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Research Brief for Resource Managers

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Response of California Spotted Owls to Fire and Salvage Logging in Southern California

Lee, D.E., M.L. Bond, M.I. Borchert, and R. Tanner. 2013. Influence of fire and salvage logging on site occupancy of spotted owls in the San Bernardino and San Jacinto Mountains of southern California. The Journal of Wildlife Management 77: 1327-1341. DOI: 10.1002/jwmg.581

Additive disturbances in the form of wildfire and post-fire salvage logging may be contributing to alarming declines in southern California spotted owls (*Strix occidentalis occidentalis*). Although previous mixed-conifer studies in the Sierra Nevada showed no effect of high-severity burning on owl populations, the diminutive, southern California spotted owl differs substantially in its response to fire and logging. In southern California, owls occupy mixed-vegetation habitats. Twenty-two isolated owl populations are located in and around the high-elevation conifer "islands" which are surrounded by desert and semi-desert chaparral. Previous studies indicate that the southern California spotted owls at lower-elevations sites produce comparatively more offspring than at higher elevations sites. In this study, the average core area of the owls' pre-fire forest habitat was 106 ha with a greater proportion of hardwoods compared to an average core area of 180 ha in the Sierra in which conifers dominate.

Management Implications:

- 50 ha of high severity fire appears to be a threshold beyond which extinction probabilities increase for the California spotted owl.
- Post-fire salvage logging has the potential to increase owl extinction rates relative to burned sites.
- Fire-killed trees within core areas should be retained unless non-occupancy has been confirmed by protocol-level surveys conducted over multiple years.
- The best conservation measure for southern California spotted owls would be to reduce human-caused ignitions in southern California forests, especially at lower elevations.

The two goals of this study were: 1) to discern whether or not fires altered owl occupancy dynamics from 2003 to 2011; and 2) to discover if there is a critical threshold of vegetation change caused by fire and salvage logging that can affect owl occupancy.

Although there were no statistically significant effects of fire or salvage logging in this study, burned sites had lower colonization probabilities and greater extinction probabilities than unburned sites (Fig. 2). Further, when >50 ha of forested habitat burned severely, site extinction probability increased by 0.003 with each

additional ha burned. Thus, 50 ha of high severity fire appeared to be a threshold beyond which extinction probabilities increased. In this study, 75% of the sites burned less than the 50 ha threshold. Salvage logging further reduced occupancy compared to sites that only burned.

Methods

All the owl sites (single or paired owls) within the San Bernardino National Forest in the San Bernardino (SBM) and San Jacinto Mountains (SJM) were identified and surveyed up to eight times annually (March1 to August 31) starting in 1989 through to 2011. Two types of surveys were used each year: presence-absence surveys; and reproductive surveys located in roosts and nests. The reproductive surveys evaluated the reproductive status of 136 pairs in the SBM and 32 owl pairs in the SJM. Vegetation was assessed in 203-ha circles centered on the most recently used nest tree for each owl. Infrared aerial photos taken in 2003 with 1-m resolution were used to plot the nest locations and the postfire vegetation was reassessed using National Agricultural Imager Program imagery of the SBNF taken in 2009. The circular plots were defined as "burned" if the core area was in a fire from 2003 to 2007. They were considered high-severity burn plots if tree cover changed significantly. Aerial photographs from Google Earth (1-ha cells) were used to assess post-fire tree removal (i.e. clearcutting).

Data from both mountain ranges were pooled: ninety-seven sites were never burned, 71 sites burned from 2003-2007, and 21 of the burned sites were salvage logged. Data were then sorted into "all detections" and "pair" datasets, which were then used to create year- and site-specific model averages (via Program Presence 4.0). Averages were used to estimate detection, occupancy, colonization, and extinction probabilities for burned, burned & logged, and unburned sites, both before and after fire.

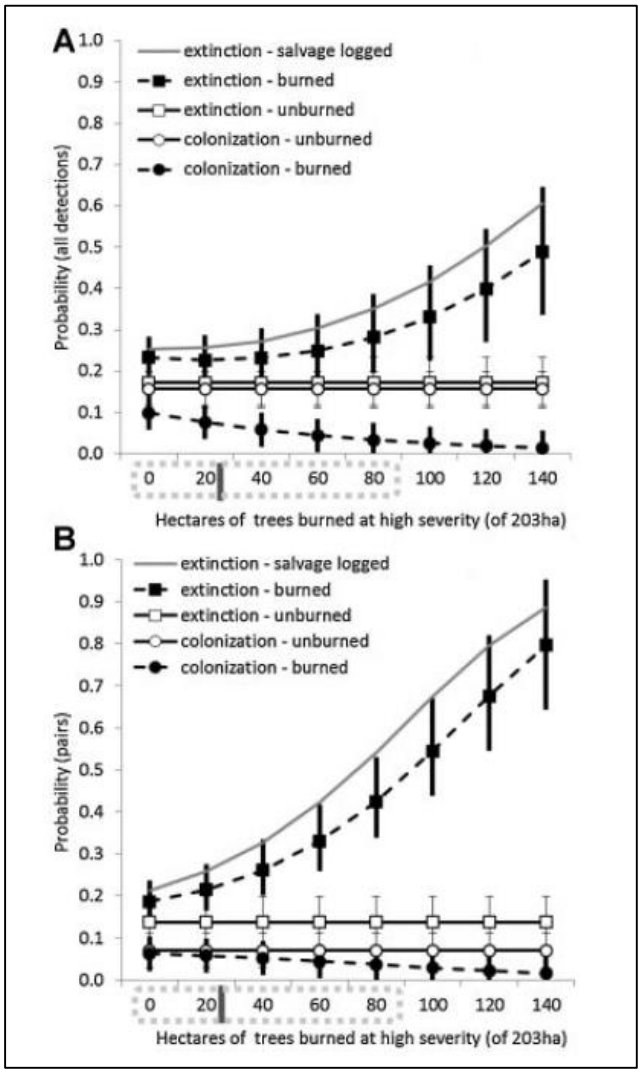

Figure 2. Model-averaged relationship between site colonization and extinction probability and the hectares of owl habitat that burned at high severity within a 203-ha circle around the nest or roost centroid of 71 California spotted owl sites in the San Bernardino and San Jacinto mountains from 2003 to 2011 from all-detection (A) and pairs-only (B) data as calculated from model-averaged beta parameters. Filled symbols and dashed lines are burned owl sites (±SE), open symbols and solid lines are unburned sites (±SE), and solid gray lines represent burned and salvage logged site extinction probabilities. Vertical gray line in x-axis indicates the mean amount of owl habitat that burned at high severity in all burned sites. Dotted gray rectangle in x-axis indicates 95% confidence interval of amount of owl habitat that burned at high severity in all burned sites. We set individual (site-specific) covariate values to the mean for each covariate.