle National Environmental Policy Act and Avian Protection Plan Guidance for Renewable Energy, until programmatic permits from the USFWS are available. The analysis of potential impacts on, and mitigation for, golden eagles shall be made in coordination with the USFWS*." The analysis of potential impacts in the guidance document relies on use surveys to inform the Bayesian model developed by the USFWS. I will comment on the use surveys later, under the heading "Pre-construction Surveys to Predict and Mitigate Impacts."

Also in the Solar Design PEIS document (page W-30), "*To the extent practicable, placing tall structures, such as meteorological towers and solar power towers, to avoid known flight paths of birds and bats*." As commented earlier, avoiding flight paths by birds and bats requires appropriate surveys performed by behavioral ecologists during the day for most birds and at night for owls, goatsuckers, and bats. The research-level surveys take time, and must be performed at a sufficiently fine spatial great and sufficient spatial extent for the ecologists to discern trajectories of flight paths so that tall structures can be sited to minimize collision risk.

On page W-32, the Solar Design PEIS proposes "*Conducting pre-construction surveys by qualified personnel, such as a qualified biologist, in areas with potential to adversely affect special status species (Section 5.10.4.1.1 of the Draft Solar PEIS) and utilizing approved survey techniques or established species-specific survey protocols to determine the presence of special status species in the project area*." I concur with this measure, but after having reviewed environmental review documents for numerous renewable energy projects in the DRECP area, I am concerned about the qualifications of consultants that have been hired to perform these types of surveys. I have seen too often where the surveys were performed at the wrong time of year or wrong time of day and using extremely cursory methods. I have also seen ample evidence that the biologists performing the surveys were often uncertain about how to interpret sign of the species' presence, or the meaning of observed behaviors or of positive or negative detections. Biologists performing this type of work need to start somewhere, so I am not suggesting that only the most qualified biologists be hired to perform surveys at renewable energy projects, but there should always be a qualified biologist who accompanies the biologists of lesser skill.

On page W-36, the Solar Design PEIS included "*Informing personnel of the potential for wildlife interactions around facility structures*." I concur with this measure, but in my experience it will take more than a sentence in the EIR/EIS for this measure to be meaningful. The renewable energy companies participating with the DRECP need to fund full-time personnel to deal with these and similar situations involving wildlife. There has to be a commitment from the energy companies to fund personnel to actually take seriously any reports of wildlife interactions around facility structures. Just as a

case in point, I found a golden eagle killed by a derelict utility line spanning low across a gorge in a wind resource area. The utility line used to collect power from a wind project, but the wind turbines were removed years ago and the line was cut and dangles from the next pole to the north, atop the northern ridge forming the gorge. In 2011 I informed personnel, and then I informed resource agency personnel, and to this day that derelict line still spans the gorge and continues to kill birds. If personnel are overwhelmed and underfunded, then it will not matter how often monitors or technicians inform personnel. It will take more commitment than this.

Adaptive management measures for burrowing owls included the following: AM-DFA-AG-4, Passive relocation, and AM-DFA-AG-5, Translocation. Passive location will be ineffective in the Imperial Valley because the solar projects will cover too much of the habitat and the remainder of the habitat will be occupied by burrowing owls and will not be able to crowd in more owls. This same limitation will occur in other DFAs where siting of large solar projects will conflict with burrowing owl habitat preferences.

As for translocation, it is well known by now that this method is ineffective, and too often leads to conflict with burrowing owls in the receiving areas and net negative impacts.

Injured Wildlife

Rehabilitation facilities should be identified in advance so that injured animals can be transported to the appropriate facilities. An annual fund provided to rehab facilities would also help ensure the continued availability to deal with wildlife emergencies. After performing a survey of rehabilitation facilities (E. Leyvas and K. S. Smallwood, unpublished data), a reasonable fee per killed or injured raptor would be $3,000 per bird. A reasonable fee for non-raptors might be half this cost, but Leyvas and I lack the information yet to make an empirically sound estimate.

PRE-CONSTRUCTION SURVEYS TO PREDICT AND MITIGATE IMPACTS

The EIR/EIS indicated that use surveys would be used to establish baselines of relative abundance, and that post-construction survey results would be compared to the baselines. Given the stated purpose and my experience with surveys implemented at wind energy projects, I can conclude that the intended objectives of these measures would be to (1) predict project impacts based on use and behavior rates prior to construction, (2) measure impacts due to avoidance or attraction to the project, and (3) develop the means to test relationships between collision fatality rates and use or behavior rates. These objectives would rely on certain assumptions being true, including: (1) fatality rates correlate with use rates; (2) differences in use rates on and off site will indicate avoidance or attraction of the project by wildlife; (3) changes in avian or bat use over time will correlate with collision fatality rates. Having spent 15 years on these objectives at wind energy projects, and having tested the underlying assumptions fairly rigorously, I need to point out some problems with these measures. I will also suggest more effective measures.

Assessments of proposed renewable energy projects are needed to decide whether project sites are suitable and to decide on the appropriate mitigation to minimize, reduce, rectify, or offset project impacts. Data needed for these assessments are of several types, which generally can inform three levels of risk assessment. The coarsest level of assessment is determining the likelihood of species' occurrences at a project site. Supporting data for this level of assessment consist of species' geographic range maps and habitat descriptions, but should also include rigorous surveys on site. At this level, biologists overlay the project boundary onto geographic range maps and compare environmental conditions of the project site to published descriptions of the species' habitat. Also at this level, use surveys might be performed. Use surveys consist of counting birds of each species during fixed time periods and within a fixed maximum radius. The radius and survey time periods are fixed so that levels of survey effort can be known and used for comparing use rates through time or between places. Use surveys can confirm species' occurrences, although they are less suitable for confirming absence, especially for species that are active during times of day or seasons other than when the surveys were performed, or for rarely occurring species.

A finer level of assessment consists of comparing the relative abundance of birds between a proposed project site and other project sites where fatality rate estimates were already made. For this level of assessment, use surveys or point counts are typically relied upon. Use rates, or the number of sightings of a species per survey or per hour, are compared to post-construction fatality rates so that the use rates observed at a proposed project site can be compared to predict a fatality rate at the proposed project site.

The finest level of assessment is comparing activity patterns within the proposed project area so that project facilities can be installed at locations where collision impacts will be minimized. Use rates can crudely serve this level of assessment, so long as the observation stations were sufficiently spread throughout the project area to obtain use rates, or "passage rates," within land areas that were small enough to match the spatial grain at which the collision risk of solar arrays needs to be compared. No scientific standard has been established for the spatial grain needed for comparing use rates to guide renewable energy project layouts.

At the spatial grain decided upon, biologists would need to populate the cells of an analytical grid with use rates for the species of concern. The number of stations would also have to be multiplied by the survey time needed to adequately represent hourly, seasonal, and inter-annual variation in relative abundance or passage rates. If the goal is comprehensive coverage of passage rates across a proposed project site, then a survey effort intended to yield comparable use rates at sufficiently fine-grained temporal and spatial scales across the entire study area would be much greater than any survey effort likely implemented at solar projects to date.

A reasonable alternative would be to sample the project area for use rates. In this approach, observation stations would be located based on random, systematic, or even arbitrary selection methods. The key to this approach would be in accurately

extrapolating use rates within sampled areas to the rest of the project area. In other words, the use rates must lead to predictive models, and the predictor variables in the models must have been measured consistently throughout the project area. Furthermore, the survey areas must reasonably represent the larger project area so that gradient effects do not confound the extrapolation. Sampling for use rates was the approach that I applied qualitatively to more carefully site wind turbines and predict impacts at the Buena Vista Wind Energy project (Lamphier-Gregory et al. 2005) and quantitatively at the Tres Vaqueros Wind Energy project (Smallwood and Neher 2010), and the Vasco Winds Energy project (Smallwood and Neher 2011). Nevertheless, the underlying use rates should have been derived from several years of surveys covering all seasons and times of day. I have seen no evidence outside the Altamont Pass that sampled use rates were extrapolated from surveyed areas to entire project areas to guide the siting of renewable energy projects.

A superior alternative to use rates for informing renewable energy project layouts would be to perform behavior surveys. Whereas use surveys serve to indicate relative abundance, they are inadequate for quantifying behavior patterns other than whether each bird is flying or perching. Biologists do not need to know how many birds per hour pass 1,000 meters over a solar project. What biologists *do* need to know is how often a bird of a given species performs specific behaviors suspected to result in collisions, such as gliding, contouring, attacking prey, chasing competitors, fleeing, or attempting to land on what the bird thought was a body of water. Biologists also need to know how often birds are performing these behaviors in specific wind conditions and over specific types of terrain during those specific wind conditions. Behavior patterns tend to be more stable than a species' relative abundance, so predictive models should be more robust among locations and years, but appropriate behavior surveys are performed using different methods from use surveys.

Whether relying on use rates or behavior rates, the analyst must evaluate whether the data were gathered with sufficient spatial grain and extent, and with sufficient representation of seasons, times of day, and wind, vegetation cover, and topographic conditions. Furthermore, if use surveys are being relied upon, then the analyst must evaluate whether the data adequately represent the peaks, nadirs, and intervening portions of any natural, multi-annual population cycle that may or may not be linked to a climate cycle.

Utilization data must also be examined for biases. If the use rates are biased, then the biases need to be quantified so that the use rates can be adjusted to account for the biases. Potential biases include (a) trends in detection rates with distance from the observer, (b) variation in the maximum survey radius (relates to (a)), (c) variation in the visible portion of the airspace out to the maximum survey radius, (d) trends in detection rates with survey session duration, (e) differences in detection rates between visual backdrops such as sky versus terrain, and (f) variation in the maximum ceiling for counting birds. Along with quantifying biases, error should be calculated, reported, and carried through calculations of rates.

Finally, either use rates or behavior rates must be compared to landscape factors, wind conditions, seasons, and times of day that are known or suspected to associate with both wildlife activity patterns and solar project impacts. Most of the factors will include uncertainty, and probably will vary spatially and temporally, so their general patterns must be tempered by consideration of local conditions. Data collected onsite must be suitable for testing hypotheses with adequate statistical power. Also due to the uncertainty in the collision factors, each study needs to report study design, data gathering methods, and analytical methods so that future studies can benefit from the effort.

Monitoring data need to be made public. Transparency and the sharing of results compose a hallmark of science, and goes to what I stated earlier – that solutions come from first learning of the magnitude and nature of the impacts. Too much of the data already gathered at renewable energy projects do not appear to be readily available to the public, which interferes with my ability to predict project impacts and to suggest mitigation options.

1. Predicting Impacts

Presumably, the purpose of predicting impacts would be to either decide on the suitability of the proposed site for constructing the renewable energy project, or decide how much compensatory mitigation will be needed. If the objective of preconstruction surveys is to predict project impacts, then the reason for making the prediction needs to be stated clearly. If the reason is to decide whether the project should proceed, then decision thresholds are needed, such as levels of site use that would result in unacceptable losses to avian or bat species. If the reason is to decide on the level of compensatory mitigation, then levels of use need to translate into levels of compensation.

If the intended objective is to predict collision fatality rates based on preconstruction use rates, then I must point out that there is no basis for doing so other than documenting that a particular species is present. Among the many wind energy projects where use rates have been related to fatality rates, no significant spatial or inter-annual correlation has been found (De Lucas et al. 2008, Ferrer et al. 2012). For some species I have found seasonal correlations between fatality rates and use rates, but for other species I have not even found seasonal correlations (Smallwood 2010).

2. Measuring Avoidance or Attraction Impacts

Pseudoreplication often diminishes tests of avoidance of a site or attraction to a site. To rigorously test whether a project displaces particular species, or attracts some species, then experimental design is paramount. Such a test requires the following principles of experimental design: (1) control or reference treatments to be compared with the manipulated treatment; (2) replication of treatments, including of the control treatment; (3) spatial interspersion of treatments; and, (4) appropriate spatial and temporal scales of implementation. A single project site is unsuitable for treatment replication or interspersion, so two of the four principles of experimental design cannot

be satisfied. The project size might be large enough to satisfy the spatial scale of observation needed for some bird and bat species, but probably not for large birds such as golden eagles, red-tailed hawks, or barn owls. The temporal scale would suffice only if it included enough pre-construction years to include natural temporal variability such as at least one full cycle of any multi-annual cycles, which are common among wildlife species. In other words, measuring avoidance or attraction at a renewable energy project site with sufficient confidence might be impossible due to experimental design shortfalls.

A means to mitigate the experimental design shortfalls would be to implement a Before-After, Control-Impact (BACI) design. A BACI design should control for temporal trends that could otherwise confound comparisons of use or behavior rates through time, although it cannot control for spatial confounding. There might be something special about the project site that confounds comparisons of use rates between the renewable energy project site and offsite control plots. The comparison of use and behavior rates between the on and off site will always be compromised by lack of treatment replication and interspersion.

3. Testing whether Fatality Rates Relate to Use Rates

Most likely, the use rates proposed in the EIR/EIS were inspired by methods practiced at wind energy facilities during the past 25 years. Orloff and Flannery (1992) related fatality rates to use rates in the Altamont Pass Wind Resource Area, and other biologists subsequently copied this method in the Altamont Pass (e.g., Howell and DiDonato 1991, Smallwood and Thelander 2004, 2005; WEST 2006) and elsewhere. It became commonplace in wind energy reports to see post-construction fatality rates regressed on preconstruction use rates, even though the regression was obviously very weak and suffered from pseudoreplication and other analytical problems.

The following discussion addresses specific shortfalls and challenges to relying on use rates to predict fatality rates at renewable energy projects.

(A) Use survey efforts too small

Hundreds and even thousands of hours of use surveys are often needed to detect a single individual of special-status or other rare species. For example, even in areas most actively used by golden eagles, observing one eagle per hour is exceptional. Many hours would be needed to obtain golden eagle use rates that can be meaningfully compared to infer displacement effects or a relationship with fatality rates. As another example, 774 hours of survey at Vasco Caves Regional Preserve in the Altamont Pass WRA failed to detect peregrine falcon (Smallwood et al. 2009b), even though this species was twice documented as killed by Altamont Pass wind turbines. At Vasco Caves, it took 387 hours per observation of merlin, 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. Special-

status and other rarely occurring species require huge survey efforts to detect them, and even then the sample sizes are too small for meaningful comparison to fatality rates.

Most likely, many species will not be detected by use surveys, as practiced at renewable energy projects.

(B) Use surveys are inappropriate for some species

Protocol surveys for burrowing owl do not include use surveys as often used in renewable energy projects (CDFW 2012). There is a reason why the protocol for burrowing owl surveys is different. Use surveys are miserable for detecting burrowing owls or for indicating relative abundance of burrowing owls (Smallwood 2013). The same is true of other species, including great-horned owl, barn owl, common poorwill, and common nighthawk.

(C) Use rates shift spatially

Use rates are often assumed to be spatially static, or at best nothing is said about the likelihood that use rates might shift spatially through time. However, animal populations are usually aggregated, and aggregations typically shift locations about generationally (Taylor and Taylor 1979). This same pattern appears to be evident in the Altamont Pass for golden eagles (Figure 5), red-tailed hawks, American kestrels, burrowing owls, and multiple other bird species (Smallwood, unpublished data). In Figure 1, golden eagle use rates increased in the North Flynn portion of the Altamont Pass Wind Resource Area while they decreased in GB Midway and increased for three years and then decreased the following three years on the East Slope. These and other trends were evident at the other sites within the APWRA. Golden eagle activity periods clearly shift locations in the APWRA, so in any given year some portions of the Altamont are highly populated when other portions are depopulated. Obtaining a year or two of avian use surveys might not represent relative abundances of birds during the subsequent one or two years at a particular site.

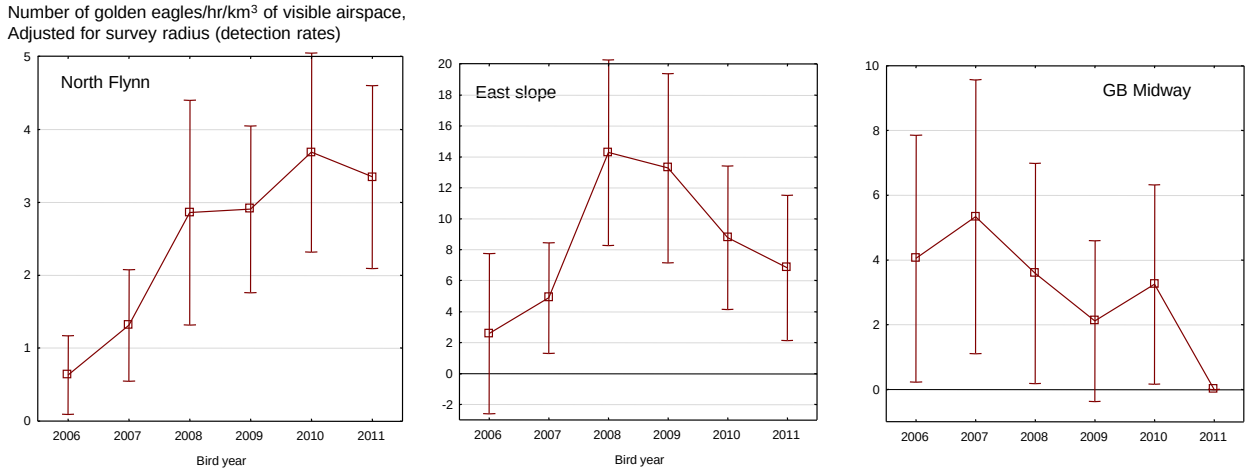

***Figure 5**. Golden eagle use rates adjusted for visible volumes of airspace in three portions of the Altamont Pass WRA, serving as examples of how different trends in*

activity were concurrent in the same project area. Golden eagles shift their activity areas through time.

At relatively large spatial scales, animal populations are often present or absent (or nearly absent). Moderate densities might be rare (Smallwood 1999, 2001, 2002). Throughout the geographic range of golden eagles, many eagles can be counted at some locations, very few to none can be found in many locations, and intermediate numbers of eagles are likely rarely found in the remainder of the locations. This is the type of result that one should expect of aggregated populations, and in fact it is what we see.

The existence of only several clusters of abundance likely leaves single-species use rates unsuitable as a predictor variable in a least-squares linear regression analysis because it is the clusters that are influencing the regression slope rather than project-specific use rates. In other words, use rates likely do not express the type of continuous variable that is implied in recent attempts to regress fatality rates on use rates, and therefore does not express the intended scope of inference, i.e., it is a form of pseudoreplication.

(D) Seasonal representation requires many surveys

Unless many hours of surveys are consistently performed among solar project sites every month over several years, then use rates will be biased when compared to fatality rates. Seasonal trends in relative abundance are substantial (Figure 6). These high-frequency oscillations add to the complexity of lower-frequency oscillations representing multi-annual cycles, and these latter cycles are likely adding to the complexity of even longer-term cycles of abundance. There is no standard that exists on how many surveys over which duration of time is needed to qualify use rates as representative of relative abundance or as suitable for comparison to fatality rates.

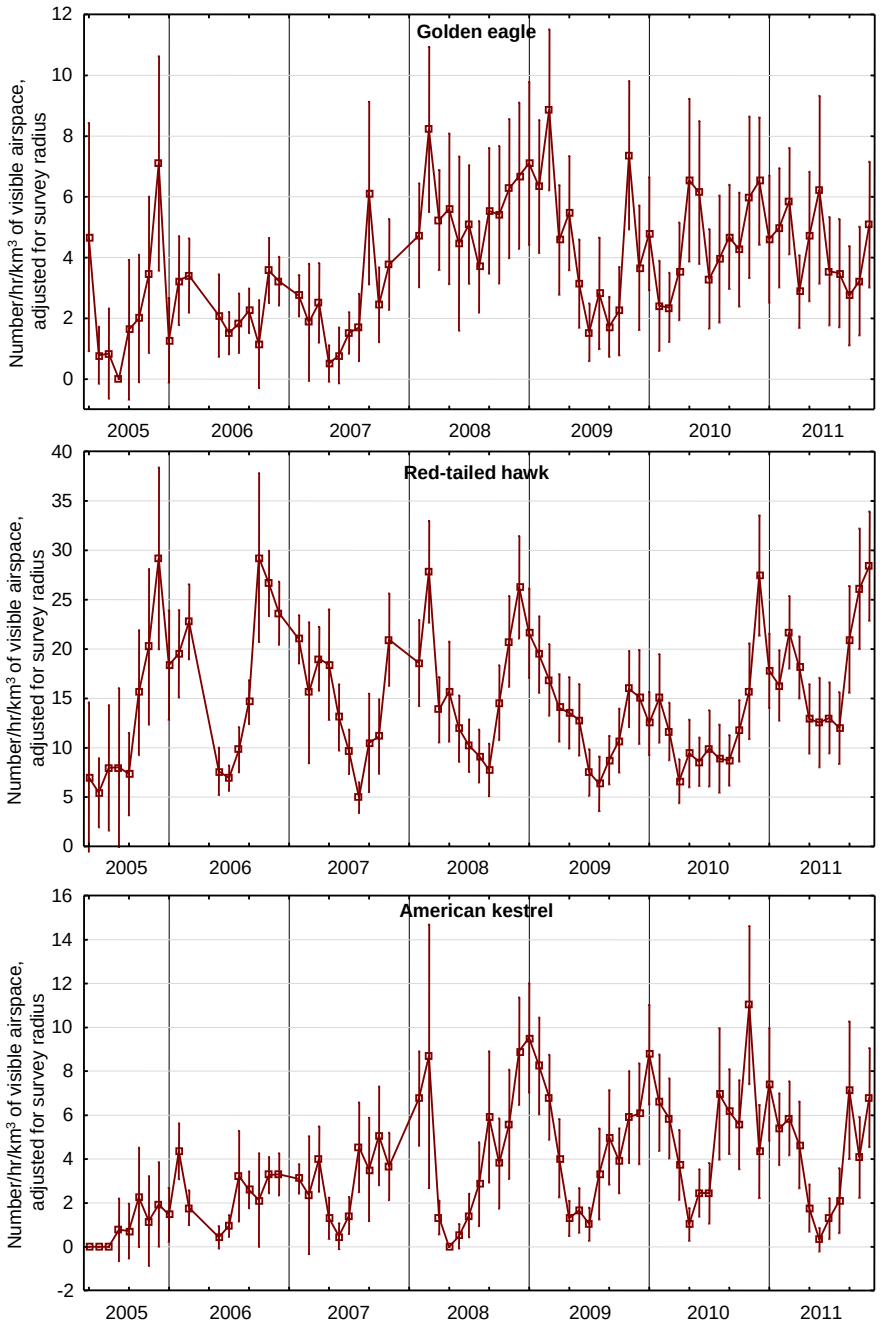

Figure 6. *Mean (and 90% CI) monthly use rates measured in the Altamont Pass WRA for golden eagle (top), red-tailed hawk (middle), and American kestrel (bottom).*

(E) Adjustment needed for variation in visible 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 (the vertical limit is usually not reported). A common maximum survey radius has been 800 m, but it has varied from 50 m to unlimited distance. 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 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 consultants can see birds as high as they often seem to think they can see them in distance (800 m), 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 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 renewable energy projects in the western U.S. From station to station, and from project site to project site across the U.S., the visible volume of airspace surveyed will vary greatly due to variability in topography and vegetation cover surrounding each station (or due to solar panels). To illustrate the influence of this variability, a colleague and I constructed a digital elevation model (DEM) of the Altamont Pass WRA and we calculated the volume of airspace visible from each of the 84 observation stations (Figure 7). We found that out to 800 m, the visible volume of the available airspace ranged 50% to 95%, so the observation stations with the least visible airspace could yield utilization rates that are half of those measured at the stations with the most visible airspace, and the two-fold difference would be due only to the difference in how much airspace was visible. 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.

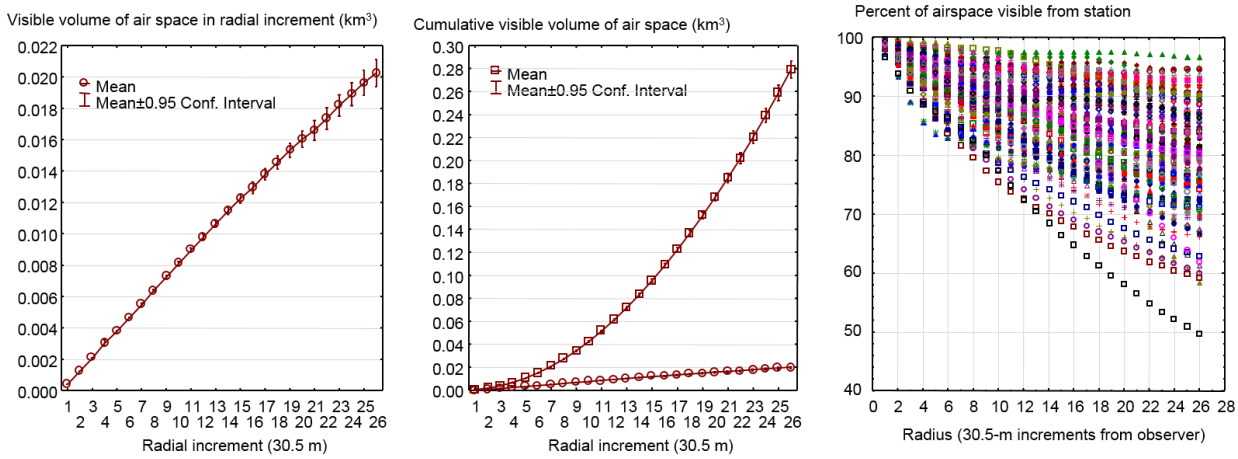

Figure 7. *Plot-specific changes in mean visible volumes of airspace within increasing distance from the observer (left graph), cumulative change of mean visible volume of airspace with increasing distance from observer (middle graph, including visible volume of airspace in radial bands depicted by circles), and decreasing percentages of the surveyed airspace that is actually visible to the observer as distance increases (right graph). Visible volumes of airspace were calculated within a 140-m ceiling and within specific radial bands from the observer (x-axis) among 84 observation stations in the Altamont Pass WRA. Note that our maximum survey radius was 800 m. 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 U.S. might qualify as very misleading.*

(F) Detection rates decline with distance from the observer

A colleague and I quantified the effect of variable distances of birds from the observer, using our digital elevation model (DEM) of a project area in the Altamont Pass. We calculated detection functions, which allowed the projection of our detection rates to visible volumes of airspace within the maximum survey radii used by other investigators. Most bird species exhibited a detection vacuum near the observer, probably due to the birds avoiding the observer, and then detection rates declined rapidly with increasing distance from a zone around the observer where detections had peaked (Figure 8). Without accounting for the effect of distance from the observer, utilization rates cannot be compared without bias among renewable energy projects, nor can utilization rates be compared appropriately among species.

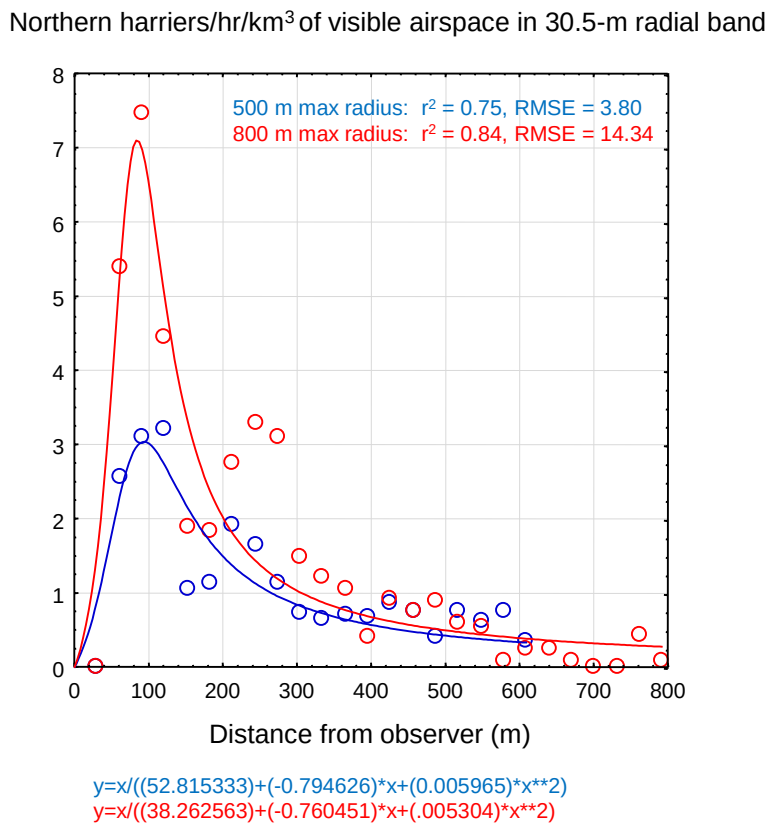

Figure 8. *Northern harrier detection rates increased with increasing distance from the observer to a peak at about 95 m from the observer, and thereafter rapidly decreased with increasing distance from the observer in the Altamont Pass Wind Resource Area.*

(G) Influences of visual background unknown

When observation stations are located on hill peaks, many of the birds in the survey area will fly or perch below the horizon, such as downslope from the observer, and these birds will have terrain or vegetation backgrounds. When observation stations are located on slopes, valley bottoms, or on flat ground surrounded by a flat landscape, then many of the birds in the survey area will fly or perch above the horizon. It is often more difficult to detect birds against a terrain or vegetation background, but at certain times of day and angles to the sun, it can also be very difficult to detect birds against a sky background. The differences in background due to differences in terrain and the locations of observation stations on that terrain will likely translate to differences in detection rates and differences in estimated utilization rates. These differences can bias estimation of utilization rates, and so should be investigated.

I examined golden eagle utilization rates for differences between observation stations located in larger versus shallower terrain in the Altamont Pass WRA. Differences in the patterns of the data suggested that golden eagles in larger terrain, i.e., larger hills, were more difficult to detect beginning at 244 m (8 radial bands) from the observer (Figure 9). The observers were detecting about the same number of golden eagles out to 213 m

(7 radial bands in Figure 9), whether in small hills or large hills, but at 244 m and farther the observers were seeing about three times the number of eagles over the small hills. Golden eagles appear to be easier to detect with a sky background. Focused research is needed to more carefully quantify differences in detection rates before resulting utilization rates can be compared and interpreted with any confidence.

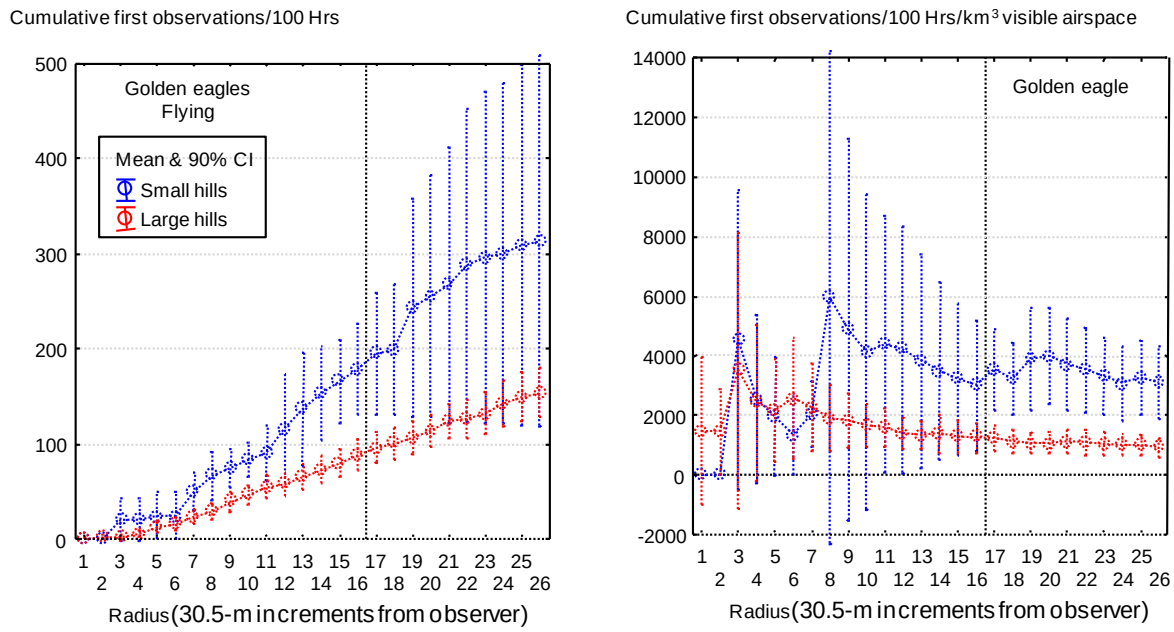

Figure 9. *Cumulative Golden eagle detections increased more rapidly over small hills than they did over large hills (left graph), but golden eagle detections per 100 hours per km3 of visible airspace were about equal through 7 30.5-m (100-foot) radial bands extending from the observer, and then were about 3-fold greater over small hills (right graph).*

(H) Survey duration affects use rates

My colleagues and I found that session duration affects use rates, whereby use rates increase through the first 10 minutes of survey, then decline after 22 minutes (Smallwood et al. 2009). The most efficient survey duration is about 10 to 15 minutes, if the objective is to estimate use rates. If the objective is to quantify behavior rates, on the other hand, longer session duration is more effective.

(I) Radar detections uncertain

Use rates derived from radar surveillance suffer from a number of problems. Species identifications are often not possible, or are based on assumptions about size class, flight speed, flock size, and time of night when the radar target(s) was observed. Visual confirmation of radar targets is rare, often ranging between 0% and 2%. In summary, radar is unlikely to provide the species-specific information that one needs to understand collision rates or causal factors.

Summary Comments on Use Rates

Use rates, whether they be quantified from observations made during diurnal surveys or radar surveillance, are prone to large uncertainties and bias, and are extremely complicated. The reported results of use surveys are often shockingly simplistic, such as consisting of percentage composition of each species observed during surveys. The reported results are often simple because analysts discover that interpreting the data is complicated. It is for this reason, most likely, that results of use surveys have rarely been published in the peer reviewed literature, and those that were published have reported poor performance.

If the objective is merely to document presence of particular species, then the appropriate surveys should be directed toward those species. For example, burrowing owl presence should be based on protocol surveys for burrowing owls. For songbirds, 5 minute to 10 minute point counts should be the method used. There is nothing wrong with documenting presence, but appropriate methods should be used, and not just use surveys as so often relied upon at renewable energy projects.

BEHAVIOR SURVEYS AS SUPERIOR ALTERNATIVE TO USE SURVEYS

Behavior surveys provide information that is more helpful for impact predictions, understanding the factors related to project impacts, and for finding solutions in the form of mitigation to reduce, rectify, and offset impacts. Unlike use surveys, behaviors surveys need not be performed for multiple years or at as many observation stations. Behavior surveys, if implemented correctly, should also be free of the substantial biases that confound use surveys, as outlined above. Behavior surveys should cost less, while also generating much more useful information.

A full year of behavior surveys prior to project development should provide sufficient information to predict impacts and to serve as a baseline for estimating post-construction impacts such as displacement. Behaviors related to foraging, predator avoidance, social organization and mate acquisition are relatively stable, and are expressed more consistently than is relative abundance. However, behavior surveys need to be performed by behavioral ecologists familiar with the collision issues. This approach was the reason for the accurate predictions of fatality rates at the Buena Vista Wind Energy Project (Lamphier-Gregory et al. 2005), but more importantly it was the reason for the 80% reduction in fatality rates caused by the project (Smallwood 2011). Not only should the flight behaviors of birds be recorded, but their flight paths should be related to a digital elevation model of the project area so that slope and wind measurements can be used to predict flight paths. It is important to predict the major flight paths of species of concern so that the project can be laid out to minimize collision hazard (Smallwood et al. 2009a).

In my experience, behavior surveys are most efficient when they last one hour. Any longer, and the observers grow disinterested and lose focus. Any less, and the efficiency of the surveys is compromised by the logistical demands of closing down surveys,

relocating, and starting new surveys. A key point to behavior surveys is that they are not counts of abundance, but rather are supposed to be high-quality recording of flight behaviors. Therefore, quality tracking of individual birds or groups of birds is more important than tracking all of the birds available at any given time.

In the surveys I do, behavior attributes are recorded on point features for use in geographic information system (GIS), but the point features are recorded every few seconds rather than every minute as typical of the use surveys. The point features of course result in line features representing flight paths. It is the flight paths that we can intersect with interesting features of the landscape, proposed or existing solar arrays, fence lines, or gen-ties. Those point features closest to the intersections of the line features can inform of the height above ground and specific behaviors being performed by the bird. Our capacity for predictive modeling is therefore much greater.

Each survey session begins with wind and temperature measurements, so that I can later relate behavior rates to weather conditions. I record the station number, date, and start time on a handheld map and on two worksheets in an electronic spreadsheet format. These three variables are key variables that enable merging of the data in all three formats when it is time for analysis. As key variables, it is critical that special care be given to recording them consistently and without error. One sheet is for session attributes, such as observer's initials, temperature, wind direction, average and maximum wind speeds, and percentage cloud cover. These attributes are recorded at the start and end of each session, and the values averaged for session representation in analysis. The other sheet is for bird observations during the session, which the observers record into voice recorders during the survey. The first bird I see is assigned letter A, and the first recorded observation of bird A is assigned 1, and the second observation is 2, and so on (Figure 10). These observations are recorded on a field map as A1 and A2, and they are also recorded in a spreadsheet with the same designations. Along with each record, I also record species, height above ground, behavior, number in group, and specific details about near or actual collisions with project infrastructure. The alphanumeric values assigned to birds also serve as key variables enabling the merging of data from field maps and the observation worksheet. All voice recordings must be transcribed to spreadsheets within 24 hours of survey.

Mapped behavior data should be digitized for use in GIS, preferably with the help of a GIS analyst. A simple form of analysis consists of overlaying flight paths of individual species under a range of conditions, such as wind speeds and wind directions, or time of day. Flight patterns should be evident, and potential impacts inferred from the flight paths. A more rigorous analysis would involve constructing predictive models based on associations between flight locations and mapped slope and vegetation measurements. Candidate modeling approaches could be Discriminant Function Analysis or Fuzzy Logic (Smallwood et al. 2009b).

To quantify displacement and attraction impacts caused by the project, the behavior surveys should be continued for a year after construction. A BACI design would help control for variation in behavior rates due to the change in years, although only one impact site will be possible in the design. The BACI design's power would be diminished

by the existence of only one real plot representing the impact portion of the design, but it will still yield useful results.

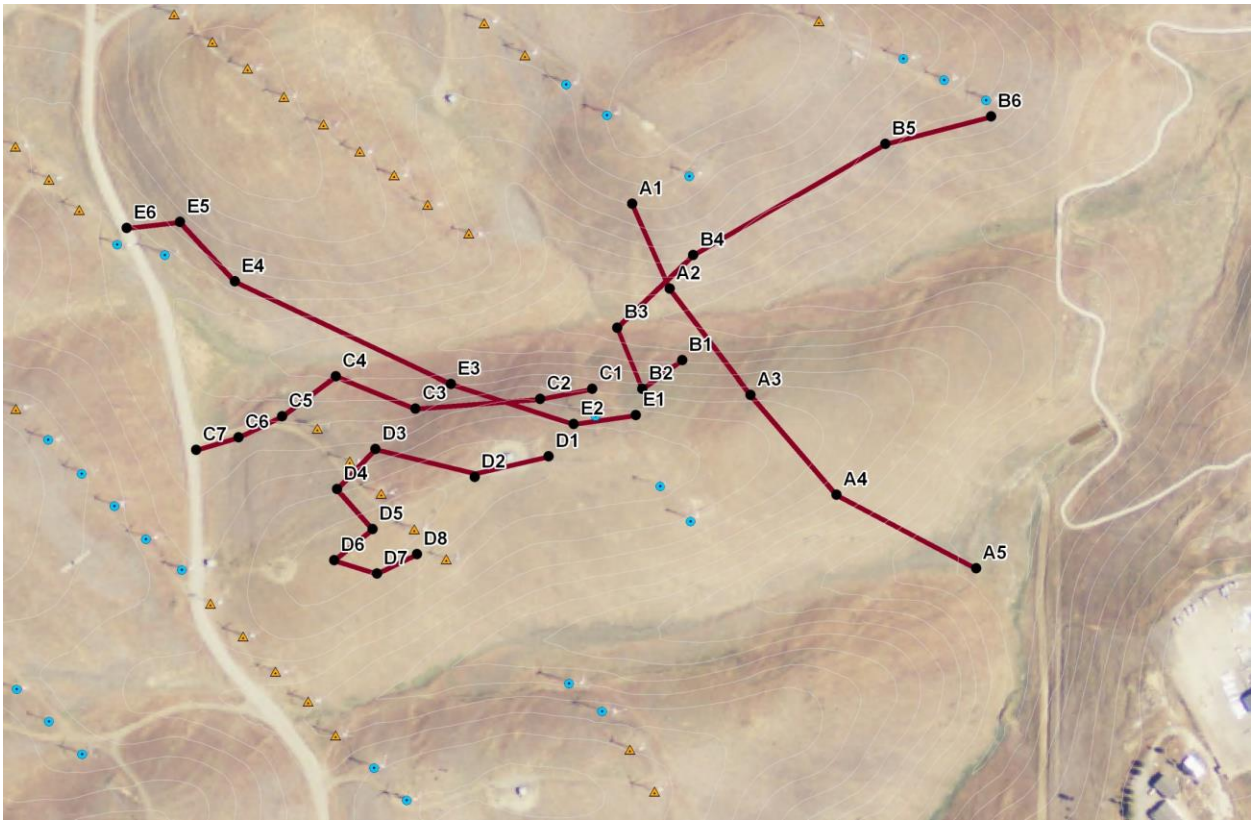

Figure 10. *Example bird flight paths and connecting point features where behavior attributes were recorded. These data were from one of my project sites in the Altamont Pass. The triangles and circles were 40-KW wind turbines.*

NOCTURNAL SURVEYS

Radar surveillance generally fails to identify targets to species. A superior nocturnal monitoring method is the use of thermal imaging. For longer than a year I have been using a FLIR T620 thermal imaging camera with an 84 mm lens. I can identify many of the targets to species or at least to larger taxonomic groups, including at distances out to 1,000 m. During 550 hours of nocturnal surveys I have seen many bats flying within my study plots and interacting with the wind turbines in my plots, and I have watched the flights of hundreds of burrowing owls, great-horned owls, and barn owls. I also have observed common poorwills and species usually active during the day, such as cormorants, ducks, and songbirds. I also record mammalian species visiting the wind turbines to forage on birds and bats killed by the wind turbines or placed by my research team for detection trials. I can see where the striped skunks, coyotes, foxes, badgers, raccoons, house cats, and bobcats are going, which can help me tailor the detection trial to more accurately estimate the proportion of fatalities not found during searches (see below).

The FLIR T620 camera and 84 mm lens cost about $31,000 in 2011. Lesser equipment will not be nearly as effective as this camera and lens. The results, however, justify the cost. A tripod is also needed.

I record observations onto handheld map images of the study area. When I record data to the map, I use a red light to minimize my visibility to wildlife. I record attribute data into a voice recorder, which I transcribe to an electronic spreadsheet the next morning. The T620 also records still photos and video, and I often record my observations in both photo and video formats. The recordings often help me interpret what I saw during the surveys.

The thermal imaging equipment I use enables me to identify most animals to species, but also to observe their behaviors. Observing behaviors is much more useful than obtaining a flight trajectory from radar. I can see how birds and bats react to the renewable energy infrastructure, which is invaluable.

Similar to the diurnal behavior surveys, to quantify displacement and attraction impacts caused by the project, nocturnal surveys should be continued for a year after construction. A BACI design would help control for variation in nocturnal behavior rates due to the change in years, although only one impact site will be possible in the design. The BACI design's power would be diminished by the existence of only one real plot representing the impact portion of the design, but it will still yield useful results.

POST-CONSTRUCTION FATALITY MONITORING

Learning from the impacts caused by earlier renewable energy projects should be an essential element of project impact assessment and mitigation planning. Both trends and apparent outliers in fatality rates can be instructive when assessing and planning new projects. The essential elements of scientifically defensible fatality rate estimates include: (1) detecting as many of the available fatalities as possible; and, (2) adjusting the number of found fatalities by the proportion not found. The duration of the average search interval matters greatly to both of these factors. During the past two years I have worked with three search intervals at two studies, including 7 and 28 day intervals at one study and <5 day intervals at another. Also at the latter study, another monitor overlapped many of my study plots with an average search interval of 42 days. What I learned from these various search intervals is that the longer intervals can be more efficient for large bird carcasses, but short search intervals are crucial for obtaining reasonable fatality rate estimates of small birds and bats. I suggest a search interval of no longer than two weeks. A search interval of weekly would be appropriate for bats.

I recommend that at least a third of the project area be searched periodically for dead or injured birds and bats. The project area should be divided into grid cells or other sampling units (such as solar arrays) that are then sampled randomly or systematically (with a random starting point) for inclusion in the fatality monitoring. Standardization of the field and analytical methods should include the following for most species.

1. Periodic fatality searches at time intervals of no more than two weeks. Fatality searches should be conducted along transects separated by no more than 7 m in most environments, but closer if ground visibility is poor and farther apart if ground visibility is excellent. Trained dogs should be used to improve detection rates of bats and very small birds, if necessary. Search intervals should not be split between groups of solar arrays or between seasons.

2. Fatality monitoring should last at least one year, which ought to be extended to three years if a surprisingly large number of birds or bats are found. Surveys should cover all seasons, in order to capture variation due to seasons and multi-annual cycles of abundance or weather conditions.

3. Detection trials should be integrated into routine fatality monitoring, whereby fresh carcasses (very short time between death and when the carcass was placed in a freezer) are marked discreetly and placed at random locations within the fatality search areas and at random times within periodic time intervals such as weekly. Carcasses should be placed at a rate that does not exceed new fatality finds by the searchers. The fatality searchers should be blind to the trial to the degree possible. All trial and found carcasses should be left in the field so as not to disrupt the ecology of scavenging in the project area, and so that missed trial carcasses can potentially be found during later searches. Detection rates should be combined, rather than treated separately for searcher detection error and scavenger removal. The proportion of carcasses found should be the metric used to adjust fatality rates, and should not involve mean days to carcass removal.

For its simplicity and freedom from bias when the detection trial is implemented properly, I recommend the Horvitz and Thompson (1952) estimator:

$$F_A = \frac{F_U}{D},$$

Where F_U is the unadjusted number of fatalities/MW/year (the found carcasses), D is the proportion of placed carcasses that is detected by searchers performing standard searches, and F_A is the fatality rate adjusted for the proportion of carcasses found amongst those that were available to be found fatality throughout a given monitoring period. I calculate the standard error of the adjusted fatality rate, $SE[F_A]$, using the Delta Method:

$$\sqrt{\left(\left(\left(\frac{\mathbf{1}}{\boldsymbol{D}}\right) \times \boldsymbol{SE}(\boldsymbol{F_U})\right)^{\mathbf{2}} + \left(\left(\boldsymbol{F_U} \times \left(\frac{-\mathbf{1}}{\boldsymbol{D}^{\mathbf{2}}}\right)\right) \times \boldsymbol{SE}(\boldsymbol{D})\right)^{\mathbf{2}}\right)}$$

where SE stands for standard error, F_A and F_U are adjusted and unadjusted fatality rates, and D is overall detection rate.

GOLDEN EAGLE TAKE AUTHORIZATION

The number of golden eagles allowed to be taken in 2014 will be 15, but this number could vary from year to year because it will be calculated annually. However, the EIR/EIS did not explain how 15 golden eagles was determined, or whether predicted habitat loss contributed to it. The EIR/EIS needs to clearly explain how take authorization was determined, especially given that the USFWS issued a rule change allowing for take authorization and went through a public review process doing so. The USFWS has provided guidance for predicting impacts. Was the guidance followed?

According to the EIR/EIS, two years of pre-project surveys will inadequately inform of golden eagle numerical trends. However, golden eagle abundance changes over longer periods and the cycles vary from place to place even within an energy resource area (see Figure 5). Two years of use surveys will be inadequate for predicting the take of golden eagles.

A core mitigation element of the golden eagle guidelines issued by the US Fish and Wildlife Service involves monitoring at renewable energy projects as a contribution to research on how best to minimize and reduce impacts to golden eagles. According to the US Fish and Wildlife Service (2013:iv), "*The Service has determined that the best way to obtain the needed scientific information is to work with industry to develop ACPs for wind projects as part of an adaptive-management regime and comprehensive research program tied to the programmatic-take-permit process. In this scenario, ACPs will be implemented at operating wind facilities with an eagle take permit on an "experimental" basis…*" And on page v, "*As the results from monitoring experimental ACPs across a number of facilities accumulate and are analyzed, scientific information in support of certain experimental ACPs may accrue…*" However, this measure is flawed by the monitoring itself and who is performing the monitoring and who is paying for it. The monitors have been consulting firms, whose clients are the energy companies. It has been the energy companies who establish the monitoring protocols, and not the Technical Advisory Committees (TACs), as these protocols are usually established in advance of the first TAC meeting. They are issued with the RFP to consulting firms, who then bid on the monitoring job based on the costs they estimate will be needed to meet the company's protocol. The monitoring protocols often constrain the monitors to the proportion of the facility monitored, the duration of monitoring, the fatality search interval, the search radius, the types and duration of searcher detection and carcass persistence trials, and the type of fatality rate estimator that will be used and whether the persistence adjustment will be based on mean days to carcass removal or the proportion of carcasses remaining. The utilization monitoring protocols established by the energy companies constrain the monitors to the number of observation points, duration of monitoring, the time interval between observation sessions, and whether utilization surveys will be performed after construction. The energy companies can also have a strong influence on the reporting of the monitoring results and discussion. In other words, the monitoring-based research that is anticipated by the USFWS will be heavily influenced by the energy companies and by consulting firms disinclined to upset their clients, unless the EIR/EIS is revised to specifically require that monitoring protocols are developed by qualified TACs.

As explained in my earlier comments, use surveys serve as ineffective predictors of fatality rates at wind projects. Therefore, the plan of the USFWS to rely on utilization and fatality monitoring as a research tool is misguided in its trust in the usefulness of the use surveys.

According to the USFWS (2013:vii), "*The Service recommends collecting information that will allow estimation of the eagle exposure rate (eagle-minutes flying within the project footprint per hour per kilometer^2)...*" However, there is no evidence that minutes of exposure relates to fatality rates. Golden eagles spending 10 hours of every day soaring over valleys will never be killed by wind turbines, whereas eagles spending 30 seconds of each day crossing low over an elevation break in a ridge slope will likely experience fatalities. The behaviors of the birds matter much more than the amount of time they are present in the airspace around a project.

According to the modeling approach used by USFWS (2013:69), the exposure rate was defined as "*eagle-minutes flying below 200 m in height within the project footprint (in proximity to turbine hazards) per hr per km^2.*" However, this exposure rate will be biased in the same ways as described in earlier comments. That is, perceived exposure rates will be functions of the proportion of the surveyed airspace that is actually visible to the observer and of detection rates as a function of distance from the observer. Another bias will be the proportion of the airspace that is surveyed with a terrain background versus an atmosphere background, because detection can be very different between these backgrounds and observation stations will vary greatly in these proportions of survey backgrounds. For example, an observer on flat ground who is surveying for eagles over flat terrain will have sky as the background, whereas an observer on a hill surrounded by other hills and deep valleys will be surveying for eagles against some sky background and a lot of terrain background. It is much more difficult to detect golden eagles against a terrain background. Without adjusting for these biases, exposure rates will vary among projects for reasons that are different than understood by the analyst.

The USFWS assumes that collision risk is proportional to use, and its model distributes use evenly across the study area without accounting for spatial structure. This assumption, however, was a flaw of the model, because spatial structure is critically important to golden eagle flight patterns and collision rates with wind turbines. Not all use of a project's airspace is the same, as the model assumes.

The model also assumes a constant collision rate near 1% for golden eagles that fly within the hazard zone of a wind turbine. However, there has been no adequate empirical foundation for this assumption. The 1% value is simply a guess that was made by an investigator in Europe, and has been copied by others wishing to forecast fatality rates based on collision risk models. Hull and Muir (2013) could not support this collision rate value for Tasmanian wedge-tailed eagles (*Aquila audax fleayi*) and white-bellied sea-eagles (*Haliaeetus leucogaster*), as their data indicated collision rates ranged 3% to 19%. Not only is 1% value the product of a guess, but the definition of collision avoidance remains vague. Does the 1% collision rate apply to eagles passing through the

wind farm, flying past an individual wind turbine, or passing through the rotor plane of an operational wind turbine? Different reports of collision avoidance models have used this value in different contexts.

The USFWS model treats golden eagles as targets flying along set trajectories with random origins. However, golden eagles fly strategically over their habitat, typically performing the same flight behaviors repeatedly over the same aspects of the landscape under the same wind conditions. Golden eagles are also highly reactive to situations they observe on the landscape, including reactions to humans and to opportunities for prey capture. And golden eagle flight behavior is reactive to wind and temperature conditions, which the USFWS model fails to consider.

In summary, I do not recommend using the USFWS collision risk model for predicting eagle take. This said, I could not determine how the EIR/EIS came up with 15 eagles as the authorized take in 2014.

ALTERNATIVES ANALYSIS

The EIR/EIS rejected distributed generation as a viable alternative, and so omitted it from the alternatives analysis. According to the EIR/EIS (page II.8-7), "*...current research indicates that development of both distributed generation and utility-scale renewable energy will be needed to meet California's RPS and climate change goals, along with other energy resources and energy efficiency technologies (NREL 2010; Linvill et al 2011; California Office of the Governor 2012; Zichella and Hladik 2013).*" I reviewed the cited documents to determine whether they supported this conclusion, and I found that they did not.

It is worth noting that Zichella and Hladik are environmentalists, but not energy experts. Neither is the California Office of the Governor an energy expert. Linvill et al. (2011) was prepared by members of an advocacy organization dedicated to promoting renewable energy development.

The conclusions and recommendations in Zichella and Hladik (2013) were opposite the conclusion attributed to them. Zichella and Hladik (2013) argued for "smart from the start," or relying on existing infrastructure to develop new renewable capacity, and not expanding the grid to do so. A map in Zichella and Hladik (2013) identified much of the DRECP area as unsuitable for renewable energy development.

Similarly, Linvill et al. (2011) provided no support for the EIR/EIS conclusion to leave distributed generation out of the alternatives analysis. Linvill et al. (2011) was an unpublished advocacy report comparing "business as usual" to a "clean energy vision." Linvell et al. appeared to promote distributed generation in combination with energy conservation strategies, but also promoted utility-scale renewable energy generation.

NREL (2010) was an information circular that was obviously prepared for the public so that the public can better understand the grid and what types of energy generation

contributes to the grid. I found no support in this circular for the conclusion made by the CEC et al. (2014) to strike distributed generation from the alternatives analysis.

The California Office of the Governor (2012) was a policy argument, and not an analysis. It argued in favor of the Governor's opinion that the DRECP should be viewed as a partner and not as a competitor to distributed generation. This opinion piece was unsuitable as source material for the decision to eliminate distributed generation as an alternative in the EIR/EIS. After all, the Governor of California is not calling the shots on how the EIR/EIS is prepared. Correct?

CEC et al. (2014: II.8-7) continued, "*For a variety of reasons (e.g., upper limits on integrating distributed generation into the electric grid, cost, lack of electricity storage in most systems, and continued dependency of buildings on grid-supplied power), distributed energy generation alone cannot meet the goals for renewable energy development. Ultimately, both utility-scale and distributed generation renewable energy development will need to be deployed at increased levels, and the highest penetration of solar power overall will require a combination of both types (NREL 2010).*" However, as pointed out above, the EIR/EIS lacks support in source documents and therefore does not appear to be founded by evidence or an analysis. These statements appear to be more of an opinion than the type of conclusion that should appear in a CEQA or NEPA document. A reasonable alternative could consist of aggressive development of distributed generation in combination with energy conservation strategies and a reduced utility-scale development scenario.

Under CEQA,[1] "[*A] paramount consideration is the right of the public to be informed in such a way that it can intelligently weigh the environmental consequences of any contemplated action and have an appropriate voice in the formulation of any decision*." The public needs information that is thorough, relevant, unbiased, and honest; the public needs full disclosure of the environmental setting and possible cumulative impacts. Documents presenting information from a biased perspective will tend to include omissions, logical fallacies, internal contradictions, and unfounded responses to substantial issues. These types of problems can be found in the EIR/EIS, beginning with the decision to drop distributed generation as an alternative from the alternatives analysis. The inappropriate and incorrect citation of source material indicates strong bias in favor of utility-scale renewable energy development and against the development of distributed generation and energy conservation strategies. This bias needs to be checked, because as I discussed in my earlier comments, the impacts of developing industrial solar and wind energy projects across so much of the southwestern portion of California will not only be significant, but devastating. On the other hand, there are no known adverse impacts to wildlife caused by distributed generation or energy conservation strategies.

[1] Environmental Planning and Information Council vs. County of El Dorado (1982) 131 Cal. App. 3d 350, 354.

ADDITIONAL COMMENTS

According to the EIR/EIS (11.3-88), compensation ratios for covered birds and bats are to be assessed every 5 years based on surveys and an assessment of "debts" to "gains" from the impacts and previous compensation. However, wildlife populations tend to cycle multi-annually, so assessing debts and gains could be misleading without the help of long-term monitoring. Further, the monitoring would have to include areas anticipated to realize the gains, or areas where mitigation will later be implemented.

Monitoring for assessing the effectiveness of mitigation appeared vague and unrealistic. If monitoring is going to detect both the impacts of projects and the benefits of mitigation, then it will have to be expansive and carefully designed. Use surveys, which have become popular at renewable energy projects, are unsuitable for predicting or explaining fatality rates, as found in peer-reviewed papers and a lot of unpublished research that I've done.

The EIR/EIS proposed the formation of Technical Advisory Committees for individual projects, but its proposed TAC composition was characterized as agency personnel rather than the experts in the field. Most of the expertise on the issues of wildlife impacts at renewable energy facilities are non-agency scientists. TACs should also include experts.

Thank you for your attention,

Shawn Smallwood, Ph.D.

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Curriculum Vitae

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Born May 3, 1963 in Sacramento, California.
Married, father of two.

Ecologist

Expertise

- Finding solutions to controversial problems related to wildlife interactions with human industry, infrastructure, and activities; and,

- Using systems analysis and experimental design principles to identify meaningful ecological patterns that can inform conclusions and management decisions.

Education

Ph.D. Ecology, University of California, Davis. September 1990.
M.S. Ecology, University of California, Davis. June 1987.
B.S. Anthropology, University of California, Davis. June 1985.
Corcoran High School, Corcoran, California. June 1981.

Experience

- 388 professional publications, including:
- 67 peer reviewed publications
- 24 in non-reviewed proceedings
- 288 reports, declarations, and book reviews
- 8 in mass media outlets
- 80 public presentations of research results at meetings
- Reviewed many professional papers and reports
- Testified in 4 court cases.

Guest Editor, *Wildlife Society Bulletin*, 2012-2013. Edited invited papers representing international views on the impacts of wind energy on wildlife and how to mitigate the impacts.

Associate Editor, *Journal of Wildlife Management*, March 2004 to 30 June 2007.

Editorial Board Member, *Environmental Management*, 10/1999 to 8/2004.

Associate Editor, *Biological Conservation*, 9/1994 to 9/1995. Administered independent scientific reviews of submitted, professional papers in ecology and conservation biology, and made recommendations to the Editors.

Member, Alameda County Scientific Review Committee (SRC), 8/06 to 4/11. As part of a five member committee, I investigated the causes of bird and bat collisions in the Altamont Pass Wind Resource Area, and I recommended mitigation and monitoring measures. The SRC reviews the science underlying the Alameda county Avian Protection Program, and advises the County on how to reduce wildlife fatalities.

Research Ecologist, 2/06 to 12/07, under contract to East Bay Regional Parks District. Performed research of how fossorial mammals and raptors responded to grazing treatments and wind turbines at Vasco Caves Regional Preserve. I designed the study, trained the fatality monitors and behavior observers, mapped the burrows of fossorial mammals, analyzed the data, and took the lead on writing the report.

Consulting Ecologist, 7/04 to 12/07, California Energy Commission (CEC). In collaboration with Lawrence-Livermore National Lab, I performed independent research funded by the CEC on bird behavior in the Altamont Pass Wind Resources Area. I also provided consulting services as needed to the CEC. I produced several reports to the CEC and the CEC's Public Interest Energy Research program.

Consulting Ecologist, 11/99 to present, U.S. Navy. I provide endangered species surveys at multiple Navy facilities, hazardous waste site monitoring, and habitat restoration for the endangered Fresno kangaroo rat, California tiger salamander, California red-legged frog, California clapper rail, western burrowing owl, and other species. I have worked at Naval Air Station Lemoore; Naval Weapons Station, Seal Beach, Detachment Concord; Naval Security Group Activity, Skaggs Island; National Radio Transmitter Facility, Dixon.

Part-time Lecturer, 1/98 to 2005, California State University, Sacramento. I taught Contemporary Environmental Issues, Natural Resources Conservation (twice), Mammalogy, Behavioral Ecology, and Ornithology Lab.

Senior Ecologist, 1999 to 2005, BioResource Consultants. I planned and carried out research and monitoring projects, and analyzed complex data related to avian fatalities at wind turbines, avian electrocutions on electric distribution poles across California, and avian fatalities at transmission lines.

Systems Ecologist, 7/96 to present, Consulting in the Public Interest, www.cipi.com. I am part of a multi-disciplinary consortium of scientists facilitating large-scale, environmental planning projects and litigation. We provide risk assessments, assessments of management practices, and expert witness testimony.

Chairman, Conservation Affairs Committee, The Wildlife Society--Western Section, 1999-2001. I prepared position statements and led efforts directed toward conservation issues, including travel to Washington, D.C. to lobby Congress for more wildlife conservation funding.

Systems Ecologist, 1/95 until about 2000, Institute for Sustainable Development. I headed ISD's program on integrated resources management. I developed indicators of ecological integrity for large areas, using remotely sensed data, local community involvement and GIS.

Associate, 1997-1998, Department of Agronomy and Range Science, University of California, Davis. I worked with Shu Geng and Mingua Zhang on several projects related to wildlife interactions with agriculture and patterns of fertilizer and pesticide residues in groundwater across a large landscape.

Lead Scientist, 6/96 to 6/99, National Endangered Species Network. I headed NESN's efforts to inform academic scientists and environmental activists about emerging issues regarding the Endangered Species Act and other environmental laws pertaining to special status species. I also testified at public hearings on behalf of environmental groups and endangered species.

Ecologist, 1/97 to 6/98, Western Foundation of Vertebrate Zoology. I conducted field research to determine the impact of past mercury mining on the status of California red-legged frogs in Santa Clara County, California.

Senior Systems Ecologist, 7/94 to 12/95, EIP Associates, Sacramento, California. Provided consulting services in environmental planning. I also developed a quantitative assessment of land units for their conservation and restoration opportunities, using the ecological resource requirements of 29 special status species. I mapped vegetation and land use, and derived new spatial data from a GIS overlay of these variables with soil types, flood zones, roads, and other spatially referenced data. Using these derived data, I developed a set of indicators for prioritizing areas within Yolo County that will receive mitigation funds for habitat easements and restoration.

Post-Graduate Researcher, 10/90 to 6/94, with Dr. Shu Geng, Department of Agronomy and Range Science, *U.C. Davis*. Studied landscape and management effects on temporal and spatial patterns of abundance among pocket gophers and species of Falconiformes and Carnivora in the Sacramento Valley. I also developed and analyzed a data base of energy use in California agriculture, and I assisted with a landscape (GIS) study of groundwater contamination across Tulare County, California.

Co-teacher, 1/91 to 6/91 and 1/93 to 6/93, Graduate Group in Ecology, U.C. Davis. Co-taught conservation biology with Dr. Christine Schonewald.

Reader, 3/90 to 6/90, Department of Psychology, U.C. Davis. Assisted students of Psychobiology (taught by Dr. Richard Coss) with research and writing term papers.

Research Assistant, 11/88 to 9/90, with Dr. Walter E. Howard, Department of Wildlife and Fisheries Biology, U.C. Davis. Tested durable baits for pocket gopher control in forest plantations, and developed gopher sampling methods.

Fulbright Research Fellow, Indonesia, 7/88 to 11/88. Tested use of new sampling methods for monitoring the number of Sumatran tigers and six other species of endemic felids, and evaluated methods used by other researchers.

Research Assistant, 7/87 to 6/88, with Dr. Terrell P. Salmon, Wildlife Extension, Department of Wildlife and Fisheries Biology, U.C. Davis. Developed empirical models of mammal and bird invasions in North America, and a rating system for priority research and control of exotic species based on economic, environmental, and human health hazards in California.

Student Assistant, 3/85 to 6/87, with Dr. E. Lee Fitzhugh, Wildlife Extension, Department of Wildlife and Fisheries Biology, U.C. Davis. Developed and implemented a statewide mountain lion track count for long-term monitoring of numbers and distribution. I've continued the statewide track count since 1985 (the last count was in 2008). I also developed quantitative methods to identify individual mountain lions by their tracks, and to differentiate mountain lion and dog tracks.

Projects

Test of avian safety of new closed-bladed wind turbine. I designed and implemented a before-after, control-impact experimental design to test the avian safety of a new wind turbine model developed by FloDesign Wind Turbine Corporation. Supported by a $718,000 grant from the California Energy Commission's Public Interest Energy Research program and a 20% match share contribution from FloDesign, I manage a crew of seven field biologists and a GIS analyst who are performing periodic fatality searches and behavior surveys, carcass detection trials, nocturnal behavior surveys using a thermal camera, and spatial analyses. Field work began on 1 April 2012.

Behavior surveys for developing predictive models of avian flight behaviors to carefully site wind turbines in repowering in the Altamont Pass. Funded by NextEra Energy, LLC and East Bay Regional Park District, I manage a crew of five field biologists and a GIS analyst who perform behavior surveys focused on golden eagles and nocturnal surveys on bats and owls. The goal is to quantify flight patterns for development of predictive models to more carefully site new wind turbines in repowering projects. Field work began in May 2012.

Research to reduce avian mortality due to wind turbines at Altamont Pass. I used GPS and GIS to map and study environmental impacts of 5,400 wind turbines. I related the number of raptor fatalities at wind turbines to the degree of aggregation of prey species around the turbines, as well as many other factors related to where the turbines are located, how they are designed and operated, and how raptors behave in the Altamont Pass Wind Resource Area. I also serve on the Alameda County Scientific Review Committee, charged with recommending scientific monitoring methods and mitigation measures for reducing avian mortality.

Research to reduce avian mortality on electric distribution poles. From 2000 through 2007, I directed research toward reducing bird electrocutions on electric distribution poles. I led fatality monitoring efforts at 10,000 poles multiple times in California, spanning Orange County to Glenn County, and I produced two large reports.

Cook *et al*. v. Rockwell International *et al*., No. 90-K-181 (D. Colorado). I provided expert testimony on the role of burrowing animals in affecting the fate of buried and surface-deposited radioactive and hazardous chemical wastes at the Rocky Flats Plant, Colorado. I provided expert reports based on four site visits and the most extensive document review of burrowing animals ever conducted. I conducted transect surveys for evidence of burrowing animals and other wildlife on and around waste facilities. I also discovered substantial intrusion of waste structures by burrowing animals. I testified in federal court in November 2005, and my clients were subsequently awarded a $553,000,000 judgment by a jury.

Hanford Nuclear Reservation Litigation. I provided expert testimony on the role of burrowing animals in affecting the fate of buried radioactive wastes at the Hanford Nuclear Reservation, Washington. I provided three expert reports based on three site visits and extensive document review. I predicted and verified a certain population density of pocket gophers on buried waste structures, as well as incidence of radionuclide contamination in body tissue. I conducted transect surveys for evidence of burrowing animals and other wildlife on and around waste facilities. I also discovered substantial intrusion of waste structures by burrowing animals.

Expert Testimony and Declarations on Residential and Commercial Development Proposals. I have testified before the California Coastal Commission, California Energy Commission, County Boards of Supervisors, and City Councils, and I have participated with press conferences and have been deposed by attorneys. I prepared expert witness reports and court declarations, which are summarized under Reports (below).

Expert Testimony on Proposed Gas-fired Power Plants. I provided comments letters, declarations, expert reports, and oral testimony on the impacts and appropriate mitigation of about eight natural gas-fired power plants in California.

Expert Testimony on Proposed Wind Farms. I provided comment letters and oral testimony to administrative law courts in Klickitat and Skamania Counties, Washington, which convinced the court in Skamania County to require the replacement of a negative declaration with an EIS. I provided written testimony and deposition in support of litigation brought against the development of wind turbines in Cook County, Texas, which resulted in a settlement. I also provided written comments on the first EIR for the Buena Vista Wind Energy Project in Contra County, California, prompting the withdrawal of that EIR and the preparation of an improved EIR which was later certified.

Protocol-level endangered species searches and recovery efforts. I search for special-status species using agency protocols. I also helped with recovery of the Fresno kangaroo rat at Lemoore Naval Air Station.

Conservation of the endangered Fresno kangaroo rat. From 2000 through 2014, I performed applied research to identify the factors responsible for the decline of this endangered species at Lemoore Naval Air Station, and implemented habitat enhancements designed to reverse the trend and to expand the area occupied by this species.

Impact of West Nile Virus on yellow-billed magpies. From 2005 through 2008, I worked under contract to the Sacramento-Yolo Mosquito and Vector Control District to gather post-West Nile Virus epidemic data to pre-epidemic data I had gathered on multiple bird species in the Sacramento Valley in the 1990s, but particularly on yellow-billed magpie and American crow, which are particularly susceptible to WNV.

Workshops on HCPs. Assisted Dr. Michael Morrison with organizing and conducting a 2-day workshop on Habitat Conservation Plans, sponsored by Southern California Edison, and another 1-day workshop sponsored by PG&E. These Workshops were attended by academics, attorneys, and consultants with HCP experience. We guest-edited a Proceedings published in Environmental Management.

Mapping of biological resources along Highways 101, 46 and 41. I used GPS and GIS to delineate vegetation complexes and locations of special-status species along 26 miles of highway in San Luis Obispo County, 14 miles of highway and roadway in Monterey County, and in a large area north of Fresno, including within reclaimed gravel mining pits.

GPS mapping and monitoring at restoration sites and at Caltrans mitigation sites. I monitored the success of translocated elderberry shrubs at one location, the success of willows at another location, and the response of wildlife to the succession of vegetation at both these sits. I am also used GPS to monitor the response of fossorial animals to yellow star-thistle eradication and natural grassland restoration efforts at Bear Valley, Colusa County, and at the decommissioned Mather Air Force Base in Sacramento County.

Mercury effects on Red-legged Frog. I helped assess the possible impacts of historical mercury mining on the federally listed California red-legged frog in Santa Clara County. I also measured habitat variables in numerous streams.

Opposition to proposed No Surprises rule. I wrote a white paper and summary letter explaining scientific grounds for opposing the incidental take permit (ITP) rules providing ITP applicants and holders with general assurances they will be free of compliance with the Endangered Species Act once they adhere to the terms of a "properly functioning HCP." I obtained 188 signatures of scientists and environmental professionals on the letter submitted to the US Fish and Wildlife Service, National Marine Fisheries Service, and US Senate.

Natomas Basin Habitat Conservation Plan alternative. I designed narrow channel marsh to increase the likelihood of survival and recovery in the wild of giant garter snake, Swainson's hawk and Valley Elderberry Longhorn Beetle. The design included replication and interspersion of treatments for experimental testing of critical habitat elements. I provided a report to Northern Territories, Inc.

Assessment of Environmental Technology Transfer to China, and Assessment of Agricultural Production System. I twice traveled to China and interviewed scientists, industrialists, agriculturalists, and the Directors of the Chinese Environmental Protection Agency and the Department of Agriculture to assess the need and possible pathways for environmental clean-

up technologies and trade opportunities between the US and China. I spent a total of five weeks in China, including in Shandong and Linxion Provinces and in Beijing.

Yolo County Habitat Conservation Plan. I performed the landscape ecology study of Yolo County to identify the priority land units to receive mitigation so as to most improve ecosystem functionality from the perspective of 29 special-status species of wildlife and plants. I rated land units using a hierarchically structured indicators approach to apply principles of landscape and ecosystem ecology, conservation biology, and local values. I derived GIS maps to help guide the conservation area design, and then I developed implementation strategies.

Mountain Lion Track Count. After developing it, I implemented the carnivore monitoring program throughout California since 1985. I count tracks of mountain lion, bobcat, black bear, coyote, red and gray fox, raccoon, striped skunk, badger, and black-tailed deer. I also monitor vegetation cover and land use. The transect was established on dusty, dirt roads within randomly selected quadrats.

Sumatran Tiger and other Felids. I designed and conducted track counts for seven species of wild cats in Sumatra, including the Sumatran tiger, fishing cat, and golden cat. I spent four months on Sumatra and Java, and learned Bahasa Indonesia (the official Indonesian language). I was awarded a Fulbright Research Fellowship to complete the project.

Wildlife in Agriculture. Beginning as my post-graduate research, I have studied pocket gophers and other wildlife in 40 alfalfa fields throughout the Sacramento Valley, and I surveyed for wildlife along a 200 mile road transect for six years. The data were analyzed using GIS and methods from landscape ecology, and the results were published and presented orally to farming groups in California and elsewhere. I also conducted the first study of wildlife in cover crops used on vineyards and orchards.

Agricultural Energy Use and Tulare County Groundwater Study. I developed and analyzed a data base of energy use in California agriculture, and collaborated on a landscape (GIS) study of groundwater contamination across Tulare County, California.

Pocket Gopher Damage in Forest Clearcuts. I tested various poison baits and baiting regimes for pocket gopher control in forest plantations, and I developed gopher sampling methods. I conducted the most extensive field study of pocket gophers ever, involving thousands of gophers in 68 research plots on 55 clearcuts among 6 National Forests in northern California.

Risk Assessment of Exotic Species in North America. I developed empirical models of mammal and bird species invasions in North America, as well as a rating system for assigning priority research and control to exotic species in California, based on economic, environmental, and human health hazards.

Representative Clients/Funders

Law offices and environmental groups
Law Offices of Stephan C. Volker
Law Offices of Berger & Montague
Lozeau | Drury LLP
Law Offices of Roy Haber
Law Offices of Edward MacDonald
Law Office of John Gabrielli
Law Office of Bill Kopper
Law Office of Donald B. Mooney
Law Office of Veneruso & Moncharsh
Law Office of Steven Thompson
Law Office of Brian Gaffney
California Wildlife Federation
Defenders of Wildlife
Sierra Club
National Endangered Species Network
Spirit of the Sage Council
The Humane Society
Hagens Berman LLP
Environmental Protection Information Center
Goldberg, Kamin & Garvin, Attorneys at Law
Californians for Renewable Energy (CARE)
Seatuck Environmental Association
Friends of the Columbia Gorge, Inc.
Save Our Scenic Area
Alliance to Protect Nantucket Sound
Friends of the Swainson's Hawk
Alameda Creek Alliance
Center for Biological Diversity
California Native Plant Society
Endangered Wildlife Trust
and BirdLife South Africa
AquAlliance
Oregon Natural Desert Association
Save Our Sound

Businesses
G3 Energy and Pattern Energy
Emerald Farms
Pacific Gas & Electric Co.
Southern California Edison Co.
Georgia-Pacific Timber Co.
Northern Territories Inc.
David Magney Environmental Consulting
Wildlife History Foundation
Comstocks Business (magazine)
FloDesign Wind Turbine
NextEra Energy Resources, LLC
EDF Renewables
Altamont Winds LLC
National Renewable Energy Lab
BioResource Consultants
Tierra Data
Black and Veatch
Terry Preston, Wildlife Ecology Research Center
EcoStat, Inc.

Government agencies
US Navy
US Department of Agriculture
US Forest Service
US Fish & Wildlife Service
California Energy Commission
California Office of the Attorney General
California Department of Fish & Game
California Department of Transportation
California Department of Forestry
California Department of Food & Agriculture
Ventura County Counsel
County of Yolo
Tahoe Regional Planning Agency
Sustainable Agriculture Research & Education Program
Sacramento-Yolo Mosquito and Vector Control District
East Bay Regional Park District
County of Alameda

Other organizations and individuals
Don & LaNelle Silverstien
Seventh Day Adventist Church
Escuela de la Raza Unida
Susan Pelican and Howard Beeman
Residents Against Inconsistent Development, Inc.
Bob Sarvey
Mike Boyd
Hillcroft Neighborhood Fund
Joint Labor Management Committee, Retail Food Industry
Lisa Rocca
Kevin Jackson
Dawn Stover and Jay Letto
Nancy Havassy
Catherine Portman (for Brenda Cedarblade)

Representative special-status species experience

Common name	Species name	Description
Field experience		
California red-legged frog	*Rana aurora draytonii*	Protocol searches; detected at multiple sites
Foothill yellow-legged frog	*Rana boylii*	Research; detections at multiple sites
Western spadefoot	*Spea hammondii*	Searches and search detections
California tiger salamander	*Ambystoma californiense*	Protocol searches; detected at multiple sites
Coast range newt	*Taricha torosa torosa*	Searches and multiple detections
Blunt-nosed leopard lizard	*Gambelia sila*	Detected in San Luis Obispo County
California Horned Lizard	*Phrynosoma coronatum frontale*	Searches; detected in San Luis Obispo Co.
Western pond turtle	*Clemmys marmorata*	Searches; detected at multiple sites
San Joaquin kit fox	*Vulpes macrotis mutica*	Protocol searches; detections
Sumatran tiger	*Panthera tigris*	Research in Sumatra
Mountain lion	*Puma concolor californicus*	Research and publications
Point Arena mountain beaver	*Aplodontia rufa nigra*	Remote camera operation
Giant kangaroo rat	*Dipodomys ingens*	Detected in Cholame Valley
Fresno kangaroo rat	*Dipodomys nitratoides*	Research, conservation at NAS Lemoore
Monterey dusky-footed woodrat	*Neotoma fuscipes luciana*	Non-target captures and mapping of dens
Salt marsh harvest mouse	*Reithrodontomys raviventris*	Habitat assessment, monitoring
Salinas harvest mouse	*Reithrodontomys megalotus distichlus*	Captures in Salinas area; habitat assessment
California clapper rail	*Rallus longirostris*	Surveys at Concord Weapons Station
Golden eagle	*Aquila chrysaetos*	Research in Altamont Pass
Swainson's hawk	*Buteo swainsoni*	Research in Sacramento Valley
Northern harrier	*Circus cyaeneus*	Research and publication
White-tailed kite	*Elanus leucurus*	Research and publication
Loggerhead shrike	*Lanius ludovicianus*	Research in Sacramento Valley
Least Bell's vireo	*Vireo bellii pusillus*	Detected in Monterey County
Willow flycatcher	*Empidonax traillii extimus*	Research at Sierra Nevada breeding sites
Burrowing owl	*Athene cunicularia hypugia*	Research at multiple locations
Valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	Research and publication
Analytical		
Arroyo southwestern toad	*Bufo microscaphus californicus*	Research and report.
Giant garter snake	*Thamnophis gigas*	Research and publication.
Northern goshawk	*Accipiter gentilis*	Research and publication.
Northern spotted owl	*Strix occidentalis*	Research and reports.

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Mete, A., N. Stephenson, K. Rogers, M. G. Hawkins, M. Sadar, D. Guzman, D. A. Bell, J. Shipman, A. Wells, K. S. Smallwood, and J. Foley. 2014. Emergence of Knemidocoptic mange in wild Golden Eagles (Aquila chrysaetos) in California. Emerging Infectious Diseases: Accepted

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Brown, K., K. S. Smallwood, and B. Karas. 2013. Final 2012-2013 Annual Report Avian and Bat Monitoring Project Vasco Winds, LLC. Prepared for NextEra Energy Resources, Livermore, California. http://www.altamontsrc.org/alt_doc/p274_ventus_vasco_winds_2012_13_avian_bat_monitoring_report_year_1.pdf

Smallwood, K. S., L. Neher, D. Bell, J. DiDonato, B. Karas, S. Snyder, and S. Lopez. 2009. Range Management Practices to Reduce Wind Turbine Impacts on Burrowing Owls and Other Raptors in the Altamont Pass Wind Resource Area, California. Final Report to the California Energy Commission, Public Interest Energy Research – Environmental Area, Contract No. CEC-500-2008-080. Sacramento, California. 183 pp. http://www.energy.ca.gov/ 2008publications/CEC-500-2008-080/CEC-500-2008-080.PDF

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Comments on Environmental Documents

I was retained or commissioned to comment on environmental planning and review documents, including:

- Declaration on Tule Wind project FEIR/FEIS (2013; 24 pp);
- Sunrise Partners LANDPRO Solar Project Mitigated Negative Declaration (2013; 11 pp);
- Declaration in opposition to BLM fracking (2013; 5 pp);
- Rosamond Solar Project Addendum EIR (2013; 13 pp);
- Pioneer Green Solar Project EIR (2013; 13 pp);
- Reply to Staff Responses to Comments on Soccer Center Solar Project Mitigated Negative Declaration (2013; 6 pp);
- Soccer Center Solar Project Mitigated Negative Declaration (2013; 10 pp);
- Plainview Solar Works Mitigated Negative Declaration (2013; 10 pp);
- Reply to the County Staff's Responses on comments to Imperial Valley Solar Company 2 Project (2013; 10 pp);

- Imperial Valley Solar Company 2 Project (2013; 13 pp);
- FRV Orion Solar Project DEIR (PP12232) (2013; 9 pp);
- Casa Diablo IV Geothermal Development Project (3013; 6 pp);
- Reply to Staff Responses to Comments on Casa Diablo IV Geothermal Development Project (2013; 8 pp);
- FEIS prepared for Alta East Wind Project (2013; 23 pp);
- Metropolitan Air Park DEIR, City of San Diego (2013;);
- Davidon Homes Tentative Subdivision Map and Rezoning Project DEIR (2013; 9 pp);
- Analysis of Biological Assessment of Oakland Zoo Expansion Impacts on Alameda Whipsnake (2013; 10 pp);
- Declaration on Campo Verde Solar project FEIR (2013; 11pp);
- Declaration on North Steens Transmission Line FEIS (2012; 62 pp);
- City of Lancaster Revised Initial Study for Conditional Use Permits 12-08 and 12-09, Summer Solar and Springtime Solar Projects (2012; 8 pp);
- J&J Ranch, 24 Adobe Lane Environmental Review (2012; 14 pp);
- Reply to the County Staff's Responses on comments to Hudson Ranch Power II Geothermal Project and the Simbol Calipatria Plant II (2012; 8 pp);
- Hudson Ranch Power II Geothermal Project and the Simbol Calipatria Plant II (2012; 9 pp);
- Desert Harvest Solar Project EIS (2012; 15 pp);
- Solar Gen 2 Array Project DEIR (2012; 16 pp);
- Ocotillo Sol Project EIS (2012; 4 pp);
- Beacon Photovoltaic Project DEIR (2012; 5 pp);
- Declaration on Initial Study and Proposed Negative Declaration for the Butte Water District 2012 Water Transfer Program (2012; 11 pp);
- Mount Signal and Calexico Solar Farm Projects DEIR (2011; 16 pp);
- City of Elk Grove Sphere of Influence EIR (2011; 28 pp);
- Comment on Sutter Landing Park Solar Photovoltaic Project MND (2011; 9 pp);
- Statement of Shawn Smallwood, Ph.D. Regarding Proposed Rabik/Gudath Project, 22611 Coleman Valley Road, Bodega Bay (CPN 10-0002) (2011; 4 pp);
- Declaration of K. Shawn Smallwood on Biological Impacts of the Ivanpah Solar Electric Generating System (ISEGS) (2011; 9 pp);
- Comments on Draft Eagle Conservation Plan Guidance (2011; 13 pp);
- Comments on Draft EIR/EA for Niles Canyon Safety Improvement Project (2011; 16 pp);
- Declaration of K. Shawn Smallwood, Ph.D., on Biological Impacts of the Route 84 Safety Improvement Project (2011; 7 pp);
- Rebuttal Testimony of Witness #22, K. Shawn Smallwood, Ph.D, on Behalf of Intervenors Friends of The Columbia Gorge and Save Our Scenic Area (2010; 6 pp);
- Prefiled Direct Testimony of Witness #22, K. Shawn Smallwood, Ph.D, on Behalf of Intervenors Friends of the Columbia Gorge and Save Our Scenic Area. Comments on Whistling Ridge Wind Energy Power Project DEIS, Skamania County, Washington (2010; 41 pp);

- Evaluation of Klickitat County's Decisions on the Windy Flats West Wind Energy Project (2010; 17 pp);
- St. John's Church Project Draft Environmental Impact Report (2010; 14 pp.);
- Initial Study/Mitigated Negative Declaration for Results Radio Zone File #2009-001 (2010; 20 pp);
- Rio del Oro Specific Plan Project Final Environmental Impact Report (2010;12 pp);
- Answers to Questions on 33% RPS Implementation Analysis Preliminary Results Report (2009: 9 pp);
- SEPA Determination of Non-significance regarding zoning adjustments for Skamania County, Washington. Second Declaration to Friends of the Columbia Gorge, Inc. and Save Our Scenic Area (Dec 2008; 17 pp);
- Comments on Draft 1A Summary Report to CAISO (2008; 10 pp);
- Categorical Exemption of Hilton Manor Project, as determined by County of Placer (2009; 9 pp);
- Protest of CARE to Amendment to the Power Purchase and Sale Agreement for Procurement of Eligible Renewable Energy Resources Between Hatchet Ridge Wind LLC and PG&E (2009; 3 pp);
- Tehachapi Renewable Transmission Project EIR/EIS (2009; 142 pp);
- Delta Shores Project EIR, south Sacramento (2009; 11 pp + addendum 2 pp);
- Declaration of Shawn Smallwood in Support of Care's Petition to Modify D.07-09-040 (2008; 3 pp);
- The Public Utility Commission's Implementation Analysis December 16 Workshop for the Governor's Executive Order S-14-08 to implement a 33% Renewable Portfolio Standard by 2020 (2008; 9 pp);
- The Public Utility Commission's Implementation Analysis Draft Work Plan for the Governor's Executive Order S-14-08 to implement a 33% Renewable Portfolio Standard by 2020 (2008; 11 pp);
- Draft 1A Summary Report to California Independent System Operator for Planning Reserve Margins (PRM) Study (2008; 7 pp.);
- SEPA Determination of Non-significance regarding zoning adjustments for Skamania County, Washington. Declaration to Friends of the Columbia Gorge, Inc. and Save Our Scenic Area (Sep 2008; 16 pp);
- California Energy Commission's Preliminary Staff Assessment of the Colusa Generating Station (2007; 24 pp);
- Rio del Oro Specific Plan Project Recirculated Draft Environmental Impact Report (2008: 66 pp);
- Replies to Response to Comments Re: Regional University Specific Plan Environmental Impact Report (2008; 20 pp);
- Regional University Specific Plan Environmental Impact Report (2008: 33 pp.);
- Clark Precast, LLC's "Sugarland" project, Negative Declaration (2008: 15 pp.);
- Cape Wind Project Draft Environmental Impact Statement (2008; 157 pp.);
- Yuba Highlands Specific Plan (or Area Plan) Environmental Impact Report (2006; 37 pp.);
- Replies to responses to comments on Mitigated Negative Declaration of the proposed

Mining Permit (MIN 04-01) and Modification of Use Permit 96-02 at North Table Mountain (2006; 5 pp);

- Mitigated Negative Declaration of the proposed Mining Permit (MIN 04-01) and Modification of Use Permit 96-02 at North Table Mountain (2006; 15 pp);
- Windy Point Wind Farm Environmental Review and EIS (2006; 14 pp and 36 Powerpoint slides in reply to responses to comments);
- Shiloh I Wind Power Project EIR (2005; 18 pp);
- Buena Vista Wind Energy Project Notice of Preparation of EIR (2004; 15 pp);
- Negative Declaration of the proposed Callahan Estates Subdivision (2004; 11 pp);
- Negative Declaration of the proposed Winters Highlands Subdivision (2004; 9 pp);
- Negative Declaration of the proposed Winters Highlands Subdivision (2004; 13 pp);
- Negative Declaration of the proposed Creekside Highlands Project, Tract 7270 (2004; 21 pp);
- On the petition California Fish and Game Commission to list the Burrowing Owl as threatened or endangered (2003; 10 pp);
- Conditional Use Permit renewals from Alameda County for wind turbine operations in the Altamont Pass Wind Resource Area (2003; 41 pp);
- UC Davis Long Range Development Plan of 2003, particularly with regard to the Neighborhood Master Plan (2003; 23 pp);
- Anderson Marketplace Draft Environmental Impact Report (2003: 18 pp + 3 plates of photos);
- Negative Declaration of the proposed expansion of Temple B'nai Tikyah (2003: 6 pp);
- Antonio Mountain Ranch Specific Plan Public Draft EIR (2002: 23 pp);
- Response to testimony of experts at the East Altamont Energy Center evidentiary hearing on biological resources (2002: 9 pp);
- Revised Draft Environmental Impact Report, The Promenade (2002: 7 pp);
- Recirculated Initial Study for Calpine's proposed Pajaro Valley Energy Center (2002: 3 pp);
- UC Merced -- Declaration of Dr. Shawn Smallwood in support of petitioner's application for temporary restraining order and preliminary injunction (2002: 5 pp);
- Replies to response to comments in Final Environmental Impact Report, Atwood Ranch Unit III Subdivision (2003: 22 pp);
- Draft Environmental Impact Report, Atwood Ranch Unit III Subdivision (2002: 19 pp + 8 photos on 4 plates);
- California Energy Commission Staff Report on GWF Tracy Peaker Project (2002: 17 pp + 3 photos; follow-up report of 3 pp);
- Initial Study and Negative Declaration, Silver Bend Apartments, Placer County (2002: 13 pp);
- UC Merced Long-range Development Plan DEIR and UC Merced Community Plan DEIR (2001: 26 pp);
- Initial Study, Colusa County Power Plant (2001: 6 pp);
- Comments on Proposed Dog Park at Catlin Park, Folsom, California (2001: 5 pp + 4 photos);
- Pacific Lumber Co. (Headwaters) Habitat Conservation Plan and Environmental Impact

Report (1998: 28 pp);

- Final Environmental Impact Report/Statement for Issuance of Take authorization for listed species within the MSCP planning area in San Diego County, California (Fed. Reg. 62 (60): 14938, San Diego Multi-Species Conservation Program) (1997: 10 pp);
- Permit (PRT-823773) Amendment for the Natomas Basin Habitat Conservation Plan, Sacramento, CA (Fed. Reg. 63 (101): 29020-29021) (1998);
- Draft Recovery Plan for the Giant Garter Snake (*Thamnophis gigas*). (Fed. Reg. 64(176): 49497-49498) (1999: 8 pp);
- Review of the Draft Recovery Plan for the Arroyo Southwestern Toad (*Bufo microscaphus californicus*) (1998);
- Ballona West Bluffs Project Environmental Impact Report (1999: oral presentation);
- California Board of Forestry's proposed amended Forest Practices Rules (1999);
- Negative Declaration for the Sunset Skyranch Airport Use Permit (1999);
- Calpine and Bechtel Corporations' Biological Resources Implementation and Monitoring Program (BRMIMP) for the Metcalf Energy Center (2000: 10 pp);
- California Energy Commission's Final Staff Assessment of the proposed Metcalf Energy Center (2000);
- US Fish and Wildlife Service Section 7 consultation with the California Energy Commission regarding Calpine and Bechtel Corporations' Metcalf Energy Center (2000: 4 pp);
- California Energy Commission's Preliminary Staff Assessment of the proposed Metcalf Energy Center (2000: 11 pp);
- Site-specific management plans for the Natomas Basin Conservancy's mitigation lands, prepared by Wildlands, Inc. (2000: 7 pp);
- Affidavit of K. Shawn Smallwood in Spirit of the Sage Council, et al. (Plaintiffs) vs. Bruce Babbitt, Secretary, U.S. Department of the Interior, et al. (Defendants), Injuries caused by the No Surprises policy and final rule which codifies that policy (1999: 9 pp).

I also issued formal comments on the following documents:

- Draft Program Level EIR for Covell Village (2005; 19 pp);
- Bureau of Land Management Wind Energy Programmatic EIS Scoping document (2003: 7 pp.);
- NEPA Environmental Analysis for Biosafety Level 4 National Biocontainment Laboratory (NBL) at UC Davis (2003: 7 pp);
- Notice of Preparation of UC Merced Community and Area Plan EIR, on behalf of The Wildlife Society—Western Section (2001: 8 pp.);
- Preliminary Draft Yolo County Habitat Conservation Plan (2001; 2 letters totaling 35 pp.);
- Merced County General Plan Revision, notice of Negative Declaration (2001: 2 pp.);
- Notice of Preparation of Campus Parkway EIR/EIS (2001: 7 pp.);
- Draft Recovery Plan for the bighorn sheep in the Peninsular Range (*Ovis candensis*) (2000);
- Draft Recovery Plan for the California Red-legged Frog (*Rana aurora draytonii*), on

behalf of The Wildlife Society—Western Section (2000: 10 pp.);

- Sierra Nevada Forest Plan Amendment Draft Environmental Impact Statement, on behalf of The Wildlife Society—Western Section (2000: 7 pp.);
- State Water Project Supplemental Water Purchase Program, Draft Program EIR (1997);
- Davis General Plan Update EIR (2000);
- Turn of the Century EIR (1999: 10 pp);
- Proposed termination of Critical Habitat Designation under the Endangered Species Act (Fed. Reg. 64(113): 31871-31874) (1999);
- NOA Draft Addendum to the Final Handbook for Habitat Conservation Planning and Incidental Take Permitting Process, termed the HCP 5-Point Policy Plan (Fed. Reg. 64(45): 11485 - 11490) (1999; 2 pp + attachments);
- Covell Center Project EIR and EIR Supplement (1997).

Position Statements I prepared the following position statements for the Western Section of The Wildlife Society, and one for nearly 200 scientists:

- Recommended that the California Department of Fish and Game prioritize the extermination of the introduced southern water snake in northern California. The Wildlife Society--Western Section (2001);
- Recommended that The Wildlife Society—Western Section appoint or recommend members of the independent scientific review panel for the UC Merced environmental review process (2001);
- Opposed the siting of the University of California's 10th campus on a sensitive vernal pool/grassland complex east of Merced. The Wildlife Society--Western Section (2000);
- Opposed the legalization of ferret ownership in California. The Wildlife Society--Western Section (2000);
- Opposed the Proposed "No Surprises," "Safe Harbor," and "Candidate Conservation Agreement" rules, including permit-shield protection provisions (Fed. Reg. Vol. 62, No. 103, pp. 29091-29098 and No. 113, pp. 32189-32194). This statement was signed by 188 scientists and went to the responsible federal agencies, as well as to the U.S. Senate and House of Representatives.

Printed Mass Media

Smallwood, K.S., D. Mooney, and M. McGuinness. 2003. We must stop the UCD biolab now. Op-Ed to the Davis Enterprise.

Smallwood, K.S. 2002. Spring Lake threatens Davis. Op-Ed to the Davis Enterprise.

Smallwood, K.S. Summer, 2001. Mitigation of habitation. The Flatlander, Davis, California.

Entrikan, R.K. and K.S. Smallwood. 2000. Measure O: Flawed law would lock in new taxes. Op-Ed to the Davis Enterprise.

Smallwood, K.S. 2000. Davis delegation lobbies Congress for Wildlife conservation. Op-Ed to the Davis Enterprise.

Smallwood, K.S. 1998. Davis Visions. The Flatlander, Davis, California.

Smallwood, K.S. 1997. Last grab for Yolo's land and water. The Flatlander, Davis, California.

Smallwood, K.S. 1997. The Yolo County HCP. Op-Ed to the Davis Enterprise.

Radio/Television

FOX News, Energy in America: Dead Birds Unintended Consequence of Wind Power Development, August 2011.

KXJZ Capital Public Radio -- Insight (Host Jeffrey Callison). Mountain lion attacks (with guest Professor Richard Coss). 23 April 2009;

KXJZ Capital Public Radio -- Insight (Host Jeffrey Callison). Wind farm Rio Vista Renewable Power. 4 September 2008;

KQED QUEST Episode #111. Bird collisions with wind turbines. 2007;

KDVS Speaking in Tongues (host Ron Glick), Yolo County HCP: 1 hour. December 27, 2001;

KDVS Speaking in Tongues (host Ron Glick), Yolo County HCP: 1 hour. May 3, 2001;

KDVS Speaking in Tongues (host Ron Glick), Yolo County HCP: 1 hour. February 8, 2001;

KDVS Speaking in Tongues (host Ron Glick & Shawn Smallwood), California Energy Crisis: 1 hour. Jan. 25, 2001;

KDVS Speaking in Tongues (host Ron Glick), Headwaters Forest HCP: 1 hour. 1998;

Davis Cable Channel (host Gerald Heffernon), Burrowing owls in Davis: half hour. June, 2000;

Davis Cable Channel (hosted by Davis League of Women Voters), Measure O debate: 1 hour. October, 2000;

KXTV 10, In Your Interest, The Endangered Species Act: half hour. 1997.

Posters at Professional Meetings

Smallwood, K. S. and C. G. Thelander. 2005. Lessons learned from five years of avian mortality research in the Altamont Pass WRA. AWEA conference, Denver, May 2005.

Neher, L., L. Wilder, J. Woo, L. Spiegel, D. Yen-Nakafugi, and K.S. Smallwood. 2005. Bird's eye view on California wind. AWEA conference, Denver, May 2005.

Smallwood, K. S., C. G. Thelander and L. Spiegel. 2003. Toward a predictive model of avian fatalities in the Altamont Pass Wind Resource Area. Windpower 2003 Conference and Convention, Austin, Texas.

Smallwood, K.S. and Eva Butler. 2002. Pocket Gopher Response to Yellow Star-thistle Eradication as part of Grassland Restoration at Decommissioned Mather Air Force Base, Sacramento County, California. White Mountain Research Station Open House, Barcroft Station.

Smallwood, K.S. and Michael L. Morrison. 2002. Fresno kangaroo rat (*Dipodomys nitratoides*) Conservation Research at Resources Management Area 5, Lemoore Naval Air Station. White Mountain Research Station Open House, Barcroft Station.

Smallwood, K.S. and E.L. Fitzhugh. 1989. Differentiating mountain lion and dog tracks. Third Mountain Lion Workshop, Prescott, AZ.

Smith, T. R. and K. S. Smallwood. 2000. Effects of study area size, location, season, and allometry on reported *Sorex* shrew densities. Annual Meeting of the Western Section of The Wildlife Society.

Presentations at Professional Meetings and Seminars

Siting wind turbines to minimize raptor collisions: Altamont Pass Wind Resource Area. US Fish and Wildlife Service Golden Eagle Working Group, Sacramento, California, 8 January 2015.

Evaluation of nest boxes as a burrowing owl conservation strategy. Sacramento Chapter of the Western Section, The Wildlife Society. Sacramento, California, 26 August 2013.

Predicting collision hazard zones to guide repowering of the Altamont Pass. Conference on wind power and environmental impacts. Stockholm, Sweden, 5-7 February 2013.

Impacts of Wind Turbines on Wildlife. California Council for Wildlife Rehabilitators, Yosemite, California, 12 November 2012.

Impacts of Wind Turbines on Birds and Bats. Madrone Audubon Society, Santa Rosa, California, 20 February 2012.

Comparing Wind Turbine Impacts across North America. California Energy Commission Staff Workshop: Reducing the Impacts of Energy Infrastructure on Wildlife, 20 July 2011.

Siting Repowered Wind Turbines to Minimize Raptor Collisions. California Energy Commission Staff Workshop: Reducing the Impacts of Energy Infrastructure on Wildlife, 20 July 2011.

Siting Repowered Wind Turbines to Minimize Raptor Collisions. Alameda County Scientific Review Committee meeting, 17 February 2011

Comparing Wind Turbine Impacts across North America. Conference on Wind energy and Wildlife impacts, Trondheim, Norway, 3 May 2011.

Update on Wildlife Impacts in the Altamont Pass Wind Resource Area. Raptor Symposium, The Wildlife Society—Western Section, Riverside, California, February 2011.

Siting Repowered Wind Turbines to Minimize Raptor Collisions. Raptor Symposium, The Wildlife Society—Western Section, Riverside, California, February 2011.

Wildlife mortality caused by wind turbine collisions. Ecological Society of America, Pittsburgh, Pennsylvania, 6 August 2010.

Map-based repowering and reorganization of a wind farm to minimize burrowing owl fatalities. California burrowing Owl Consortium Meeting, Livermore, California, 6 February 2010.

Environmental barriers to wind power. Getting Real About Renewables: Economic and Environmental Barriers to Biofuels and Wind Energy. A symposium sponsored by the Environmental & Energy Law & Policy Journal, University of Houston Law Center, Houston, 23 February 2007.

Lessons learned about bird collisions with wind turbines in the Altamont Pass and other US wind farms. Meeting with Japan Ministry of the Environment and Japan Ministry of the Economy, Wild Bird Society of Japan, and other NGOs Tokyo, Japan, 9 November 2006.

Lessons learned about bird collisions with wind turbines in the Altamont Pass and other US wind farms. Symposium on bird collisions with wind turbines. Wild Bird Society of Japan, Tokyo, Japan, 4 November 2006.

Responses of Fresno kangaroo rats to habitat improvements in an adaptive management framework. California Society for Ecological Restoration (SERCAL) 13th Annual Conference, UC Santa Barbara, 27 October 2006.

Fatality associations as the basis for predictive models of fatalities in the Altamont Pass Wind Resource Area. EEI/APLIC/PIER Workshop, 2006 Biologist Task Force and Avian Interaction with Electric Facilities Meeting, Pleasanton, California, 28 April 2006.

Burrowing owl burrows and wind turbine collisions in the Altamont Pass Wind Resource Area. The Wildlife Society—Western Section Annual Meeting, Sacramento, California, February 8, 2006.

Mitigation at wind farms. Workshop: Understanding and resolving bird and bat impacts. American Wind Energy Association and Audubon Society. Los Angeles, CA. January 10 and 11, 2006.

Incorporating data from the California Wildlife Habitat Relationships (CWHR) system into an impact assessment tool for birds near wind farms. Shawn Smallwood, Kevin Hunting, Marcus Yee, Linda Spiegel, Monica Parisi. Workshop: Understanding and resolving bird and bat impacts. American Wind Energy Association and Audubon Society. Los Angeles, CA. January 10 and 11, 2006.

Toward indicating threats to birds by California's new wind farms. California Energy Commission, Sacramento, May 26, 2005.

Avian collisions in the Altamont Pass. California Energy Commission, Sacramento, May 26, 2005.

Ecological solutions for avian collisions with wind turbines in the Altamont Pass Wind Resource Area. EPRI Environmental Sector Council, Monterey, California, February 17, 2005.

Ecological solutions for avian collisions with wind turbines in the Altamont Pass Wind Resource Area. The Wildlife Society—Western Section Annual Meeting, Sacramento, California, January 19, 2005.

Associations between avian fatalities and attributes of electric distribution poles in California. The Wildlife Society—Western Section Annual Meeting, Sacramento, California, January 19, 2005.

Minimizing avian mortality in the Altamont Pass Wind Resources Area. UC Davis Wind Energy Collaborative Forum, Palm Springs, California, December 14, 2004.

Selecting electric distribution poles for priority retrofitting to reduce raptor mortality. Raptor Research Foundation Meeting, Bakersfield, California, November 10, 2004.

Responses of Fresno kangaroo rats to habitat improvements in an adaptive management framework. Annual Meeting of the Society for Ecological Restoration, South Lake Tahoe, California, October 16, 2004.

Lessons learned from five years of avian mortality research at the Altamont Pass Wind Resources Area in California. The Wildlife Society Annual Meeting, Calgary, Canada, September 2004.

The ecology and impacts of power generation at Altamont Pass. Sacramento Petroleum Association, Sacramento, California, August 18, 2004.

Burrowing owl mortality in the Altamont Pass Wind Resource Area. California Burrowing Owl Consortium meeting, Hayward, California, February 7, 2004.

Burrowing owl mortality in the Altamont Pass Wind Resource Area. California Burrowing Owl Symposium, Sacramento, November 2, 2003.

Raptor Mortality at the Altamont Pass Wind Resource Area. National Wind Coordinating Committee, Washington, D.C., November 17, 2003.

Raptor Behavior at the Altamont Pass Wind Resource Area. Annual Meeting of the Raptor Research Foundation, Anchorage, Alaska, September, 2003.

Raptor Mortality at the Altamont Pass Wind Resource Area. Annual Meeting of the Raptor Research Foundation, Anchorage, Alaska, September, 2003.

California mountain lions. Ecological & Environmental Issues Seminar, Department of Biology, California State University, Sacramento, November, 2000.

Intra- and inter-turbine string comparison of fatalities to animal burrow densities at Altamont Pass. National Wind Coordinating Committee, Carmel, California, May, 2000.

Using a Geographic Positioning System (GPS) to map wildlife and habitat. Annual Meeting of the Western Section of The Wildlife Society, Riverside, CA, January, 2000.

Suggested standards for science applied to conservation issues. Annual Meeting of the Western Section of The Wildlife Society, Riverside, CA, January, 2000.

The indicators framework applied to ecological restoration in Yolo County, California. Society for Ecological Restoration, September 25, 1999.

Ecological restoration in the context of animal social units and their habitat areas. Society for Ecological Restoration, September 24, 1999.

Relating Indicators of Ecological Health and Integrity to Assess Risks to Sustainable Agriculture and Native Biota. International Conference on Ecosystem Health, August 16, 1999.

A crosswalk from the Endangered Species Act to the HCP Handbook and real HCPs. Southern California Edison, Co. and California Energy Commission, March 4-5, 1999.

Mountain lion track counts in California: Implications for Management. Ecological & Environmental Issues Seminar, Department of Biological Sciences, California State University, Sacramento, November 4, 1998.

"No Surprises" -- Lack of science in the HCP process. California Native Plant Society Annual Conservation Conference, The Presidio, San Francisco, September 7, 1997.

In Your Interest. A half hour weekly show aired on Channel 10 Television, Sacramento. In this episode, I served on a panel of experts discussing problems with the implementation of the Endangered Species Act. Aired August 31, 1997.

Spatial scaling of pocket gopher (*Geomyidae*) density. Southwestern Association of Naturalists 44th Meeting, Fayetteville, Arkansas, April 10, 1997.

Estimating prairie dog and pocket gopher burrow volume. Southwestern Association of Naturalists 44th Meeting, Fayetteville, Arkansas, April 10, 1997.

Ten years of mountain lion track survey. Fifth Mountain Lion Workshop, San Diego, February 27, 1996.

Study and interpretive design effects on mountain lion density estimates. Fifth Mountain Lion Workshop, San Diego, February 27, 1996.

Small animal control. Session moderator and speaker at the California Farm Conference, Sacramento, California, Feb. 28, 1995.

Small animal control. Ecological Farming Conference, Asylomar, California, Jan. 28, 1995.

Habitat associations of the Swainson's Hawk in the Sacramento Valley's agricultural landscape. 1994 Raptor Research Foundation Meeting, Flagstaff, Arizona.

Alfalfa as wildlife habitat. Seed Industry Conference, Woodland, California, May 4, 1994.

Habitats and vertebrate pests: impacts and management. Managing Farmland to Bring Back Game Birds and Wildlife to the Central Valley. Yolo County Resource Conservation District, U.C. Davis, February 19, 1994.

Management of gophers and alfalfa as wildlife habitat. Orland Alfalfa Production Meeting and Sacramento Valley Alfalfa Production Meeting, February 1 and 2, 1994.

Patterns of wildlife movement in a farming landscape. Wildlife and Fisheries Biology Seminar Series: Recent Advances in Wildlife, Fish, and Conservation Biology, U.C. Davis, Dec. 6, 1993.

Alfalfa as wildlife habitat. California Alfalfa Symposium, Fresno, California, Dec. 9, 1993.

Management of pocket gophers in Sacramento Valley alfalfa. California Alfalfa Symposium, Fresno, California, Dec. 8, 1993.

Association analysis of raptors in a farming landscape. Plenary speaker at Raptor Research Foundation Meeting, Charlotte, North Carolina, Nov. 6, 1993.

Landscape strategies for biological control and IPM. Plenary speaker, International Conference on Integrated Resource Management and Sustainable Agriculture, Beijing, China, Sept. 11, 1993.

Landscape Ecology Study of Pocket Gophers in Alfalfa. Alfalfa Field Day, U.C. Davis, July 1993.

Patterns of wildlife movement in a farming landscape. Spatial Data Analysis Colloquium, U.C. Davis, August 6, 1993.

Sound stewardship of wildlife. Veterinary Medicine Seminar: Ethics of Animal Use, U.C. Davis. May 1993.

Landscape ecology study of pocket gophers in alfalfa. Five County Grower's Meeting, Tracy, California. February 1993.

Turbulence and the community organizers: The role of invading species in ordering a turbulent system, and the factors for invasion success. Ecology Graduate Student Association Colloquium, U.C. Davis. May 1990.

Evaluation of exotic vertebrate pests. Fourteenth Vertebrate Pest Conference, Sacramento, California. March 1990.

Analytical methods for predicting success of mammal introductions to North America. The Western Section of the Wildlife Society, Hilo, Hawaii. February 1988.

A state-wide mountain lion track survey. Sacramento County Dept Parks and Recreation. April 1986.

The mountain lion in California. Davis Chapter of the Audubon Society. October 1985.

Ecology Graduate Student Seminars, U.C. Davis, 1985-1990: Social behavior of the mountain lion; Mountain lion control; Political status of the mountain lion in California.

Other forms of Participation at Professional Meetings

- Scientific Committee, Conference on Wind energy and Wildlife impacts, Stockholm, Sweden, February 2013.

- Workshop co-presenter at Birds & Wind Energy Specialist Group (BAWESG) Information sharing week, Bird specialist studies for proposed wind energy facilities in South Africa, Endangered Wildlife Trust, Darling, South Africa, 3-7 October 2011.

- Scientific Committee, Conference on Wind energy and Wildlife impacts, Trondheim, Norway, 2-5 May 2011.

- Chair of Animal Damage Management Session, The Wildlife Society, Annual Meeting, Reno, Nevada, September 26, 2001.

- Chair of Technical Session: Human communities and ecosystem health: Comparing perspectives and making connection. Managing for Ecosystem Health, International Congress on Ecosystem Health, Sacramento, CA August 15-20, 1999.

- Student Awards Committee, Annual Meeting of the Western Section of The Wildlife Society, Riverside, CA, January, 2000.

- Student Mentor, Annual Meeting of the Western Section of The Wildlife Society, Riverside, CA, January, 2000.

Reviews of Journal Papers (Scientific journals for whom I've provided peer review)

Journal	**Journal**
American Naturalist	Journal of Animal Ecology
Journal of Wildlife Management	Western North American Naturalist
Auk	Journal of Raptor Research
Biological Conservation	National Renewable Energy Lab reports
Canadian Journal of Zoology	Oikos
Ecosystem Health	The Prairie Naturalist
Environmental Conservation	Restoration Ecology
Environmental Management	Southwestern Naturalist
Functional Ecology	The Wildlife Society--Western Section Trans.
Journal of Zoology (London)	Proc. Int. Congress on Managing for Ecosystem Health
Journal of Applied Ecology	Transactions in GIS
Ecology	Tropical Ecology
Biological Control	The Condor

Committees

- Scientific Review Committee, Alameda County, Altamont Pass Wind Resource Area
- Ph.D. Thesis Committee, Steve Anderson, University of California, Davis
- MS Thesis Committee, Marcus Yee, California State University, Sacramento

Other Professional Activities or Products

Testified in Federal Court in Denver during 2005 over the fate of radio-nuclides in the soil at Rocky Flats Plant after exposure to burrowing animals. My clients won a judgment of $553,000,000. I have also testified in many other cases of litigation under CEQA, NEPA, the Warren-Alquist Act, and other environmental laws. My clients won most of the cases for which I testified.

Testified in Skamania County Hearing in 2009 on the potential impacts of zoning the County for development of wind farms and hazardous waste facilities.

Testified in deposition in 2007 in the case of O'Dell et al. vs. FPL Energy in Houston, Texas.

Testified in Klickitat County Hearing in 2006 on the potential impacts of the Windy Point Wind Farm.

Memberships in Professional Societies

The Wildlife Society
Raptor Research Foundation

Honors and Awards

Certificate of Appreciation, The Wildlife Society—Western Section, 2000, 2001
Fulbright Research Fellowship to Indonesia, 1987.
Northern California Athletic Association Most Valuable Cross Country Runner, 1984.
J.G. Boswell Full Academic Scholarship, 1981 (Paid expenses for undergraduate education).
American Legion Award, Corcoran High School, 1981, and John Muir Junior High, 1977.
CIF Section Champion, Cross Country in 1978 and Track & Field 2 mile run in 1981.
National Junior Record, 20 kilometer run, 1982.
National Age Group Record, 1500 meter run, 1978

Community Activities

District 64 Little League Umpire, 2003-2007
Dixon Little League Umpire, 2006-07
Davis Little League Chief Umpire and Board member, 2004-2005
Davis Little League Safety Officer, 2004-2005
Davis Little League Certified Umpire, 2002-2004
Davis Little League Scorekeeper, 2002
Davis Visioning Group member
- Petitioner for Writ of Mandate under the California Environmental Quality Act against City of Woodland decision to approve the Spring Lake Specific Plan, 2002
- Served on campaign committees for City Council candidates