Proposal to Sample Burrowing Owls Across the Altamont Pass Wind Resource Area

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The Alameda County Scientific Review Committee (SRC) identified the need for focused study on burrowing owls in the Altamont Pass Wind Resource Area (APWRA) (SRC doc P90). The needs were to estimate the distribution and abundance of burrowing owls across the APWRA and to further understand the behaviors of burrowing owls that might lead to their frequent deaths nearby wind turbines. Since the SRC generated the earlier burrowing owl study proposal (P90), the need for distribution and abundance data has increased because repowering projects are under planning and environmental review. These data are needed for careful siting of new turbines to minimize burrowing owl impacts.

The APWRA encompasses about 16,500 hectares (ha). An area of this size would require many biologists to census the burrowing owl population. A more efficient approach would be to sample the area, mapping all the active burrowing owl burrows within each sampled area. So long as the samples are representative of the environmental variation in the APWRA, and so long as the cumulative area of the sampling plots is large enough, the mapped burrowing owl burrows within the sampling plots could inform predictive models of burrowing owl burrow locations. Sufficiently accurate predictive models could then be extrapolated throughout the non-sampled areas to guide wind turbine siting during repowering.

The goal of the burrowing owl study proposed herein is to inform repowering of where burrowing owls are most likely to reside in highest abundance and in moderate abundance, so that wind turbines can be sited to maximize their distances from high abundance areas. Trade-offs will be required, however, because siting will also have to consider collision risks to golden eagles, red-tailed hawks, and American kestrels. Also, there may be other considerations, such as sites that may be favored by burrowing owls for nocturnal foraging. The objectives of the study are to estimate (1) nest density; (2) spatial distribution of burrowing owl populations across the APWRA; and (3) quantify use and availability of specific landscape features and slope attributes across the APWRA. The ongoing ad-hoc recording of burrowing owl burrows during fatality searches could also contribute to objective 2.

METHODS

I would rather sample at least 10% of the total area of the APWRA, or about 1,600 ha. About 540 ha have already been sampled in a study at Vasco Caves Regional Preserve in 2006-2007, though it might be worthwhile to sample this area again. I propose using the terrain to decide on sampling plot boundaries, rather than a grid or on circles. Using the terrain can improve survey efficiency by enabling the investigator to readily see the study boundaries while in the field. I used this approach to map burrows of fossorial mammals and burrowing owls at Vasco Caves Regional Preserve, and found that it improved my efficiency a great deal. Using the terrain also

better fits the distribution of burrowing owl colonies, which also rely on the terrain to distribute themselves.

In describing the steps I propose for selecting sampling plots, I use the following terminology. *Sub-watersheds* are slopes bounded by ridge crests and ridge lines that drain rainfall into a stream until the stream reaches a node with another stream (Figure 1). Multiple sub-watersheds form a watershed. *Prominent ridge crests* and *prominent valley bottoms* are the major ridge crests and valley bottoms of the local area. The areas between prominent ridge crests can include additional ridge crests at lower elevations, as well as additional streambeds that are at higher elevations than the prominent valley bottom.

I propose the following sequence of steps for selecting sampling plots and at arriving at sampling plot boundaries.

1. Divide APWRA into approximately 21 wind turbine fields, defined by ownership and turbine type (this step was accomplished already, but could use some review);
2. Select a random point from each turbine field, totaling 21 random points;
3. Each point serves as a starting place to grow a polygon representing a burrowing owl sampling plot, using decision rules to grow the polygon;
4. Initial candidate boundaries are those of the sub-watershed polygon(s) encompassing the selected point;
5. Additional sub-watershed polygons are appended to reach the nearest prominent ridge crest and nearest prominent valley bottom (the sub-watershed might already extend to these landscape features);
6. If needed, sub-watershed polygons are added from the other side of the nearest prominent valley bottom until the opposing prominent ridge crest composes part of the sampling plot boundary;
7. If needed, additional sub-watershed polygons are added along the reach of the nearest prominent valley bottom and extending to the nearest prominent ridge crests until a sufficient sampling plot area has been incorporated;
8. The minimum sampling plot area equals 40 ha and the maximum area equals 100 ha, with the goal of sampling at least 1,000 ha in the APWRA.

Once sites are selected and sampling plot boundaries delineated, I propose that digital elevation models of the APWRA be used to identify all of the ground areas that are visible from roadside vantage points, as well as all the ground that is hidden from view. The hidden ground would be surveyed from off-road vantage points and by foot. This way, all of the surface area within each sampling plot would be searched.

Locating active burrowing owl burrows will be done in the morning and evening hours, using binoculars from a parked vehicle at roadside vantages. I estimate that one vantage will be needed per 15 ha, so about 3 to 7 per sampling plot. As noted above, ground surface areas hidden from roadside vantages will be surveyed by foot. Each sampling area would be surveyed at least twice during the period April through June. Active burrows will be noted on hand-held maps, then mapped by GPS during mid-day hours after all the burrows have been noted on maps.

I estimated a budget in the following table. I left travel time to and from the project site blank, because it will depend on who does the job. I also did not estimate travel or lodging costs for the same reason.

Task	**Minimum hours**
Selecting sampling sites and plot boundaries (GIS)	15
Identifying roadside & off-road vantages and hidden ground (GIS)	8
Performing vantage-point surveys	120
Performing foot surveys	42
Travel between plots	12
Travel to and from site	
Data processing and analysis	10
Reporting	10
Total	≥217

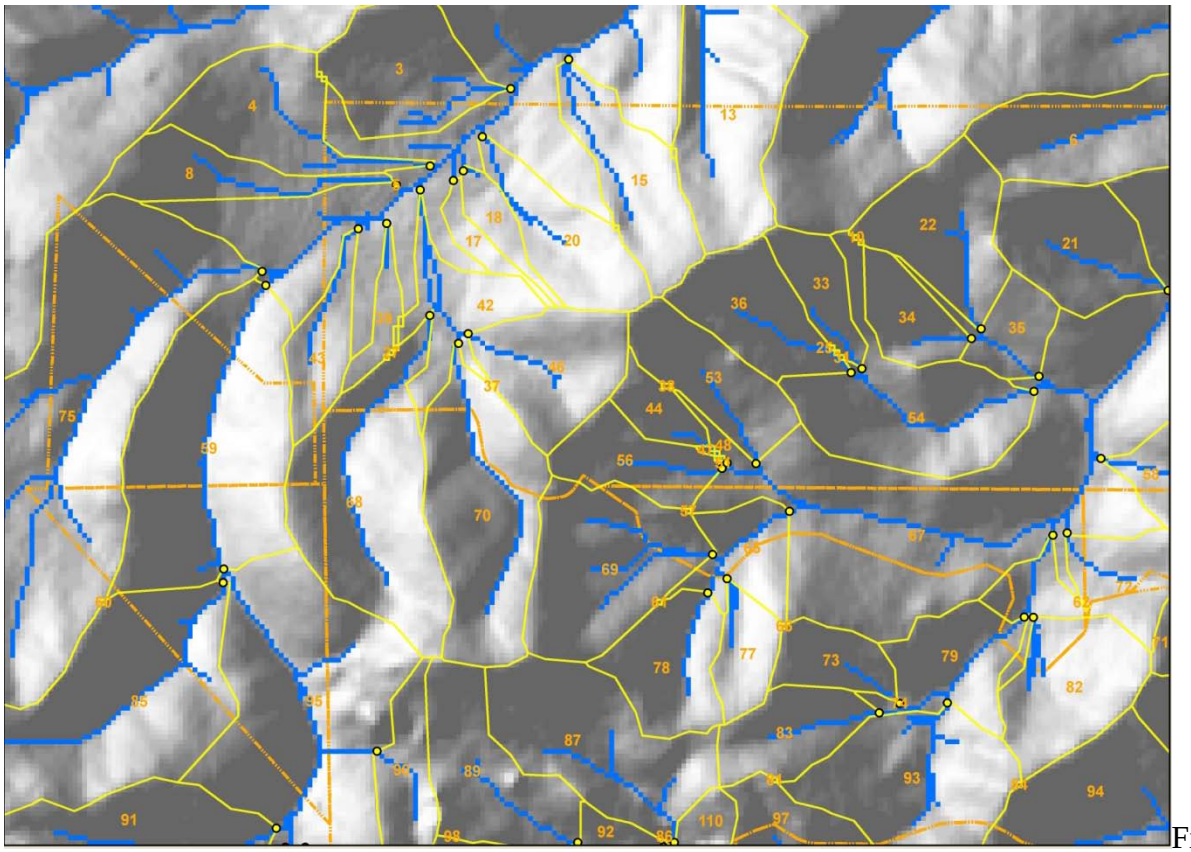

Figure 1. Example distribution of sub-watersheds, where blue lines represent streams, yellow lines depict sub-watershed boundaries, numbers are sub-watershed labels, and orange lines are property boundaries.