DRAFT RECOVERY PLAN

FOR

CHAPARRAL AND SCRUB

COMMUNITY SPECIES EAST OF SAN FRANCISCO BAY,

CALIFORNIA

(November 2002)

Region 1
U.S. Fish and Wildlife Service
Portland, Oregon

Approved: XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Manager, California/Nevada Operations Office, Region 1,
U.S. Fish and Wildlife Service

Date: ______________________________________

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EXECUTIVE SUMMARY

Introduction: This recovery plan covers six species of plants and animals that occur predominantly in chaparral and scrub habitat, primarily in a four-county area east of San Francisco Bay in California. One plant, *Arctostaphylos pallida* (pallid manzanita), and one animal, Alameda whipsnake (*Masticophis lateralis euryxanthus*), are federally listed as threatened. In addition, four species of concern are addressed, three plants (*Arctostaphylos manzanita* ssp. *laevigata* [Contra Costa manzanita], *Cordylanthus nidularius* [Mt. Diablo bird's-beak], and *Eriogonum truncatum* [Mt. Diablo buckwheat]) and one animal (Berkeley kangaroo rat [*Dipodomys heermanni berkeleyensis*]). The latter two are presumed extinct.

To varying degrees the loss, fragmentation, and degradation of habitat has resulted in, or continues to cause, the decline of species covered in this recovery plan. This trend is likely to continue. The Association of Bay Area Governments projects 1.4 million new residents will work and live within the greater San Francisco Bay area by the year 2020. The counties east of San Francisco Bay are expected to lead the region in this growth. As the population grows, protecting remaining habitat and conducting land management actions essential for species recovery are likely to become more difficult. Whether it be returning natural disturbance regimes to fire adapted habitats such as chaparral, or conducting fuel reduction for the prevention of catastrophic wildfires, conducting vegetation management on highly flammable habitats within the urban/wildland interface will be a challenge.

The Endangered Species Act mandates the preparation of recovery plans for listed species unless such a plan would not contribute to their conservation. Recovery plans detail the actions necessary to achieve self-sustaining, wild populations of listed species so they will no longer require protection under the Endangered Species Act. Species of concern are not required to have recovery plans. However, nonlisted species are included in this recovery plan because a community-level strategy provides opportunities for pre-listing conservation of species that have needs similar to those of listed species.

Recovery Objectives: The ultimate goal of this recovery plan is to delist the two threatened species and to ensure the long-term conservation of the extant species of concern. For the two presumed extinct species of concern the immediate goal is to confirm their status. If the species are not rediscovered, insights gained about the reasons for their extinction may assist in community restoration. If extant populations of the species are discovered, the ultimate goal would be to ensure their long-term conservation.

Recovery Priority: Priority numbers, per criteria published by Federal Register notice (48 FR 43098; September 21, 1983), are 9C for Alameda whipsnake and 11C for *Arctostaphylos pallida*.

Community-Level Strategy for Recovery and Conservation: This recovery plan presents a community-level strategy for recovery and conservation because all of the listed and nonlisted species addressed here co-occur in the same natural communities. The likelihood of successful recovery for listed species is increased by protection of intact communities. Protecting the community will provide opportunities for pre-listing conservation of nonlisted species, which likely have needs similar to those of listed species. The community-level strategy is determined by the available information on biology, distribution, and population status of covered species; extent, location, and quality of existing habitats; and how present and anticipated land and fire management activities will affect these species within the landscape east of San Francisco Bay. The major goals of the recovery strategy include:

- formation of a Recovery Implementation Team that will work to develop and implement both immediate and long-term cooperative active management of the chaparral and scrub communities;

- protection of identified habitat from development, fragmentation, degradation, and incompatible uses;

- restoration of successional habitat through reintroduction of the natural disturbance regime (fire);

- protection of populations representing the full range of genetic variation and geographic extent of the species (including reintroduction as necessary); and

- achievement of self-sustaining status in specified populations.

The four key elements that compose this community-level recovery and conservation strategy are described below:

1. Recovery Criteria

The community-level approach facilitates species recovery and conservation but does not negate the need to consider the requirements of each species. Thus, separate criteria are given in the recovery plan for delisting the two threatened species and for achieving long-term conservation of the four nonlisted species of concern, in order to track their progress toward recovery or conservation and ensure that all of their recovery and conservation needs are addressed. Community health indicators will be monitored to determine appropriate adaptive management techniques

Common elements of the recovery criteria for *Arctostaphylos pallida* and the Alameda whipsnake, and conservation criteria for the species of concern, are that:

- Specified recovery areas are secured and protected from incompatible uses.

- Management plans oriented to species conservation (and adaptively updated based on current research) are approved and implemented for recovery areas.

- Monitoring in recovery areas demonstrates stable or improving trends in species populations and successional diversity of natural habitat.

- Threats are ameliorated or eliminated, and fire techniques for habitat management are studied and implemented.

Protection strategies for species of concern are based on the assumptions that if populations are secure from threats, co-occur with listed species, are stable or increasing, and remain extant throughout the species' historical range, their long-term conservation will be ensured.

2. Habitat Protection

Building on an already extensive network of large land holdings (Federal lands, State, regional, and local parklands, and water district lands), this recovery plan focuses on restoring habitat; reviewing and determining if existing protection mechanisms (*e.g.*, conservation easements, deed restrictions, agency policies) are adequate; and developing priorities for future land or easement purchases. In some cases, protecting smaller land holdings, typically in private ownership, may be essential for recovery. These holdings may help maintain corridors for dispersal or protect the full range of genetic variation and geographic extent of a species. Special care must be taken to work cooperatively with all landowners. Providing financial and other incentives for landowners to continue species-compatible land uses and accept conservation easements is of a high priority.

Reducing further fragmentation of habitat is crucial for recovery. In some cases unoccupied habitat, if in a corridor area or area needed for population augmentation, reintroduction, or introduction, can be as crucial to recovery as the protection of occupied habitat. Planning and diligence on the part of the Recovery Implementation Team will be necessary to avoid the loss of recovery opportunities due to further fragmentation.

3. Monitoring and Research Programs

This recovery plan has been developed based on the best scientific information currently available. However, many important aspects of species biology and management have not yet been studied. Thus, continued research, in conjunction with adaptive management, is a crucial component of this plan. Recovery criteria and tasks must be reevaluated for each species as research is completed.

Primary information needs for the species covered in this recovery plan are:

- studies of the effects of fire management options on species;
- assessment of chaparral and scrub community health;
- habitat management research;
- studies of ecology and biology;
- surveys to better determine species distribution, abundance, and genetic variability; and
- studies of reproduction and demography

4. Adaptive Management

In many cases, active management of the land is necessary both to address vital fire management issues and/or to maintain and enhance habitat values for the species covered in this recovery plan. However, management strategies have not been investigated for most species and fire management needs to proceed. Management related research may take multiple years to complete, and although management plans exist for many of the large landholdings, management specifically addressing recovery of these species either has not been developed, is not in place, or does not address the needs of both the species and fire management. The only practical approach is adaptive management, where management is applied, population responses are monitored, the outcomes are evaluated, and management is readjusted accordingly.

The return of natural processes, such as disturbance, to the chaparral and scrub communities is essential for long-term, large-scale community health. Reintroducing disturbance, including fire, will require cooperative efforts among various agencies and acceptance by all stakeholders including the general public. Adaptive management will be used to determine the most biologically sound and efficient techniques within the overarching framework of safe fire management.

Implementation Participants: Although we have the statutory responsibility for implementing this recovery plan, and only Federal agencies are mandated to take part in the effort (through land ownership, licensing, or permitting responsibilities), the participation of a variety of groups in both initial recovery plan implementation and the subsequent adaptive management process, is essential to successful recovery. This recovery plan recommends the establishment of a regional, cooperative public/private Recovery Implementation

Team to enlist the participation of all stakeholder groups and interested parties. This team will develop participation plans, coordinate education and outreach efforts, assist in developing economic incentives for conservation and recovery, ensure that adaptive management is practiced, and oversee the implementation of other recovery and management tasks.

Total Estimated Cost of Recovery: The total estimated cost of recovery for the two federally listed species and conservation of the four nonlisted species of concern is broken down by priority of tasks. Certain costs, such as land acquisition for the Alameda whipsnake and some of the management actions, have yet to be determined.

Priority 1 tasks: Total $6,403,000+
Those actions that must be taken to prevent extinction or prevent the species from declining irreversibly in the foreseeable future.

Priority 2 tasks: Total $5,867,600+
Those actions that must be taken to prevent a significant decline in species population or habitat quality, or some other significant negative impact short of extinction.

Priority 3 tasks: Total $742,500+
All other actions necessary to meet recovery objectives.

There are likely to be additional costs that are yet to be determined.

Date of Recovery: Because recovery is defined in relation to community health, which is thought to be dependent on disturbance regimes such as fire, the date of recovery for the Alameda whipsnake is anticipated to be a minimum of one and one-half fire cycles or 45 years (based on 30-year fire cycles in coastal scrub). The time anticipated for recovery of *Arctostaphylos pallida* is anticipated to be a minimum of at least three fire cycles or approximately 120 years (based on 40-year fire cycles in maritime chaparral).

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I. INTRODUCTION

Alameda, Contra Costa, and western San Joaquin Counties lie just east of San Francisco Bay and are in the northern portion of the southern Coast Range. California's Coast Ranges extend over 800 kilometers (500 miles) from near the Oregon border southward to the Santa Barbara area. San Francisco Bay divides them into two ranges, the northern and southern Coast Ranges (Schoenherr 1992).

On the coastal side of the southern Coast Range, the climate is heavily influenced by the presence of comparatively cold water offshore. As a result, heavy fog often cloaks the coastal slopes. This influence of the maritime climate has resulted in diverse assemblages of plants (such as coastal sage scrub, northern coastal scrub, and maritime chaparral), which are watered with the fog drip characteristic of this region. Another important component of the vegetation in the southern Coast Range is chaparral, which dominates on hot south-facing slopes. Cooler north-facing slopes tend to be occupied by woodlands and the interior valleys of the Coast Ranges are dominated by annual grasslands. This distinctive patterning of vegetation is also influenced by soil, slope, and fire, and is accentuated by the long, dry summers of the area's Mediterranean climate (Schoenherr 1992). This variety of vegetation has led to unique assemblages of insects, birds, reptiles, amphibians, and mammals.

The Diablo Range is part of the inner south Coast Range of California. The Diablo Range is 32 to 48 kilometers (20 to 30 miles) wide and extends in a northwest to southeast direction as a more or less continuous mountain chain for approximately 300 kilometers (190 miles) from San Pablo Bay in central California to Polonio Pass in northeast San Luis Obispo County. The Diablo Range varies from 600 to 1,280 meters (2,000 to 4,200 feet) in elevation and is broken by four or five east to west passes. These passes divide the Diablo Range into several distinct units: Contra Costa Hills, Mt. Diablo, Mt. Hamilton Range, Panoche Hills, San Carlos Range, and Estrella Hills (Sharsmith 1982). This recovery plan covers chaparral and scrub communities in Alameda, Contra Costa, western San Joaquin, northern Santa Clara, and southern Solano Counties (Figure 1).

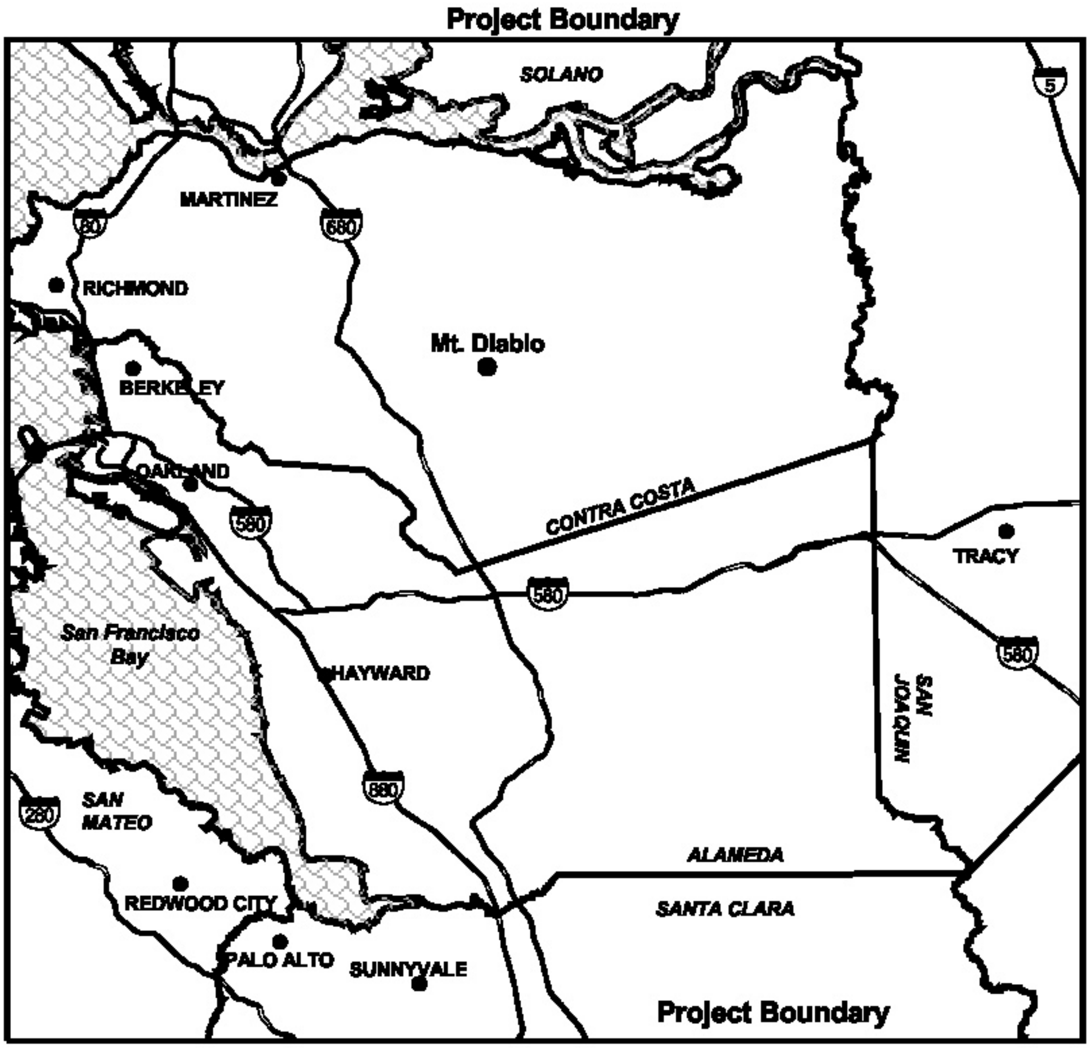


Figure 1. Map of Plan Area.

10 0 10 Miles

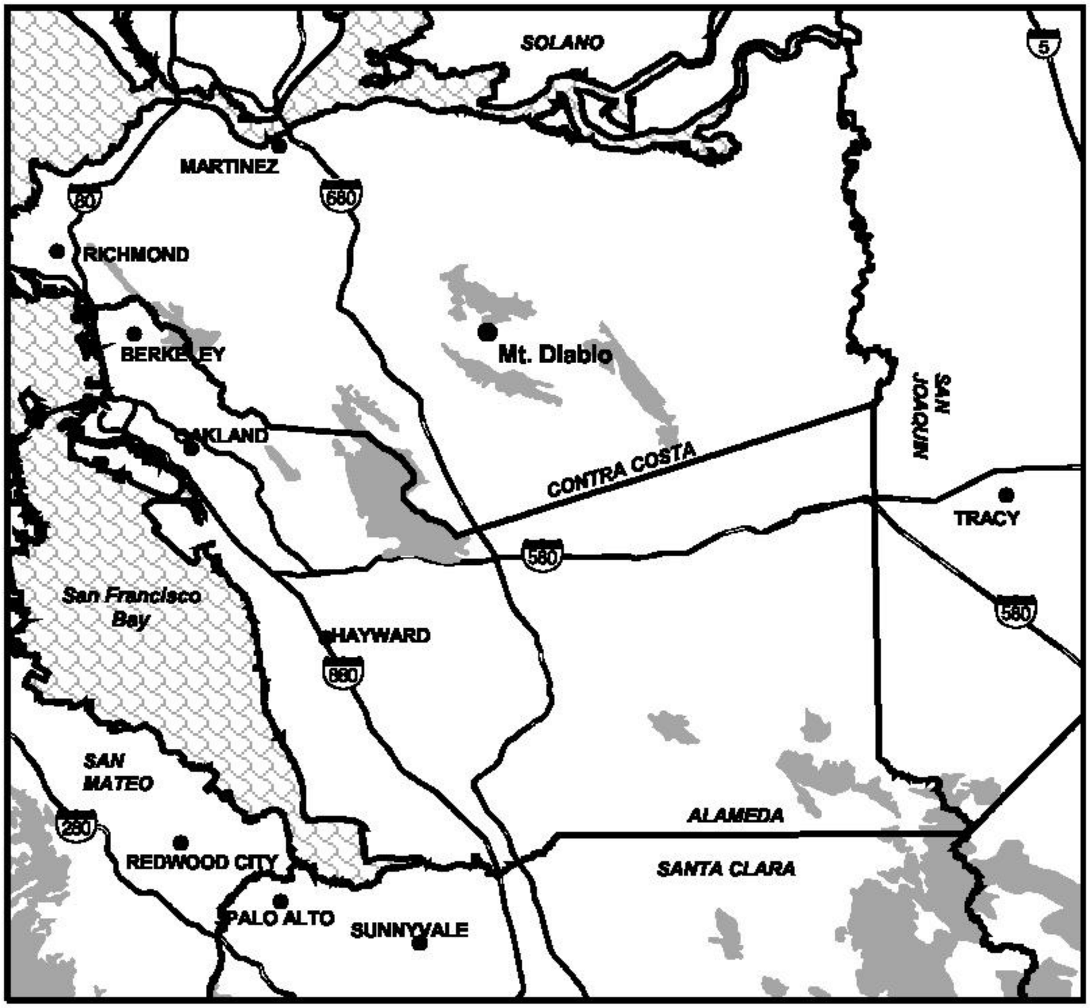
1:650,000

USFWS Draft Recovery Plan

Portions of the Diablo Range are thought to have been surrounded by marine embayments (seawater) since the middle Miocene era, when modern plants and animals were developing. Much of the surface of the Diablo Range is composed of Franciscan series rock. The soils formed from Franciscan rock are believed to partially control the present distribution of certain plant species in the Diablo Range (Sharsmith 1982). Serpentine rock, which is a frequent component of Franciscan rock, yields a soil rich in heavy metals and low in nutrients required for plant growth (Kruckeberg 1984). Because of this unique serpentine soil, a distinctive and specialized group of plant species has developed.

Fire has played and continues to play a role in shaping the vegetative communities of the Diablo Range. Many fire-adapted plant species occur here, at times defining communities by their presence. The normal succession of vegetation can be interrupted by fire, producing a patchwork or mosaic of different plant communities, or communities with differing age classes (Bowerman 1944).

The area covered by this recovery plan is within a zone of biogeographical transition between coastal and interior habitats, between lowland grassland and higher elevation woodland and chaparral, and between southern and northern elements of the Coast Ranges flora. All of these influences give rise to the relatively high degree of local and regional biodiversity in the area east of San Francisco Bay. Maintaining biological diversity requires attention to the ecosystem, the species within those ecosystems, and the genetic makeup of those species (Wilcox 1998). This recovery plan will focus on maintaining biological diversity of the chaparral and scrub community (an ecosystem component), selected species within this community, and the genetic integrity of these selected species (Figure 2).



Landcover data from Davis et al. (1998). Areas of chaparral smaller than 100 hectares (247 acres) were not delineated.

Figure 2. Map of chaparral / scrub vegetation.

10 0 10 Miles

1:650,000

USFWS Draft Recovery Plan

A. Overview

1. Species Represented

Listed Species. - This recovery plan covers the Alameda whipsnake (*Masticophis lateralis euryxanthus*) and *Arctostaphylos pallida* (pallid manzanita), which are federally listed as threatened (Table 1).

Unlisted Species. - Additionally, this recovery plan covers three plants and one animal that are not federally listed but have been previous candidates for Federal listing, are currently State listed and/or recognized by the California Native Plant Society as rare, or are presumed extinct (Table 1). These species are *Arctostaphylos manzanita* ssp. *laevigata* (Contra Costa manzanita), *Cordylanthus nidularius* (Mt. Diablo bird's-beak), *Eriogonum truncatum* (Mt. Diablo buckwheat), and the Berkeley kangaroo rat (*Dipodomys heermanni berkeleyensis*). The latter two species are now presumed extinct.

The two species that are presumed to be extinct are included because plants and animals thought to be gone have sometimes been "rediscovered". In the period between 1988 and 1994, 13 plant taxa were rediscovered in California. As natural habitat in California continues to shrink, time runs out for chance encounters with these species. Plants that have not been seen in 50 years may still have viable seed at historical locations, but once those locations are paved or the soil too degraded those species may become extinct. A comprehensive approach toward rediscovery may very well prove fruitful; if so, measures could then be taken to safeguard the individuals and their habitat (Skinner *et al*. 1999). If, however, the species is not rediscovered, the knowledge gained during surveys of historical and remaining habitat may provide clues to the reasons they vanished and could well be crucially important for protecting the habitat or community from further degradation. *Eriogonum truncatum* and the Berkeley kangaroo rat both were historically found in chaparral and scrub communities and adjacent grasslands. Including these two species in comprehensive surveys conducted for the other species covered in this plan may result in the discovery of extant populations.

Table 1. Species covered in the draft recovery plan for chaparral and scrub community species east of San Francisco Bay, California

Species	Status[a]	Recovery Priority[b]	Federal Listing Date and Reference; State Listing Date	Comments[c]
Eriogonum truncatum (Mt. Diablo buckwheat)	1A			Category 1 in 1980, determined not warranted in 1993; Presumed extinct
Cordylanthus nidularius (Mt. Diablo bird's-beak)	SR, 1B		none; 6 Oct 1978	Category 1 in 1980, removed in 1996; Population status - unknown
Arctostaphylos manzanita ssp. *laevigata* (Contra Costa manzanita)	1B			Population status - unknown
Arctostaphylos pallida (pallid manzanita)	FT, SE, 1B	11C	22 Apr 1998 (63 FR 19842); 5 Oct 1979	Population status - declining
Berkeley kangaroo rat (*Dipodomys heermanni berkeleyensis*)				Category 2 in 1994, no current Federal Status; Presumed extinct
Alameda whipsnake (*Masticophis lateralis euryxanthus*)	FT, ST	9C	5 Dec 1997 (62 FR 64306); 27 June 1971	Population status - declining

[a] FE: federally endangered. FT: federally threatened. SE: State endangered. ST: State threatened. SR: State rare. 1A: California Native Plant Society - Plants Presumed Extinct in California. 1B: California Native Plant Society - Rare, Threatened or Endangered in California and elsewhere.

[b] Recovery Priority: See Appendix A for how recovery priorities are established for listed species. Only federally listed species are assigned a recovery priority number.

[c] Category 1 candidates were those taxa for which we had on file substantial information on biological vulnerability and threats to support preparation of listing proposals. Category 2 candidates were those taxa for which data in our possession indicates listing is possibly appropriate, but for which substantial data on biological vulnerability and threats are not currently known or on file to support the proposed rule. Categories 1 and 2 were discontinued in 1996; these categories no longer apply.

Within the Contra Costa Hills section of the Diablo Range lie the Oakland/Berkeley Hills, which form a moderately rugged belt about 24 kilometers (15 miles) long and 16 kilometers (10 miles) wide with a prominent western-facing scarp (Hinds 1952). Situated immediately east of San Francisco Bay, the vegetation is influenced by maritime climate; fog drip may account for an equivalent of 25 centimeters (10 inches) of precipitation in the Berkeley Hills (Schoenherr 1992). Both the Alameda whipsnake and *Arctostaphylos pallida* occur within the Contra Costa Hills section of the Diablo Range. *Arctostaphylos pallida* is restricted to the Oakland/Berkeley Hills, primarily on north and east facing slopes where bare, siliceous (rich in the mineral silica), mesic (containing medium amounts of moisture) soils with low fertility exist (Amme and Havlik 1987*a*). The Berkeley kangaroo rat once occurred in this area but is now presumed to be extinct.

Mount Diablo is an isolated peak within the Diablo Range. The main peak (Summit of Mount Diablo) rises to a height of 1,166 meters (3,849 feet). North Peak, 1,080 meters (3,563 feet) high, is northeast of the main peak, to which it is connected by a long ridge. The north side of the mountain as a whole is steep. On the south and southeast sides, Mount Diablo drops down at first steeply and then more gently. A narrow strip or outcrop of serpentine, less than 0.8 kilometers (less than ½ mile) wide and about 8 kilometers (5 miles) long, runs north of the summit in a northeasterly direction, passing just north of Deer Flat. Mount Diablo has a Mediterranean climate with infrequent summer fog. However, at other times of the year fog may cover the summit or the lower parts of the mountain, and on occasion snow falls on the summit (Bowerman 1944). These climatic conditions, together with slope aspect and soil and rock types, determine plant communities (Schoenherr 1992). The Alameda whipsnake occurs on Mt. Diablo, along with *Arctostaphylos manzanita* ssp. *laevigata* and *Cordylanthus nidularius*. *Eriogonum truncatum* and Berkeley kangaroo rat once occurred in this area but are now presumed to be extinct.

The Mount Hamilton Range is the last subdivision of the Diablo Range that is covered in this recovery plan. Forming an unbroken, well defined, and relatively isolated mountain block approximately 80 kilometers (50 miles) long and 48 kilometers (30 miles) wide, it is delimited on the north by Niles Canyon, Sunol Valley, Livermore Valley, and Altamont Pass (all in Alameda County), and on the south by Pacheco Pass in southern Santa Clara County. Within the most northerly portion of the Mount Hamilton Range lies Sunol and Cedar Mountain Ridge. The area just north of Alameda County's border with Santa Clara County is the southernmost extent of the Alameda whipsnake. *Eriogonum truncatum* and Berkeley kangaroo rat once occurred in this area but are now presumed to be extinct.

2. Biotic Communities Represented

Six community designations have been chosen to represent this floristically complex area: chaparral, maritime chaparral, coastal sage scrub, edaphic communities, annual grasslands, and woodlands.

Chaparral. - Chaparral is a floristically rich, shrub dominated community, supporting approximately 240 species of woody plants (Ornduff 1974). Shrubs in this community are mostly evergreen, with leaf characteristics such as resinous, waxy, or ill-tasting coatings, which decrease water loss or discourage herbivores. Woody stems and relatively deep root systems are also characteristic of the evergreen species within chaparral. Nutrient and water absorption in chaparral evergreens (*e.g.*, *Adenostoma fasciculatum* [chamise] and *Arctostaphylos* [manzanitas]) seems to be enhanced by mycorrhizal fungi. Above-ground growth of evergreen shrubs occurs for 4 to 6 months during the winter and spring. The rest of the year, growth goes into the roots. Common evergreen shrubs include *Arctostaphylos* spp., *Baccharis pilularis* (coyote brush), and *Adenostoma fasciculatum*. Many chaparral plants have growth or reproductive strategies to survive drought and fire. In the Coast Ranges, chaparral typically occurs on south-facing slopes or in association with serpentine or other depauperate (poor) soils (Schoenherr 1992).

Maritime Chaparral. - Maritime chaparral is a unique kind of chaparral that occurs in patches on the coastal side of the southern Coast Ranges. Shrubs here form low, conspicuous mounds in open areas among *Quercus* (oak) or *Pinus* (pine) woodlands (where planted *Eucalyptus* spp. may also be present). The significant feature that differentiates this form of chaparral from that in the southern part of the state is the presence of abundant summer fog. Many maritime chaparral species have adaptations to survive both drought and fire. Maritime chaparral is dominated by a number of endemic *Arctostaphylos* and *Ceanothus* (California lilac) species. The community also includes *Adenostema fasciculatum*, the most common species in many chaparral communities (Schoenherr 1992). In the Coast Ranges, maritime chaparral occurs in patches on the coastal side of the Ranges.

Coastal Sage Scrub. - The coastal sage scrub community has been called soft chaparral because many of the dominant plants bend easily and/or have soft, flexible leaves. Many of the shrubs are odoriferous, such as *Salvia mellifera* (black sage), or are drought-deciduous as is the case with *Mimulus aurantiacus* (bush monkeyflower) and *Artemisia californica* (California sagebrush). Coastal sage scrub thrives under the influence of a maritime climate; however, it is not restricted to coastal regions and can be found inland in locations where there is fog (such as Mt. Diablo). Precipitation from rain may be low in these areas, averaging 25 centimeters (10 inches), but high humidity keeps evaporation rates low and fog drip provides enough moisture for these shallow rooted plants (Schoenherr 1992). Northern coastal scrub is the variety of coastal sage scrub found from Point Sur, Monterey County, north to southern Oregon. Most of the shrubs are evergreen, and there is an important herbaceous element. Dominant shrubs include *Baccharis pilularis*, *Eriodictyon californicum* (California yerba santa), *Gaultheria shallon* (salal) and *Lupinus arboreus* (yellow-flowered tree lupine). Coastal sage scrub and northern coastal scrub plants have adaptations to survive drought and fire (Schoenherr 1992). Structure differs among stands, ranging from patchy oceanside cover of nearly prostrate subshrubs to the tall shrub layer (up to 2.0 meters or 7 feet) found at Mt. Diablo (Mooney 1988). In the Coast Ranges, coastal sage scrub occurs on south and north-facing slopes. On north-facing slopes the vegetation is more chaparral-like (Schoenherr 1992).

Edaphic Communities. - Edaphic communities grow on specialized soils such as those derived from the rock serpentinite. Plants can be endemic (growing only in that specialized soil), facultative (able to grow in specialized or nonspecialized soil in the same location), or indicator plants (able to grow on nonserpentine soils but exclusively utilize serpentine soils in certain geographic locations). In the Coast Ranges within Alameda, Contra Costa, and western San Joaquin Counties, indicator species for serpentine outcrops include *Pinus jeffreyi* (Jeffrey pine) and *Calocedrus decurrens* (incense cedar). A facultative species is *Adenostoma* *fasciculatum*, which may be dwarfed and slow-growing on serpentine soils. Growth on serpentine soils requires drought tolerance and the ability to deal with high concentrations of certain minerals such as nickel and chromium (Schoenherr 1992). Some species may also be adapted to survive fire. In the Coast Ranges, serpentine soils are associated with certain fault zones. In Alameda, Contra Costa, and western San Joaquin Counties, serpentine soils are associated with the Hayward Fault Zone and occur in the Oakland/Berkeley Hills and on Mt. Diablo (McCarten 1987).

Annual Grasslands. - European settlement has permanently altered California's grasslands. A combination of factors are thought responsible: (1) invasion by nonnative plant species, (2) changes in herbivorous animals and their grazing patterns, (3) cultivation, and (4) changes in the natural fire regime (Heady 1988). Today's annual grasslands of California include a wide mixture of mostly nonnative species, which respond to local site variation in soil nutrients (McGown and Williams 1968), temperature, or moisture, or are limited by allelopathic antagonisms (toxic exclusion by other plants) (Heady 1988). Annual plants begin to germinate in the fall with the first rains, grow slowly through winter and rapidly in spring, and mature in early summer. By summer the plants have set seed and died. Buried viable seeds may live for years. Much of the grassland in Alameda, Contra Costa, and western San Joaquin Counties (in fact, over 3,200,000 hectares or 8 million acres statewide) has been invaded by *Centaurea solstitialis* (yellow star-thistle). Methods for control of this noxious nonnative weed include burning over 3 consecutive years, controlled grazing during the bolting stage (May through June), mowing, irrigating, and planting other species that will outcompete *C. solstitialis* (Thomsen *et al.* 1994). The first two methods are those most often used in Alameda, Contra Costa, and western San Joaquin Counties. In the Coast Ranges annual grasslands occur adjacent to the chaparral and scrub communities mentioned above. Several of the species in this plan use this interface between grassland and chaparral or scrub.

Woodlands. - Woodlands are also intermixed with or adjacent to many chaparral/scrub communities. A variety of woodland communities exist within the recovery plan area. These woodland communities may include various *Quercus* (oak) species, mixed evergreens including *Pinus sabiniana* (grey pine), *Sequoia sempervirens* (coast redwood), *Arbutus menziesii* (Pacific madrone), *Umbellularia californica* (California bay); the summer-dormant *Aesculus californica* (California buckeye), and *Acer macrophyllum* (bigleaf maple), a common component of riparian vegetation. In the early 1900's *Pinus radiata* (Monterey pine) was planted to forest the barren hills in preparation for coming real estate developments, and nonnative *Eucalyptus* species were planted for hardwood production (East Bay Regional Park District *in litt*. undated) and as windbreaks.

3. Natural Disturbance Regimes

The natural disturbance regime most commonly associated with chaparral/scrub communities is fire. Other natural disturbances, such as landslides, droughts, and herbivory, have also affected these communities but to a lesser extent. Chaparral communities have evolved in association with fire over millions of years, and in fact require fire for proper health, vigor, and reproduction. Most chaparral plants have adaptations enabling them to recover after a burn, by sprouting from roots or root-crown burls, having seeds that require fire to break dormancy, or requiring fire to remove shrub-derived toxins in the soil that inhibit seed germination. Additionally, some herbaceous species will not germinate unless ash is present on the ground when it rains. Some characteristics of chaparral species, such as the volatile oils found in certain species (especially in the leaves), seem to facilitate fire.

Fire may be a necessary environmental factor for chaparral stands composed only of *Adenostoma fasciculatum* (chamise), as these stands do not seem to be sustainable in the absence of fire (Hanes 1988). After a natural disturbance such as fire, succession in chaparral generally passes through several stages. For the first 1 to 3 years, cover is dominated by short-lived herbs and subshrubs. Shrubs are present as seedlings and root-crown sprouts. From 3 to 15 years, herbaceous species disappear as shrubs and subshrubs enlarge, but the canopy remains open. From approximately 10 to 30 or more years, the shrub cover increases, the canopy begins to close, relatively short-lived shrubs begin to die, and dead material accumulates (England 1988). This timeline can be affected by species composition, slope, aspect, elevation, precipitation, and soil type. In northern California, because of the more mesic (wetter) conditions, a chaparral stand may become decadent in 20 to 25 years (Sampson 1944) and senile when older than 60 years (Hanes 1988). As chaparral stands age, diversity may decrease. For example, *Eriodictyon* (yerba santa), *Lotus scoparius* (common deerweed), and many *Ceanothus* species are relatively short-lived (less than 40 years) shrubs and subshrubs that disappear from stands that have not been disturbed for decades (Hanes 1988). Increasing age also reduces the growth and reproduction of individual plants (Schoenherr 1992). The amount of canopy closure is strongly affected by the age of the stand. Under some conditions the chaparral species may be overtopped by woodland species, leading to loss of the chaparral community altogether (Hanes 1988). Within pure stands of *A. fasciculatum*, the levels of plant-produced toxins and water-repellent substances in the soil appear to inhibit the germination of *A. fasciculatum* itself and may, in part, be responsible for the decadence (Hanes 1988).

Coastal scrub may not change greatly in the absence of disturbance (deBecker 1988). However, some evidence exists that coastal scrub may be invaded by chamise, chaparral, forest or woodland species after a 50-year lapse in disturbance (McBride 1974 as cited in deBecker 1988)

Fires in Mediterranean ecosystems affect animal communities as well. Fires can kill animals directly through incineration and asphyxiation and indirectly through changes in the plant community (Quinn 1994). However, many species are able to survive fires and flourish in the post-fire years. Fire survival by reptiles can be readily explained by the need of most reptiles to escape heat in hot, sunny Mediterranean climates. Wildfires are most likely to occur during the day and in hot weather, when many reptiles would be occupying heat refugia (Quinn 1994), or would be in a thermoregulatory state allowing them to outrun the fire. Small mammals are likely to sustain losses. However, populations of some species of kangaroo rat (*Dipodomys* spp.), a nocturnal burrowing rodent, are known to survive fires (Chew *et al.* 1959 as cited in Quinn 1994, L. Saslaw pers. comm. 1998). Marked changes in animal species composition and abundance may be seen in post-fire years. For example, soil dwelling insects may decline while foliage insects may become quite abundant. Force (1981, as cited in Quinn 1994) postulated that the abundance of insects present the spring after fire was due to migration from unburned areas or from islands of unburned vegetation. In Californian chaparral, the maximum number of species and individuals of reptiles is reached in the early years after fire, when regenerating shrubs provide an optimal mixture of cover and open areas for foraging and thermoregulation (Quinn 1994). Mammals undergo the greatest and most variable short-term changes in response to fire, with some species' populations being severely depleted and others showing sharp increases (Quinn 1994). The sequence of plant succession and the nearest source population undoubtedly play a role in the various responses of vertebrate and invertebrate species during post-fire years.

Prior to fire suppression, it is likely that naturally occurring fires were kept in check by previously burned areas, and by limited dead understory or fuel load. Much of the chaparral habitat in the east Bay area has not burned for many decades (Figure 3). Heavy fuel loads caused by historic fire suppression increase the risk of catastrophic wildfire. This fuel load in close proximity to human habitation presents great concern to local, regional, and State jurisdictions. Large, hot fires can kill threatened and endangered species and may adversely affect the proper functioning of the chaparral community. Animal and insect species normally able to escape by fleeing or burrowing may not survive the intense heat and smoke from rapidly spreading fires fueled by excess dead understory. Recolonization by these species will be more difficult the larger the area burned. If fires are too hot, reestablishment of shrubs may not progress quickly enough to provide chaparral habitat, and the resulting erosion when the rains come can result in a significant loss of already limited topsoil (Schoenherr 1992). Presently, rather than completely suppressing fire, agencies are managing fire in these high-risk areas. Current fire management includes prescribed burning and requirements for homeowners to use specific plants and housing materials, clear brush away from their homes, and create fire breaks on their property.

Reestablishment of, and succession within, the chaparral community following a fire is still being investigated. Along with fire intensity, the length of time between fires, the amount of nitrogen removed from the soil, the growth patterns of the various chaparral species, and the grazing regime all affect how the chaparral community will look and function in the years after a fire (Christensen 1994, Naveh 1994, Quinn 1994, Keeley 1987).

Information on the long-term effects (*e.g.* greater than 50 years) on chaparral from fire substitutes, such as scraping, are unknown. With scraping we are concerned

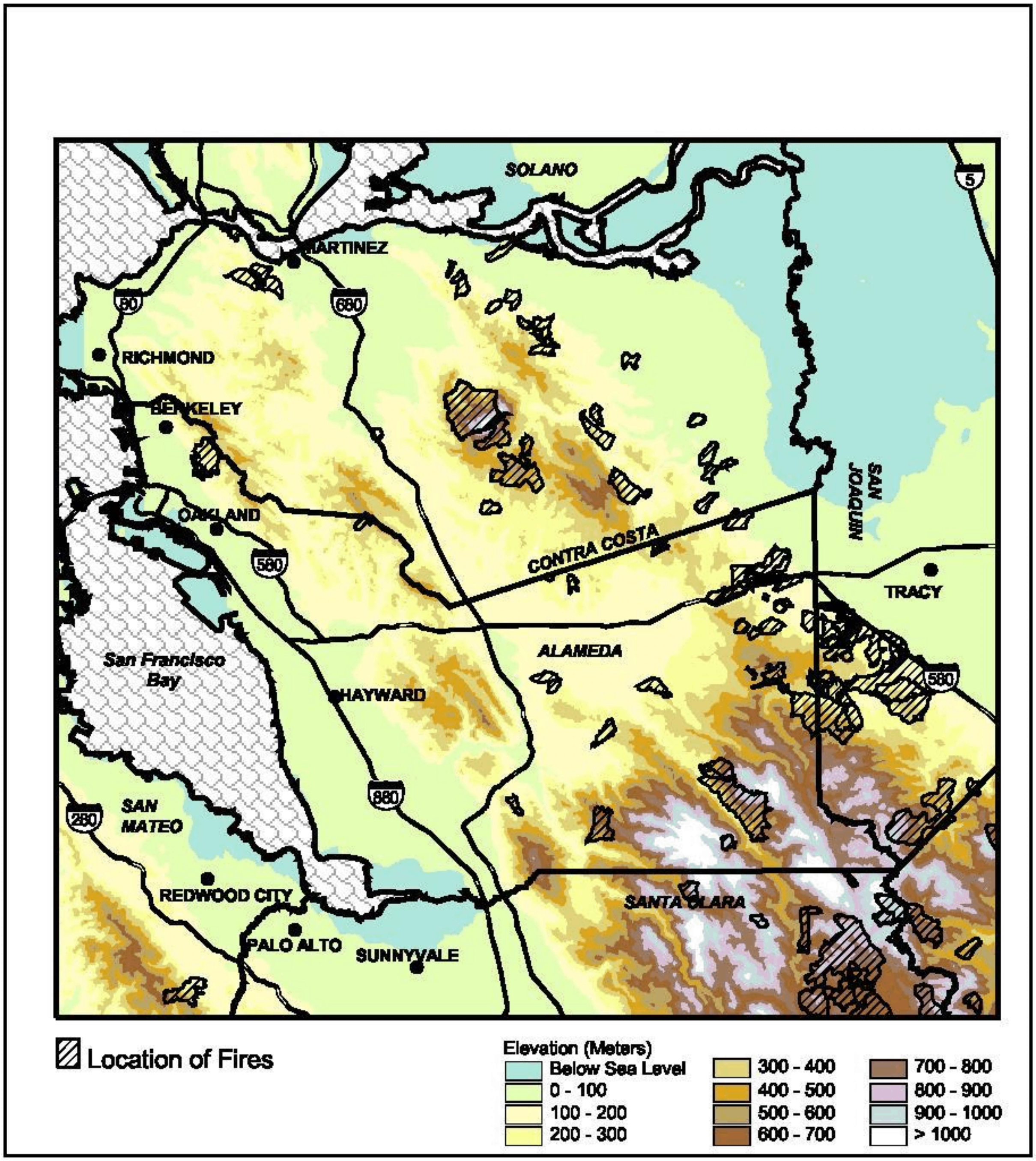


Figure 3. Locations of fires from 1951-1996. (California Department of Forestry and Fire Protection, 1999)

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that the topsoil characteristics, nutrient cycling, seed bank integrity, microtopography, and soil chemistry could be altered over time. Such alterations to soil characteristics may put species such as *Arctostaphylos pallida*, an obligate to depauperate soils, at risk of being out-competed by other species.

B. Reasons for Decline and Threats to Communities

Human habitation and increasing urbanization threaten the chaparral and scrub communities and the species covered in this recovery plan. All species in the plan are threatened by loss and fragmentation of habitat and by interference with the habitat's natural disturbance regime (*e.g.*, effects of fire suppression). Plant species that are naturally very localized and rare are additionally threatened by hybridization with nonnative plants, accidental crushing, herbicide spraying, tree cutting, genetic complications (such as inbreeding depression), and/or random naturally occurring events (such as disease, drought, landslides, and catastrophic wildfires). Other species are threatened by possible predation from and competition with nonnative feral cats and pigs and incompatible land uses (such as overgrazing, mining, and off-road vehicular traffic).

Fragmentation and loss of habitat is a serious concern. The negative effects on a natural community and its species caused by habitat loss are more obvious than the effects of fragmentation. However, recent research into the effects of habitat fragmentation describe serious ecological consequences to the vegetation community including: (1) loss of native plant and animal species, (2) invasion of exotic species, (3) increased soil erosion, and (4) decreased water quality (Collinge 1996).

For the rule listing the Alameda whipsnake as threatened (U.S. Fish and Wildlife Service 1997), we identified areas where conversion and encroachment into potential habitat of the Alameda whipsnake occurred between 1970 and 1996. Approximately 25 projects in Alameda County and 41 projects in Contra Costa County either converted or encroached upon chaparral/scrub habitat. Habitat was directly lost to urban growth, and fragmentation due to freeway construction and commercial and residential developments created barriers to species dispersal, further isolating populations and subpopulations (U.S. Fish and Wildlife Service 1997). Isolation increases the probability of local extinction through genetic complications such as genetic drift (random change in allele frequencies leading to the loss of genetic variability) and inbreeding depression (loss of viability and/or fecundity associated with mating among relatives due to the expression of deleterious genes). Both genetic drift and inbreeding depression reduce the ability of populations and individuals to successfully respond to environmental stresses (K. Ralls *in litt*. 1998).

Sixty percent of listed and proposed species in the United States (as of January 1996) are imperiled to some extent by either nonnative species or fire suppression (Wilcove and Chen 1998). The effects of nonnative plants and animals on the species covered in this recovery plan are or may become significant and costly. Some chaparral areas have been replaced by nonnative plant species or overtopped by woodland species, causing the chaparral community to retreat. *Arctostaphylos pallida* can easily hybridize with ornamental *Arctostaphylos* spp. planted by homeowners. Hybridization could eradicate the genetic uniqueness of future generations of this native species (Amme and Havlik 1987*a*). Protecting its genetic structure is costly, and removing ornamental plants can be disagreeable and cumbersome for homeowners. The domestic cat (*Felis domesticus*) and pig (*Sus scrofa*) have been either allowed to become feral or were purposely introduced into the wild, and continue to have negative effects on native plants and animals. Feral cat colonies have become established in parks and other wildlife habitat areas, greatly depleting populations of birds, small rodents, reptiles and amphibians (Roberto 1995). Native rodents, lizards and snakes are known to be among the prey of feral cats (Hubbs 1951). Because feral cats live at higher densities than native predators, they can devastate native prey in localized areas. Feral pigs have widespread influences on a number of habitats in California. The effects of feral pigs on natural habitats have been studied at the Great Smoky Mountains National Park (Bratton 1974 as cited in DeBenedetti 1986) and Pinnacles National Monument (DeBenedetti 1986). Plant species diversity and total herbaceous cover diminished, and even soil chemistry was changed. Altering vegetation has secondary impacts on the distribution of small animals and amphibian species that are dependent on vegetation for food and cover (Bratton 1974 as cited in DeBenedetti 1986). Soil losses, trail damage and the creation of paths that lead visitors astray have also been noted.

Increasing urbanization in California has promoted an avid fire suppression policy. Within the recovery plan area, this fire suppression policy has been in place for over 50 years and has led to an increase in the amount of dead and dying woody vegetation and a disruption of the natural disturbance regime of the chaparral/scrub community. During the same time period the style of residential development has significantly increased fire risks. Wood shingle or shake roofed houses with wood siding were constructed in great numbers along ridges and steep hillsides. Built on narrow, winding roads, these houses and their wooden decks, stairs, and fences were often surrounded by unmaintained grass, brushlands, pine, and *Eucalyptus* groves. Today the *Eucalyptus* groves and pine trees are ageing. As these trees age they become more susceptible to damage from wood boring beetles (*Phoracantha* spp.), bark beetles (*Dendroctonus* spp.), and pine pitch canker (*Fusarium circinatum*), increasing the volume of dead material and likewise fire risk (East Bay Regional Park District *in litt*., undated). Additionally, in the absence of fire many of the chaparral and scrub communities are aging (becoming decadent, then senile). This aging process can reduce growth and reproduction and increase the accumulation of dead material in the understory (Schoenherr 1992).

Together these factors add up to a very real threat of catastrophic fires near the urban-wildland interface (East Bay Regional Park District *in litt*. undated). This threat has put tremendous pressure on management agencies to reduce the perceived cause: the fuel load in surrounding native vegetation. Fuel loads have undoubtedly increased during the era of fire-suppression, and if fire suppression continues both urban dwellers and the species in this recovery plan will continue to be at risk. Many land management agencies in the plan area are practicing prescribed burning, chemical and mechanical control, and grazing in efforts to reduce the fuel load. Conducting these activities without considering species protection and chaparral/scrub community health parameters also has put the species in this recovery plan at risk. Community "health" here refers to biotic communities that are nondecadent; occur in a mosaic, with appropriate recruitment; and face limited or no threats from disease, nonnative species, or incompatible land uses (off-road vehicles, mining, etc.). The main challenge in recovering the species and chaparral/scrub communities addressed in this recovery plan is integrating their recovery needs with fire and fuel load management requirements.

Specific reasons for decline and threats are discussed for each species in Chapter II (Species Accounts).

C. Conservation Measures

Approximately 25 percent of the land within Alameda and Contra Costa Counties is owned by public entities including city, State, and regional park lands, public utility agency watershed lands, Federal properties, and other open space lands (J. DiDonato *in litt*. 1999). Public lands providing habitat for species covered in this recovery plan include lands under the jurisdiction of the California Department of Parks and Recreation, East Bay Regional Park District, East Bay Municipal Utility District, San Francisco Public Utility, Contra Costa Water District, U.S. Department of Energy, U.S. Bureau of Land Management, and the Cities of Walnut Creek, Oakland and Berkeley. Nonprofit land conservation groups such as Save Mount Diablo facilitate the transfer of lands from private to public ownership. Most public lands are covered by existing land management plans that, in some cases, already assist in recovery efforts for species covered in this plan. In other cases the management actions are identified but have not been fully implemented, or the land management plan has yet to be completed.

Only a few of the private developments that have disturbed or destroyed habitat of the Alameda whipsnake have set aside (or propose to set aside) habitat for this species in perpetuity. These "set asides" have involved on-site conservation measures and minimal management requirements. In the future, compensation options may include off-site conservation or conservation banks with endowment funds established to provide funding for perpetual management of these areas as Alameda whipsnake habitat. None of the plant species have been afforded this same "set aside" effort.

Specific conservation measures for individual species are covered within the Species Accounts section of this recovery plan. Several water and park districts have established directives regarding rare, threatened and endangered species. The most significant conservation efforts currently underway in Alameda, Contra Costa, western San Joaquin and northern Santa Clara Counties are discussed below.

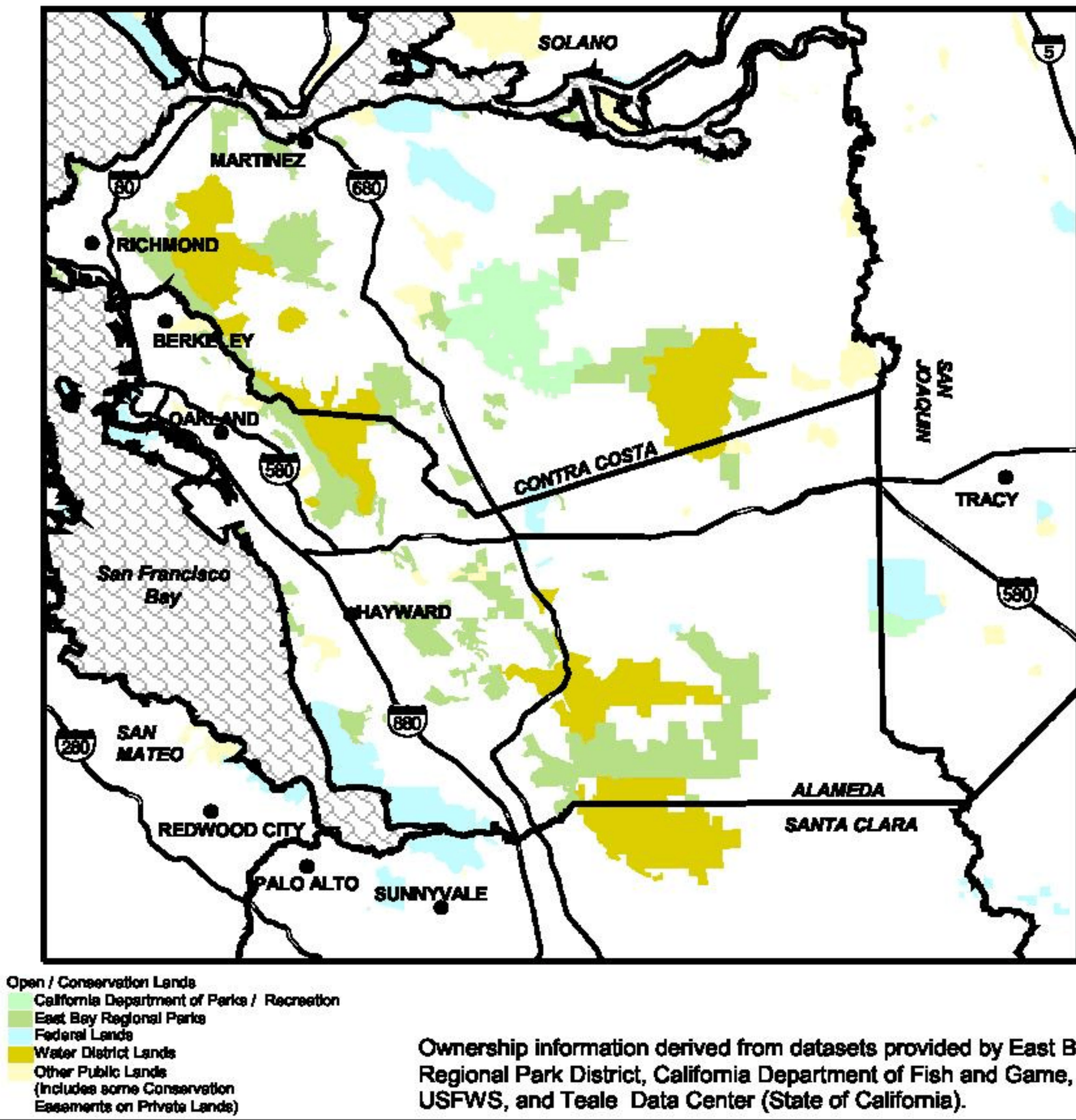
Figure 4 provides an overview of open and conservation lands within the recovery plan area. More detail can be found in Figures 6, 8, 11, 13, 17, 18 and 19. Table 2 provides information useful in interpreting the figures mentioned above.

1. California Department of Parks and Recreation

The Resource Directive for the California Department of Parks and Recreation specifies that State Parks are to be managed to restore, protect, and maintain native environmental complexes and indigenous flora and fauna, and to preserve and perpetuate representative examples of natural plant communities common to a unit and region. "The California Department of Parks and Recreation shall develop and implement a vegetation restoration and management plan, restoring fires as an important part of the ecological process of the plant communities at the Park through prescription burning...which simulates the historic natural fires. Fire suppression activities that may affect plants shall be addressed to minimize resource damage. Rare or endangered plants in the Parks shall be protected and managed for their perpetuation. The Parks shall conduct systematic surveys and mapping of populations, as well as additional surveys during flowering season prior to any potentially deleterious activity. Threatened and endangered wildlife species shall be protected and managed for their perpetuation. Plans shall be prepared and implemented for management of threatened and endangered animal species, and protection of their habitats occurring in the Park. Reestablishment of extirpated native fauna shall also be considered" (California Department of Parks and Recreation 1990).

2. East Bay Regional Park District

The mission of the East Bay Regional Park District specifies that the District will "identify, evaluate, conserve, enhance, and restore rare, threatened, endangered, or locally important species of plants and animals and their habitats, using scientific research, field experience, and other proven methodologies. Populations of listed species will be monitored through periodic observations of their condition, size, habitat, reproduction, and distribution. Conservation of rare, threatened, and endangered species of plants and animals and their supporting habitats will take precedence over other activities, if the District determines that the other uses and



Ownership information derived from datasets provided by East Bay Regional Park District, California Department of Fish and Game, USFWS, and Teale Data Center (State of California).

Figure 4. Map of open and conservation lands in Alameda, Contra Costa, San Joaquin, and Santa Clara Counties, California, as of 2000.

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Table 2. Open and conservation lands in Alameda, Contra Costa, San Joaquin, and Santa Clara Counties, California, as of 2000.

Title	Purpose	County	Owner or Management Agency	Species Present	Comments
Mt. Diablo State Park	state park	Contra Costa	California Department of Parks and Recreation	Alameda whipsnake, *Arctostaphylos manzanita* ssp. *laevigata*, *Cordylanthus nidularius*, *Eriogonum truncatum**, Berkeley kangaroo rat*	Established beginning 1921
Carnegie State Vehicle Recreation Area	off-road vehicle park	Alameda	California Department of Parks and Recreation	Alameda whipsnake?, *Eriogonum truncatum**	Alameda/chaparral whipsnake and/or Intercross
East Bay Regional Park -Tilden	regional park	Contra Costa	East Bay Regional Park District	Alameda whipsnake, *Arctostaphylos pallida*, Berkeley kangaroo rat*	Established beginning 1940

Title	Purpose	County	Owner or Management Agency	Species Present	Comments
East Bay Regional Park -Garin/Dry Creek	regional park	Alameda	East Bay Regional Park District	Alameda whipsnake	Established beginning 1965 Part of Garin Woods is within the California State University Hayward campus
East Bay Regional Park -Las Trampas	regional park	Alameda, Contra Costa	East Bay Regional Park District	Alameda whipsnake	Established beginning 1966
East Bay Regional Park -Briones	regional park	Contra Costa	East Bay Regional Park District	Alameda whipsnake	Established beginning 1965
East Bay Regional Park -Machado	land bank	Alameda	East Bay Regional Park District	Alameda whipsnake?	
East Bay Regional Park -Temescal	regional park	Alameda	East Bay Regional Park District	*Arctostaphylos pallida*?	
East Bay Regional Park -Roberts	recreation area	Alameda	East Bay Regional Park District	*Arctostaphylos pallida*?	
East Bay Regional Park -Cull Canyon	recreation area	Alameda	East Bay Regional Park District	Alameda whipsnake?	

Title	Purpose	County	Owner or Management Agency	Species Present	Comments
East Bay Regional Park -5 Canyons	land bank	Alameda	East Bay Regional Park District	Alameda whipsnake?	
East Bay Regional Park -Bishop Ranch	land bank	Contra Costa	East Bay Regional Park District	Alameda whipsnake?	
East Bay Regional Park -Black Diamond Mines	regional park	Contra Costa	East Bay Regional Park District	Alameda whipsnake *Arctostaphylos manzanita* ssp. *laevigata*?	Established beginning 1973
East Bay Regional Park -Pleasanton Ridge	regional park	Alameda	East Bay Regional Park District	Alameda whipsnake	Established beginning 1984
East Bay Regional Park - Sunol/Ohlone Wilderness/Mission Peak/Del Valle/Camp Ohlone	regional park	Alameda	East Bay Regional Park District	Alameda whipsnake	Established beginning 1975 Alameda/chaparral whipsnake and/or Intercross

Title	Purpose	County	Owner or Management Agency	Species Present	Comments
East Bay Regional Park -Morgan Territory/ Round Valley	regional park	Contra Costa	East Bay Regional Park District	Alameda whipsnake	Established beginning 1975
East Bay Regional Park -Diablo Foothills	regional park	Contra Costa	East Bay Regional Park District	Alameda whipsnake	Established beginning 1976
East Bay Regional Park -Leona Open Space	regional park	Alameda	East Bay Regional Park District	Alameda whipsnake?	Established beginning 1986
East Bay Regional Park -Huckleberry Botanic Preserve	regional park	Alameda, Contra Costa	East Bay Regional Park District	*Arctostaphylos pallida* Alameda whipsnake?	Established beginning 1941
East Bay Regional Park -Sobrante Ridge	regional park	Contra Costa	East Bay Regional Park District	*Arctostaphylos pallida* Alameda whipsnake?	Established beginning 1940
East Bay Regional Park -Sibley Volcanic	regional park	Alameda, Contra Costa	East Bay Regional Park District	*Arctostaphylos pallida* Alameda whipsnake?	

Title	Purpose	County	Owner or Management Agency	Species Present	Comments
East Bay Regional Park -Redwood	regional park	Alameda, Contra Costa	East Bay Regional Park District	*Arctostaphylos pallida* Alameda whipsnake?	
East Bay Regional Park -Claremont Canyon	regional park	Alameda	University of California, Berkeley & East Bay Regional Park District	Alameda whipsnake Berkeley kangaroo rat*	
East Bay Regional Park -Anthony/ Lake Chabot	regional park	Alameda	East Bay Regional Park District	Alameda whipsnake?	
East Bay Regional Park -Wildcat Canyon	regional park	Contra Costa	East Bay Regional Park District	Alameda whipsnake?	
East Bay Regional Park -Kennedy Grove	regional park	Contra Costa	East Bay Regional Park District	Alameda whipsnake?	
City of Walnut Creek - Lime Ridge/ Shell Ridge	city open space	Contra Costa	City of Walnut Creek	Alameda whipsnake? *Arctostaphylos manzanita* ssp. *laevigata*?	

Title	Purpose	County	Owner or Management Agency	Species Present	Comments
City of Oakland-Joaquin Miller	city park	Alameda	City of Oakland	*Arctostaphylos pallida*	
Livermore Area Recreation and Park District-Brushy Peak	park	Alameda	Livermore Area Recreation and Parks District	Alameda whipsnake?	Area appears isolated
Bureau of Land Management - Mt. Diablo	land holdings and mineral extraction	Contra Costa	Bureau of Land Management	Alameda whipsnake? *Eriogonum truncatum*?*	Federal Land, two 16-hectare (40-acre) parcels, disposition being considered
Lawrence Livermore National Laboratory - Site 300	radiation testing facility	Alameda, San Joaquin	Department of Energy	Alameda whipsnake	Federal Land, Alameda/chaparral whipsnake and/or Intercross
East Bay Municipal District -Gateway	watershed	Contra Costa	East Bay Municipal Utility District	Alameda whipsnake?	
East Bay Municipal District -Lafayette Reservoir	watershed	Contra Costa	East Bay Municipal Utility District	Alameda whipsnake?	very isolated, recent surveys did not result in the detection of Alameda whipsnake

Title	Purpose	County	Owner or Management Agency	Species Present	Comments
East Bay Municipal District - Upper San Leandro	watershed	Alameda, Contra Costa	East Bay Municipal Utility District	Alameda whipsnake *Arctostaphylos pallida*	
East Bay Municipal District - Briones	watershed	Contra Costa	East Bay Municipal Utility District	Alameda whipsnake?	
East Bay Municipal District - Pinole	watershed	Contra Costa	East Bay Municipal Utility District	Alameda whipsnake	
East Bay Municipal District - Siesta Valley	watershed	Contra Costa	East Bay Municipal Utility District	Alameda whipsnake, Berkeley kangaroo rat*	
East Bay Municipal District - San Pablo	watershed	Contra Costa	East Bay Municipal Utility District	Alameda whipsnake, Berkeley kangaroo rat*	
Contra Costa Water District -Los Vaqueros	watershed	Alameda, Contra Costa	Contra Costa Water District	Alameda whipsnake	
San Francisco Public Utility - Alameda and Calaveras (San Antonio and Calaveras Reservoirs)	watershed	Alameda, Santa Clara	San Francisco Public Utility	Alameda whipsnake, Berkeley kangaroo rat*	Alameda/chaparral whipsnake and/or Intercross

Title	Purpose	County	Owner or Management Agency	Species Present	Comments
UC Berkeley - Strawberry Canyon	University Lands	Alameda	University of California, Berkeley	Alameda whipsnake?, Berkeley kangaroo rat*	
City of Oakland - Leona Heights Park	city park	Alameda	City of Oakland	Alameda whipsnake	Now within urbanized area
Clayton Ranch/ Chaparral Springs	public trust	Contra Costa	Save Mt. Diablo & East Bay Regional Park District	Alameda whipsnake	Wildlife corridor
Bailey Development (proposed)	compensation (proposed)	Alameda	Bailey & East Bay Regional Park District	Alameda whipsnake	On-site (proposed)
Blue Rock Development (proposed)	compensation for loss of Alameda whipsnake (proposed)	Alameda	Blue Rock & East Bay Regional Park District	Alameda whipsnake	On-site (proposed)
Rossmoor Neighborhood 9 Development	mitigation for loss of Alameda whipsnake	Contra Costa	Unknown	Alameda whipsnake	On-site

Title	Purpose	County	Owner or Management Agency	Species Present	Comments
Rossmoor Neighborhood 4 Development	mitigation for loss of Alameda whipsnake	Contra Costa	Unknown	Alameda whipsnake	On-site
Alamo Summit Development	mitigation for loss of Alameda whipsnake	Contra Costa	Unknown	Alameda whipsnake?	Location unknown
Minor Subdivision 117-89	mitigation for loss of Alameda whipsnake	Contra Costa	Unknown	Alameda whipsnake?	Location unknown
Blackhawk	mitigation for loss of Alameda whipsnake	Contra Costa	Unknown	Alameda whipsnake?	Location unknown
Centex/ Intown	mitigation for loss of Alameda whipsnake	Alameda	Unknown	Alameda whipsnake?	Location unknown

Title	Purpose	County	Owner or Management Agency	Species Present	Comments
Rancho Palomares	mitigation for loss of Alameda whipsnake	Alameda	Unknown	Alameda whipsnake?	Location unknown
Walpert Ridge	mitigation for loss of Alameda whipsnake	Alameda	California Department of Fish and Game & East Bay Regional Park District	Alameda whipsnake?	Conservation easement
Pleasanton Ridge	conservation bank	Alameda	Shea Homes	Alameda whipsnake	Bank opened in 1999 principally for California red-legged frog

? - Species name followed by a question mark (?) indicates that habitat exists but species status is currently unknown.

* - Species name followed by an asterisk (*) indicates historical sightings only, these species are presumed extinct.

activities would have a significant adverse effect on these natural resources" (East Bay Regional Park District *in litt*. 1997).

3. Federal Lands

In the area covered by this recovery plan, Federal lands include lands owned by the Bureau of Land Management and U.S. Department of Energy. The Bureau of Land Management owns one 16-hectare (40-acre) parcel, located on Mt. Diablo. This parcel is adjacent to Mt. Diablo State Park and may have saleable mineral rights. No specific land management activities have been implemented; however, this parcel is being reviewed for possible dispersal (S. Fitton pers. comm. 1999). The U.S. Department of Energy lands consist of over 2,800 hectares (7,000 acres), known as the Lawrence Livermore National Laboratory, Site 300, in Alameda and western San Joaquin Counties. The U.S. Department of Energy is preparing a biological assessment on their activities that may affect the Alameda whipsnake, including prescribed burning. Avoidance, minimization, and conservation efforts to offset effects will also be addressed (J. Woollett pers. comm. 1999).

4. Water Districts

East Bay Municipal Utility District. - The East Bay Municipal Utility District's Watershed Master Plan has guiding principles that include ensuring protection of the natural, cultural, and historical resources of the watershed on a long-term basis; respecting natural resources; sustaining and restoring populations of native plants and animals and their environments; and providing for appropriate public access to the watershed consistent with the protection of natural resources and water quality (East Bay Municipal Utility District *in litt*. 1996).

San Francisco Public Utility. - The San Francisco Public Utility's management plan has not yet been completed (T. Koopmann pers. comm. 1999).

Contra Costa Water District. - Contra Costa Water District's building of the Los Vaqueros Reservoir required the U.S. Bureau of Reclamation to consult with us under section 7 of the Endangered Species Act. The Alameda whipsnake, then a candidate species, was included in the conference section of the biological opinion issued by our Sacramento Fish and Wildlife Office on November 8, 1996. The terms and conditions in the opinion for the whipsnake included providing a fire management plan within the proposed Los Vaqueros Resource Management Plan (U.S. Fish and Wildlife Service 1996*a*). Contra Costa Water District recently completed the final draft of the Los Vaqueros Resource Management (Contra Costa Water District *in litt*. 1999). Resource protection is one of the seven goals of the management plan. Impacts to special status plants, animal species, and natural resources are to be avoided, minimized and/or mitigated; and all long-term environmental commitments are to be met (*e.g.*, conditions of the biological opinion). The management plan contains mandatory tasks that conform to specific regulatory requirements identified during approval of the Los Vaqueros Reservoir, as well as recommended and optional tasks. The management plan and any specific plans developed under it (*e.g.*, fire management plan) must be approved by our Sacramento Fish and Wildlife Office.

5. Other Conservation Efforts

Save Mount Diablo. - Save Mount Diablo, a nonprofit organization dedicated to preserving land on Mt. Diablo, has acquired or helped to acquire thousands of acres on and around Mt. Diablo. Much of the acreage has been incorporated into Mt. Diablo State Park. This nonprofit also focuses efforts on preserving wildlife corridors (S. Adams *in litt.* 1999).

Pleasanton Ridge Conservation Bank. - The Pleasanton Ridge Conservation Bank, owned by Shea Homes, is a land-based bank that provides compensatory mitigation for third parties. The location of this bank will assist in protecting part of an Alameda whipsnake population and promote linkages with other nearby populations. The bank principally benefits the federally threatened California red-legged frog (*Rana aurora draytonii*) (Wetland Mitigation Bank Development Corporation *in litt*. 1998).

Other Efforts. - Other conservation efforts underway include participation by State, Federal and private landowners. Habitat Conservation Plans, authorized under section 10 of the Endangered Species Act, are being pursued by both State and private (including those lands in public trust) landowners within the recovery plan area. Region-wide Habitat Conservation Plans may play a key role in the recovery of the listed species in this recovery plan by protecting occupied habitat, crucial areas of connectivity, and by providing management that will improve the health of the chaparral/scrub community. Federal agency involvement includes consultations with us pursuant to section 7 of the Endangered Species Act. Current section 7 consultations are beginning to contribute to the recovery of the Alameda whipsnake. One consultation includes prescribed fire as a management tool for decadent chaparral, with monitoring to assess success. Section 6 of the Endangered Species Act authorizes Federal financial assistance to the State to carry out conservation of endangered or threatened species; in the future such grants may be directed toward projects benefitting the two listed species through the California Department of Fish and Game.

II. SPECIES ACCOUNTS

A. *Eriogonum truncatum* (Mt. Diablo buckwheat)

1. Description and Taxonomy

Taxonomy. - Torrey and Gray (1870) described *Eriogonum truncatum* (Mt. Diablo buckwheat) from a specimen collected by Brewer in 1862 from Marsh's Ranch on the east base of Mt. Diablo. The reference to the summit of the eastern peak as reported in Torrey and Gray (1870) apparently is incorrect (Bowerman 1944, California Native Plant Society 1979).

Description. - *Eriogonum truncatum* (Figure 5) is described as an erect annual in the knotweed family (Polygonaceae), 10 to 40 centimeters (4 to 16 inches) high with one to several stems. The basal leaves (at the base of the plant) are oblong-oblanceolate (inversely lanceolate) to obovate (egg shaped), and 2 to 5 centimeters (0.8 to 2 inches) long. The basal leaves are tomentose (with dense wool-like hairs) below (California Native Plant Society 1979) and less tomentose and greenish above (Munz 1968). The cauline leaves (leaves borne on the stems) are smaller at 1 to 3 centimeters (0.4 to 1.2 inches) (California Native Plant Society 1979). The flowers have white petals, becoming rose colored at maturity. The involucres (a whorl of leaves or bracts at the base of the flower or inflorescence) are tomentose and borne at the ends of wishbone-like tomentose branches (Munz 1968, B. Ertter *in litt*. 1999). The inflorescence is open and erect to spreading. The achenes (fruit) are dark brown and glabrous (smooth) (California Native Plant Society 1988). *Eriogonum truncatum* can be distinguished from similar species (*Eriogonum luteolum* var. *caninum*) by differing involucres and stems (Munz 1968).

2. Historical Distribution

Historically, this plant is known from 12 herbarium collections from Contra Costa, Alameda, and Solano Counties (Figure 6). The historical locations include the collection site of the type specimen from Marsh's Ranch at the east base of

Figure 5. Illustration of *Eriogonum truncatum* (Mt. Diablo buckwheat) (from Abrams 1950, with permission).

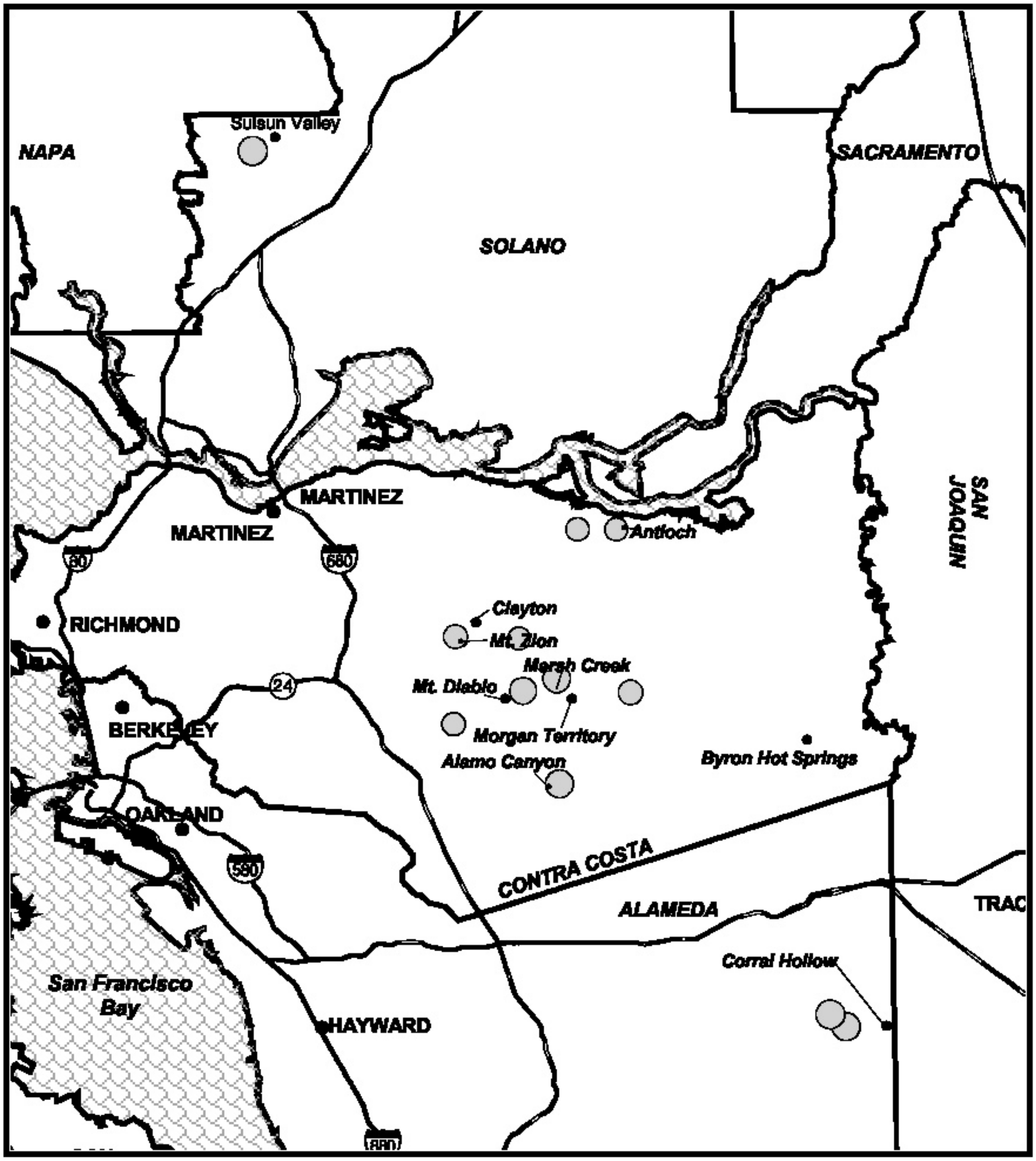

Figure 6. Historical distribution of *Eriogonum truncatum* (Mt. Diablo buckwheat).

Species Locations from California Natural Diversity Database and FWS files

9 0 9 Miles

1:545,000

USFWS Draft Recovery Plan

Mt. Diablo and two other collections from the Marsh Creek area (California Natural Diversity Data Base 1998). In addition, E. L. Greene collected a specimen in 1888 from east of Mt. Diablo (California Native Plant Society 1979). It is believed that these sites are currently in private ownership. Several collections are from Mt. Diablo, including a collection by Parry in 1883, and Bowerman's collections from the knoll west of Mount Zion in 1936 and the east face of Alamo Canyon above Wilson's barn in 1933 (California Native Plant Society 1979, California Natural Diversity Data Base 1998). The sites of Parry's and Bowerman's Mt. Zion collection are thought to be within the current Mt. Diablo State Park boundaries. The site of the Alamo Canyon collection is likely in private ownership. Other historical locations within Contra Costa County include a collection 3.2 kilometers (2 miles) west of Antioch in 1940 (California Natural Diversity Data Base 1998), and a collection from Antioch in 1886 (California Native Plant Society 1979). These locations are not specific enough to determine current ownership. In Alameda County, *Eriogonum truncatum* was collected at two locations in 1940, one from the summit of Corral Hollow Road and one from the head of Corral Hollow (California Natural Diversity Data Base 1998). Both of these Corral Hollow locations are currently part of the California State Parks system. Finally, one collection was made from Suisun at 305 to 610 meters (1,000 to 2,000 feet) in Solano County in 1888 (California Native Plant Society 1979). The specific location is not given and current ownership is unknown. This specimen, housed at Duke University, was annotated by J. L. Reveal in 1972 as *Eriogonum truncatum*; previously the specimen had been filed as simply *Eriogonum* spp. (R. Wilbur pers. comm. 1999). The accuracy of these localities varies (Figure 6); locality information is a compilation from a variety of sources including the California Natural Diversity Database, California Native Plant Society herbarium labels, California Department of Parks and Recreation, and Bowerman (1944).

The 1940 Hoover collections from Corral Hollow and west of Antioch appear to be the last time this species was documented. Site visits at a few historical locations by Katherine Culligan in 1985, Virginia Dains in 1986, and Dean Taylor in 1986 and 1987 failed to relocate this species. According to Dean Taylor, some habitat remains west of Mt. Zion and at Corral Hollow (V. Dains *in litt*. 1987, D. Taylor *in litt*. 1987, California Native Plant Society 1988). One collection listed as *Eriogonum truncatum* in Calflora was collected by Dean Taylor in 1991 from south of Byron Hot Springs. This specimen was the skeletal remains from the previous year's plant (it was collected in the year after the plant flowered), so its actual identification is ambiguous and not conclusive (D. Taylor pers. comm. 2000).

3. Life History and Habitat

Reproduction and Demography. - Very little is known of *Eriogonum truncatum*. The species was an annual. Its flowering period has been described as May to June (Bowerman 1944), April to June (Munz 1968), and from April to September (B. Ertter *in litt*. 1999). Bowerman (1944) noted that this plant was rare.

Habitat and Community Associations. - *Eriogonum truncatum* is thought to have grown in chaparral, coastal scrub, and valley and foothill grasslands on dry, exposed clay or rock surfaces (California Natural Diversity Data Base 1998).

On Mt. Diablo, *Eriogonum truncatum* was found from 333 to 348 meters (1,100 to 1,150 feet) on both east and west exposures with grassy slopes. Associated species were *Bromus rubens* (foxtail brome), *Rhus diversiloba* (poison oak), *Galium nuttallii* (climbing bedstraw), *Artemisia californica* (California sagebrush), and *Eriophyllum jepsonii* (Jepson's eriophyllum) (Bowerman 1944). At the Corral Hollow sites, the plant was found on barren clay spots at elevations of approximately 242 to 485 meters (800 to 1,600 feet) (California Natural Diversity Data Base 1998). On Marsh Creek Road at the base of Mt. Diablo a plant collected by E. L. Greene (1903) was described as "locally common along rocky banks." The lowest recorded elevation, of 106 meters (350 feet), was the site 16 kilometers (10 miles) from Clayton on Marsh Creek Road (California Natural Diversity Data Base 1998). Although we know the elevation, 300 to 600 meters (1,000 to 2,000 feet), no information on the habitat of the Solano County site is available.

4. Reasons for Decline and Threats to Survival

Reasons for Decline. - *Eriogonum truncatum* may have been out-competed by nonnative annual grasses (B. Ertter *in litt*. 1999). Many native annuals declined following European settlement, as nonnative introduced annual grass species came to dominate California grasslands (Heady 1988). Overgrazing on Mt. Diablo may have given the nonnative grasses a competitive advantage over the buckwheat, the nonnative grasses eventually replacing the buckwheat on the barren bits of soil and rock on which it was found (B. Ertter *in litt*. 1999). The realignment of Marsh Creek Road is thought to have removed at least one occurrence (plants at the base of the east side of Mt. Diablo). Any remaining occurrences were likely destroyed during conversion of lands to the small ranches common in the area. The extensive clay mining at the Corral Hollow sites was thought to have been the reason for extirpation (D. Taylor *in litt*. 1987); however, recent research into the mining history of the area suggests that the mining had ceased prior to the plants' discovery (J. Bennet pers. comm. 1999). The reasons for extirpation near Antioch and Suisun are unknown, but urbanization in the vicinity of Antioch has eliminated substantial areas of former grassland habitat.

Habitat loss and competition with nonnatives, primarily annual grasses, may affect survival if the species is rediscovered (B. Ertter *in litt*. 1999). The Corral Hollow sites are within the area of the proposed extension of the California Department of Parks and Recreation's Carnegie off-road vehicle park, although the recreational use of this area has yet to be finalized (K. MacKay pers. comm. 1999). If the species is still extant in Corral Hollow, off-road vehicular activity may be detrimental. It is unlikely that if rediscovered, *Eriogonum truncatum* would be found in numerous or large populations. Therefore, this species could be subject to the same random events and isolated population threats as other plant species covered in this recovery plan. The effects of wildfire or prescribed burns on this species are unknown.

5. Conservation Efforts

There have been no active conservation measures taken to protect this plant from extinction. Evidently, 45 years transpired before efforts were made to determine if the plant remained at any of the historical sites, although evidence of the plant's demise was common knowledge prior to this time. In 1975, we published a notice accepting the report of the Smithsonian Institution as a petition for the listing of species as threatened or endangered. The report considered *Eriogonum truncatum* threatened (40 FR 27823) (U.S. Fish and Wildlife Service 1975). In 1979, this proposal and several others were withdrawn under the Endangered Species Act Amendments of 1978 as they had expired (44 FR 70796) (U.S. Fish and Wildlife Service 1979). In 1980, we published a Review of Plant Taxa, in which *Eriogonum truncatum* was listed as a taxon currently under review and was given the status of category 1 (45 FR 82480) (U.S. Fish and Wildlife Service 1980). (See Table 1 for definitions of category 1 and category 2 candidates.) In 1983, we published changes, additions, and deletions to the 1980 Review. *Eriogonum truncatum* was changed to a category 2 candidate (48 FR 53640) (U.S. Fish and Wildlife Service 1983). In the 1985 update to the Review, *Eriogonum truncatum* retained the category 2 status (50 FR 39526) (U.S. Fish and Wildlife Service 1985). The 1990 update listed *Eriogonum truncatum* as a category 2 candidate, but indicated that the taxon was possibly extinct (55 FR 6184) (U.S. Fish and Wildlife Service 1990). In the September 1993 Review, *Eriogonum truncatum* was no longer considered for listing. At the time, the species was categorized as 3A, indicating that we had persuasive evidence of extinction, but that if rediscovered, it might be a high priority for listing (58 FR 51144) (U.S. Fish and Wildlife Service 1993*a*). In the December 1993 Review, we determined that making a final finding on *Eriogonum truncatum* was not warranted, citing that there was sufficient evidence that the species was extinct (58 FR 84824) (U.S. Fish and Wildlife Service 1993*b*). *Eriogonum truncatum* no longer has any Federal designation.

The California Native Plant Society lists *Eriogonum truncatum* as presumed extinct (California Native Plant Society list 1A). With this designation the species need not be included in surveys of appropriate habitat under the California Environmental Quality Act. Should the taxon be rediscovered, however, it is mandatory that it be fully considered during preparation of environmental documents relating to the California Environmental Quality Act (Skinner and Pavlik 1994).

6. Conservation Strategy

Eriogonum truncatum is identified in a recent California Native Plant Society document describing research needs as "an extinct plant with high rediscovery potential" (California Native Plant Society 1999). As an annual, *Eriogonum truncatum* may have been found only sporadically, as germination may have depended on favorable climatic conditions (Schoenherr 1992). It is critical to continue searching for this species in the historic sites, surrounding areas, and all suitable habitat over several years (California Native Plant Society 1979, 1988).

Conservation Tasks for Rediscovered Plants. - In the event of rediscovery, both immediate and long-term actions will be needed. Outlining these actions in a recovery plan increases the potential for participation by both State and Federal agencies and for funding to carry out needed actions. Three actions - status review, plant stabilization, and protection of plants and habitat - would be needed concurrently. First, a status review should be conducted immediately to assess if there are threats from current or planned activities such as grazing, fire, nonnative plant species, rodents, insects, habitat conversion, inbreeding depression, etc. The status review should include consideration of whether existing mechanisms for protection are adequate. The results of the status review would help determine if the plant warrants listing. Second, stabilizing the plants or populations of plants by alleviating threats to short-term survival would be essential. Such stabilization efforts may include controlling invasive nonnative or native vegetation, erosion, and/or destructive rodents and insects, and providing insurance for the population by collecting and storing seed (if such collection would not further imperil the population's survival). Third, securing and protecting the habitat and the existing plants would be essential. If the plant is rediscovered on public lands, it would be important to work with the land manager to develop a site-specific management plan that would include yearly monitoring measures to minimize any threats. If the plant is rediscovered on private lands, the willingness of the land owner to participate in recovery efforts would need to be assessed and encouraged. If the landowner (and land manager or lessee) were amenable, an agreement should be developed to formalize plant protection. This agreement could be temporary or long-term, depending on the willingness of the landowner and the needs of the species.

After short-term mechanisms for protection are in place, then long-term management should begin. Different approaches should be evaluated. An implementation team, consisting of members with the expertise to determine appropriate measures and the means to implement measures, would be of great benefit. Options include reintroduction to historic sites, propagation in greenhouses and/or botanical gardens, and seed collection and storage. Other necessary actions would include the alleviation of threats, securing sites, maintaining or enhancing abundance, developing and implementing a monitoring plan, conducting essential research (*e.g.*, demography, genetics, reproductive biology, and propagation techniques), reassessing status every 5 years to determine if Federal listing is warranted, and coordinating efforts with conservation and recovery tasks for other species covered in this recovery plan or throughout the recovery plan area. Although tasks are outlined here, they will not all necessarily be appropriate to the future situation, nor is the list complete.

B. *Cordylanthus nidularius* (Mt. Diablo bird's-beak)

1. Description and Taxonomy

Taxonomy. - Howell (1943, as cited in Bowerman 1944) described *Cordylanthus nidularius* from specimens he collected in 1942 on serpentine on Mt. Diablo northeast of Deer Flat at 2,000 feet (606 meters) elevation. Bowerman (1944) listed these plants under *Cordylanthus pilosus*, but described the plants from the serpentine area of Mt. Diablo as being unlike any other *Cordylanthus*, and suggested careful study in the field was needed to determine whether these plants are a distinct entity. Prior to the printing of Bowerman (1944), Howell's description of *Cordylanthus nidularius* as a new species was published; Bowerman noted this publication in an inserted footnote.

In their monograph on *Cordylanthus* (a taxonomic revision of the genus based on morphological studies, seed coat patterns, and chromosome number), Chuang and Heckard (1986) placed *Cordylanthus nidularius* in the subgenus *Cordylanthus*. The subgenus was then split into sections based principally on type of inflorescence, corolla shape and color, seed coat morphology, distribution, habitat, and chromosome number; *C. nidularius* was placed in section

Cordylanthus. Chuang and Heckard also suggested that *C. nidularius* is most closely related to *C. tenuis,* although the two species are geographically isolated from each other.

Description. - *Cordylanthus nidularius* (Figure 7), an annual herb in the snapdragon family (Scrophulariaceae), forms prostrate branches with stems 10 to 14 centimeters (4 to 16 inches) long and is root-hemiparasitic (California Department of Fish and Game 1988). Root-hemiparasitic refers to the habit of members of *Cordylanthus* of forming haustoria along the finer roots. These haustoria are enlarged structures that form a vascular connection with roots of surrounding "host" plants, through which the plant presumably receives water and mineral elements from the host (Chuang and Heckard 1986). This species often forms mats of interlaced branches over much of its serpentine chaparral habitat. The leaves are narrow, linear, unlobed, and 1 to 5 centimeters (0.4 to 2.0 inches) long. The flowers, which appear from June to August, are solitary or in two to three loose clusters. The petals are white with two pale purple lines and are 14 to 15 millimeters (0.5 inch) long. A second *Cordylanthus* species, *C. pilosus*, occurs on Mt. Diablo; however, this species differs in its erect habit and the shape of its outer floral bracts (modified leaves near flower inflorescence) (California Department of Fish and Game 1988). *C. nidularius* can be separated from both *C. tenuis* and *C. pilosus* by the outer bracts being three-lobed, the segments having enlarged tips. Both *C. tenuis* and *C. pilosus* have outer bracts that are entire (not lobed) with enlarged, and in the case of *Cordylanthus pilosus*, angulate, tips.

2. Historical and Current Distribution

Historical and Current Distribution. - *Cordylanthus nidularius* is endemic to serpentine on Mt. Diablo (Chuang and Heckard 1986) (Figure 8). The type collection of *C. nidularius* was from northeast of Deer Flat on Mt.

Figure 7. Illustration of *Cordylanthus nidularius* (Mt. Diablo bird's-beak) (from Abrams 1951, with permission).

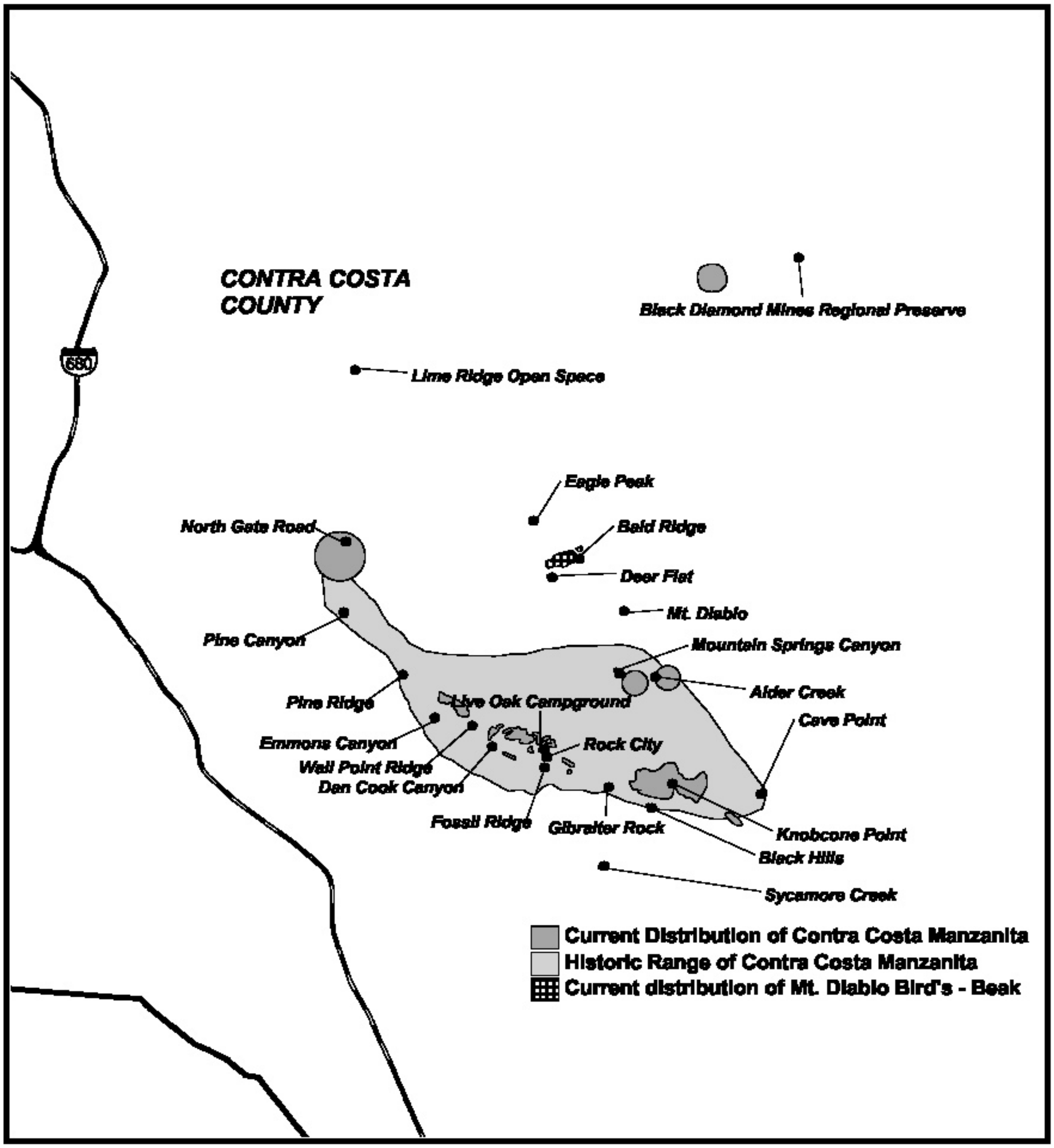

Figure 8. Distribution of *Cordylanthus nidularius* (Mt. Diablo bird's-beak) and *Arctostaphylos manzanita* spp. *laevigata* (Contra Costa manzanita).

3 0 3 Miles

1:160,000

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Diablo in 1942 at 606 meters (2,000 feet) (Howell 1943). Chuang and Heckard (1986) mention three known populations as of 1978 that were highly localized within 0.5 kilometer (0.3 mile) of each other between two Quaternary landslides that interrupt the main serpentine strip extending several kilometers along the north side of Mt. Diablo. In an area where there was a wildfire in 1977, four small patches were found on the crest of Bald Ridge, one patch on Eagle Peak Trail, and one patch on a ridge north of Deer Flat (A. Johnson in litt. 1978).

Currently, *Cordylanthus nidularius* is found in what is referred to as a "single population" above Deer Flat, along what is now known as Bald Ridge, on the north side of Mt. Diablo from 670 to 890 meters (2,200 to 2,900 feet) in elevation. The population occurs in chaparral in a localized seam of serpentine soil on 0.8 hectare (2 acres) within Mt. Diablo State Park (California Department of Fish and Game 1988). The number of plants varies from year to year as is typical of annual species, but probably ranges in the hundreds (California Department of Fish and Game 1988, J. Ferriera *in litt*. 1994).

3. Life History and Habitat

Reproduction and Demography. - This genus flowers during hot summers in arid environments. The hemi-parasitic habit of these plants may permit them to thrive at a time when most annuals have ceased to grow (Piehl 1966 as cited in Chuang and Heckard 1971). The host plant of this species has not yet been determined. Other *Cordylanthus* species use a perennial host, possibly a member of the heath (Ericaceae) or pine (Pinaceae) family. Host plant distance for this genus has been measured as far away as 3 meters (10 feet). Although unconfirmed, bees are the likely pollinator of *Cordylanthus nidularius* (M. Wetherwax *in litt*. 1999). A. Johnson (*in litt*. 1978) noted that the *C. nidularius* she saw occurred in "patches" ranging from approximately 2 by 2 meters (7 by 7 feet) to 2 by 9 meters (7 by 30 feet) within openings of chaparral.

Observations of the genus *Cordylanthus* in the wild and propagation studies in controlled environments indicate at least two factors that may affect reproductive success of this genus. The primary factor is openness of substrate; the plants seldom grow where there is competition or in closed vegetation. Disturbed sites, such as firebreaks, road edges, and post-fire landscapes, as well as very sparse grasslands and chaparral stands, appear to harbor the best populations of this genus. The second factor may be precipitation pattern, with long winters and good rains at either end of the season promoting recruitment (R. Raiche *in litt*. 1999).

Habitat and Community Associations. - The substrate supporting *Cordylanthus nidularius* is a localized seam of serpentine soil, where the plant occurs in chaparral openings in association with *Arctostaphylos glauca* (big-berried manzanita), *Calochortus pulchellus* (Mt. Diablo fairy lantern), *Astragalus gambellianus* (Gambell's locoweed), *Quercus durata* (leather oak), *Hesperolinon breweri* (Brewer's dwarf-flax), *Heteromeles arbutifolia* (toyon), *Pinus sabiniana* (gray pine), *Streptanthus glandulosus* (bristly jewelflower), *Monardella douglasii* (Douglas' mountainbalm), and *Navarretia mellita* (honeyscented pincushionplant) (California Native Plant Society 1977, California Department of Fish and Game 1988). Field notes (A. Johnson *in litt*. 1978) indicate that the species seemed to prefer litter of *A. glauca*, and was not found near *P. sabiniana* or *Q. durata*. Johnson also noted associated species including *Achillea lanulosa* (common yarrow), *Melica californica* (California melicgrass), *Sitanion hystrix* (bottlebrush squirreltail), *Galium andrewsii* (phloxleaf bedstraw), *Eriodictyon californicum* (California yerbasanta), *Lotus* spp. (birdsfoot trefoils), mosses, and grasses such as *Festuca* spp. (fescues).

4. Reasons for Decline and Threats to Survival

Reasons for Decline. - Not enough information exists to determine the original extent of the population or populations observed when the species was described, nor to determine if there has been a decline or change in distribution. Because of its association with serpentine soils, it is quite possible that this plant is naturally rare. It has been suggested that any decline may be due to shading or competition from adjacent plants, due to lack of regular fire (R. Raiche *in litt*. 1999).

Threats to Survival. - As a narrowly distributed serpentine endemic, this population (California Department of Fish and Game 1988) is primarily threatened by random catastrophic extinction from disease, drought, or other unforeseen events. This population may no longer contain the genetic variation needed to survive these random naturally occurring events. This population may also be threatened by inadvertent mismanagement, further development of hiking trails (B. Olson *in litt*. 1994), or maintenance of an existing trail (J. Kerbavaz pers. comm. 1999). If the habitat is split into smaller, more isolated units, the amount of incoming solar radiation, water, wind or nutrients may be altered, thereby magnifying the effects of external factors such as invasion of nonnative plants, foot traffic, and erosion (Saunders *et al.* 1991). In a response to a status request from the U.S. Fish and Wildlife Service (*in litt*. 1994), California Department of Parks and Recreation ecologist Jean Ferreira stated that no impacts were known (J. Ferriera *in litt*. 1994).

Competition and predation are common threats to narrowly distributed species. Competition from aggressive plant species may threaten *Cordylanthus nidularius* (U.S. Fish and Wildlife Service 1995) or its host plant. Although invasive plants may be slower to disperse into serpentine soils, they nonetheless remain a threat (B. Olson *in litt*. 1994). Rooting by feral pigs may be a threat (California Natural Diversity Data Base 1998).

Fire suppression is also suspected to be a threat to this species (R. Raiche *in litt*. 1999), however, definitive information on the effects of fire suppression and prescribed burns is needed. B. Olson (*in litt*. 1994) noted that in those areas where recovery from fire is more advanced, *Cordylanthus nidularius* numbers are fewer, and suggested that as perennial native vegetation becomes more dominant in the burned areas, *C. nidularius* will lose its niche and eventually be outcompeted by other low-growing perennial vegetation. A. Johnson (in litt. 1978) suggested that from the evidence of the patches found, it was possible that where the 1977 fire spared the chaparral it spared seeds of *C. nidularius* as well. *C. nidularius* was evident following the 1977 wildfire (C. Nielson *in litt*. 1999). Competition for sunlight may occur as the manzanitas come back following the 1977 fire; most plants were seen in open areas, but several plants were seen within shaded areas at the base of manzanita plants (J. Kerbavaz pers. comm. 1999). It is not known whether *C. nidularius* is fire-adapted or is resilient to occasional burning; however, the ability of the host plant to survive repeated burns may be as important or more so to the long-term survival of *C. nidularius*.

5. Conservation Efforts

On October 6, 1978, the State of California listed *Cordylanthus nidularius* as rare. Federal government efforts on *C. nidularius* began as a result of section 12 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.), which directed the Secretary of the Smithsonian Institution to prepare a report on those plants considered to be endangered, threatened, or extinct in the United States. This report, known as House Document No. 94-51, was presented to Congress on January 9, 1975, and included *C. nidularius* as endangered. We published a notice on July 1, 1975 (40 FR 27823) (U.S. Fish and Wildlife Service 1975) accepting the report of the Smithsonian Institution as a petition for listing. The following year we published a proposal to determine 1,700 vascular plant species to be endangered on June 16, 1976 (42 FR 24523) (U.S. Fish and Wildlife Service 1976); *C. nidularius* was included in this proposal. In 1979 this proposal and several others were withdrawn, as under the Endangered Species Act Amendments of 1978 they had expired (44 FR 70796) (U.S. Fish and Wildlife Service 1979). In 1980, we published an updated notice that included categorizing *C. nidularius* as a category 1 candidate for Federal listing (45 FR 82480) (U.S. Fish and Wildlife Service 1980). (See Table 1 for definitions of category 1 and category 2 candidates.) However, in 1983 the category was changed to category 2 (48 FR 53640) (U.S. Fish and Wildlife Service 1983). In the next update (U.S. Fish and Wildlife Service 1985) the category 2 candidate status was retained (50 FR 39526). In 1990 another revision returned *C. nidularius* to category 1 candidate status (55 FR 6184) (U.S. Fish and Wildlife Service 1990). We continually found that the petition of this species was warranted but precluded by other pending listing actions. In 1995 our Sacramento Fish and Wildlife Office recommended in a draft document that *C. nidularius* be listed as threatened (U.S. Fish and Wildlife Service 1995). However, in 1996, prior to action on the recommendation, *C. nidularius* was removed from the candidate list during the reclassification of 96 candidate taxa (U.S. Fish and Wildlife Service 1996*b*). The findings indicated that current available information did not support issuance of a proposed listing, and the species was believed stable and protected from threats by Mt. Diablo State Park guidance (61 FR 7457) (U.S. Fish and Wildlife Service 1996*b*). *C. nidularius* is currently unofficially considered a species of concern.

No specific conservation management efforts have been conducted for *Cordylanthus nidularius*, although the California Native Plant Society has assisted in monitoring this species' status. Suggestions for management were proposed as far back as 1977 by the California Native Plant Society. These suggestions included determining the extent of the current population and comparing it to historic records, alerting personnel at Mt. Diablo State Park to the locations of the plants, monitoring annually to determine fluctuations in the population, and an investigation of the impact of the 1977 wildfire (California Native Plant Society 1977). It is unclear whether any of these suggestions were implemented.

As a species classified as 1B by the California Native Plant Society, *Cordylanthus nidularius* must be fully considered during preparation of environmental documents relating to the California Environmental Quality Act (Skinner and Pavlik 1994).

6. Conservation Strategy

The most urgent conservation need is adequate funding and personnel to carry out the California Department of Parks and Recreation Directive for Rare and Endangered Plant species. This directive states that "Systematic surveys for rare and endangered plants shall be made throughout the unit. For each species, populations shall be mapped, and a management plan for its protection and perpetuation shall be prepared and implemented as part of the vegetation restoration and management plan. Prior to any potentially deleterious activity, including site-specific development, trail or facilities construction or relocation, or prescribed burns, additional surveys for rare or endangered plants shall be made during the appropriate flowering season in the areas that will be affected" (California Department of Parks and Recreation 1990).

Although *Cordylanthus nidularius* exists on protected land managed under a Resource Directive, the conservation of this plant is not assured. Due to budget and personnel constraints, monitoring of this population by Park staff has been sporadic. Botanists from the California Native Plant Society have conducted monitoring to detect trends; however, no research on essential topics has been conducted. No evidence of active management efforts exist.

In order to prepare a meaningful management plan, certain aspects of this plant's biology still need to be investigated. It is essential to understand the dynamics of this "population". For example, it is unclear whether the "population" is a single population made up of patches of individuals or contains a few populations that are genetically distinct. This information could be essential in the event of a catastrophic event as well as in preparing for propagation activities. The root host, pollinators, and seed germination requirements are unknown, among other aspects of the species' biology. Survival of *Cordylanthus nidularius* may hinge on the ability to reproduce this plant *in situ* (in the original position) and *ex situ* (outside of the original position, *e.g.* in captive propagation). Any naturally occurring event could lead to a drastic reduction in population size and possible extirpation. To buffer the effects of naturally occurring events, discovering or establishing populations that are disjunct from the current known population may prove essential. Human-caused threats also need to be identified, addressed, and monitored as part of a management plan. Additionally, the role of fire should be addressed immediately, both as a research need and a management tool. California Department of Parks and Recreation has proposed a prescribed burn that would encompass this area. This controlled burn should take place only under the most rigorous research and monitoring framework with the research results used to improve the chances for long-term persistence of this species.

Collection and banking of seed in Center for Plant Conservation certified botanic gardens is also a high-priority action for *Cordylanthus nidularius*. Seed banking is prudent to guard against extinction of the species from chance catastrophic events and to provide material for enhancement efforts in existing populations, reintroductions, and/or introductions to new sites. Other important conservation activities for *C. nidularius* include research on seed germination and propagation techniques to assist in establishing refugia populations.

If plants (or additional populations) are discovered on private lands that are not part of Mount Diablo State Park, they should be secured (through land acquisition, conservation easements, or other means), monitored, and managed.

In addition, unoccupied habitat that might provide space for expansion of the population and habitat for pollinators and seed dispersers must be protected.

C. *Arctostaphylos manzanita* ssp. *laevigata* (Contra Costa manzanita)

1. Description and Taxonomy

Taxonomy. - Eastwood (1933) described *Arctostaphylos manzanita* ssp. *laevigata* as *Arctostaphylos laevigata* from a specimen she collected on the old road halfway up Mt. Diablo in 1922 (Bowerman 1944). She suggested that this species was related to *A. stanfordiana*, from which it was distinguished by its white rather than rose-colored flowers, panicles with pubescence, and thicker branches. *A. manzanita* was considered yet a different species with a much more arborescent (tree-like) growth habit and slightly larger flowers than either *A. laevigata* or *A. stanfordiana*. *A. pungens* was also classified as a separate species, having an erect but low growth habit consistent with *Arctostaphylos laevigata* and *Arctostaphylos stanfordiana,* but having slightly larger flowers and club-shaped peduncle (Eastwood 1934). McMinn (1939, as cited in Bowerman 1944) suggested that *A. manzanita ssp. laevigata* might be a hybrid between *A. manzanita* and *A. stanfordiana*; however, the proposed parent species are absent from Mt. Diablo. McMinn suggested that long isolation might have permitted some stabilization of this hybrid form, and Bowerman pointed out that a few shrubs on Mt. Diablo approach *A. stanfordiana* in habit, but these plants were destroyed in the 1931 wildfire (Bowerman 1944, Adams 1940). Abrams (1951) recognized Eastwood's treatment and *A. laevigata's* close affinity to *Arctostaphylos stanfordiana*; however, Munz and Keck (1959) placed *Arctostaphylos laevigata* as a subspecies to *Arctostaphylos manzanita*, where it has remained.

Since Eastwood's description, the tremendously diverse *Arctostaphylos* genus has had at least four treatments, with many taxa becoming synonymous with others, and others being further divided. *A. manzanita* ssp. *laevigata* has not escaped this fate, and has been referred to in the literature not only as *A. manzanita* (Bowerman 1944), *A. laevigata* (Eastwood 1934) and *A. stanfordiana* (Abrams 1951), but also as *A. pungens* ssp. *laevigata* (Howell 1945). Morphologically, many similarities exist between *A. manzanita* and *A. pungens*; however, the fruits, leaves and petioles of *A. manzanita* are larger.

Molecular genetic and morphologic studies are currently being conducted at San Francisco State University to derive a phylogeny of the group and clarify relationships of *Arctostaphylos* species and subspecies (V. Parker *in litt*. 1994). Preliminary results using ribosomal DNA sequencing indicate that it may be appropriate to elevate *A. manzanita* ssp. *laevigata* to a full species (M. Vasey pers. comm. 1999).

Description. - *Arctostaphylos manzanita* ssp. *laevigata* (no illustration available, but see closely related subspecies in Figure 9) is a non-burl-forming, low, intricately branching, bushy shrub of the heath family (Ericaceae). The young stems, leaves and inflorescence are clothed with a fine close pubescence (covered with soft, short hairs). The mature leaves are glossy and smooth, from oblong to lanceolate, with acute apex and base, and with about equal numbers of stomata (small openings through which gaseous exchange takes place) on upper and lower leaf surfaces. *A. manzanita* ssp. *laevigata* has small, white flowers, arranged in drooping panicles (an indeterminate type of inflorescence with two or more flowers on each branch) with generally dark stems and small bracts shorter than the smooth pedicels (stalk to single flower of an inflorescence). The corolla measures about 7 millimeters (0.28 inch). Flowers appear from January to February and fruits from July to August. The fruits are bright red and usually rather asymmetrical.

2. Historical and Current Distribution

Many of the *Arctostaphylos* species that occur in California are narrowly limited within the state (Gankin and Major 1964). *A. manzanita* ssp. *laevigata* readily fits the description of being narrowly limited, possibly even endemic to Mt. Diablo (Figure 8). *A. manzanita* ssp. *laevigata* was originally described as endemic to Mt. Diablo (Eastwood 1934, Bowerman 1944, Howell 1945).

Figure 9. Illustration of *Arctostaphylos manzanita* ssp. *manzanita*, a close relative of Contra Costa manzanita (*Arctostaphylos manzanita* ssp. *laevigata*) (from Abrams 1951, with permission).

The location of the type collection is "Mount Diablo, along the side of the old road about halfway up the mountain", May 17, 1922, *Eastwood* 11082." Unfortunately this location, without further clarification, is difficult to determine. Bowerman (1944) lists the following locations with additional information from main or figure text in parentheses: "East of Alder Creek, 1900 feet; East of Mountain Springs Canyon, 2000 feet; road 8.9 miles from North Gate, 2600 feet; Pine Canyon mouth, near most northerly west-heading streamlet on topographic map; Emmons Canyon, west fork, south face; adjacent north face of Pine Ridge; Wall Point ridge; Inner (ridge of) Black Hills; Knoll south of Cave Point; Fossil Ridge, north face; South face east of Dan Cook Canyon; Dan Cook Canyon".

Some locations only had one to four individuals, but not all locations had plant counts. Two additional locations are described solely within the main or figure text: "East of Knob-cone Point, the site of the 1931 fire; and Sycamore Creek, including the west fork of Sycamore Canyon on the south-facing slope, the east fork of Sycamore Canyon on the south-facing slope, and the northeast fork of Sycamore Creek, southwest and northwest exposures." *Arctostaphylos manzanita* ssp. *laevigata* has been reported from other locations but the identity of these plants needs clarification (S. Edwards pers. comm. 1999). Some mention is made of this plant occurring on Mt. Saint Helena in Lake County (R. Gankin *in litt*. 1985), at East Bay Regional Park District's Black Diamond Mines Regional Preserve near Antioch (California Native Plant Society *in litt*. undated), and the City of Walnut Creek's Lime Ridge (R. Hawley pers. comm. 1999).

The California Natural Diversity Data Base (1998) lists the current distribution of *Arctostaphylos manzanita* ssp. *laevigata* as a localized area within Mt. Diablo State Park: Wall Point east to Live Oak Campground, west of Rock City; the Nature Trail just west of Park Headquarters; Dan Cook Canyon; and below Gibraltar Rock. This description may indicate a more restricted range than historically recorded, or may be an artifact of the absence of directed surveys.

3. Life History and Habitat

Reproduction and Demography. - As very little has been published on *Arctostaphylos manzanita* ssp. *laevigata*, only general information on the genus is presented. *Arctostaphylos* is a genus of evergreen woody plants found growing for the most part under more or less xeric (dry) conditions. The thick and coriaceous (leather-like), erectly borne leaves are typical of xerophilous (arid adapted) plants. The bark of older stems is a striking feature, being predominantly smooth, thin, and of a deep mahogany color. The flower buds are generally formed late in the previous season and anthesis (flowering) is usually triggered by the first sustained rise in temperature after the winter rains (Adams 1940).

Arctostaphylos manzanita ssp. *laevigata* does not have a root crown from which to re-sprout after a fire or other disturbance. This species, therefore, is an obligate seeder. The conditions necessary for successful sprouting from seed are unknown. As with other obligate seeders, fire or scarification by digestive processes may be required for germination (Schoenherr 1992). State Park Ranger C. Nielson (*in litt*. 1999), suggested that based on his observations following several prescribed fires on Pine Ridge at Mt. Diablo State Park, *Arctostaphylos manzanita* ssp. *laevigata* responded well. Bowerman noted that the time of year the fire occurred and the number and vitality of the fruits may be factors involved in the different rate of reproduction seen following two wildfires in areas dominated by *Arctostaphylos manzanita* ssp. *laevigata* and *Arctostaphylos auriculata* (Mt. Diablo manzanita). Wall Point was devastated by wildfire in October of 1925, killing most of the individual manzanita plants. It was not until 1940 that the manzanitas were again established. Knob-cone Point was burned in July 1931, and following the wildfire seedlings of both manzanita species came up in abundance (Bowerman 1944).

Habitat and Community Associations. - *Arctostaphylos manzanita* ssp. *laevigata* is a constituent of chaparral, normally on southern exposures from 152 to 788 meters (500 to 2,600 feet). This plant rarely occurs among trees on north-facing hillsides. Typical associates include *Adenostoma fasciculatum* (chamise) and another endemic *Arctostaphylos* species, *A. auriculata* (Mt. Diablo manzanita) (Bowerman 1944). Other species associated with *A. manzanita* ssp. *laevigata* include *Arctostaphylos glandulosa* (Eastwood manzanita), *Baccharis pilularis* (coyote brush), *Eriodictyon californicum* (California yerbasanta), *Salvia mellifera* (black sage), and *Mimulus aurantiacus* (orange bush monkeyflower) (California Natural Diversity Data Base 1998).

4. Reasons for Decline and Threats to Survival

Reasons for Decline. - It is unknown whether *Arctostaphylos manzanita ssp. laevigata* has declined or has always been restricted in distribution. Botanists knowledgeable of the area are either of the impression that there has been no decline (S. Edwards pers. comm. 1999) or are reserving judgment. There have been no population trend studies from which to determine if there has been a decline, and until all historical locations are revisited a determination of trend is premature.

Threats to Survival. - The California Native Plant Society records *Arctostaphylos manzanita* ssp. *laevigata* as endangered in a portion of its range (Skinner and Pavlik 1994). Road maintenance, succession to woodland, clearing for a fire break, recreational uses, brush and slash burning, and fire suppression have been listed as threats to the species (California Natural Diversity Data Base 1998). Ill-timed prescription burns could also be a threat. Other threats may include damage from feral pigs or the paddocking of livestock on the periphery of Mt. Diablo State Park. Additionally, small, isolated populations are vulnerable to extinction from random fluctuations in population size due to naturally occurring events such as disease or variations in population characteristics caused by annual weather patterns, and other factors. If the populations become small, then they may also become vulnerable to the effects of genetic drift (the loss of genetic variability) and inbreeding depression (the expression of deleterious genes). These phenomena reduce the ability of populations and individuals to respond successfully to environmental stresses (K. Ralls *in litt*. 1998); although these effects have not yet been identified as threats, they should be considered possible threats to the long term conservation of the species.

5. Conservation Efforts

No specific conservation efforts have been conducted for this species. This species appears never to have had Federal status. As a species classified as 1B by the California Native Plant Society, *Arctostaphylos manzanita* ssp. *laevigata* must be fully considered during preparation of environmental documents relating to the California Environmental Quality Act (Skinner and Pavlik 1994).

6. Conservation Strategy

It has not been confirmed that *Arctostaphylos manzanita* ssp. *laevigata* populations are declining. However, evidence exists that the chaparral and scrub communities of which *A. manzanita* ssp. *laevigata* is a component may, in some areas, be suffering from the interruption of natural disturbance regimes. Fire suppression activities have led to decadent chaparral and scrub communities. The extent of this decadence and the resulting long-term effect on *A. manzanita* ssp. *laevigata* population trends is unknown. Mapping of population locations and monitoring of population trends, as identified under the California Department of Parks and Recreation Resource Directive (California Department of Parks and Recreation 1990), are clearly essential for an accurate portrayal of *Arctostaphylos manzanita* ssp. *laevigata* and chaparral/scrub community health. Protecting the populations on Mt. Diablo State Park lands will be essential to the long-term conservation of this species, as will the protection of other public lands identified as having this species. The reestablishment of disturbance, such as fire, may prove essential to the long-term survival of *Arctostaphylos manzanita* ssp. *laevigata*. Developing methods of propagation, including knowledge of pollinators and the requirements for seed germination, may be a safeguard needed to prevent this species from future decline. Finally, a status review should be undertaken once current versus historic distribution, population health and threats, and available protection mechanisms have been established (approximate time line of 3 years), to determine if further protection, such as Federal listing, is needed.

Cooperating and coordinating with other agencies who have a stake in Mt. Diablo State Park (or other areas that may be found to harbor *Arctostaphylos manzanita* ssp. *laevigata*) is essential. Establishing conservation strategies in cooperation with California Department of Forestry and Fire Protection and California Department of Parks and Recreation fire personnel are a priority. Determining defensible areas, conditions for “let it burn” policies, fire break construction, and other pre-suppression or suppression activities should be agreed upon and incorporated into fire management plans and fire personnel training programs.

D. *Arctostaphylos pallida* (pallid manzanita)

1. Description and Taxonomy

Taxonomy. - *Arctostaphylos pallida*, a member of the heath family (Ericaceae), was described by Eastwood (1933), based on a specimen collected in 1902 by W. W. Carruth on the summit of the East Oakland Hills. Prior to Eastwood's treatment, these plants were included in *Arctostaphylos andersonii*. Jepson (1925, 1939) did not recognize the new species and continued to include the material under *Arctostaphylos andersonii*. McMinn (1939) published the combination *Arctostaphylos andersonii* var. *pallida* (Eastw.) J. E. Adams ex McMinn, apparently agreeing with Adams' conclusions (first presented in his 1935 dissertation at U. C. Berkeley) that the Oakland material was distinct but related to *Arctostaphylos andersonii*. This combination was not published by Adams until several years later (Adams 1940). In their floristic treatment of California, Munz and Keck (1959) followed McMinn's treatment. Subsequently, however, Wells (1969, 1990) recognized Eastwood's original placement of this taxon as a species separate from *Arctostaphylos andersonii*. Wells (1993) retained this treatment of the genus in the current Jepson Manual (Hickman 1993) addressing the higher plants of California. Molecular and morphological studies of *Arctostaphylos* taxa are currently being conducted at San Francisco State University. DNA sequencing will be used to derive a phylogeny of the group and clarify relationships among the taxa (V. Parker *in litt*. 1994).

Description. - *Arctostaphylos pallida* (Figure 10) is an upright, non-burl-forming shrub in the heath family (Ericaceae). *A. pallida* attains heights of up to 4 meters (13 feet), with rough, gray or reddish bark. The twigs are bristly and canescent

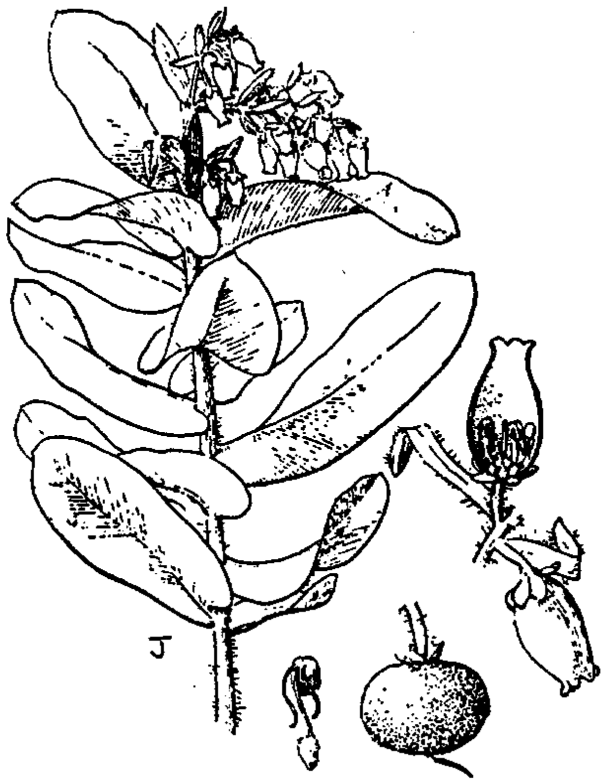


Figure 10. Illustration of *Arctostaphylos pallida* (pallid manzanita) (from Abrams 1951, with permission).

(covered with fine hairs). The pale green leaves surround (clasping) the stem, and are sessile (attached directly to the stem). The shape of the leaves range from ovate to triangular with auriculate (ear-shaped) lobes at the base. The leaves are bristly, glaucous (covered with a whitish waxy covering), 2.5 to 4.5 centimeters (1.0 to 1.8 inches) long, 2 to 3 centimeters (0.8 to 1.2 inches) wide (Wells 1993), and strongly overlapping. The dense, white, rose, or white-rose tinged (B. Johnson *in litt*. 1983) flowers are urn-shaped and 6 to 7 millimeters (0.2 to 0.3 inch) long. The flowering period is from December to March (California Department of Fish and Game 1979).

Another conspicuous characteristic of *Arctostaphylos pallida* is the development of dead or decorticated (de-barked) areas on the branches and trunks (Davis 1973 as cited in Amme and Havlik 1987*a*). This condition, called bark stripping, was first described by Adams (1934) in individuals of *Arctostaphylos myrtifolia* (Ione manzanita) and *Arctostaphylos viscida* (sticky whiteleaf manzanita). Bark stripping is most common in the older individuals. Adams deemed it to have a pathological origin, but Davis disagreed, suggesting that "stripping is a positive adaptation to the Mediterranean climate". He hypothesized that in areas protected from fire, the ability of the shade intolerant *Arctostaphylos pallida* plants to maintain live tissue lessens; in order to continue meristem growth without adding new increments of living tissue the plant partially shuts down growing cells, resulting in tissue sloughing that manifests as bark stripping (Davis 1973 as cited in Amme and Havlik 1987*a*, Hanes 1988).

2. Historical and Current Distribution

Historical Distribution. - *Arctostaphylos pallida* was originally described as occurring in the "East Oakland Hills", the "hills back of Piedmont", and on "Moraga Ridge" (Eastwood 1933, Adams 1940). Some confusion still exists on exact locations of historical collections due to the inaccuracy of the collection information.

Current Distribution. - The overall current range of *Arctostaphylos pallida* is similar to that known when the species was described in 1933 (Figure 11). The size of the extant populations is, however, thought to be smaller due to habitat destruction and fragmentation by urbanization (B. Olson *in litt*. 1994). Only two

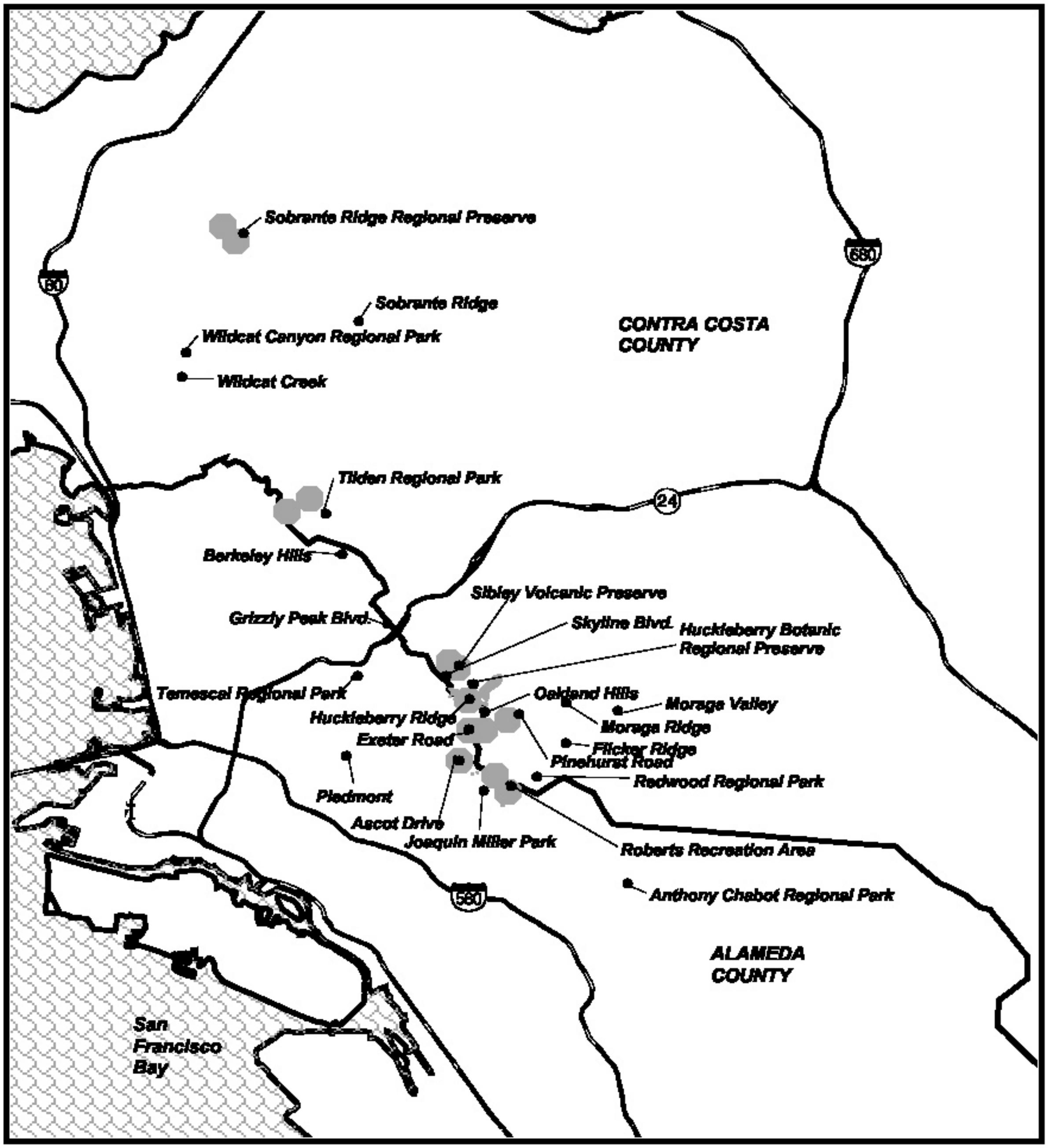


Figure 11. Distribution of *Arctostaphylos pallida* (pallid manzanita).

Species Locations

2 0 2 4 Miles

1:200,000

USFWS Draft Recovery Plan

large populations are known, one at Huckleberry Ridge, the presumed type locality in Alameda and Contra Costa Counties, and the other at Sobrante Ridge in Contra Costa County. Sobrante Ridge is completely within a 111-hectare (277-acre) Regional Preserve owned and managed by East Bay Regional Park District. Most of the population at Huckleberry Ridge is within lands owned and managed by East Bay Regional Park District as part of the 94-hectare (236-acre) Huckleberry Botanic Regional Preserve. Scattered plants within the Huckleberry Ridge population also exist on privately owned lots along Villanova and Manzanita Drives in the City of Oakland (California Natural Diversity Data Base 1998).

Several other small (natural and planted) populations occur in Alameda or Contra Costa Counties. For example, the *Arctostaphylos pallida* population located on East Ridge above Pinehurst Road in Contra Costa County has 25 plants (from seedlings to adults), which are in poor condition from shading and threatened by possible hybridization with *Arctostaphylos tomentosa* ssp. *crustacea* (brittle-leaf manzanita). According to East Bay Municipal Utility District, the current property owner, these plants were located only recently when the property was purchased. Proposed management by East Bay Municipal Utility District includes rectifying some of the shading and competition problems, and collecting seed for greenhouse propagation for the purpose of planting this species in a more manageable location. This area is determined to have an extremely high wildfire potential and East Bay Municipal Utility District is considering a plan to remove the woody plants and plant grasses to reduce the fire threat to nearby homes (D. Harvey and E. Warne *in litt.* 1997).

Other documented occurrences of *Arctostaphylos pallida* are on privately owned lots adjacent to Skyline Blvd on Ascot Drive, Exeter (California Natural Diversity Data Base 1998), and Archery Field Road (K. Cuneo *in litt*. 1994); and an unspecific historic reference to Moraga Valley (B. Olson *in litt*. 1994). Scattered locations on public lands include three occurrences at Joaquin Miller Park owned by the City of Oakland; one occurrence at Redwood Regional Park; and two occurrences documented at Tilden Regional Park (California Natural Diversity Data Base 1998). Both Regional Parks are owned and managed by East Bay Regional Park District. In 1992, three individual plants were discovered at Sibley Volcanic Preserve, also owned and managed by East Bay Regional Park District

(B. Olson *in litt*. 1992, B. Olson *in litt*. 1994, California Natural Diversity Data Base 1998).

Not all these satellite populations of *Arctostaphylos pallida* are naturally occurring. As part of a Civilian Conservation Corps project in the late 1930's the late James Roof, founding director of the Regional Parks Botanic Garden, directed a planting program that is thought to have included *A. pallida*. Roof attempted to establish satellite populations along and near the ridge line of the Oakland/Berkeley Hills along Skyline and Grizzly Peak Boulevards (B. Johnson *in litt*. 1983). Today the plants at the Rotary Camp Area on Skyline Boulevard; at Bay View Trail in Joaquin Miller Park (California Natural Diversity Data Base 1998); and near the Tilden Botanic Garden in Tilden Park (Park Hills Road/Golf Course Road and Shasta Road intersection, and Wildcat Canyon Road) are the survivors of Roof's planting effort (B. Johnson *in litt*. 1983, Amme and Havlik 1987*b*). Any population near or within Sibley, Roberts, Redwood, and Anthony Chabot Parks, and an unreported population at Temescal Park, would also be strongly suspected to contain plants that were planted by Roof (B. Johnson *in litt*. 1983). No record of *Arctostaphylos pallida* has been found for Anthony Chabot Park. Although not purposefully planted, another naturalized stand of *Arctostaphylos pallida* occurs along Skyline Boulevard adjacent to Joaquin Miller Park (California Natural Diversity Data Base 1998), having been transported there in the early 1970's as seed in road cut material taken from Huckleberry Ridge (Amme and Havlik 1987*a*).

3. Life History and Habitat

Reproduction and Demography. - Chaparral consisting of *Arctostaphylos* (manzanitas) often forms a stiff, almost impenetrable stand. About half of the species of *Arctostaphylos* can re-sprout after fire (burl-forming). The other half cannot, and are known as obligate-seeders (non-burl-forming) (Hanes 1988). *Arctostaphylos pallida* is an obligate-seeder, reproducing sexually only from seed. Bees appear important in pollination (D. Amme pers. comm. 1997). Stands of *Arctostaphylos* develop at a moderate rate. Cover may be 50 percent in 10-year-old stands, 80 percent in 25-year-old stands, and 100 percent in 50-year-old stands (Hanes 1988). *Arctostaphylos* older than 50 years can begin to decline (Philpot 1977 as cited in Amme and Havlik 1987*a*).

The understory of *Arctostaphylos pallida* is generally free of vegetation, including young *Arctostaphylos*, because of the allelopathic effect of phytotoxins (toxins produced by plants) produced by roots, fallen fruit, leaf litter and exfoliating bark of *A. pallida*. Obligate-seeding *Arctostaphylos*, such as *A. pallida*, need fire to remove phytotoxins from the soil and scarify the seed coat to initiate sprouting (Keeley and Zedler 1978, Wells 1969, Chou and Muller 1972 as cited in Amme and Havlik 1987*b*). Scarification of the seed coat by digestion or mechanical disturbance may be an alternative to fire under certain conditions. For instance, birds can also play an important role in successful recruitment of *A. pallida*, provided that the seeds they digest and excrete fall on appropriate soils (Amme and Havlik 1987*a*). Fortunately seeds are long-lived, remaining viable in the soil for many years (Keeley 1987, 1991). No alternatives to fire are known for the removal of phytotoxins from the soil.

Arctostaphylos pallida also can reproduce asexually by layering. Layering occurs when, to reach the sunlight, branches reach out from the plant's base, come into contact with the deep leaf litter, and produce roots. Some extensive clones of *A. pallida* have developed in this manner (Amme and Havlik 1987*a*).

Arctostaphylos pallida is a fire-adapted chaparral shrub (Amme and Havlik 1987*b*) that shows signs of decline with great size and age (Amme and Havlik 1987*a*). Fire suppression in the Oakland/Berkeley Hills, in combination with increased browsing of tree and shrub seedlings and acorns by deer and livestock, has led to structural and compositional change in habitats within the range of *A. pallida*. Open-canopied oak woodlands maintained historically by frequent fire have been converted, in the absence of fire, into closed-canopied woodland-forests dominated by *Umbellularia californica* (California bay), other native trees, or exotic coniferous or *Eucalyptus* forests (McBride 1974, B. Olson *in litt*. 1994, Safford 1995). The denser canopies of these forests and woodlands create a microclimate unsuitable for healthy *A. pallida* plants. For example, the small population of *A. pallida* above Pinehurst Road persists in the understory of a closed-canopy forest of *Umbellularia californica* (California bay) and *Arbutus menziesii* (madrone). No signs of recent fire are present at this site and the site may not have burned for more than 100 years (R. Nuzum *in litt*. 1997). Most of the 14 adult *A. pallida* in this population are unhealthy and show signs of fungal infections and bark stripping. At the Huckleberry Ridge population, the effects of fire suppression are evident. *A. pallida* plants are generally wider than they are tall, a consequence of growing away from the overstory canopy to reach light, and all of the plants displayed bark stripping (Amme and Havlik 1987*a*). Fire may not have occurred at Huckleberry Ridge for 70 years or longer (R. Nuzum *in litt*. 1997, D. Harvey and E. Warne *in litt*. 1997).

Habitat and Community Associations. - *Arctostaphylos pallida* is a plant with narrow environmental tolerances. Plants are limited to bare, sterile, siliceous mineral (silica rich) soil indicative of the shale-chert formation soil series (B. Johnson *in litt*. 1983). The two main populations of *A. pallida* occur on Middle Miocene cherts and shales of the Monterey Group (mapped as Millsholm series in the Soil Conservation Service Soil Survey of Contra Costa County) (Stratford and Edwards 1984, R. Nuzum *in litt*. 1997). Satellite populations are on Pinehurst Shale and Joaquin Miller Formation (Radbruch 1969 as cited in Amme and Havlik 1987*b*), with a small stand occurring on soft sandstone. *A. pallida* grows on these soils in areas that experience the maritime influence of summer fog, but appears to be absent on the same substrate where summer air and soil temperatures are higher (B. Johnson *in litt*. 1983).

Mean annual precipitation in the Oakland/Berkeley Hills is between 55 and 65 centimeters (22 and 26 inches) (Patton 1956). Fog drip may add an additional 25 centimeters (10 inches) of precipitation over the year (Gilliam 1962 as cited in Amme and Havlik 1987*a*). When fog is present in the summer, solar energy is reduced and condensation on plant leaves lowers evapotranspiration rates, resulting in less stress for many plants during summer (Stone *et al.* 1950).

Arctostaphylos pallida is found from 200 to 445 meters (656 to 1,460 feet) in elevation (Amme and Havlik 1987*a*). Populations that occur in maritime chaparral appear to be the largest and most viable, whereas the populations that occur in coastal scrub, closed-cone coniferous forest, and *Eucalyptus* forest appear to be relictual or remnant populations that have been invaded by other native and nonnative trees and shrubs. In maritime chaparral, *A. pallida* appears to be co-dominant with other woody shrubs and shrub-form trees, including *A. tomentosa* ssp. *crustacea* (brittle-leaf manzanita), V*accinium ovatum* (huckleberry), *Chrysophylla minor* (chinquapin),and several shrub-form *Quercus* spp. (oaks). Adult *Vaccinium* shrubs do not seem to be affected by *A. pallida* allelopathy (the ability of one strain of plant to adversely influence another, usually by the production of a chemical inhibitor); however, seedlings are affected. Amme and Havlik (1987*b*) suggest that the adult *Vaccinium* plants re-sprouted after a fire or were established soon after one. In coastal scrub, *A. pallida* occurs occasionally in a community dominated by *Baccharis pilularis* (coyote brush) and *Toxicodendron diversilobum* (poison oak). In closed-cone coniferous forest and *Eucalyptus* forest, *A. pallida* is an occasional understory component of the canopy (B. Olson *in litt*. 1994). However, over the long term *A. pallida* is intolerant of shade (Amme and Havlik 1987*a*).

4. Reasons for Decline and Threats to Survival

Arctostaphylos pallida was listed as threatened in 1998 (U.S. Fish and Wildlife Service 1998*a*) based on an analysis of the five listing factors under section 4(a)(1) of the Endangered Species Act. The threats to the species were classified under these factors: (1) the present or threatened destruction, modification, or curtailment of its habitat or range (destruction from residential developments - impacts major in past but likely to be minor in future); (2) overutilization for commercial, recreational, scientific, or education purposes (possible trampling or collection as rare plant, considered a minor threat); (3) disease or predation (fungal infection, shading by competing plants); (4) the inadequacy of existing regulatory mechanisms (limited protection under State law, incomplete implementation of State management plan); and (5) other natural or manmade factors affecting its continued existence (senescence and lack of germination due to fire suppression, hybridization, herbicide use, fragmentation and introduction of exotic plants due to previous urban development). Currently, all threats identified at the time of listing are still considered relevant. The primary threat is habitat alteration from changes in interval or seasonality of burning due to fire suppression; minor habitat loss may occur due to single-family residential development on infill vacant lots and potential construction and maintenance of recreational facilities and fuel breaks.

Reasons for Decline. - Residential development in the Oakland/Berkeley Hills has increased the indiscriminate use of herbicides, bulldozing of *Arctostaphylos pallida* plants, loss of habitat, fragmentation, introduction of nonnative and competitive species, and avid fire suppression policies – all of which have had, and continue to have, negative effects on *A. pallida*. Natural factors, such as fungal infections, have also taken their toll on *A. pallida* populations (U.S. Fish and Wildlife Service 1998*a*). Approximately half of the documented occurrences of *Arctostaphylos pallida* are declining, while the trend of the remaining occurrences is uncertain or unknown (California Natural Diversity Data Base 1998).

Although *Arctostaphylos pallida* occupies most of its historic range, local habitat destruction due to residential development has resulted in dramatic losses. For example, up to 50 percent of the plants in some locations along Manzanita Way in the Oakland Hills were lost due to development (B. Olson *in litt*. 1994). Residential development at Huckleberry Ridge has contributed to the introduction of nonnative landscape and weedy plant species that compete with the remnant *A. pallida* population (Amme and Havlik 1987*b*). Small populations, in particular, have been affected by shading from planted *Eucalyptus* spp., *Pinus radiata* (Monterey pine), and *Cupressus* spp. (cypresses), and by competition with other aggressive nonnative plant species including *Genista monspessulana* (French broom), *Vinca major* (periwinkle), and *Senecio mikanioides* (German ivy) (Amme *et al.* 1986, B. Olson *in litt*. 1994, N. Havlik pers. comm. 1997). A few landowners have planted other species of *Arctostaphylos* as landscape plants (Amme and Havlik 1987*b*). *A. pallida* has hybridized with these planted *Arctostaphylos* (B. Johnson *in litt*. 1983). It is not known whether this hybridization has yet led to a decline of *A. pallida*, but botanists believe that it is a significant threat to the recovery of the species (Amme and Havlik 1987*b*). The use of herbicides along roadsides has had negative effects on regeneration of *A. pallida* along Skyline Boulevard (Amme and Havlik 1987*a*); however, the extent of these effects is unknown.

In October of 1991, a firestorm swept over portions of the Oakland/Berkeley Hills. Immediately following the fire, fire prevention activities such as brush removal increased. Private land owners, East Bay Municipal Utility District, East Bay Regional Park District, local fire districts, the University of California - Berkeley, and the California Department of Forestry and Fire Protection removed brush in *Arctostaphylos pallida* populations with little attention being paid towards identifying and preserving individual *A. pallida* plants or insuring the long-term viability of *A. pallida* populations (B. Olson *in litt*. 1994).

Naturally occurring events have negatively affected some *Arctostaphylos pallida* populations. A drought in the late 1970's followed by the heavy rains of early 1980's resulted in a significant dieback of *A. pallida* plants at Huckleberry Ridge. A status survey in the mid-1980's indicated that the Huckleberry Ridge population had an estimated 2,400 to 2,700 plants, over half of which showed signs of branch and stem dieback. Samples of dead and dying branches and roots were taken to plant pathologist Dr. Robert Raabe, who believed a root fungus was the cause of dieback. Fungus attacks the root system when moisture in the ground is abundant and drainage is poor – conditions highly favorable to fungi (Amme and Havlik 1987*b*). The condition of the Huckleberry Ridge population was subsequently described as poor, even though remaining healthy branches appeared to be vigorous (Amme and Havlik 1987*a*). The smaller of the two populations, at Sobrante Ridge, had an estimated 1,700 to 2,000 plants in the mid-1980's and the status and vigor of the plants appeared good. This population was not affected by the fungus (Amme *et al.* 1986, Amme and Havlik 1987*b*).

Threats to Survival. - The primary threats to *Arctostaphylos pallida* are the effects of fire suppression, shading, and competition from native and nonnative plants. The species also is threatened by disease, herbicide spraying, hybridization, and the ongoing effects of habitat loss and fragmentation (U.S. Fish and Wildlife Service 1998*a*). Additionally, as populations of *A. pallida* dwindle, the negative effects of genetic drift and inbreeding depression may be magnified. Small populations often are subject to increased genetic drift and inbreeding as consequences of their small populations (Ellstrand and Elam 1993). A loss of genetic variability, and consequent reduction in genetic fitness, provides less opportunity for a species to successfully adapt to environmental change (Ellstrand and Elam 1993).

The Sobrante Ridge population of *Arctostaphylos pallida* suffers the least human impact. The Huckleberry Ridge population, however, suffers from significant direct and indirect human impact where residential housing is built among the *A*. *pallida* (Amme and Havlik 1987*b*). Residential expansion has resulted in the planting and subsequent spread of many nonnative and native species of trees and shrubs (Amme and Havlik 1987*a*). Many of these species grow faster than *A. pallida* and, in some locations, completely shade them. Excessive shade and overcrowding can cause a slow decline in the plant's overall health and vigor that can lead to the spread of disease (Smith 1985, Amme and Havlik 1987*a*). Some of these nonnative plants have escaped and now exist within Huckleberry Ridge Preserve, covering portions as large as 0.4 hectare (1 acre) (B. Olson pers. comm. 1999).

The genetic integrity of *Arctostaphylos pallida* is threatened by hybridization with other species of *Arctostaphylos* introduced into the vicinity of *A. pallida* populations (D. Amme, pers. comm. 1994). At least three other species of *Arctostaphylos* have been used for landscaping on private lands along Manzanita Way, a road that borders the Huckleberry Ridge Preserve. Hybrids between *A. pallida* and a common associate, *A. tomentosa* ssp. *crustacea* (brittle leaf manzanita), are known to occur within two separate populations (Amme *et al.* 1986, D. Harvey and E. Warne 1997 *in litt*. as per J. Dunne). Hybrids have also been observed between *A. pallida* and *A. glauca* (bigberry manzanita) in Oakland parks (D. Amme pers. comm. 1997). *A. pallida* closely resembles *A. pajaroensis* (Pajaro manzanita), a species native to the Pajaro River area of Monterey County. Hybrids may be occurring between these two species in areas where residents have planted *A. pajaroensis* along Huckleberry Ridge (D. Amme pers. comm. 1997). Hybridization with any of these taxa could result in a hybrid manzanita “swarm” (a series of highly variable forms produced by the crossing and back-crossing of hybrids) replacing pure *A. pallida* (Amme and Havlik 1987*b*, Amme *et al.* 1986). The Sobrante Ridge population is not as threatened by hybridization, as currently there are no planted nonnative manzanitas (Amme and Havlik 1987*b*); however, with the presence of *A. tomentosa* ssp. *crustacea* (brittle-leaf manzanita), hybridization may be occurring (D. Harvey and E. Warne *in litt*. 1997).

Approximately 50 percent of the Huckleberry Ridge population of *Arctostaphylos pallida* was affected in the 1980's by a *Botryosphaeia* fungus and an unknown root fungus that attacked the roots of the plants, causing branch and stem dieback (Smith 1985, Amme and Havlik 1987*a*). After the dieback the Huckleberry Ridge population was considered in poor condition although the remaining healthy branches were vigorous (Amme and Havlik 1987*b*, California Natural Diversity Data Base 1998). The current condition of the Huckleberry Ridge population is uncertain. If the wet, cold weather conditions that induced the fungal infection are repeated, another infection could occur, reducing the vigor of the population (D. Amme pers. comm. 1994). Currently, there appears to be a virus affecting the branches of plants; the pathogen is unknown (B. Olson pers. comm. 1999).

Possibly the single most important factor limiting the recovery of the *Arctostaphylos pallida* is the continuing suppression of its natural disturbance regime (B. Johnson *in litt*. 1983). It is believed that fire plays a major role in maintaining the health of manzanita stands and the genetic diversity of populations (Reid and Oechel 1984). Without fire, or some other disturbance, manzanita stands tend to become decadent. Lower portions of plants die off as they are shaded by the uppermost branches. The accumulation of dead branches and years of leaf litter increases fuel for wildfires, thus increasing the heat and duration of those fires (Green 1981 as cited in Sparks and Oechel 1984). Under such fuel loading conditions, individual manzanitas and a percentage of seed within the soil may not survive slow moving fires with high temperatures (Bentley and Fenner 1958).

Due to past and present fire suppression policies and inactive or ineffective fire management plans, the long-term viability of *Arctostaphylos pallida* is in doubt. Both the Huckleberry and Sobrante Ridge populations suffer from overshading, disease, and low recruitment, possibly as a result of fire suppression (R. Nuzum *in litt*. 1997, B. Olson pers. comm. 1999, H. Forbes *in litt*.1999). In the 1800's, before the expansion of urban areas into the Oakland/Berkeley Hills, major natural or human-caused fires periodically burned through manzanita habitat mainly from east to west driven by dry "Diablo Winds" during the late summer and fall (East Bay Regional Park District *in litt*. 1996, R. Nuzum *in litt*. 1997). These fires rarely threatened the lower-lying residential communities of Berkeley and Oakland. From about 1900 to 1940, fire management practice changed from unrestricted burning to permitted burning only (Sampson 1944, Dunne *et al.* 1991). The California Department of Forestry and Fire Protection currently has a policy of immediate suppression of all wildfires (B. Harrington pers. comm. 1996). Due to the expansion of homes up to the crest of the Oakland/Berkeley Hills during the 1940's and 1950's, human-caused fires, such as the Oakland Hills firestorm of 1991, are now a major threat to human safety (East Bay Regional Park District *in litt*. 1996).

Fragmentation of *Arctostaphylos pallida* natural habitat has also been a result of the residential development in the Oakland/Berkeley Hills. Splitting the habitat into smaller, more isolated units may be altering the physical environment by changing factors such as the amount of incoming solar radiation (Saunders *et al.* 1991), which over time may have a negative effect on this species. Additionally, small, isolated populations are vulnerable to extinction from random fluctuations in population size due to naturally occurring events such as disease or variations in population characteristics caused by annual weather patterns, and other factors. Small populations are also vulnerable to the effects of genetic drift (the loss of genetic variability) and inbreeding depression (the expression of deleterious genes). These phenomena reduce the ability of populations and individuals to respond successfully to environmental stresses.

Although most populations are within public lands, where residential development is not occurring, direct mortality of individual plants due to urban development remains a threat. Individual plants now existing in a planned development within Oakland's city limits are at risk from grading and associated effects of residential development (H. Forbes *in litt*. 1999). Although mitigation in the form of management funding has been proposed to offset the loss of these individual plants (B. Olson pers. comm. 1999), the loss of these plants illustrates that not all individuals are on protected lands. On East Bay Regional Park District lands, establishing and maintaining fuel breaks for fire protection or providing for recreational facilities may result in removal of some *Arctostaphylos pallida* plants (B. Olson *in litt.* 1997).

5. Conservation Efforts

The California Fish and Game Commission listed *Arctostaphylos pallida* (common name given is Alameda manzanita) as an endangered species under the California Endangered Species Act in October of 1979. The species was federally listed as threatened in 1998 (U.S. Fish and Wildlife Service 1998*a*). The California Native Plant Society lists *A. pallida* as 1B, thereby making the plant eligible to be fully considered during preparation of environmental documents relating to the California Environmental Quality Act (Skinner and Pavlik 1994).

The California Department of Fish and Game and East Bay Regional Park District jointly developed the Alameda Manzanita Management Plan in 1987. The mission of the plan was to determine and implement management activities that would improve the condition of the remaining populations and help in their recovery (Amme and Havlik 1987*b*). Six primary goals were developed: (1) control exotic and native plant competition, (2) protect the gene pool, (3) investigate the ecology and required habitat, (4) establish new populations, (5) develop a stewardship cooperation program with private and agency input, and (6) compile an education pamphlet.

Experiments were begun, including: removal of competing native *Quercus* (oaks), *Umbellularia californica* (California bay) and *Arbutus menziesii* (madrone) over 450 square meters (5,000 square feet) at Sobrante Ridge; removal of *Acacia* (acacia) over 90 square meters (1,000 square feet), and the removal of *Eucalyptus* (eucalyptus) and *Genista monspessulana* (French broom) over 900 square meters (10,000 square feet) within Huckleberry Botanic Regional Preserve; removal of dead manzanita debris and leaf litter, with the seeding of untreated manzanita seed along 135 square meters (1,500 square feet) of Huckleberry Trail; removal of *Eucalyptus* and *Pinus radiata* (Monterey pine) trees overtopping *Arctostaphylos pallida* near Roberts Recreation Area (270 square meters or 3,000 square feet); and initial seed germination trials testing various scarification treatments (Amme and Havlik 1987*b*). Where plants shading *A. pallida* were removed, the manzanita responded dramatically with vigorous spring growth. However, no recruitment of *A. pallida* was noted at any site and initial scarification treatments were not promising (Amme and Havlik 1987*b*).

In a 1993 fuel management and habitat improvement experiment at the Huckleberry Ridge site, a small area overgrown with a dense stand of *Arctostaphylos pallida* was cleared and the cut vegetation was piled and burned. Seedlings of *A. pallida* were present the following year. Hand pulling of *Genista monspessulana* (French broom) was necessary during 1994 and 1995. During a site visit in March of 1997, 40 to 50 *A. pallida* were present. Most were 10 to 15 centimeters (4 to 6 inches) tall, vigorous, and well-branched. The seedlings were found on the barer soil areas. In addition to continued invasion by

G. monspessulana, native *Baccharis* (coyote brush) had begun to invade the site (E. Leong *in litt*. 1997).

Although short-lived, these experiments did begin to answer management questions and provide direction for future research. Unfortunately, due to limited funding and conflicting fire management policies, the Alameda Manzanita Management Plan was only partially carried out (B. Olson pers. comm. 1999). More than half of the remaining occupied habitat for this species, including both large populations and numerous smaller populations, occur on lands owned by the East Bay Regional Park District (B. Olson *in litt*. 1997). East Bay Regional Park District included funding needs for *Arctostaphylos pallida* management as Measure W on the 1998 ballot, but this measure was defeated (B. Olson pers. comm. 1999).

6. Recovery Strategy

Recovery of *Arctostaphylos pallida* must focus on protecting and managing the remaining populations by working cooperatively with public landowners (the East Bay Regional Park District, East Bay Municipal Utilities District, and City of Oakland) and private landowners to ensure the long-term survival of the species on their lands. Because *A. pallida* is limited in its range, all occurrences on public lands must be managed and protected in perpetuity. Management includes: native and nonnative tree removal; control of other nonnative vegetation; reintroduction of the natural disturbance regime needed for the maintenance of the chaparral habitat and populations of *A. pallida*; and the reduction of other observed threats (threats are listed in Appendix D). Public outreach and cooperation must be stressed for successful implementation of recovery for *A. pallida*. Populations on private land should be voluntarily protected through conservation easements or other means. On public lands protection should, at least, involve securing the populations in perpetuity themselves and a minimum of a 460-meter (500-yard) buffer around each population, where possible, to reduce external influences and allow expansion of the populations. We know that in some cases existing housing will preclude buffers of this size. However, in areas where this limitation currently does not exist, we recommend using the large buffer to minimize the risk to human life and property. Other unoccupied habitat at the sites on public lands might provide space for expansion of the populations. Habitat for pollinators and seed dispersers must be protected. Existing sites (especially the Sobrante Ridge and Huckleberry Regional Reserve population) should also be enhanced.

Another high priority action is the development and implementation of sound management plans for all the populations on public lands. These plans should include a fire management section that discusses the possibility of prescribed burns to address the declining health and lack of recruitment within the *Arctostaphylos pallida* stands. The use of prescribed burns will be most practicable at the Sobrante Ridge site, which has a larger buffer between the existing population and the surrounding housing. The fire management section should also address fire suppression and fuels management activities to ensure that these activities are compatible with the recovery goals for this species. A fire management plan has been started but not completed for the populations on East Bay Municipal Utility District land. Because the threat of a catastrophic wildfire in this area is so immediate and would be devastating to the human community, cooperation on this plan should be a high priority. The plans should include provisions for standardized monitoring of *A. pallida* populations every 3 years to determine demographic trends. The plans should also include strategies to minimize known threats at the sites as well as to identify new threats as they may occur. If new threats are identified or other new information becomes available, the management plans need to be reevaluated and revised.

Historic locations should be surveyed to determine whether suitable habitat remains, the species persists at the sites, and/or the sites may be suitable for reintroduction of the species. Additionally surveys should include areas on Millsholm Series soils along the ridge of the Oakland/Berkeley hills from approximately 5 miles southeast of Joaquin Miller Park to Sobrante Ridge. Suitability of historic locations for reintroduction or introduction would depend upon: (1) whether potential habitat exists, (2) the presence and magnitude of threats, and (3) whether the sites can be secured and managed for the long-term protection of the species. Surveys should also include other chaparral habitat to determine whether undiscovered populations may exist. If new populations are discovered, they should be protected and managed. If new populations are not discovered, reintroductions or introductions should occur.

Second priority is given to reintroductions to historical sites and third priority to introduction of new sites within the historical range of the species. The lower priority of reintroduction and introduction is based on the uncertainty and difficulty associated with these strategies (Falk *et al*. 1996). However, long-term survival in nature for *Arctostaphylos pallida* is problematic if new populations are not established. *Arctostaphylos pallida* occurs in only two major populations, and additional separate preserves are desirable to reduce the risk of a natural catastrophe or human-caused event eliminating most or all of its populations.

Reintroductions and introductions should be considered experimental because "the reintroduction of any species is inherently complex" and "the science of reintroduction is in its infancy" (Falk *et al*. 1996). Any attempted reintroduction should be for specific, defensible reasons and should be conducted with the recognition that: (1) determining the outcome takes time (years and perhaps decades) and (2) planning and long-term commitment are essential (Falk *et al.* 1996).

Reintroduction sites should be on public lands, in areas where relatively natural fire regimes can be maintained. Any attempted reintroduction must follow our controlled propagation policy (U.S. Fish and Wildlife Service 2000*c*). Reintroduced and introduced populations should not be counted toward recovery goals until they have persisted without intervention through the natural fire cycle (years and perhaps decades). Until there is evidence that such actions are likely to be successful, *A. pallida* should not be considered for delisting.

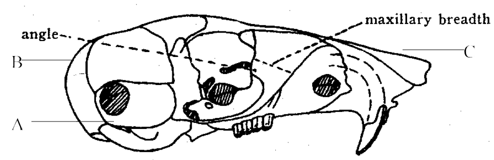
Collection and banking of seed in Center for Plant Conservation certified botanic gardens are also important recovery tasks for *Arctostaphylos pallida*. Seed banking is prudent to guard against extinction of the species from chance catastrophic events and to provide potential material for enhancement efforts in existing populations, reintroductions, and/or introductions to new sites. Care should be taken to ensure that seed collection does not adversely affect the donor population.

Certain research projects are also necessary for recovery, including: (a) assessing, and if necessary reducing, the threat of hybridization of *Arctostaphylos pallida* with other *Arctostaphylos*; (b) identifying the pathogens that have caused die-back, and developing techniques to prevent or combat pathogen attack on existing stands; (c) demographic studies determining limiting life stages including germination requirements; and (d) genetic studies to be used in reintroduction or introduction attempts. Other actions for *Arctostaphylos pallida* recovery include reducing the threat of nonnative plants and decreasing herbicide spraying.

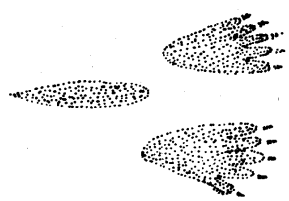
E. Berkeley kangaroo rat (*Dipodomys heermanni berkeleyensis*)

1. Description and Taxonomy

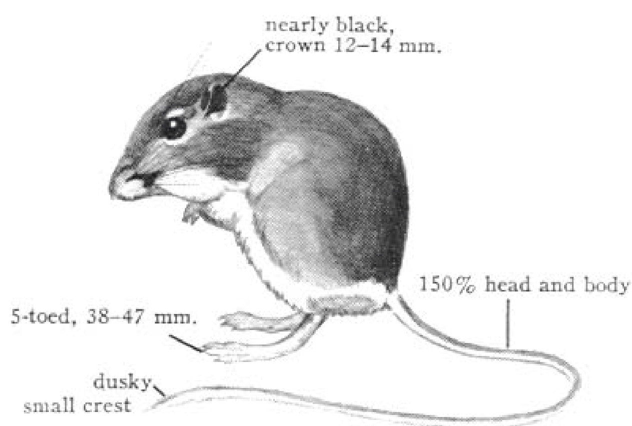
Taxonomy. - The Berkeley kangaroo rat (*Dipodomys heermanni berkeleyensis*) (Figure 12) was first described as *Dipodomys berkeleyensis* by Grinnell (1919), one of four new kangaroo rats he described from west-central California. Grinnell and McLean collected the type specimen at the head of Dwight Way, Berkeley, California, within the area known as the Oakland/Berkeley Hills. Hooper (1936) reviewed 12 specimens of *D. heermanni* (Heermann's kangaroo rat) from Mt. Diablo, Contra Costa County, California. He determined that they were Berkeley kangaroo rats and referred to them as *D. heermanni berkeleyensis*, thereby designating the Berkeley kangaroo rat as a subspecies of *D. heermanni*. He distinguished between the Berkeley kangaroo rat and *D. h. heermanni*, *D. h. goldmani* and *D. h. tularensis* (Tulare kangaroo rat) as distinct races. Although Grinnell (1933) had included the Berkeley kangaroo rat, Ingles (1948) made no mention of the Berkeley kangaroo rat and gave no reason for its omission. The taxonomic treatment by Hall (1981) includes the Berkeley kangaroo rat but references only Grinnell's two works on this subspecies.



Skull of ***Dipodomys*** showing position of maxillary arch



Tracks of kangaroo rat



HEERMANN KANGAROO RAT

(South from San Francisco Bay and San Joaquin County)

Figure 12. Illustration of a subspecies of *Dipodomys heermanni* closely related to the Berkeley kangaroo rat (*Dipodomys heermanni berkeleyensis*) (from Ingles 1965, with permission).

Description. - All kangaroo rats have external fur-lined cheek pouches, small ears, elongated hind limbs and shorter forelimbs. The tail of the kangaroo rat is tufted on the end and is always longer than the head and body combined (Ingles 1948). The descriptive name "kangaroo rat" comes from its distinctive bipedal locomotion (two-footed hopping). The tracks left by hopping show only the hind feet and tail marks. The forelimbs are short with strong claws that facilitate digging burrows. There are four functional toes with or without (depending on species) a functionless fifth toe high up on the inside of the hind foot (Ingles 1965). Other characteristics of kangaroo rats include a larger head compared to typical rodents; large, dorsally placed eyes; and small rounded ears (U.S. Fish and Wildlife Service 1998*b*). Important in classification to species is the shape of the maxillary bone in the skull. The paired maxillary bones make up the maxillary arch and bear all upper teeth but incisors. Also useful in classification is the shape of the baculum (sesamoid bone in the penis) (Ingles 1965).

Identification. - Berkeley kangaroo rats are a broad-faced, five-toed, middle-sized kangaroo rat. The total length of the type specimen was 301 millimeters (12 inches), the hind foot measured 41 millimeters (1.7 inches), and the weight was 77.0 grams (2.7 ounces). The Berkeley kangaroo rat differs from its nearest relative to the east, the Tulare kangaroo rat, in having a darker dorsal body-color, more solidly black and broader dorsal and ventral tail stripes, smaller light markings on ears and face, and blacker coloration of major dark markings. The skull has much less inflated bullae, broader interparietal, and broader rostrum (Grinnell 1919) (see A, B, and C respectively on skull illustration, Figure 12).

2. Historical and Current Distribution

Historical and Current Distribution. - In the original description of the species (Grinnell 1919), the Berkeley kangaroo rat was known only from the open hill tops immediately east of the City of Berkeley, California, on Dwight Way Hill at elevations from 90 to 515 meters (300 to 1,700 feet). In 1922 a specimen was collected north of Eureka Peak near the head of Siesta Valley, and in 1927 a specimen was collected by E. J. Hampton at "Orinda Lake" (Museum of Vertebrate Zoology 1999, California Natural Diversity Data Base 1998). Some confusion has existed about the location of Orinda Lake; it was thought to be San Pablo Reservoir, but is now thought to be the lake in Orinda Park near Eureka

Peak (G. Beeman pers. comm. 1999). By 1936, 12 specimens had been collected on Mt. Diablo, 20 miles east of Berkeley, at elevations around 90 meters (3,000 feet) (R. Orr *in litt*. 1936, E. Hooper *in litt*. 1936, D. Johnson *in litt*. 1936, F. Palmer *in litt*. 1936). All collected specimens but one are housed at the University of California, Berkeley, in the Museum of Vertebrate Zoology. The Natural History Museum of Los Angeles County has one specimen in its collection, which was collected at Strawberry Canyon in 1938 by J. C. von Bloeker (D. Janiger *in litt*.1999). The last museum record is of a specimen collected in 1940 at the Calaveras Reservoir Dam in Alameda County by K. E. Stager (Museum of Vertebrate Zoology 1999, California Natural Diversity Data Base 1998) (Figure 13). There is no indication that Berkeley kangaroo rats were trapped after that date at any of the above locations, so the animal has been presumed to be extinct. Berkeley kangaroo rats certainly no longer persist within the Oakland/Berkeley Hills, due to urban development and the resulting increase in domestic cats (J. Patton *in litt*. 1998). However, recent incidental accounts from other areas are intriguing.

During a small mammal trapping session at San Pablo Reservoir in the 1980's, kangaroo rats were listed as individuals captured (G. Beeman pers. comm. 1999). Also in the 1980's a "rat" was trapped at the base of Mt. Diablo and kept in captivity (G. Beeman pers. comm. 1999). The description of the rat strongly suggested that it may have been a kangaroo rat. The third account was from the early 1990's, when a homeowner from the Blackhawk area at the base of Mt. Diablo claimed their cat had captured a kangaroo rat (G. Beeman pers. comm. 1999). None of these accounts can be verified as no specimens or photos were taken. Gary Beeman, a local biologist, has been searching for the Berkeley kangaroo rat for over 10 years and has stated that populations may potentially still be extant. The Corral Hollow area of eastern Alameda and western San Joaquin Counties still harbors kangaroo rats. Some specimens from this area have been labeled as *D. h. berkeleyensis*, but are most likely the Tulare kangaroo rat (*D. h. tularensis*) (J. Patton *in litt*. 1999). Within East Bay Regional Park District's Ohlone Wilderness, a kangaroo rat was trapped in April 2000, and although it appeared to have characteristics of both subspecies, a comparison with study skins put the animal closer to *tularensis* than *berkeleyensis* (J. DiDonato *in litt*. 2000).

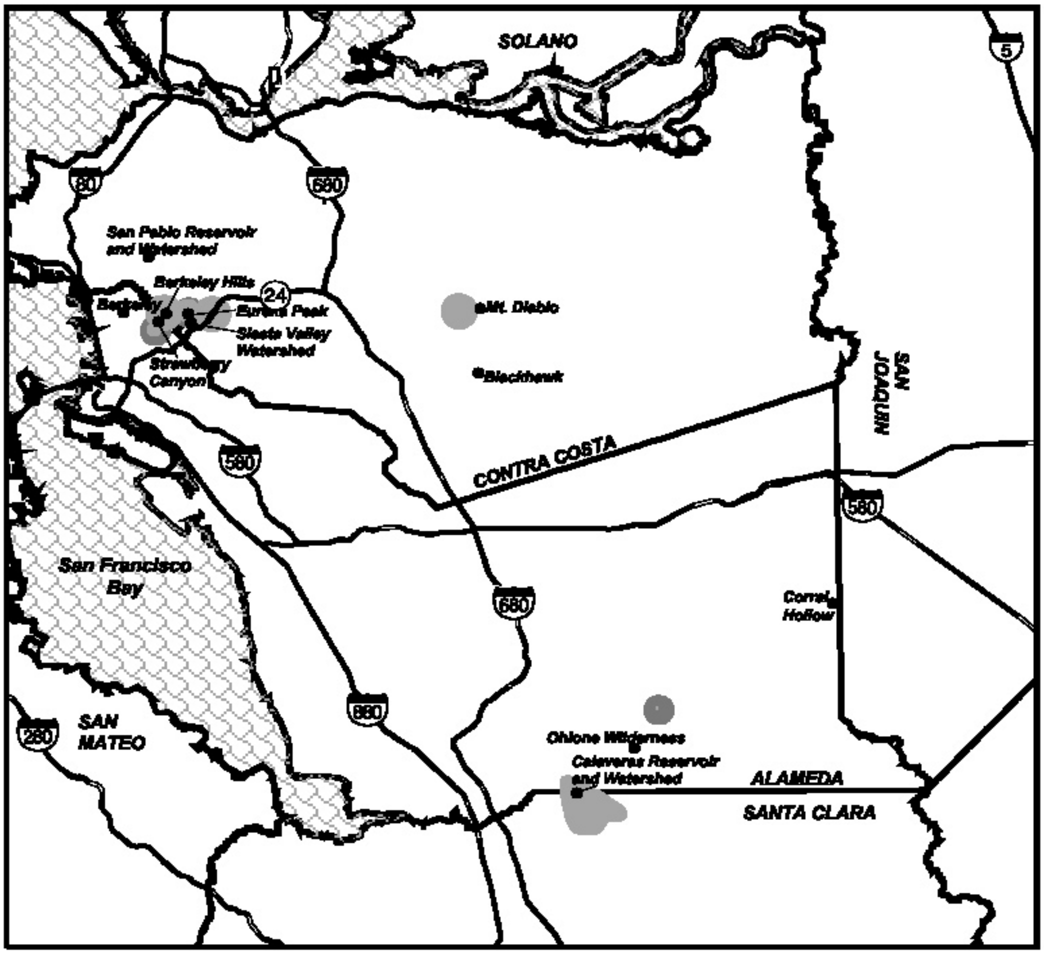


Figure 13. Historical distribution of Berkeley kangaroo rat
(Dipodomys heermanni ssp. *berkeleyensis).*

Species Locations

10 0 10 Miles

1:650,000

USFWS Draft Recovery Plan

3. Life History and Habitat

Kangaroo rats are adapted to arid conditions, having nocturnal foraging habits and other physiological adaptations to conserve water. There may be clinal variation (a gradual variation in a particular inherited characteristic found across a series of adjacent populations in a group of related organisms) with respect to water conservation. The maritime Santa Cruz kangaroo rat (*D. venustus*) is not nearly as physiologically efficient in water conservation (Church 1962 as cited in Ingles 1965) as are two of the desert species of kangaroo rat, the banner-tailed kangaroo rat (*D. spectabilis*) of Arizona and the Merriam's kangaroo rat (*D. merriami*) (Schmidt-Nielsen and Schmidt-Nielsen 1953, Ingles 1965). Tests demonstrate that the amount of humidity in the air can play a crucial role in the ability of kangaroo rats to avoid desiccation.

Kangaroo rats forage at night, collecting and carrying seeds in external fur-lined cheek pouches. Kangaroo rats typically have a diet consisting of seeds but may also eat some types of herbaceous vegetation and insects. Most kangaroo rats gather seeds when they are available and cache them for later consumption. Depending on the species, caches can be made within the burrow, as with the Heermann kangaroo rat (Ingles 1948), or in small pits on the surface of the soil, as with the Fresno kangaroo rat (*Dipodomys nitratoides exilis*) (U.S. Fish and Wildlife Service 1998*b*). The diet preferences of the Berkeley kangaroo rat are unknown.

Reproduction and Demography. - Very little is known about the Berkeley kangaroo rat; therefore, information from the parent species or other subspecies is presented. The Heermann kangaroo rat remains relatively solitary until the March to August breeding season, when it may breed as many as three times, producing litters of two to five pups (young) each. A nest of fine grass, roots, and seed husks is constructed within the burrow at depths of 30 to 75 centimeters (12 to 30 inches) below the surface (Ingles 1948). The pups are born in the burrow nest where they remain until they are fully furred and able to move about easily (U.S. Fish and Wildlife Service 1998*b*). Females born in the first litter have one and sometimes two litters of their own before winter. In some areas kangaroo rats can be the mainstay of predator populations (owls, coyotes, foxes, snakes, etc.), with a resulting high mortality rate within the kangaroo rat population. Most individuals probably do not live much beyond 1 year, although individuals over 5 years old have been recaptured (Ingles 1965).

Habitat and Community Associations. - Little is known about the favored habitat of the Berkeley kangaroo rat; what information we do have comes from field notes of the biologists who collected the specimens. References are made to Berkeley kangaroo rats being collected on bare ridges near rocky outcrops (D. Johnson *in litt*. 1936) and on thin soils with scattered chaparral species and small annual grasses (E. Hooper *in litt*. 1936). Burrows of Berkeley kangaroo rats were found in the same areas as meadow vole (*Microtus* spp.), gopher (*Thomomys* spp.), and ground squirrel (*Spermophilus beecheyi*) burrows (F. Palmer *in litt*. 1936, E. Hooper *in litt*. 1936). The Heermann kangaroo rat frequently digs its burrows beneath a protecting rock or shrub, with a main burrow and perhaps six entrances/exits (Ingles 1948). The field notes did not provide information on the location of Berkeley kangaroo rat burrows relative to rocks or shrubs.

4. Reasons for Decline and Threats to Survival

Reasons for Decline. - No data exist on the factors that led to the decline of the Berkeley kangaroo rat. Undoubtedly urbanization and the associated feral predators such as cats had a significant impact on the population or populations within the Oakland/Berkeley Hills. The other locations, Calaveras Reservoir and Mt. Diablo, did not experience the same level of urbanization. However, habitat destruction or degradation may have played a role, as might rodent poisoning programs, a prevalent practice from the turn of the century up through the 1970's.

If the Berkeley kangaroo rat is rediscovered, it is inevitable that there will be ongoing threats to its survival. Low population numbers, rodenticide use, predation, and incompatible land uses are all probable threats.

5. Conservation Efforts

In 1994, our Sacramento Fish and Wildlife Office recommended the Berkeley kangaroo rat be included as a category 2 candidate in the Animal Notice of Review. (See Table 1 for definition of category 2 candidate.) The trend of the subspecies was listed as unknown and clarification of the systematics of this taxon (i.e., its relationship to the Tulare kangaroo rat) was recommended (U.S. Fish and Wildlife Service *in litt*. 1994). Clarification of systematics, as well as the limits of the Berkeley kangaroo rat's geographic range, had been suggested by Williams (1986) in a Mammalian Status Report to the California Department of Fish and Game. Later in 1994 we listed the status of the Berkeley kangaroo rat in the Federal Register as a category 2, although it was not proposed for listing at the time (59 FR 58982) (U.S. Fish and Wildlife Service 1994*a*). Currently this species has no formal Federal designation. No specific conservation efforts have been taken to protect this species; however, some of the historical locations are now within University, park or watershed boundaries and have remained as open space. The Dwight Hill Way specimen may have been collected on land that belonged to UC Berkeley; however, specific information on the collection location was not provided. The Mt. Diablo specimens were collected on private lands that are now owned by the California Department of Parks and Recreation as part of Mt. Diablo State Park. The Calaveras Reservoir specimens were collected in what is now San Francisco Utility watershed land.

6. Conservation Strategy

One of the most practical conservation strategies is to include the Berkeley kangaroo rat in surveys that are being conducted for other species in this recovery plan. During surveys for these other species a habitat assessment for Berkeley kangaroo rat should be conducted, consisting of searching for appropriate burrows and collecting scat. If habitat is appropriate and burrows and scat are present, then trapping surveys should be conducted to identify species. Eventually, it may be possible to conduct surveys through scat collection and analysis using genetic markers. The Smithsonian Institution has developed a similar technique for other mammalian species. Analyzing scat is much less intrusive than trapping, takes fewer field hours, and can be conducted effectively without extensive training or having to obtain a trapping permit. If scat collected from any of the historical locations were identified to species using this technique, live trapping would then be necessary to confirm rediscovery (identification to subspecies using genetic markers is not practical at this time, so in-hand verification would be needed). Surveys should be conducted in the area of the 1936 captures and other suitable habitat on and around Mt. Diablo, and in the area of the 1939/1940 captures and other suitable habitat at Calaveras

Reservoir. At a minimum, a habitat assessment should be done on Eureka Peak to determine the level of urban disturbance. If suitable habitat still exists, trapping surveys should be conducted. The three locations of recent sightings should be investigated thoroughly for suitable habitat, with trapping surveys conducted if habitat still remains. Given detailed survey protocols, botanists and herpetologists could conduct habitat assessments during their scheduled plant or whipsnake surveys. Trapping would need to be conducted by qualified mammalogists.

To aid in rediscovery, public outreach should be done to describe identification of the species and assist reporting of sightings. Involving the public in the rediscovery process would not only provide us with potential locations to survey, but would provide a forum to discuss reasons for the species' decline and extinction including the part that domestic and feral cats play in the demise of small native mammal populations, the negative impact that ground squirrel control has had on a variety of rodents, and the impact of habitat loss and fragmentation.

If the Berkeley kangaroo rat is rediscovered, an immediate status review should be conducted to identify threats. Immediate protection should be implemented through cooperative efforts with landowners and land managers. Once the status review has been completed, conservation actions should be considered such as have been identified for the Fresno kangaroo rat, which is in similar circumstances - see the Recovery Plan for Upland Species of the San Joaquin Valley (U.S. Fish and Wildlife Service 1998*b*). Because so little is known about the Berkeley kangaroo rat, a team of mammalogists should be convened upon rediscovery to review the appropriateness of the following actions under the prevailing circumstances. Conservation actions to be considered should include immediate protection, reduction or elimination of threats, increased survey intensity, habitat management and restoration, genetic analysis, and, if warranted, other more intensive actions such as captive propagation.

- Conduct genetic analysis of rediscovered individuals and museum specimens to begin determining the amount of genetic isolation and the amount of diversity within the population. Compare to nearest neighbor, the Tulare kangaroo rat, to determine the role that this subspecies may play in the conservation of the Berkeley kangaroo rat. This information will be essential if captive breeding and/or reintroduction/relocation is needed to aid in conservation of the species.

- Intensify and continue efforts to locate populations of Berkeley kangaroo rats within the historical range of the species. Such surveying may include developing a method of identifying kangaroo rat scat through genetic analysis. If additional populations are discovered, are threatened, and are unable to be protected *in situ*, then it may be necessary to consider bringing the individuals into captivity. This measure would provide for a captive breeding colony and/or relocation, and would be done only under the direction of a U.S. Fish and Wildlife Service-approved captive propagation and genetics management plan.

- Begin habitat management studies and restoration. Restore habitat at historical locations in anticipation of reintroduction from either the captive individuals or those in need of relocation. Determine if connectivity is possible between existing or existing and reintroduced populations. Determine minimal area to be protected and negotiate easements or fee title with willing landowners. Easements would need to include land management guidelines that would promote conservation of the Berkeley kangaroo rat. If landowners are unwilling, then relocation or captivity may be the only option. Agreements for relocation would need to be negotiated. Request that East Bay Municipal Utility District, University of California Berkeley, and California Department of Parks and Recreation add into their land management plans that they would provide for reintroduction into historical habitat, and/or for protection, creation, and restoration of like habitat within these lands.

- Begin to reduce or eliminate possible threats. Work with the California Department of Pesticide Regulation to implement pesticide bulletins for Berkeley kangaroo rat, similar to those done for the Fresno kangaroo rat. These bulletins describe the necessary precautions and bait station design to protect these animals from getting into normal rodenticide bait stations. These bulletins should be drafted, even prior to rediscovery, for areas where habitat still exists.

- With input from mammal specialists, discuss the need for activities such as captive breeding, relocation, reintroduction techniques, etc. Captive breeding techniques could be developed using other subspecies of Heermann's kangaroo rat as surrogates.

- Make use of information gained from the Fresno kangaroo rat to assist in refining Berkeley kangaroo rat conservation strategy and planning for further actions. If listing is warranted then the conservation strategy will need updating to include recovery criteria.

- Monitor all populations and their supporting biotic communities twice annually for the first 5 years, annually for the next 5 years, and then at 3-year intervals until recovery is achieved or conservation goals are met.

F. Alameda whipsnake (*Masticophis lateralis euryxanthus*)

1. Description and Taxonomy

Taxonomy. - Two subspecies of the California whipsnake (*Masticophis lateralis*) are recognized: *M. l. euryxanthus* and *M. l. lateralis*. Various common names have been used for the genus *Masticophis*. The common name "Alameda striped racer" is currently used for *M. l. euryxanthus* by several authors, including Jennings (1987). Based on Stebbins (1985), we use the common name "Alameda whipsnake" for *M. l. euryxanthus* and "chaparral whipsnake" for *M. l. lateralis*. Riemer (1954) first described the Alameda whipsnake as a new subspecies of "striped racer" in the publication COPEIA. Riemer's description of the new subspecies was based on the differences between *M. l. lateralis* and *M. l. euryxanthus* in eight morphological characteristics. The *M. l. euryxanthus* specimens used in Riemer's comparison were the following: the type specimen collected in 1950 from the Berkeley Hills, Alameda County, two specimens from the vicinity of Berkeley, and one each from Somersville, Alamo, and Mt. Diablo in Contra Costa County. Several of these characteristics were illustrated with a drawing comparing a *M. l. euryxanthus* from Alameda County, with an *M. l. lateralis* specimen from San Benito County (considerably south of Alameda and

Contra Costa Counties). Riemer (1954) also stated that possible intergrades[1] were examined; however, he did not see them alive and therefore, did not use the color characteristics. Color on preserved snakes fades significantly over time, making two of the eight characters, dorsal color and dorsolateral stripe color, indeterminable on preserved specimens (Stebbins *in litt*. 1999, H. Greene pers. comm. 1998). Riemer (1954) provided a map indicating an area of possible intergrades in eastern Alameda County. Jennings (1983) segregated 36 museum specimens from Alameda and Contra Costa Counties into *M. l. euryxanthus*, *M. l. lateralis*, and *M. l. euryxanthus*/*M. l. lateralis* intergrades, and produced a detailed map of specimen locations and the zone of intergradation. This zone, according to Jennings, represents an area where both subspecies co-occur and breed, producing an individual with characteristics that reflect, to varying degrees, both parents. Jennings' segregation did not always match Riemer's, and Jennings posited that this discrepancy was a result of the increased number of specimens he had available for the comparison of relative variation. Within the 36 specimens, some of the characteristics reviewed were more variable than others. For example, Jennings found the width of the dorsolateral stripe to be more variable than the fairly consistent dorsal color (M. Jennings pers. comm. 1999).

[1] It is important to note that the term "intergradation" describes an intermediate form of an animal, but does not in itself describe hybridization (the offspring of two animals of different species or varieties of species); clinal variation (a gradual variation in a particular inherited characteristic found across a series of adjacent population); or expected variation within the population (a difference existing between the individuals of a species). Therefore, the particular author's definition, if known, is stated in the text. We use the term "intercross" to describe all crosses between individuals of different species, subspecies, and distinct population segments of vertebrates. Intercrosses between subspecies of the same taxonomic species, or between members of different vertebrate populations of the same taxonomic species or subspecies, are a common, natural, and expected occurrence in nature wherever ranges are adjacent or overlap. Protection, through a rule making process, can be afforded by the Endangered Species Act (i.e. Similarity of Appearance; U.S. Fish and Wildlife Service 1977) if the progeny of such an intercross shares characteristic traits of the listed parent and more closely resembles the listed parent's taxon than an entity intermediate between it and the other known or suspected nonlisted parental stock (U.S. Fish and Wildlife Service 1996*c*). For more details on our Proposed Intercross Policy see Appendix C.

Description. - The California whipsnake (*Masticophis lateralis*) is characterized by smooth dorsal scales with 17 dorsal scale rows at midbody, having the lower preocular scale wedged between the upper labial scales, and having a divided anal plate (Figure 14). The scientific name of the Alameda whipsnake (*Masticophis lateralis euryxanthus*) is apt (Jennings 1983). The specific name *lateralis,* of Latin origin meaning "of the side", apparently alludes to the whipsnake's conspicuous lateral stripe. The subspecific name *euryxanthus,* is derived from the Greek *eury*-, meaning wide or broad, and *xanthus*, yellow, likely referring to the wide yellow-orange lateral stripe.

This wide lateral stripe is one of the eight distinguishing characteristics on which this subspecies designation is based. The Alameda whipsnake has a broader lateral stripe than the chaparral whipsnake, ranging from one plus two half-scale rows wide to two full scale rows wide, as compared to the two half-scale rows of the chaparral whipsnake. The color of the stripe is yellow-orange in the Alameda whipsnake, versus cream or yellow in the chaparral whipsnake. The adult Alameda whipsnake virtually lacks black spotting on the ventral surface of the head and neck. Juveniles may show very sparse or weak black spots. A light stripe between nostril and eye is usually not interrupted by dark vertical lines along the margins of the loreal scale. There is usually no dark line across the rostral scale. The yellow-orange lateral stripe connects anteriorly with the light ventral surface (Riemer 1954). The dorsal color is absent from the ventrals for a greater distance back from the snout (tip of rostral scale) in the Alameda whipsnake (4.5 to 6 times the snout-parietal distance) than in the chaparral whipsnake (1.5 to 4 times the snout-parietal distance) (Riemer 1954). The Alameda whipsnake has a sooty black dorsal color, while the chaparral whipsnake is more olive, olive brown, blackish-olive or dark brown (Riemer 1954).

2. Historical and Current Distribution

Historical and Current Distribution. - When Riemer (1954) first described the Alameda whipsnake, only six specimens had been collected and preserved. These collections suggest that the Alameda whipsnake was distributed in the Berkeley Hills and around Mt. Diablo. By 1970 there were a total of 14 observations or specimens within Alameda and Contra Costa Counties; however, two of these specimens (from Mines Road southeast of Livermore) were identified as

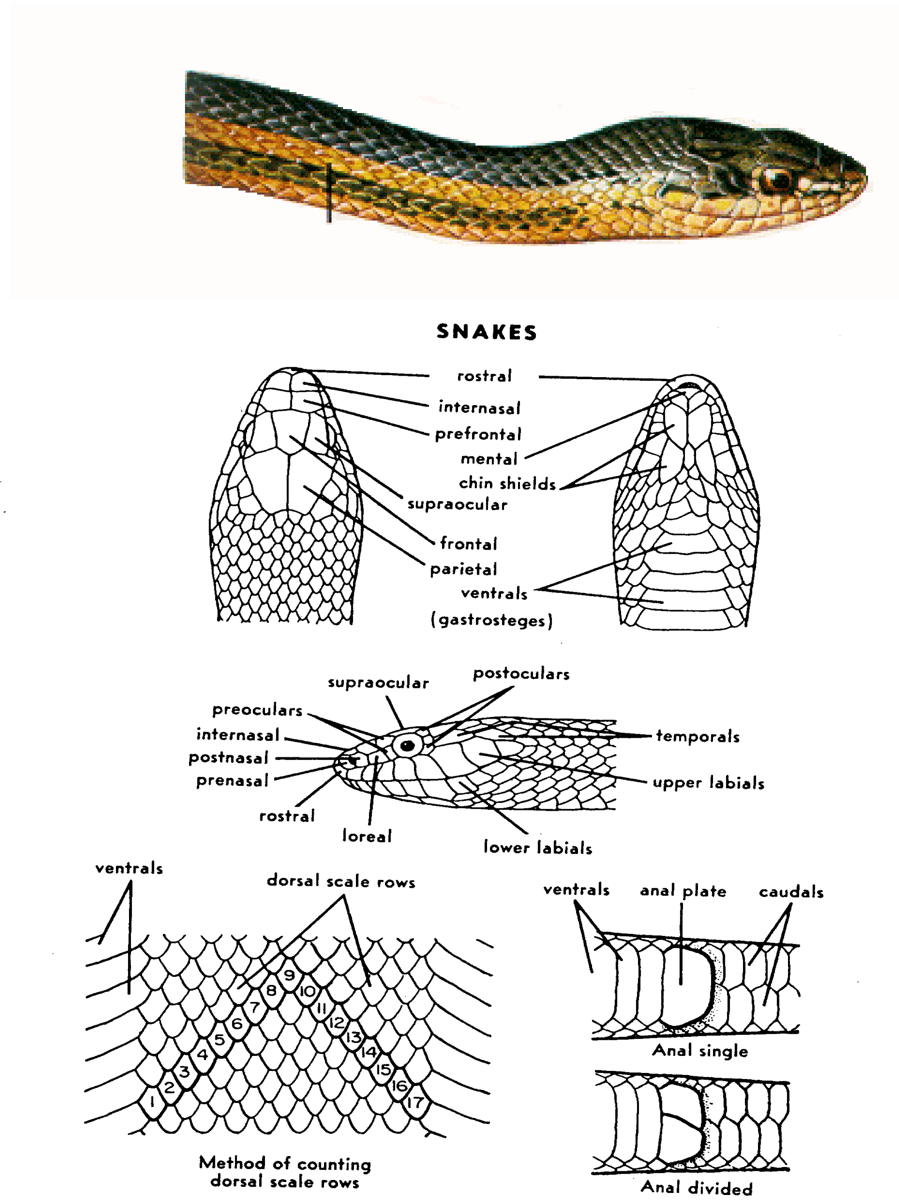


Figure 14. Illustration of *Masticophis lateralis* (specimen from Contra Costa County) and snake scale characteristics (Illustrated by Robert C. Stebbins, from Stebbins 1985, with permission).

chaparral whipsnake (Jennings *in litt*. 1994). With these limited data, the extent of historical distribution is difficult to determine.

The Alameda whipsnake likely inhabited suitable chaparral and scrub habitats within Alameda, Contra Costa, and possibly western San Joaquin and northern Santa Clara Counties. The extent to which the chaparral whipsnake or individuals with intergrade characteristics existed in these areas is not clear. It is inappropriate to estimate historical distribution from current vegetation distribution because the East Bay Area has experienced rapid changes in vegetation in the last 100 years. At the turn of the century, suppression of the natural fire regime, removal of cattle grazing in areas experiencing urbanization, and the planting of nonnative and native tree species for landscaping and commercial plantations significantly altered the vegetation types in the Oakland/Berkeley Hills (J. Kent pers. comm. 1999). Throughout the entire range of the Alameda whipsnake, more recent urbanization has resulted in removal of much chaparral and scrub habitat.

The distribution map (Figure 15) indicates the locations of the six specimens preserved as of 1954, the additional eight (including the two chaparral whipsnakes) as of 1970, and the more recent sightings and collections. The map also includes the chaparral whipsnake locations within the recovery plan area.

The current distribution of the Alameda whipsnake is best described as five populations within a fragmented regional metapopulation. There remain only two or perhaps three potential corridors for gene flow between populations. A northern corridor remains between the Tilden-Briones and the Oakland-Las Trampas populations, and a southern corridor remains between Hayward-Pleasanton Ridge and Sunol-Cedar Mountain populations. Remaining natural habitat in these areas may provide a movement corridor for the Alameda whipsnake, but it is as yet unknown whether whipsnakes are able to use these corridors in a manner that would promote gene flow. The Oakland-Las Trampas population and the Hayward-Pleasanton Ridge population are divided by Interstate 580, and it has not yet been determined whether whipsnakes could move between these populations by traveling underneath the raised portions of the Interstate.

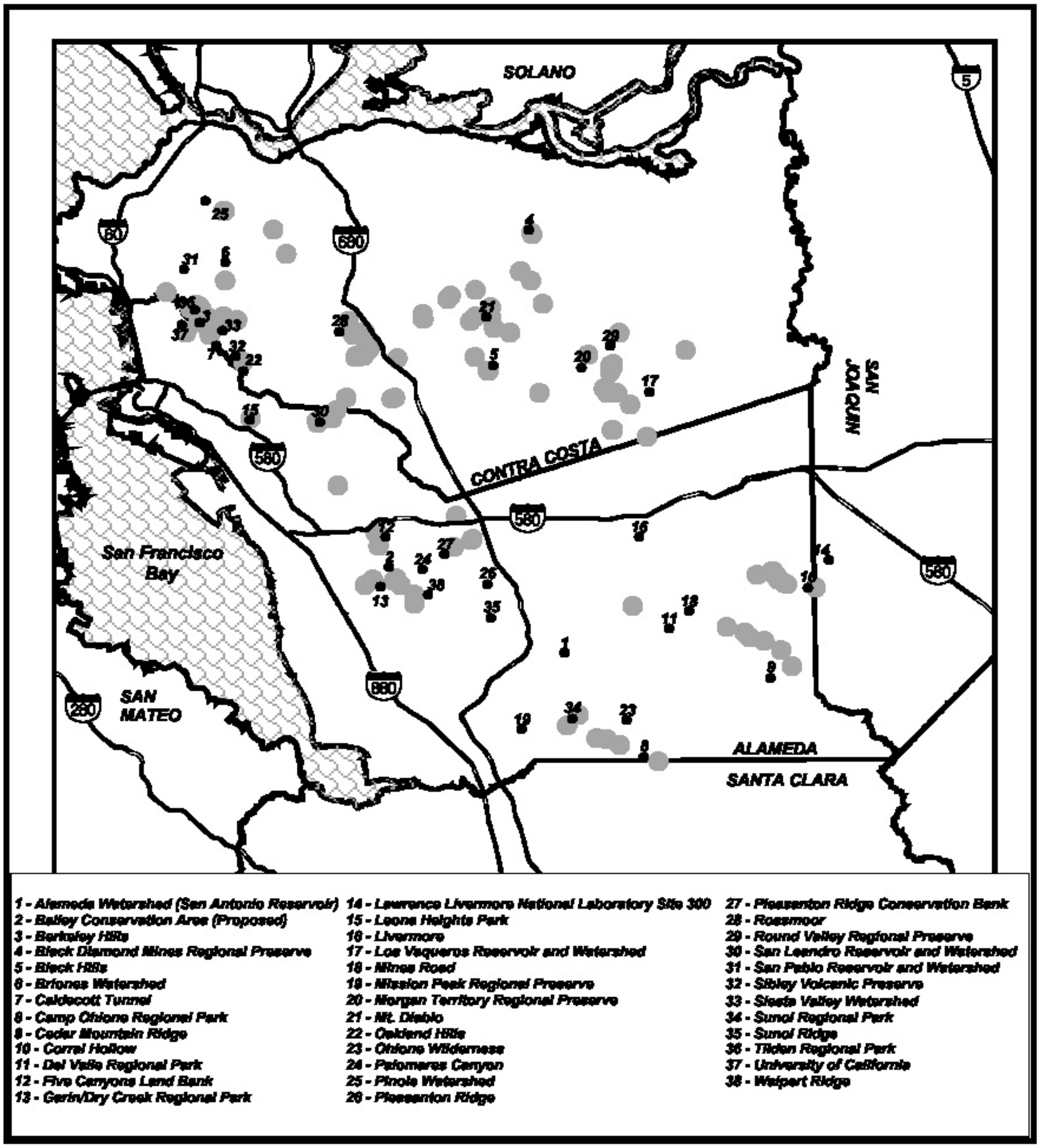


Figure 15. Known locations of Alameda whipsnake *(Masticophis lateralis ssp. euryxanthus)* and chaparral whipsnake *(Masticophis lateralis ssp. lateralis)* within the plan area.

Species Locations

10 0 10 Miles

1:650,000

USFWS Draft Recovery Plan

Within the five populations there are probably varying degrees of isolation due to natural and human-caused barriers. Therefore, there may be some subpopulations within each population that are geographically and genetically isolated and others that may contribute to gene flow within each population. The boundaries of these five populations and the two corridors represent the extent of suitable habitat that includes known Alameda whipsnake locations.

Within the boundaries are areas of both suitable habitat and areas that link suitable habitat. These links facilitate movement of individuals between habitat areas and are important for dispersal and gene flow (Beier and Noss 1998). Additionally, areas of habitat that are currently unsuitable or believed to be low-quality are also included within the boundaries in Figure 16. These suboptimal habitat types may be needed for the long-term viability of metapopulations (Carroll et al. 1996). Because the species was listed as threatened due to habitat loss, fragmentation, and degradation, it is prudent to preserve areas that may be restorable in the future. Even if habitat quality is relatively low, these areas provide opportunities for dispersal of young animals from recovering populations. As populations increase the offspring of those individuals living in high-quality habitats often only find available low-quality habitats. This expansion (often followed by contraction) of populations protects some very complex evolutionary processes. Dispersal and population expansion can allow previously unconnected subpopulations to come into contact and exchange genetic information. Natural selection pressures may also vary enough in these suboptimal habitats to create locally adapted subpopulations that differ genetically from the source population. The effects would increase the genetic diversity, and thus the long-term viability, of the species. Specific locations of source populations and suboptimal habitats that would serve these functions for the Alameda whipsnake have yet to be determined.

The five populations and the northern and southern corridors are henceforth referred to in this document as Recovery Units. Historical and current information on whipsnake sightings or collections (based on the California Natural Diversity Data Base [1998] unless otherwise noted) is summarized below.

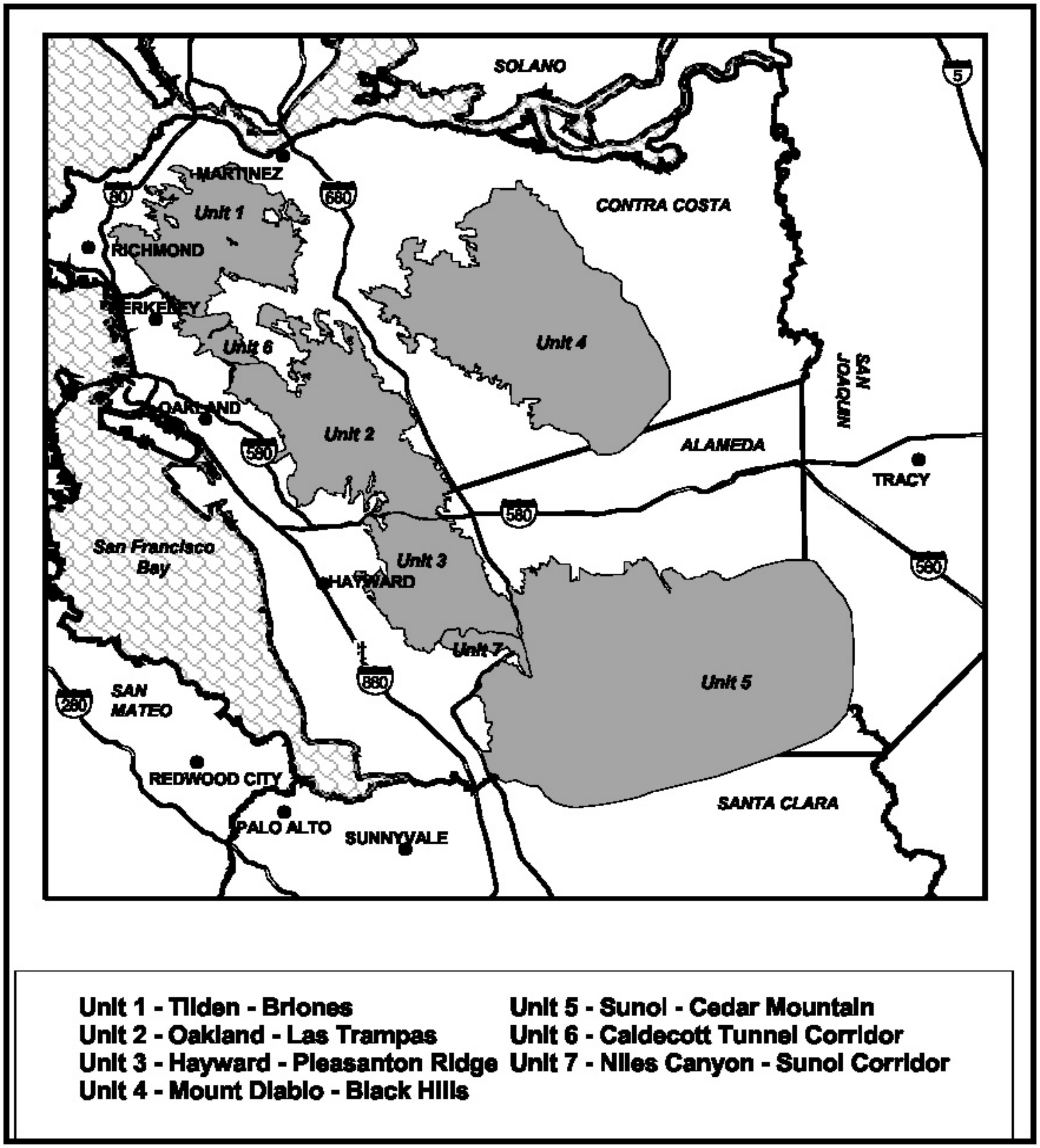


Figure 16. Seven recovery units of the Alameda whipsnake *(Masticophis lateralis ssp. euryxanthus)* .

10 0 10 Miles

1:650,000

USFWS Draft Recovery Plan

a. Recovery Unit 1 (Tilden-Briones)

Many of the specimens collected and preserved in the late 1940's and early 1950's came from this area, in particular Tilden Regional Park. The high number of collections from this area probably reflects the park's proximity to the University of California, Berkeley, where the specimens were ultimately housed. The Alameda whipsnake still persists in Tilden Regional Park (managed by East Bay Regional Park District), as demonstrated by Karen Swaim during a 1990 - 1992 telemetry study on this subspecies. The remaining locations result from status surveys conducted in the late 1980's and early 1990's for East Bay Municipal Utility District on their Briones/San Pablo/Pinole/Siesta Valley Watershed lands, and from incidental sightings. It is presumed that the whipsnake is still extant on the East Bay Municipal Utility District lands. The current status of the whipsnake in the vicinity of the incidental sightings is unknown.

b. Recovery Unit 2 (Oakland-Las Trampas)

Status surveys for East Bay Municipal Utility District (lands in Upper San Leandro Watershed) and private developers account for more than half of the current known locations within this Recovery Unit. It is presumed that the whipsnake is still extant on the East Bay Municipal Utility District lands. Some of the private developments, however, have removed and fragmented habitat. In one of these locations (Rossmoor), adjacent land is being protected, and limited monitoring has shown that a breeding population of whipsnakes occupies the mitigation lands. The status of other developments and their effects on the whipsnake are unknown at this time. Status of the remaining occupied habitat in some of the historic areas is also in question. For example, one collection in 1953 was from Leona Heights Park, now surrounded by the city of Oakland. Whether the whipsnake has been able to survive in this fragmented habitat is unknown.

c. Recovery Unit 3 (Hayward-Pleasanton Ridge)

No historical sightings appear in the records for this Recovery Unit. In 1974, Alameda whipsnakes were captured in Hayward for use in thesis research by G. A. Hammerson. Alameda whipsnakes are still thought to be extant at Garin Woods based on an early 1990's report of a dead whipsnake at Calhoun Road, east of Mission Boulevard. Adjacent to Garin Woods lies the Garin/Dry Creek Regional Park, owned and managed by East Bay Regional Park District. An incidental sighting was recorded on Walpert Ridge in 1994 and a breeding population was documented on the proposed Bailey Ranch Mitigation Lands in 1999 (K. Swaim pers. comm. 1999). Other sightings along this Ridge are from status surveys conducted in the 1980's and 1990's for private development proposals. The construction of these developments has meant the loss of occupied habitat and habitat fragmentation.

To the east of Walpert Ridge lie Palomares Canyon, Sunol Ridge and Pleasanton Ridge. Field observations of Palomares Canyon suggest there is little opportunity for movement of whipsnakes across the canyon. Although it is not an impenetrable barrier, some areas and activities along the canyon would deter frequent dispersal. Chaparral/scrub habitats that existed on the walls of the canyon have been overtopped by taller vegetation, remaining chaparral/scrub is being replaced by vineyards, and housing development continues to increase along the road.

No whipsnakes are recorded from Sunol Ridge; however, there is no indication that surveys have been conducted. Pleasanton Ridge has been surveyed for private development proposals and for the Pleasanton Ridge Conservation Bank, resulting in sightings during 1991, 1992, and 1996. The Pleasanton Ridge Conservation Bank now protects habitat in perpetuity for the Alameda whipsnake, and they are presumed extant.

d. Recovery Unit 4 (Mount Diablo-Black Hills)

Black Diamond Mines Regional Preserve, on the northern edge of this Recovery Unit, has yielded only two specimens. In 1944 a specimen was incidentally collected, and in 1995 a whipsnake was reported as killed by a bicycle. The area between Black Diamond Mines Regional Preserve and Mt. Diablo has only recently been surveyed as a result of proposed private development. Once the Alameda whipsnake was identified in this area the property was purchased by Save Mt. Diablo to add to a wildlife corridor connection. Although no historical collections were made on Mt. Diablo proper, more current collections and sightings have occurred in the area from the 1970's through the 1990's with some regularity. Some whipsnakes from this area exhibit characteristics intermediate between the two subspecies (“intergrades”). The southern edge of Mt. Diablo, called the Black Hills, was surveyed as a result of a private development proposal. Six whipsnakes were captured during a survey in 1989 and one during a 1990 survey. Several of the specimens showed intergrade characters, but were considered to be closer to the Alameda whipsnake (K. Swaim pers. comm. 1999). The whipsnakes are presumed extant in the area although some habitat was lost to development.

Further east in Contra Costa Water District's Los Vaqueros Watershed, whipsnakes were found in the 1980's as a result of status surveys for the construction of the Los Vaqueros Reservoir. Alameda whipsnakes are presumed extant as the chaparral/scrub habitat was not affected by actions relating to reservoir construction or inundation. Adjacent to the watershed are two of East Bay Regional Park District's Regional Preserves, Morgan Territory and Round Valley, both of which contain habitat and have sightings recorded from the 1990's (California Natural Diversity Data Base 1998). South of this area there was one incidental collection of an Alameda whipsnake in 1981. During a recent site visit it was noted that there was very little chaparral/scrub habitat in this area, and that residential development had been occurring (H. Bell *in litt*. 1999*a*).

e. Recovery Unit 5 (Sunol-Cedar Mountain)

This Recovery Unit is the most southern and is of interest as it is the interface between the chaparral whipsnake and the Alameda whipsnake. Whipsnakes were sighted and collected beginning in the 1970's in Corral Hollow (a valley that runs west to east, opening up into the San Joaquin Valley). One half of Corral Hollow lies in Alameda County and the other in western San Joaquin County. The majority of sightings and collections during this time came from work done by Brian Sullivan as part of a master's thesis. Sullivan reported six whipsnakes from Corral Hollow Road (called Tesla Road in Alameda County) during this time (B. Sullivan pers. comm. 1998). Three were sightings and three were collections. The sightings could have been either Alameda or chaparral whipsnakes, as definitive identification was not made at the time, and the three collections were later identified by Jennings as two chaparral whipsnakes and one intergrade. There are no reports of whipsnakes from Corral Hollow Road in the 1980's. However, a specimen collected during field work conducted in the late 1980's at the adjacent Lawrence Livermore National Laboratory Site 300 (owned by the U.S. Department of Energy) was noted as being closer to the chaparral whipsnake in its characteristics.

Most sightings and collections from the 1990's have been identified as being closer in appearance to chaparral whipsnake than Alameda whipsnake. However, the 1980's field work and 1998 status surveys on Site 300 have indicated that in the same general area individual whipsnakes can exhibit characteristics along a continuum from chaparral to Alameda whipsnake. (The chaparral/scrub habitat in Site 300 where whipsnakes were found in 1998 is also much more sparse than previously recognized whipsnake habitat [H. Bell *in litt*. 1999*b*.])

Mines Road lies to the south of Corral Hollow, and runs along the base of Cedar Mountain Ridge. Whipsnakes collected along this road have all been identified as chaparral whipsnakes.

Within the East Bay Regional Park complex of Sunol, Mission Peak, Ohlone, Camp Ohlone, Del Valle, and the San Francisco Public Utility Alameda (San Antonio reservoir) Watershed, sightings were recorded beginning in the 1970's. They are identified as either Alameda whipsnake, closer to Alameda whipsnake, intergrades or unknown (California Natural Diversity Data Base 1998).

All areas discussed within the Sunol-Cedar Mountain Recovery Unit are presumed to contain extant populations.

f. Recovery Unit 6 (Caldecott Tunnel Corridor)

This northern corridor connects the Tilden-Briones and the Oakland-Las Trampas populations. Crossing the Alameda and Contra Costa County lines, this corridor encompasses lands owned by East Bay Municipal Utility District (Siesta Valley and Gateway watersheds), East Bay Regional Park District (Claremont Canyon and Sibley Volcanic Regional Preserves and Huckleberry Botanic Regional Preserve), California Department of Transportation, University of California, Berkeley, Lawrence Berkeley National Laboratory, and the Cities of Berkeley and Oakland, as well as private holdings. Whipsnake sightings in this corridor Recovery Unit include sightings from the 1940's, 1950's, and the 1990's. The older sightings are very general in nature, but occurred in areas that did and generally still do contain suitable habitat. One sighting, in a residential area, lies just outside of the Recovery Unit. The current status of the whipsnake in this corridor is unknown.

g. Recovery Unit 7 (Niles Canyon/Sunol Corridor)
This corridor connects the Hayward-Pleasanton Ridge and the Sunol-Cedar Mountain populations. This corridor is completely within Alameda County on lands predominantly owned by East Bay Regional Park District (Vargas Plateau) and San Francisco Public Utility watershed lands (Alameda Watershed). No sightings are reported for this area; however, surveys have not been conducted. The current status of the whipsnake in this corridor is unknown.

Within all seven Recovery Units, areas of potential habitat remain that have yet to be surveyed for the presence of Alameda whipsnake.

3. Life History and Habitat

Reproduction and Demography. - Members of the genus *Masticophis* are slender, fast-moving, diurnal snakes with a broad head, large eyes, and slender neck. When hunting, these snakes commonly move with the head held high and occasionally move it from side to side, perhaps to aid in depth perception. Prey is seized with great speed, pinioned under loops of the body, and engulfed without constriction. These snakes are good climbers that can escape into scrub or trees. They also seek shelter in rock piles or outcrops or in small mammal burrows (Stebbins 1985).

In a study of the thermal responses of the Alameda whipsnake, Hammerson (1979) observed that snakes emerged from burrows in the morning with a low body temperature, often exposing just the head first, then basking in full or partial sun until they reached a body temperature of 33.0 to 34.1 degrees Celsius (91.4 to 93.4 degrees Fahrenheit) (mean value, n = 4). The snakes maintained a high body temperature (compared with other snakes) during the day, and retreated to burrows when soil surface temperatures began to fall.

Swaim (1994) used trapping and radiotelemetry to study several aspects of the life history of Alameda whipsnake at several sites in Alameda and Contra Costa Counties. Adult snakes had a bimodal seasonal activity pattern with peaks during the spring mating season and a smaller peak during late summer and early fall. Although short, above-ground movements may occur during the winter, Alameda whipsnakes generally retreat in November into a hibernaculum and emerge in

March. Courtship and mating were observed from late March through mid-June. During this time males move around throughout their home ranges, but females appear to remain at or near their hibernacula, where mating occurs. Male home ranges range from 1.9 to 8.7 hectares (4.7 to 21.5 acres) in size (mean of 5.5 hectares or 13.6 acres, n = 4), and showed a high degree of spatial overlap. One female was observed copulating with more than one male during a mating season, but the extent to which females mate with multiple males (polyandry) is unknown. Suspected egg-laying sites for two females were located in grassland with scattered shrub habitat. Three individual snakes monitored for nearly an entire activity season appeared to maintain stable home ranges. Movements of these individuals were multi-directional and individual snakes returned to specific areas and retreat sites after long intervals of nonuse. Snakes had one or more core areas (areas of concentrated use) within their home range with large areas of the home range receiving little use.

Sperm is stored by the male over winter in the epididymides and vas deferens (Goldberg 1975). Copulation commences soon after emergence from winter hibernacula (Swaim 1994). Females begin yolk deposition in mid-April (Goldberg 1975), and intervals of 47, 50, and 55 days have been recorded between dates of first known mating and first egg laid (Hammerson 1978). Average clutch size is 7.21 (6-11, n = 19), with a significant correlation between body size and clutch size (Goldberg 1975). Once the female lays her eggs, it will be about 3 months of incubation before the young appear in the late summer and fall. These hatchlings have been seen and captured above ground from August through November (Hammerson 1978, Swaim 1994). Prey items were sometimes detected in the stomachs of captured hatchlings during this period indicating that at least some hatchling snakes feed prior to winter hibernation (Swaim 1994). California whipsnakes take 2 to 3 years to reach maturity, with adults growing to nearly 1.5 meters (5 feet). Captive whipsnakes may live for about 8 years (Jennings *in litt*. 1994).

Habitat and Community Associations. - The distribution of the California whipsnake closely coincides with the distribution of chaparral in California (Stebbins 1985). Both subspecies are most often observed in chaparral and scrub communities. Swaim (1994) documented Alameda whipsnakes in several types of scrub and chaparral communities, including coastal sage scrub, chaparral, and northern coastal scrub. Telemetry data for six snakes indicated that home ranges of Alameda whipsnakes were centered on shrub communities, but that snakes range out into adjacent habitats, including grassland, oak savanna, and oak-bay woodland. Radio locations of telemetered snakes were clustered in areas of scrub with an open or partially open canopy, and on south-, southwest-, southeast-, east-, and northeast-facing slopes. Most radio locations for five snakes at a study site in Tilden Regional Park, Berkeley, California, were also within the distribution of major rock outcroppings and talus. Alameda whipsnakes were also frequently found in adjacent grassland and oak woodland/savanna habitats. Most grassland and woodland locations were within 50 meters (170 feet) of the scrub habitat, but distances of greater than 150 meters (500 feet) from scrub were also documented during the telemetry study. The distance that whipsnakes will move into open grassland is unknown. California whipsnakes have been observed in grassland, oak savanna, and along the edge of riparian vegetation at distances greater than 300 meters (1,000 feet) from scrub habitats, usually in areas where rock outcrops are abundant (K. Swaim pers. comm. 1999). The majority of grassland use was documented during spring. The most common types of retreat site in both the grassland and scrub communities were small rodent burrows and rock crevices; however, brush piles, deep soil crevices and debris piles were also used (Swaim 1994). G. Beeman (pers. comm. 1999) has noted that Alameda whipsnake locations are near riparian areas. It is unclear what role water plays in the life history of this species.

Lizards, especially the western fence lizard (*Sceloporus occidentalis*), appear to be an important prey item of whipsnakes (Stebbins 1985, Swaim 1994, H. Greene pers. comm. 1998), although other prey items are taken including frogs, snakes, and birds (Stebbins 1985, Swaim 1994). Stomach contents of field-captured whipsnakes were exclusively lizards and included western fence lizard and western skink (*Eumeces skiltonianus*) (Swaim 1994). Stomach contents of museum specimens were almost exclusively lizards (H. Greene pers. comm. 1998). Shine (1980) suggested that all of the major characteristics of whipsnakes, including diurnal and terrestrial activity, slender body form, large eyes, high preferred body temperature, and oviparity are adaptations that facilitate the pursuit and capture of fast-moving diurnal prey, usually lizards.

4. Reasons for Decline and Threats to Survival

The Alameda whipsnake was listed as threatened in 1997 (U.S. Fish and Wildlife Service 1997) based on an analysis of the listing factors under section 4(a)(1) of the Endangered Species Act. The current threats to the species are assorted under these five factors: (1) the present or threatened destruction, modification, or curtailment of its habitat or range (urban development, inappropriate grazing practices, habitat alteration from fire suppression); (2) overutilization for commercial, recreational, scientific, or education purposes (reptile collectors); (3) disease or predation (increased predation from native and nonnative predators due to urbanization); (4) the inadequacy of existing regulatory mechanisms (limited protection under State law, difficulty of fire management at urban/wildland interface); and (5) other natural or manmade factors affecting its continued existence (inappropriate grazing, spread of nonnative plants, fragmentation, genetic drift, and fire suppression creating closed-canopy habitat and increasing severity of fires).

Reasons for Decline. - Habitat loss and fragmentation (and the resulting decline of Alameda whipsnake populations) were the primary reason for both the State and Federal listing of this species. Habitat fragmentation from urban development and associated highway and road construction has likely prevented or severely reduced movement of individuals between areas of suitable habitat. This urban development has also reduced the total amount of suitable habitat available for the Alameda whipsnake. The remaining fragments of habitat account for the five areas identified as "populations" in the final rule (U.S. Fish and Wildlife Service 1997) (Figure 16). The current threats to the habitat of the Alameda whipsnake, as presented in the Federal listing notice (U.S. Fish and Wildlife Service 1997), are urban development and associated impacts due to increased population densities, inappropriate grazing practices, unauthorized collection, and alteration of suitable habitat from fire suppression.

The effects on Alameda whipsnakes of differing intensities of grazing have not yet been examined. S. McGinnis (*in litt*. 1992) has suggested that overgrazing, which significantly reduces or eliminates shrub and grass cover, has affected the habitat of the Alameda whipsnake in many areas east of the Coast Range. Conversely, tall dense nonnative grass and closed-canopy scrub may reduce densities of lizard prey in some situations and hamper foraging success for the visually oriented whipsnake (K. Swaim pers. comm. 1999).

Prey preference tests with both adult and hatchling Alameda whipsnakes have shown a preference for lizard prey. S. McGinnis (*in litt*. 1992) suggests the species is a classic example of a feeding specialist. Highly efficient at capturing lizards, the whipsnake thrives when lizards are abundant. However, when resident lizard populations undergo a temporary decline due to unusual pressures such as drought, the Alameda whipsnake may not be able to shift to alternative food sources (S. McGinnis *in litt*. 1990). Whether such a food shortage would result in a decline in affected Alameda whipsnake populations is unknown.

The invasion of California's native grassland and coastal prairie by nonnative plants has adversely affected native flora and fauna. Numerous nonnative species have invaded these plant communities (Heady 1988, Heady *et al.* 1988). Introduced nonnative plants, such as *Genista monspessulana* (French broom), *Carprobrotus* spp. (iceplant), *Eucalyptus* (Eucalyptus), and *Ulex europaeus* (gorse), often outcompete and supplant native vegetation. In the absence of control and eradication programs, invasive nonnative plants may eliminate the remaining native plants, potentially degrading the habitat, increasing fire risk, and reducing the prey base. Swaim (1994) noted during her research on Alameda whipsnake home range that radio-tracked whipsnakes did not make use of large stands of *Eucalyptus*.

Urban encroachment has greatly restricted the natural fire regime of chaparral (see introduction for chaparral and fire ecology). The policy of fire suppression in the areas where urban and wildlands interface began in the 1930's, became most pronounced in the 1950's, and continues today. Fire suppression can alter the structure of whipsnake habitat by allowing plants to establish a closed canopy (Parker 1987) that will tend to create relatively cool conditions. Tall shaded stands of vegetation such as *Toxicodendron diversilobum* (poison oak), *Baccharis pilularis* (coyote brush), or other thick vegetation may not provide the optimum temperature gradient for Alameda whipsnakes. Telemetry and trapping data show that Alameda whipsnakes and some of their lizard prey species are less likely to be found or less abundant where these plant species create a closed canopy (K. Swaim pers. comm. 1999).

Threats to Survival. - All five remaining populations of the Alameda whipsnake are threatened by more than one factor, including habitat loss, fire suppression, fragmentation, grazing practices, and mining. Each of these populations potentially consists of several to numerous subpopulations with varying degrees of connectivity among them.

In the western portion of the Alameda whipsnake's range, the Tilden-Briones population is threatened by habitat loss and fragmentation due to urban/suburban growth, mostly around the perimeter. However, continuing suburban/rural development is also fragmenting inner portions. This population is also threatened by catastrophic wildfire and by *Eucalyptus* and other nonnatives replacing chaparral and scrub communities. However, the remaining habitat overlaps with regional parklands and municipal watersheds in this area to the extent that regional preservation and land management beneficial to the Alameda whipsnake may be possible.

The Oakland-Las Trampas population is threatened by the decline in habitat quality as chaparral/scrub stands become decadent, a high potential for catastrophic wildfire, and the effects of habitat loss and fragmentation as a result of urban development.

The Hayward-Pleasanton Ridge population is the most susceptible to extirpation. This population has lost significant areas of occupied habitat to urban development, and pressure to develop continues to be intense. Additionally, the open space and conservation lands are the most disjunct of any of the five areas. There is a high probability that this population is isolated from the populations to the north and south. This isolation increases the susceptibility of this population to genetic drift and catastrophic events.

In the eastern portion of the whipsnakes' range, the Mount Diablo-Black Hills population is threatened by a high potential for catastrophic wildfire, suburban/rural development and its associated impacts, and incompatible land uses such as mining. Because of the location of public lands, the actions of private nonprofit organizations to protect wildlife corridors, and the potential for improved fire and grazing management on these lands, this population is a good candidate for recovery, barring uncontrolled development.

The Sunol-Cedar Mountain population is threatened by catastrophic wildfire and incompatible land uses including mining and off-road vehicle use. Although fairly free of habitat loss or fragmentation due to suburban development, the pressure for housing is increasing. This southern population may have the highest probability of unauthorized collection. Because of its remote roads and abundant assemblage of native reptiles, this area attracts reptile enthusiasts and collectors.

All of the above populations are threatened to some degree by grazing practices, which may degrade Alameda whipsnake habitats either through overgrazing or from removal of grazing (U.S. Fish and Wildlife Service 1997 and H. Bell *et al. in litt*. 1999).

The two corridors have differing threats. The Caldecott Tunnel corridor is already highly developed and fragmented. Much of this area suffered a catastrophic firestorm on October 20, 1991, eliminating much of the vegetation and causing severe structural damage to homes as well as taking human lives. However, not all fire danger has been eliminated, and care will be taken in rebuilding and revegetating the area. Vegetation with low volatility is being promoted, including nonnative species. Native chaparral and scrub species, for example *Artemisia californica* (California sagebrush), are being discouraged (National Fire Protection Association 1993). Therefore, existing or future vegetation communities may or may not promote movement of the whipsnake through this corridor. The Niles Canyon-Sunol corridor has physical barriers that would impede or prohibit the movement of individual whipsnakes. These barriers include Alameda Creek, a 0.3- to 0.6-meter (12- to 24-inch) high concrete barrier that lies south of Niles Canyon Road and north of Alameda Creek, railroad tracks that run along both sides of Alameda Creek, and heavy vehicular traffic along Niles Canyon Road. The degree to which these barriers discourage or halt the movement of whipsnakes is unclear. Appropriate vegetation is also limited in this corridor, much of the land being under cultivation or mined for gravel (U.S. Fish and Wildlife Service 2000*b*) (Figure 16).

A number of native and nonnative mammals and birds are known or likely to be predators of the Alameda whipsnake including the California kingsnake (*Lampropeltis getula californiae*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), opossum (*Didelphis virginianus*), coyote (*Canis latrans*), gray fox (*Vulpes cinereoargenteus*), and hawks (*Buteo* species). Urbanization can lead to increased numbers and access to habitat by native predators, leading to increased levels of predation on native fauna (Goodrich and Buskirk 1995). The recent introduction of the red fox (*Vulpes vulpes*), a species not native to California, poses an additional threat to the Alameda whipsnake. In situations where Alameda whipsnake habitat has become fragmented, isolated, and otherwise degraded by human activities, increased predatory pressure may become excessive, especially where aggressive nonnative species, such as rats (*Rattus* species), feral pigs (*Sus scrofa*), and feral and domestic cats (*Felis domesticus*) and dogs (*Canis familiaris*) are introduced. These additional threats become particularly acute where urban development immediately abuts Alameda whipsnake habitat. A growing movement to maintain feral cat populations in parklands magnifies this threat (J. Coleman *et al. in litt*. 1997, and Roberto 1995). Although the actual impact of predation on Alameda whipsnakes under such situations has not been studied, feral cats are known to prey on reptiles, including the yellow-bellied racer (*Coluber constrictor*) (Hubbs 1951), a fast, diurnal snake closely related to the Alameda whipsnake (Stebbins 1985). Feral cats can have significant impacts on local lizard populations that inhabit isolated habitat patches (H. Greene pers. comm. 1998).

The Alameda whipsnake is threatened directly and indirectly by the effects of fire suppression policies common in urban areas. Fire suppression activities directly affect the Alameda whipsnake by allowing the buildup of fuel (underbrush and woody debris), which exacerbates the intensity of wildfires if they occur. Although most snakes are likely to retreat into burrows or rock crevices or to move from the fire's path there is still the potential for individual snakes to be burned. Natural fires occur in the late summer and early fall when accumulated fuel is abundant and dry. The intensity of these fires is likely to be higher than in prescribed burns, which typically are scheduled during wetter months. During the late summer and early fall, hatchling and adult Alameda whipsnakes are above ground (Swaim 1994), and populations may sustain direct losses from fires (Quinn 1994). Burns during wetter months, however, may indirectly affect the Alameda whipsnake, as burning the chaparral and scrub habitats during this time may be detrimental to the health of the chaparral/scrub community. Prescribed burns are only one form of vegetation management used to reduce fuel loads; others include discing and bulldozing fire breaks, moderate to heavy grazing to limit vegetative growth, and replacing chaparral/scrub habitat with grassland through mechanical or chemical means. The timing and extent of these activities will determine their effects on the Alameda whipsnake. (Also see effects of habitat degradation due to closed canopy in sections I.A.3 [Natural Disturbance Regimes] and I.B [Reasons for Decline and Threats to Community] above.)

The past and ongoing fragmentation of Alameda whipsnake habitat makes some populations of this species more vulnerable to extinction. The Tilden-Briones and Oakland-Las Trampas populations occupy a narrow, interrupted band of ridgetop chaparral dividing the heavily urbanized Oakland/Berkeley Hills to the west from the rapidly urbanizing Highway 680 corridor to the east (U.S. Fish and Wildlife Service 1997). Habitat patches with high ratios of edge to interior are known to be less valuable for some species than are round or square patches with lower edge to interior ratios (Jimerson and Hoover 1991 and Saunders *et al.* 1991). In fragmented habitats, species most prone to extinction are those that depend on native vegetation, require combinations of different habitat types, require large territories, and exist at low densities (Saunders *et al.* 1991). Continuing urban encroachment not only exacerbates the habitat fragmentation problem, but greatly restricts the ability of land owners and land managers to conduct effective fire management practices.

Further fragmentation or habitat loss within any of the five populations and any increase in habitat degradation or impediments to movement within the two corridors will undoubtedly affect the ability of the population(s) to rebound from natural or human-induced events. Small, isolated populations are vulnerable to extinction from random fluctuations in population size due to catastrophic events such as fire or variations in population characteristics (*e.g.*, sex ratios) caused by annual weather patterns, food availability, and other factors. Because many of the populations and subpopulations of Alameda whipsnakes are isolated by developments and major roadways, natural recolonization is unlikely and in some cases impossible. Small populations are also vulnerable to the effects of genetic drift (the loss of genetic variability) and inbreeding depression (the expression of deleterious genes). These phenomena reduce the ability of populations and individuals to respond successfully to environmental stresses (K. Ralls *in litt.* 1998).

Although the Alameda whipsnake does not appear to be particularly popular among reptile collectors, the Federal listing of the Alameda whipsnake could raise its value within reptilian trade markets and increase the threat of unauthorized collection above current levels (U.S. Fish and Wildlife Service 1997). The extent to which this threat has materialized is unknown.

5. Conservation Efforts

The California Environmental Quality Act and California Endangered Species Act afford the Alameda whipsnake some conservation benefits. The whipsnake was listed as a threatened species by the State of California in 1971 (California Department of Fish and Game 1987). Although these State laws provide a measure of protection to the species, resulting in the formulation of mitigation measures to reduce or offset impacts for projects proposed in certain areas of Alameda whipsnake habitat, these laws are not adequate to protect the species in all cases (U.S. Fish and Wildlife Service 1997). The Endangered Species Act of 1973, as amended, affords the Alameda whipsnake protection from take (Endangered Species Act, section 9); however, exceptions do exist that allow for the "taking" of the species (Endangered Species Act, sections 7 and 10).

The Alameda whipsnake was proposed as endangered along with the callippe silverspot butterfly (*Speyeria callippe callippe*) and the Behren's silverspot butterfly (*Speyeria zerene behrensii*) on February 4, 1994 (59 FR 5377) (U.S. Fish and Wildlife Service 1994*b*). The final ruling, issued on December 5, 1997, listed the whipsnake as threatened (62 FR 64306) (U.S. Fish and Wildlife Service 1997), but did not include a designation of critical habitat. On March 8, 2000, we published the proposed determination of critical habitat for the Alameda whipsnake (65 FR 12155), fulfilling an out-of-court settlement agreement (U.S. Fish and Wildlife Service 2000*a*). The final determination was subsequently published on October 3, 2000 (65 FR 58933) (U.S. Fish and Wildlife Service 2000*b*). The critical habitat designation has been challenged in court; its status remains unresolved as this plan goes to press.

To date approximately 228 hectares (570 acres) have been protected in perpetuity as conservation lands. This level of protection is a result of mitigation of lawful take of the Alameda whipsnake. In addition, 14 hectares (35 acres) have been protected in perpetuity within a conservation land based bank (Table 2).

Save Mt. Diablo, a local lands protection organization, has been instrumental in the protection of over 800 hectares (2,000 acres) in the Black Hills area of Mt. Diablo, more than half of which is confirmed occupied Alameda whipsnake habitat. This protection was a condition of development of the lower elevation acres, and the land has been dedicated to Mt. Diablo State Park. One of the developments installed a “snake wall”, built to exclude and protect the whipsnake from the 9.6-hectare (24-acre) development; however, culverts were installed for drainage, rendering the wall permeable to the snakes (G. Beeman pers. comm. 1999). Save Mt. Diablo has also been active in protecting a wildlife corridor from Mt. Diablo to Black Diamond Mines Regional Preserve. Within this corridor the organization has purchased “Chaparral Springs”, a 133-hectare (333-acre) parcel with approximately 16 hectares (40 acres) of high quality chaparral, and (in conjunction with East Bay Regional Park District) a portion of “Clayton Ranch”. Future plans may include protection of adjacent properties (S. Adams pers. comm. 1999).

The Pleasanton Ridge Conservation Bank in Alameda County is the first mitigation bank where “credits” can be purchased to offset the lawful “taking” of the Alameda whipsnake. The 262-hectare (654-acre) site will protect approximately 14 hectares (35 acres) of Alameda whipsnake habitat, as well as functioning as a preserve area for the threatened California red-legged frog (*Rana aurora draytonii*).

Lands protected by designations as Regional Parks, watersheds, Federal facilities, State Parks, and local parks contain approximately 20 percent of the remaining Alameda whipsnake habitat (Figure 16 and Table 2). Although not always specifically managed for the whipsnake, the quasi-protected status of these open lands has established the foundation for the recovery strategy for the Alameda whipsnake.

6. Recovery Strategy

The recovery strategy for the Alameda whipsnake combines long-term protection of large blocks of habitat; protection in perpetuity of strategic areas such as habitat harboring population centers or areas needed for connectivity of populations; special management considerations such as fire management, grazing regimes, and control of destructive nonnative species; and research that focuses on management objectives and recovery of the species. Surveys are needed to determine appropriate site-specific areas for recovery actions, and monitoring serves to assess successes and failures. Because of the difficulty of managing the urban/wildland interface, regional cooperation and public outreach must be an integral part of this recovery strategy. The recent designation of critical habitat for the Alameda whipsnake has focused public attention on this species, its conservation needs, and the potential conflicts between a rapidly growing area and a species that inhabits chaparral and scrub.

Because little is known about which actions will provide the most benefit toward the goal of recovering the Alameda whipsnake, we recommend both long-term research/management and immediate active management actions. Adaptive management will be critical to incorporate new information into evolving land and species management strategies. Essential components of the recovery strategy for this species are the implementation of habitat management, both immediate and long-term; protection of habitat from development, fragmentation, degradation, and incompatible uses; protection in perpetuity of Alameda whipsnake population centers that represent the full range of genetic variation and geographic extent of the species; and the achievement of self-sustaining status by reducing or eliminating threats identified in the listing process or later.

The recovery criteria below (Chapter III) for the Alameda whipsnake propose a minimum number of populations per Recovery Unit and, if known, potential locations. However, the criteria are based on preliminary data and may change. Because this landscape is characterized by periodic disturbances such as fire, protecting more than one population within each Recovery Unit is prudent. The advent of man-made disturbances, some of which may not be identified for years to come (*e.g.*, the effects of pollution on reptiles), also makes it advisable to protect multiple population centers. These population centers should be separated enough to reduce the potential for the same disturbance to negatively affect more than one population center, but close enough so that through generations, genetic exchange (through naturally occurring dispersal) is possible. Of course, it is necessary to protect additional habitat beyond the population center itself. Buffering those population centers from threats (most of which are man-made) and providing safe passage for individual whipsnakes as they move between populations is essential for the long-term survival of this species. Providing additional habitat for population expansion or geographic shifts in population centers over time will lower the extinction probability and should not be overlooked in determining the minimum size of areas needed for protection in perpetuity.

Protection must include: (1) ensuring long-term protection of identified lands in Recovery Units, and (2) protection in perpetuity of strategically situated focus areas. The majority of the recovery efforts are focused on an already extensive network of open and conservation lands in public ownership. However, specific lands in private ownership play an essential role in certain aspects of recovery. Protection of smaller private holdings may provide essential connectivity between lands in public ownership that harbor Alameda whipsnake populations, or protect the species' full range of genetic variation and geographic extent. Of course, protecting land without insuring that the land is functioning as habitat for the species in question will not allow us to reach the goal of recovery. The urban/wildland interface adds an extra layer of complexity to the job of appropriately managing chaparral/scrub habitat for the Alameda whipsnake. Coordinated efforts will be pivotal in the success of land and species management actions.

Focus areas identified as needing protection in perpetuity should preferably be on public lands, and should currently be occupied by a known population, have a high likelihood of harboring a population (surveys and mapping and assessment tasks can be utilized for pinpointing these areas), or be needed for connecting populations within or between Recovery Units. Focus areas should include enough acreage to protect a buffer area as well as the population itself. Specific surveys and research tasks will help to identify these areas and acreages. For connectivity, protected corridors should be a minimum of 3.2 kilometers (2 miles) wide, with no more than 20 percent of the interface between the population center and corridor interrupted by development. To the maximum extent possible, corridors should use lands that already have some degree of protection. Areas of connectivity should be protected in perpetuity and contain chaparral/scrub, adjacent grassland, rock outcrops and sufficient prey species to allow whipsnakes to either travel through or reside within the area. Currently identifiable focus areas and actions are described below for individual Recovery Units. However, in most cases, site-specific boundaries of focus areas will be refined during the mapping and assessment tasks, the completion of essential surveys and research tasks, and the cooperative process of developing management strategies with both public and private landowners and land managers. Focus areas may be identified for certain research tasks, directed surveys, specific land management actions, and/or directed acquisition or protection.

This recovery plan's emphasis on focus areas within the Recovery Units does not imply that the other areas within the Recovery Units are not essential. Areas outside of the focus areas will be conserved through special management (*e.g.*, fire management that benefits habitat) or protection (*e.g.*, full avoidance measures, habitat conservation plans, section 7 consultations, conservation easements, conservation banks, and land purchases). Protection should be either long-term (75-100 years) or in perpetuity. This level of protection may already be ensured by the directives of the land management agencies; however, if not, then means of securing these lands should be pursued.

Special management considerations should focus on reducing or ameliorating threats to the Alameda whipsnake. As discussed below in the Stepdown Narrative (Task 7), immediately necessary short-term habitat management should be combined with a long-term research and management program addressing questions about life history and habitat requirements. Both long-term and short-term management should be adapted appropriately as research results become available.

Another key to the recovery of the Alameda whipsnake is the participation of the large landowners and land managers: California Department of Parks and Recreation, U.S. Department of Energy, U.S. Bureau of Land Management, East Bay Regional Park District, Save Mt. Diablo, University of California at Berkeley, East Bay Municipal Water District, Contra Costa Water District, and the San Francisco Public Utility. A cooperative effort to implement steps in the recovery plan should include the landowners and land managers mentioned above, interested public and stakeholders, species experts, professional and academic researchers, the California Department of Fish and Game, the California Department of Forestry and Fire, the California Department of Transportation, the Federal Highways Administration, the Federal Emergency Management Authority, the Biological Resources Division of the U. S. Geological Survey, and the U. S. Fish and Wildlife Service.

Essential to the implementation of recovery tasks and acceptance of the recovery goals by the public are the acceptance and support of national, State, regional and local fire prevention organizations. Involving the Recovery Implementation Team in certain fire management platforms will help move this aspect of recovery forward. For example, the goals of the National Wildland/Urban Interface Fire Protection Initiative (established in 1986) include creating general public awareness of the wildland interface problem, encouraging formation of partnerships among problem-solvers and interest groups, and focusing on the development of local solutions to wildland/urban interface fire problems. The active Hills Emergency Forum coordinates the collection, assessment and sharing of information on East Bay hills fire hazards and provides a forum for building interagency consensus on a variety of topics including public education programs and fuel reduction strategies.

Table 3 summarizes the status of threats, the recovery potential, and the general recovery goals for the five major population areas and two corridors (the seven Recovery Units). Recovery Units (Figure 16) serve as areas where recovery actions will take place. A unit-by-unit strategy with focus areas follows below.

a. Recovery Unit 1 (Tilden-Briones)

The Tilden-Briones Recovery Unit has 60.4 percent of its land in open space or conservation status. These lands include East Bay Regional Park District's Sobrante Ridge, Kennedy Grove, Wildcat Canyon, Tilden Regional Park, and Briones Regional Park; and East Bay Municipal Utility District's San Pablo Reservoir and Watershed, Briones Watershed and Pinole Watershed.

Table 3. Summary of Threats, Major Landowners, Community Health, and Recovery Potential for the Seven Recovery Units of the Alameda Whipsnake.

Recovery Unit	Threats	Landowner	Community Health	Recovery Potential
1. Tilden-Briones	*fire suppression; nonnatives; **habitat loss and fragmentation due to urban growth; ***grazing practices	East Bay Municipal Utility District; East Bay Regional Park District	varying successional stages; *Eucalyptus* replacing scrub	High with active management; mostly public and open lands
2. Oakland-Las Trampas	fire suppression; nonnatives; habitat loss and fragmentation due to urban growth; grazing practices	East Bay Municipal Utility District; East Bay Regional Park District; City of Oakland; private	varying successional stages; *Eucalyptus* replacing scrub	High with active management and if status survey indicates robust populations
3. Hayward-Pleasanton Ridge	fire suppression; loss of habitat and fragmentation and due to urban growth; grazing practices; genetic isolation; high vulnerability to catastrophic events	East Bay Regional Park District; Shea Homes; private	decadent	Medium with active management and strategic protection
4. Mt. Diablo-Black Hills	fire suppression; habitat loss and fragmentation due to rural/suburban development and mining; grazing practices; genetic isolation	Bureau of Land Management; Contra Costa Water District; California Department of Parks and Recreation; East Bay Regional Park District; Save Mount Diablo; City of Walnut Creek	varying successional stages; some prescribed fire conducted on Mt. Diablo; wildfires within the last few decades	High with active management and strategic protection; mostly public and open lands

Recovery Unit	Threats	Landowner	Community Health	Recovery Potential
5. Sunol-Cedar Mountain	fire suppression; pressure for suburban development increasing; incompatible land uses including off-road vehicles and mining; grazing practices; unauthorized collecting	East Bay Regional Park District; San Francisco Water District; California Department of Parks and Recreation; U.S. Department of Energy; private	decadent	High with active management, restoration, and mitigation for incompatible land uses; hybrids not detrimental
6. Caldecott Tunnel Corridor	fire suppression; nonnatives; loss of habitat and fragmentation due to urban development;	East Bay Regional Park District; East Bay Municipal Utility District; University of California, Berkeley; Lawrence Berkeley Laboratory; Cities of Oakland and Berkeley; private	varying successional stages; catastrophic firestorm within the last decade	Medium with active management, restoration, and strategic protection
7. Niles Canyon-Sunol Corridor	incompatible land uses including agriculture and mining; physical barriers	East Bay Regional Park District; San Francisco Water District; private	varying successional stages but limited in extent	Medium with active management, restoration, barrier removal, and strategic protection

*Fire suppression includes activities that raise the risk of catastrophic wildfires or firestorms including “no burn” policies that have led to decadent chaparral and scrub communities and succession from open-canopy, fire-adapted species to more closed-canopy, non-fire-adapted species. Fire suppression also includes actions taken to reduce volatile vegetation including repeated burning, discing, and mechanical, herbivorous, or herbicidal removal of chaparral and scrub for fire breaks.
**Habitat loss and fragmentation includes not only the direct effects of urban/suburban/rural growth but also the associated impacts of increased populations. Associated impacts include increased predation and harassment on the Alameda whipsnake from domestic and feral cats and dogs, increases in predation by certain native predators such as racoons, increased harassment due to increased recreational use, and increased mortality due to heavier road traffic.
***Grazing practices may indicate over-grazing or the cessation of grazing altogether, both of which have been implicated in habitat degradation.

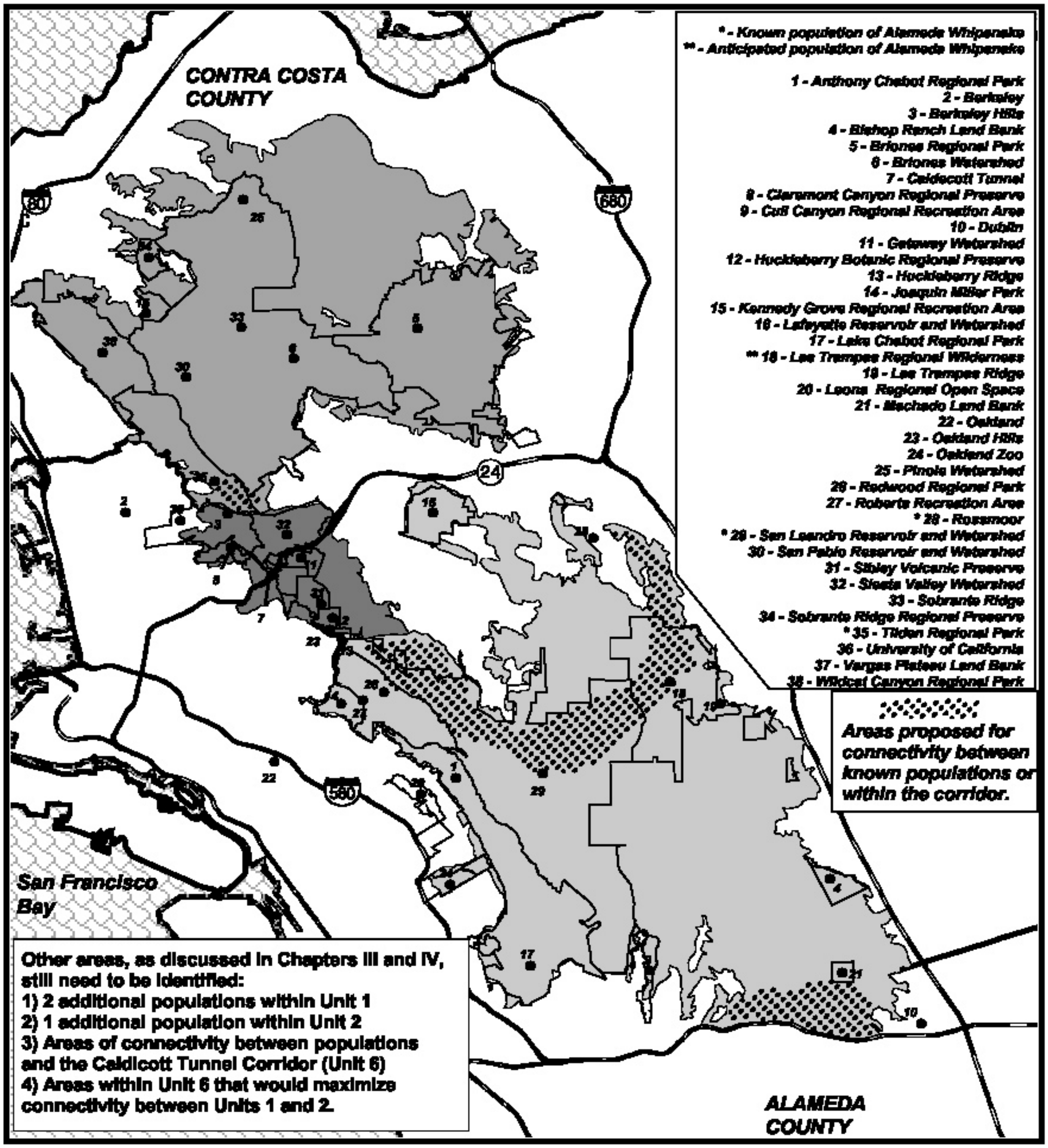


Figure 17. Recovery units 1, 2, and 6 of the Alameda whipsnake *(Masticophis lateralis* ssp. *euryxanthus).*

2 0 2 4 6 Miles

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Long-term protection should be sought for all lands mentioned above. Protection in perpetuity should be sought for lands that currently harbor Alameda whipsnake populations. Within this Recovery Unit, a minimum of three Alameda whipsnake populations should have protection in perpetuity. Tilden Regional Park (35 on Figure 17) has already been identified as an area harboring an Alameda whipsnake population. Two other population centers, as well as lands connecting all three populations, need to be identified during the tasks associated with mapping, assessment, and surveying. Essential for connectivity with Recovery Unit 2 will be protection of the area between Tilden Regional Park and the Caldecott Tunnel Corridor (Recovery Unit 6) properties of East Bay Municipal Utility District (Siesta Valley) and the University of California, Berkeley (32 and 36 on Figure 17 respectively).

Land management for this Recovery Unit should include specific management for Alameda whipsnake and its habitat, including but not limited to addressing *Eucalyptus* (eucalyptus) and *Genista monspessulana* (French broom) encroachment into chaparral/scrub habitats, limiting feral cat populations, implementing appropriate grazing management, promoting connectivity over the Caldecott Tunnel Corridor to the Oakland-Las Trampas Recovery Unit, and coordinating with fire management jurisdictions/agencies. Developing fire management and fire prevention techniques that not only protect human life and structures, but also integrate recovery goals, will undoubtedly be the greatest challenge in this Recovery Unit. Recovering this Recovery Unit will require cooperation with fire management jurisdictions/agencies. One research task currently being tested is the integration of whipsnake life history data into the FARSITE fire modeling program. This research, conducted by U. C. Berkeley students, will help determine the constraints under which prescribed fires should be conducted to improve Alameda whipsnake habitat. With such cooperative efforts already underway, this Recovery Unit has potential to serve as a primary area for fostering cooperative processes.

b. Recovery Unit 2 (Oakland-Las Trampas)

This Recovery Unit has developmental pressures around its entire perimeter. Within the Recovery Unit, 44.6 percent of the land is in open space or conservation status. These lands include East Bay Regional Park District's Roberts Recreation Area, Redwood Regional Park, Leona Open Space, Anthony and Lake Chabot Regional Parks along the east side of the Recovery Unit, Las Trampas Regional Wilderness and Machado and Bishop Ranch Land Banks on the west side of the Recovery Unit, and Cull Canyon Regional Recreation Area at the southern end of the Recovery Unit; East Bay Municipal Utility District's Upper San Leandro Reservoir and Watershed (approximately in the middle of the Recovery Unit) and the somewhat isolated Lafayette Reservoir and Watershed; and lands owned by the City of Oakland, including Joaquin Miller Park and Oakland Zoo on the west side of the Recovery Unit. Long-term protection should be sought for all of the above lands. Protection in perpetuity should be sought for lands that currently harbor Alameda whipsnake populations. Within this Recovery Unit, a minimum of four populations of Alameda whipsnakes should be provided protection in perpetuity. Identified to date as areas harboring Alameda whipsnake populations are the lands west and south of Rossmoor (28 on Figure 17) and the east side of Upper San Leandro Reservoir (29 on Figure 17). An additional population may be located at Las Trampas Regional Wilderness (18 on Figure 17), but surveys are needed to confirm the extent of the Alameda whipsnake population. Although some lands within Rossmoor are conserved for the whipsnake, the lands around Rossmoor are not protected. Cooperative efforts should be pursued to protect this Alameda whipsnake population in perpetuity. Surveys for a fourth population should first focus on the northwestern portion of the Recovery Unit (where a population of Alameda whipsnake would provide individuals for dispersal into the Caldecott Tunnel Corridor-Recovery Unit 6), and its southern boundary (where a population of Alameda whipsnake would provide individuals for dispersal into the Hayward-Pleasanton Ridge-Recovery Unit 3), including the area west of Dublin.

Areas essential for connectivity should include the areas between known and yet to be identified populations. Two areas need additional surveys, mapping, and assessment to determine the best areas for connectivity. In the north, where the Recovery Unit narrows to the Caldecott Tunnel Corridor (Recovery Unit 6), either Redwood Regional Park or Gudde Ridge to the east might provide connectivity between the San Leandro Watershed population and Recovery Unit 6. Along the interface of this Recovery Unit with Hayward-Pleasanton Ridge (Recovery Unit 3), optimal areas for connectivity also need to be identified and preserved (see further discussion under Recovery Unit 3).

On private lands, known occupied habitat along the Highway 24 and Interstate 580 and 680 corridors should be protected through full avoidance measures, habitat conservation plans, section 7 consultations, conservation easements, fee title, and/or acquisition with an emphasis in retaining connectivity.

Efforts to regain connectivity with Recovery Unit 3 should be coordinated between the Recovery Units, and connecting lands should be protected in perpetuity. If regaining connectivity is determined to be feasible, appropriate undercrossing structures and suitable vegetation should be researched and implemented.

Land management for this Recovery Unit should include specific management for Alameda whipsnake and its habitat, including but not limited to addressing *Eucalyptus* (eucalyptus) and *Genista monspessulana* (French broom) encroachment into chaparral/scrub habitats (particularly on the west side of the Oakland Hills), limiting feral cat populations, implementing appropriate grazing management, promoting connectivity over the Caldecott Tunnel Corridor to the Tilden-Briones Recovery Unit and with the Hayward-Pleasanton Ridge Recovery Unit, and coordinating with fire management jurisdictions/agencies.

Fire management plans should be coordinated between the land management agencies and should maximize habitat enhancement for Alameda whipsnake. Las Trampas Regional Wilderness could function as a research site for fire effect studies.

c. Recovery Unit 3 (Hayward-Pleasanton Ridge)

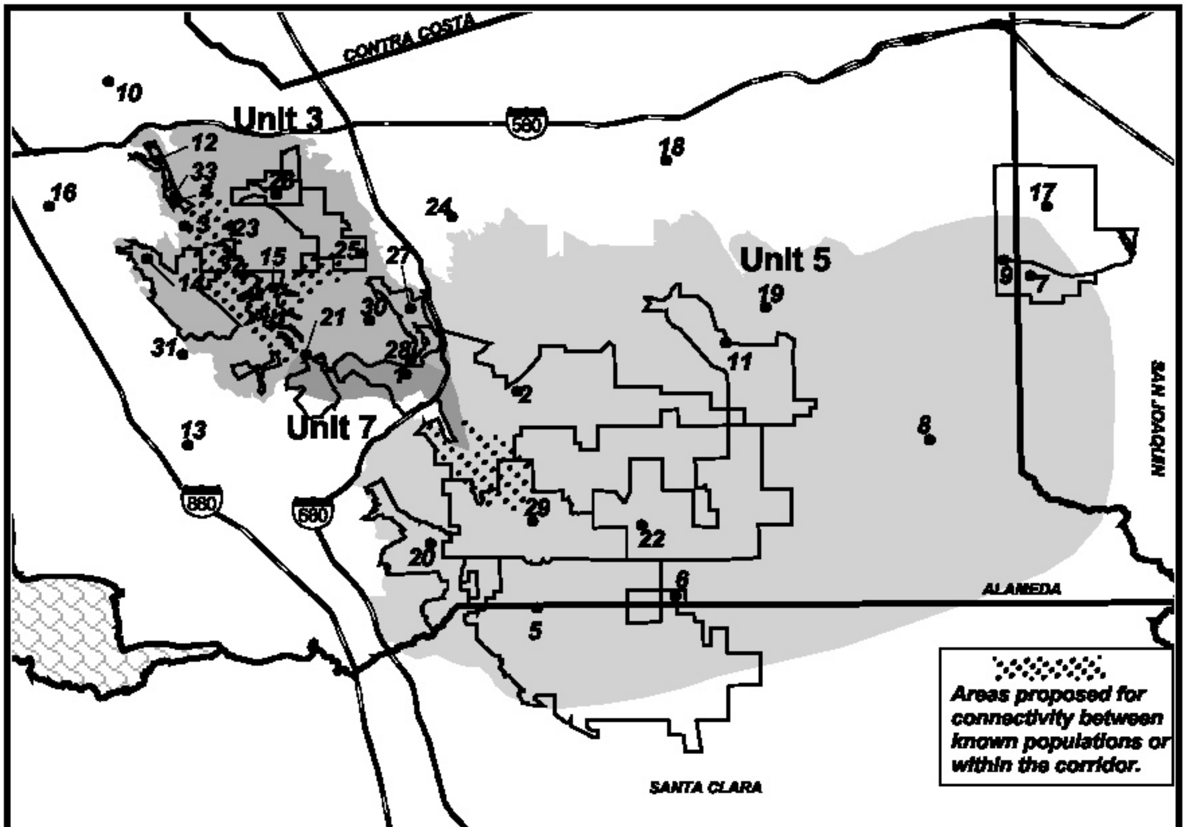
The Hayward-Pleasanton Ridge Recovery Unit is the smallest of the five major Recovery Units, has the least contiguous lands in open space or conservation, and is under intense development pressure (30.4 percent of land in open space or conservation status). Based on the limited information available on the Alameda whipsnake population(s) in this Recovery Unit, fragmentation that leads to isolation of known populations needs to be avoided. To recover this Recovery Unit will require (1) immediate minimization of habitat fragmentation and isolation, (2) strategic protection of habitat, and (3) land management actions that promote Alameda whipsnake distribution, abundance and dispersal.

To ensure recovery of the Alameda whipsnake, fragmentation within this Recovery Unit needs be carefully monitored. Although no more than 5 percent fragmentation in any Recovery Unit is recommended, the location of fragmentation within this Recovery Unit may isolate a population or subpopulation before reaching the 5 percent level. Difficult choices will need to be made by the Cities of Pleasanton, Hayward, Union City, Fremont, and Sunol. Planning efforts should be coordinated and general plans may need amending. Types of zoning that would assist in recovery include enacting ordinances to protect ridge-tops and require structures to be placed a minimum distance structures from chaparral and scrub plant communities.

Protection must focus on securing in perpetuity lands that will: (1) provide for a minimum of three Alameda whipsnake populations, (2) maximize connectivity of lands currently in open space or conservation, (3) connect this Recovery Unit with the Niles Canyon-Sunol Corridor (Recovery Unit 7), and (4) enhance opportunities to regain connectivity between this Recovery Unit and the Oakland-Las Trampas Recovery Unit (Recovery Unit 2). Open space lands include East Bay Regional Park District's Garin/Dry Creek and Pleasanton Ridge Regional Parks, Geldeman Land Bank, and Five Canyons Land Bank. Conservation lands include the Walpert Ridge Conservation Easement and the Pleasanton Ridge Conservation Bank (Shea Homes); the Blue Rock and Bailey Conservation areas are also proposed.

Surveys are a priority within this Recovery Unit to determine population centers and determine site-specific areas for connectivity among population centers within the Recovery Unit and between these population centers and Recovery Units 2 and 7. Recent trapping efforts indicate that Pleasanton Ridge Conservation Bank and the proposed Bailey Conservation Area (26 and 3 on Figure 18) harbor population centers. The extent of the population centers should be confirmed with further surveys. Geldeman Land Bank and Sunol Ridge (15 and 30 on Figure 18) are two other possible locations of population centers and should be surveyed.

Strategic protection should be implemented to maximize connectivity of occupied habitat and protected habitat. Priorities include connecting the open space and conservation lands along the length of Walpert Ridge (32 on Figure 18), and



* Known populations of Alameda Whipsnakes
** Anticipated populations of Alameda Whipsnakes

1 - Alameda Creek
2 - Alameda Watershed (San Antonio Reservoir)
* 3 - Bailey Conservation Area (Proposed)
4 - Blue Rock Conservation Area (Proposed)
5 - Calaveras Reservoir and Watershed
6 - Camp Ohlone Regional Park
7 - Carnegie State Recreation Area
8 - Cedar Mountain Ridge
9 - Corral Hollow
10 - Cull Canyon Regional Recreation Area
11 - Del Valle Regional Park
12 - Five Canyons Land Bank
13 - Fremont
14 - Garin/Dry Creek Regional Park
** 15 - Geldeman Land Bank
16 - Hayward
17 - Lawrence Livermore National Laboratory Site 300
18 - Livermore
19 - Mines Road
20 - Mission Peak Regional Preserve
21 - Niles Canyon
22 - Ohlone Wilderness
23 - Palomares Canyon
24 - Pleasanton
25 - Pleasanton Ridge
* 26 - Pleasanton Ridge Conservation Bank
27 - Pleasanton Ridge Regional Park
28 - Sunol
** 29 - Sunol Regional Park
** 30 - Sunol Ridge
31 - Union City
32 - Walpert Ridge
33 - Walpert Ridge Conservation Easement

Figure 18. Recovery units 3, 5, and 7 of the Alameda whipsnake *(Masticophis lateralis* ssp.*euryxanthus).*

Other areas, as discussed in Chapters III and IV, still need to be identified:
1) 1 additional population within Unit 3
2) Areas of connectivity with Unit 2
3) Areas within Unit 7 that would maximize connectivity between Units 3 and 5.
4) Additional populations within Unit 5.

3 0 3 6 9 Miles

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connecting Walpert Ridge with Pleasanton Ridge Conservation Bank or further south connecting Walpert Ridge with Pleasanton Ridge (25 on Figure 18). Palomares Canyon, which separates Walpert Ridge and Sunol Ridge, is vegetated by oak/bay woodland, with only fingers of chaparral remaining. It is unknown whether these fingers harbor whipsnakes or could (possibly with restoration) facilitate movement of whipsnakes toward and across the Palomares Canyon Road. The road and adjacent houses may deter passage. Therefore, the feasibility of east/west connectivity across Palomares Canyon is unknown and will require further investigation. If, through the mapping and assessment tasks and directed surveys, it is determined that connectivity across Palomares Canyon is not feasible, the width of the connectivity area to the south (Walpert Ridge with Pleasanton Ridge) should be maximized (i.e. greater than 2 miles in width) to provide ample opportunities for the Alameda whipsnake to persist in this Recovery Unit. Surveys, mapping, and assessment of Regional Park properties (Geldeman Land Bank), the hills east of Union City, and Sunol Ridge would determine site-specific areas for connectivity with Niles Canyon-Sunol Corridor (Recovery Unit 7).

For connectivity between Recovery Unit 3 and Recovery Unit 2, the area for interface may be dictated by locations where crossing under Interstate 580 is feasible. Surveys for presence of Alameda whipsnakes and detailed habitat assessments could assist in optimizing the design and connectivity of these areas. It is likely that some of these lands needed for connectivity are currently in private ownership. On private lands, protection is encouraged through conservation easements, conservation banks, or fee title.

It has been argued that trying to reconnect Recovery Units 2 and 3 is impossible because Interstate 580 acts as a barrier and protected lands are lacking in the northern portion of Recovery Unit 3. The potential for connectivity should be investigated further, with consideration of the following: if reestablishing connectivity is shown to be economically infeasible, then a genetic analysis of whipsnakes in Recovery Unit 3 should be undertaken to determine the extent and rate of historical movement between Recovery Units 2 and 3. This rate of movement will then need to be mirrored through translocation of individual snakes between the Recovery Units (moving individuals from one Recovery Unit to the other and vise versa). Translocation will require a genetics management plan and reintroduction plan that meets our policy. It may be determined that the undercrossing and land purchases needed are indeed more economically feasible when compared to the intensive management needed to conduct a genetics study and successfully transfer whipsnakes between Recovery Units. Opportunities to reestablish connectivity may arise when Interstate 580 needs upgrading, as it may be possible to engineer undercrossings at that time.

On private and public lands outside of the areas needed for population centers or for connectivity (focus areas), occupied habitat and suitable buffers should be protected through full avoidance measures, habitat conservation plans, section 7 consultations, conservation easements, conservation banks, or fee title.

Land management plans for this Recovery Unit should include specific management for the Alameda whipsnake and its habitat, including restoration of Palomares Canyon chaparral/scrub community, appropriate grazing regimes, optimizing sizes and shapes of protected habitat, buffering habitat from the indirect effects of urban development, reducing or removing threats such as feral cats, potentially augmenting grassland habitat (providing rock outcrops), and strategically planning land acquisitions when considering park or watershed expansions. Careful and coordinated monitoring of this Recovery Unit is essential. We recommend research into restoration and habitat enhancement that promotes connectivity in this Recovery Unit.

Fire management plans should incorporate the focus areas (connectivity areas and population centers) when designing defensible locations for fighting wildfires. It is important to place fire breaks or other areas of wildfire defense in configurations that do not cause wildfires to surround and negatively affect an entire Alameda whipsnake population. Ridge line breaks should be designed to limit disturbance to connectivity features such as rock outcrops or scrub patches. Coordination with fire management jurisdictions/agencies is essential.

Grazing pressure within this Recovery Unit should be carefully monitored. Large expanses of grassland divide Walpert, Sunol, and Pleasanton Ridges, and overgrazing during drought/suboptimal rainfall years or undergrazing during optimal rainfall years may affect whipsnake movement. Current grazing regimes on open and conservation lands should be assessed immediately to ensure no adverse impacts to the whipsnake. On private lands, public outreach should be utilized to convey optimal grazing regimes for habitat enhancement.

If, for any reason, the recovery of the Recovery Unit appears to be in jeopardy, then genetic research should be conducted immediately on the population(s) within the Recovery Unit to determine the level of genetic uniqueness and the role that individual snakes may have in the future genetic health of other Recovery Units. Transfer from other populations and/or captive breeding with subsequent reintroduction of whipsnakes would be considered only after the genetic management plan is completed, but may be necessary to prevent extirpation within this Recovery Unit or irreparable harm to other Recovery Units from such an extirpation.

d. Recovery Unit 4 (Mount Diablo-Black Hills)

The Mount Diablo-Black Hills Recovery Unit has experienced extreme development pressure on the west and southern borders, and this pressure is increasing on the northern and eastern borders. Within the Recovery Unit, 32.4 percent of the lands are in open space or conservation status. Lands in open space or under Federal ownership include the California Department of Parks and Recreation's Mt. Diablo State Park; the Bureau of Land Management parcels on Mt. Diablo; East Bay Regional Park District's Diablo Foothills and Castle Rock Regional Parks and Morgan Territory, Round Valley, and Black Diamond Mines Regional Preserves; the City of Walnut Creek's Lime Ridge and Shell Ridge Open Space; and Contra Costa Water District's Los Vaqueros Watershed. Conservation lands include the East Bay Regional Park District's cooperative effort with Save Mount Diablo at the Clayton Ranch and Save Mount Diablo's Chaparral Springs (Figure 19).

Long-term protection should be sought for all of the above lands. Protection in perpetuity should be sought for lands that currently harbor Alameda whipsnake population centers. Due to the complete isolation of this Recovery Unit, a minimum of five Alameda whipsnake population centers should be protected in perpetuity.

Identified to date as areas harboring Alameda whipsnake populations are Mt. Diablo (9 on Figure 19), Black Diamond Mines Regional Preserve (1 on

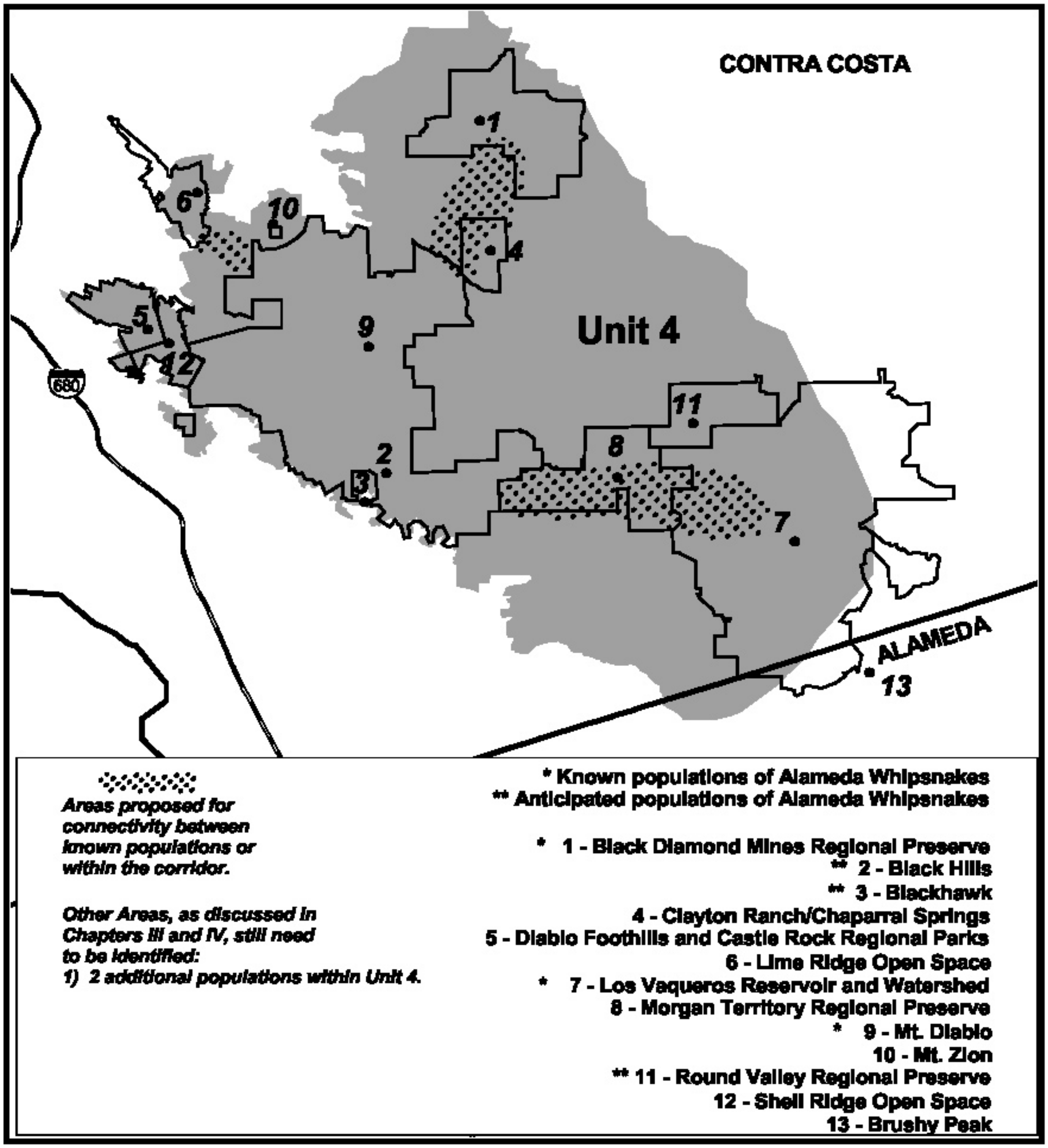

Figure 19. Recovery unit 4 of the Alameda whipsnake *(Masticophis lateralis ssp.euryxanthus).*

3 0 3 6 Miles

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Figure 19), and Los Vaqueros Reservoir and Watershed (7 on Figure 19). Additional populations may be located within the State Park, potentially Black Hills (2 on Figure 19), Round Valley Regional Preserve (11 on Figure 19), or the Clayton Ranch/Chaparral Springs area (4 on Figure 19); however, further surveys are needed to provide site-specific information or population extent. Lime Ridge has not had any surveys, and although no historical sightings are known from this area, habitat is present and surveys are recommended. Although outside of the Recovery Unit, an area of interest is Brushy Peak (Livermore Area Recreation and Park District) (13 on Figure 19), a potentially isolated location southeast of the Recovery Unit. Surveys would be of interest in this area to determine the degree of isolation. Information gained by presence would provide insight into dispersal capabilities of this species or persistence in isolation.

Contiguous open lands connect Mt. Diablo with the Los Vaqueros Watershed and should be protected in perpetuity to ensure connectivity between these populations. Efforts by Save Mount Diablo and East Bay Regional Park have protected lands essential to linking Mt. Diablo with Black Diamond Mines Regional Preserve (4 on Figure 19), however, the remaining lands are still in private ownership. Pursuing protection in perpetuity of lands that would connect Mt. Diablo with Black Diamond Mines is a priority. If Lime Ridge does harbor a population, then lands connecting it with Mt. Diablo should be protected through conservation easements, conservation banks, or fee title.

Land management plans for this Recovery Unit should include specific management for Alameda whipsnake and its habitat, including but not limited to addressing the health of chaparral/scrub, fire management, recreation, reducing or removing threats such as feral pigs, and optimizing the role of grazing.

The grazing history in this Recovery Unit is varied. Some areas have been and continue to be grazed or overgrazed, whereas other areas, such as Mt. Diablo State Park, were grazed historically, but are not now. Broad statements about grazing in this Recovery Unit are thus inappropriate. Grazing should be managed in a way that promotes Alameda whipsnake habitat and community health, taking into account other listed species such as the California red-legged frog, San Joaquin kit fox, and species of concern. This effort will require research coupled with adaptive management.

Two quarries are actively mined within this Recovery Unit. In the northwest corner (Mt. Zion), the Clayton Quarry (Hanson Aggregates) has been in operation since 1966 and more northerly Mitchell Canyon Quarry (RMC Pacific Materials) has been in operation since 1991. Both were in operation prior to the listing of the Alameda whipsnake as threatened and have restoration plans on file. Upon closure of areas, restoration activities and end-use designation should take into account the needs of the Alameda whipsnake. The Contra Costa County Planning Office can assist by informing quarry owners of the types of restoration and end-use designations appropriate for Alameda whipsnake recovery efforts. Restoration should include planting chaparral and scrub vegetation that is native to the mountain and placement of rock outcrops or other forms of refugia that will encourage recolonization by Alameda whipsnakes. End-use designations that should be considered are open space, State Park land, or a preserve.

To retain habitat for buffers around population centers and to provide for expansion of populations or shifts in population centers, avoidance of chaparral/scrub habitat and adjacent grasslands during rural and suburban development is important.

Fire management plans should incorporate the focus areas (connectivity areas and population centers) when designing defensible locations for fighting wildfires. It is important to place fire breaks or other areas of wildfire defense in configurations that do not cause wildfires to surround and negatively affect an entire Alameda whipsnake population. Ridge line breaks should be designed to limit disturbance to connectivity features such as rock outcrops or scrub patches. Coordination with fire management jurisdictions/agencies is essential.

This Recovery Unit is well suited to function as a research site for fire management, grazing, and restoration studies.

e. Recovery Unit 5 (Sunol-Cedar Mountain)

This is the most southern Recovery Unit and is important because it is the interface between the chaparral whipsnake and the Alameda whipsnake. Although the Sunol-Cedar Mountain Recovery Unit has not had the same degree of habitat loss and fragmentation that other Recovery Units have had, the pressure for housing is increasing, particularly in the Pleasanton/Livermore area, as is vehicular traffic through Corral Hollow. Within this Recovery Unit, 32.4 percent of the lands are in open space or conservation status, including East Bay Regional Park District's complex of Mission Peak, Sunol, Ohlone, Del Valle, and Camp Ohlone; San Francisco Public Utility's Calaveras Reservoir and Watershed and Alameda (San Antonio Reservoir) Watershed; the California Department of Parks and Recreation's Carnegie Vehicle Recreation Area, and the U.S. Department of Energy's Lawrence Livermore National Laboratory Site 300 (Figure 18).

Long-term protection should be sought for all lands mentioned above. Protection in perpetuity should be sought for lands that currently harbor Alameda whipsnake population centers. A population center is anticipated to exist at Sunol Regional Park. However, because the distribution of subspecies is unresolved within this Recovery Unit, the definitive locations of other Alameda whipsnake populations are not identified at this time. To determine Alameda whipsnake population centers in this Recovery Unit would require extensive surveys and genetic research.

Connectivity areas in this Recovery Unit should focus on connecting the Sunol Regional Park population center with the Niles Canyon-Sunol Corridor (Recovery Unit 7), and between other populations as identified.

Surveys in the Corral Hollow area, including Lawrence Livermore National Laboratory Site 300 and the Carnegie Recreational Vehicle Park in Alameda and San Joaquin Counties, and the Alameda Watershed and Mission/Ohlone area in Alameda County should include the collection of genetic material, precise measurements of the eight distinguishing characteristics, and detailed habitat associations. Surveys that include collection of genetic material, precise measurements of the eight distinguishing characteristics, and detailed habitat associations should also be conducted to the south in the Calaveras Reservoir and Watershed (and potentially further south) in Santa Clara County and east to the Stanislaus County line, to help in the collection of genetic material and for comparison of the two whipsnake subspecies present in that area.

Research on both the chaparral whipsnake and the Alameda whipsnake within this Recovery Unit will help direct future recovery goals and tasks. Although the Alameda and chaparral whipsnakes differ in the eight descriptive characteristics (see Species Account), variations exist within each subspecies. For example, there have been whipsnakes collected on Mt. Diablo, isolated from the Sunol-Cedar Mountain Recovery Unit, whose eight characteristics did not definitively belong to the Alameda whipsnake subspecies, but were intermediate in nature. Clearly, the chaparral whipsnake inhabits the area south of the Sunol-Cedar Mountain Recovery Unit, but it is unclear whether some or all of the whipsnakes within this Recovery Unit represent: a) hybrids (the offspring of two animals of different species or varieties of species; b) a clinal variation (a gradual variation in a particular inherited characteristic found across a series of adjacent populations; and/or c) an expected variation (the difference existing between the individuals of a species). Although museum specimens have been revisited in an attempt to define the range of the Alameda whipsnake, no genetic work has been conducted to clarify the status of whipsnake subspecies in this Recovery Unit. Additionally, no habitat preference studies or behavioral studies exist to assist in distinguishing between these subspecies.

Research into the similarities and differences between the Alameda and chaparral whipsnake (including genetic makeup, habitat preferences, and behavior) to determine the degree of subspeciation may become necessary. Easily recognizable differences in these two subspecies should be published and distributed. If, however, the subspecies are not easily recognizable or there are intercross progeny[2], then a rule-making process may be necessary to protect the Alameda whipsnake.

If intercross progeny are identified, and if it is determined that these individuals share the traits that characterize the taxon of the listed parent, and the progeny more closely resemble the listed parent's taxon than an entity intermediate between it and the other known or suspected nonlisted parental stock, then the protection of the Endangered Species Act extends to these individuals.

If the chaparral subspecies or the intercross progeny: (1) so closely resemble in appearance the Alameda whipsnake that enforcement personnel would have

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[2] We define "intercross" as all crosses between individuals of different species, subspecies and distinct population segments and "intercross progeny" as the descendants of intercross events. The terms hybrid, intergrade, cross, or interbreed are also in general usage.

substantial difficulty in differentiating between the listed and unlisted species; (2) the effect of this substantial difficulty is an additional threat to the Alameda whipsnake; and (3) such treatment of the unlisted entity will substantially facilitate the enforcement and further the policy of the Endangered Species Act, then the Secretary of the Interior could promulgate a Similarity of Appearance Determination (50 CFR 17.50) for the intercross progeny and/or the chaparral whipsnake within this geographic Recovery Unit. This determination would entitle the chaparral whipsnake and/or the intercross progeny, within this Recovery Unit, to the same protection offered the Alameda whipsnake. During this determination the threats should be specified and if necessary a Special Rule promulgated to exempt certain proposed actions. For example, if the only threat to the Alameda whipsnake is commercial trade in chaparral whipsnakes, and Alameda whipsnakes could be co-mingled such that law enforcement was unable to differentiate the entities, then a Similarity of Appearance Determination with a Special Rule exempting incidental take[3] could be issued. This would prohibit the collection and trade of both subspecies while allowing us to issue incidental take permits for other activities.

Land management plans in this Recovery Unit should address health of chaparral/scrub, fire management, recreation, unauthorized collection, and incompatible land uses (such as mining). For example, the California Department of Parks and Recreation should address and minimize the direct and indirect effects of recreational activities, specifically off-road vehicles, on Alameda whipsnakes and chaparral/scrub habitat, and the Department of Energy should determine and minimize the direct, indirect, and cumulative effects to the Alameda whipsnake and its habitat as a result of their active burning regime and other maintenance and remediation activities. As appropriate, reestablishment and restoration of habitat should be conducted. Private lands, where heavy grazing has occurred, may be areas suitable for restoration. Unauthorized collection may be an issue in this area due to its remoteness and attractiveness to herpetologists. Land management agencies can assist in controlling unauthorized

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[3] The Endangered Species Act of 1973, as amended describes “Take” as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. “Incidental take” is take that results from, but is not the purpose of, carrying out an otherwise lawful activity.

collection of whipsnakes (either subspecies) by notifying our Sacramento Fish and Wildlife Office and California Department of Fish and Game of suspected illegal activities.

f. Recovery Unit 6 (Caldecott Tunnel Corridor)

Some lands in this corridor are in open space, including lands owned by the University of California, Berkeley; Lawrence Berkeley National Laboratory (within the University lands); California Department of Transportation; East Bay Regional Park District's Claremont Canyon Regional Park, Sibley Volcanic Preserve, and Huckleberry Botanic Preserve; and East Bay Municipal Utility District's Siesta Valley Watershed and Gateway Watershed. However, private lands in the Caldecott Tunnel area provide essential connectivity between Recovery Units 1 and 2.

To ensure connectivity between Recovery Units 1 and 2, a significant portion of the above mentioned lands would need to be protected in perpetuity, and strategically situated private landowners would need to participate in management, restoration, and/or protection programs designed to benefit the Alameda whipsnake. Surveys, mapping and assessment will determine site-specific actions.

The Cities of Berkeley and Oakland, as well as the landowners mentioned above, should have land management plans that address human activity impacts, including *Eucalyptus* (eucalyptus) and *Genista monspessulana* (French broom) encroachment into chaparral/scrub habitats, increased predation, and fuels management. Continuing cooperation between landowners and State and Federal staff should occur in designing any vegetation management activities within this corridor.

Much remaining historical habitat was destroyed in the catastrophic firestorm of 1991. Restoration of the area should focus on native plantings with low fuel loads. Concerns exist that providing habitat for the whipsnake may increase fire risk and add additional regulatory burdens upon homeowners and land managers. Because of these perceived conflicts, extensive public outreach will be required. Landowner incentives such as safe harbor agreements should be implemented. All plans for improving whipsnake habitat in this area should be in cooperation with the appropriate fire districts, the Hills Emergency Forum and the National Wildland/Urban Interface Fire Protection Initiative. Support for the proposed East Bay Hills Fire Hazard Reduction Environmental Impact Report would promote this cooperative effort and streamline the regulatory process.

g. Recovery Unit 7 (Niles Canyon/Sunol Corridor)

Although open space or public trust lands exist within this corridor, not all of the land is habitat that would promote connectivity. East Bay Regional Park District does own some lands with chaparral and scrub (Vargas Plateau Land Bank) as does the San Francisco Public Utility (Alameda Watershed). However, some of this land is in cultivation.

To ensure connectivity between Recovery Units 3 and 5, a significant portion of the above mentioned lands would need to be protected in perpetuity, and strategically-situated private landowners would need to participate in management, restoration, and/or protection programs designed to benefit the Alameda whipsnake.

Surveys of the Vargas Plateau will assist in determining presence and where to concentrate site-specific connectivity actions with Recovery Unit 3. Alameda Creek and Niles Canyon should be surveyed for presence and to determine enhancement potential and specific sites where barriers should be removed.

Land management plans need to address health and possible restoration of chaparral/scrub habitats, fire management, grazing, and incompatible land uses such as mining and agriculture. Habitat enhancement within the Alameda Creek floodplain should be implemented if appropriate, and restoration of the gravel quarry should be addressed as areas close (see discussion of mine closure above under Recovery Unit 4, section II.F.6.d). Safe passage for the whipsnake across Niles Canyon Road, including barrier removal or construction of undercrossings, should be investigated and implemented.

III. RECOVERY

A. Objectives

The overall objectives of this recovery plan are to:

- Ameliorate the threats that caused *Arctostaphylos pallida* and Alameda whipsnake to be listed and ameliorate any other newly identified threats in order to be able to delist these two federally listed species.

- Ensure the long-term conservation of *Arctostaphylos manzanita* ssp. *laevigata* and *Cordylanthus nidularius.*

- Confirm the status of the two presumed extinct species of concern, *Eriogonum truncatum* and Berkeley kangaroo rat. If these species are not rediscovered, insights gained as to reasons for extirpation may assist in community restoration. If extant populations of these species are discovered, the ultimate goal would be to ensure their long-term conservation.

Interim goals of this recovery plan include: (1) stabilizing and protecting populations, (2) conducting research necessary to refine reclassification and recovery criteria, and (3) promoting the natural processes and improving the health of the chaparral and scrub communities upon which these species depend. Because data upon which to base decisions about reclassification and recovery are mostly lacking, recovery criteria in this plan are necessarily preliminary.

B. Community-Based Recovery Strategy

A general recovery strategy for the chaparral community is described in this section. Specific recovery strategies for the species covered in this recovery plan are described in individual species accounts (Chapter II) and recovery tasks are detailed in the Stepdown Narrative (Chapter IV). Recovery criteria for federally listed species and conservation strategies for species of concern are summarized in section III.C below.

This recovery plan presents a community-level strategy for recovery and conservation because all of the listed species and nonlisted species co-occur in the same natural communities. The likelihood of successful recovery for listed species is increased by protecting communities intact. Protecting the communities will provide opportunities for pre-listing conservation of nonlisted species that have needs similar to those of listed species. The community-level strategy is determined by the available information on biology, distribution, and population statuses of covered species; extent, location, and quality of existing habitats; and how present and anticipated land and fire management activities will affect the covered species within the landscape east of San Francisco Bay.

Recovery and long-term conservation tasks emphasized in this recovery plan are: (1) protection of habitat and populations; (2) habitat management and restoration, including the reintroduction of a disturbance regime, removal/control of destructive nonnative species, and protection from pesticide use; (3) surveying and monitoring; (4) *ex situ* conservation measures such as captive propagation and seed banking; (5) research; and (6) public participation, outreach, and education.

Habitat Protection
All species covered in this recovery plan are threatened by the loss, fragmentation, or degradation of chaparral habitat in the eastern San Francisco Bay Area. Therefore, areas currently, historically, or potentially occupied by the species are recommended for habitat protection and/or special management considerations. High priority protection areas are of three general types: (1) areas currently occupied by populations considered essential to the species (*e.g.*, population centers, populations at the edge of the range, populations that may provide stepping stones among populations, and populations representing the full range of genetic variation and geographic extent); (2) areas providing connectivity (i.e. among populations within a Recovery Unit) or corridors (i.e. between Recovery Units) for Alameda whipsnake populations; and (3) areas for augmentation of species (actions ranging from propagation of plant species to restoration of habitat for Alameda whipsnake). Factors influencing choice of sites for protection and the level of protection also include habitat size and quality, ease of protection, and cost. Wherever possible, protection or augmentation should first be on larger blocks of land and on publicly-owned lands. Actions on

smaller or privately-owned parcels would require cooperation from private individuals and entities to ensure recovery and long-term conservation of the species covered in the recovery plan. Types of cooperative efforts include selling of land, selling or granting of easements, or voluntary cooperation in special management programs such as reintroductions, fire management, grazing regimes, or other compatible types of land use that maintain or enhance habitat values for chaparral species.

It is preferable to protect habitat in large blocks. Ideally, protected areas or preserves should be large enough to make controlled fire feasible, and also large enough to minimize the chance of the entire area being burned in a wildfire. Additionally, larger protected areas and preserves have a smaller perimeter to area ratio, resulting in less effect to the interior from external factors such as nonnative vegetation or feral cats. Small fragments of habitat may not maintain proper ecosystem functioning and often lose native plant species, thereby reducing the diversity of native vegetation and wildlife (Soulé *et al*. 1992). Factors that need to be considered in determining the appropriate size of protected areas and preserves include, but are not restricted to: (1) the area needed for establishment, expansion, and buffering of species; (2) the area needed to minimize edge effects from nonnative plants and feral cats, different environmental conditions along the edge of the management area, and chance catastrophic events; (3) the area needed to manage periodic burns for the maintenance of the chaparral and scrub habitats; (4) the current and potential future land uses of surrounding land; (5) the shape of the preserve; and (6) the area needed to support the interactions of community biotic (living) and abiotic (nonliving) factors.

Because of the importance of intact communities to the recovery or conservation of these species, we recommend that the extent of habitat loss and fragmentation and successional stages of habitat be monitored. Until research shows otherwise, the maximum proportion of habitat loss within any Recovery Unit should not exceed 5 percent over current (2002) conditions.

Habitat Management and Restoration

Management plans need to be developed for selected chaparral lands. In many cases, effective habitat management and restoration techniques are undeveloped or unknown for species covered in this recovery plan. Therefore, management must be “adaptive” or flexible, based on new data, research, or observed outcomes of ongoing management. Fire management is a high priority management strategy. Other potential management may include various forms of vegetation management (*e.g.*, clearing) or control of destructive nonnative species. The impacts of various management strategies on individual species need to be studied. In some cases, management techniques for one species may conflict with techniques for other species--research may contribute to resolution of these conflicts. Management plans should also include strategies to minimize known threats and also to identify new threats as they may appear. If new threats are identified or other new information becomes available, management plans need to be reevaluated and revised.

Methods to return decadent chaparral communities to a healthy state are the subject of much debate. Different techniques to reestablish healthy chaparral and scrub communities have been investigated in southern California, but little research has been conducted in the area of this recovery plan. Prescribed fires are one method of restoring community health; however, the primary goal of prescribed burning is generally not chaparral or scrub health, but rather the reduction of fuel loads around urban areas and reduction of *Centaurea solstitialis* (star-thistle) in more rural areas (Kevin Shaffer pers. comm. 1999). Careful consideration must be given to whether current fire management programs meet the conservation and recovery goals of the species covered in this recovery plan. Depending on their design and implementation, fire management programs can have positive or negative effects on the species covered in this recovery plan (see also section I.A.3, Natural Disturbance Regimes). Therefore, the design and implementation of fire management programs within Alameda, Contra Costa, and western San Joaquin Counties play a pivotal role in the recovery of these species (Kevin Shaffer pers. comm. 1999).

Ronald L. Myers, in his keynote presentation at the Fire Effects on Rare and Endangered Species and Habitats Conference in 1995 (Myers 1997), recommended that fire management should be directed toward maintaining the “ecological integrity” of targeted “critical elements,” basing management actions both on ecological principles and on knowledge and inferences about life histories and the dynamics of those elements. He did not suggest necessarily recreating historic landscapes and processes, because much of our fire management is based on inferences rather than data. Instead he suggested that actions (*e.g.*, fire episodes) must be monitored and feedback from monitored trends should drive future management actions (i.e., adaptive management). Determining the "critical elements" as they relate to species covered in this recovery plan, implementing research and recovery tasks that will maintain "ecological integrity," and meeting the agencies' needs for fire suppression, fuel reduction and star-thistle management, will be crucial to the success of this recovery effort.

Because the species covered in this recovery plan evolved in a fire-adapted community, and because fire shapes the health of the community, we have chosen fire cycle lengths to define length of time to recovery. Although re-establishment of and succession within the chaparral community after fire is still being investigated, these processes are considered important for recovery of these species as is an appropriate length of time between fires. Having fires too frequently or too infrequently may both be detrimental to these species. The length of time between fires, the amount of nitrogen removed from the soil, the growth patterns of the various chaparral species, and whether the area is grazed all play a role in the appearance and function of the chaparral community over time (Christensen 1994, Naveh 1994, Quinn 1994, Keeley 1987). Fire cycles east of San Francisco Bay within maritime chaparral are estimated to occur on an average every 40 years. Fire cycles within coastal scrub occur every 20 to 30 years, and within grasslands every 5 years (C. Rice pers. comm. 2001).

Monitoring

Surveys and monitoring provide information ranging from filling informational gaps to refining recovery criteria. Prioritization of these tasks reflects their importance to species recovery. For example, most of the surveys will be priority 2 tasks, but surveys for Alameda whipsnake within Recovery Unit 3 is considered a higher priority because the threat of fragmentation is so high there that opportunities for recovery are already being lost.

Controlled Propagation

Controlled propagation of animals and plants in certain situations is an essential tool for the conservation and recovery of listed species. In the past, we have used controlled propagation to reverse population declines and to successfully return listed species to suitable habitat in the wild (U.S. Fish and Wildlife Service

2000*c*). Though controlled propagation has a supportive role in the recovery of some listed species, the intent of the Endangered Species Act is "to provide a means whereby the *ecosystems* upon which endangered species and threatened species depend may be conserved" (emphasis added). Controlled propagation is not a substitute for addressing factors responsible for an endangered or threatened species' decline. Therefore, our first priority is to recover wild populations in their natural habitats wherever possible (U.S. Fish and Wildlife Service 2000*c*).

Research

The research tasks recommended in this recovery plan are needed to provide answers to help achieve recovery or conservation of the covered species. Some research is essential to the survival of these species. Research on fire ecology and management, habitat utilization by Alameda whipsnake, and *Arctostaphylos pallida* pathogens are essential to species survival. Other research is necessary to delist these species. Because of public safety issues, fuels management research is of high priority and has already begun.

Cooperative Efforts and Outreach

To efficiently utilize resources and streamline regulatory response time, regional cooperative efforts should be encouraged and are a high priority. Public outreach regarding fire issues is also a high priority action. Because these species occur in or adjacent to highly developed areas, public outreach and cooperation must be stressed. Other public outreach tasks include educating the public about the value of ecosystems and the role of endangered species recovery.

C. Recovery and Conservation Criteria

"The recovery of endangered species and the restoration of damaged ecosystems may be the greatest technical challenge in biological conservation" (Pavlik 1996, p.150). "Recovered" species are expected to be restored to a point where their long-term survival in nature is ensured. Criteria used to evaluate when listed species are "recovered" should include number and distribution of populations, population sizes, and probabilities of persistence over specific time periods (Mace and Lande 1991, Tear *et al*. 1993, Schemske *et al*. 1994, Carroll *et al*. 1996). However, development of realistic, appropriate recovery criteria is hampered by lack of adequate and reliable demographic and genetic data (Schemske *et al*.

1994, National Research Council 1995, Tear *et al*. 1995, Cypher 1998) as well as by the difficulties of applying population viability analysis and extinction theory to assess likelihood of extinction in any particular situation (*e.g.*, Mace and Lande 1991, National Research Council 1995, Taylor 1995). Additional and better data increase the reliability of population forecasting and assessment of recovery potential (Scott *et al*. 1995). However, the Committee on Scientific Issues in the Endangered Species Act suggest that setting scientifically defensible recovery criteria will demand resources well beyond those currently available (National Research Council 1995). Because new data may change our appraisal of what constitute appropriate recovery criteria, the criteria recommended in this recovery plan are preliminary and warrant reevaluation when additional data become available.

1. Plant Species

a. Listed Plant Species.

One federally listed plant species is included in the plan: *Arctostaphylos pallida*.

Recovery criteria for *Arctostaphylos pallida* are summarized in Table 4. In general, recovery criteria for *Arctostaphylos pallida* are based on: (1) protection and adaptive management in perpetuity of all current locations on East Bay Regional Park District lands, East Bay Municipal Utility District lands, City of Oakland lands, and in some cases historical occurrences (Table 5); (2) evidence that populations at these sites are stable or increasing over three fire cycles; (3) storage of seed in Center for Plant Conservation certified facilities; and (4) development of reliable seed germination and propagation techniques. Protection of sites should target the largest possible blocks of land and should include a buffer of 460 meters (1,500 feet), or as large as is feasible. Protection should involve populations throughout the known range of the species. Populations should be monitored at appropriate time intervals (see individual species accounts, Chapter II). Demographic research with factor analysis should be conducted to identify limiting life history stages.

Table 4. Generalized recovery criteria for *Arctostaphylos pallida* and conservation criteria for plant species of concern.

Species	Recovery Step	I. Secure and protect specified recovery areas from incompatible uses	II. Management plan approved and implemented for recovery areas, including survival and recovery of the species as the objectives	III. Monitoring in recovery areas demonstrates:	IV. Other actions
Arctostaphylos pallida	delist	a) Existing populations: Oakland Hills metapopulation including all populations on East Bay Regional Park lands, East Bay Municipal Utilities lands, and City of Oakland lands; and Sobrante Ridge metapopulation along with adjacent unoccupied habitat and a 460-meter (1,500-foot) buffer b) 5 additional populations (either newly discovered, reintroduced or introduced populations) along with adjacent unoccupied habitat and a 460-meter (1,500-foot) buffer	a) Existing populations: Oakland Hills metapopulation including all populations on East Bay Regional Park lands, East Bay Municipal Utilities lands, and City of Oakland lands; and Sobrante Ridge metapopulation along with adjacent unoccupied habitat and a 460-meter (1,500-foot) buffer b) 5 additional populations (either newly discovered, reintroduced or introduced populations) in suitable locations in the wild, along with adjacent unoccupied habitat and a 460-meter (1,500-foot) buffer	a) Population monitoring is stable or increasing with evidence of natural recruitment for a period of 3 fire cycles (approximately 120 years) that include normal disturbances b) Habitat monitoring shows a mosaic of multi-age class stands, and anthropogenically created habitat does not occur within any Recovery Unit over current (2001) conditions	a) Ameliorate or eliminate threats (see Appendix D). b) Re-establish natural fire frequency c) Study importance of different fire techniques for habitat management d) Store seeds of disjunct populations in at least two Center for Plant Conservation certified facilities e) Enhance existing populations at Sobrante Ridge, Huckleberry Preserve, and Joaquin Miller Park f) Evidence that the preserves are not made unmanageable by small size, proximity to urban development, or fragmentation

Species	Recovery Step	I. Secure and protect specified recovery areas from incompatible uses	II. Management plan approved and implemented for recovery areas, including survival and recovery of the species as the objectives	III. Monitoring in recovery areas demonstrates:	IV. Other actions
Arctostaphylos manzanita ssp. *laevigata*	conserve	c) Mount Diablo metapopulation along with sufficient adjacent unoccupied habitat for fire management and a 460-meter (1,500-foot) buffer.	c) For all populations and any occupied or unoccupied habitat identified as essential to survival	c) Population monitoring stable or increasing over 60 years	g) Store seeds in at least two Center for Plant Conservation certified facilities.
Cordylanthus nidularius	conserve	d) Mount Diablo population e) 4 additional populations (either newly discovered or introduced populations) along with adjacent unoccupied habitat within Mount Diablo State Park	d) Include species specific management within management plan for Mount Diablo	d) Population monitoring stable or increasing over 60 years at both the original and additional populations.	h) Store seeds in at least two Center for Plant Conservation certified facilities

Note: *Eriogonum truncatum* should have delisting or conservation strategies developed for the species, if any population(s) are rediscovered. These strategies may involve amending this recovery plan.

Table 5. Recovery needs for *Arctostaphylos pallida* (pallid manzanita) occurrences in the California Natural Diversity Database (1998).

Element Occurrence number	Recovery Area	Population Name	Ownership	Actions needed based upon threats listed in California Natural Diversity Database
1	Sobrante Ridge	Sobrante Ridge Regional Preserve	East Bay Regional Park District	Protect from threats, manage, and enhance
2	Tilden	Tilden Park	East Bay Regional Park District	Protect from threats and manage
3	Huckleberry Ridge	Joaquin Miller Park	Oakland	Protect from threats, manage, and enhance
4	Huckleberry Ridge	Huckleberry Botanic Area	East Bay Regional Park District	Protect from threats, manage, and enhance
8	Huckleberry Ridge	Redwood Park North	East Bay Municipal Utility District	Protect from threats and manage
9	Huckleberry Ridge	Roberts	East Bay Regional Park District	Protect from threats and manage
10	Huckleberry Ridge	Exeter chaparral	Private	Determine availability to add as buffer to the Huckleberry botanic area
12	Huckleberry Ridge	Ascot Drive	Private	Check genetic distinctiveness of individuals, and voluntary protection until it can be re-established elsewhere
13	Tilden	Tilden Park-upper Wildcat Creek	East Bay Regional Park District	Protect from threats and manage

Element Occurrence number	Recovery Area	Population Name	Ownership	Actions needed based upon threats listed in California Natural Diversity Database
14	Sobrante Ridge	Sobrante Ridge outside of park boundary?	Private and East Bay Regional Park District?	Natural habitat between Morningside Drive and Heavenly Ridge should be surveyed for *Arctostaphylos pallida* - any survey should include mapping of precise location and aerial extent
15	Huckleberry Ridge	Sibley Volcanic	East Bay Regional Park District	Protect from threats and manage

?: Ownership needs confirmation.

In order to delist, reintroducing or introducing several additional populations of *Arctostaphylos pallida* may be necessary. However, because reintroduction and introduction of populations are expensive and experimental (Falk *et al*. 1996), surveying historical sites and potential habitat within the historical range to locate currently unknown populations is also recommended. It is recommended that an additional five populations be discovered, reintroduced, or introduced. In addition, research is needed on genetics, disease, and pollinators.

b. Plant Species of Concern

Conservation criteria for *Arctostaphylos manzanita* ssp. *laevigata* and *Cordylanthus nidularius* are summarized in Table 4. Because existing information on species of concern is limited, high priority should be given to research identifying species range and distribution (i.e., surveys), status of populations, threats to the species, and details of demography, reproduction, and (in some cases) genetics. Ensuring long-term conservation of species of concern involves meeting criteria similar to those given above for reclassifying listed plant species: protection and management of known sites, evidence of stable or increasing populations over a number of years, and seed banking at Center for Plant Conservation certified facilities. These criteria assume that long-term conservation has been achieved if populations remaining throughout the historical range are not declining, and are secure from threats.

Additionally, because *C. nidularius* occurs only in one location, establishment of refugia populations is necessary.

If *Eriogonum truncatum* is rediscovered, the conservation tasks for rediscovered plants detailed in Chapter II should be implemented.

2. *Animal Species*

a. *Listed Animal Species*

One federally listed animal species is included in this recovery plan: the Alameda whipsnake.

Recovery criteria for the Alameda whipsnake are summarized in Table 6. Focus areas requiring protection in perpetuity are: three populations (including Tilden Regional Park and two populations to be identified) in the Tilden-Briones Recovery Unit; four populations (including the area south and west of Rossmoor, the east side of Upper San Leandro Reservoir, and two populations to be identified) in the Oakland-Las Trampas Recovery Unit; three populations (including Pleasanton Ridge Conservation Bank, the proposed Bailey Conservation Area, and one population to be identified) in the Hayward-Pleasanton Ridge Recovery Unit; five populations (including Mount Diablo, Black Diamond Mines Regional Preserve, and Los Vaqueros Watershed, and two populations to be identified) in the Mount Diablo-Black Hills Recovery Unit; currently existing populations (locations to be determined based on surveys and subspecies delineation) in the Sunol-Cedar Mountain Recovery Unit; open space lands in Caldecott Tunnel Corridor and Niles Canyon/Sunol Corridor required for connectivity among Recovery Units (specific locations to be determined based on survey and assessment); and corridors required for connectivity among the populations within the above Recovery Units. Focus areas are described in greater detail in the Alameda whipsnake recovery strategy (II.F.6 above). Because certain data upon which to base decisions about Alameda whipsnake reclassification and recovery are lacking, delisting and recovery criteria in this recovery plan are necessarily preliminary and will need reassessment as appropriate.

Table 6. Generalized recovery criteria for Alameda whipsnake

Species	Recovery Step	I. Secure and protect specified recovery areas from incompatible uses	II. Research completed, analyzed, and incorporated in management plans	III. Management plan approved and implemented for recovery areas, with survival and recovery of the species as objectives	IV. Monitoring in recovery areas demonstrates:	V. Other actions
Alameda whipsnake	delist	Secure and protect specified recovery areas from incompatible uses through: a) Protection for 75-100 years of 90 percent of “long-term protection” habitat in Task 5.3.1.1 - 5.3.1.5 b) Permanent protection of 100 percent of focus areas (“protection in perpetuity” habitat in Tasks 5.3.1.1-5.3.1.7), as refined based on spatial analysis (Tasks 3.1.1-3.1.3) and surveys (tasks in Table 7). Areas include population centers, connectivity areas, corridors, and buffer areas)	Incorporate into management plans the data from priority life history and habitat research tasks: a) Priority 1 tasks (7.1, 7.9, 7.10, 7.11, 7.14, and 7.17) b) Priority 2 tasks (7. 12, 7.13, 7.15, 7.16, and 7.24) Additionally, c) Other priority 2 tasks will need completion before monitoring can begin (7.18 and 7.19) d) Some implementation tasks, such as relocation and/or reintroduction are not yet determined to be necessary for recovery. If, however, they are determined to be essential, then other priority 2 tasks (7.21and 7.23) will need completion prior to implementation	Management plans which have the survival and recovery of the species as objectives are: a) Approved and implemented on 100 percent of all focus areas b) Approved and implemented on 30 percent of lands outside of focus areas but within the recovery unit boundaries c) Approved and implementation has begun in an additional 20 percent of the recovery units outside the focus areas d) Assured of adequate funding for long-term management	Monitoring in recovery areas demonstrates: a) Representative populations or subpopulations representing the genetic variation and geographic extent of the species, as identified by surveys (Table 7) and genetic study (Tasks 7.23, 7.24), are stable or increasing with evidence of natural recruitment for a period of 1.5 fire cycles (approximately 60 years) that include normal disturbances. b) Habitat monitoring shows a mosaic of multi-age class stands, and that habitat fragmentation has not appreciably increased (less than 5 percent) within any recovery unit over current (2002) conditions.	a) Ameliorate or eliminate threats (see Appendix D). b) Achieve a mosaic of habitats, ideally through re-establishment of natural fire frequency. c) Increased public awareness within the 4 county area on urban/wildland issues.

Note: Delisting or conservation strategies should be developed for Berkeley kangaroo rat, if any population(s) are rediscovered. This process may involve amending this recovery plan.

b. Animal Species of Concern

If the Berkeley kangaroo rat is rediscovered, recovery or conservation criteria should be developed, possibly involving amendment of this recovery plan, and conservation tasks should be implemented for the rediscovered population as detailed in Chapter II.

D. Recovery Priorities

Actions necessary to recover (or delist) a listed species or ensure the long-term conservation of a species of concern are ranked in three categories:

> **Priority 1**- an action that must be taken to prevent extinction or to prevent a species from declining irreversibly in the foreseeable future.
> **Priority 2** - an action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.
> **Priority 3** - all other actions necessary to meet recovery or conservation objectives.

Although recovery or conservation actions are ranked for each species individually, wherever possible this recovery plan focuses on multispecies actions. Where an action involves several species, the recovery/conservation priority reflects both the needs of individual species and the broad benefit to the group of species. Because situations change as time passes, recovery/conservation priorities must be considered in the context of what has already happened and is likely to happen at all sites. Therefore, the priorities assigned are intended to guide, not to constrain, the allocation of limited conservation resources.

IV. STEPDOWN NARRATIVE

1. Form a Recovery Implementation Team that cooperatively implements specific management actions necessary to recover these species (Priority 2).

   A key to the recovery of the listed species and the conservation of the species of concern is the participation of the large landowners and land managers: California Department of Parks and Recreation, Department of Energy, Bureau of Land Management, East Bay Regional Park District, Save Mt. Diablo, University of California at Berkeley, East Bay Municipal Water District, Contra Costa Water District, San Francisco Water District, and Cities of Berkeley and Oakland. Additionally, cooperation by the fire prevention organizations from national, State, regional and local levels will be essential. Any effort to implement the recovery tasks would take into account the priority of human safety and include the cooperation of landowners and land managers mentioned above, as well as interested public and stakeholders, species experts, professional and academic researchers, the California Department of Fish and Game, the California Department of Forestry and Fire Protection, California Native Plant Society, the Biological Resources Division of the U. S. Geological Survey, and the U. S. Fish and Wildlife Service. Additionally, for technical advice, the invitation and participation should include herpetologists, botanists, ecologists, range, fire effects experts, and other experts as appropriate.

2. Conduct public outreach and education; and develop and implement a regional cooperative program.

   Public outreach and cooperation must be stressed for successful implementation of recovery for *Arctostaphylos pallida* and Alameda whipsnake; and conservation for the species of concern. These species occur in or adjacent to highly developed areas. Many threats to the species (perhaps especially for Alameda whipsnake) are also threats to the homeowners (*e.g.*, catastrophic fire storms). Added threats facing the species include: planting of *Eucalyptus* (eucalyptus), *Pinus radiata* (Monterey pine), *Genista monspessulana* (French broom), and nonnative *Arctostaphylos* spp. (nonnative manzanitas); and the introduction of domestic and feral cats (*Felis domesticus*). Additionally, some recovery actions, such as prescribed burns, will likely cause some public concern. Because of the complexity and sensitivity of these issues, it must be a priority for the U.S. Fish and Wildlife Service and California Department of Fish and Game to work cooperatively with the public and with fire management agencies, including California Department of Forestry and Fire Protection.

2.1 Develop and implement a comprehensive outreach program.

The outreach program should focus on providing information to interested and affected landowners and the general public about: (1) species covered in the recovery plan, (2) what is meant by recovery, (3) how recovery can be achieved, and (4) the need of fire management for habitat maintenance and the continued survival of the species. Private landowners should become familiar with special status plant and animal species that occur on their land, with the significance of the populations, and with available conservation measures, including conservation easements and incentive programs (see Task 2.2). For private lands with potential occurrences of species covered in the recovery plan (with historical occurrences or otherwise within the range of the species), permission should be sought to conduct surveys. If populations of species covered in the recovery plan are identified, landowners should be informed of their significance and should be encouraged to continue land uses that support the species' habitat.

Within the area east of San Francisco Bay, many avenues for communication with the general public exist. Formal and informal educational opportunities exist in the form of universities, colleges, and junior colleges and the many parks, zoos, and wildlife rehabilitation facilities. Continuing to utilize existing platforms such as the Fire Safe Council, the National Wildland/Urban Interface Fire Protection Initiative, and the Hills Emergency Forum will help solidify the fledgling cooperative effort begun as the Alameda whipsnake fire effects research group. Outreach programs can provide correct information regarding fire management and

Arctostaphylos pallida or Alameda whipsnake fire and grazing intensity issues. A comprehensive outreach program should begin before or concurrent with the release of the draft recovery plan. Funding sources for outreach plans are often limited. Creative solutions should be pursued.

2.1.1 Develop species specific outreach.

Outreach should include development of species specific outreach information.

2.1.1.1 Provide schools within the area covered by the recovery plan with information about the species and recovery efforts (Priority 2).

To foster interest about special status species among young people, schools within the area covered by the recovery plan should be provided with information about all of the covered species and recovery efforts.

2.1.1.2 Create and distribute a pamphlet for landowners regarding *Arctostaphylos pallida* (Priority 2).

A pamphlet should be created and distributed to landowners near the Huckleberry Preserve. The pamphlet should explain the problem of hybridization of *Arctostaphylos pallida* with nonnative *Arctostaphylos* and provide some potential solutions. The pamphlet also should provide tangible examples such as East Bay Municipal Utility District removing the nonnative *Arctostaphylos* (manzanitas) planted around the East Bay Municipal Utility District water tank on Manzanita Drive. The uniqueness of this species and its role within the declining chaparral/scrub community should be stressed.

2.1.1.3 Provide information to use for interpretive programs on the conservation of Alameda whipsnake (Priority 3).

We should provide information on life history, threats, recovery strategies, and successes to State and regional park personnel and visitors. Ranger talks and written materials could be used to further the public outreach program.

2.1.1.4 Allow for captive Alameda whipsnakes to be used for educational displays at facilities that are within the range of the Alameda whipsnake (Priority 3).

Occasionally, Alameda whipsnakes are unable to be released back into the wild due to injury or other causes. Streamlining the process by which threatened species may be kept in captivity for educational purposes would be helpful for public outreach. Part of the outreach program would be the conditions under which the snakes are kept, the type of educational information presented, the ultimate disposition of the snake, and a form letter that allows the temporary transfer of the whipsnakes from the U.S. Fish and Wildlife Service to the educational facility. Participants might include American Zoological Association member zoos and rehabilitation facilities.

2.1.1.5 Provide information to use for interpretive programs on the conservation of *Arctostaphylos manzanita* ssp. *laevigata* and *Cordylanthus nidularius* (Priority 3).

We should provide information on life history, threats, conservation strategies, and successes to the personnel and visitors at Mount Diablo State Park.

Ranger talks and written materials could be used to further the public outreach program.

2.1.1.6 Develop and implement information for Mount Diablo State Park for *Eriogonum truncatum* (Priority 2).

We should work with the California Department of Parks and Recreation to develop information regarding *Eriogonum truncatum*. The general public should be aware of the reasons for the extirpation of this species from its original range and be encouraged to participate in its possible rediscovery.

2.1.1.7 Develop and distribute information on the Berkeley kangaroo rat (Priority 2).

We should work with parks and schools within the historic range of the Berkeley kangaroo rat to develop information regarding the Berkeley kangaroo rat. The general public should be aware of the reasons for the extirpation of this species from its original range and be encouraged to participate in its possible rediscovery.

Additionally, we should assist in developing and distributing information regarding habitat and species identification that could be used during surveys for other species (see Task 6.1.3).

2.1.2 Communicate with the public on the recovery status for *Arctostaphylos pallida* and Alameda whipsnake (Priority 3).

Part of the outreach program should be providing yearly progress reports to Congressional representatives. Additionally, we should communicate with the public, business industry, policy makers, academics, researchers, consultants, environmental organizations, other stakeholders, and regional, State, and Federal agencies as accomplishments occur. Information from the tracking database (see Task 10) could be used in developing the annual and periodic progress reports.

2.1.3 Provide information to the public and other interested parties regarding urban wildland interface issues.

2.1.3.1 Provide information to the public on fire issues (Priority 1).

We should work with California Department of Forestry and Fire Protection to provide information to the public regarding urban wildland interface issues.

2.1.3.2 Provide information to the California Department of Forestry and Fire Protection Vegetation Management Program (Priority 2).

We should work with the California Department of Forestry and Fire Protection Vegetation Management Program. This program is designed to assist private landowners in managing their land. Unfortunately, this program has often been used to "improve grazing opportunities," resulting in the removal of chaparral and scrub. Information designed to promote recovery of chaparral/scrub communities should be provided as well as information on section 9 of the Endangered Species Act.

2.1.4 Provide worker awareness training.

Training for fire management personnel, park maintenance personnel, pesticide applicators, and others will further the recovery of the Alameda whipsnake and *Arctostaphylos pallida*. Some successful training programs have included threatened and endangered species classroom training, "tailgate" sessions, and identification cards for use in the field.

2.1.4.1 Provide worker awareness training for *Arctostaphylos pallida* (Priority 1).

Provide worker awareness training for fire management personnel, vegetation management personnel, and pesticide applicators.

2.1.4.2 Provide worker awareness training for Alameda whipsnake (Priority 2).

Provide worker awareness training for fire management personnel, City of Oakland and East Bay Regional Park District maintenance personnel, park maintenance personnel, vegetation management personnel, and pesticide applicators.

2.2 Develop and implement economic or other incentives to private landowners for conservation and recovery of covered species on private lands through cooperative programs and other groups (Priority 2).

We should work with nonprofit organizations (such as land trusts) to foster conservation efforts. Support and assistance of private landowners in conserving and recovering the species in this recovery plan may be gained by developing economic and other incentive programs (including relief from taxes, tax credits, tax deductible habitat management, implementation of "no surprises" initiative and safe harbor Habitat Conservation Plans).

2.3 Work cooperatively to develop regional planning efforts.

We should work cooperatively to foster various regional planning efforts to aid in the recovery of these species.

2.3.1 Work cooperatively through information exchange with organized groups such as the Alameda/Contra Costa Biodiversity Working Group that provide policy makers with policy recommendations (Priority 2).

The Outreach Program should provide information on appropriate zoning or ordinances for essential chaparral and scrub communities (open space or low density zoning; ridgeline ordinances), and on the programs that we provide to the private landowner and public landowner or managers to allow for economic progress while protecting listed species and the ecosystems on which they depend, including information on Habitat Conservation Plans, the Safe Harbor Initiative, and the No Surprises policy.

2.3.2. Encourage and assist counties, cities, water districts, park districts, and private landowners in the development and implementation of Habitat Conservation Plans (Priority 2).

City and county governments are the primary agencies that decide land uses, and thus, their involvement in any future recovery planning process is essential. We should provide information on the value of Habitat Conservation Plans to both the city and county governments, private landowners and general public. Regional planning efforts that incorporate multiple species and vegetation communities, or wide-ranging activities (such as fuels reduction) should take priority over individual Habitat Conservation Plans. Large-scale Habitat Conservation Plans will assist in reaching recovery goals. In this way, large scale land management decisions take into account the recovery of many listed and candidate species, and economize on time, effort and funds.

2.3.3 Encourage and assist in the development and implementation of conservation banks separately or in conjunction with Regional Habitat Conservation Plans (Priority 2).

Most applicable for Alameda whipsnake, conservation banks should be promoted as a means of overcoming many of the problems associated with offsetting lost habitat on a piecemeal basis. Conservation banks can be developed either in conjunction with or separately from Habitat Conservation Plans. Conservation banks that use private lands and promote connectivity should be a priority. Other areas should be determined after the mapping, assessment, and analysis of each Recovery Unit is completed (see Tasks 3.1.1, 3.1.2, and 3.1.3).

2.4 Encourage participation in research.

Actively encourage the participation of colleges, universities, and private research and consulting firms in research. The recovery task information should be provided to faculty for possible student thesis projects, as well as through channels that may reach private researchers and consulting firms. Many of the research tasks are discrete and could be accomplished over a few years of study, making them appropriate for thesis projects or short-term grants. By encouraging research involvement we would be accomplishing both public outreach and specific recovery tasks.

2.4.1 Make available the life history research prioritization list to the research community and other plan participants (Priority 2).

The life history research prioritization list could be disseminated through an Internet list server or by meeting with university staff and students.

2.4.2 Assist in providing research opportunities and funding to the research community and other plan participants (Priority 1).

We should assist through various programs including section 4 recovery funds, fostering partnerships between land management agencies and researchers, section 6 funding, and potentially through compensation/mitigation funding to provide research opportunities. We and the California Department of Fish and Game should expedite Recovery Permits [10(a)1(A)] and Scientific Collecting Permits, respectively, to researchers who are willing to assist in completing recovery tasks.

3. Conduct mapping, assessment, and analysis exercise.

The Gap Analysis Project vegetation data currently available to us is inadequate to develop delisting criteria for Alameda whipsnake as well as individual tasks for this and other species covered in this recovery plan. Currently, we generally do not have available the level of detail needed to determine areas for specific habitat management for Alameda whipsnake, areas for directed surveys for both the Alameda whipsnake and *Arctostaphylos pallida*, and precise locations for potential reintroduction areas for *A. pallida*. Once these data are available, analyses to refine delisting criteria, recovery tasks and conservation strategies, as appropriate, should be completed.

3.1 Acquire sufficiently detailed coverages of the chaparral and scrub communities.

Mapping must include sufficiently detailed chaparral/scrub vegetation coverages to address the above deficiencies. Coverages for soil types, precipitation, slope, aspect, important habitat features (*e.g.*, rock outcrops), current sighting information, fire history, fire management jurisdictions, land use, land owners/managers, etc. are needed.

3.1.1 Inventory and coordination of existing spatial data (Priority 1).

All of the large land owners/managers have existing databases and Geographic Information Systems (GIS) coverages. This information should be inventoried and assessed for accuracy. Datasets should be combined into seamless coverages representing a "best available" Geographic Information System dataset in the Universal Transverse Mercator (UTM) Zone 10 NAD83 projection, including spatial data from overlapping recovery plans. These Geographic Information System data should be made available for use by all Implementation Team members, including spatial data from overlapping recovery plans. The data should be used to provide up-to-date information on occupied and potential habitat, and areas of restricted activities (useful for fire personnel).

3.1.2 Identify data gaps and procure additional data (Priority 1).

Data gaps should be identified, and any gaps in the data should be ameliorated (*e.g.*, by purchasing additional coverages, digitizing existing coverages, conducting aerial reconnaissance and/or groundtruthing). We also should work with the California Natural Diversity Data Base to update and correct records for species covered in this recovery plan.

If it is determined that a more detailed vegetative cover layer is needed, one should be developed at a scale no less detailed than 1:2,000.

3.1.3 Analyze results from Geographic Information System mapping exercise (Priority 1).

The results from the Geographic Information System mapping exercise should be used to refine delisting criteria, recovery tasks, and conservation strategies, as appropriate. Future uses of the Geographic Information System mapping could include minimizing the effects of catastrophic firestorms and other ongoing actions for recovery.

3.2 Establish and utilize a centralized database (Priority 2).

A centralized database should be provided to the Implementation Team members, providing them with up to date information on occupied and potential habitat, and the types of activities that would be restricted in those areas (*e.g.*, restrictions on staging areas for emergency responses to wildfires) (also see Task 4.1.2). This task could be done in association with the Memorandum of Understanding (see Task 4.1.3).

3.3 Provide updated information and necessary funding to information access points such as fire model programs (*e.g.*, Fire Effects Information System and FARSITE programs) (Priority 2).

Reliance on the Internet, databases, and modeling are increasing. Identifying these information access points and supplying needed information and funding are essential to communication strategies.

4. Protect and conserve the ecosystems upon which these species depend.

The purpose of the Endangered Species Act is "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved [recovered]...". Only through the protection and eventual recovery of the ecosystem can we recover listed species in the wild. Without conserving the ecosystems, the best we can hope for is species existence in captivity or under other intensively managed situations. Decline in the two listed species in this recovery plan is in part due to habitat loss, fragmentation, or degradation of the chaparral and scrub community, an ecosystem component. Information from Task 3.1.3 can be used in identifying or refining areas to protect.

4.1 Develop and implement immediate and cooperative active management of the chaparral and scrub communities with a goal of returning these communities to a healthy state.

Immediate management actions should be developed and implemented within a research and/or monitoring framework so that success can be gauged and adaptive techniques incorporated. The actions need to create a mosaic of age classes of chaparral and scrub, promote natural disturbance regimes, eliminate invasion by nonnative species, promote adjacent habitats and/or features so as to benefit the covered species, promote connectivity of chaparral habitat for Alameda whipsnake, and incorporate the research results as outlined in the research section.

4.1.1 Implement immediate management actions that return or mimic natural disturbance regimes and promote recovery of Alameda whipsnake and *Arctostaphylos pallida* and conservation of other species covered in this recovery plan (Priority 1).

Some study of historical fire patterns, and site evaluations of burned areas as well as areas where alternative methods have been used (*e.g.*, grazing of goats, hand clearing, etc.), will help determine management efficacy. Emphasis should be on a return to natural disturbance regimes, but it is recognized that this goal may not be possible in all areas in need of active management. However, it is essential for the recovery of *Arctostaphylos pallida* that a disturbance regime be re-established.

4.1.2 Incorporate recovery goals and conservation strategies into California Department of Forestry and Fire Protection's wildlife protection zones (Priority 1).

Work with the California Department of Forestry and Fire Protection and local jurisdictions to incorporate recovery goals and conservation strategies into the California

Department of Forestry and Fire Protection's wildlife protection zones. The Implementation Team will work with California Department of Forestry and Fire Protection and local jurisdictions by providing information on the degree of risk catastrophic firestorms pose to the species covered in this recovery plan, determining areas of defensibility that would limit the threat of catastrophic loss of habitat and minimize impacts of fire fighting activities, and cooperatively determining areas where a "let it burn" policy may be appropriate.

4.1.3 Develop Memoranda of Understanding between California Department of Forestry and Fire Protection and the local/regional/State lands and fire authorities, and U.S. Fish and Wildlife Service and California Department of Fish and Game for fuels reduction, fire suppression policies, and fire fighting activities that will encourage health of chaparral/scrub communities and the recovery/conservation of the species covered within this recovery plan (Priority 1).

These Memoranda of Understanding should be considered a high priority for recovery. Many past and current fire management activities negatively affect the health of chaparral/scrub communities and the species covered in this recovery plan. One outcome of these Memoranda of Understanding should be the development of a Natural Resources Protection Guidebook for Fire Management Officers, such as was written in 1998 for San Diego County through a collaborative effort between Federal, State, and local government agencies.

4.1.4 Ensure that current and future uses of pesticides do not adversely impact the chaparral/scrub ecosystem (Priority 1).

Work with public agencies, including the California Department of Pesticide Regulation, and major landowners to develop safe guidelines that consider the effects to the scrub and chaparral communities from application of pesticides, herbicides, insecticides, fungicides, and rodenticides. These guidelines should take into consideration all the listed species, all species of concern, and all extirpated species with high rediscovery potential. These guidelines could be incorporated into existing or future management plans (see Task 8.1).

4.2 Coordinate various management actions to economize on duplication of efforts and funds.

We should work with the land management agencies to coordinate the implementation of management actions, the integration of fire management actions, and surveys.

4.2.1 Implement management actions that combine and coordinate management tasks from the various species covered in this recovery plan as well as geographically overlapping recovery plans (Serpentine Soils of the San Francisco Bay Area, California Red-legged Frog, Upland Species of the San Joaquin Valley, Large-flowered Fiddleneck, etc.) (Priority 2).

Many of these plans cover areas that overlap somewhat with the area covered in this recovery plan. Some tasks could be combined, while other task implementation needs caution so as not to counteract other recovery goals. Establishment of a database to track overlapping tasks will assist in this effort as will dissemination of information to all involved participants.

4.2.2 Integrate other land use needs and fire management into the immediate management actions to prevent duplication of efforts and economize on funds (Priority 1).

As with task 4.1.1, coordination is essential in economizing efforts and funds. Many of the landowners/managers already have existing fire management and land management documents. Coordination of the needs of these species and fire and land management needs will not only economize but will reduce the potential for land management employees not having all information at hand. Some specific examples would include incorporating Alameda whipsnake life history information into models used by fire agencies, such as FARSITE and the U.S. Department of Agriculture's Fire Effects Information System. It is also essential to incorporate up to date information on occupied habitat into the fire management guidance documents, not only to reduce direct take, but also to promote recovery. Special or minimum impact suppression requirements will need to be determined for sensitive areas and fire prevention techniques, likewise, will need refinement. This task can be incorporated into Memoranda of Understanding discussed in Task 4.1.3.

4.2.3 Combine surveys for special status species when appropriate (Priority 2).

If surveys need to be performed for Alameda whipsnake or *Arctostaphylos pallida*, other listed species or species of concern covered under recovery plans within the area should be surveyed. For example, in the Oakland Hills surveys for bay checkerspot (*Euphydryas editha bayensis*) and callippe silverspot butterflies should be performed when vegetation management is proposed for the serpentine grasslands within the Recovery Units for Alameda whipsnakes.

4.3 Protect habitat from increased human-caused fragmentation.

Human-caused habitat fragmentation is a significant problem in the area east of San Francisco Bay. Because the effects of habitat fragmentation can have serious ecological consequences to the vegetation community, it is essential to limit additional fragmentation that causes isolation of Alameda whipsnake populations or makes protected or preserved areas untenable for fire management. Until research shows otherwise, the extent of habitat fragmentation within any Alameda whipsnake Recovery Unit should remain below a 5 percent threshold over current (2002) conditions. Within areas for recovery of *Arctostaphylos pallida*, including areas for reintroduction, no additional anthropogenically caused habitat fragmentation should occur.

Regional planning efforts, including the metropolitan transportation plan and regional plans, should analyze the region-wide effects of their actions on habitat fragmentation.

4.3.1 Coordinate with California Department of Transportation and the Federal Highway Administration on projects included in regional transportation improvement program (Priority 1).

Federal agencies must ensure that the actions that they authorize, fund or carry out do not jeopardize the continued existence of listed species. Numerous projects listed in the 1998 Metropolitan Regional Transportation Plan would further fragment habitat directly or by facilitating additional urban encroachment. The Federal Highway Administration and Caltrans should participate in a region-wide planning process to address the cumulative effects of their highway projects. Projects are scheduled that range from building auxiliary lanes to highway widening to boring another tunnel through the Caldecott corridor.

4.3.2 Coordinate with agencies for tracking of habitat fragmentation (Priority 1).

Additional aerial flyovers at annual intervals should be performed and digitized to track habitat loss and fragmentation. (The U.S. Army Corps of Engineers and the U.S. Geological Survey conduct regular flyovers and costs could be shared.) Other efforts may be included, such as tracking processes within habitat conservation plans or section 7 consultations. Federal agencies including the Bureau of Reclamation and other water purveyors should assist in mapping and aerial flyovers of their service areas. This information should be used to determine progress toward recovery and as an early alert to where and when the habitat is becoming too fragmented and a reclassification of the listed species to endangered would be necessary.

Any affected planning departments should work with us to develop a notification process for project proposals in the preliminary map stage. This information can be used to notify landowners of their section 10(a)(1)(B) responsibilities to obtain an incidental take permit and to assist in minimizing and tracking fragmentation. This information can also help in ensuring that section 9 ("Prohibited Acts") violations are minimized.

5. Protect and secure existing populations and habitat of covered species.

Natural lands that are known to contain species covered in this recovery plan should be protected. Protection of these lands includes identification and minimization of threats (see Tasks 5.2.3, 5.3.2, 5.4.1.2, 5.4.2.3) and appropriate and adaptive management (see Task 8.1) to ensure species survival and recovery. Special agreements may need to be developed to ensure this level of protection. Land protection may include deed restrictions, conservation easements, or fee title acquisition.

5.1 Establish permanent staff within the large landowning agencies dedicated to listed species recovery and special status species conservation.

Many of these large landowning agencies have directives for protecting State and Federal special status species. However, staff and funding is often not specifically dedicated to this task. To implement the tasks within this recovery plan will require intensive management. Additional staff should be hired to implement this recovery plan.

5.1.1 Determine staffing levels appropriate for recovery plan implementation (Priority 1).

Each land management agency should work with us to determine staffing levels appropriate for recovery plan implementation. For example, it is anticipated that East Bay Regional Park District would need a full-time preserve manager to manage the Huckleberry and Sobrante Ridge Preserves and Caldecott Tunnel corridor for the Alameda whipsnake. We foresee that the preserve manager would implement and oversee maintenance, restoration, potential reintroductions, and management at all East Bay Regional Park District *Arctostaphylos pallida* populations.

5.1.2 Fund and hire additional staff (Priority 1).

The preserve manager should have a background in botany or plant ecology, and be knowledgeable about the management of natural areas. The duties of the preserve manager would include: (1) coordinating implementation of management tasks; (2) conducting or coordinating monitoring of rare plant populations; (3) coordinating with staff involved in managing the protected areas; (4) coordinating with public or private groups that are interested in visiting the preserves; (5) enlisting and supervising volunteers who can help with preserve monitoring and maintenance activities; and (6) coordinating with us and the California Department of Fish and Game on this or other recovery tasks.

5.2 Protect and secure populations of *Arctostaphylos pallida*.

Protection in perpetuity of all populations on East Bay Regional Park lands, East Bay Municipal Utility District lands, and City of

Oakland lands is essential to the recovery of *Arctostaphylos pallida.* Additionally, any established satellite populations must be protected and secured. Although the protection of plants *in situ* is a priority, it may not be feasible to protect individual plants that occur on private lands in people's back yards (especially those on private land at Exeter and Ascot Lanes where habitat may be too fragmented). In order to reduce the threat from random naturally occurring events, recovery will also include reintroduction or introduction within historic range (Task 9.1.3), storage of seed (Task 9.1.1), and propagation within botanical facilities (Task 9.1.2). Management plans need to be developed and implemented in cooperative efforts between the U. S. Fish and Wildlife Service, East Bay Regional Park District, East Bay Municipal Utility District, and the City of Oakland (see Tasks 8.1.1 to 8.1.8).

5.2.1 Protect populations of *Arctostaphylos pallida* at Huckleberry Ridge area in perpetuity (Priority 1).

All *Arctostaphylos pallida* populations on East Bay Regional Park lands, East Bay Municipal Utility District lands, and City of Oakland lands need to be protected in perpetuity. Although much of the Huckleberry Ridge area is within the East Bay Regional Park District, concerns remain as to whether the current level of protection will allow the full recovery of this species. First, the protection offered by the Park District is not in perpetuity, a requirement for a species with such a limited range. Second, the conditions and actions that threaten this population still exist. Ameliorating these threats is essential to the protection of this area (see task 5.2.3). We will work with East Bay Regional Park District, East Bay Municipal Utility District, and the City of Oakland to accomplish these tasks (5.2.3.1 through 5.2.3.4).

5.2.2 Protect populations of *Arctostaphylos pallida* at Sobrante Ridge area in perpetuity (Priority 1).

Although much of the Sobrante Ridge area is within the East Bay Regional Park District, concerns remain as to whether the current level of protection will allow the full recovery of this species. First, the protection offered by the Park District is not in perpetuity, a requirement with a species with such limited range. Second, the conditions and actions that threaten this population still exist. Ameliorating these threats is essential to the protection of this population. We will work with East Bay Regional Park District to accomplish these tasks (5.2.3.1 through 5.2.3.4).

5.2.3. Reduce or eliminate threats to *Arctostaphylos pallida*.

The threats that recently led to the listing of this species as federally threatened have not decreased. The invasion of nonnatives, the hybridization with nonnatives, competition from natives, detrimental effects of herbicide spraying, damage from brush clearing for fire breaks, and the detrimental effects of other fire suppression activities all still threaten this species. In addition, fungal disease appears to be repeatedly threatening the Huckleberry Ridge population, and the pathogens and the short- and long-term effects of infection are poorly understood. For recovery to occur, these threats need to be ameliorated.

5.2.3.1 Coordinate with agencies and landowners/managers to reduce threat posed by fire suppression activities and catastrophic fire storms (Priority 1).

Work in cooperation with California Department of Forestry and Fire Protection, East Bay Regional Park District, and East Bay Municipal Utility District to determine how fire suppression activities can be altered to reduce threats to *Arctostaphylos pallida.*

5.2.3.2 Determine and implement long-term removal of competing plants and vegetation management.

Long-term competition removal and vegetation management may include developing a time table for meeting control objectives, identifying land ownership boundaries, notifying the public of large-scale or long-term removal of competing plant species within county, regional, or local lands, and implementing an outreach program aimed at removal of competing plants on private lands. Competition and vegetation management should be discussed within any management plans written for *Arctostaphylos pallida* (see Task 8.1).

5.2.3.2.1 Reduce competition from both native and nonnative plants (Priority 2).

Establish and implement a vegetation management program. This program should include removal of *Eucalyptus* spp. (eucalyptus), *Genista monspessulana* (French broom), *Vinca major* (periwinkle), and *Senecio mikaniodes* (German ivy). Selected native trees or shrubs that are outcompeting *Arctostaphylos pallida* should also be removed.

Remove or appropriately prune all nonnative and selected native trees and shrubs that pose direct shading and competition to *Arctostaphylos pallida*. Use methods that are the least damaging to *A. pallida*. Hand clear without use of heavy equipment for vegetation removal adjacent to *A. pallida* habitat in order to prevent soil compaction or damage to existing *A. pallida* individuals.

5.2.3.2.2 Reduce the threat of hybridization to *Arctostaphylos pallida* from planted *Arctostaphylos* spp. (Priority 2).

Take steps to remedy the presence of nonnative *Arctostaphylos* that present the threat to *A. pallida*. Cooperate with local citizens and the City of Oakland in discouraging any future plantings of nonnative *Arctostaphylos*. Public outreach and education will be an integral part of this later process. Conduct management of nonnative *Arctostaphylos* spp.

5.2.3.3 Reduce the threat of fungal disease (Priority 1).

Implement management actions recommended from research (see task 7.6) to alleviate fungal disease.

5.2.3.4 Reduce threat of herbicide spraying (Priority 2).

In order to avoid accidental application or possible contact from herbicide drift, prohibit use of any herbicides that affect broadleaf plants within 30 meters (100 feet) of *Arctostaphylos pallida.* Additionally, land management agencies and public works departments need to discuss with us any use of pesticides within any potential chaparral habitat for *A. pallida*.

5.3 Protect and secure habitat for and populations of the Alameda whipsnake.

Work in cooperation with public and private landowners/land managers to assure long-term and perpetual protection of habitat in a manner that promotes recovery. Private lands should be protected through voluntary conservation measures (such as easements, management agreements, land exchanges or donations, conservation banks, fee title, habitat conservation plans) and then adaptively managed. Public lands may already have certain measures in place that protect, to varying degrees, chaparral and scrub habitat for Alameda whipsnake (i.e. zoning or ordinance restrictions). These measures need review in light of recovery objectives, and a determination made if the protection is adequate to meet recovery goals. If it is determined that the type of protection currently in place does not offer the necessary protection to ensure recovery, then strengthening of zoning or ordinances is one option; other options include, but should not be limited to, the voluntary measures discussed above, or land acquisition by public agencies. Land acquisition by public agencies should focus on those areas where protection of chaparral scrub habitat for Alameda whipsnake overlaps with needs of other species in this recovery plan or is part of a focus area (such as areas needed for connectivity, corridor, or population centers). Federal agencies should ensure that the actions they fund, permit, or carry out assist in recovery goals.

5.3.1 Protect and secure populations of Alameda whipsnake.

Strategic land protection shall include population centers (including breeding, foraging, and egg-laying habitats), dispersion areas, connectivity areas, buffer areas, be representative of the subspecies' genetic diversity, be of a size and shape to protect from catastrophic events, and shall include public and private lands as appropriate. Protection of populations includes lands needed for corridors. Emphasis should be on using public lands first. However, certain areas in private ownership may be essential to recover this species. It is recognized that some areas will need protection in perpetuity and others areas will need protection over a specified long-term (see Tasks 2.2 and 2.3 for protection measures). With the information currently available, listed below are the areas in need of long-term protection or protection in perpetuity. However, not all areas have been identified and all areas will need further refinement. The mapping, assessment, and analysis (see Tasks 3.1.1 - 3.1.3) and the directed surveys (see Task 6) will identify as yet unidentified areas or refine areas identified.

5.3.1.1 Protect and secure Alameda whipsnake populations within Tilden-Briones Recovery Unit 1 (Priority 2).

Establish long-term protection of East Bay Regional Park District's Sobrante Ridge, Kennedy Grove, Wildcat Canyon, Tilden Regional Park, and Briones Regional Park; and East Bay Municipal Utility District's San Pablo Reservoir Watershed, Briones Reservoir Watershed and Pinole Valley. Achieve protection in perpetuity of the population at Tilden Regional Park, the area between Tilden Regional Park and the Caldecott Tunnel Corridor, and two other, as yet to be identified, population centers and their connectivity areas.

5.3.1.2 Protect and secure Alameda whipsnake populations within Oakland-Las Trampas Recovery Unit 2 (Priority 1).

Establish long-term protection for East Bay Regional Park District's Roberts, Redwood, Leona Open Space, Anthony and Lake Chabot along the east side of the Recovery Unit, Las Trampas and Bishop Ranch on the west side of the Recovery Unit, and Cull Canyon at the southern end of the

Recovery Unit; East Bay Municipal Utility District's Upper San Leandro Reservoir and Watershed situated approximately in the middle of the Recovery Unit; and lands owned by the City of Oakland including Joaquin Miller Park and Oakland Zoo. Achieve protection in perpetuity for populations at San Leandro Reservoir, Las Trampas Ridge Regional Park, Rossmoor, one more population to be identified, and connectivity areas between the population centers and Recovery Units 1 and 3.

5.3.1.3 Protect and secure Alameda whipsnake populations within Hayward-Pleasanton Ridge Recovery Unit 3 (Priority 1).

Establish long-term protection for East Bay Regional Park District's Garin/Dry Creek, Pleasanton Ridge, Geldeman Land Bank, and Five Canyons Land Bank. Achieve protection in perpetuity for the proposed Blue Rock and Bailey Conservation areas, Pleasanton Ridge Conservation Bank, one additional population center to be identified, and connectivity areas between the population centers and Recovery Units 2 and 7. Because of the extent of private lands in this Recovery Unit, the Cities of Pleasanton, Hayward, Union City, Fremont, and Sunol should consider revising general plans to ensure appropriate zoning or ordinances are in place that protect Alameda whipsnake habitat to the fullest extent.

5.3.1.4 Protect and secure Alameda whipsnake populations within Mount Diablo-Black Hills Recovery Unit 4 (Priority 2).

Establish long-term protection for California Department of Parks and Recreation's Mt. Diablo State Park, the Bureau of Land Management parcels on Mt. Diablo, East Bay Regional Park District's Diablo Foothills and Castle Rock, Morgan Territory/Round Valley, and Black Diamond Mines, the City of Walnut Creeks' Lime Ridge and Shell Ridge, and Contra Costa Water District's Los Vaqueros Watershed. Achieve protection in perpetuity for three population centers on Mt. Diablo, one at Los Vaqueros Watershed, and one at Black Diamond Mines and connectivity areas including Crystal Springs and Clayton Ranch.

5.3.1.5 Protect and secure Alameda whipsnake populations within Sunol-Cedar Mountain Recovery Unit 5 (Priority 2).

Establish long-term protection of East Bay Regional Park District's complex of Mission Peak, Sunol, Ohlone, Del Valle, and Camp Ohlone, San Francisco Public Utility's Calaveras and Alameda (San Antonio Reservoir) Watersheds, California Department of Parks and Recreation's Carnegie Vehicle Recreation Area, and the U.S. Department of Energy's Lawrence Livermore National Laboratory Site 300. Achieve protection in perpetuity of anticipated population at Sunol Regional Park and connectivity of this park with Recovery Unit 7. Other populations areas and areas of connectivity are to be determined.

5.3.1.6 Protect and secure Alameda whipsnake populations within Caldecott Tunnel Corridor Recovery Unit 6 (Priority 1).

Establish protection in perpetuity of a significant portion of University of California, Berkeley lands; Lawrence Berkeley National Laboratory; California Department of Transportation lands; East Bay Regional Park District's Claremont Canyon, Sibley Volcanic, and Huckleberry Botanic Preserve; and East Bay Municipal Utility District's Siesta Valley and Gateway Area. Precise areas are to be determined.

5.3.1.7 Protect and secure Alameda whipsnake populations within Niles Canyon-Sunol Recovery Unit 7 (Priority 1).

Establish protection in perpetuity of a significant portion of East Bay Regional Park District's Vargas Plateau and San Francisco Public Utilities Alameda Watershed. Precise areas are to be determined.

5.3.2 Reduce or eliminate threats to Alameda whipsnake.

5.3.2.1 Ensure that current or future uses of rodenticides, herbicides, pesticides, etc. do not adversely affect the Alameda whipsnake directly or indirectly through prey reduction or habitat alteration (Priority 2).

The U.S. Environmental Protection Agency Interim Measures for the use of rodenticides in Alameda and Contra Costa Counties have been drafted. A thorough review of the direct and indirect effects of these bulletins on the Alameda whipsnake should be completed and comments provided to, and incorporated by, the Environmental Protection Agency. It is anticipated that other such bulletins for pesticides, herbicides and fungicides may be forthcoming; these bulletins should also be handled as above.

5.3.2.2 Protect loss of habitat or prey from competing nonnative species.

Competition from nonnatives varies within each Recovery Unit, and therefore, the necessary actions will vary with the degree of threat. Recovery tasks (3.1.1 - 3.1.3) will include assessing the threats of nonnatives within each Recovery Unit.

5.3.2.2.1 Control nonnative plants (Priority 2).

Eucalyptus spp. (eucalyptus) and other nonnative invasive plants that are invading the chaparral/scrub communities and adjacent grasslands must be removed or controlled to a level that the threat from these nonnatives no longer exists.

5.3.2.2.2 Control feral cats, pigs, and other nonnative predators (Priority 2).

Nonnative predator populations, particularly feral cats and pigs, should be controlled to the level that direct predation and competition for prey are minimal to nonexistent.

Landowners/managers should initiate control methods in areas of occupied habitats or those unoccupied habitats where planned or natural reintroduction is occurring. Public awareness will be an important component of any feral animal control program. An emphasis on prevention of feral animal populations should be included in the landowner/manager and public dialogue.

If red foxes, or other nonnative species such as dogs or rats, are determined to have a negative effect on the recovery of the Alameda whipsnake, then similar actions to those above should be implemented.

5.3.2.3 Ensure that native predators do not threaten the recovery of the Alameda whipsnake (Priority 3).

Native predators, such as racoons, can increase in and adjacent to housing. If native predators are determined to have a negative effect on the recovery of the Alameda whipsnake, then efforts to reduce or control their numbers should be considered. For example, providing public education about negative impacts of feeding or providing shelter for wildlife.

5.3.2.4 Ensure that unauthorized collection does not occur (Priority 2).

Outreach may be one of the most useful tools in limiting unauthorized collection. Pet stores should be made aware of the status of the Alameda whipsnake and the legal ramifications of handling this species. In areas open to the public, such as State Parks, rangers and interpretive personnel should be made aware of the types of actions that may indicate that individuals are trying to illegally trap the whipsnake. In areas where the public is limited (watersheds, preserves, mitigation banks), law enforcement personnel can likewise be informed. Both State and Federal wildlife law enforcement personnel can include the Alameda whipsnake in their list of species monitored for illegal interstate and international trade.

5.3.2.5 Ensure that the chaparral whipsnake and/or intercross progeny of the Alameda and chaparral whipsnake within any of the Recovery Units does not threaten the protection afforded the Alameda whipsnake by the Endangered Species Act (Priority 2).

We believe that the Sunol-Cedar Mountain Alameda whipsnake (*M. l. euryxanthus*) population breeds with the chaparral whipsnake (*M. l. lateralis*), also common in this area. We consider whipsnakes found within this Sunol-Cedar Mountain area to be the listed entity if they more closely resemble the *M. l. euryxanthus* than *M. l. lateralis*. However, no research has been conducted to determine under what conditions these two subspecies hybridize, and whether the resulting offspring have characteristics that would classify them as intergrades (intercross). There are other possible explanations for the intergrade specimens that warrant investigation, including clinal variation from south to north, and expected variation within the population (H. Greene pers. comm. 1998). Without genetic analysis, morphological comparisons, and behavioral/habitat preference studies comparing *M. l. euryxanthus* and *M. l. lateralis*, one cannot determine the level of uniqueness between and within these two subspecies, or whether they are in the process of speciation (see Tasks 7.23 and 7.24). Erring on the side of caution, protecting the Sunol-Cedar Mountain population may be important as it may prove to be the reservoir of genetic variation. Genetic variation is necessary for the Alameda whipsnake to adapt in a rapidly changing environment. However, one must also be cautious that habitat enhancement (or destruction) does not favor one subspecies over the other and disrupt natural processes.

Promulgation of a Similarity of Appearance Determination may be appropriate for the Sunol-Cedar Mountain Recovery Unit, or other Recovery Units as well. If research results indicate there is a threat to the recovery of Alameda whipsnake due to the close or overlapping proximity of the chaparral whipsnake, then the promulgation of a Similarity of Appearance Determination should be written and published in the Federal Register.

5.4 Protect and manage populations of *Arctostaphylos manzanita* ssp. *laevigata* and *Cordylanthus nidularius* on Mount Diablo.

5.4.1 Protect and manage *Arctostaphylos manzanita* ssp. *laevigata.*

Protect and manage all populations within Mt. Diablo as per California Department of Parks and Recreation Resource Directive. If other public lands yield positive identification of this species, then protection and management of the other disjunct sites is essential (*e.g.*, Lime Ridge or Black Diamond Mines Regional Preserve). Protection and management of the disjunct populations also should be established in perpetuity. Management plans should be developed and implemented for all populations (see Tasks 8.1.23 - 8.1.26) and monitoring also should occur for all populations (see Task 8.2.4).

5.4.1.1 Determine current distribution and status of *Arctostaphylos manzanita* ssp. *laevigata* (Priority 2).

Arctostaphylos manzanita ssp. *laevigata* should be inventoried and its distribution mapped in order to help determine the current status. All historical locations should be surveyed (see Task 6.2.28).

5.4.1.1.1 Map all current and historical locations (Priority 2).

Mapping should include a complete literature review for historical information on this species, as well as ground truthing to determine if *Arctostaphylos manzanita* ssp. *laevigata* occurs at any of the historical locations, and to determine the health and extent of current populations.

5.4.1.1.2 Clarify the identity of the specimens found outside of eastern Contra Costa County (Priority 2).

Specimens should be sent to a species expert for identification. Should the specimens from Vaca Mountains and Mt. St. Helena be identified as *Arctostaphylos manzanita* ssp. *laevigata*, conservation measures should apply to these populations.

5.4.1.1.3 Assess existing and potential threats to *Arctostaphylos manzanita* ssp. *laevigata* (Priority 2).

An analysis of threats should be conducted promptly. Information on type of threats, severity, and how to decrease or eliminate the threats should be collected.

Threats may include but are not limited to, damage by feral pigs, fire suppression, wildfires, recreational activities, herbivory, competition, predation on seeds, etc.

5.4.1.2. Decrease or eliminate any identified threats (Priority 2).

Using information obtained from assessment of threats Task 5.4.1.1.3 and from monitoring (see Task 8.2.4), take actions to decrease or eliminate threats.

5.4.1.3 Encourage protection of *Arctostaphylos manzanita* ssp. *laevigata* and its chaparral/scrub community in the private sector (Priority 2).

Private lands adjacent to Mt. Diablo State Park or other areas may harbor *Arctostaphylos manzanita* ssp. *laevigata*. Private landowners and other stakeholders should be provided with information on this species, the types of protection needed, and ways that private landowners can participate in the conservation of a rare species. Incentives should be provided to encourage private landowners to volunteer.

5.4.2 Protect and manage *Cordylanthus nidularius*.

Protect and manage all populations within Mt. Diablo State Park as per California Department of Parks and Recreation Resource Directive. If other populations of this species are found, protection and management of these populations should occur in perpetuity. Although the California Department of Parks and Recreation Directive provides a framework for this and other rare plant species to be protected and conserved, lack of adequate funding and personnel has limited implementation of this directive. In a cooperative effort between the U. S. Fish and Wildlife Service, California Native Plant Society, and California Department of Parks and Recreation, a management plan for this species should be developed and implemented (see Tasks 8.8.1.23 - 8.1.26 and 8.2.4).

5.4.2.1 Determine current distribution and status of *Cordylanthus nidularius*.

All serpentine areas on Mt. Diablo should be surveyed to determine if additional populations or colonies of *Cordylanthus nidularius* exist (see Task 6.2.28).

Cordylanthus nidularius should be inventoried and its distribution accurately mapped in order to help determine the current status and to assist with Task 5.4.2.4.

5.4.2.2.1 Map all locations (Priority 2).

Mapping should include ground truthing of locations.

5.4.2.2.2 Assess existing and potential threats to *Cordylanthus nidularius* (Priority 2).

An analysis of threats should be conducted promptly. Information on type of threats, severity, and how to decrease or eliminate the threats should be collected.

Threats may include feral pigs, erosion, recreation, trails, and possibly prescribed burns.

5.4.2.3 Decrease or eliminate any identified threats (Priority 2).

Using information obtained from assessment of threats (Task 5.4.2.2.2) and monitoring (see Task 8.2.4), take actions to decrease or eliminate threats.

5.4.2.4 Coordinate with California Department of Forestry and Fire Protection, California Department of Parks and Recreation and California Department of Fish and Game in determining and implementing best management practices for protecting *Cordylanthus nidularius* in the event of a wildfire (Priority 1).

Because the sole *Cordylanthus nidularius* population occurs adjacent to a fire break and road, it is especially important to be cautious in creating fire breaks and placing equipment. We should coordinate with the California Department of Forestry and Fire Protection, California Department of Parks and Recreation, and California Department of Fish and Game to determine the best placement for equipment and the best management practices.

5.4.2.5 Determine protection measures for this species through research and coordination with the California Department of Forestry and Fire Protection and California Department of Parks and Recreation (Priority 2).

We should work with the California Department of Forestry and Fire Protection, California Department of Fish and Game, and California Department of Parks and Recreation to determine protective measures for this species with regards to defensible space, suppression activities, burn policy, etc., and incorporate this information into Mt. Diablo State Park's wildfire management plan. In addition, include training for fire personnel on the location of the plants and the protection measures necessary to preclude disturbance or destruction of individual plants.

6. Survey historical locations and other potential habitat where species covered in the recovery plan may occur.

Recovery of listed species and long-term conservation of the species of concern covered in this recovery plan will often require relocating historical populations or locating new populations of these species. Historical locations should be surveyed to determine whether suitable habitat remains, the species persists at the sites, and/or the sites may be suitable for reintroduction. Suitability of historical locations for reintroduction would depend upon: (1) whether potential habitat exists, (2) the presence and magnitude of threats, and (3) whether the sites can be secured and managed for the long-term protection of the species. Surveys should also include other potential chaparral or scrub habitat to determine whether undiscovered populations may exist. If new populations are discovered, they should be protected and managed as discussed above. During the surveys, potential introduction sites should also be identified.

In addition, general surveys should be performed on any areas proposed for protection.

At historical locations for *Arctostaphylos pallida,* clear overstory and disturb the soil to determine if seed bank may be viable.

A range-wide survey for the Alameda whipsnake has not been conducted and would be prohibitively expensive. However, surveys will be necessary to refine areas for protection and to track habitat loss. Locations specified in the table represent our current knowledge of historical or likely areas. In the future new information (*e.g.* about habitat preferences), may lead to additional locations for surveys.

To increase the likelihood of rediscovering of *Eriogonum truncatum*, all historical sites need to be analyzed with regard to soil type, geomorphology, elevation, aspect, historic and current plant communities, and historic and current activities. The common components of all historical sites may provide insight on the species' specific habitat requirements. Concurrently with this information gathering, initial plant specific surveys of each appropriate historical site should be conducted. Historical areas and like areas within Alameda, Contra Costa and Solano Counties should be surveyed for at least 3 consecutive years (barring any extreme weather patterns). After 3 consecutive years of surveys, rediscovery potential should be assessed to determine if surveys should be continued, where, and under what conditions.

Surveys for the Berkeley kangaroo rat should be included in both botanical and Alameda whipsnake surveys where historical habitat for the Berkeley kangaroo rat overlaps. Additionally, directed surveys for the Berkeley kangaroo rat should be conducted where reports of potential occurrences exist or there is a high likelihood that habitat remains.

6.1 Establish a survey program and protocol for species covered in the recovery plan.

6.1.1 Establish a survey program and protocol for the plant species covered in the recovery plan (Priority 2).

Botanical surveys need to follow a standard protocol. Botanical surveys should be floristic (identifying all plants on site to species, subspecies, or variety to compile a comprehensive list) and performed during a time of year when the plants are identifiable (may involve multiple visits during the growing season).

6.1.2 Establish a survey program and protocol for Alameda whipsnake.

6.1.2.1 Develop and implement survey protocols and standard recommendations for the Alameda whipsnake (Priority 2).

Survey protocols that will assist in collecting information of value for recovery should be developed in cooperation with the California Department of Fish and Game. Standard Recommendations to minimize to the greatest extent the effects of ground disturbing activities should be developed and implemented.

6.1.2.2 Provide training on survey guidelines and the handling of Alameda whipsnakes (Priority 2).

To ensure consistency in recording data useful for recovery, training should be provided to qualified herpetologists on a yearly basis. This effort could be coordinated by the U.S. Fish and Wildlife Service, the Western Section of The Wildlife Society, and California Department of Fish and Game.

6.1.3 Develop survey protocol for the Berkeley kangaroo rat (Priority 3).

Habitat assessment for Berkeley kangaroo rat can be included in both botanical and Alameda whipsnake surveys. Habitat assessment should include burrow assessment and scat collection for further identification. Because individuals conducting the habitat assessment will likely not be mammalogists, information on habitat, burrow size, and other identifying factors should be developed. If habitat assessment indicates potential presence, then appropriate trapping should be done by a qualified mammalogist.

6.2 Conduct surveys.

Specific locations that need to be surveyed for one or more species covered in the recovery plan are given in Table 7. To increase efficiency and reduce costs, integrated programs involving several species in the same geographic area should be implemented where possible.

7. Conduct necessary biological research and use results to guide recovery/conservation efforts.

Although knowledge of all life history aspects is useful in recovery, time and monetary constraints require prioritizing research. Because immediate management action is needed to address declining habitat health, research should first focus on life history aspects most likely to be affected by, or to affect the success/failure of, the immediate management actions.

Specific life history aspects and/or habitat requirements of the covered species need further study. Studies on the reproductive biology and limiting life stages for the covered plant species are needed. Many aspects of Alameda whipsnake life history and/or habitat requirements are still unknown, including whether Alameda whipsnake biology differs from the chaparral subspecies. For successful recovery, these questions will need to be answered with long-term efforts.

Table 7. Survey needs of historical and potential habitat by geographic area. See Figures 1, 8, 11, and 15 - 19 for locations of specific geographic areas.

Task	Location	Listed Taxa and Taxa of Concern	Comments	Priority
	ALAMEDA COUNTY			
6.2.1	Within units as determined from mapping and assessment task	*Arctostaphylos pallida* *Eriogonum truncatum* Berkeley kangaroo rat	Recovery task 3.1.1-3.1.3 Areas for potential reintroduction on public lands for *Arctostaphylos pallida* Habitat assessment	2
6.2.2	Within units as determined from mapping and assessment task	Alameda whipsnake Berkeley kangaroo rat	Recovery tasks 3.1.1-3.1.3 for determining 2 additional population centers and site-specific connectivity for Unit 1; additional population center for Unit 2 and site-specific connectivity with Unit 3; site-specific connectivity within Unit 3 and between Unit 3 and Unit 7 Habitat assessment	1
6.2.3	Exeter chaparral	*Arctostaphylos pallida*	Check to see if developed and the extent of habitat	2
6.2.4	Adjacent to Huckleberry Preserve	*Arctostaphylos pallida*	Check to see if developed for expansion of Huckleberry Preserve or as buffer	2
6.2.5	South of San Joaquin Miller Park	*Arctostaphylos pallida*	Presence and extent on Redwood Regional Park Lands	2

Task	Location	Listed Taxa and Taxa of Concern	Comments	Priority
6.2.6	Near San Leandro Reservoir	*Arctostaphylos pallida*	Presence and extent on East Bay Municipal Park Lands	2
6.2.7	Anthony Chabot Park	*Arctostaphylos pallida*	Presence and extent	2
6.2.8	Brushy Peak	Alameda whipsnake	Presence and extent of isolation	3
6.2.9	West of Dublin	Alameda whipsnake	Presence to determine connectivity potential between Unit 2 and Unit 3	1
6.2.10	Regional Park Properties	Alameda whipsnake	Confirm presence of population center at Las Trampas and Sunol; presence at Mission/Ohlone complex; assess corridor potential between Units 2 and 3 at Cull Canyon, Anthony Chabot and Lake Chabot; connectivity within Unit 3 at Pleasanton Ridge and 5 Canyons; site-specific connectivity with Unit 7 at Garin/Dry Creek, Geldeman, and Pleasanton Ridge; assess connectivity within Unit 7 at Vargas Plateau.	2
6.2.11	Bailey Ranch Area	Alameda whipsnake	Confirm population center; effects of urban edge and success of mitigation	1

Task	Location	Listed Taxa and Taxa of Concern	Comments	Priority
6.2.12	Hills east of Union City	Alameda whipsnake	Connectivity potential with Unit 7	1
6.2.13	Sunol Ridge	Alameda whipsnake	Presence and connectivity potential between Walpert Ridge and Pleasanton Ridge	1
6.2.14	Palomares Canyon	Alameda whipsnake	Presence and connectivity potential between Walpert Ridge and Pleasanton Ridge	1
6.2.15	Alameda Watershed	Alameda whipsnake Berkeley kangaroo rat	Site-specific connectivity between Unit 7 and anticipated population at Sunol Regional Park: presence and comparison with *M. l. lateralis* Presence and comparison with *D. h. tularensis*	2
6.2.16	Caldecott Tunnel Area	Alameda whipsnake Berkeley kangaroo rat	Presence and site-specific connectivity and protection potential between Units 1 and 2 Presence; no confusion with *D. h. tularensis* in this area	1
6.2.17	Vargas Plateau	Alameda whipsnake	Presence and connectivity potential with Unit 3	1
6.2.18	Alameda Creek	Alameda whipsnake	Presence and enhancement to improve connectivity between Units 3 and 5	1

Task	Location	Listed Taxa and Taxa of Concern	Comments	Priority
6.2.19	Niles Canyon	Alameda whipsnake	Presence and find solution to barriers and site-specific connectivity between Units 3 and 5	1
6.2.20	Berkeley Hills	Berkeley kangaroo rat	Presence	3
6.2.21	Corral Hollow	*Eriogonum truncatum* Berkeley kangaroo rat	Presence and extent Presence and comparison with *D. h. tularensis*	2
6.2.22	Corral Hollow	Alameda whipsnake Berkeley kangaroo rat	Presence and comparison with *M. l. lateralis* Presence and comparison with *D. h. tularensis*	2
6.2.23	Calaveras Reservoir and Watershed	Alameda whipsnake Berkeley kangaroo rat	Presence and comparison with *M. l. lateralis* Presence and comparison with *D. h. tularensis*	2
	CONTRA COSTA COUNTY			
6.2.24	Within units as determined from mapping and assessment task	*Arctostaphylos pallida* *Eriogonum truncatum* Berkeley kangaroo rat	Recovery tasks 3.1.1-3.1.3 Areas for potential reintroduction on public lands for *Arctostaphylos pallida*	2
6.2.25	Within units as determined from mapping and assessment task	Alameda whipsnake Berkeley kangaroo rat	Recovery task 3.1.1-3.1.3. Additional population in Unit 2	2
6.2.26	North of Briones	*Arctostaphylos pallida*	Presence and areas for potential reintroduction on public lands	2

Task	Location	Listed Taxa and Taxa of Concern	Comments	Priority
6.2.27	East of Wildcat Creek	*Arctostaphylos pallida*	Presence and areas for potential reintroduction on public lands	2
6.2.28	Mount Diablo	*Eriogonum truncatum* *Arctostaphylos manzanita* ssp. *laevigata* *Cordylanthus nidularius* Berkeley kangaroo rat	Presence and extent of occupied habitat on serpentine to determine if additional occurrences Habitat assessment	2
6.2.29	Mount Diablo	Alameda whipsnake Berkeley kangaroo rat	3 additional population centers Habitat assessment	2
6.2.30	Los Vaqueros	Alameda whipsnake	Monitor effect of reservoir and proposed expansion	3
6.2.31	Lime Ridge	*Arctostaphylos manzanita* ssp. *laevigata* Alameda whipsnake	Presence Presence and effect of urban edge	2
6.2.32	Gateway	Alameda whipsnake	Presence and connectivity potential with Unit 1	2
6.2.33	Huckleberry Preserve	Alameda whipsnake	Presence and site-specific connectivity	2
6.2.34	Lafayette Reservoir	Alameda whipsnake	Persistence in isolated areas	2
6.2..35	Antioch	*Eriogonum truncatum*	Presence and extent of occupied habitat	3
6.2.36	South of Byron Hot Springs	*Eriogonum truncatum*	Presence and extent of occupied habitat	2
6.2.37	Flicker Ridge	*Arctostaphylos pallida*	Presence and extent of occupied habitat	2
6.2.38	San Pablo Reservoir	Berkeley kangaroo rat	Presence	3
6.2.39	Eureka Peak	Berkeley kangaroo rat	Presence	3

Task	Location	Listed Taxa and Taxa of Concern	Comments	Priority
	SAN JOAQUIN COUNTY			
6.2.40	Corral Hollow including Site 300, Carnegie Off-road Vehicle Recreation Park	Alameda whipsnake Berkeley kangaroo rat *Amsinckia grandiflora* *Eriogonum truncatum*	Presence and comparison with *M. l. lateralis* Presence and comparison to *D. h. tularensis* Presence and extent of occupied habitat	2
	SANTA CLARA COUNTY			
6.2.41	East of Calaveras Watershed to Stanislaus County line, south to Mt. Hamilton	Alameda whipsnake Berkeley kangaroo rat	Presence and comparison with *M. l. lateralis* Presence and comparison to *D. h. tularensis*	2
6.2.42	Calaveras Reservoir and Watershed	Berkeley kangaroo rat Alameda whipsnake	Presence and comparison to *D. h. tularensis* Presence and comparison with *M. l. lateralis*	2
	SOLANO COUNTY			
6.2.43	Suisun	*Eriogonum truncatum*	Presence and extent of occupied habitat	3

However, information at hand indicates that the chaparral and scrub communities in much of the Alameda whipsnake's range is in a decadent state and may be negatively affecting the whipsnake's current status. If the Alameda whipsnake is to be recovered, then the condition of these communities must be attended to immediately. With this in mind, recovery goals will proceed along two equally important paths, with the knowledge gained from one redirecting the path of the other. Thus, both long-term and immediate research needs are identified.

The most urgent research needs for both *Arctostaphylos pallida* and Alameda whipsnake that are directly related to immediate active management needs are the study of the effects, both direct and indirect, of prescribed burns and other vegetation management actions. This research is expected to be the cornerstone of any future approved management actions. It is essential that all affected landowners/managers participate to some degree in this research project. The results of this research project will determine, along with other life history research completed within this time period, the direction of recovery actions and consultation under sections 7 and 10 of the Endangered Species Act as it relates to fire, other disturbance regimes, and land use. A principal investigator should be appointed and funded to oversee this cooperative research program. To facilitate the coordination required to accomplish this urgent research/management need, it is recommended that a Memorandum of Understanding be prepared that details the role of participants such as coordinating permitting actions and commitments of financial resources and staff.

As information from the research becomes available, both long term and immediate active management actions will be adapted to reflect needed changes (adaptive management). If it is determined at any time during this recovery process that, due to lack of life history and/or status information, the recovery of *Arctostaphylos pallida* or Alameda whipsnake is being compromised by taking these immediate active management steps, active management will be curtailed as appropriate. For instance, studying the effects of fire on the individual snakes inhabiting the burn area would be considered essential to the immediate management actions that are anticipated to take place. If a prescribed fire results in a high percentage of

Alameda whipsnake mortality, as identified from radio-telemetry research, the burns would be put on hold until data could be analyzed and recommendations to decrease mortality incorporated. Studying the long-term effect of fire on recruitment, longevity, etc., although equally important, could take place concurrently or after the direct impact of fire on individual whipsnakes has been assessed. Threatened species cannot withstand high levels of mortality without putting them at risk of becoming endangered. Therefore, balance and prioritization are essential to recovery.

Life history and habitat requirement research needs for the recovery of *Arctostaphylos pallida* and Alameda whipsnake and the conservation of *Cordylanthus nidularius* and *Arctostaphylos manzanita* ssp. *laevigata* are listed in Table 8.

8. Prepare management plans and implement appropriate management in areas inhabited by special status species.

8.1 Prepare and implement management plans.

Management plans should be developed for areas and species identified in Table 9. If existing land use management documents or species management plans exist, they could be used and modified to incorporate the tasks within this recovery plan. Management plans should include strategies to minimize threats to special status species, as well as to identify new threats should they appear. Management plans should also include specific resource and habitat objectives and monitoring (Task 8.2). If new threats are identified or other new information becomes available, management plans need to be re-evaluated and revised. Additionally, management plans should include an operations and maintenance schedule for the completion of ongoing routine tasks and one-time tasks.

Paramount to the recovery or conservation of the special status species is the implementation of active management. Any management plan that is developed should be implemented.

Table 8. Life history and habitat requirement research needs for the covered species. Additional information is provided in individual species accounts (Chapter II).

Task Number	Task Description	Priority
7.1.	Determine how best to re-establish the historical disturbance regime, or biologically acceptable alternatives (species specific information will gained through implementation of recovery tasks below).	1
7.2	Research seed germination treatments for *Arctostaphylos pallida* including various scarification treatments and heat/moisture tests to determine potential effect of burning of vegetation while the soil is damp.	1
7.3	Perform prescribed burns for *Arctostaphylos pallida* under experimental conditions. Include establishment of permanent monitoring plots with an estimation of the pre-burn vegetation cover, pre- and post seed bank sampling, estimates of soil heating, post-fire seedling recruitment, and post-burn vegetation composition.	1
7.4	Determine reproductive biology of *Arctostaphylos pallida* including analysis of pollinators, determination of whether plants are self-fertilizing, fruit set, seed set, number of mature fruits reaching the soil, and the effect of predation on fruit survival.	2
7.5	Perform demographic studies determining limiting life stages for *Arctostaphylos pallida*.	2
7.6	Conduct research into all pathogens of *Arctostaphylos pallida*, including ways to prevent their spread. Provide management recommendations and other techniques for preventing the spread of the fungal disease and any other pathogen that may be affecting *Arctostaphylos pallida*.	1

Task Number	Task Description	Priority
7.7	If necessary, develop propagation techniques for *Arctostaphylos pallida*.	2
7.8	Perform genetics studies on *Arctostaphylos pallida.* Determine whether significant genetic differentiation occurs within or between *Arctostaphylos pallida* populations or colonies, and assess patterns of genetic diversity. Use the results to guide decisions about seed/plant sources for satellite reserves.	2
7.9	Determine the direct and indirect effects of prescribed burns on the Alameda whipsnake and co-occurring species by implementing a 5-year research project at a minimum of 3 locations.	1
7.10	Determine the direct and indirect effects of fuel reduction methods other than prescribed burns on the Alameda whipsnake; hand clearing, goat grazing, herbicide use, etc.	1
7.11	Determine minimum patch size for subpopulations for Alameda whipsnake.	1
7.12	Determine successional stage of chaparral, scrub, grassland, or other communities preferred including what range of human-caused disturbance (*e.g.* grazing) can be tolerated by the Alameda whipsnake and if there are any differences in tolerance during life history stages (*e.g.* juveniles versus gravid female).	2
7.13	Determine level of use and importance of nonchaparral/scrub communities for Alameda whipsnake.	2
7.14	Determine the relative importance of habitat features, such as rock outcrops for Alameda whipsnake.	1

Task Number	Task Description	Priority
7.15	Determine the amount of dispersion, including dispersion success, into created, restored, or modified habitat, including north facing slopes for Alameda whipsnake.	2
7.16	Determine successful creation/restoration of scrub/chaparral habitat for Alameda whipsnake with emphasis on connectivity areas or corridors.	2
7.17	Determine refugia, sunning locations, foraging areas, and egg-laying location preferences for Alameda whipsnake.	1
7.18	Determine age class of first breeding, fecundity rates per age class, clutch size, and mortality rates and causes per stage and age class (eggs, young, and adults) for Alameda whipsnake.	2
7.19	Determine demographic information of selected subpopulations, such as birth and death rates for Alameda whipsnake.	2
7.20	Determine the ability of the Alameda whipsnake to vary diet with changes in environmental conditions affecting prey species (*e.g.*, drought).	3
7.21	Determine relocation/reintroduction techniques and gauge success, including conducting behavioral studies necessary for successful relocation/reintroduction for Alameda whipsnake.	2
7.22	Investigate other, as yet unidentified, threats such as parasites or pathogens for Alameda whipsnake.	3
7.23	Determine the genetic relationship among and between the five populations of the Alameda whipsnake.	2
7.24	Determine the role of the intercross, intercross progeny, and the chaparral whipsnake in the recovery of the Alameda whipsnake, including behavioral/habitat preference, morphological, and/or genetic studies.	2

Task Number	Task Description	Priority
7.25	Study basic pollination biology of *Arctostaphylos manzanita* var. *laevigata.*	2
7.26	Research seed germination treatments for *Arctostaphylos manzanita* ssp. *laevigata* including various scarification treatments and heat/moisture tests to determine potential effect to seed germination of burning of vegetation while the soil is damp.	2
7.27	Perform demographic studies determining limiting life stages for *Arctostaphylos manzanita* ssp. *laevigata.*	2
7.28	Identify *Arctostaphylos manzanita* occurring at Mt. St. Helena and Vaca Mountains.	3
7.29	Identify host plant for *Cordylanthus nidularius*.	2
7.30	Study basic pollination biology of *Cordylanthus nidularius.*	2
7.31	Research seed germination treatments for *Cordylanthus nidularius* including various scarification treatments and heat/moisture tests to determine potential effects of burning of vegetation while the soil is damp.	2
7.32	Research role of natural disturbance regimes on both *Cordylanthus nidularius* and its host plant.	2
7.33	Study effects of fire on *Cordylanthus nidularius* and its host plant.	2
7.34	Perform demographic studies determining limiting life stages for *Cordylanthus nidularius.*	2
7.35	Develop propagation techniques for *Cordylanthus nidularius.*	2
7.36	Perform genetics studies on *Cordylanthus nidularius* in order to establish refugia populations.	2

Table 9. Areas where management plans need to be developed and implemented.

Task	Action	Area	Species	Comments	Priority
8.1.1	Develop	Huckleberry Ridge	*Arctostaphylos pallida* Alameda whipsnake	All East Bay Regional Park lands in area including: Tilden Park, Huckleberry Botanic area, Roberts Park, Sibley Volcanic area, and any area determined to be a reintroduction area for *Arctostaphylos pallida*	1
8.1.2	Implement	Huckleberry Ridge	*Arctostaphylos pallida* Alameda whipsnake	All East Bay Regional Park lands in area including: Tilden Park, Huckleberry Botanic area, Roberts Park, Shelby Volcanic area, and any area determined to be a reintroduction area for *Arctostaphylos pallida*	1
8.1.3	Develop	Huckleberry Ridge	*Arctostaphylos pallida* Alameda whipsnake	All East Bay Municipal Utility District land including any area determined to be a reintroduction area for *Arctostaphylos pallida*	2

Task	Action	Area	Species	Comments	Priority
8.1.4	Implement	Huckleberry Ridge	*Arctostaphylos pallida* Alameda whipsnake	All East Bay Municipal Utility District land including any area determined to be a reintroduction area	2
8.1.5	Develop	Huckleberry Ridge	*Arctostaphylos pallida* Alameda whipsnake *and other species from other plans	Joaquin Miller Park	2
8.1.6	Implement	Huckleberry Ridge	*Arctostaphylos pallida* Alameda whipsnake	Joaquin Miller Park	2
8.1.7	Develop	Sobrante Ridge	*Arctostaphylos pallida* Alameda whipsnake		2
8.1.8	Implement	Sobrante Ridge	*Arctostaphylos pallida* Alameda whipsnake		2
8.1.9	Develop	Recovery Units 1-7	Alameda whipsnake	East Bay Regional Park District lands that are identified as Alameda whipsnake population centers, connectivity areas or corridors	2
8.1.10	Implement	Recovery Units 1-7	Alameda whipsnake	East Bay Regional Park District lands that are identified as Alameda whipsnake population centers, connectivity areas or corridors	2

Task	Action	Area	Species	Comments	Priority
8.1.11	Develop	Recovery Units 1-7	Alameda whipsnake	East Bay Municipal Utility District lands that are identified as Alameda whipsnake population centers, connectivity areas or corridors	2
8.1.12	Implement	Recovery Units 1-7	Alameda whipsnake	East Bay Municipal Utility District lands that are identified as Alameda whipsnake population centers, connectivity areas or corridors	2
8.1.13	Develop	Recovery Units 1-7	Alameda whipsnake	City of Berkeley lands that are identified as Alameda whipsnake population centers, connectivity areas or corridors	2
8.1.14	Implement	Recovery Units 1-7	Alameda whipsnake	City of Berkeley lands that are identified as Alameda whipsnake population centers, connectivity areas or corridors	2
8.1.15	Develop	Recovery Units 1-7	Alameda whipsnake	University of California, Berkeley lands that are identified as Alameda whipsnake population centers, connectivity areas or corridors	2

Task	Action	Area	Species	Comments	Priority
8.1.16	Implement	Recovery Units 1-7	Alameda whipsnake	University of California, Berkeley lands that are identified as Alameda whipsnake population centers, connectivity areas or corridors	2
8.1.17	Develop	Recovery Units 1-7	Alameda whipsnake	National Laboratories lands that are identified as Alameda whipsnake population centers, connectivity areas or corridors	2
8.1.18	Implement	Recovery Units 1-7	Alameda whipsnake	National Laboratories lands that are identified as Alameda whipsnake population centers, connectivity areas or corridors	2
8.1.19	Develop	Recovery Units 1-7	Alameda whipsnake	San Francisco Public Utility lands that are identified as Alameda whipsnake population centers, connectivity areas or corridors	2
8.1.20	Implement	Recovery Units 1-7	Alameda whipsnake	San Francisco Public Utility lands that are identified as Alameda whipsnake population centers, connectivity areas or corridors	2

Task	Action	Area	Species	Comments	Priority
8.1.21	Develop	Recovery Units 1-7	Alameda whipsnake	Contra Costa Water District lands that are identified as Alameda whipsnake population centers, connectivity areas or corridors	2
8.1.22	Implement	Recovery Units 1-7	Alameda whipsnake	Contra Costa Water District lands that are identified as Alameda whipsnake population centers, connectivity areas or corridors	2
8.1.23	Develop	Recovery Units 1-7	Alameda whipsnake *Arctostaphylos manzanita* ssp. *laevigata*, *Cordylanthus nidularius*	California Department of Parks and Recreation lands that are identified as Alameda whipsnake population centers or corridors, connectivity areas	2
8.1.24	Implement	Recovery Units 1-7	Alameda whipsnake *Arctostaphylos manzanita* ssp. *laevigata*, *Cordylanthus nidularius*	California Department of Parks and Recreation lands that are identified as Alameda whipsnake population centers, connectivity areas or corridors	2
8.1.25	Develop	Recovery Unit 4	Alameda whipsnake *Arctostaphylos manzanita* ssp. laevigata, *Cordylanthus nidularius*	Save Mount Diablo lands that are identified as Alameda whipsnake population centers, connectivity areas or corridors	2

Task	Action	Area	Species	Comments	Priority
8.1.26	Implement	Recovery Unit 4	Alameda whipsnake *Arctostaphylos manzanita* ssp. *laevigata*, *Cordylanthus nidularius*	Save Mount Diablo lands that are identified as Alameda whipsnake population centers, connectivity areas or corridors	2
8.1.27	Develop	Recovery Unit 4	Alameda whipsnake	City of Walnut Creek lands that are identified as Alameda whipsnake population centers, connectivity areas or corridors	2
8.1.28	Implement	Recovery Units 1-7	Alameda whipsnake	City of Walnut Creek lands that are identified as Alameda whipsnake population centers, connectivity areas or corridors	2
8.1.29	Develop	Recovery Units 1-7	Alameda whipsnake	Bureau of Land Management lands that are identified as Alameda whipsnake population centers, connectivity areas or corridors	3
8.1.30	Implement	Recovery Units 1-7	Alameda whipsnake	Bureau of Land Management lands that are identified as Alameda whipsnake population centers, connectivity areas or corridors	3

Management activities should be evaluated periodically, and adjusted as indicated to maximize the potential for survival, conservation, and recovery of listed species and other species of concern. This process of evaluating and adjusting management as needed is termed "adaptive management". Results of new biological research (see Task 7) should also be considered in adaptive management schemes.

8.2 Develop and incorporate into the management plans appropriate monitoring for each of the special status species and habitat.

Continue population monitoring where currently underway and begin, wherever possible, for all specified populations regardless of whether management plans have been developed or formal protection has been secured.

Monitoring is needed to determine population trends, to determine if and when additional management actions should be performed, and to determine the efficacy of management actions.

8.2.1 Establish monitoring protocols for the species covered in this recovery plan (Priority 2).

Develop monitoring protocols to evaluate the success of management activities and to determine trends of the special status species populations. Standardized protocols are needed to ensure consistency of monitoring performed between people and over time. Monitoring for co-occurring species should be coordinated to increase efficiency and reduce costs.

8.2.2 Monitor all populations of *Arctostaphylos pallida* (Priority 2).

Incorporate standardized monitoring of *Arctostaphylos pallida* into management plans (see Tasks 8.1.1 to 8.1.8). Promptly monitor all known populations on East Bay Regional Park lands, East Bay Municipal Utility District lands, and City of Oakland land to establish baseline information for gauging the success of proposed management strategies. Baseline monitoring to determine current extent of population (canopy cover by age classes) should be conducted. Additionally, monitoring the effects of fire should be conducted annually for the first 5 years following a fire or disturbance and then every 5 years to determine demographic trends until recovery criteria (Table 4) are met. As part of monitoring of age classes after a fire, factor analysis should be performed regarding survivorship of each life stage. After the recovery criteria are met, results will be evaluated to determine the frequency and intensity of further monitoring fire.

Other monitoring needs include monitoring problem areas for invasive nonnative plants, as well as to determine if there is a reoccurrence of any fungal outbreak. Monitoring for evidence of diseased *Arctostaphylos pallida* plants and for competition by invasive nonnative plants needs to occur at least annually. Monitoring of any newly discovered, reintroduced, and introduced populations also needs to be incorporated into the management plans. All monitoring results should be documented.

8.2.3 Choose and monitor representative populations or subpopulations of Alameda whipsnake (Priority 2).

A minimum of one representative population (or subpopulation) within each of the five major Recovery Units should be chosen immediately and a status survey conducted to establish the baseline for gauging success of recovery efforts. Monitoring should commence and determine the success of immediate management actions and long term recovery goals. The monitoring of these populations should continue every year for the first 5 years, and then every third year until species recovery criteria have been met. These populations should include no more than three that are under an active land management treatment, and at least two that will serve as controls.

8.2.4 Monitor *Arctostaphylos manzanita* ssp. *laevigata* and *Cordylanthus nidularius* on Mount Diablo (Priority 2).

Standardized monitoring of *Arctostaphylos manzanita* ssp. *laevigata* and *Cordylanthus nidularius* should be incorporated into a management plan (see Task 8.1.3). Baseline monitoring to determine current extent of the population should be conducted. Monitoring of known populations should begin promptly to establish baseline information for gauging the success of proposed conservation strategies.

8.2.5 Perform long-term ecological monitoring of chaparral/scrub habitat including adjacent grasslands to determine age mosaic and extent of fragmentation (Priority 1).

Long-term ecological monitoring is used to describe the measurement of community variables to determine change over the long-term (1.5 to 3 fire cycles). Using information from Task 4.3.2, monitor average patch size of fragments and age classes of vegetation stands to ensure that multi-age class mosaics of self-sustaining chaparral/scrub exist. Mosaic of age classes should be measured every 5 to 10 years.

Other variables to be measured should include, but not be limited to, fuel loads, canopy cover, and biodiversity. The schedule of remeasurement needs to be determined, but it is anticipated that the interval within grassland community will be more frequent than the chaparral/scrub.

This information should be used to determine when additional habitat management should be performed.

9. Augment, reintroduce, and/or introduce species covered in this recovery plan.

Augmenting, reintroduction, or introduction of species covered in this recovery plan may be necessary to achieve the recovery or conservation goals of this recovery plan. Specific sites for augmentation are currently unknown. Information from mapping and assessment study (see Tasks 3.1.1 -3.1.3) should be used to help identify sites.

Our policy requires that an assessment of the potential benefits and risks must be undertaken and reasonable alternatives requiring less intervention objectively evaluated (U.S. Fish and Wildlife Service 2000*c*). Controlled propagation should be conducted in a manner that will to the maximum extent possible, preserve the genetic and ecological distinctness of the listed species and minimize risks to existing wild populations.

9.1 Undertake artificial augmentation, reintroduction, or introduction efforts where necessary for special status plants

Where it is deemed necessary, artificial enhancement, reintroduction or introduction efforts for special status plants should be undertaken. Prior to reintroduction or introduction of special status plants, genetics studies are needed (see Tasks 7.8 and 7.35) to ensure that new populations will not disrupt unique local gene complexes. Plant reintroduction or introduction efforts should be undertaken using collected seeds or plant propagules. Any enhancements, reintroductions, or introduction efforts must follow our policy regarding controlled propagation (U.S. Fish and Wildlife Service 2000*c*).

9.1.1 Collect and store seed for plant taxa covered in the recovery plan.

Because the plants occur in very few locations, collection and banking of seed of the plant taxa in Center for Plant Conservation certified botanic gardens is prudent to guard against extinction from chance catastrophic events. Seed collections for plant taxa should be representative of both population and species level genetic diversity. Collections should follow guidelines that have been published by the Center for Plant Conservation (1991). Plant taxa for which seed banking is necessary are listed in Table 10. Priority 1 is given to taxa known from one or two locations. If *Eriogonum truncatum* is rediscovered, seed banking should occur only if the population(s) are large enough.

Table 10. Plant taxa for which seeds need to be stored.

Task #	Taxa	Priority
9.1.1.1	*Arctostaphylos pallida*	1
9.1.1.2	*Cordylanthus nidularius*	1
9.1.1.3	*Arctostaphylos manzanita* ssp. *laevigata*	2
9.1.1.4	*Eriogonum truncatum*	1

9.1.2 Propagate *Arctostaphylos pallida* within botanical facilities (Priority 2).

Arctostaphylos pallida should be propagated within botanical facilities to use for reintroductions or introductions.

9.1.3 Enhance existing *Arctostaphylos pallida* populations (Priority 2).

Enhance existing *Arctostaphylos pallida* populations at Sobrante Ridge, Huckleberry Preserve, and Joaquin Miller Park. The existing populations need to be enlarged. Sites should be identified where one or more of the following actions are possible: (1) removing surface live and dead material to bare mineral soil, (2) pile burning of debris or spot surface burning, or (3) seeding with *Arctostaphylos pallida* seed that has been mechanically or chemically scarified.

9.1.4 Establish *Arctostaphylos pallida* in satellite reserves.

In areas where appropriate unoccupied habitat exists within either East Bay Regional Park lands or East Bay Municipal

Utility District land, establish founder populations of *Arctostaphylos pallida*. Appropriate unoccupied habitat for founder populations consists of large areas of habitat with Millsholm loam soils, chaparral community, and within the fog zone. Manage vegetation so *Arctostaphylos pallida* spontaneously regenerates and colonizes.

9.1.4.1 Initiate reintroduction or introductions where appropriate for *Arctostaphylos pallida* (Priority 2).

Potential areas for reintroduction or introductions should include areas on siliceous cherts, Tice shales, Rodeo shale, and Hambre shale. Surveys of appropriate chaparral habitat should refine suitable sites for reintroductions or introductions. Ideally, areas chosen for reintroduction or introductions should be buffered by a minimum of 460 meters (1,500 feet) to allow for expansion and to allow for use of fire as a management tool.

As mentioned previously in Task 6, suitability of historical locations for reintroduction would depend upon: (1) whether potential habitat exists, (2) the presence and magnitude of threats, and (3) whether the sites can be secured and managed for the long-term protection of the species.

Sites chosen for reintroduction or introductions should be protected in perpetuity by fee title or conservation easements. Sites should be prepared by removing nonnative vegetation and invasive native vegetation that could compete with *Arctostaphylos pallida* seedlings.

9.1.4.2 Transplant *Arctostaphylos pallida* (Priority 2).

The source of transplants should be from cuttings or seed. During first growing season perform weekly monitoring of *Arctostaphylos pallida* transplants. Provide supplemental watering, mycorrhizal inoculation, and low-level application of nutrients for the first growing season.

9.1.4.3 Monitor augmented sites (Priority 2).

After establishment, monitor growth and survivorship of transplanted *Arctostaphylos pallida* at least four times annually. Shift to minimum annual monitoring after the fifth growing season. Monitor associated vegetation to determine competition from nonnative plants. Provide adaptive levels of vegetation management in response to invasive nonnative plants.

9.1.5 Establish refugia populations of *Cordylanthus nidularius*.

To minimize the effects of naturally occurring events such as competition, seed predation, and catastrophic events such as landslides, refugia populations should be established. In areas where appropriate unoccupied habitat exists within Mt. Diablo State Park lands, establish founder populations of *Cordylanthus nidularius*. Appropriate unoccupied habitat consists of areas of habitat with serpentine soils and chaparral community. Manage vegetation so *Cordylanthus nidularius* spontaneously regenerates and colonizes.

9.1.5.1 Initiate introductions where appropriate for *Cordylanthus nidularius* (Priority 2).

Surveys of appropriate serpentine habitat on Mt. Diablo habitat should identify suitable sites for introduction.

As mentioned previously in Task 6, suitability of sites for reintroduction or introduction would depend upon (1) whether potential habitat exists, (2) the presence and magnitude of threats, and (3) whether the sites can be secured and managed for the long-term protection of the species. Additionally, suitable sites for introduction of *Cordylanthus nidularius* would also need to have the host plant present.

9.1.5.2 Propagate and transplant *Cordylanthus nidularius* (Priority 2).

The source of transplants should be from seed. Monitor *Cordylanthus nidularius* transplants twice a week during the first summer to ensure seedling survival.

9.1.5.3 Monitor introduction sites (Priority 2).

After establishment, monitor growth and survivorship of transplanted *Cordylanthus nidularius* annually for 3 years. Monitor associated vegetation at least twice during the growing season for continued presence of the host plant and to determine competition from nonnative plants. Provide adaptive levels of vegetation management in response to invasive nonnative plants.

9.2 Augment Alameda whipsnake populations.

To ensure recovery of the Alameda whipsnake, populations should be maintained and increased. Habitat restoration can increase areas available for expansion and increase success of connectivity. Removal of threats and the implementation of land-use management plans may allow for improved carrying capacity. As this area will continue to lose habitat, augmentation is essential for recovery of the Alameda whipsnake.

9.2.1 Restore habitat for Alameda whipsnake.

Habitat should be restored particularly where successful occupancy is anticipated or needed to protect the integrity of a subpopulation and/or where connectivity needs are identified. Restoration includes, but is not limited to, the return of fire as a natural disturbance regime, removal of nonnatives or vegetation that overtops chaparral/scrub, and providing rock outcrops or other forms of retreat or hibernacula. Priorities would include the Caldecott Tunnel Corridor (Recovery Unit 6), the Niles Canyon-Sunol Corridor (Recovery Unit 7), and other areas as determined or refined during status surveys and mapping and assessment tasks.

9.2.1.1 Restore habitat in Tilden-Briones (Recovery Unit 1) (Priority 2).

Conduct selected restoration in areas of catastrophic firestorm and areas invaded by nonnatives. Priority should be given to providing for connectivity between populations and connecting these populations with the Caldecott Tunnel Corridor (Recovery Unit 6). When appropriate, coordinate restoration efforts with *Arctostaphylos pallida* buffers or preserves.

9.2.1.2 Restore habitat in Oakland-Las Trampas (Recovery Unit 2) (Priority 1).

Conduct selected restoration in areas invaded by nonnatives. Priority should be given to providing for connectivity between populations and connecting these populations with the Caldecott Tunnel Corridor (Recovery Unit 6). When appropriate, coordinate restoration efforts with *Arctostaphylos pallida* buffers or preserves.

9.2.1.3 Restore habitat in Hayward-Pleasanton Ridge (Recovery Unit 3) (Priority 1).

Conduct selected restoration in areas of overtopping of chaparral/scrub and historically over-grazed areas. Priority should be given to providing for connectivity between populations and connecting these populations with Oakland-Las Trampas (Recovery Unit 2) and the Niles Canyon-Sunol Corridor (Recovery Unit 7).

9.2.1.4 Restore habitat in Mt. Diablo-Black Hills (Recovery Unit 4) (Priority 2).

Conduct selected restoration in areas of incompatible land uses, including restoration of habitat on Mt. Zion and Mitchell Canyon as land is reclaimed after mining/quarrying operations. Priority should be given to providing for connectivity between populations and connecting these populations with Black Diamond Mines Regional Preserve and Los Vaqueros Watershed.

9.2.1.5 Restore habitat in Sunol-Cedar Mountain (Recovery Unit 5) (Priority 2).

Conduct selected restoration in areas of incompatible landuses, including restoration of off-road vehicle use, heavily grazed areas, and mining/quarrying operations. Priority should be given to providing for connectivity between populations and connecting these populations with the Niles-Canyon Corridor (Recovery Unit 7).

9.2.1.6 Restore habitat in Caldecott Tunnel Corridor (Recovery Unit 6) (Priority 1).

Conduct selected restoration in areas affected by catastrophic firestorm or invasion by nonnatives, with emphasis on creating a safe corridor of habitat between Recovery Units 1 and 2 (Tilden-Briones and Oakland-Las Trampas, respectively). When appropriate, coordinate restoration efforts with *Arctostaphylos pallida* buffers or preserves.

9.2.1.7 Restore habitat in Niles Canyon-Sunol Corridor (Recovery Unit 7) (Priority 1).

Conduct selected restoration in areas of incompatible landuses, including restoration of Alameda Creek, cultivated areas and mining/quarrying operations. Removal of barriers or providing safe passage is an essential restoration action. Priority should be given to providing for connectivity between Hayward-Pleasanton Ridge (Recovery Unit 3) and Sunol-Cedar Mountain (Recovery Unit 5).

9.2.2 Enhance occupied habitat and adjacent habitat for Alameda whipsnake (Priority 2).

In an effort to increase patch size, not only should occupied habitat be enhanced, but adjacent habitat as well. Minimum patch size and restoration techniques will be determined through research and adaptive management techniques. These techniques can include, but are not limited to prescribed burning, mechanical or chemical manipulation, varying grazing techniques, creation of habitat features such as rock outcrops, and improving prey distribution and abundance.

9.2.3 Determine whether a captive breeding program is warranted. If it is determined that captive breeding is warranted, then the captive breeding program should be developed and implemented, and its role clearly defined.

Controlled propagation (captive breeding) should be supported by an approved genetics management plan. Controlled propagation may be approved to conduct recovery related research, to maintain refugia populations (*e.g.*, keep captive individuals until a threat such as catastrophic fire has passed), and to rescue species or population segments at risk of imminent extinction or extirpation in order to prevent the loss of essential genetic viability.

9.2.3.1 Develop a genetics management plan (Priority 3).

A genetics management plan is appropriate if it works to compensate for a loss of genetic viability in the listed taxa that have been genetically isolated in the wild as a result of human activity. The genetics management plan should be developed by U.S. Fish and Wildlife Service personnel familiar with these plans, with technical expertise from herpetological geneticists and zoological associations.

9.2.3.2 Implement a captive breeding program (Priority 3).

Based on the results of Tasks 9.2.3 and 9.2.3.1, implement the captive breeding program under the guidance of the genetics management plan.

9.2.3.3 Develop reintroduction program in coordination with captive breeding program (Priority 3).

Successful reintroduction programs are the result of knowing life history and behavioral information of the listed species. Both need to be incorporated into a reintroduction program. Locations chosen for reintroduction would be based on results of the genetic work and on identification of priority areas.

10. Develop a tracking process for the completion of recovery tasks and the achievement of delisting criteria (Priority 3).

A tracking process should be developed to track the completion of recovery tasks and progress toward delisting. Utilizing information from specific tasks (4.3.2), the recovery criteria such as the degree of human-caused fragmentation can be tracked. Information from the tracking process can be used in outreach (see Task 2.1.2) and in helping identify when a species can be delisted (see Task 11).

11. Refine delisting criteria.

Information gathered through mapping, surveys, and research (see Tasks 3.1.1 - 3.1.3, 6.2, 7.1) needs to be analyzed to refine delisting criteria.

11.1 Determine if Population Viability Analysis is warranted and whether results should be incorporated into or used to refine recovery criteria (Priority 2).

The results of the Population Viability Analysis may be useful in quantifying recovery criteria for Alameda whipsnake. However, currently adequate life history data are lacking.

11.2 Conduct Population Viability Analyses if warranted (Priority 2).

If it is determined that Population Viability Analysis is warranted (Task 11.1) it should be conducted.

11.3 Refine delisting criteria based on mapping, assessment, analysis and other research tasks (Priority 3).

Based on the results of the mapping, assessment, and analysis (see Tasks 3.1.1 3.1.3); research tasks (Task 7); and potential Population Viability Analyses (see Task 11.2), the delisting criteria may need to be refined.

12. Conduct status reviews of species of concern to determine if listing as endangered or threatened is necessary (Priority 3).

One of the objectives of this recovery plan is to ensure the long-term conservation of species of concern by carrying out tasks specific to the needs of these species. Listing of species of concern covered in this recovery plan may be necessary if tasks specific to the needs of these species are not undertaken within 5 years. Status reviews for *Cordylanthus nidularius* and *Arctostaphylos manzanita* ssp. *laevigata* should be performed. If either *Eriogonum truncatum* or Berkeley kangaroo rat is rediscovered, a status review to determine if listing is necessary should be started immediately following rediscovery.

13. Assess the applicability, value, and success of this recovery plan to the recovery of *Arctostaphylos pallida* and Alameda whipsnake every 5 years until the recovery criteria are achieved (Priority 3)

    Rather than having to revise the entire recovery plan, it is proposed that minor revisions, clarifications, and prioritization changes be made through an addendum. This addendum would address data gaps identified in this version of the recovery plan including areas for specific habitat management, directed surveys, and reintroduction areas; and necessary changes discussed in previous recovery tasks (2, 3, 4, 6, 7, 9 and 10). It would provide a summary of the recovery tasks implemented to date, and it would be a forum to solicit comments from the Implementation Team, stakeholders, and others interested parties on any proposed major changes. Major changes, elimination, or addition of recovery tasks may initiate a revision.

V. IMPLEMENTATION SCHEDULE

The implementation schedule that follows outlines actions and estimated costs for this recovery plan. It is a guide for meeting the objectives discussed in Chapter III of this recovery plan. This schedule describes and prioritizes tasks, provides an estimated time table for performance of tasks, indicates the responsible agencies, and estimates costs of performing tasks. These actions, when accomplished, should further the recovery and conservation of the covered species.

<u>Key to Terms and Acronyms used in the Implementation Schedule</u>

Definition of task priorities:

Priority 1 An action that must be taken to prevent extinction or prevent the species from declining irreversibly in the foreseeable future.

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

Priority 3 All other actions necessary to meet recovery or conservation objectives.

Definition of task durations:

Continual A task that will be implemented on a routine basis once begun.

Ongoing A task that is currently being implemented and will continue until action is no longer necessary.

Unknown Either task duration or associated costs are not known at this time.

Total costs:

TBD	To be determined

Responsible parties:

ACBWG	Alameda and Contra Costa Biodiversity Working Group
Berkeley	City of Berkeley
BOR	Bureau of Reclamation
BLM	Bureau of Land Management
BRD	Biological Resources Division of the U.S. Geologic Survey
CCWD	Contra Costa Water District
CDF	California Department of Forestry and Fire Protection
CDFG	California Department of Fish and Game
CDPR	California Department of Parks and Recreation
CalEPA	California Department of Pesticide Regulation
Caltrans	California Department of Transportation
CNPS	California Native Plant Society
COUN	County
DOE	U.S. Department of Energy
EBRPD	East Bay Regional Park District
EBMUD	East Bay Municipal Utility District
EPA	U.S. Environmental Protection Agency
FHWA	Federal Highway Administration
Fremont	City of Fremont
Hayward	City of Hayward
HEF	Hills Emergency Forum
LARPD	Livermore Area Recreation and Parks District
LRFJ	Local and Regional Fire Jurisdictions
Pleasanton	City of Pleasanton
RSABG	Rancho Santa Ana Botanical Garden
Shea Homes	Shea Homes (owners of the Pleasanton Conservation Bank)
SFPU	San Francisco Public Utility
SMD	Save Mt. Diablo

Sunol	Town of Sunol
Oakland	City of Oakland
OWN	Private landowners or parties
UCB	University of California, Berkeley
Union City	Union City
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
Walnut Creek	City of Walnut Creek

*	Primary responsible partner: a partner likely to take the lead on, or have an especially large role in, implementing the recovery task.
†	Continued implementation of task expected to be necessary after delisting.
‡	Task expected to be necessary until delisting of the species.

Implementation Schedule for Draft Chaparral and Scrub Community Species East of San Francisco Bay, California Recovery Plan

Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units) Total Costs[2]	FY 1	FY 2	FY 3	FY 4	Comments/Notes
1	2.1.3.1	Provide information to public on fire issues	continual‡	USFWS* CDF*, HEF CDPR, EBRPD EBMUD ,UCB	6	0.15			0.15	Provide information every 3 years until species are recovered
1	2.1.4.1	Provide worker awareness training for *Arctostaphylos pallida*	continual‡	USFWS* EBRPD* Oakland EBMUD	30	0.25	0.25	0.25	0.25	
1	2.4.2	Assist in providing research opportunities and funding	ongoing‡	USFWS* CDFG* BRD CCWD, CDPR DOE, EBRPD EBMUD, SFPU UCB	90	2	2	2	2	Costs reflect grantwriting and administrative support expenses for research. Also see Task 7 for specific research projects; other studies may be developed as well. Additional research needs for *A. pallida*, expected after Alameda whipsnake recovery, cannot be quantified at this time.
1	3.1.1	Inventory and coordinate existing spatial data	1 year	USFWS* CDFG, CCWD CDPR, DOE EBRPD EBMUD* SFPU, CDF BOR, UCB ACBWG	0.5	0.5				

Implementation Schedule for Draft Chaparral and Scrub Community Species East of San Francisco Bay, California Recovery Plan

Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units) Total Costs[2]	FY 1	FY 2	FY 3	FY 4	Comments/Notes
1	3.1.2	Identify data gaps and procure additional data	1 year	USFWS*	5	5				
1	3.1.3	Analyze results from Geographic Information System (GIS) mapping exercise	1 year	USFWS*	2.5	2.5				
1	4.1.1	Implement immediate management actions to return or mimic natural disturbance regimes	5 years	USFWS CDFG EBRPD EBMUD CDPR, UCB CDF CCWD, SFPU Shea Homes BLM , SMD DOE, LRFJ Caltrans	TBD					Cost dependent on mapping assessment Task 3.1.3 All listed landowners equally responsible
1	4.1.2	Incorporate recovery goals and conservation strategies into CDF wildlife protection zones	2 years	USFWS, CDF*	1	0.5	0.5			
1	4.1.3	Develop Memoranda of Understanding	2 years	USFWS* CDFG* EBRPD EBMUD, CDF* CCWD, CDPR SFPU, SMD UCB, Berkeley Oakland, BLM	7	3.5	3.5			Costs reflect expenses of MOU review by multiple agencies, meetings, presentations to management, legal review, etc.

Implementation Schedule for Draft Chaparral and Scrub Community Species East of San Francisco Bay, California Recovery Plan

Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units) Total Costs[2]	FY 1	FY 2	FY 3	FY 4	Comments/Notes
1	4.1.4	Ensure current or future uses of pesticides, herbicides, insecticides, fungicides and rodenticides do not adversely impact ecosystem	4 years	USFWS* CDFG, CalEPA* EBRPD EBMUD CCWD, CDPR SFPU, UCB Berkeley Oakland	8	2	2	2	2	
1	4.2.2	Integrate land use needs and fire management into immediate management actions	5 years	USFWS*, CDF USDA, UCB EBRPD EBMUD, CDF CCWD, CDPR SFPU, SMD UCB, Berkeley DOE, Oakland BLM	TBD					Cost dependent on mapping assessment in Task 3.1.3
1	4.3.1	Coordinate on projects included in regional transportation improvement program	ongoing‡	USFWS* Caltrans COUN FHWA* CDFG	315	7	7	7	7	Costs reflect establishment of an FTE to coordinate ESA consultations for highway/ transportation projects in Bay Area.
1	4.3.2	Coordinate with agencies for tracking of habitat fragmentation	continual‡	USFWS*, BOR COUN	TBD					Cost depends on assessment of needs in Task 3.1.3. Share costs with US Army Corps of Engineers and US Geological Survey

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					Cost Estimate (in $10,000 units)					
Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Total Costs[2]	FY 1	FY 2	FY 3	FY 4	Comments/Notes
1	5.1.1	Determine staffing levels appropriate for plan implementation	1 year	USFWS*, CDFG EBRPD EBMUD	1	1				
1	5.1.2	Fund and hire additional staff	unknown	USFWS EBRPD, CDFG EBMUD	TBD					Cost & task duration dependent on Task 5.1.1
1	5.2.1	Protect populations of *Arctostaphylos pallida* at Huckleberry Ridge area in perpetuity	ongoing†	USFWS* CDFG EBRPD* EBMUD Oakland	TBD					Cost dependent on Tasks 5.1.1, 8.1.1, 8.1.3
1	5.2.2	Protect populations of *Arctostaphylos pallida* at Sobrante Ridge area in perpetuity	ongoing†	USFWS* CDFG EBRPD*	TBD					Cost dependent on Tasks 5.1.1, 8.1.7
1	5.2.3.3	Reduce threat of fungal disease	unknown	USFWS, CDFG EBRPD* Oakland EBMUD*	TBD					Task duration and cost dependent on management recommendations from Task 7.6
1	5.3.1.2	Protect and secure populations of Alameda whipsnake in Recovery Unit 2	continual†	USFWS* CDFG Oakland DOE, EBRPD EBMUD, OWN	TBD					Precise extent and locations need to be determined. High development threat in this Recovery Unit

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Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units) Total Costs[2]	FY 1	FY 2	FY 3	FY 4	Comments/Notes
1	5.3.1.3	Protect and secure populations of Alameda whipsnake in Recovery Unit 3	ongoing[†]	USFWS CDFG EBRPD* Shea Homes OWN Pleasanton Hayward Union City Fremont Sunol	TBD					Precise extent and locations need to be determined. High development threat in this Recovery Unit
1	5.3.1.6	Protect and secure populations of Alameda whipsnake in Recovery Unit 6	continual[†]	USFWS* CDFG Caltrans EBRPD EBMUD, DOE UCB, Berkeley Oakland OWN	TBD					Precise extent and locations need to be determined. High development threat in this Recovery Unit
1	5.3.1.7	Protect and secure populations of Alameda whipsnake in Recovery Unit 7	continual[†]	USFWS CDFG EBRPD* SFPU*, OWN	TBD					Precise extent and locations need to be determined. High development threat in this Recovery Unit
1	5.4.2.**3**	Coordinate to determine best management strategies for *Cordylanthus nidularius* in the event of a wildfire	2 years	USFWS* CDPR, CDF CDFG	2	1	1			
1	6.2.2	Conduct surveys of historical and potential habitat within Recovery Units as determined from tasks 3.1.1 to 3.1.3 in Alameda County for Alameda whipsnake and Berkeley kangaroo rat	3 years	USFWS CDFG	10			3.3	3.3	Other responsible parties and leads will be identified upon completion of tasks 3.1.1 to 3.1.3

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Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units) Total Costs[2]	FY 1	FY 2	FY 3	FY 4	Comments/Notes
1	6.2.9	Conduct surveys of historical and potential habitat west of Dublin (Alameda County) for Alameda whipsnake	3 years	USFWS* CDFG OWN	6			2	2	
1	6.2.11	Conduct surveys of historical and potential habitat at Bailey Ranch area (Alameda County) for Alameda whipsnake	3 years	USFWS* CDFG EBRPD OWN	6			2	2	
1	6.2.12	Conduct surveys of historical and potential habitat in hills east of Union City (Alameda County) for Alameda whipsnake	3 years	USFWS* CDFG OWN	6			2	2	
1	6.2.13	Conduct surveys of historical and potential habitat at Sunol Ridge (Alameda County) for Alameda whipsnake	3 years	USFWS* CDFG OWN	6			2	2	
1	6.2.14	Conduct surveys of historical and potential habitat at Palomares Canyon (Alameda County) for Alameda whipsnake	3 years	USFWS* CDFG OWN	6			2	2	
1	6.2.16	Conduct surveys of historical and potential habitat at Caldecott Tunnel area (Alameda County) for Alameda whipsnake	3 years	USFWS* CDFG EBRPD Caltrans EBMUD	6			2	2	
1	6.2.17	Conduct surveys of historical and potential habitat at Vargas Plateau (Alameda County) for Alameda whipsnake	3 years	USFWS* CDFG EBRPD	6			2	2	
1	6.2.18	Conduct surveys of historical and potential habitat at Alameda Creek (Alameda County) for Alameda whipsnake	3 years	USFWS* CDFG	6			2	2	

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Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units) Total Costs[2]	FY 1	FY 2	FY 3	FY 4	Comments/Notes
1	6.2.19	Conduct surveys of historical and potential habitat at Niles Canyon (Alameda County) for Alameda whipsnake	3 years	USFWS CDFG EBRPD* SFPU* Caltrans	6			2	2	
1	7.1	Determine how to best re-establish historical disturbance regime	10 years	USFWS* CDFG, CDF	15	1.5	1.5	1.5	1.5	Research targeting major threats
1	7.2	Research seed germination treatments for *Arctostaphylos pallida*	2 years	USFWS* CDFG*	3	1.5	1.5			Research targeting major threats
1	7.3	Perform prescribed burns for *Arctostaphylos pallida* under experimental conditions	3 years	USFWS* CDF CDFG * EBRPD* EBMUD	7.5		2.5	2.5	2.5	Research targeting major threats
1	7.6	Conduct research into all pathogens of *Arctostaphylos pallida*, including ways to prevent their spread	3 years	USFWS* CDFG*	7.5	2.5	2.5	2.5		Research targeting major threats
1	7.9	Determine direct and indirect effects of prescribed burns on Alameda whipsnake	5 years	USFWS*, CDF EBRPD EBMUD CDPR, CDFG UCB CCWD, DOE OWN	20	4	4	4	4	Research targeting major threats
1	7.10	Determine direct and indirect effects of fuel reduction methods other than prescribed burns on Alameda whipsnake	5 years	USFWS*, CDF EBRPD EBMUD CDPR, CDFG UCB, LRFJ	20	4	4	4	4	Research targeting major threats

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Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units) Total Costs[2]	FY 1	FY 2	FY 3	FY 4	Comments/Notes
1	7.11	Determine minimum patch size for subpopulations of Alameda whipsnake	5years	USFWS* CDFG	10	2	2	2	2	Can be incorporated into Task 7.9 & 7.10
1	7.14	Determine relative importance of habitat features for Alameda whipsnake	3 years	USFWS* CDFG	6	2	2	2		Can be incorporated into Task 7.9 & 7.10
1	7.17	Determine refugia, sunning locations, foraging areas, and egg-laying location preferences for Alameda whipsnake	5 years	USFWS* CDFG	10	2	2	2	2	Can be incorporated into Task 7.9 & 7.10
1	8.1.1	Develop management plan for all East Bay Regional Park District lands in Huckleberry Ridge area	3 years	USFWS* EBRPD* CDFG	7.5	2.5	2.5	2.5		
1	8.1.2	Implement management plan for all East Bay Regional Park District lands in Huckleberry Ridge area	continual[†]	USFWS EBRPD* CDFG	TBD					Cost dependent on 8.1.1
1	8.2.5	Perform long-term ecological monitoring of chaparral/scrub habitat	continual[‡]	USFWS* EBRPD EBMUD CDFG CDPR DOE SFPU	TBD					Cost depends on scope assessed in Task 3.1.3. Use information from Task 4.3.2
1	9.1.1.1	Collect and store seed for *Arctostaphylos pallida*	4 years	USFWS* CDFG EBRPD* RSABG, UCB	1.2	0.3	0.3	0.3	0.3	
1	9.1.1.2	Collect and store seed for *Cordylanthus nidularius*	2 years	USFWS*, CDFG, CDPR* RSABG UCB	0.6	0.3	0.3			

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Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units) Total Costs[2]	FY 1	FY 2	FY 3	FY 4	Comments/Notes
1	9.1.1.4	Collect and store seed for *Eriogonum truncatum*	unknown	USFWS* CDFG* RSABG, UCB	TBD					If it is rediscovered, seed banking should occur only if the population (s) are large enough
1	9.2.1.2	Restore habitat for Alameda whipsnake within Oakland/Las Trampas (Recovery Unit 2)	continual‡	USFWS CDFG EBMUD* EBRPD* Oakland OWN	TBD					Cost dependent on amount of acreage to be restored which is unknown
1	9.2.1.3	Restore habitat for Alameda whipsnake within Hayward/Pleasanton Ridge (Recovery Unit 3)	continual‡	USFWS, CDFG EBRPD* Shea Homes* OWN	TBD					Cost dependent on amount of acreage to be restored which is unknown
1	9.2.1.6	Restore habitat for Alameda whipsnake within Caldecott Tunnel Corridor (Recovery Unit 6)	continual‡	USFWS, CDFG EBRPD* EBMUD* UCB, DOE OWN, Berkeley Oakland	TBD					Cost dependent on amount of acreage to be restored which is unknown
1	9.2.1.7	Restore habitat for Alameda whipsnake within Niles Canyon/Sunol Corridor (Recovery Unit 7)	continual‡	USFWS, CDFG EBRPD SFPU* COUN*, OWN Caltrans	TBD					Cost dependent on amount of acreage to be restored which is unknown
1	Priority 1 Tasks Subtotal				640.3	65	54.35	68.85	58	

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Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units)					Comments/Notes
					Total Costs[2]	FY 1	FY 2	FY 3	FY 4	
2	1	Form Recovery Implementation Team	1 year	USFWS* CDFG* EBRPD EBMUD CCWD, SFPU Berkeley Oakland, UCB CDF CNPS, COUN DOE Caltrans Shea Homes OWN	2.5	2.5				All stakeholders will be invited to participate
2	2.1.1.1	Provide schools with species and recovery effort information	continual[‡]	USFWS* CDFG	1.55	0.35				$500 to revise every five years
2	2.1.1.2	Create and distribute *Arctostaphylos pallida* pamphlet	1 year	USFWS* CDFG EBRPD*	0.3		0.3			
2	2.1.1.6	Develop and implement information on *Eriogonum truncatum*	1 year	USFWS* CDPR*	0.1		0.1			
2	2.1.1.7	Develop and distribute information on Berkeley kangaroo rat	1 year	USFWS* EBRPD SFPU	0.15		0.15			
2	2.1.3.2	Provide information to the CDF vegetation management program	continual[‡]	USFWS*, CDF CDFG	6	0.05	0.05	0.05	0.05	
2	2.1.4.2	Provide worker awareness training for Alameda whipsnake	continual[‡]	USFWS*, CDF CDFG	11.25	0.25	0.25	0.25	0.25	In association with landowners

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Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units) Total Costs[2]	FY 1	FY 2	FY 3	FY 4	Comments/Notes
2	2.2	Develop and implement economic or other incentives	unknown	USFWS* CDFG, COUN OWN	TBD					Cost and duration depend on nature of incentives developed
2	2.3.1	Work with groups that provide policy makers with policy recommendations	ongoing ‡	USFWS* CDFG*	12	0.1	0.1	0.1	0.1	
2	2.3.2	Encourage and assist development and implementation of Habitat Conservation Plans	ongoing ‡	USFWS* CDFG, COUN* OWN	4.5	0.1	0.1	0.1	0.1	
2	2.3.3	Encourage and assist development and implementation of conservation banks	ongoing ‡	USFWS* CDFG*, COUN OWN	0.5					
2	2.4.1	Make available life history research prioritization list	1 year	USFWS*	0.05		0.05			
2	3.2	Establish and utilize centralized database	continual‡	USFWS* CDFG	TBD					Time for establishment 1 year; to use continual. Availability will be to Implementation Team.
2	3.3	Provide updated information and funding to fire model programs	continual‡	USFWS*, CDF	0.5					
2	4.2.1	Implement management actions which combine and coordinate management tasks from overlapping recovery plans	ongoing‡	USFWS*, CDF USDA, UCB EBRPD EBMUD, CDF CCWD, CDPR SFPU, SMD UCB, Berkeley DOE, Oakland BLM	TBD					Also Responsible Parties from overlapping recovery plans

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Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units) Total Costs[2]	FY 1	FY 2	FY 3	FY 4	Comments/Notes
2	4.2.3	Combine surveys for special status species when appropriate	ongoing‡	USFWS, CDFG CDPR, DOE EBRPD EBMUD, SFPU UCB, CCWD	TBD					Also Responsible Parties from overlapping recovery plans
2	5.2.3.2.1	Reduce competition from both native and nonnative plants	ongoing†	USFWS* CDFG CDPR, DOE EBRPD EBMUD Caltrans FHWA CCWD, SFPU UCB	TBD					Implementation linked to management plans developed under Task 8.1
2	5.2.3.2.2	Reduce threat of hybridization	continual†	USFWS* CDFG EBRPD OWN Oakland	TBD					Implementation linked to management plans developed under Task 8.1
2	5.2.3.4	Reduce threat of herbicide spraying	continual†	USFWS CDFG EBRPD* EBMUD* Oakland*	TBD					Implementation linked to management plans developed under Task 8.1
2	5.3.1.1	Protect and secure populations of Alameda whipsnake in Recovery Unit 1	continual†	USFWS CDFG EBMUD* OWN EBRPD*	TBD					Precise extent and location need to be determined

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					Cost Estimate (in $10,000 units)					
Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Total Costs[2]	FY 1	FY 2	FY 3	FY 4	Comments/Notes
2	5.3.1.4	Protect and secure populations of Alameda whipsnake in Recovery Unit 4	continual[†]	USFWS CDFG CCWD* EBRPD*, SMD Walnut Creek BLM CDPR*, OWN	TBD					Precise extent and location need to be determined
2	5.3.1.5	Protect and secure populations of Alameda whipsnake in Recovery Unit 5	continual[†]	USFWS* CDFG EBRPD SFPU, OWN	TBD					Precise extent and location need to be determined

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Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units) Total Costs[2]	FY 1	FY 2	FY 3	FY 4	Comments/Notes
2	5.3.2.1	Ensure current or future uses of rodenticides, herbicides, pesticides, etc. do not adversely affect Alameda whipsnake	continual†	USFWS* CalEPA* EBRPD EBMUD CCWD, CDPR CDFG, UCB DOE, CCWD Caltrans Berkeley Fremont Hayward LARPD Pleasanton Shea Homes SFPU, SMD Oakland OWN Sunol Union City Walnut Creek BLM	TBD					Ongoing training needed; scope of threats and necessary management to be determined.

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Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units)					Comments/Notes
					Total Costs[2]	FY 1	FY 2	FY 3	FY 4	
2	5.3.2.2.1	Control nonnative plants to reduce threat to Alameda whipsnake	continual†	USFWS EBRPD EBMUD CCWD, CDPR CDFG, UCB DOE, CCWD Caltrans Berkeley Fremont Hayward LARPD Pleasanton Shea Homes SFPU, SMD Oakland OWN Sunol Union City Walnut Creek BLM	TBD					All landowners equally responsible parties. Scope of threats to be assessed via Tasks 3.1.1-3.1.3

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Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units) Total Costs[2]	FY 1	FY 2	FY 3	FY 4	Comments/Notes
2	5.3.2.2.2	Control feral cats and pigs and other nonnative predators	continual[†]	USFWS EBRPD EBMUD CCWD, CDPR CDFG, UCB DOE, CCWD Caltrans Berkeley Fremont Hayward LARPD Pleasanton Shea Homes SFPU, SMD Oakland OWN Sunol Union City Walnut Creek	100					All landowners equally responsible parties. Cost 2.5 annually starting in year 6.

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2	5.3.2.4	Ensure unauthorized collection does not occur	ongoing ‡	USFWS EBRPD EBMUD CCWD, CDPR CDFG, UCB DOE, CCWD Caltrans Berkeley Fremont Hayward LARPD Pleasanton Shea Homes SFPU, SMD Oakland OWN Sunol Union City Walnut Creek	TBD					All landowners are equally responsible parties. Cose of outreach an d enforcement unknown
2	5.3.2.5	Ensure chaparral whipsnake and/or intercross progeny does not threaten Alameda whipsnake	3 years	USFWS* CDFG*	TBD					Cost and timing dependent of Task 7.2.4
2	5.4.1.1.1	Map all current and historic locations of *Arctostaphylos manzanita* ssp. *laevigata*	1 year	USFWS* CDFG, CDPR*	0.2		0.2			
2	5.4.1.1.2	Clarify identity of *Arctostaphylos* specimens found outside eastern Contra Costa County	3 years	USFWS* CDFG*	0.45	0.15	0.15	0.15		
2	5.4.1.1.3	Assess existing and potential threats to *Arctostaphylos manzanita* ssp. *laevigata*	1 year	USFWS* CDFG, CDPR*	1			1		

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2	5.4.1.2	Decrease or eliminate any identified threats to *Arctostaphylos manzanita* ssp. *laevigata*	unknown	USFWS* CDFG, CDPR*	TBD					Cost and duration dependent on task 5.4.1.1.3
2	5.4.1.3	Encourage protection of *Arctostaphylos manzanita* ssp. *laevigata* in private sector	continual	USFWS* CDFG	TBD					Costs dependent on Task 5.4.1.1.3
2	5.4.2.1.1	Map all locations of *Cordylanthus nidularius*	1 year	USFWS* CDFG, CDPR*	0.1	0.1				
2	5.4.2.1.2	Assess existing and potential threats to *Cordylanthus nidularius*	1 year	USFWS* CDFG* CDPR*	1		1			
2	5.4.2.2	Decrease or eliminate any identified threats to *Cordylanthus nidularius*	unknown	USFWS CDFG* CDPR*	TBD					Cost and duration dependent on task 5.5.2.1.2
2	5.4.2.4	Determine protective measures for *Cordylanthus nidularius*	1 year	USFWS* CDFG * CDPR*	1		1			
2	6.1.1	Establish survey program and protocol for covered plant species	2 years	USFWS* CDFG*	4	2	2			
2	6.1.2.1	Develop and implement survey protocols and standard recommendations for Alameda whipsnake	3 years	USFWS* CDFG*	4	2	2			in process
2	6.1.2.2	Provide training on survey guidelines and handling of Alameda whipsnake	continual[‡]	USFWS* CDFG*	2.35		0.2	0.05	0.05	
2	6.2.1	Conduct surveys of historical and potential habitat within units as determined from tasks 3.1.1 to 3.1.3 in Alameda County for *Arctostaphylos pallida*, *Eriogonum truncatum* and Berkeley kangaroo rat	4 years	USFWS* CDFG * EBRPD EBMUD, DOE SFPU, UCB	6			1.5	1.5	
2	6.2.3	Conduct surveys of historical and potential habitat at Exeter chaparral (Alameda County) for *Arctostaphylos pallida*	1 year	USFWS* CDFG* Oakland	0.1			0.1		

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2	6.2.4	Conduct surveys of historical and potential habitat adjacent to Huckleberry preserve (Alameda County) for *Arctostaphylos pallida*	1 year	USFWS CDFG EBMUD*	0.2			0.2		
2	6.2.5	Conduct surveys of potential habitat south of Joaquin Miller Park (Alameda County) for *Arctostaphylos pallida*	2 years	USFWS CDFG EBMUD* EBRPD*	2			1	1	
2	6.2.6	Conduct surveys of potential habitat near San Leandro Reservoir (Alameda County) for *Arctostaphylos pallida*	2 years	USFWS* CDFG EBMUD	2			1	1	
2	6.2.7	Conduct surveys of potential habitat at Anthony Chabot Park (Alameda County) for *Arctostaphylos pallida*	2 years	USFWS* CDFG, EBRPD	3			1.5	1.5	
2	6.2.10	Conduct surveys of historical and potential habitat at Regional Park Properties (Alameda County) for Alameda whipsnake	3 years	USFWS CDFG EBRPD*	8			2.66	2.66	X # of parks
2	6.2.15	Conduct surveys of historical and potential habitat at Alameda Watershed (Alameda County) for Alameda whipsnake and Berkeley kangaroo rat	3 years	USFWS CDFG SFPU*	4			1.33	1.33	
2	6.2.21	Conduct surveys of historical and potential habitat at Corral Hollow (Alameda County) for *Eriogonum truncatum* and Berkeley kangaroo rat	4 years	USFWS* CDFG, CDPR* DOE*, OWN	6			1.5	1.5	
2	6.2.22	Conduct surveys of historical and potential habitat at Corral Hollow (Alameda County) for Alameda whipsnake and Berkeley kangaroo rat	3 years	USFWS* CDFG, CDPR* DOE*, OWN	6			2	2	

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					Cost Estimate (in $10,000 units)					
Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Total Costs[2]	FY 1	FY 2	FY 3	FY 4	Comments/Notes
2	6.2.23	Conduct surveys of historical and potential habitat at Calaveras Reservoir and Watershed (Santa Clara County) for Alameda whipsnake and Berkeley kangaroo rat	3 years	USFWS CDFG, SFPU*	4			1.33	1.33	
2	6.2.24	Conduct surveys of historical and potential habitat within units as determined from tasks 3.1.1 to 3.1.3 in Contra Costa County for *Arctostaphylos pallida*, *Eriogonum truncatum* and Berkeley kangaroo rat	4 years	USFWS* CDFG	6			1.5	1.5	
2	6.2.25	Conduct surveys of historical and potential habitat within units as determined from tasks 3.1.1 to 3.1.3 in Contra Costa County for Alameda whipsnake and Berkeley kangaroo rat	3 years	USFWS CDFG	10			3.33	3.33	Other responsible parties and leads will be identified upon completion of tasks 3.1.1 to 3.1.3
2	6.2.26	Conduct surveys of potential habitat north of Briones (Contra Costa County) for *Arctostaphylos pallida*	2 years	USFWS* CDFG EBMUD EBRPD, OWN	3			1.5	1.5	
2	6.2.27	Conduct surveys of potential habitat east of Wildlcat Creek (Contra Costa County) for *Arctostaphylos pallida*	2 years	USFWS* CDFG	3			1.5	1.5	
2	6.2.28	Conduct surveys of historical and potential habitat on Mount Diablo (Contra Costa County) for *Eriogonum truncatum*, *Arctostaphylos manzanita* ssp. *laevigata*, *Cordylanthus nidularius*, and Berkeley kangaroo rat	4 years	USFWS* CDFG, CDPR BLM, OWN	6			1.5	1.5	

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Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units) Total Costs[2]	FY 1	FY 2	FY 3	FY 4	Comments/Notes
2	6.2.29	Conduct surveys of historical and potential habitat on Mount Diablo (Contra Costa County) for Alameda whipsnake and Berkeley kangaroo rat	3 years	USFWS* CDFG, CDPR* BLM, OWN	6			2	2	
2	6.2.31	Conduct surveys of historical and potential habitat at Lime Ridge (Contra Costa County) for *Arctostaphylos manzanita* ssp. *laevigata* and Alameda whipsnake	3 years	USFWS CDFG Walnut Creek*	4			1.33	1.33	
2	6.2.32	Conduct surveys of historical and potential habitat at Gateway (Contra Costa County) for Alameda whipsnake	3 years	USFWS CDFG, OWN EBMUD*	4			1.33	1.33	
2	6.2.33	Conduct surveys of historical and potential habitat at Huckleberry Preserve (Contra Costa County) for Alameda whipsnake	3 years	USFWS CDFG EBRPD*	2			0.66	0.66	
2	6.2.34	Conduct surveys of historical and potential habitat at Lafayette Reservoir (Contra Costa County) for Alameda whipsnake	ongoing (3 years)	USFWS CDFG EBMUD*	4	1.33	1.33			First of 3 years completed.
2	6.2.36	Conduct surveys of potential habitat south of Byron Hot Springs (Contra Costa County) for *Eriogonum truncatum*	4 years	USFWS* CDFG, OWN	6			1.5	1.5	
2	6.2.37	Conduct surveys of historical and potential habitat at Flicker Ridge (Contra Costa County) for *Arctostaphylos pallida*	2 years	USFWS* CDFG	2			1	1	
2	6.2.40	Conduct surveys of historical and potential habitat at Corral Hollow (San Joaquin County) for Alameda whipsnake, Berkeley kangaroo rat, *Amsinckia grandiflora*, and *Eriogonum truncatum*.	4 years	USFWS CDFG, DOE* CDPR*, OWN	6			1.5	1.5	

Implementation Schedule for Draft Chaparral and Scrub Community Species East of San Francisco Bay, California Recovery Plan

Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units) Total Costs[2]	FY 1	FY 2	FY 3	FY 4	Comments/Notes
2	6.2.41	Conduct surveys of historical and potential habitat East of Calaveras Watershed to Stanislaus County line, south to Mt. Hamilton (Santa Clara County) for Alameda whipsnake and Berkeley kangaroo rat	3 years	USFWS* CDFG* OWN	6			2	2	
2	6.2.42	Conduct surveys of historical and potential habitat at Calaveras Reservoir and Watershed (Santa Clara County) for Alameda whipsnake and Berkeley kangaroo rat	3 years	USFWS CDFG SFPU*	6			2	2	
2	7.4	Determine reproductive biology of *Arctostaphylos pallida*	3 years	USFWS* CDFG, CDFG	4.5	1.5	1.5	1.5		
2	7.5	Perform demographic studies determining limiting life stages for *Arctostaphylos pallida*	5 years	USFWS* CDFG EBRPD	10	2	2	2	2	
2	7.7	Develop propagation techniques for *Arctostaphylos pallida*	3 years	USFWS* CDFG, UCB RSABG	4.5	1.5	1.5	1.5		
2	7.8	Perform genetic studies on *Arctostaphylos pallida*	3 years	USFWS* CDFG*	2.4	0.8	0.8	0.8		
2	7.12	Determine successional stage of chaparral, scrub, grassland, or other communities preferred by Alameda whipsnake	5 years	USFWS* CDFG, CCWD CDPR, DOE EBRPD EBMUD, SFPU UCB	10	2	2	2	2	Can be combined with Task 7.13

Implementation Schedule for Draft Chaparral and Scrub Community Species East of San Francisco Bay, California Recovery Plan

Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units)					Comments/Notes
					Total Costs[2]	FY 1	FY 2	FY 3	FY 4	
2	7.13	Determine level of use and importance of non-chaparral/scrub communities for Alameda whipsnake	5 years	USFWS* CDFG, CCWD CDPR, DOE EBRPD EBMUD, SFPU UCB	10	2	2	2	2	Can be combined with Task 7.12
2	7.15	Determine the amount of dispersion into created, restored, or modified habitat for Alameda whipsnake	5 years	USFWS* CDFG, CCWD CDPR, DOE EBRPD EBMUD, SFPU UCB	10	2	2	2	2	
2	7.16	Determine successful creation/restoration of scrub/chaparral habitat for Alameda whipsnake	10 years	USFWS* CDFG, CCWD CDPR, DOE EBRPD EBMUD, SFPU UCB	10	1	1	1	1	
2	7.18	Determine age class of first breeding, fecundity rates per age class, clutch size, and mortality rates for Alameda whipsnake	5 years	USFWS* CDFG, CCWD CDPR, DOE EBRPD EBMUD, SFPU UCB	20	4	4	4	4	
2	7.19	Determine demographic information of selected sub-populations of Alameda whipsnake	5 years	USFWS* CDFG, CCWD CDPR, DOE EBRPD EBMUD, SFPU UCB	20		4	4	4	

Implementation Schedule for Draft Chaparral and Scrub Community Species East of San Francisco Bay, California Recovery Plan

Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units) Total Costs[2]	FY 1	FY 2	FY 3	FY 4	Comments/Notes
2	7.21	Determine relocation/reintroduction techniques and gauge success of techniques for Alameda whipsnake	5 years	USFWS* CDFG*	10		2	2	2	
2	7.23	Determine the genetic relationship among and between the five Recovery Units for Alameda whipsnake	3 years	USFWS* CDFG	12		4	4	4	
2	7.24	Determine the role of the intercross, intercross progeny, and chaparral whipsnake in the recovery of the Alameda whipsnake	5 years	USFWS* CDFG	20		4	4	4	
2	7.25	Study basic pollination biology of *Arctostaphylos manzanita* ssp. *laevigata*	3 years	USFWS* CDFG*	4.5	1.5	1.5	1.5		
2	7.26	Research seed germination treatments for *Arctostaphylos manzanita* ssp. *laevigata*	3 years	USFWS* CDFG*	4.5	1.5	1.5	1.5		
2	7.27	Perform demographic studies determining limiting life stages for *Arctostaphylos manzanita* ssp. *laevigata*	5 years	USFWS* CDFG, CDPR	10	2	2	2	2	
2	7.29	Identify host plant for *Cordylanthus nidularius*	3 years	USFWS* CDFG*, CDPR	4.5	1.5	1.5	1.5		
2	7.30	Study basic pollination biology of *Cordylanthus nidualarius*	3 years	USFWS* CDFG*, CDPR	4.5	1.5	1.5	1.5		
2	7.31	Research seed germination treatments for *Cordylanthus nidularius*	3 years	USFWS* CDFG*, CDPR	4.5	1.5	1.5	1.5		
2	7.32	Research role of natural disturbance regimes on both *Cordylanthus nidularius* and its host plant	3 years	USFWS* CDFG*, CDPR	4.5	1.5	1.5	1.5		
2	7.33	Study effects of fire on *Cordylanthus nidularius* and its host plant	5 years	USFWS* CDFG*, CDF CDPR	7.5	1.5	1.5	1.5	1.5	

Implementation Schedule for Draft Chaparral and Scrub Community Species East of San Francisco Bay, California Recovery Plan

Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units)					Comments/Notes
					Total Costs[2]	FY 1	FY 2	FY 3	FY 4	
2	7.34	Perform demographic studies determining limiting life stages for *Cordylanthus nidularius*	5 years	USFWS* CDFG*, CDPR	10	2	2	2	2	
2	7.35	Develop propagation techniques for *Cordylanthus nidularius*	3 years	USFWS* CDFG*, CDPR	4.5	1.5	1.5	1.5		
2	7.36	Perform genetic studies on *Cordylanthus nidularius* in order to establish refugia populations	3 years	USFWS* CDFG*, CDPR	0.36	0.12	0.12	0.12		
2	8.1.3	Develop management plan for all East Bay Municipal Utility District lands in Huckleberry Ridge area	3 years	USFWS* EBMUD* CDFG	7.5	2.5	2.5	2.5		
2	8.1.4	Implement management plan for all East Bay Municipal Utility District lands in Huckleberry Ridge area	continual†	USFWS EBMUD* CDFG	TBD					Cost dependent on Task 8.1.3
2	8.1.5	Develop management plan for City of Oakland land at Joaquin Miller Park	3 years	USFWS* Oakland* CDFG	6	2	2	2		
2	8.1.6	Implement management plan for City of Oakland land at Joaquin Miller Park	continual†	USFWS Oakland* CDFG	TBD					Cost dependent on Task 8.1.5
2	8.1.7	Develop management plan for East Bay Regional Park District land at Sobrante Ridge	3 years	USFWS* EBRPD* CDFG	6	2	2	2		
2	8.1.8	Implement management plan for East Bay Regional Park District land at Sobrante Ridge	continual†	USFWS EBRPD* CDFG	TBD					Cost dependent on Task 8.1.7

Implementation Schedule for Draft Chaparral and Scrub Community Species East of San Francisco Bay, California Recovery Plan

Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units) Total Costs[2]	FY 1	FY 2	FY 3	FY 4	Comments/Notes
2	8.1.9	Develop management plan for Alameda whipsnake Recovery Units 1-7 for identified population centers, connectivity areas, or corridors on East Bay Regional Park District lands	3 years	USFWS* EBRPD* CDFG	9	3	3	3		
2	8.1.10	Implement management plan for Alameda whipsnake Recovery Units 1-7 for identified population centers, connectivity areas, or corridors on East Bay Regional Park District lands	continual†	USFWS EBRPD* CDFG	TBD					Cost dependent on Task 8.1.9
2	8.1.11	Develop management plan for Alameda whipsnake Recovery Units 1-7 for identified population centers, connectivity areas, or corridors on East Bay Municipal Utility District lands	3 years	USFWS* EBMUD* CDFG	9	3	3	3		
2	8.1.12	Implement management plan for Alameda whipsnake Recovery Units 1-7 for identified population centers, connectivity areas, or corridors on East Bay Municipal Utility District lands	continual†	USFWS EBMUD* CDFG	TBD					Cost dependent on Task 8.1.11
2	8.1.13	Develop management plan for Alameda whipsnake Recovery Units 1-7 for identified population centers, connectivity areas, or corridors on City of Berkeley lands	3 years	USFWS* Berkeley* CDFG	6	2	2	2		
2	8.1.14	Implement management plan for Alameda whipsnake Recovery Units 1-7 for identified population centers, connectivity areas, or corridors on City of Berkeley lands	continual†	USFWS Berkeley* CDFG	TBD					Cost dependent on Task 8.1.1.13

Implementation Schedule for Draft Chaparral and Scrub Community Species East of San Francisco Bay, California Recovery Plan

Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units)					Comments/Notes
					Total Costs[2]	FY 1	FY 2	FY 3	FY 4	
2	8.1.15	Develop management plan for Alameda whipsnake Recovery Units 1-7 for identified population centers, connectivity areas, or corridors on University of California, Berkeley lands	3 years	USFWS* UCB*, CDFG	6	2	2	2		
2	8.1.16	Implement management plan for Alameda whipsnake Recovery Units 1-7 for identified population centers, connectivity areas, or corridors on University of California, Berkeley lands	continual†	USFWS, UCB* CDFG	TBD					Cost dependent on Task 8.1.1.15
2	8.1.17	Develop management plan for Alameda whipsnake Recovery Units 1-7 for identified population centers, connectivity areas, or corridors on National Laboratories lands	3 years	USFWS* DOE*, CDFG	6	2	2	2		
2	8.1.18	Implement management plan for Alameda whipsnake Recovery Units 1-7 for identified population centers, connectivity areas, or corridors on National Laboratories lands	continual†	USFWS, DOE* CDFG	TBD					Cost dependent on Task 8.1.1.17
2	8.1.19	Develop management plan for Alameda whipsnake Recovery Units 1-7 for identified population centers, connectivity areas, or corridors on San Francisco Public Utility lands	3 years	USFWS*, SFPU*, CDFG	6	2	2	2		
2	8.1.20	Implement management plan for Alameda whipsnake Recovery Units 1-7 for identified population centers, connectivity areas, or corridors on San Francisco Public Utility lands	continual†	USFWS SFPU*, CDFG	TBD					Cost dependent on Task 8.1.1.19

Implementation Schedule for Draft Chaparral and Scrub Community Species East of San Francisco Bay, California Recovery Plan										
					Cost Estimate (in $10,000 units)					
Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Total Costs[2]	FY 1	FY 2	FY 3	FY 4	Comments/Notes
2	8.1.21	Develop management plan for Alameda whipsnake Recovery Units 1-7 for identified population centers, connectivity areas, or corridors on Contra Costa Water District lands	3 years	USFWS* CCWD* CDFG	6	2	2	2		
2	8.1.22	Implement management plan for Alameda whipsnake Recovery Units 1-7 for identified population centers, connectivity areas, or corridors on Contra Costa Water District lands	continual†	USFWS CCWD* CDFG	TBD					Cost dependent on Task 8.1.1.21
2	8.1.23	Develop management plan for Alameda whipsnake Recovery Units 1-7 for identified population centers, connectivity areas, or corridors for Alameda whipsnake and for all populations of *Arctostaphylos manzanita* ssp. *laevigata* and *Cordylanthus nidularius* on California Department of Parks and Recreation lands	3 years	USFWS* CDPR*, CDFG	7.5	2.5	2.5	2.5		
2	8.1.24	Implement management plan for Alameda whipsnake Recovery Units 1-7 for identified population centers, connectivity areas, or corridors for Alameda whipsnake and for all populations of *Arctostaphylos manzanita* ssp. *laevigata* and *Cordylanthus nidularius* on California Department of Parks and Recreation lands	continual†	USFWS CDPR*, CDFG	TBD					Cost dependent on Task 8.1.1.23

Implementation Schedule for Draft Chaparral and Scrub Community Species East of San Francisco Bay, California Recovery Plan

Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units) Total Costs[2]	FY 1	FY 2	FY 3	FY 4	Comments/Notes
2	8.1.25	Develop management plan for Alameda whipsnake Recovery Unit 4 for identified population centers, connectivity areas, or corridors for Alameda whipsnake and for all populations of *Arctostaphylos manzanita* ssp. *laevigata* and *Cordylanthus nidularius* on Save Mount Diablo lands	3 years	USFWS* SMD*, CDFG	6	2	2	2		
2	8.1.26	Implement management plan for Alameda whipsnake Recovery Unit 4 for identified population centers, connectivity areas, or corridors for Alameda whipsnake and for all populations of *Arctostaphylos manzanita* ssp. *laevigata* and *Cordylanthus nidularius* on Save Mount Diablo lands	continual†	USFWS SMD*, CDFG	TBD					Cost dependent on Task 8.1.1.25
2	8.1.27	Develop management plan for Alameda whipsnake Recovery Unit 4 for identified population centers, connectivity areas, or corridors on City of Walnut Creek lands	3 years	USFWS* Walnut Creek* CDFG	6	2	2	2		
2	8.1.28	Implement management plan for Alameda whipsnake Recovery Unit 4 for identified population centers, connectivity areas, or corridors on City of Walnut Creek lands	continual†	USFWS Walnut Creek* CDFG	TBD					Cost dependent on Task 8.1.1.27
2	8.2.1	Establish monitoring protocols for the species covered in this plan	2 years	USFWS* CDFG*	2	1	1			
2	8.2.2	Monitor all populations of *Arctostaphylos pallida*	continual‡	USFWS* CDFG EBRPD* EBMUD Oakland	TBD					Cost dependent on monitoring protocols

Implementation Schedule for Draft Chaparral and Scrub Community Species East of San Francisco Bay, California Recovery Plan

Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units) Total Costs[2]	FY 1	FY 2	FY 3	FY 4	Comments/Notes
2	8.2.3	Choose and monitor representative populations of Alameda whipsnake	5 years	USFWS* CDFG	25		5	5	5	Other Responsible Parties to be identified once sites are chosen
2	8.2.4	Monitor *Arctostaphylos manzanita* ssp. laevigata and *Cordylanthus nidularius* on Mount Diablo	continual	USFWS, CDFG, CDPR*	TBD					Cost dependent on monitoring protocols
2	9.1.1.3	Collect and store seed of *Arctostaphylos manzanita* ssp. *laevigata*	4 years	USFWS* CDFG, CPDR* RSABG, UCB	1.2	0.3	0.3	0.3	0.3	
2	9.1.2	Propagate *Arctostaphylos pallida* within botanical facilities	5 years	USFWS* CDFG UCB, RSABG	TBD					Cost dependent on Task 7.7
2	9.1.3	Enhance existing *Arctostaphylos pallida* populations	5 years	USFWS CDFG EBMUD* EBRPD* Oakland	TBD					Cost dependent on locations to be identified
2	9.1.4.1	Initiate reintroduction or introductions where appropriate for *Arctostaphylos pallida*	1 year	USFWS* CDFG EBRPD* EBMUD*	TBD					Cost dependent on locations to be identified
2	9.1.4.2	Transplant *Arctostaphylos pallida*	1 year	USFWS CDFG EBRPD* EBMUD*	TBD					Cost dependent on locations to be identified
2	9.1.4.3	Monitor augmented sites of *Arctostaphylos pallida*	continual‡	USFWS CDFG EBRPD* EBMUD*	TBD					Cost dependent on locations to be identified

Implementation Schedule for Draft Chaparral and Scrub Community Species East of San Francisco Bay, California Recovery Plan

Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units) Total Costs[2]	FY 1	FY 2	FY 3	FY 4	Comments/Notes
2	9.1.5.1	Initiate introductions where appropriate for *Cordylanthus nidularius*	1 year	USFWS* CDFG, CDPR*	TBD					Cost dependent on locations to be identified
2	9.1.5.2	Propagate and transplant *Cordylanthus nidularius*	1 year	USFWS* Botanic garden CDFG, CDPR*	TBD					Costs depend on Tasks 7.31, 7.35, 7.36
2	9.1.5.3	Monitor introduction sites of *Cordylanthus nidularius*	continual	USFWS CDFG, CDPR*	TBD					Cost dependent on locations to be identified
2	9.2.1.1	Restore habitat for Alameda whipsnake within Tilden/Briones (Recovery Unit 1)	unknown	USFWS CDFG EBRPD* EBMUD* OWN	TBD					Task duration and Total Costs are dependent on amount of habitat to be enhanced.
2	9.2.1.4	Restore habitat for Alameda whipsnake within Mt. Diablo/Black Hills (Recovery Unit 4)	unknown	USFWS EBRPD * CDPR*, BLM CDF, CCWD* Walnut Creek* OWN	TBD					Including quarry restoration plans. Task duration and Total Costs are dependent on amount of habitat to be enhanced.
2	9.2.1.5	Restore habitat for Alameda whipsnake within Sunol/Cedar Mountain (Recovery Unit 5)	unknown	USFWS CDFG EBRPD* SFPU*, CDPR* DOE*, OWN	TBD					Task duration and Total Costs are dependent on amount of habitat to be enhanced.

Implementation Schedule for Draft Chaparral and Scrub Community Species East of San Francisco Bay, California Recovery Plan

Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units)					Comments/Notes
					Total Costs[2]	FY 1	FY 2	FY 3	FY 4	
2	9.2.2	Enhance occupied habitat and adjacent habitat for Alameda whipsnake	unknown	USFWS, CDFG CDF, EBRPD EBMUD CCWD, SFPU UCB, DOE BLM, Berkeley Oakland Pleasanton Fremont Hayward, LRFJ Shea Homes SMD, Sunol Union City Walnut Creek	TBD					Task duration and Total Costs are dependent on amount of habitat to be enhanced.
2	11.1	Determine if Population Viability Analysis should be conducted for Alameda whipsnake	1 year	USFWS* CDFG*	TBD					Need information from Tasks 7.18, 7.19
2	11.2	Conduct Population Viability Analysis if warranted	2 years	USFWS* CDFG	TBD					Dependent on Task 11.1
2	Priority 2 Tasks Subtotal				586.76	72.15	91.2	119.69	74.82	
3	2.1.1.3	Provide information to use for interpretive program for Alameda whipsnake	1 year	USFWS CDPR* EBRPD*	0.1				0.1	
3	2.1.1.4	Allow for captive Alameda whipsnake to be used for educational displays	continual‡	USFWS* CDFG*	2.25	0.05	0.05	0.05	0.05	

Implementation Schedule for Draft Chaparral and Scrub Community Species East of San Francisco Bay, California Recovery Plan

Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units) Total Costs[2]	FY 1	FY 2	FY 3	FY 4	Comments/Notes
3	2.1.1.5	Provide information to use for interpretive programs on *Arctostaphylos manzanita* ssp. *laevigata* and *Cordylanthus nidularius*	1 year	USFWS* CDFG, CDPR*	0.1				0.1	
3	2.1.2	Communicate with the public on recovery status	continual‡	USFWS* CDFG*	30	0.25	0.25	0.25	0.25	
3	5.3.2.3	Ensure native predators do not threaten the recovery of Alameda whipsnake	continual‡	USFWS* CDFG, OWN	TBD					County and City Planning
3	6.1.3	Develop survey protocol for the Berkeley kangaroo rat	2 years	USFWS* CDFG	2	1	1			
3	6.2.8	Conduct surveys of historical and potential habitat at Brushy Peak (Alameda County) for Alameda whipsnake	2 years	USFWS CDFG LARPD* EBRPD*	4				2	
3	6.2.20	Conduct surveys of historical and potential habitat in the Berkeley Hills (Alameda County) for Berkeley kangaroo rat	3 years	USFWS* CDFG, UCB*	3				1	
3	6.2.30	Conduct surveys of historical and potential habitat at Los Vaqueros (Contra Costa County) for Alameda whipsnake	ongoing	USFWS* CDFG, CCWD	3				1	
3	6.2.35	Conduct surveys of historical and potential habitat at Antioch (Contra Costa County) for *Eriogonum truncatum*	4 years	USFWS* CDFG	2				0.5	
3	6.2.38	Conduct surveys of historical and potential habitat at San Pablo Reservoir (Contra Costa County) for Berkeley kangaroo rat	3 years	USFWS* CDFG EBMUD*	4.5				1.5	
3	6.2.39	Conduct surveys of historical and potential habitat at Eureka Peak (Contra Costa County) for Berkeley kangaroo rat	2 years	USFWS* CDFG	3				1.5	

Implementation Schedule for Draft Chaparral and Scrub Community Species East of San Francisco Bay, California Recovery Plan

Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units) Total Costs[2]	FY 1	FY 2	FY 3	FY 4	Comments/Notes
3	6.2.43	Conduct surveys of historical and potential habitat at Suisun (Solano County) for *Eriogonum truncatum*	4 years	USFWS* CDFG	4			1	1	
3	7.20	Determine ability of Alameda whipsnake to vary diet with changing environmental conditions affecting prey base	15 years	USFWS* CDFG	TBD					
3	7.22	Investigate other, as yet unidentified, threats such as parasites or pathogens for Alameda whipsnake	unknown	USFWS* CDFG	TBD					Cost and duration depend on nature of threats
3	7.28	Identify *Arctostaphylos manzanita* occurring at Mt. St. Helena and Vaca Mountains	3 years	USFWS* CDFG	4.5			1.5	1.5	
3	8.1.29	Develop management plan for Alameda whipsnake Recovery Units 1-7 for identified population centers, connectivity areas, or corridors on Bureau of Land Management lands	2 years	USFWS* BLM*, CDFG	3			1.5	1.5	
3	8.1.30	Implement management plan for Alameda whipsnake Recovery Units 1-7 for identified population centers, connectivity areas, or corridors on Bureau of Land Management lands	continual[†]	USFWS BLM*, CDFG	TBD					Cost dependent on Task 8.1.29
3	9.2.3.1	Develop genetics management plan for Alameda whipsnake	1 year	USFWS* CDFG*	1					Development of a genetics management plan will occur after year 4
3	9.2.3.2	Implement captive breeding program for Alameda whipsnake	3 years	USFWS* CDFG*	TBD					Depends on assessed need and feasibility of reintroductions (Tasks 7.2.1, 9.2.3.1)

Implementation Schedule for Draft Chaparral and Scrub Community Species East of San Francisco Bay, California Recovery Plan

Task Priority	Task Number	Task Description[1]	Task Duration	Responsible Parties	Cost Estimate (in $10,000 units)					Comments/Notes
					Total Costs[2]	FY 1	FY 2	FY 3	FY 4	
3	9.2.3.3	Develop and implement reintroduction program in coordination with captive breeding program for Alameda whipsnake	3 years	USFWS* CDFG	TBD					Depends on assessed need and feasibility of reintroductions (Tasks 7.2.1, 9.2.3.1)
3	10	Develop a tracking process for the completion of recovery tasks and achievement of delisting criteria	1 year	USFWS*	1			1		
3	11.3	Refine delisting criteria	1 year	USFWS*	2			2		
3	12	Conduct status reviews of species of concern	1 year	USFWS*	2.4					Status reviews conducted after year 4
3	13	Produce and distribute an addendum to this recovery plan every 5 years	continual‡	USFWS*	2.4					Addendum produced every 5 years starting in year 5
3	Priority 3 Tasks Subtotal				74.25	1.3	1.3	7.3	12	
	Total Estimated Cost of Recovery: $13,013,100 + additional costs that cannot be estimated at this time									

[1] Task Description : Please see Stepdown Narrative (Chapter II) for a full list of species included in each task.

[2] Total costs for continuing and ongoing actions are calculated based on estimated 45-year timeframe for recovery of Alameda whipsnake and 120-year timeframe for recovery of *Arctostaphylos pallida*.

VI. REFERENCES

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VII. APPENDICES

Appendix A. Priorities for Recovery of Threatened and Endangered Species.

Degree of Threat	Recovery Potential	Taxonomy	Priority	Conflict
	High	Monotypic Genus	1	1C 1
	High	Species	2	2C 2
High	High	Subspecies	3	3C 3
	Low	Monotypic Genus	4	4C 4
	Low	Species	5	5C 5
	Low	Subspecies	6	6C 6
	High	Monotypic Genus	7	7C 7
	High	Species	8	8C 8
Moderate	High	Subspecies	9	9C 9
	Low	Monotypic Genus	10	10C 10
	Low	Species	11	11C 11
	Low	Subspecies	12	12C 12
	High	Monotypic Genus	13	13C 13
	High	Species	14	14C 14
Low	High	Subspecies	15	15C 15
	Low	Monotypic Genus	16	16C 16
	Low	Species	17	17C 17
	Low	Subspecies	18	18C 18

C = conflict with construction or other economic activity

Priority numbers are 9C for Alameda whipsnake (moderate threat, high recovery potential, subspecies) and 11C for *Arctostaphylos pallida* (moderate threat, low recovery potential, full species).

Appendix B. Listed, Candidate, and Species of Concern within the Recovery Plan Area But Not Featured in this Recovery Plan (excludes aquatic species)

Scientific Name	Common Name	Federal Category	Recovery Plan
Adela oplerella	Opler's longhorn moth	SC	Serpentine Soil Species of the San Francisco Bay Area
Aegialia concinna	Ciervo aegialian scarab beetle	SC	Upland Species of the San Joaquin Valley
Agelaius tricolor	tricolored blackbird	SC	None
Ambystoma californiense	California tiger salamander	C	Draft Vernal Pool Multi-Species, in preparation
Ammodramus savannarum	grasshopper sparrow	SC	None
Amphispiza belli belli	Bell's sage sparrow	SC	None
Amsinckia grandiflora	large-flowered fiddleneck	E	Large-flowered Fiddleneck
Anniella pulchra pulchra	silvery legless lizard	SC	None
Anthicus antiochensis	Antioch Dunes anthicid beetle	SC	None
Anthicus sacramento	Sacramento anthicid beetle	SC	None
Apodemia mormo langei	Lange's metalmark butterfly	E	Three Endangered Species Endemic to Antioch Dunes
Asio flammeus	short-eared owl	SC	None
Aster lentus	Suisun Marsh aster	SC	Draft Tidal Marsh Ecosystems of Central and Northern California, in preparation
Astragalus tener var. tener	alkali milk-vetch	SC	Draft Vernal Pool Multi-Species, in preparation
Athene cunicularia hypugea	western burrowing owl	SC	None

Scientific Name	Common Name	Federal Category	Recovery Plan
Atriplex joaquiniana	valley spearscale	SC	None
Atriplex cordulata	heartscale	SC	None
Atriplex depressa	brittlescale	SC	None
Botaurus lentiginosus	American bittern	SC	None
Branchinecta longiantenna	longhorn fairy shrimp	E	Draft Vernal Pool Multi-Species, in preparation
Branchinecta conservatio	Conservancy fairy shrimp	E	Draft Vernal Pool Multi-Species, in preparation
Branchinecta lynchi	vernal pool fairy shrimp	T	Draft Vernal Pool Multi-Species, in preparation
Branta canadensis leucopareia	Aleutian Canada goose	Delisted	Aleutian Canada Goose
Buteo regalis	ferruginous hawk	SC	None
Calypte costae	Costa's hummingbird	SC	None
Carduelis lawrencei	Lawrence's goldfinch	SC	None
Castilleja campestris ssp. succulenta	fleshy owl's-clover	T	Draft Vernal Pool Multi-Species, in preparation
Chaetura vauxi	Vaux's swift	SC	None
Charadrius montanus	mountain plover	PT	None
Charadrius alexandrinus nivosus	western snowy plover	T	Draft Western Snowy Plover, Pacific Coast Population
Chlidonias niger	black tern	SC	None
Chondestes grammacus	lark sparrow	SC	None
Chorizanthe robusta	robust spineflower	E	None
Cirsium fontinale var. campylon	Mt. Hamilton thistle	SC	Serpentine Soil Species of the San Francisco Bay Area
Cirsium crassicaule	slough thistle	SC	None

Scientific Name	Common Name	Federal Category	Recovery Plan
Clarkia concinna ssp. automixa	South Bay clarkia	SC	None
Clarkia franciscana	Presidio clarkia	E	Serpentine Soil Species of the San Francisco Bay Area
Clemmys marmorata pallida	southwestern pond turtle	SC	None
Clemmys marmorata marmorata	northwestern pond turtle	SC	None
Coelus gracilis	San Joaquin dune beetle	SC	Upland Species of the San Joaquin Valley
Contopus cooperi	olive-sided flycatcher	SC	None
Cophura hurdi	Antioch cophuran robberfly	SC	None
Cordylanthus mollis ssp. hispidus	hispid bird's-beak	SC	None
Cordylanthus maritimus ssp. palustris	northcoast bird's-beak	SC	Draft Tidal Marsh Ecosystems of Central and Northern California, in preparation
Cordylanthus mollis ssp. mollis	soft bird's-beak	E	Draft Tidal Marsh Ecosystems of Central and Northern California, in preparation
Cordylanthus palmatus	palmate-bracted bird's-beak	E	Upland Species of the San Joaquin Valley
Corynorhinus (=Plecotus) townsendii townsendii	Pacific western big-eared bat	SC	None
Delphinium recurvatum	recurved larkspur	SC	None
Delphinium californicum ssp. interius	interior California larkspur	SC	None
Dendroica occidentalis	hermit warbler	SC	None

Scientific Name	Common Name	Federal Category	Recovery Plan
Desmocerus californicus dimorphus	valley elderberry longhorn beetle	T	Valley Elderberry Longhorn Beetle
Efferia antiochi	Antioch efferian robberfly	SC	None
Elanus leucurus	white-tailed (=black shouldered) kite	SC	None
Empidonax difficilis	Pacific-slope flycatcher	SC	None
Erysimum capitatum ssp. angustatum	Contra Costa wallflower	E	Three Endangered Species Endemic to Antioch Dunes
Eschscholzia rhombipetala	diamond-petaled poppy	SC	Upland Species of the San Joaquin Valley
Eumops perotis californicus	greater western mastiff-bat	SC	None
Euphydryas editha bayensis	bay checkerspot butterfly	T	Serpentine Soil Species of the San Francisco Bay Area
Falco peregrinus anatum	American peregrine falcon	Delisted	American Peregrine Falcon
Fritillaria falcata	talus fritillary	SC	None
Fritillaria liliacea	fragrant fritillary	SC	None
Geothlypis trichas sinuosa	saltmarsh common yellowthroat	SC	Draft Tidal Marsh Ecosystems of Central and Northern California, in preparation
Haliaeetus leucocephalus	bald eagle	T	Pacific Bald Eagle
Helianthella castanea	Diablo rock-rose	SC	None
Helminthoglypta nickliniana bridgesi	Bridges' Coast Range shoulderband snail	SC	None
Hemizonia parryi ssp. congdonii	pappose spikeweed	SC	None
Hesperolinon breweri	Brewer's dwarf-flax	SC	None

Scientific Name	Common Name	Federal Category	Recovery Plan
Holocarpha macradenia	Santa Cruz tarplant	PT	None
Horkelia cuneata ssp. sericea	Kellogg's (wedge-leaved) horkelia	SC	None
Hydrochara rickseckeri	Ricksecker's water scavenger beetle	SC	None
Hygrotus curvipes	curved-foot hygrotus diving beetle	SC	None
Idiostatus middlekaufi	Middlekauf's shieldback katydid	SC	None
Isocoma arguta	Carquinez goldenbush	SC	None
Juglans californica var. hindsii	Northern California black walnut	SC	None
Lanius ludovicianus	loggerhead shrike	SC	None
Lasthenia conjugens	Contra Costa goldfields	E	Draft Vernal Pool Multi-Species, in preparation
Lathyrus jepsonii var. jepsonii	Delta tule-pea	SC	Draft Tidal Marsh Ecosystems of Central and Northern California, in preparation
Lepidurus packardi	vernal pool tadpole shrimp	E	Draft Vernal Pool Multi-Species, in preparation
Lilaeopsis masonii	Mason's lilaeopsis	SC	Draft Tidal Marsh Ecosystems of Central and Northern California
Linderiella occidentalis	California linderiella	SC	Draft Vernal Pool Multi-Species, in preparation
Lytta molesta	molestan blister beetle	SC	None
Masticophis flagellum ruddocki	San Joaquin coachwhip (=whipsnake)	SC	None
Melanerpes lewis	Lewis' woodpecker	SC	None
Melospiza melodia pusillula	Alameda (South Bay) song sparrow	SC	None
Melospiza melodia samuelis	San Pablo song sparrow	SC	Draft Tidal Marsh Ecosystems of Central and Northern California, in preparation

Scientific Name	Common Name	Federal Category	Recovery Plan
Melospiza melodia maxillaris	Suisun song sparrow	SC	None
Metapogon hurdi	Hurd's metapogon robberfly	SC	None
Microcina lumi	Fairmont microblind harvestman	SC	Serpentine Soil Species of the San Francisco Bay Area
Myosurus minimus ssp. apus	little mousetail	SC	Draft Vernal Pool Multi-Species, in preparation
Myotis ciliolabrum	small-footed myotis bat	SC	None
Myotis thysanodes	fringed myotis bat	SC	None
Myotis volans	long-legged myotis bat	SC	None
Myotis yumanensis	Yuma myotis bat	SC	None
Myotis evotis	long-eared myotis bat	SC	None
Myotis thysanodes	fringed myotis bat	SC	None
Myotis ciliolabrum	small-footed myotis bat	SC	None
Myrmosula pacifica	Antioch mutillid wasp	SC	None
Neotoma fuscipes annectens	San Francisco dusky-footed woodrat	SC	None
Nothochrysa californica	San Francisco lacewing	SC	None
Numenius americanus	long-billed curlew	SC	None
Oenothera deltoides ssp. howellii	Antioch Dunes evening-primrose	E	Three Endangered Species Endemic to Antioch Dunes
Pelecanus occidentalis californicus	California brown pelican	E	California Brown Pelican
Perdita hirticeps luteocincta	yellow-banded andrenid bee	SC	None
Perognathus inornatus	San Joaquin pocket mouse	SC	None
Phacelia phacelioides	Mt. Diablo phacelia	SC	None

Scientific Name	Common Name	Federal Category	Recovery Plan
Philanthus nasilis	Antioch sphecid wasp	SC	None
Phrynosoma coronatum frontale	California horned lizard	SC	None
Plegadis chihi	white-faced ibis	SC	None
Rallus longirostris obsoletus	California clapper rail	E	Salt Marsh Harvest Mouse and California Clapper Rail, currently being revised in Draft Tidal Marsh Ecosystems of Central and Northern California
Rana boylii	foothill yellow-legged frog	SC	None
Rana aurora draytonii	California red-legged frog	T	California Red-legged Frog
Reithrodontomys raviventris	salt marsh harvest mouse	E	Salt Marsh Harvest Mouse and California Clapper Rail, currently being revised in Draft Tidal Marsh Ecosystems of Central and Northern California
Sagittaria sanfordii	valley sagittaria	SC	Draft Tidal Marsh Ecosystems of Central and Northern California, in preparation
Sanicula maritima	adobe sanicle	SC	None
Sanicula saxatilis	rock sanicle	SC	None
Scapanus latimanus parvus	Alameda Island mole	SC	None
Scaphiopus hammondii	western spadefoot toad	SC	Draft Vernal Pool Multi-Species, in preparation
Selasphorus rufus	rufous hummingbird	SC	None
Selasphorus sasin	Allen's hummingbird	SC	None
Sorex ornatus sinuosus	Suisun ornate shrew	SC	Draft Tidal Marsh Ecosystems of Central and Northern California, in preparation

Scientific Name	Common Name	Federal Category	Recovery Plan
Sorex vagrans halicoetes	salt marsh vagrant shrew	SC	Draft Tidal Marsh Ecosystems of Central and Northern California, in preparation
Speyeria callippe callippe	callippe silverspot butterfly	E	In Preparation
Sphyrapicus ruber	red-breasted sapsucker	SC	None
Spizella breweri	Brewer's sparrow	SC	None
Sterna antillarum (=albifrons) browni	California least tern	E	California Least Tern
Streptanthus albidus ssp. peramoenus	most beautiful (uncommon) jewelflower	SC	Serpentine Soil Species of the San Francisco Bay Area
Streptanthus hispidus	Mt. Diablo jewelflower	SC	None
Suaeda californica	California sea blite	E	Draft Tidal Marsh Ecosystems of Central and Northern California, in preparation
Thryomanes bewickii	Bewick's wren	SC	None
Toxostoma redivivum	California Thrasher	SC	None
Trifolium amoenum	showy Indian clover	E	In Preparation
Tropidocarpum capparideum	caper-fruited tropidocarpum	SC	None
Tuctoria greenei	Greene's tuctoria	E	Draft Vernal Pool Multi-Species, in preparation
Vulpes macrotis mutica	San Joaquin kit fox	E	Upland Species of the San Joaquin Valley

Appendix C. The proposed U.S. Fish and Wildlife Service Intercross Policy (61 FR 4710).

Endangered and Threatened Wildlife and Plants; Proposed Policy and Proposed Rule on the Treatment of Intercrosses and Intercross Progeny (the Issue of "Hybridization"); Request for Public Comment

Summary: The Fish and Wildlife Service and the National Marine Fisheries Service (Services) propose a policy that will include, within the scope of a listing for a specific taxon, ``hybrid'' individuals that more closely resemble a parent belonging to a listed species than they resemble individuals intermediate between their listed and unlisted parents. The Services propose to add to their joint regulations the terms ``intercross'' and ``intercross progeny'' and indicate the inclusion of intercross individuals within the original listing action for the parent entity.

The proposed policy is intended to allow the Services to aid in the recovery of listed species by protecting and conserving intercross progeny, eliminating intercross progeny if their presence interferes with conservation efforts for a listed species, and fostering intercrossing when this would preserve remaining genetic material of a listed species. The proposed policy would only sanction these actions where recommended in an approved recovery plan, supported in an approved genetics management plan (which may or may not be part of an approved recovery plan), implemented in a scientifically controlled and approved manner, and undertaken to compensate for a loss of genetic viability in listed taxa that have been genetically isolated in the wild as a result of human activity. Nothing in this regulation would excuse compliance with section 10 of the Endangered Species Act.

Supplementary Information:

Background

The Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.), requires the Services to identify, protect, manage, and recover species of plants and animals in danger of extinction. To carry out this responsibility, the Services are required to rely on the best available scientific and commercial information and to develop sound policies to use that information in conserving endangered and threatened species and the ecosystems on which they depend. By implication, the Act also promotes protection of the genetic resources of those species. Under the definition of ``species'' found in the Act, the Services can apply the protections of the

Act to any species or subspecies of fish or wildlife or plants, or any distinct population segment of any species of vertebrate fish or wildlife that meets the definition of endangered or threatened. The Act does not attempt to define ``species'' in biological terms, and thus allows the term to be applied according to the best current biological knowledge and understanding of evolution, speciation, and genetics. While the Act does not specifically address reproductive isolation, the inclusion of subspecies and vertebrate population segments in its definition indicated that isolation is not considered absolutely essential for listing; however, it does not rule out using reproductive isolation as a consideration for listing. In the following discussion, the term ``species,'' unless qualified as indicating taxonomic species, is used in the sense of the Act to include species, subspecies, and distinct population segments of vertebrates within a taxonomic species. Advances in scientific methodology have altered some traditional concepts of taxonomic species and hybridization. Molecular genetic studies (*e.g.*, DNA analysis and protein electrophoresis) on both listed and unlisted plants and animals indicate that matings and genetic exchange between related taxonomic species may be more common events than previously believed.

Examples of introgression (the transfer of genetic material from one taxonomic species to another, and its spread among individuals of the second species) are found throughout the plant and animal kingdoms. In some cases, mating with other species and the resulting introgression have apparently been facilitated by a decline in the availability of conspecific mates. Given the low densities of many populations of rare threatened and endangered species, such introgression may be experienced by some listed species.

As a result of this information, the list of species that may contain genetic material traceable to other entities is growing. Consequently, questions have been raised as to how the Services can best deal with individual organisms and entire entities that may contain various levels of ``foreign'' genetic material.

Previous Service Position.

The previous Fish and Wildlife Service position, based upon interpretations in a series of opinions by the U.S. Department of the Interior, Office of the Solicitor, tended to discourage conservation efforts under the authorities of the Act for ``hybrids'' between taxonomic species or subspecies and the progeny produced by such matings. However, advances in biological understanding discussed earlier prompted the withdrawal of those opinions on December 14, 1990. The reasons for this action are summarized in two sentences in that withdrawal memorandum (Memorandum from Assistant Solicitor for Fish and Wildlife, U.S. Department of the Interior, to Director, U.S. Fish and Wildlife Service, dated December 14, 1990)--``New scientific information concerning genetic introgression has convinced us that the rigid standards set out in those previous opinions should be revisited. In our view, the issue of `hybrids' is more properly a biological issue than a legal one.'' This notice contains a proposed policy intended to replace previous positions held by the Services.

Intercross and Intercross Progeny Defined.
Due to connotations attached to the various terms that are in general use for matings across taxonomic boundaries and for their products (*e.g.*, cross, hybrid, intergrade, and interbreed), the Services propose to use the neutral term ``intercross'' for all crosses between individuals of different species (taxonomic species, subspecies, and distinct population segments of vertebrates). (The use of the term ``intercross'' was proposed by Dr. John C. Avise at the May 29-30, 1991, meeting of the Captive Breeding Specialist Group, Species Survival Commission, International Union for the Conservation of Nature and Natural Resources.). The phrase ``intercross progeny'' will be used for descendants of intercross events.

The degree of genetic mixing possible from intercrosses spans a broad continuum. At one extreme are cases in which a small number of individuals of a species display evidence of introgression. Genetic material originating from another entity may remain as evidence of long past and/or infrequent matings with that other entity but may have little or no effect on the morphology and behavior of the organism. At the other extreme are individuals that exhibit morphology that is intermediate between that of the parent types, nuclear DNA showing strong affinities with both parent types, some degree of functional sterility, and/or an inability to ``breed true.'' Somewhere along this continuum there may be individuals that possess DNA from past intercrosses but in most other ways are representative of a single parental stock.

The Services have identified threatened and endangered species that appear to fall at various points along this continuum. Some listed species have been found to contain individuals that appear to be products of introgression; they appear to harbor mitochondrial DNA resulting from introgression, yet there is no morphological or behavioral evidence that introgression has occurred. An apparent example of this condition is the eastern U.S. population of the gray wolf. At the other extreme, the Services have recognized cases in which mixing has reached a point where the species intended for conservation under the Act no longer exists; remaining genetic material is irretrievably mixed with that of another species (*e.g.*, the Amistad gambusia *(Gambusia amistadensis)*, which was removed from the list of endangered species in 1987).

While evidence such as similarities in mitochondrial DNA among several entities generally supports findings of introgression, such data may also be explained by alternative hypotheses. One hypothesis that is particularly difficult to rule out involves the retention of common genetic markers from common ancestral stock. Some techniques used to examine mitochondrial DNA are based on comparisons of fragment lengths of DNA obtained from mitochondria. Differences or similarities in fragment lengths do not necessarily reflect differences or similarities in the genetic codes contained in the fragments.

As molecular genetic methodology advances, it is anticipated that evidence of low levels of introgression and genetic mixing will be commonly found among a variety of organisms. In some cases, all individuals of a species may be found to display low levels of introgression, yet are able to ``breed true.'' The Services find no compelling reason to abandon recovery efforts for recognized species (those whose members morphologically, ecologically, and behaviorally bear close resemblance to one another) due solely to evidence of low-level present or past introgression, even if apparent introgression appears to be geographically widespread.

Populations of plants and animals that are very small, or have gone through a past episode of small population size, may have lost much of their previous genetic variability. In extreme cases, which might be exemplified by the mainland population of the Torrey pine *(Pinus torreyana)* and the cheetah *(Acinonyx jubatus)*, population genetic analyses seem to indicate that there is little genetic variation in the remaining population. When genetic variability falls to low levels a species may suffer from a diminished capability to respond to environmental changes and the increased potential for the adverse effects of inbreeding depression (*e.g.*, decreased fertility and/or mating, reduced numbers and survival of offspring). These effects may be catastrophic for a threatened or endangered species, and actions may be necessary to increase genetic variability before the population suffers an irreversible decline.

Proposed Policy for Intercross Progeny.

Where intercross progeny are produced as a result of a cross between an individual of a listed taxon and an individual of a taxon that is not listed, the Services believe the responsibility to conserve endangered and threatened species under the Act extends to those intercross progeny if (1) the progeny share the traits that characterize the taxon of the listed parent, and (2) the progeny more closely resemble the listed parent's taxon than an entity intermediate between it and the other known or suspected non-listed parental stock. The best biological information available, including morphometric, ecological, behavioral, genetic, phylogenetic, and/or biochemical data, can be used in this determination.

This policy will not prohibit the Services from removing intercross progeny from the wild if it is determined that those individuals must be removed to enhance the survival or recovery of the listed species. The action may be authorized under 50 CFR 17.22, 17.32, 17.62, or 17.72, or the protection of the Act may be removed by a special rule adopted under section 4(d) of the Act for threatened species.

Intercrosses between subspecies of the same taxonomic species, or between members of different vertebrate populations of the same taxonomic species or subspecies, are a common, natural, and expected occurrence in nature wherever ranges are adjacent or overlap. As with other intercrosses, the Services will treat the resulting progeny as members of the listed subspecies or population if they share the characteristic traits of that entity. This determination will be based upon the best biological information available.

Species of Hybrid Origin.

Some taxonomic species have originated through the intercrossing of two or more other taxonomic species, but have since become stable and self-sustaining biological units. This process of speciation by hybridization is well documented among plants and also is known among fishes, amphibians, and reptiles. Species that are believed to be of hybrid origin would retain or maintain eligibility for threatened or endangered status if they have developed outside of confinement, are self-sustaining, naturally occurring taxonomic species, and meet the criteria for threatened or endangered species under the Act.

Intercross Progeny Produced in Captivity.
Unnatural conditions of confinement or confining environments resulting from human activities may produce behavioral and other anomalies that lead to intercrosses that rarely, if ever, occur under ``natural'' conditions. Resulting intercross progeny are unlikely to benefit the conservation of their listed parent's taxon, and the Services would not generally consider such progeny to be members of a species protected under the Act. However, this proposed policy would extend protection under the Act to intercross progeny produced in captivity, with or without introduction to the wild, where the action is (1) recommended by an approved recovery plan, (2) supported in an approved genetics management plan (which may or may not be part of an approved recovery plan), (3) implemented in a scientifically controlled and approved manner, and (4) undertaken to compensate for a loss of genetic viability in listed taxa that have been genetically isolated in the wild as a result of human activity. Protection under the Act may apply to the individuals while they are in confinement, after their release to the wild, or during both periods.

Goals of the Proposed Policy.
The primary goal of this proposed policy is to provide the Services with the necessary flexibility to deal with diverse intercross situations to allow for the protection and conservation of intercross progeny at the level of taxonomic species, subspecies, and vertebrate populations. A second goal is to give the Services the ability to eliminate intercross progeny if their presence interferes with conservation efforts for a listed species. Alternately, it gives the Services the option to foster intercrossing where required for conservation. Because an action that would eliminate or introduce genetic material from or to a listed species must be an informed decision by experts, the Services will adopt the strongest administrative controls over such actions. Prior to implementing any action to introduce genetic material, it must be (1) recommended in an approved recovery plan, (2) supported in an approved genetics management plan (which may or may not be part of an approved recovery plan), and (3) undertaken to compensate for a loss of genetic viability in listed taxa that have been genetically isolated in the wild as a result of human activity. Further, it must be implemented in a scientifically controlled and approved manner.

This proposed rule and policy would provide several conservation benefits to species currently listed as threatened or endangered. First, it would remove the necessity for the Services to devote substantial resources to studies to determine which listed species and individuals are genetically ``pure.'' Such studies, if required, would need to be extensive; it is not presently possible to accurately predict which species and individuals have experienced introgression and to what extent. Furthermore, even if such studies were to be carried out, the interpretation of the resultant data might be ambiguous considering the limits of current technology and incomplete understanding of the mechanisms of speciation.

Second, this proposed policy would acknowledge the Services' authority to conduct conservation programs for species that meet the listing criteria of section 4(a)(1) of the Act, even though limited introgression may have taken place.

Third, where determined to be advantageous to recovery and where addressed in an approved recovery plan, the proposed policy acknowledges the Services' ability to use intercrossing to introduce small amounts of new genetic material from a closely related entity into a listed species that is genetically depauperate. The progeny of such an intercross, if they share characteristic traits of the listed species and more closely resemble it than an entity intermediate between the parents, would be fully protected by the Act. Such drastic steps are expected to be taken only rarely, and it is not the intent of this proposed policy to generally encourage the transfer of genetic material from one species to another.

Fourth, by generally excluding (where neither recommended in an approved recovery plan nor meeting the other tests set forth in this proposed policy) captive-propagated intercross progeny from the protection of the Act, the Services retain the ability to readily remove from the wild any such organisms that have been released or have escaped. Such releases or escapes may threaten existing or future recovery efforts by introducing genetic material into a listed species in the absence of a comprehensive evaluation of the likely impacts.

This proposed policy is not expected to affect current listing policy, nor will it result in adding species to the list. Several species suspected or known to be of hybrid origin (predominantly plants) are currently on the endangered and threatened species list (*e.g.*, Arizona agave *(Agave arizonica)* and Mohr's Barbara's buttons *(Marshallia mohrii)*, and protection under the Act of additional species of this nature will be consistent with this proposed policy. Such species have established themselves as self-sustaining, genetically and morphologically, stable units that continue to be recognized as taxonomic species by the scientific community. The proposed policy would not affect the Services' existing treatment of these and similar species.

Except as noted in the preceding paragraph, this proposed policy would not allow the protection of the Act to be extended to a ``classical hybrid,'' that is, an intermediate organism AB that has received half its characteristics from an unlisted parent species A and half from a listed parent species B. The offspring AB does not sufficiently resemble B to warrant protection under the Act. However, all intercross (including backcross) progeny that more closely resemble B than they resemble AB would continue to be protected by the Act (consistent with past practice). However, where produced under conditions of captivity or confinement, such intercross progeny would be protected if the intercross was recommended in an approved recovery plan and satisfied other requirements set forth in this proposed policy.

The intentional intercrossing of species under confinement and the artificial transfer of genetic material from one taxonomic species into another (i.e., transgenics) are large and growing endeavors. This proposed policy would not include (would not protect) any individual organism resulting from these activities when they are performed under conditions that confine the progeny of the parents, even temporarily, unless the action is recommended in an approved recovery plan and satisfies other requirements set forth in this policy. The production and commercialization of hybrid organisms for the pet trade, falconry, horticulture, agriculture, and aquaculture or sport fishing purposes will not otherwise be affected by this proposed policy. Likewise, organisms resulting from genetic engineering experiments that use genetic material from listed species will not otherwise be covered by this proposed policy (although endangered species permits may be required to obtain the genetic material), unless such organisms are produced for the purpose of recovery of the listed species in accordance with an approved recovery plan. Private citizens or organizations that possess plants or animals of such origin would not normally be required to obtain additional Federal permits as a result of this proposed policy.

This proposed policy is intended to assist the Services in conserving endangered and threatened species and their unique genetic complements even if all individuals of a listed species have small amounts of genetic material from another species. However, this proposed policy is not intended to provide general support for, or preclude the establishment of, ``ecologically equivalent forms'' in habitats formerly occupied by threatened or endangered species. Ecologically equivalent forms are taxonomic species, subspecies, or populations that are used as replacements for extirpated or extinct species in order to maintain an apparently stable and complete plant and animal community.

Juvenile specimens of intercrosses of a listed species and an unlisted species may be indistinguishable from the unlisted species using traditional field procedures. In such a case, it would be impossible under field conditions to properly classify the juvenile stage of a possible intercross. For this reason, all individuals that resemble a protected species should be protected until they have reached a life stage at which they can be distinguished from the listed species. The law enforcement implications of this policy are that because of similarity of appearance, taking of these individuals would be prohibited since they cannot be readily distinguished in the field from a listed species.

Public Comments Solicited

The Services intend that any final action resulting from this proposal will be as accurate and as effective as possible. Therefore, comments or suggestions from the public, other concerned governmental agencies, the scientific community, industry, or any other interested party concerning this proposed rule are hereby solicited.

Regulatory Flexibility Act and Executive Order 12866.

The Department of the Interior has determined that the proposed revisions to part 424 will not constitute a significant rule under Executive Order 12866 and certify that these changes will not have a significant economic effect on a substantial number of small entities under the Regulatory Flexibility Act (5 U.S.C. 601 et seq.). Based on the information discussed in this proposed rule, it is not expected that significant economic impacts would result. Also, no direct costs, enforcement costs, information collection, or record keeping requirements are imposed on small entities by this proposed rule. Further, the proposed rule contains no information collection or record-keeping requirements as defined by the Paperwork Reduction Act of 1995.

National Environmental Policy Act of 1969 (NEPA).

The Services believe that this action may be categorically excluded under the Services' NEPA procedures. (See 516 DM 2 Appendix I Categorical Exclusion

1.10.) After further review, the Services will decide whether an Environmental Assessment must be prepared.

Editors: The editors of this proposal are William Kramer of the Fish and Wildlife Service's Division of Endangered Species, 452 ARLSQ, Washington, D.C. 20240 (703/358-2106); and Marta Nammack, Endangered Species Division, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, Maryland 20910 (301/713-2322).

List of Subjects in 50 CFR Part 424.

Endangered and threatened species, Exports, Imports, Reporting and record keeping requirements, and Transportation.

Proposed Regulation Promulgation.

Accordingly, the Services hereby propose to amend part 424, subchapter A of chapter IV, title 50 of the Code of Federal Regulations, as set forth below:

PART 424--[AMENDED]

1. The authority citation for part 424 continues to read as follows:

Authority: Pub. L. 93-205, 87 Stat. 884; Pub. L. 95-632, 92 Stat. 3751; Pub. L. 96-159, 93 Stat. 1225; Pub. L. 97-304, 96 Stat. 1411 (16 U.S.C. 1531 et seq.).

2. It is proposed that Sec. 424.02 be amended by redesignating paragraphs (f) through (n) as paragraphs (h) through (p) respectively, and adding new paragraphs (f) and (g) to read as follows:

Sec. 424.02. Definitions.

* * * * *

(f) *Intercross* means any mating, fertilization, or other means of exchange of genetic material between different species, subspecies, or distinct vertebrate population segments within a taxonomic species.

(g) *Intercross progeny* means any and all offspring and descendants that are the product of an intercross.

* * * * *
3. It is proposed that a new Sec. 424.03 be added to subpart A to read as follows:

Sec. 424.03 Intercross and intercross progeny.

(a) Unless specified otherwise and indicated by an annotation in the ``Scientific name'' column, any species listed as endangered or threatened pursuant to the Act will include all individuals that, considering the sum of available morphological, behavioral, ecological, biochemical, genetic, and other relevant data, more closely resemble such listed species than they resemble an intermediate between their listed and unlisted parents.

(b) Individuals that are the products of intercrosses that occurred under conditions of confinement will be excepted from the inclusion in paragraph (a) of this section unless such production is:
(1) Recommended in an approved recovery plan for a listed parent species;
(2) Supported in an approved genetics management plan (which may or may not be part of an approved recovery plan);
(3) Implemented in a scientifically controlled and approved manner; and
(4) Undertaken to compensate for a loss of genetic viability in listed taxa that have been genetically isolated in the wild as a result of human activity.

Dated: February 1, 1996.

George T. Frampton, Jr.,Assistant Secretary for Fish and Wildlife and Parks, Department of the Interior.

Dated: February 2, 1996.

Nancy Foster,

Deputy Assistant Administrator for Fisheries, National Marine Fisheries Service.
[FR Doc. 96-2640 Filed 2-6-96; 8:45 am]
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Appendix D. Threats to *Arctostaphylos pallida* and Alameda Whipsnake and Steps within the Draft Recovery Plan for Threat Reduction or Elimination

SPECIES	LISTING FACTOR	THREAT	TASK NUMBERS	RECOVERY CRITERIA
Arctostaphylos pallida	A	Habitat loss from urban development (not considered significant at time of listing, but minor habitat loss has occurred from infill developments)*	Protect existing sites in perpetuity from incompatible uses (see Tasks 2.2, 5.2.1, 5.2.2), reintroduce to insular locations (see Tasks 9.1.2, 9.1.4.1, 9.1.4.2, 9.1.4.3)	I(a), I(b)
	C	Disease	Conduct research (see Tasks 2.4.1, 2.4.2, 7.6), implement management recommendations from research (see Task 5.2.3.3), and monitoring (8.2.1, 8.2.2)	IV(a)
	D	Inadequacy of CESA and CEQA	Beyond scope of recovery plan; would take legislative action to change	N/A
	D	Need for management plan implementation	Coordinate chaparral management among agencies (Tasks 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.2.2, 5.1.1,, 5.1.2, 5.2.3.2, 6.1.1, 7.4, 7.5, 8.1.1 - 8.1.8, 9.1.3)	II(a), II(b)

SPECIES	LISTING FACTOR	THREAT	TASK NUMBERS	RECOVERY CRITERIA
Arctostaphylos pallida	E	Herbicide spraying for eradication of *Eucalyptus* and for roadside spraying	Work with land management agencies and public works departments to eliminate broadleaf herbicide spraying near *Arctostaphylos pallida*. Conduct worker awareness training (see Tasks 2.1.4.1, 4.1.4 and 5.2.3.4)	IV(a)
	E	Hybridization with *Arctostaphylos glauca* and *Arctostaphylos tomentosa* ssp. *crustacea*	Reduce the threat of hybridization (see Tasks 2.1.1.2, 5.2.3.2.2, 7.8)	IV(a)
	E	Fire suppression	Public education (2.1.3.1, 2.1.3.2, 2.1.4.1), development of Memorandum of Understanding, active management (see Tasks 3.2, 3.3, 4.1.1, 4.1.2, 4.1.3 and 5.2.3.1) research (Tasks 7.1, 7.2, 7.3) monitoring (8.2.1, 8.2.2, 9.1.1.1)	IV(b), IV(c)
	E	Shading from *Eucalyptus* spp., *Pinus radiata*, and *Cupressus* spp.	Vegetation management (see Task 5.2.3.2.1)	IV(a), IV(b)

SPECIES	LISTING FACTOR	THREAT	TASK NUMBERS	RECOVERY CRITERIA
Arctostaphylos pallida	E	Competition with aggressive nonnative plant species including *Genista monospessulana* (French broom), *Vinca major* (periwinkle), and *Senecio mikaniodes* (German ivy).	Vegetation management (removal of these plants where competition is a problem) (see Task 5.2.3.2.1),and monitoring (8.2.1, 8.2.2)	IV(a), IV(b)
	E	Habitat fragmentation	Protect existing lands in perpetuity from incompatible uses (see Tasks 5.2.1, 5.2.2), reintroduce on public lands insular to development (see Tasks 9.1.1.1, 9.1.2, 9.1.4.1, 9.1.4.2, 9.1.4.3), and coordinate with agencies for tracking habitat fragmentation (see Task 4.3.2 and 8.2.5)	III (b), IV(f)
	E	Stochastic events	Survey for additional populations (see Tasks 6.2.1, 6.2.3, 6.2.4, 6.2.5, 6.2.6, 6.2.7, 6.2.24, 6.2.26, 6.2.27, 6.2.37), reintroductions (see Tasks 3.1.1-3.1.3, 7.7, 9.1.4.1, 9.1.4.2, 9.1.4.3), and seed banking (see Task 9.1.1.1)	I(a), I(b), IV(d)
	E	Genetic drift, inbreeding depression*	Research (see Task 7.8) and enhance existing populations (9.1.3)	IV(e)

SPECIES	LISTING FACTOR	THREAT	TASK NUMBERS	RECOVERY CRITERIA
Alameda whipsnake	A	Urban development	Determine key areas for protection (see Tasks 6.1.2.1, 6.1.2.2, 6.2.2, 6.2.9, 6.2.10, 6.2.11, 6.2.12, 6.2.13, 6.2.14, 6.2.15, 6.2.16, 6.2.17, 6.2.18, 6.2.19, 6.2.25, 6.2.29, 6.2.31, 6.2.32, 6.2.33). Work cooperatively to develop regional planning efforts that will protect key areas for Alameda whipsnake (see Tasks 2.3.1, 2.3.2, 2.3.3); protect and secure populations (see Tasks 5.3.1.1 - 5.3.1.7, 5.3.2.3).	I(a), I(b), III
	A	Suburban development	Work cooperatively to develop regional planning efforts that will protect key areas for Alameda whipsnake (see Tasks 2.3.1, 2.3.2, 2.3.3). Protect and secure populations (see Tasks 5.3.1.1- 5.3.1.7, 5.3.2.3).	I(a), I(b), III

SPECIES	LISTING FACTOR	THREAT	TASK NUMBERS	RECOVERY CRITERIA
Alameda whipsnake	A, E	Genetic isolation due to habitat fragmentation	Work cooperatively to develop regional planning efforts that will protect key areas for Alameda whipsnake (see Tasks 2.3.1, 2.3.2, 2.3.3). Protect and secure populations (see Tasks 5.3.1.1-5.3.1.7). Protect and secure primary areas (2.2). Test genetic isolation (see Tasks 6.2.8, 6.2.34). Coordinate with agencies for tracking habitat fragmentation (see Tasks 4.3.1, 4.3.2, and 8.2.5)	I(a), I(b), III, IV(b)
	A, E	Excessive livestock grazing	Research (2.4.1, 2.4.2) and have adaptive management based on results incorporated into management plans and Habitat Conservation plans (see Task 4.1.1, 7.10, 7.12, 9.2.1.3, 9.2.1.5, 9.2.2)	II(a), II(b), III
	A, E	Fire suppression and related wildfire problems associated with lack of fuel reduction	Public education (Tasks 2.1.3.1, 2.1.1.3, 2.1.3.2, 2.1.4.2), development of Memorandum of Understanding, active management (see Tasks 3.2, 3.3, 4.1.1, 4.1.2, and 4.1.3), research (Tasks 7.9, 7.10), and monitoring (8.2.3)	II(a), II(b), II(c), III, IV, V(b), V(c)

SPECIES	LISTING FACTOR	THREAT	TASK NUMBERS	RECOVERY CRITERIA
Alameda whipsnake	A, E	Disruptive land uses (e.g., mining and off-road vehicles)*	Protect and secure lands (see Tasks 5.3.1.1 - 5.3.1.7), habitat restoration (see Tasks 9.2.1.4, 9.2.1.5)	I(a), I(b), III
	B	Commercial collecting	Prevent unauthorized collection (Task 5.3.2.4), address similarity of appearance (see Task 5.3.2.5)	V(a)
	C	Rats, feral pigs, feral and domestic cats, and dogs	Protect loss of habitat or prey from competition non natives control (see Tasks 2.1.1.1, 2.1.1.3, and 5.3.2.2.2)	V(a), V(c)
	C	Increased native predators	Control of native predators (see Task 5.3.2.3)	V(a)
	D	Inadequacy of CESA and CEQA	Beyond scope of recovery plan; would take legislative action to change	N/A
	D	Need for management planning for open space and preserves	Work cooperatively to develop regional planning efforts that will protect key areas for Alameda whipsnake (see Tasks 2.3.1, 2.3.2, 2.3.3). Manage habitat (Tasks 3.1.1-3.1.3, 4.1.1-4.1.4, 4.2.1, 4.2.2, 5.1.1, 5.1.2, 5.3.2.1, 6.1.2.1, 7.11, 7.13-7.22, 8.1.1-8.1.30, 9.2.2, 9.2.3.1-9.2.3.3). Protect and secure populations (see Tasks 5.3.1.1 - 5.3.1.7).	I(a), I(b), II(a), II(b), II(c), III

SPECIES	LISTING FACTOR	THREAT	TASK NUMBERS	RECOVERY CRITERIA
Alameda whipsnake	E	Catastrophic wildfire	Pursue protection with California Forestry and Fire Protection (see Tasks 4.1.1, 4.1.2, and 4.1.3)	V(b)
	E	*Eucalyptus* and other non-natives replacing chaparral	Cooperative active management - adaptive (see Tasks 4.1.1-4.1.4, and 5.3.2.2.1)	III
	E	Habitat being decadent	Natural disturbance regimes reintroduced, Memorandum of Understanding (see Tasks 4.1.1, 4.1.2, 4.1.3, and 8.2.5)	III, IV(b), V(b)
	E	Genetic drift, inbreeding depression	Role of intergrades research (see Tasks 7.24, 6.2.22, 6.2.23, 6.2.40, 6.2.41, 6.2.42), similarity of appearance (see Task 5.3.2.5), land protection (see Tasks 5.3.1.1 - 5.3.1.7)	V(a)
	E	Vulnerability to catastrophic events	Primary areas pursue protection from catastrophic events (see Tasks 5.3.1.1 - 5.3.1.7, 6.2.2). Augment Alameda whipsnake (see Tasks 9.2.1.1 - 9.2.1.7, 9.2.2)	I(a), I(b), II(c), II(d), IV(a)
	E	Physical barriers *	Niles Canyon, Recovery Unit 7 (see Tasks 9.2.1.7, 6.2.30)	V(a)

* Threat identified since time of listing.