

FOLLOW-UP BURROWING OWL DISTRIBUTION AND ABUNDANCE RESEARCH, CAPITALIZING ON CURRENT STUDY

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The burrowing owl study has yielded data indicating about 500 pairs of burrowing owls attempted to nest in the Altamont Pass Wind Resource Area (APWRA) during spring 2011. Half of 46 sampling plots were not occupied, and density tended to be higher toward the northwest-southeast axis of the APWRA (Figure 1). As the study progressed, it became apparent that three follow-up research tasks could capitalize on the investment already made, and could contribute significantly to the development of predictive models intended to be used for siting wind turbines in repowering. These three tasks are proposed below.

Research Task 1: Monitor burrow use of fledgling and wintering burrowing owls

Rationale: Our four month distribution and abundance study revealed that nesting pairs of burrowing owls experience attrition by the latter part of the nesting season, or essentially two levels of nest density. The nesting density in June and July was considerably lower than I was during April and May. Therefore, the distribution of burrowing owls in the APWRA is dynamic. Whereas we have estimated two spatial distributions between early and late spring, the summer population is undergoing another change in distribution as we are winding down our current study. The emerging juveniles are flying between burrows, and are making increasingly greater use of additional burrows increasingly farther from their nest burrows. At least some of the "fledging burrows" are further upslope from the natal burrows. As this additional burrow use progresses into the late summer, the risk profile of burrowing owls may also change. It would be useful to include this emerging risk profile into predictive models of burrowing owl burrow locations for the purpose of siting turbines as part of repowering.

Methods: I propose a continuation of the ongoing burrowing owl surveys within the existing 45 sampling plots. We know the plots very well by now, so returning to them and monitoring owl burrow use would benefit from greater survey efficiency. Burrows definitely used by fledgling owls would be identified as "fledging burrows," and other non-nesting burrows would be identified as refuge burrows. This effort would continue through winter 2011/2012, and distinct phases of burrow use and burrow distribution would contribute to separate predictive models of collision risk, all of which could be either kept separate or combined for the purpose of guiding turbine siting.

Joanne Mount has been involved with the study since late April, and she's proven to be highly skilled at detecting burrowing owls. I recommend continuing to use her in the field in the same arrangement that occurs now. My time in the field could be reduced to two per week, and Lee Neher's GIS support would continue to be needed, as well.

Cost: Not including the cost of keeping Joanne Mount on the project through winter, I estimate the additional cost would be about \$23,000.

Research Task 2: Add the ground squirrel distribution as a predictor variable of the burrowing owl distribution

Rationale: All but three nesting pairs of burrowing owls were observed using ground squirrel burrows in the APWRA. Two nested within desert cottontail burrows (these could have been ground squirrel burrows, originally), and one nested in a cave in a natural rock formation. Given that so many burrowing owls rely on ground squirrel burrows, and because ground squirrels are clustered in distribution, the spatial distribution of ground squirrels should serve as a powerful predictor of burrowing owl burrow locations. Our reason for not using ground squirrel burrows in our original predictive model was that we recognized ground squirrel distributions are also dynamic. The ground squirrel distribution can be dynamic for biological reasons and due to ranch management practices, so predicting burrowing owl locations based on today's ground squirrel distribution can mislead turbine siting if the ground squirrel distribution changes in years to come. However, characterizing today's ground squirrel distribution can narrow the pool of analytical grid cells from which we can develop a predictive model of burrowing owl burrow locations. In other words, we could excise out of the analysis all slopes (and entire plots) that currently lack ground squirrel burrows, thereby reducing the contribution of vacant slopes as noise in the development of predictive models of burrowing owl burrow locations.

Methods: One or both of two approaches could be taken to map the current distribution of ground squirrels within the burrowing owl sampling plots. The approximate centers of ground squirrel complexes could be mapped using a GPS, as I did at Vasco Caves Regional Preserve (Smallwood et al. 2009). This approach could be combined with continued burrowing owl burrow surveys, so there would be some cost sharing with Research Task 1. Alternatively, one could use the latest aerial imagery of the APWRA to map polygons around ground squirrel colonies.

To assess the cost-effectiveness of both approaches, a prudent first step would be to perform a pilot mapping of burrowing systems in only two or three plots, using aerial imagery to map squirrel colonies as polygon features in GIS, and also mapping the burrow systems using a GPS during foot surveys. Not only could costs be assessed this way, but the remote sensing approach could be ground-truthed for accuracy.

Cost: Estimates of the costs of mapping ground squirrel distributions are going to be crude until both approaches are compared in a pilot study. The following estimates are preliminary. Mapping ground squirrel burrow systems in the field would cost \$20,000 to \$30,000. Using aerial imagery to map ground squirrel burrow systems would cost \$7,000 to \$10,000.

Research Task 3: Test whether burrowing owl fatalities at wind turbines vary by current burrowing owl densities and hill sizes

Rationale: During the course of our study, we happened to find one burrowing owl fatality at a location far from wind turbines, within a burrow on an access road. This owl was probably hit by an automobile before it could duck into its burrow, as it was stuffed awkwardly and firmly into its burrow. We incidentally found another two burrowing owl carcasses within 50 m of wind turbines. We learned of another burrowing owl found by the fatality searchers near a wind turbine, and near one of the owl fatalities we found. We also learned of a fourth burrowing owl found under a wind turbine within 20 m of a burrow where we had mapped a nesting pair. Three of these four burrowing owl fatalities found near wind turbines were also near relatively high-density clusters of burrowing owl nests that we had mapped during our study and which experienced relatively high attrition rates going into June and July. Though these observations were anecdotal in nature, they were consistent with my findings in my first paper on fatality rates in the Altamont Pass -- that burrowing owl fatalities found within the search areas of wind turbines correlate with the number of burrowing owl burrows occurring near wind turbines (Smallwood et al. 2001). Now that we have maps of burrowing owl burrows within 23 of 46 sampling plots, we have an opportunity to directly test whether fatality rates amongst the nearest wind turbines relate to burrowing owl burrow density at various distance intervals from turbines, and whether slope size and steepness are important factors. These tests can be performed between fatality rates and model-predicted burrowing owl burrow locations as I proposed earlier this year, but I feel that we mapped burrowing owl burrows in enough plots to warrant direct tests of relationships between fatality rates and mapped burrows.

Methods: Wind turbines at ridge crests nearest mapped burrowing owls would be searched for fatalities more intensively than usual, beginning immediately. I suggest searching these turbines at least weekly. I also suggest searching turbines regardless of whether they are being searched currently as part of the monitoring program.

Cost: The cost would depend on the number of turbines included in the directed searches and the search interval.

References Cited

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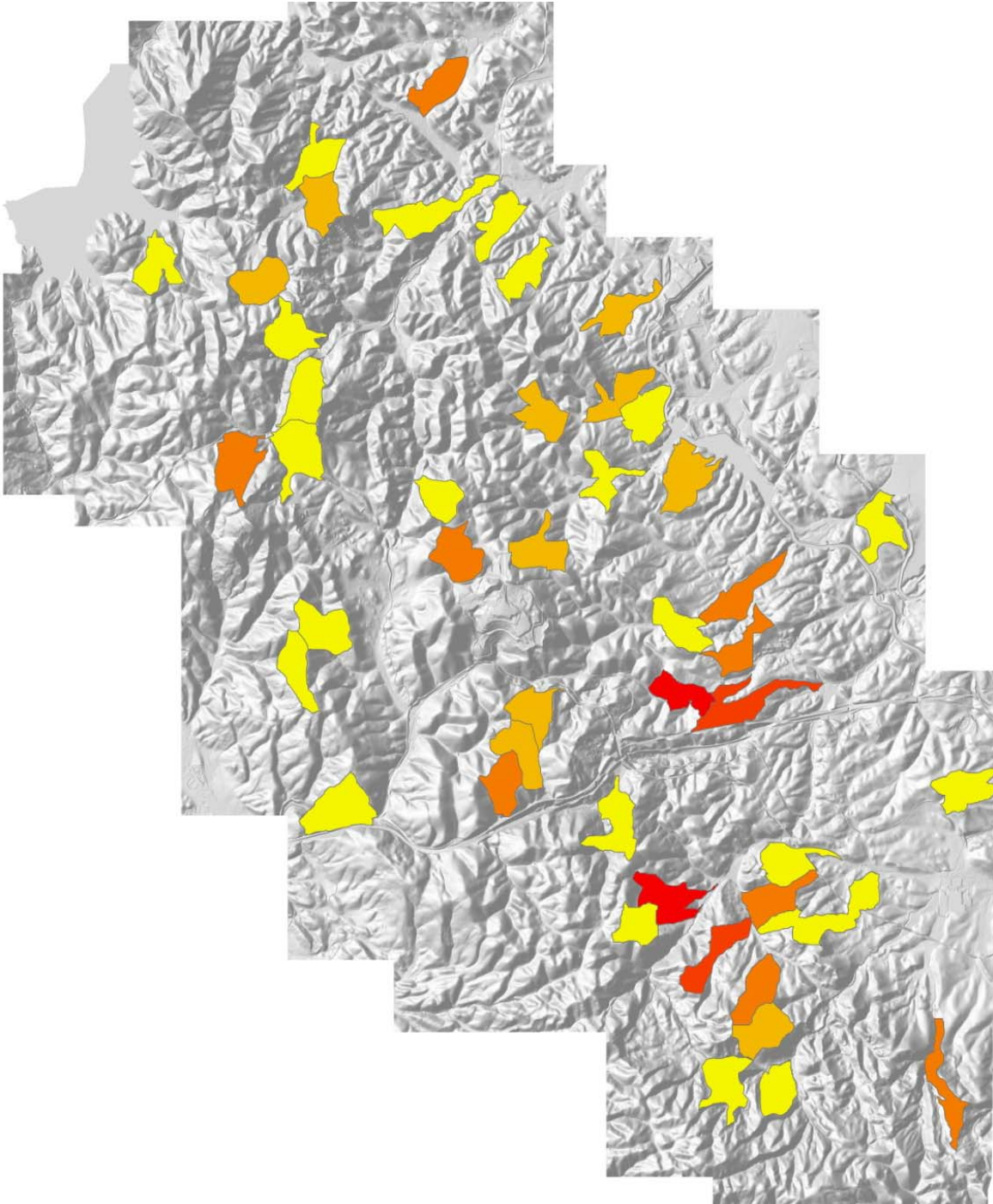


Figure 1. Distribution of nesting burrowing owls in 2011 in the Altamont Pass Wind Resource Area, Alameda and Contra Costa Counties, California. Nesting density in census plots was colored yellow for 0 nests/km², light orange for 1.7-4.2 nests/km², orange for 4.7-8.5 nests/km², light red for 10.0-11.7 nests/km², and dark red for 13.5-24.3 nests/km².

