U.S. Fish & Wildlife Service

Revised Recovery Plan for

Valley Elderberry Longhorn Beetle
(*Desmocerus californicus dimorphus*)

Photo courtesy of Jon Katz/USFWS

Revised Recovery Plan for Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*)

Region 8
U.S. Fish and Wildlife Service
Sacramento, California

Approved: _____

Acting
Regional Director, Pacific Southwest Region, Region 8,
U.S. Fish and Wildlife Service

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An electronic copy of this recovery plan is available at:
https://www.fws.gov/endangered/species/recovery-plans.html

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REVISED RECOVERY PLAN FOR VALLEY ELDERBERRY LONGHORN BEETLE (*DESMOCERUS CALIFORNICUS DIMORPHUS*)

Introduction

This document presents the U.S. Fish and Wildlife Service's (Service) plan for the conservation and recovery of the Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*). Pursuant to section 4(f) of the Endangered Species Act of 1973, as amended (16 U.S.C. § 1531 *et seq.*) (Act), a recovery plan must, to the maximum extent practicable, include (1) a description of site-specific management actions as may be necessary to achieve the plan's goals for the conservation and survival of the species; (2) objective, measurable criteria which, when met, would support a determination under section 4(a)(1) that the species should be removed from the List of Endangered and Threatened Species; and (3) estimates of the time and costs required to carry out those measures needed to achieve the plan's goal and to achieve intermediate steps toward that goal. This revised recovery plan is based on scientific information presented in the *Withdrawal of the Proposed Rule To Remove the Valley Elderberry Longhorn Beetle From the Federal List of Endangered and Threatened Wildlife* (79 FR 55874, September 17, 2014) and the *Proposed Rule; Removal of the Valley Elderberry Longhorn Beetle From the Federal List of Endangered and Threatened Wildlife* (77 FR 60238, October 2, 2012), which describe the life history and biology of the species, the current status of the species, and the threats that impact the species. Both of these documents are available at https://ecos.fws.gov.

The Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) was federally-listed as threatened under the Act on August 8, 1980, and has a recovery priority number of 9, indicating the taxon is a subspecies that is under moderate threat with a high recovery potential (45 FR 52803). The Service designated critical habitat for the species on August 8, 1980.

When listed, the Valley elderberry longhorn beetle was known from only 10 records in 3 locations (Merced County, Yolo County, and Sacramento County). Subsequent surveys throughout the Central Valley discovered more locations and the current presumed historical range is now believed to extend from Shasta County to Madera County below 500 feet in elevation (152.4 meters) (79 FR 55874). Although different ranges for the beetle have been proposed in the past, the current presumed range relies only on verifiable sightings or specimens of adult male Valley elderberry longhorn beetles (79 FR 55874). Previous iterations of the presumed range used both female sightings and exit holes to determine Valley elderberry longhorn beetle presence. Both of these metrics are unreliable as female California elderberry longhorn beetle (*Desmocerus californicus californicus*) and Valley elderberry longhorn beetles are indistinguishable in the field and exit holes cannot be accurately assigned to either species (Talley 2005).

Elderberry (*Sambucus* sp.) is the obligate larval host plant for the Valley elderberry longhorn beetle. After hatching, the larva creates a feeding gallery (set of tunnels) in the pith at the stem center (Burke 1921, Barr 1991). While only one larva is found in each feeding gallery, multiple larvae can occur in one stem if the stem is long enough to accommodate multiple galleries (Talley et al. 2006). Though rarely observed, adults have been described as feeding on the nectar, flowers, and leaves of the elderberry plant (Arnold 1984, Collinge et al. 2001), or flying between trees (Service 1984). Previous studies of the beetle (both subspecies) estimated that the larval development period inside

the plant is 2 years (Burke 1921, Linsley and Chemsak 1972), but laboratory observations have indicated that the beetle may develop into an adult in a 1-year cycle (Halstead and Oldham 1990). Arnold (1984) reported that females lay eggs singly on elderberry leaves and at the junction of leaf stalks and main stems, with all eggs laid on new growth at the outer tips of elderberry branches.

Because elderberry is the host plant for the beetle, environmental and habitat conditions that favor a robust elderberry community also benefit the beetle. Elderberry is an important component of riparian ecosystems in California (Vaghti et al. 2009). It can be found as an overstory plant or understory plant within these communities. Elderberry also occurs in upland communities such as oak woodland. Occupancy of elderberry by the Valley elderberry longhorn beetle is generally low but tends to be highest in riparian communities (Barr 1991, Collinge et al. 2001, Talley et al. 2007).

The Valley elderberry longhorn beetle is distributed throughout available habitat in a widely dispersed metapopulation (Collinge et al. 2001, Talley et al. 2006). Metapopulations are defined as a as a series of populations that are connected through movement of some individuals between these populations (Hanski 1997). At local scales, the Valley elderberry longhorn beetle occupies elderberry plants in clumps at scales that varied with the watershed (Talley 2007). Local aggregations generally covered 25-50 meter scales along the American River and Putah Creek, but were more spread out (200-300 meters) along the Cosumnes River (Talley 2007). Groups of local aggregations varied as well, but overall separate aggregations occurred at scales of 656 – 2,625 feet (200 – 800 meters) along all three river systems. These clumps of local aggregations appear more likely to represent discreet demographic units for the Valley elderberry longhorn beetle. Defining the population at landscape scales is more challenging, but the data suggest that the occupancy status of a particular area of suitable habitat (occupied or unoccupied) is spatially correlated across distances of 6.2-12.4 miles (10-20 kilometers) within the same drainage (Collinge et al 2001). That is, a patch of habitat is more likely to be occupied if there is other occupied habitat within 6.2-12.4 miles (10-20 kilometers). At landscape scales of 6.2 miles (10 kilometers) or less, occupancy appears random (Collinge et al. 2001).

Recovery Strategy

The known historical range of the Valley elderberry longhorn beetle is closely linked to the Great Valley ecosystem (79 FR 55874) of the Sacramento Valley and northern San Joaquin Valley. Research suggests that the Valley elderberry longhorn beetle is further constrained by being naturally rare within its habitat. The main known cause of the decline of the species is the loss and degradation of its habitat; therefore, the recovery strategy focuses upon this threat. There has been a significant loss and degradation of riparian and other natural habitats in the presumed historical range of the Valley elderberry longhorn beetle, much of which occurred prior to the listing of the species. Katibah (1984) estimated approximately 102,000 acres (41,300 hectares) of riparian forest remained in the Central Valley in 1984, a reduction of about 89 percent from an estimated total of 921,600 acres (373,100 hectares) of pre-settlement riparian forest area. Much of this loss has been driven by agricultural and urban development, and flood control activities throughout the Central Valley. Present day losses of Valley elderberry longhorn beetle habitat are much more limited in extent and are often associated with urban development of agricultural areas and the maintenance of levees and other flood control structures. As noted in the *Withdrawal of the Proposed Rule To Remove the Valley Elderberry Longhorn Beetle From the Federal List of Endangered and Threatened Wildlife* (79 FR 55874, September 17, 2014), ongoing and future maintenance of these levees and other flood control structures may result in additional losses of riparian vegetation and elderberry shrubs. Long-term

impacts of levee vegetation management actions may be offset with implementation of mitigation and conservation measures (e.g., establishment of preserves or restrictions on pruning). Although the data are not available to accurately determine the extent of the loss of occupied habitat, the *Withdrawal of the Proposed Rule To Remove the Valley Elderberry Longhorn Beetle From the Federal List of Endangered and Threatened Wildlife* (79 FR 55874, September 17, 2014) summarized the extent of current elderberry habitat (based on 2009 imagery) mapped within the Central Valley, and assessed how these mapped areas conform to the metapopulation structure of the Valley elderberry longhorn beetle as defined by species' experts. This preliminary assessment indicated that elderberry habitat remains limited in extent within the Central Valley and may not currently support the spatial requirements of sustainable metapopulations for the Valley elderberry longhorn beetle.

Invasive Argentine ants have been confirmed at several locations occupied by the Valley elderberry longhorn beetle (Huxel 2000). Projections from climate change modeling indicate suitable conditions will occur for Argentine ants to continue to spread in California during the next several decades (Roura-Pascual et al. 2004; Hartley et al. 2006; Roura-Pascual et al. 2011). Studies show that Argentine ants will attack and consume exposed insect larvae and eggs, including those of the Valley elderberry longhorn beetle larvae and may even interfere with adult behavior (Way et al 1992; Talley 2014, pers. comm.).

The predation threat from Argentine ants is likely to increase in the Central Valley as colonies further expand into the species' range unless additional methods of successful control within natural settings become available (Choe et al. 2014). Although additional studies are needed to better characterize the level of predation threat to the Valley elderberry longhorn beetle from Argentine ants, the best available data indicate that this invasive species is a predation threat to the Valley elderberry longhorn beetle, and it is likely to expand to additional areas within the range of the Valley elderberry longhorn beetle.

Additional threats such as pesticide use, climate change, and invasive plants may also threaten the Valley elderberry longhorn beetle. Most of these additional threats cannot be quantified because there is not enough information known about the ecology of the beetle or the effect the threat may have on the beetle. The *Withdrawal of the Proposed Rule To Remove the Valley elderberry Longhorn Beetle From the Federal List of Endangered and Threatened Wildlife* (79 FR 55874, September 17, 2014) provides the most comprehensive summary of all the potential threats to the Valley elderberry longhorn beetle. Many of the threats do not act on the beetle in isolation. For example, effects from habitat loss are compounded by potential pesticide effects that may result from having smaller habitat patches immediately adjacent to active agriculture. The recovery strategy focuses on what the Service believes are the largest threats and those actions that have the highest potential to provide a concrete path to recovery.

The recovery strategy includes: 1) the establishment of sufficiently large populations throughout the species' range to ensure each population has the resiliency to withstand stochastic events; 2) maintaining the species' current level of representation (genetic and ecological diversity) so it potentially has the capacity to adapt to future environmental changes; and 3) increasing the species' current level of redundancy through the establishment of a sufficiently large number of local- and meta-populations widely distributed throughout the species' range to allow the species to withstand catastrophic events.

We developed the recovery criteria using the concepts described in the species status assessment (SSA) framework (Service 2016). The SSA framework provides a pathway for the Service to consider what the Valley elderberry longhorn beetle and elderberry needs to maintain viability by characterizing the status of the species in terms of its resiliency, representation, and redundancy. Using the concepts of resiliency, representation, and redundancy, we also describe the recovery vision for the species.

Resiliency

Resiliency describes the ability of populations to withstand stochastic events (arising from random factors). We can measure resiliency based on metrics of population health; for example, birth versus death rates and population size. Highly resilient populations are better able to withstand disturbances such as random fluctuations in reproductive rates (demographic stochasticity), variations in rainfall (environmental stochasticity), or the effects of anthropogenic activities.

For the Valley elderberry longhorn beetle to maintain viability, the populations found throughout the Central Valley must be resilient. Stochastic events that have the potential to affect Valley elderberry longhorn beetle habitats and, in turn, their populations include drought, flooding, fire, vandalism, and other natural or human-caused disasters. A number of factors influence the resiliency of populations, including survival, dispersal, abundance, and reproduction. Influencing those factors are elements of Valley elderberry longhorn beetle habitat that determine the number of individuals a population can support and whether those populations can increase reproductive success and their distribution, thereby increasing the resiliency of the population. These demographic factors and habitat elements are defined below and are shown in Figure 1. The current literature does not suggest a population size that might indicate a resilient population. Without this data, we recognize that there is a significant amount of uncertainty in using the term "sufficiently large".

Demographic factors:

Survival – individuals need to survive to a reproductive stage

Dispersal – because of their population structure and the patchy nature of the habitat, individuals need to disperse to find suitable elderberry shrubs to feed, find mates, and deposit eggs

Recruitment – predation and other stressors (e.g., pesticides, road dust) must be low enough and survival rates sufficiently high enough to allow eggs to hatch and larva to enter host plant; and host plant stressors (e.g., water stress, fire) to be low enough to allow larvae to develop into adults

Habitat elements:

Elderberry quantity and quality – the Valley elderberry longhorn beetle only occurs on elderberry plants. Elderberry density tends to increase in moist, riparian ecosystems (Talley et al. 2007, Fremier and Talley 2009); shrub must be suitable size (≥2 cm diameter stems), and suitable quality (e.g., pith nitrogen concentration; Talley 2007), but details of what constitutes a high quality host plants and patches are still largely uncertain.

Connectivity – because Valley elderberry longhorn beetles have limited dispersal ability, many elderberry plants in reasonably sized patches (10-50-m diameter patches; Talley 2007) that are in close proximity (200-300 m apart; Talley 2007), and without dangerous barriers (e.g., highways or pesticide use between the patches) are necessary to support a resilient population of the Valley elderberry longhorn beetle

Representation

Representation describes the ability of a species to adapt to changing environmental conditions. Representation can be measured by the breadth of genetic or environmental diversity within and among populations and correlates with the probability that a species is capable of adapting to environmental changes. The more representation, or diversity, a species has, the higher the likelihood it is to adapt to changes (natural or human caused) in its environment. In the absence of species-specific genetic and ecological diversity information, we evaluate representation based on the number of distinct metapopulations (e.g., regional populations associated with distinct drainages; Collinge et al. 2001), and the extent and variability of habitat characteristics across the species' geographical range.

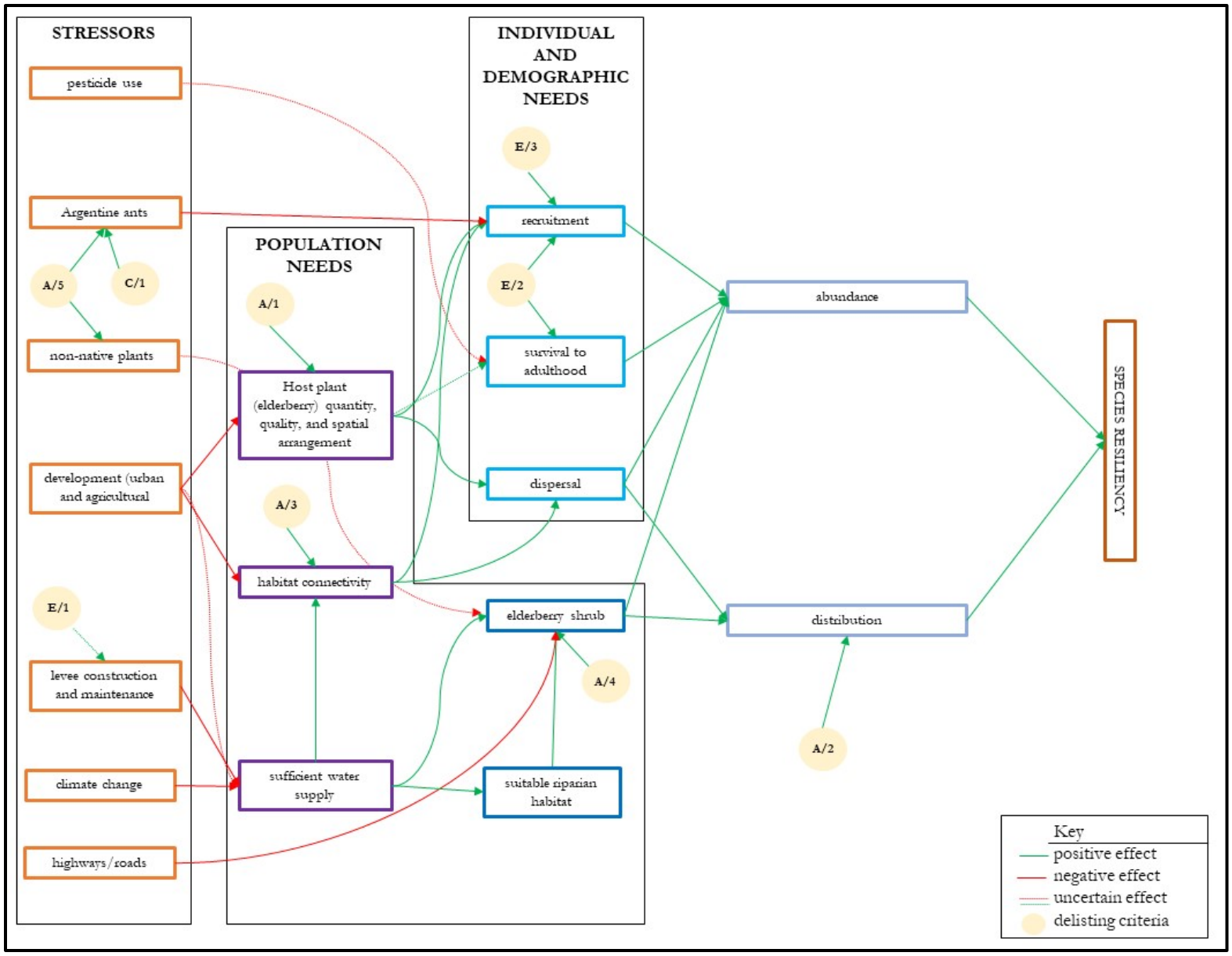


Figure 1. Conceptual model of the stressors and needs influencing the resilience of the Valley elderberry longhorn beetle.

The level of genetic diversity within and among populations of the Valley elderberry longhorn beetle is unknown. Because the Valley elderberry longhorn beetle is only found on elderberry, it has likely always been limited to areas of suitable elderberry habitat. Individual shrub occupancy is likely highly stochastic, but the highest quality Valley elderberry longhorn beetle habitat (based on occupancy rates) appears to be riparian habitat in the lower alluvial plain (Talley et al. 2007). Valley elderberry longhorn beetle exit holes are generally found on stems that are greater than one inch in diameter, with stems between 0.7 and 4.7 inches accounting for most of the exit hole observations (Talley et al. 2007). Based on these data, habitat restoration, acquisition, and enhancement should focus on riparian communities with a mix of young and mature elderberry shrubs. The habitat should also show signs of natural elderberry recruitment in the form of new saplings or young shoots from established elderberry shrubs. Although the Valley elderberry longhorn beetle is found in elderberries in both riparian and non-riparian areas, the selection mechanisms or larger habitat preferences are unknown. Occupancy rates of elderberry in riparian areas are higher, but surveys done in support of several research projects found that most seemingly suitable habitat is not occupied (Barr 1991, Collinge et al. 2001, Talley et al. 2007). It is believed that the Valley elderberry longhorn beetle has always been rare with a patchy distribution within its preferred habitat.

Redundancy

Redundancy describes the ability of a species to withstand catastrophic events. Measured by the number of metapopulations across the range of the species, and number of local populations across the range of each metapopulation, as well as each population's resiliency, distribution, and connectivity, redundancy gauges the probability that the species has a margin of safety to withstand, or the ability to bounce back from catastrophic events (such as a rare destructive natural event or episode involving many populations).

Current data suggest that the Valley elderberry longhorn beetle has populations distributed throughout the entire historical range of the species. However, given the amount of habitat lost historically, it is likely that many populations along river systems have been extirpated. A study completed in 1997 (Collinge et al. 2001) found 6.5% of the sites that were surveyed 6 years earlier showed no continued evidence of Valley elderberry longhorn beetle presence and 12.9% showed colonization over that 6 year period. Over the course of the study, occupation of drainages remained relatively constant and only one drainage that started as unoccupied by the longhorn beetle was colonized. This suggests that limited movement abilities of the Valley elderberry longhorn beetle may limit colonization potential and that unoccupied drainages may be likely to remain unoccupied (Collinge et al. 2001). Data collected during occupancy surveys generally does not provide the data to estimate a population size, and current scientific studies have not been conducted with enough consistency to ascertain population trends. Based on the information available, it is presumed that the species has a moderate level of redundancy due to broad range but locally rare occurrence.

Recovery Vision

Long-term viability for the Valley elderberry longhorn beetle is envisioned as a high level of resiliency, redundancy, and representation through protection of healthy Valley elderberry longhorn beetle populations throughout the suitable habitat found in the Central Valley. These populations are conserved in sufficient number and distribution to shield the species from complete loss from catastrophic events such as widespread, prolonged drought, catastrophic fire, extensive flooding, disease or pest outbreaks, and other natural or human-caused disasters. Additionally, populations are

adequately protected from recreational activities and the invasion of non-native plant and insect species.

To delist the species, the Valley elderberry longhorn beetle's status will require maintaining at least several self-sustaining metapopulations throughout the historical range in the Central Valley in areas with appropriate habitat. A stable metapopulation is essential to protect the species against local extirpation. It will be challenging to remove or ameliorate all threats to the species (many of the threats, particularly climate change and alteration of hydrologic regimes are difficult to reduce or control). The threat of ongoing loss of habitat in the Central Valley and limited areas for restoration in the southern portion of the range may constrain the populations in that area.

Management Units

Management units are a type of geographic area that can be designated, either with or without recovery units. The management units help organize recovery criteria throughout the range of the species and provide a spatial framework for targeting management actions to specific regions. For the Valley elderberry longhorn beetle, three management units have been identified based on watersheds (Map 1). Precipitation varies within each watershed which may influence specific vegetation communities. Each management unit also shows variation in the historical and current development and in the threats to the Valley elderberry longhorn beetle.

The management units are:

A. Sacramento River Management Unit
B. San Joaquin River Management Unit
C. Putah Creek Management Unit

Within each management unit, the major river systems correspond to the hydrologic unit code (HUC) 8 subbasin mapping units developed by the United States Geological Survey.

Recovery Goal

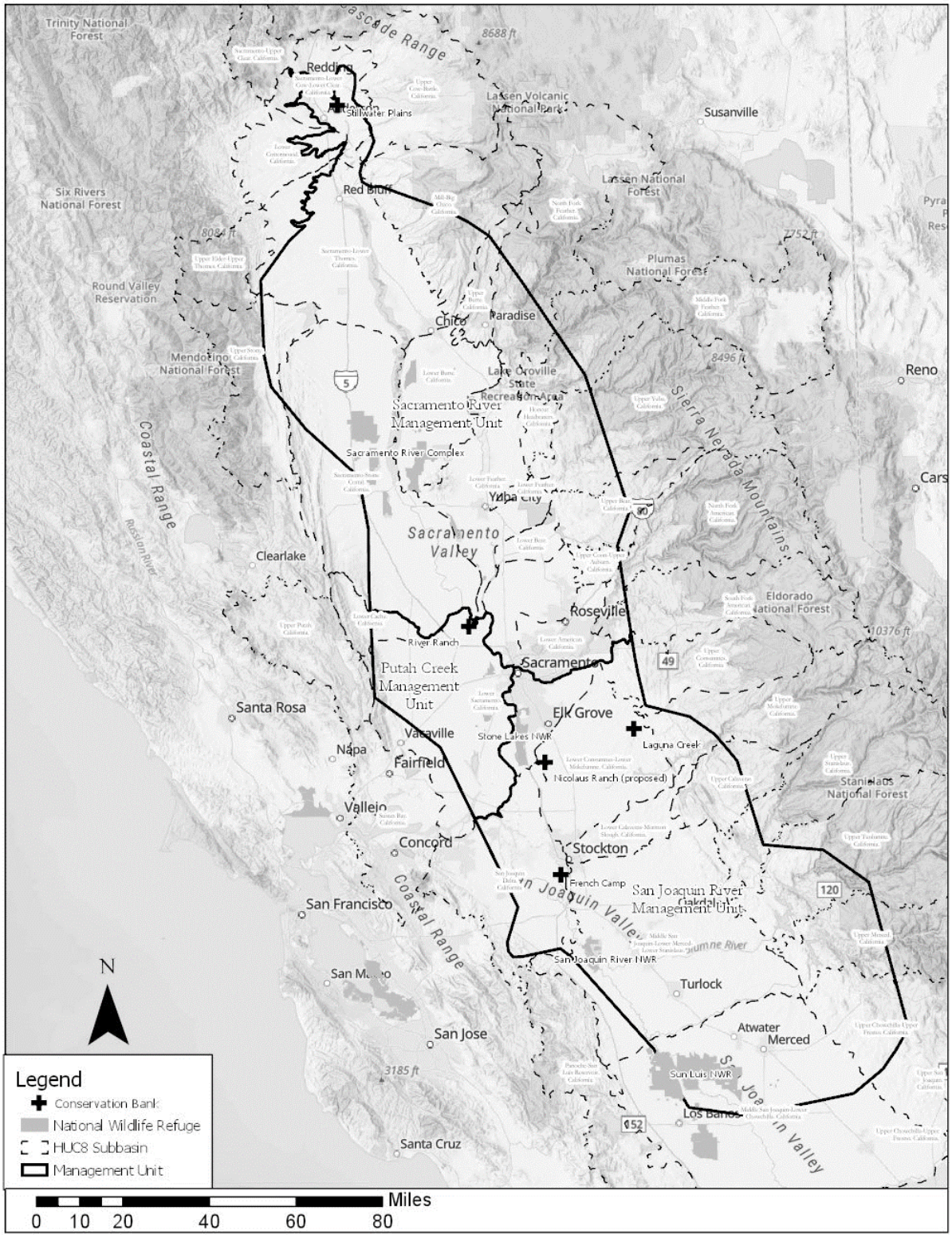
The ultimate goal of this revised recovery plan is to outline specific actions that, when implemented, will sufficiently and permanently protect self-sustaining populations throughout the ecological, geographic, and genetic range of the species and reduce the threats to the Valley elderberry longhorn beetle to allow for its eventual removal from the Act's protections.

Recovery Objectives

To meet the recovery goal, the following objectives have been identified:

- Preserve resilient populations of Valley elderberry longhorn beetle across the historical range of the species by maintaining occupancy in at least 80% of the HUC8 subbasins within each management unit (Map 1). Because some of the HUC8 subbasins are either small or have limited opportunities for restoration, 80% was deemed an appropriate number that will provide resiliency for the species. Data suggests (CNDDB 2019) that the Valley elderberry beetle continues to persist throughout its historic range despite significant habitat alteration and losses of populations in certain drainages. We assume that the species as a whole will maintain resiliency without the need for occupancy in 100% of the subbasins.

- Protect and manage a system of connected habitat patches along each river or major drainage within each HUC8 subbasin.



Map 1. Management units, HUC8 subbasins, and existing conservation banks for the Valley elderberry longhorn beetle.

Recovery Criteria

A threatened species is defined in the Act as a species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. When we evaluate whether or not a species warrants downlisting or delisting, we consider whether the species meets either of these definitions. A recovered species is one that no longer meets the Act's definitions of threatened or endangered due to amelioration of threats. Determining whether a species should be downlisted or delisted requires consideration of the same five factors that were considered when the species was listed and which are specified in section 4(a)(1) of the Act.

Recovery criteria are conditions that, when met, indicate that a species may warrant downlisting or delisting. Thus, recovery criteria are mileposts that measure progress toward recovery. Because the appropriateness of delisting is assessed by evaluating the five factors identified in the Act, the recovery criteria below pertain to and are organized by these factors. These recovery criteria are our best assessment at this time of what needs to be completed so that the species may be removed from the Act. Because we cannot envision the exact course that recovery may take and because our understanding of the vulnerability of a species to threats is likely to change as more is learned about the species and the threats, it is possible that a status review may indicate that delisting is warranted although not all recovery criteria are met. Conversely, it is possible that the recovery criteria could be met and a status review may indicate that delisting is not warranted. For example, a new threat may emerge that is not addressed by the current recovery criteria.

Delisting Criteria

Factor A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

To delist the Valley elderberry longhorn beetle, threats to the species habitat must be reduced. This reduction will be accomplished when the following have occurred:

A/1 Sufficient suitable habitat patches[1] within each management unit (Table 1) should be protected (i.e., voluntary land acquisitions, conservation easements, or other similar mechanisms). Each HUC8 subbasin within the management unit should contain at least five patches of quality habitat (see A/4) that are 656 – 2,625 feet (200 – 800 meters) long. HUC8 subbasins that are small[2] or where only a small portion of the subbasin is in the management area should contain at least one patch of quality habitat that meets the criteria in A/3 that is 656 – 2,625 feet (200 – 800 meters) long.

[1]Suitable habitat for the Valley elderberry longhorn beetle is a riparian community with a mix of young and mature elderberry shrubs as well as signs of natural elderberry recruitment in the form of new saplings or young shoots from established elderberry shrubs.

[2]Small subbasins are those that cover less than 100,000 acres within the management unit. There are 9 subbasins that meet this definition.

Table 1. Current Status of the Valley elderberry Longhorn Beetle and Its Habitat within the Management Units.

Management Unit	HUC8 Subbasin	# of protected suitable 656 – 2,625 feet (200 – 800 meter) habitat patches (needed/current)	# of occurrences (CNDDB 2018)
Putah Creek	Lower Sacramento	5/1[1, 2]	28
	Lower Cache	1-5/0	3
Sacramento River	Sacramento-Lower Cow-Lower Clear	5/1[1]	7
	Upper Cow-Battle	1-5/0	0
	Lower Cottonwood	1-5/0	2
	Mill-Big Chico	5/0	0
	Sacramento-Lower Thomes	5/0[2]	31
	Upper Stony	5/0	0
	Upper Butte	5/0	0
	North Fork Feather	1-5/0	1
	Middle Fork Feather	5/0	0
	Honcut Headwaters	5/0	0
	Lower Feather	5/0	25
	Lower Butte[2]	5/0[2]	10
	Sacramento-Stone Corral[2]	5/0[2]	23
	Upper Bear	5/0	0
	Lower Bear	1-5/0	5
	Upper Coon-Upper Auburn	1-5/0	0
	Lower American	5/0[2]	35
	North Fork American	1-5/0	5
	South Fork American	5/0	1
San Joaquin River	Upper Cosumnes	1-5/0	0
	Lower Cosumnes-Lower Mokelumne	5/2[1]	13
	Upper Mokelumne	1-5/0	1
	Upper Calaveras	5/0	0
	Lower Calaveras-Mormon Slough	5/0	6
	San Joaquin Delta	5/1[1]	3
	Upper Stanislaus	5/0	3
	Upper Tuolumne	5/0	1
	Middle San Joaquin-Lower Merced-Lower Stanislaus	5/0	14
	Upper Merced	5/0	0
	Upper Chowchilla-Upper Fresno	5/0	2
	Middle San Joaquin-Lower Chowchilla	5/0	1

[1]A conservation bank exists that has been established for the Valley elderberry longhorn beetle (Map 1)

[2]This unit contains protected habitat either on a National Wildlife Refuge, mitigation property, or other protected area, but the extent, condition, or management of the habitat is unknown.

A/2 Valley elderberry longhorn beetles should be present in at least three suitable habitat patches (from A/1) within each HUC8 subbasin. Currently 45% of the HUC8 subbasins meet this criterion (Table 1).

Because Valley elderberry longhorn beetle populations can show a pattern of short-term colonization and extinction (Collinge et al. 2001), three locations were considered the minimum need to maintain redundant populations of beetles are present in each watershed.

A/3 Protected, clusters of suitable habitat patches within HUC8 subbasins (see A/1) should be no more than 12.4 mi (20 km) from the nearest adjacent protected suitable habitat patch along the same river system or major drainage. This distance was chosen based on the results of Collinge et al. (2001) which suggested that the Valley elderberry longhorn beetle population exhibits classic metapopulation dynamics at scales of less than 12.4mi (20km).

A/4 Within the areas of protected suitable habitat, there should be a diversity of elderberry life stages and signs of natural recruitment.

A/5 All areas of protected suitable habitat need to have comprehensive management plans that maintain habitat values for the Valley elderberry longhorn beetle and address potential threats such as Argentine ants, invasive plants, pesticide and herbicide use, as well as provide for habitat maintenance and enhancement.

Implementation of habitat management plans is expected to also ameliorate threats described such as altered fire regime, vandalism and changes in environmental conditions resulting from climate change.

Factor B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

The overutilization for commercial, recreational, scientific, or educational purposes is not known to threaten the Valley elderberry longhorn beetle at this time. Therefore, no recovery criteria have been developed for this factor.

Factor C: Disease or Predation

It is believed that Argentine ants may predate Valley elderberry longhorn beetle eggs (Huxel 2000). To delist the beetle, Argentine ants should be eliminated or controlled at sites specifically designated for recovery of the Valley elderberry longhorn beetle.

C/1 A control or eradication program for Argentine ants should be implemented at each bank or other conservation area that has been established to support recovery of the Valley elderberry beetle.

Control is considered achieved when the population of Argentine ants on a site is not appreciably affecting Valley elderberry longhorn beetle recruitment.

Factor D: Inadequacy of Existing Regulatory Mechanisms

The inadequacy of existing regulatory mechanisms is not known to threaten the Valley elderberry longhorn beetle at this time. Therefore, no recovery criteria have been developed for this factor. Agencies continue to consult with the Service under the Act. To date, consultations under the Act have resulted in many protected habitat sites for the Valley elderberry longhorn beetle.

Factor E: Other Natural or Manmade Factors Affecting Its Continued Existence

Other natural or manmade factors believed to affect the continued existence of the Valley elderberry longhorn beetle: changes in hydrology from water management, changes in environmental conditions resulting from climate change, trampling and vandalism of the host plant, road construction, pesticide and herbicide overspray from adjacent agriculture (79 FR 55874). To delist the Valley elderberry longhorn beetle, these threats must be reduced. This reduction will have been accomplished when the following have occurred:

E/1 Water flows are sufficient to promote healthy elderberry and riparian habitats at all sites identified in A/1. Healthy habitats are those that have a diverse native plant community and show recruitment and multiple age classes of elderberry shrubs.

E/2 At least two of the locations in A/2 show long-term population viability. For the purpose of recovery, long-term is defined as at least 10 years.

The 10-year time frame is long enough to account for short-term colonization and extinction (Collinge et al. 2001) and encompasses years with average, above-average, and below-average rainfall conditions. The populations must demonstrate the ability to survive both precipitation extremes.

E/3 In order to maintain resiliency, the populations identified in A/2 should have 2-3 recent exit holes/1,076.4ft^2 (100m^2) of elderberry habitat.

Density information is based on Talley (2005) from areas along Putah Creek and the American River with known long-term persistent populations.

Recovery Actions

The actions identified in Table 2 below are those that, based on the best available science, the Service believes are necessary to move towards the recovery and delisting of the Valley elderberry longhorn beetle.

Priority numbers are defined per Service policy (Service 1983) as:

Priority 1: An action that must be taken to prevent extinction or to prevent a species from declining irreversibly.

Priority 2: An action that must be taken to prevent a significant decline of the species population/habitat quality or some other significant negative impact short of extinction.

Priority 3: All other actions necessary to provide for full recovery of the species.

Table 2. Recovery actions and estimated costs.

Recovery Action	Criteria Addressed	Priority Number	Estimated Cost
1. Acquire, enhance, restore, and protect suitable habitat for the Valley elderberry longhorn beetle. This action involves land acquisition, habitat management, and site improvements.	A/2, A/4, A/5	1	$100,000/HUC8 Subbasin[1] Total: $3,300,000[2]
2. Develop management and monitoring plans for protected riparian areas that consider the threats and needs of the Valley elderberry longhorn beetle. Plans should include status and demographic monitoring, non-native predator control, habitat enhancement, and other needed activities that may increase the resilience of the Valley elderberry longhorn beetle.	A/1, A/2, A/3, A/4	1	$30,000/HUC8 Subbasin[1] Total:$990,000[3]
3. Include Valley elderberry longhorn beetle conservation as a component of state and local programs to protect riparian habitat.	A/1, A/2, A/3, A/5, E/1	3	---
4. Complete studies that focus on: habitat patch size, elderberry density, and connectivity that influence the viability of individual Valley elderberry beetle populations; influences on demography and reproductive rates of the Valley elderberry longhorn beetle; and factors that influence or limit adult dispersal.	E/2	3	$50,000
5. Conduct surveys for the Valley elderberry longhorn beetle in each HUC8 subbasin to monitor and assess the health of known populations and to locate new populations.	A/2, E/3	2	$100,000
Total Estimated Cost			**$4,440,000**

[1]There are 33 HUC8 subbasins within the range of the Valley elderberry longhorn beetle.
[2]The total cost assumes that acquisition of 5 habitat patches in each subbasin is not required because there are already existing habitat patches that are suitable for the Valley elderberry longhorn beetle that the Service is unaware of or that only need adequate management plans.
[3]The total cost assumes that many existing management plans require only minor updates to address Valley elderberry longhorn beetle conservation.

Estimated Time and Cost of Recovery Actions

The estimated cost of completing the recovery actions such that the criteria have been met and the species may be considered for delisting is $4,440,000. We estimate that these actions could be accomplished by 2050, assuming that only limited areas of suitable habitat have adequate protection. Several factors contribute to the long estimated time to reach the delisting threshold. Although, many presumed extant populations of the Valley elderberry longhorn beetle are known from throughout the range, none have been monitored with enough frequency to determine long-term viability. Additionally, although several areas along the Central Valley river systems are under varying levels of protection, not all of them have adequate considerations for the Valley elderberry longhorn beetle. Recovery actions place an emphasis on acquiring, maintaining, and protecting suitable, connected habitat for the Valley elderberry longhorn beetle. In addition to specific preserves managed for the protection of the Valley elderberry beetle, riparian restoration is occurring throughout the Central Valley that may contain suitable habitat for the Valley elderberry longhorn beetle. Partnerships between federal, State, and non-governmental partners may significantly decrease the time needed to achieve the delisting criteria.

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APPENDIX A – SUMMARY OF PUBLIC, PARTNER, AND PEER REVIEW COMMENTS RECEIVED

Summary of Public Comments

We published a notice of availability in the *Federal Register* on June 27, 2019 (84 FR 30760-30764) to announce that the draft revision for the Recovery Plan for Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*) was available for public review, and to solicit comments by the scientific community, State and Federal agencies, Tribal governments, and other interested parties on the general information base, assumptions, and conclusions presented in the draft revision. An electronic version of the draft revision was posted on the Service's Species Profile website (https://ecos.fws.gov/docs/recovery_plan/Draft%20Revised%20RP%20for%20Valley%20Elderberry%20Longhorn%20Beetle_1.pdf). We also developed and implemented an outreach plan that included (1) publishing a news release on our webpage (https://www.fws.gov/sacramento/outreach/2019/06-26/) on June 26, 2019, (2) sending specific notifications to Congressional contacts in Districts 1, 3, 4, 5, 6, 7, 9, 10, 11, 15, and 16, and (3) sending specific notifications to key stakeholders in conservation and recovery efforts. These outreach efforts were conducted in advance of the *Federal Register* publication to ensure that we provided adequate notification to all potentially interested audiences of the opportunity to review and comment on the draft revision.

We did not receive any comments in response to our request.

Summary of Peer Review Comments

We solicited independent peer review between the draft and final revision in accordance with the requirements of the Act from appropriate Federal agencies, academic researchers, and scientific groups. Criteria used for selecting peer reviewers included their demonstrated expertise and specialized knowledge related to the Valley elderberry longhorn beetle or management of riparian habitat for the Valley elderberry longhorn beetle. The qualifications of the peer reviewers are in the decision file and the administrative record for this recovery plan revision.

In total, we solicited review and comment from 5 peer reviewers and numerous partner agencies. We received comments from 4 peer reviewers and no partner reviewers. Peer reviewers that responded included representatives from one federal agency (Service - Refuges) and three academic researchers. In general, the draft recovery plan revision was well-received by the peer reviewers and garnered positive comments. Several reviewers provided additional specific information, including documents and citations; we thank the reviewers for these data and we have added the information where appropriate.

We considered all substantive comments, and to the extent appropriate, we incorporated the applicable information or suggested changes into the final revised recovery plan. Below, we provide a summary of specific comments received from peer and partner reviewers with our responses; however, we addressed many of the reviewers' specific critiques and incorporated their suggestions as changes to the final revised recovery plan. Such comments did not warrant an explicit response, and as such, are not addressed here. We appreciate the input from all commenters, which helped us to consider and incorporate the best available scientific and commercial information during development and approval of the final revised recovery plan.

Peer Review:

Peer Review Comment (1): One commenter noted that there are not currently data to determine what a "sufficiently large" population of Valley elderberry longhorn beetle would be.

Response: We agreed that the data is not available to determine what sufficiently large populations of the Valley elderberry longhorn beetle might look like and added text to reflect this uncertainty.

Peer Review Comment (2): A commenter noted that with the lack of data on the genetics of the Valley elderberry longhorn beetle we do not know if it has enough genetic adaptive capacity.

Response: We clarified that the Valley elderberry longhorn beetle maintain representation to provide for potential genetic adaptability.

Peer Review Comment (3): A commenter added text to show that stressors such as road dust and pesticides may effect eggs and larva and that host plant stressors also can effect larval development.

Response: We made the suggested changes to the document.

Peer Review Comment (4): A commenter noted that elderberry suitability for the Valley elderberry longhorn beetle is still uncertain and that we do not know what the Valley elderberry longhorn beetle cues into or what elderberry traits provide the best habitat for the Valley elderberry longhorn beetle. They suggested it was also important to maintain genetic and environmental diversity of elderberry. They made suggested edits to the text.

Response: We made the suggested changes to the document.

Peer Review Comment (5): A commenter suggested changes to the core conceptual model to add roads as a stressor and made several suggestions to clarify the text.

Response: We updated the core conceptual model to incorporate the suggested changes.

Peer Review Comment (6): A commenter questioned whether the "80% of the HUC8 subbasins" referred to the total management area or the existing or historic riparian corridor. They also noted that it would be a good idea to support the 80% with a biological/ecological justification.

Response: We reworded the objective to clarify that the criteria is referring to the number of subbasins that should have occupied Valley elderberry longhorn beetle habitat and is not referring to the amount of extant of area within the management unit or riparian habitat. There is no data in the literature suggesting the extent of the population prior to the large-scale change in riparian corridors. However, data suggests that the Valley elderberry longhorn beetle continues to persist throughout its historic range despite significant habitat alteration and losses of populations in certain drainages. We assume that the species as a whole will maintain resiliency without the need for occupancy in 100% of the subbasins.

Peer Review Comment (7): A commenter noted that the HUC8 basins were difficult to see on the map.

Response: We revised the map to include defined boundaries and labels for each subbasin.

Peer Review Comment (8): A commenter noted that some clarity was needed in criteria A/2. They were unclear on the definition of "location" and noted that the selection of "3 locations" should be explained.

Response: We added text to clarify that the patches should be the suitable habitat patches from A/1 and clarified the reasoning behind the need for 3 occupied patches.

Peer Review Comment (9): A commenter noted in Factor E that elderberry appears particularly sensitive to glyphosate and suggested text change.

Response: Added suggested text to the document.

Peer Review Comment (11): A commenter noted that our cover photograph had been misattributed.

Response: Updated attribution text.

Peer Review Comment (11): A commenter noted that it was unclear which HUC8 subbasins covered the Sacramento NWR.

Response: We updated the map to show the national wildlife refuges within the management units for the Valley elderberry longhorn beetle

Peer Review Comment (12): A commenter agreed that restoring habitat and river systems is essential for beetle recovery. "Horticultural restoration has benefited many riparian and floodplain taxa in the shortterm (Golet et al. 2008); however, river physical processes must be restored for long-term survival of various taxa (Golet et al 2013 and Appendix A). This is especially true for Sacramento River NWR, where irrigation wells and electricity are decommissioned and removed after horticultural restoration is completed.

Response: Thank you for the comment.

Peer Review Comment (13): A commenter agreed that recovery action 1 and 2 were particularly necessary for the beetle. The also suggested additional monitoring and research tasks.

Response: Thank you for the comment. We felt that the suggested research and monitoring tasks were broadly captured in Table 2. However, we appreciate the specificity of the recommendations and believe they will be helpful for guiding these actions.

Peer Review Comment (14): A commenter mentioned that they would like to see a metric that reflected feasibility in Table 2. The feasibility would help provide a "roadmap" for planned land acquisition and management and would be paired with a literal description of when and where these actions would be accomplished.

Response: It is the Service's opinion that all of the actions in Table 2 are feasible. This plan update was intended to provide direct, measureable criteria for recovery of the beetle. A full "roadmap" would be included in an implementation strategy.

Peer Review Comment (15): A commenter questioned our strict interpretation of data in Talley 2007 given the uncertainty inherent in the study. They noted that giving a precise demographic meaning

to the distances between elderberry clusters because occupancy could be correlated across these distances for a variety of reasons including physical or chemical conditions or because a demographic process was similar across the distance. The commenter suggested that the most meaningful figure is that separate aggregations of beetles occurred at distances of between 200-800 meters, which suggest that distances of less than this represented more distinct demographic units. The reviewer suggested that this interpretation issue carried over to criterion A/1 and suggested changing the text to reflect a different approach to the interpretation of aggregations and distances.

Response: We reevaluated our interpretation of the data presented in Talley 2007 based on the above comment. In places noted at problematic by the commenter we modified the language to reflect the suggested interpretation of the data.

Peer Review Comment (16): A commenter noted that it was not clear what "habitat patch" referred to in Table 1.

Response: We added text indicating that the habitat patches were the ones identified in A/1.

Peer Review Comment (17): A commenter noted that we had given an incomplete account of the Collinge et al. (2001) study and misstated the dates of the study.

Response: We revised the language in the document to give a more complete accounting of the results of Collinge et al. (2001) and its implications for the beetle. We also revised the dates of the study.

Peer Review Comment (18): A commenter suggested that our cited definition for metapopulation was not the expected definition and suggested a more general one. They also noted that our distinction between migration and dispersal was not particularly clear.

Response: We revised the text with the more general version suggested by the commenter and updated the references as needed.

Peer Review Comment (19): Several commenters recommended altering text for clarity or adding, deleting, or revising specific in-text references or references included as literature cited in the Draft Plan.

Response: We made the suggested changes to the in-text references and literature cited.

Peer Review Comment (20): Several commenters noted that the Service had adequately captured the current status and threats affecting the Valley elderberry longhorn beetle and expressed support for the recovery actions outlined in the Plan

Response: Thank you for the comment.