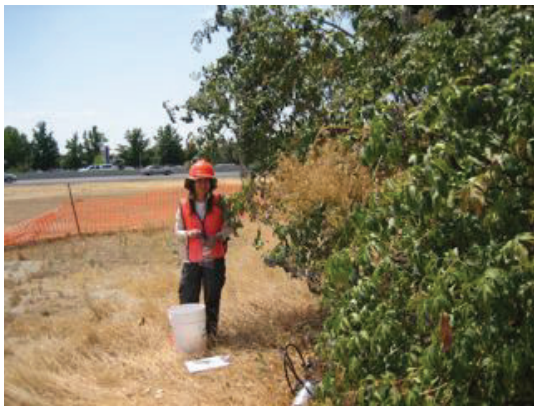
The Effects of Highways and Highway Construction Activities on Valley Elderberry Longhorn Beetle Habitat

Introduction

Caltrans strives to improve mobility for people and goods in California while preserving valuable natural resources. Roads can fragment natural habitat and limit the movement of organisms. Further, vehicular traffic and activities, such as road construction, can generate pollutants, light and noise or vibrations.

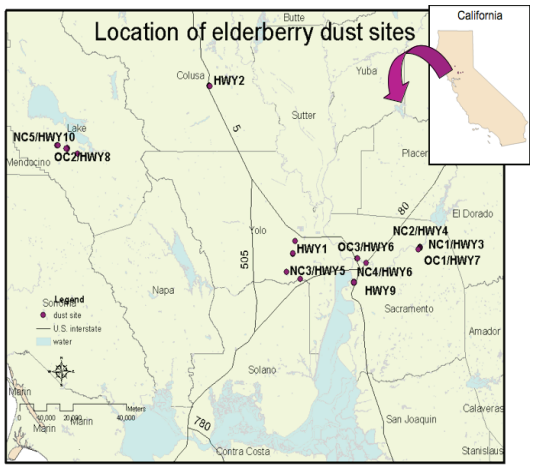


Of particular concern in the Central Valley are the effects of roads on the Federally threatened valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*). Threats to its survival and recovery include actions harming the beetle either indirectly, by impacting its host shrub, blue elderberry (*Sambucus mexicana*), or directly, through death, or disturbance of vital processes such as feeding or reproduction. Little is known about the actual effects of the highways on the beetle, leading to mitigation that is sometimes expensive and of unknown conservation effectiveness. So, Caltrans sponsored research by Theresa Talley and Marcel Holyoak of the University of California, Davis to help understand how the highway system impacts the beetle and how to reduce these impacts in a cost effective manner.

The research consisted of two parts: First, how does proximity to highways or highway construction activities affect beetle occupancy and its host shrubs? And, second, how does trimming elderberries affect beetle occupancy and its host shrubs? In the proximity work the researchers emphasized the effects of particulates, pollutants, and noise. The trimming work was an augmentation of an already ongoing effort.

Research Methods

For the proximity study, sites were selected along highways throughout the northern Central Valley and near Clear Lake. Field surveys were conducted during 2006, 2007, and 2008.



Elderberry condition was measured, counts of recent and old beetle holes were made, and background sediment deposition rates were measured. Noise levels were measured by Caltrans during May 2007. One hundred leaflets were collected from each shrub for laboratory analysis. The resulting data were statistically analyzed. Power analysis was used to test the statistical power of each comparison to reveal the probability that non-significant results were real and not due to a lack of sufficient replication.

For the trimming study pruning (removing 50% $\leq$ 2.5-cm diameter branches from each shrub), and topping (removing the top 1 m of a shrub or clump of shrubs) were examined. Research took place along the American River Parkway in Sacramento, CA. In each experiment elderberry survival, growth and condition was measured. The effects of pruning on plant nutrition were estimated, and the effects of pruning on plant defense

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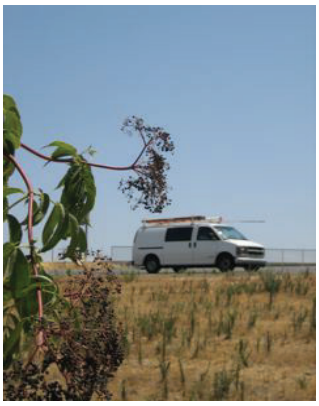
chemical production were tested. The recovery of beetle habitat was assessed by recording the number and maximum diameter of replacement branches. To assess the effects of trimming on beetle occupancy, each shrub was searched for the presence and abundance of new beetle exit holes. The resulting data wers statistically analyzed.



Research Results

The beetle occurred along roadsides and in highway post-construction sites at occupancy rates similar to non-highways sites in the northern Central Valley illustrating that these areas can serve as habitat for this threatened species. The presence of exit holes in most sites, the lack of detectable increases in dust and most foliar toxins with proximity to roads, and the similar noise levels at the highway sites in this study suggest that these elements may not occur at high enough levels in the roadside habitats examined to exclude the beetle. Often, however, only large effects were detectable in this study due to low replication. Larger-scale and/or controlled experimental studies are needed to test specific effects on the fitness and survival of beetle and elderberry individuals.

Trimming (pruning and topping) did not impact numbers of beetles in elderberry shrubs and clumps of shrubs. There were no detected changes in the condition of elderberry shrubs. The only negative effect of trimming observed was a temporary loss of habitat in the form of the cut stems, but these stems generally regrew within 3-4 years. The trimming analyses were conducted with reasonable sample sizes for detecting the effects of pruning and topping on both beetles and elderberry.

Management Suggestions

Based on the research results, the largest risk of highways and highway-associated activities to existing roadside beetle populations is likely from the direct effects of construction activities (noise, dust, movement) on adults or exposed larvae and eggs, so projects should continue to be performed outside of beetle emergence season (March to June). Weather conditions can interact with effects of highways or construction activities. For example, dust accumulations during times of drought may further stress shrubs, leading to reduced host quality or death. Weather such as humidity and wind may also affect the amount and direction of airborne particulates. Thus, the research team suggests that mitigation actions such as occasional rinsing of elderberry to remove dust and toxins, and wetting or covering of loose sediments and/or limited ground cover removal should be considered during dry and/or windy periods.

Further Reading

Talley, Theresa S. and Marcel Holyoak.2009. The effects of highways and highway construction activities on valley elderberry longhorn beetle habitat. Final Report FHWA/CA09-0925. California Department of Transportation, Division of Research and Innovation, Office of Materials and Infrastructure, Sacramento CA.

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