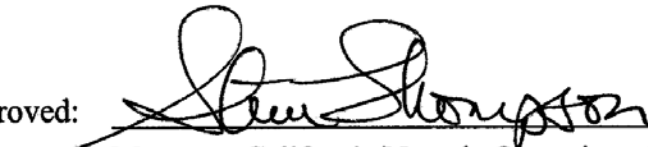


RECOVERY PLAN
FOR
GABBRO SOIL PLANTS
OF THE
CENTRAL SIERRA NEVADA FOOTHILLS

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

Approved:



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

AUG 30 2002

Date:

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PRIMARY AUTHORS

The Recovery Plan for Gabbro Soil Plants of the Central Sierra Nevada Foothills was prepared by:

Kirsten Tarp
Sacramento Fish and Wildlife Office
U.S. Fish and Wildlife Service

This recovery plan was edited by Diane Elam and Carmen Thomas. The Geographic Information System mapping analysis was conducted by Tony McKinney, Diane Elam, and Kirsten Tarp.

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EXECUTIVE SUMMARY

Introduction: This recovery plan features six species of plants that occur exclusively or primarily on gabbro soils in chaparral and woodland in the Central Sierra Nevada foothills in California. The five federally listed species include four endangered plants, *Calystegia stebbinsii* (Stebbins' morning-glory), *Ceanothus roderickii* (Pine Hill ceanothus), *Fremontodendron californicum* ssp. *decumbens* (Pine Hill flannelbush), and *Galium californicum* ssp. *sierrae* (El Dorado bedstraw), and one threatened plant, *Senecio layneae* (Layne's butterweed). In addition, *Wyethia reticulata* (El Dorado mule-ears), a species of concern, is addressed.

Conversion of habitat to urban and industrial uses has extirpated occurrences of the listed species and species of concern and degraded their habitat. The gabbro habitat in the southern portion of the Pine Hill formation is especially fragmented. Suitable "pristine" habitat remaining for a preserve system is limited, particularly in the southern portion of the Pine Hill formation.

The Endangered Species Act of 1973, as amended, 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, a species of concern is included in this recovery plan because the community-level strategy provides opportunities for prelisting conservation of the species, which has needs similar to those of listed species.

Recovery Objectives: Interim goals of this recovery plan include stabilizing and protecting populations, conducting research necessary to refine reclassification and recovery criteria, and reclassifying to threatened (*i.e.*, downlisting) *Calystegia stebbinsii* and *Ceanothus roderickii*, species currently federally listed as endangered. The ultimate goals are to (1) protect and restore sufficient habitat and numbers of populations and (2) ameliorate both the threats

that caused five of the gabbro soil plants to be listed and any other newly identified threats in order to (3) delist *Calystegia stebbinsii*, *Ceanothus roderickii*, and *Senecio layneae*, and downlist of *Fremontodendron californicum* ssp. *decumbens*, and *Galium californicum* ssp. *sierrae*, and (4) ensure the long-term conservation of *Wyethia reticulata*. *Fremontodendron californicum* ssp. *decumbens* and *Galium californicum* ssp. *sierrae* are not currently considered delistable.

Community-level Strategy for Recovery and Conservation: This recovery plan presents a community-level strategy for recovery and conservation because all of the listed species and species of concern co-occur in the same natural community. The likelihood of successful recovery for the listed species is increased by protecting entire communities, and by doing so, conservation of the species of concern is also possible. 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 biological and anthropogenic impacts will affect the covered species in the human-dominated landscape, especially in western El Dorado County.

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, individual recovery criteria are presented for each of the five federally listed species covered in this recovery plan and conservation goals are presented for the species of concern, to track their progress towards recovery, and to ensure that all of their recovery and conservation needs are addressed.

Separate criteria are given in the recovery plan for downlisting *Calystegia stebbinsii*, *Ceanothus roderickii*, *Fremontodendron californicum* ssp. *decumbens*, and *Galium californicum* ssp. *sierrae* from endangered to threatened, for delisting

Calystegia stebbinsii, *Ceanothus roderickii*, and *Senecio layneae*, and for achieving long-term conservation of *Wyethia reticulata*. Species specific downlisting and delisting criteria are described in Table III-5 in the Recovery chapter of this plan. Elements common to the recovery criteria of most listed species include:

- protection from development and incompatible uses of the habitat of populations representing the full range of genetic and geographic variation in the species; and
- achievement of self-sustaining status in specified populations.

Protection strategies for *Wyethia reticulata*, the species of concern, are based on the assumption that if populations are secure from threats, co-occur with listed species, are not declining, and remain in habitat remnants throughout the species' historical range, its long-term conservation will be ensured.

2. Habitat Protection

Considering that habitat loss is the primary cause of species endangerment for the gabbro soil plants, a central component of species recovery and conservation is to establish a network of conservation areas and reserves that represent most of the important gabbro habitat in western El Dorado County and elsewhere throughout the ranges of the species.

3. Monitoring and Research Programs

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

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

- surveys to determine species distributions;
- population censusing and monitoring;
- studies of reproduction and population characteristics;
- habitat management research;
- population genetics studies; and
- habitat and species restoration trials.

4. Habitat Management

In most cases, active management of the land is necessary to maintain and enhance habitat values for the species covered in this recovery plan. However, management strategies have not been investigated for most species. Management research (see Monitoring and Research Programs, element #3 above) may take many years to complete, and few management plans have been developed for protected areas. The only practical approach is adaptive management, where management is applied, population responses are monitored, the outcome is evaluated, and management is readjusted accordingly.

Implementation Participants: Although we, the U.S. Fish and Wildlife Service, have the responsibility for implementing this recovery plan, and only Federal agencies are mandated to take part in the effort, the participation of a variety of groups in both initial plan implementation and the subsequent adaptive management process is essential to successful recovery. Thus, the plan recommends the establishment of a cooperative program that would coordinate land use planning among interested parties in local, State, and Federal government and the private sector to aid recovery of gabbro species in western El Dorado County. This program would develop a participation plan, coordinate education and outreach efforts, assist in developing economic incentives for conservation and recovery, ensure that adaptive management is practiced, and define other recovery and management tasks as necessary.

Total Estimated Cost of Recovery: The total estimated cost of recovery for the five listed plant species and the long-term conservation of the one species of concern is broken down by priority of tasks. Certain costs, such as securing and protecting serpentine habitat in Nevada County and the cost of long term management, have yet to be determined.

Priority 1 tasks: \$30,759,000+

Those actions that must be taken to prevent extinction or prevent the species from declining irreversibly in the foreseeable future.

Priority 2 tasks: \$10,315,600+

Those actions that must be taken to prevent a significant decline in the species population or habitat quality, or some other significant negative impact short of extinction.

Priority 3 tasks: \$440,000

All other actions necessary to meet the recovery and conservation objectives outlined in this recovery plan.

Date of Recovery: Recovery is defined in relation to natural fire cycles of approximately 30 years for most species covered in this recovery plan. Assuming recovery criteria are met, *Calystegia stebbinsii* and *Ceanothus roderickii* could be delisted after three natural fire cycles (approximately 80 to 100 years), and *Fremontodendron californicum* ssp. *decumbens* could be downlisted after two natural fire cycles (approximately 60 years). *Senecio layneae* could be delisted after 60 years, and *Galium californicum* ssp. *sierrae* could be downlisted after 60 years.

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I. INTRODUCTION

In the Sierra Nevada foothills in California, gabbro soils are found within discontinuous rock outcrops from Plumas to Tuolumne Counties (Figure I-1). Gabbro soils are derived from mafic rocks (high in magnesium and iron) and are composed of the minerals plagioclase, olivine, clinopyroxene, iron oxides, and hornblende (Hunter and Horenstein 1991). Gabbro, a dark large-crystalline rock, is formed when liquid magma cools slowly underground. A red soil is formed when the rock is exposed and weathers at the earth's surface (EIP Associates 1991). Gabbro soils are well-drained and are underlain by gabbrodiorite rocks at a depth of more than 1 meter (3.3 feet) (U.S. Department of Agriculture, Soil Conservation Service 1974).

The six plants addressed in this recovery plan, *Calystegia stebbinsii* (Stebbins' morning-glory), *Ceanothus roderickii* (Pine Hill ceanothus), *Fremontodendron californicum* ssp. *decumbens* (Pine Hill flannelbush), *Galium californicum* ssp. *sierrae* (El Dorado bedstraw), *Senecio layneae* (Layne's butterweed), and *Wyethia reticulata* (El Dorado mule-ears) (hereafter collectively called the gabbro plants) (Table I-1), are restricted chiefly to gabbro-derived soils. These plants occur primarily on the Pine Hill formation, an area of approximately 10,400 hectares (25,700 acres), in western El Dorado County (Figure I-2). *Ceanothus roderickii*, *F. californicum* ssp. *decumbens*, and *G. californicum* ssp. *sierrae* are endemic to gabbro-derived soils on the Pine Hill formation, and *Calystegia stebbinsii* and *S. layneae* occur on gabbro and serpentine-derived soils. One known occurrence of *S. layneae* is found on metamorphic rock-derived soils. Two of these plants, *Calystegia stebbinsii* and *S. layneae*, have a few known isolated occurrences off the Pine Hill formation in either El Dorado, Nevada, Tuolumne, or Yuba Counties, California.

The Pine Hill formation ranges in elevation from 628 meters (2,060 feet) at its peak to 138 meters (453 feet) near the northwest edge. Most of the Pine Hill formation lies between 390 to 420 meters (1,279 to 1,377 feet), which is distinctly higher than the surrounding land. The Pine Hill formation is covered by three distinct vegetative types; grassland, oak woodland, and chaparral. A majority, 66

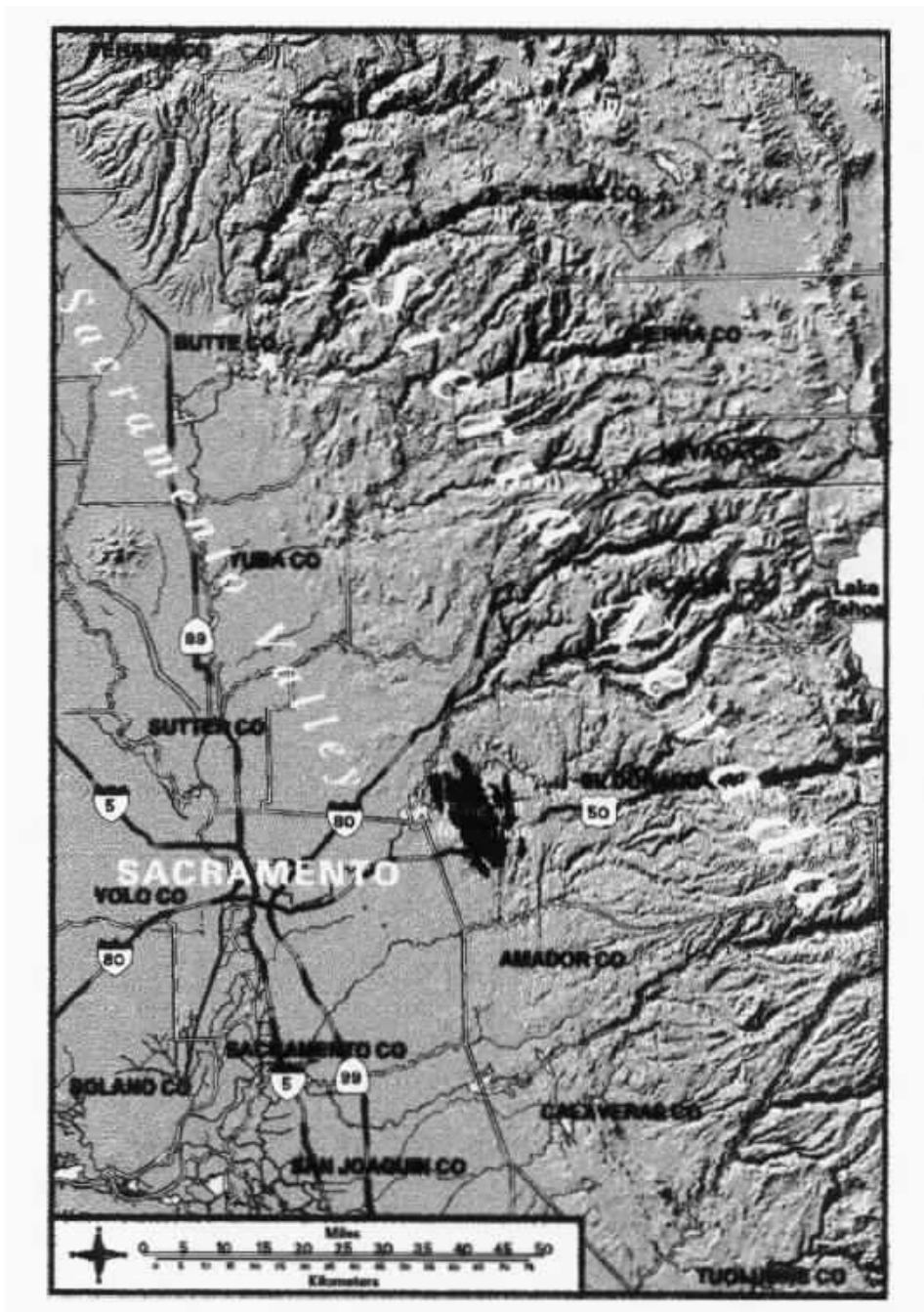


Figure I-1. Area map showing counties referred to in the recovery plan.

Table I-1. Species covered in the gabbro plants recovery plan.

Species	State/Federal Status	Recovery Priority¹
<i>Calystegia stebbinsii</i> Stebbins' morning-glory	CE/FE	5C
<i>Ceanothus roderickii</i> Pine Hill ceanothus	CR/FE	5C
<i>Fremontodendron californicum</i> ssp. <i>decumbens</i> Pine Hill flannelbush	CR/FE	6C
<i>Galium californicum</i> ssp. <i>sierrae</i> El Dorado bedstraw	CR/FE	6C
<i>Senecio layneae</i> Layne's butterweed	CR/FT	5C
<i>Wyethia reticulata</i> El Dorado mule-ears	--/SC	N/A

CE - California Endangered

CR - California Rare

FE - Federal Endangered

SC - Federal Species of Concern

FT - Federal Threatened

¹ Recovery Priority: See Appendix A for an explanation of how recovery priorities are assigned for listed species.

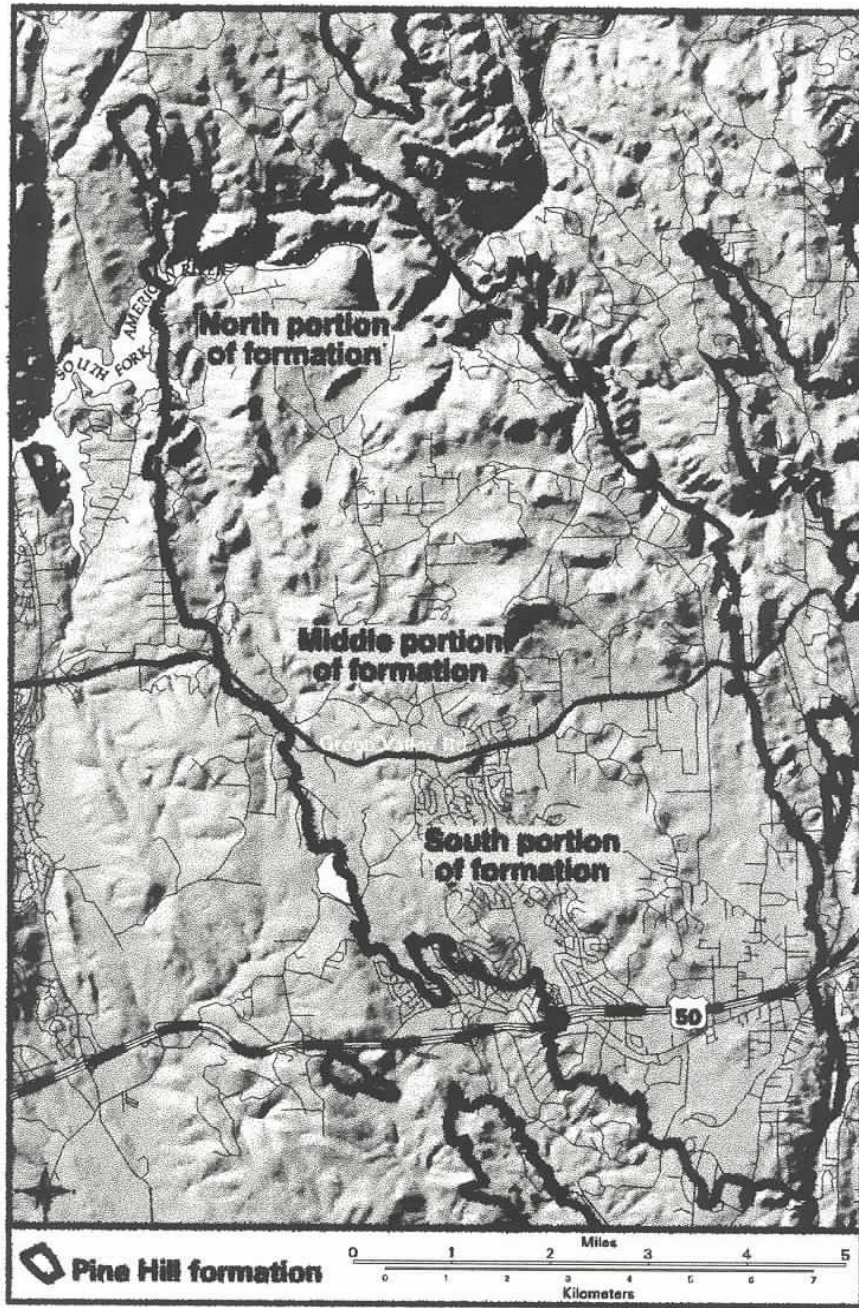


Figure I-2. Map showing the Pine Hill formation.

percent, of the Pine Hill formation is covered with chaparral species such as *Arctostaphylos viscida* (whiteleaf manzanita), *Adenostoma fasciculatum* (chamise), *Ceanothus cuneatus* (buckbrush), *C. lemmonii* (Lemmon's ceanothus), *Heteromeles arbutifolia* (toyon), and *Rhamnus californica* (coffeeberry). The remaining portions of Pine Hill are covered equally with oak woodland, dominated by *Quercus kelloggii* (black oak), *Q. wislizenii* (interior live oak), and grassland habitats. Pine Hill is composed of a series of interconnecting ridges and drained by a number of streams. One major river, the South Fork of the American River, bisects Pine Hill as it flows out of the Sierra Nevada. The ridges on Pine Hill are wide and rounded, almost plateau-like with large areas near the ridge tops of less than 10 percent slope. Usually, the slopes on Pine Hill are moderate (less than 50 percent), except for the American River Canyon, which has slopes greater than 50 percent (Hunter and Horenstein 1991).

Gabbro plants are most commonly associated with the Rescue soils series, especially Rescue very stony sandy loam and Rescue extremely stony sandy loam, on the Pine Hill formation (EIP Associates 1991) (Figure I-3). The Rescue series soils are well drained soils underlain by gabbrodiorite (granular igneous) rocks. The surface layer of these soils is reddish-brown sandy loam about 25 centimeters (10 inches) thick. Subsoils are reddish-yellow and vary in texture from sandy loam to sandy clay loam. Beneath the subsoil, underlying materials are coarser and sandier (U.S. Department of Agriculture, Soil Conservation Service 1974). Rescue very stony sandy loam and Rescue extremely stony sandy loam are associated with slopes and ridge tops. The very stony sandy loam is similar to the typical sandy loam profile except that stones occupy 1 to 3 percent of the soil. The extremely stony sandy loam is characterized by numerous rock outcrops (rocks cover 3 to 15 percent of the soil) and the soil's surface layer is only 7.5 to 20 centimeters (3 to 8 inches) thick (Hunter and Horenstein 1991).

Several comparisons have been made between gabbro and serpentine soils. Many species considered endemic to serpentine soils are also found on gabbro soils (Wilson 1986, Hunter and Horenstein 1991). The soil types are considered similar because they support unique assemblages of plant species, have similar mineral compositions, appear to influence plant distributions in much

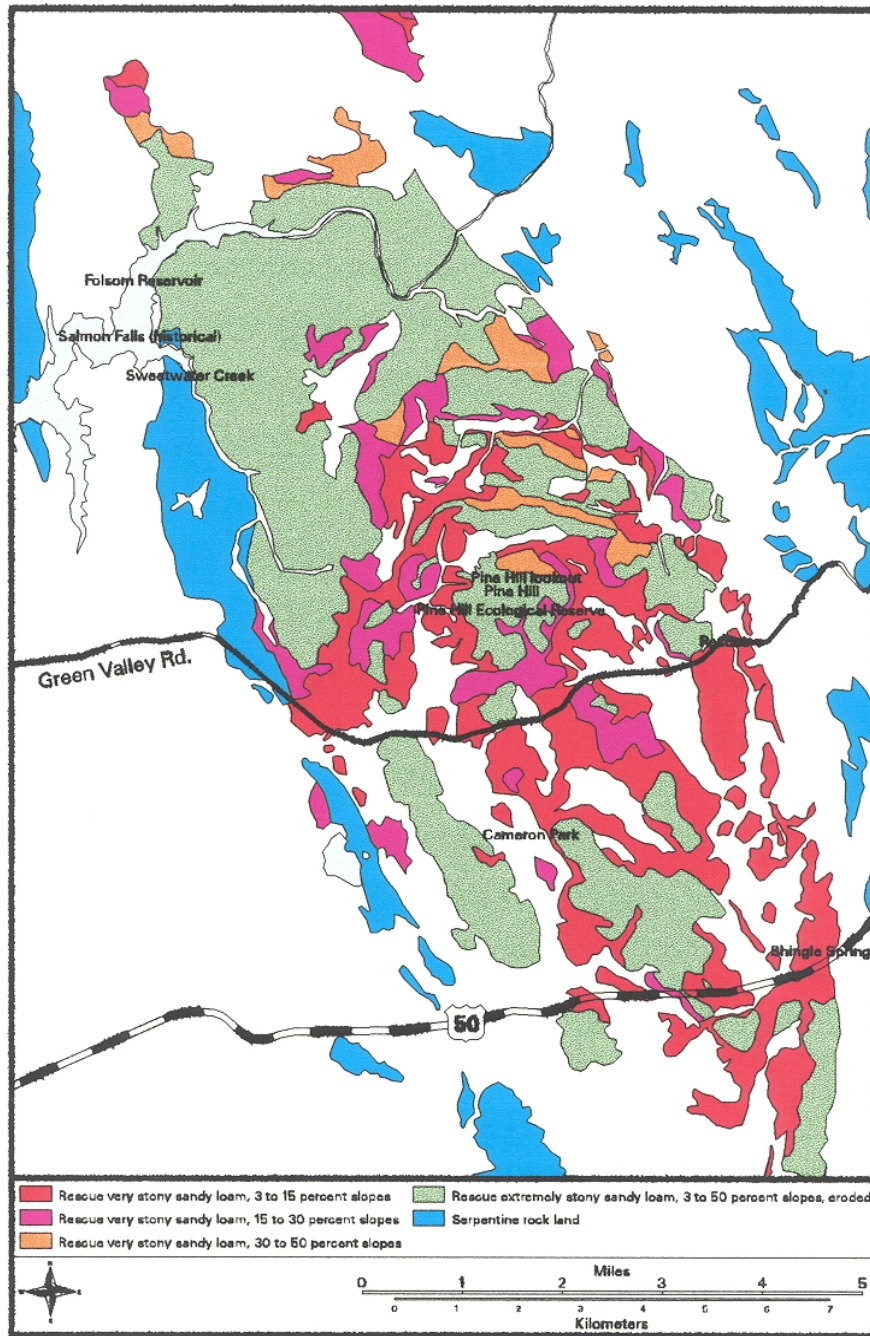


Figure I-3. Map showing Rescue soil series on the Pine Hill formation.

the same way, and are formed through a similar process. However, comparison of serpentine soil quality with that of gabbro soil, as discussed below, indicates they are less similar than previously believed.

Serpentine endemic plants make up 10 percent of the flora within the State of California (Kruckeberg 1984). Despite the high diversity of plant species that are known endemics on serpentine soils, serpentine environs support very little total plant biomass. Serpentine soils are formed from weathered ultramafic (extremely basic) rocks such as serpentinite, dunite, and peridotite. Serpentine soils provide a harsh environment for plant growth. Several factors contribute to the inhospitability of serpentine soils to plant growth including: (1) a low calcium/magnesium ratio; (2) lack of essential nutrients such as nitrogen, potassium, and phosphorous; and (3) high concentrations of heavy metals (mineral toxicity). Species that have been able to colonize these harsh environs have genetically adapted to the barren serpentine condition (Kruckeberg 1984).

Gabbro soils, in comparison, are rich in iron and magnesium and contain low concentrations of cobalt, chromium, and nickel (Wilson 1986; Hunter and Horenstein 1991). Gabbro soils have calcium/magnesium ratios that are slightly lower than those in more silicate rocks that have less calcium, but are much higher than those in serpentine soils (Alexander 1991). The calcium/magnesium ratios of Pine Hill gabbro soils average 1.66 and range from 0.625 to 3.33 (Hunter and Horenstein 1991). Serpentine soils, in comparison, typically have a very low calcium to magnesium ratio, around 1.0. McCarten (1986) found that calcium/magnesium ratios within San Francisco Bay area serpentine soils ranged from 0.04 to 0.7.

Pine Hill gabbro soils are not as inhospitable for the growth of most plants as are serpentine soils. Wilson (1986) studied plant species diversity and vegetation associated with the Pine Hill formation. Nearly 74 percent of the 343 species found within his sample plots in the general area of the Pine Hill formation were found on gabbro soils, while 41 percent of the species were found on serpentine soils. Sample plots on the more common metamorphic and granitic soils of the area were found to contain 66 percent of the area's plant species. Additionally, serpentine soils supported a greater percentage of native plant

species than the gabbro, granite, or metamorphic soils within his study. Serpentine plots contained 76 percent native plant species, as compared to 64 percent in gabbro, 37 percent in granite, and 62 percent in metamorphic soil plots (Wilson 1986).

The reasons for the significant diversity of plant species and the presence of several endemic plant species on the Pine Hill gabbro formation are not fully known. Several other gabbro and serpentine outcrops that occur throughout the Sierra Nevada mountain range do not support endemic species (Hunter and Horenstein 1991).

Most botanists agree that a combination of several different unique conditions are responsible for local endemism of several plant species on the Pine Hill formation. These conditions may include elevation, suboptimum soil fertility in gabbro soils, aspect (northern or southern), steepness of slope, and climate. Pine Hill is a unique ecosystem that covers elevations that are distinctly higher than the surrounding lands. Several plants have found discrete niches on the Pine Hill formation. Both *Pinus ponderosa* (ponderosa pine) and *Calocedrus decurrens* (incense cedar), which occur at the top of Pine Hill, are usually found throughout the mixed conifer zone of the Sierra Nevada Mountains, at higher elevations from 900 to 2,000 meters (3,000 to 6,000 feet). The gabbro soils on Pine Hill are not as favorable for plant growth as are the surrounding granitic and metamorphic substrates that occur off the gabbro formation. The Rescue series soils on Pine Hill are composed of very thin topsoils covered with significant amounts of rock, a condition unfavorable for plant growth. Wilson (1986) found differences in habitat type relative to substrate and aspect. Pine Hill oak woodlands were found on metamorphic north-facing slopes, whereas chaparral was found on north-facing gabbro substrates. The unique combination of factors discussed above partially answer the question of why Pine Hill supports several locally endemic plant species. Before the total picture can be drawn, numerous other factors will need to be considered by future botanists and geologists.

II. SPECIES ACCOUNTS

A. Species Habitats and Descriptions

A total of 740 plant species have been recorded from the Pine Hill gabbro formation and adjoining serpentine and metamorphic rocks. Approximately 10 percent of the native plant species known from California are represented within this tiny fraction of the State (Horenstein and Ehrgott 1997). The vegetation type of this area is distinctive enough that Robert Holland (1986), based upon Wilson (1986), designated a community known as gabbroic northern mixed chaparral, a community restricted to Rescue stony loam soils of western El Dorado County, in the Pine Hill area. Holland (1986) characterized this community as being restricted to ultramafic gabbro soils in a mixed chaparral dominated by *Adenostoma fasciculatum* (chamise), and usually occurring on rather dry or xeric (arid) exposures. Sawyer and Keeler-Wolf (1995) have included gabbroic northern mixed chaparral within the Chamise series and Whiteleaf manzanita series.

Hunter and Horenstein (1991) synthesized information on the vegetation of the Pine Hill formation. The three plant communities occurring on the Pine Hill formation in western El Dorado County are chaparral, woodland, and grassland, which occupy 66.3 percent, 17.6 percent, and 16.9 percent of the Pine Hill formation respectively (Hunter and Horenstein 1991).

Chaparral vegetation is dominated by evergreen woody shrubs that have small thick leaves. Three groupings of chaparral occur on the Pine Hill formation-- dense chaparral, open chaparral, and chaparral-woodland (Figure II-1). Dense chaparral, with greater than 75 percent cover, comprises 21.7 percent of the total area of the Pine Hill formation. Many patches of dense chaparral are nearly pure stands of either *Adenostoma fasciculatum* (chamise) or *Arctostaphylos viscida* (whiteleaf manzanita) with little understory (Hunter and Horenstein 1991). Open chaparral, with a canopy cover of 20 to 75 percent, comprises 21.7 percent of the total area. *Adenostoma fasciculatum* or *Arctostaphylos viscida* are dominants in the open chaparral. Representative

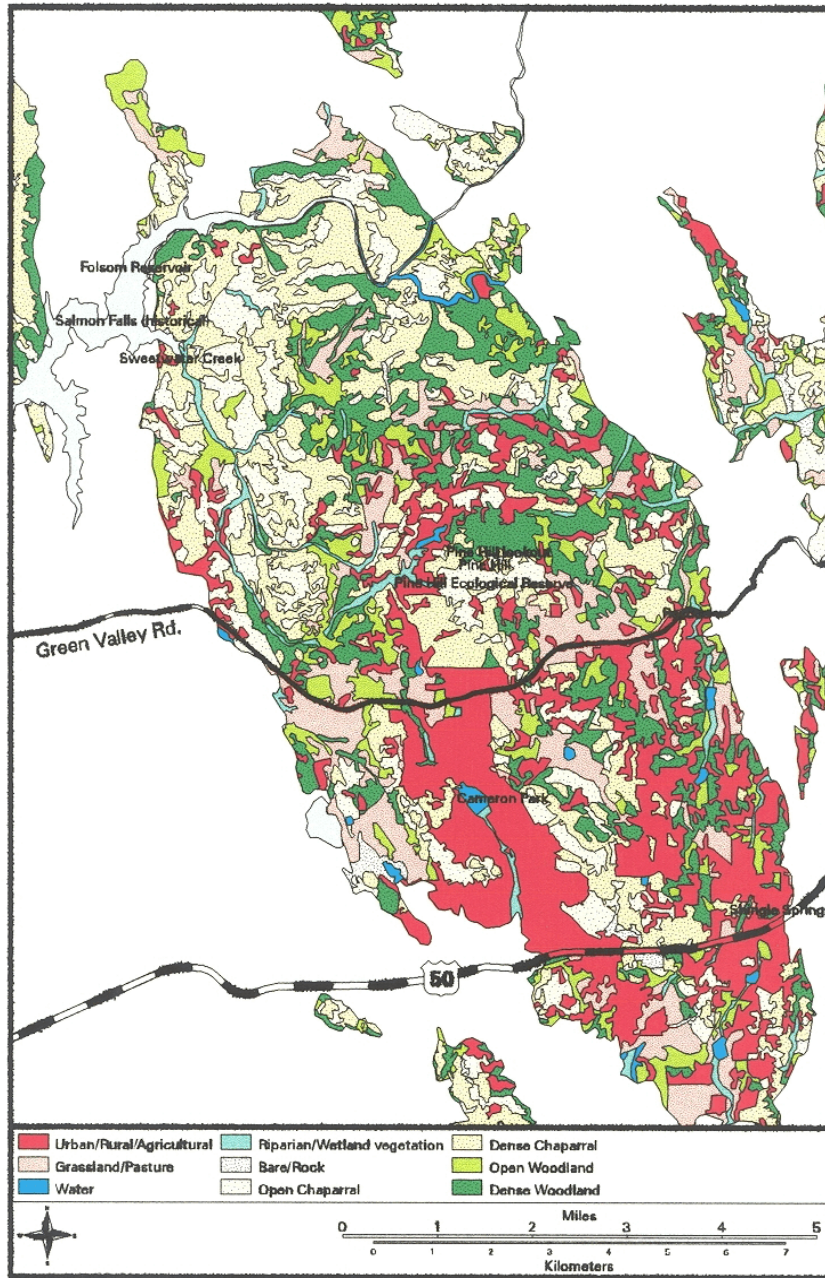


Figure II-1. Map showing vegetation communities on the Pine Hill formation.

understory species include *Lepechinia calycina* (woodbalm), *Diplacus aurantiacus* (orange bush monkeyflower), *Polygala cornuta* (Sierran milkwort), *Salvia sonomensis* (creeping sage), *Brodiaea* spp. (brodiaea), and *Bromus* spp. (brome) (Hunter and Horenstein 1991). Open chaparral patches are highly associated with Rescue extremely stony sandy loam soils, where many of the restricted gabbro species occur. Chaparral-woodland comprises 28.2 percent of the total area and differs from dense chaparral chiefly in that the canopy dominance is shared by trees, mainly *Quercus wislizenii* (interior live oak) and *Cercis occidentalis* (California redbud), and shrubs (Hunter and Horenstein 1991).

Patches of grasslands covering 16.9 percent of the Pine Hill formation are primarily anthropogenic (human-caused). They are dominated by nonnative, primarily annual, grasses and forbs. None of the restricted gabbro species occur in the grasslands (Wilson 1986, Hunter and Horenstein 1991).

Woodland covers 17.6 percent of the area. Typically woodlands have a discontinuous tree canopy, a sub-canopy of shrubs also present in chaparral, some vines, and an herbaceous understory. Although the chaparral dominants *Adenostoma* (chamise) and *Arctostaphylos* spp. (manzanita) are frequently present in the shrub layer, *Cercis occidentalis* (California redbud), *Rhamnus californica* (California buckthorn), and *Heteromeles arbutifolia* (toyon) are more abundant. The vine *Toxicodendron diversiloba* (Pacific poison oak) is abundant within most woodlands. Other vines present include *Clematis virgata* (virgin's bower), *Lonicera hispida* (California honeysuckle), *Galium nuttallii* (climbing bedstraw), *Aristolochia californica* (California dutchman's pipe), *Rubus ursinus* (California blackberry), and *Vitis californica* (California wild grape). A number of herbs that are absent from chaparral occur in the woodlands, such as *Sanicula pinnatifida* (poison sanicle) and *Plantago lanceolata* (narrow leaf plantain) (Hunter and Horenstein 1991).

The woodlands are a heterogeneous group including riparian corridors and oak woodlands. Riparian woodlands are most commonly dominated by *Populus fremontii* (Fremont's cottonwood), *Quercus lobata* (California white oak), and *Salix* (willow) species. Other canopy species frequently present in riparian

woodlands include *Acer negundo* (box elder), *Alnus rhombifolia* (white alder), *Fraxinus latifolia* (Oregon ash), *Styrax officinalis* (drug snowbell), and *Umbellularia californica* (California bay). Outside riparian corridors, *Quercus douglasii* (blue oak) and *Q. wislizenii* (interior live oak) dominate most woodlands, and *Aesculus californica* (California buckeye) and *Pinus sabiniana* (foothill pine) are frequently present. Some patches of woodland are dominated by *Quercus kelloggii* (California black oak) and *Pinus ponderosa* (ponderosa pine), particularly on the north flanks of the higher hills, along the American River Canyon, and in drainages near the American River (Hunter and Horenstein 1991).

Eight rare plant species are associated with gabbroic or serpentine-derived soils near the Pine Hill formation in western El Dorado County within chaparral or woodland communities--the six target species of this recovery plan (Tables II-1 and II-2) plus two other species of concern (*Chlorogalum grandiflorum* [Red Hills soaproot] and *Helianthemum suffrutescens* [Bisbee Peak rush rose]). Because most of their occurrences are not on gabbro soil formations, the two latter species will be covered in other recovery plans for the portion of their range off the Pine Hill formation. On the Pine Hill formation, the gabbro plants occur in three zones or areas (see Figure I-2). The southern zone occurs south of Green Valley Road. The central zone is situated north of Green Valley Road and south of Sweetwater Creek. The northern zone is situated north of Sweetwater Creek.

1. *Calystegia stebbinsii* (Stebbins' Morning-glory)

Taxonomy - Brummitt (1974) described *Calystegia stebbinsii* (Stebbins' morning-glory) from the type collection made by G. Ledyard Stebbins in 1970, 17 kilometers (10 miles) west of Placerville in El Dorado County, California. A type specimen is a specimen or series of specimens chosen when the taxon is described. A taxon (plural=taxa) is any taxonomic grouping of any rank, for example a family, species, or subspecies.

Description - *Calystegia stebbinsii* is a leafy herbaceous perennial (persisting or living for several years with a period of growth each year) in the

Table II-1. Special status plant species associated with gabbro soil in western El Dorado County on the Pine Hill formation.

Species	Known Worldwide Range	Occurrence in Other Counties
<i>Calystegia stebbinsii</i> Stebbins' morning-glory	Northern and southern parts of Pine Hill geologic formation; also, near Grass Valley in Nevada County	Nevada County has one small localized area along McCourtney Road
<i>Ceanothus roderickii</i> Pine Hill ceanothus	Pine Hill geologic formation in El Dorado County; northern, central, and southern areas	None
<i>Fremontodendron californicum</i> ssp. <i>decumbens</i> Pine Hill flannelbush	Within 3.2 kilometers (2 miles) of the summit of Pine Hill in El Dorado County	None verified; specimens from two small populations in Yuba and Nevada Counties need to be identified
<i>Galium californicum</i> ssp. <i>sierrae</i> El Dorado bedstraw	Pine Hill geologic formation in El Dorado County; northern, central, and southern areas	None
<i>Senecio layneae</i> Layne's butterweed	Foothills of El Dorado, Yuba, and Tuolumne Counties	One localized area in Tuolumne County and one small localized area in Yuba County
<i>Wyethia reticulata</i> El Dorado mule-ears	Pine Hill geologic formation in El Dorado County; northern, central and southern areas	None

Table II-2. Estimated percentage distribution of the special status plants within the southern, central, and northern areas of the Pine Hill formation.²

Species	South	Central	North	Other
<i>Calystegia stebbinsii</i> Stebbins' morning-glory	45 percent 174 hectares (430 acres)		47 percent 182 hectares (450 acres)	8 percent 28 hectares (70 acres)
<i>Ceanothus roderickii</i> Pine Hill ceanothus	56 percent 219 hectares (540 acres)	10 percent 40 hectares (100 acres)	34 percent 134 hectares (330 acres)	
<i>Fremontodendron californicum</i> ssp. <i>decumbens</i> Pine Hill flannelbush		100 percent 154 hectares (380 acres)		
<i>Galium californicum</i> ssp. <i>sierrae</i> El Dorado bedstraw	58 percent 57 hectares (140 acres)	17 percent 16 hectares (40 acres)	25 percent 24 hectares (60 acres)	
<i>Senecio layneae</i> Layne's butterweed	49 percent 198 hectares (490 acres)	12 percent 47 hectares (115 acres)	6 percent 24 hectares (60 acres)	33 percent 134 hectares (330 acres)
<i>Wyethia reticulata</i> El Dorado mule-ears	57 percent 287 hectares (710 acres)	30 percent 150 hectares (370 acres)	13 percent 65 hectares (160 acres)	

²See Figure I-2 for locations of the south, central, and north areas within the Pine Hill formation. Estimation of acreage based on California Natural Diversity Data Base (1997).

morning-glory family (Convolvulaceae) (Figure II-2). Its stems, which range up to 1 meter (3.3 feet) in length, generally lie flat on the ground. The leaves are palmately lobed (lobing radiating from a common point) with the two outermost lobes (major expansion or bulge) being divided again. The leaf lobes are narrow and lance-shaped. White flowers are on stalks 3 to 13 centimeters (1 to 5 inches) long and bear two leaf-like bracts. The fruit is a slender capsule. *Calystegia stebbinsii* flowers from May through June. *Calystegia occidentalis* (chaparral false bindweed) and *C. purpurata* ssp. *saxicola* (Pacific false bindweed) also occur on gabbro-derived soils in the Pine Hill area (Wilson 1986). *Calystegia stebbinsii* can be distinguished from other California morning-glories by its distinctively shaped leaves, each having 7 to 9 narrow lance-shaped lobes.

Historical and Current Distribution - *Calystegia stebbinsii* occurs in two localized areas. Most occurrences of *C. stebbinsii* are discontinuously scattered within two population centers in the northern and southern portions of the Pine Hill formation (Figure II-3). An occurrence is defined by the California Natural Diversity Data Base as a location separated from other locations of the species by at least one-fourth mile; an occurrence may contain all or part of one or more populations. *Calystegia stebbinsii* does not occur in the central part of the Pine Hill formation. *Calystegia stebbinsii* in El Dorado County is associated with chaparral on gabbroic soils. It occurs within openings within chaparral, associated with *Arctostaphylos viscida* (whiteleaf manzanita). In 1991, it was discovered in Nevada County near the County landfill, where it was sparsely scattered over a distance of 6.5 kilometers (3.5 miles) (California Natural Diversity Data Base 1998). In Nevada County it occurs on serpentine in chaparral associated with *Adenostoma fasciculatum* (chamise), *Arctostaphylos* sp. (manzanita), and *Pinus sabiniana* (foothill pine) (California Natural Diversity Data Base 1998).

2. *Ceanothus roderickii* (Pine Hill Ceanothus)

Taxonomy - Beecher Crampton first collected *Ceanothus roderickii* (Pine Hill ceanothus) from Pine Hill in El Dorado County, California on June 1, 1956. The type specimen for *C. roderickii* was collected from “approximately 3 miles west of Shingle Springs, California” by Walter and Irja Knight. Walter

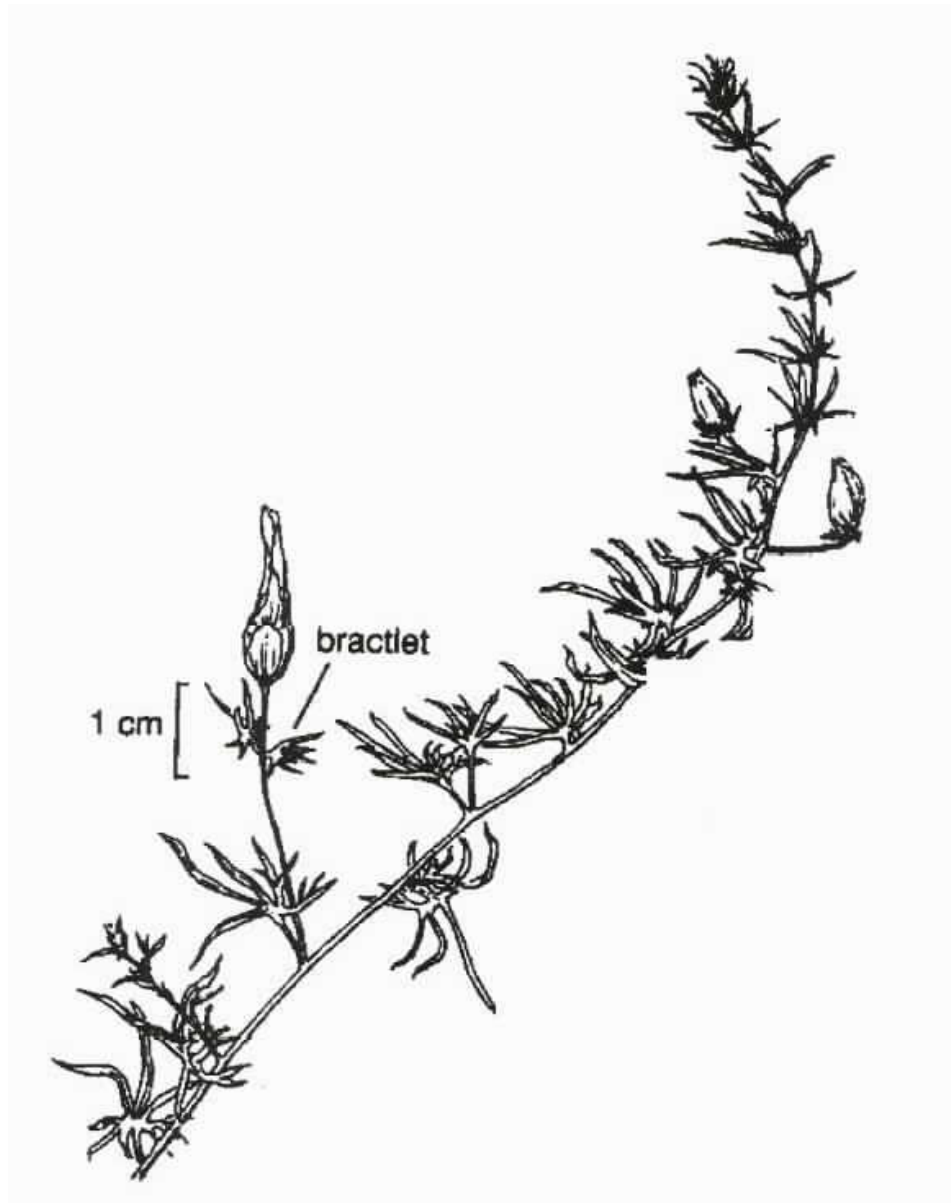


Figure II-2. Illustration of *Calystegia stebbinsii* (Stebbins' morning-glory) (from Hickman 1993, with permission).

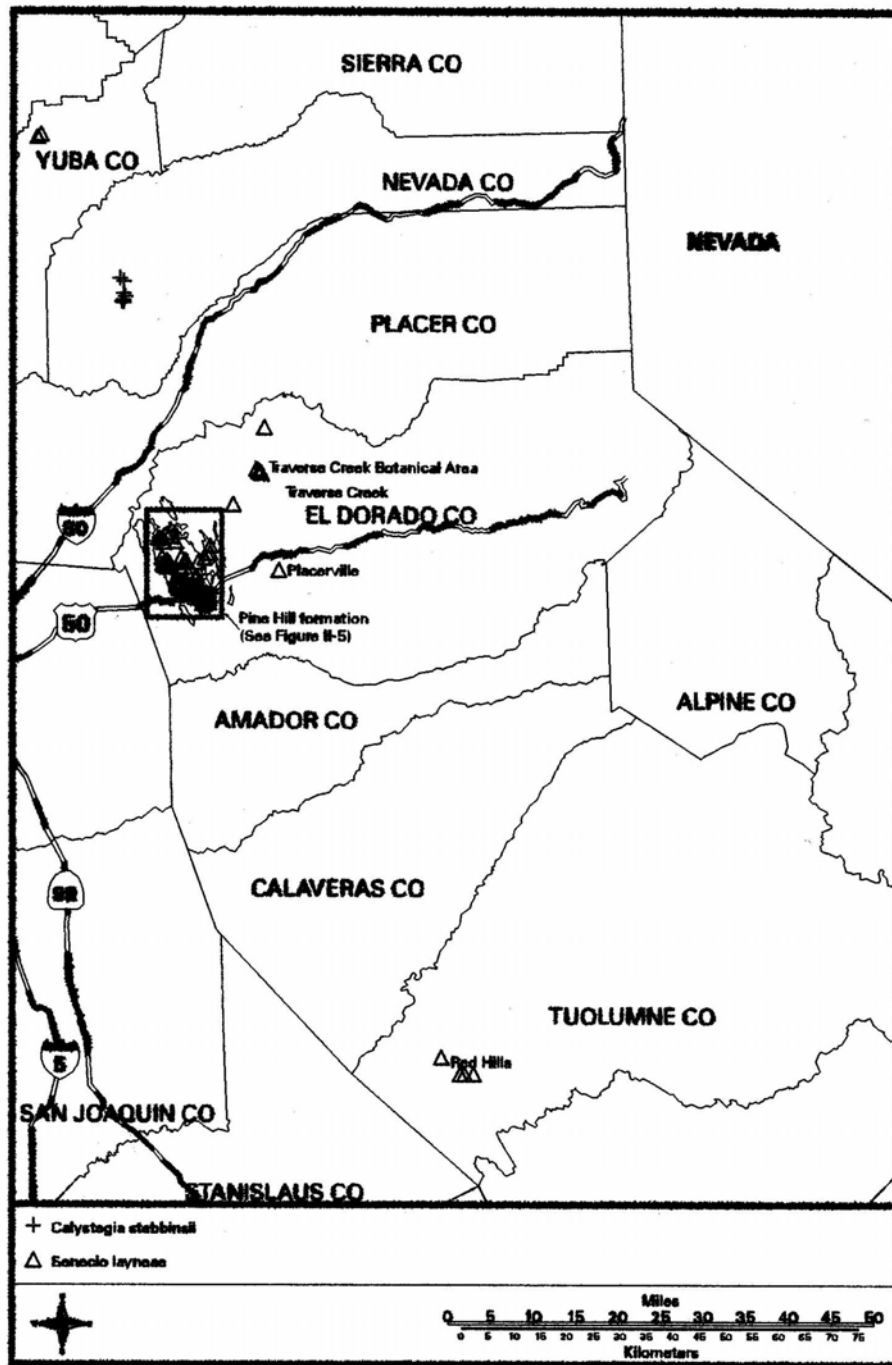


Figure II-3. Distribution of *Calystegia stebbinsii* and *Senecio layneae*. Enlargement of the boxed area is provided on Page II-12, Figure II-5.

Knight (1968) described *Ceanothus roderickii* as *Ceanothus rodericki*, naming it after Wayne Roderick, who first recognized the horticultural value of this endemic shrub. Due to an orthographic change, the correct spelling is *Ceanothus roderickii*. Knight (1968) considered *C. roderickii* to be most closely related to *C. cuneatus* (buckbrush), which also grows throughout the area. *Ceanothus roderickii* is suggested to resemble the sprawling *C. fresnensis* (Fresno mat), which grows a considerable distance to the south at higher elevations; plants of the two species grown in a regional park flowered at different times (Knight 1968). *Ceanothus cuneatus* (buckbrush), *C. integerrimus* (deerbrush), *C. lemmonii* (Lemmon's ceanothus), *C. leucodermis* (chaparral whitethorn), and *C. palmeri* (Palmer ceanothus) also occur on the Pine Hill gabbro complex and in the surrounding area (Wilson 1986).

Description - *Ceanothus roderickii* (Figure II-4) is a prostrate evergreen shrub of the buckthorn family (Rhamnaceae) that generally grows to 3 meters (9.8 feet) in diameter. The smooth gray-brown branches radiate from a central axis and root when they come into contact with the ground. Its leaves are semi-erect with entire (smooth-edged) margins. Small whitish flowers tinged with blue appear from May through June. Its fruit is an inconspicuously horned, globe-shaped capsule. *Ceanothus roderickii* can be differentiated from its congeners (other species of the same genus, other related species) by a combination of its blue-tinged flowers, prostrate habit, and inconspicuously horned fruit.

Historical and Current Distribution - *Ceanothus roderickii* is restricted to gabbro soil in openings in chaparral or less frequently on previously disturbed sites within chaparral (Wilson 1986). It is restricted to one localized area of approximately 10 known extant occurrences discontinuously scattered in the Pine Hill formation in the north, central, and south areas (California Natural Diversity Data Base 1998) (Figure II-5).

3. *Fremontodendron californicum* ssp. *decumbens* (Pine Hill Flannelbush)

Taxonomy - Beecher Crampton made the first collection of *Fremontodendron californicum* ssp. *decumbens* in 1956. Robert M. Lloyd (1965)

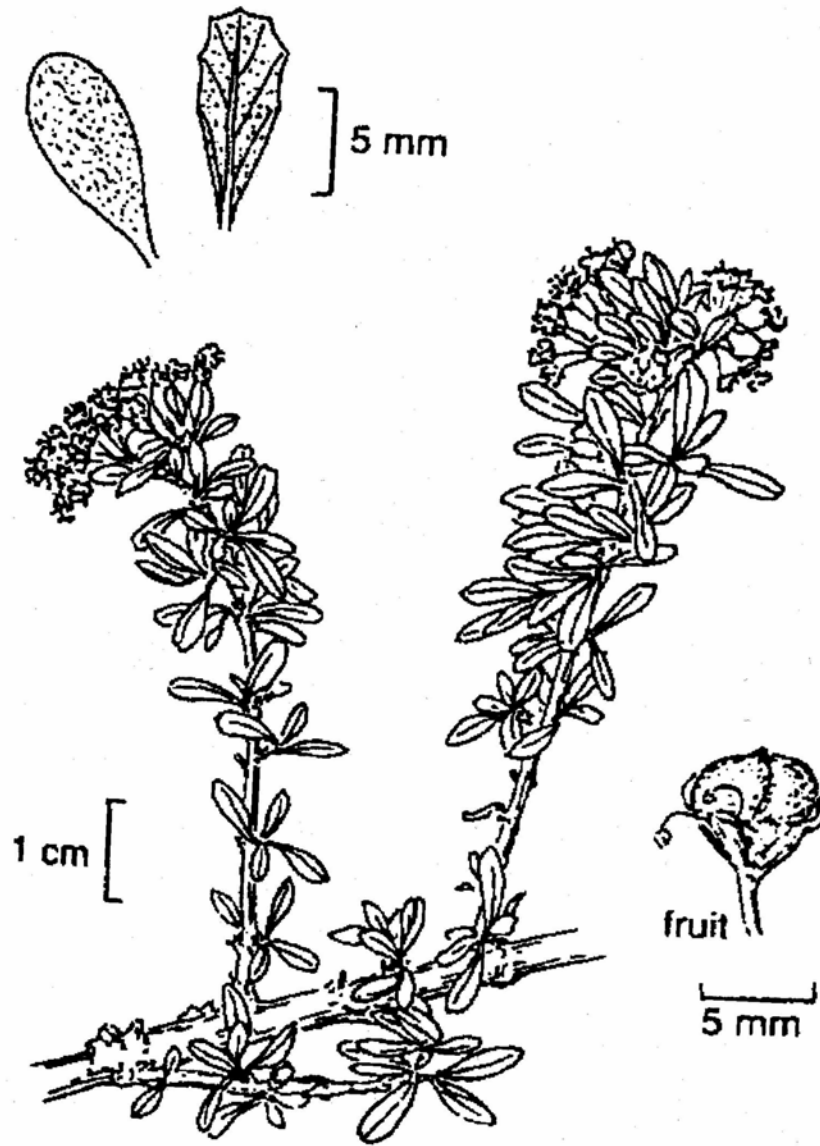


Figure II-4. Illustration of *Ceanothus roderickii* (Pine Hill ceanothus) (from Hickman 1993, with permission).

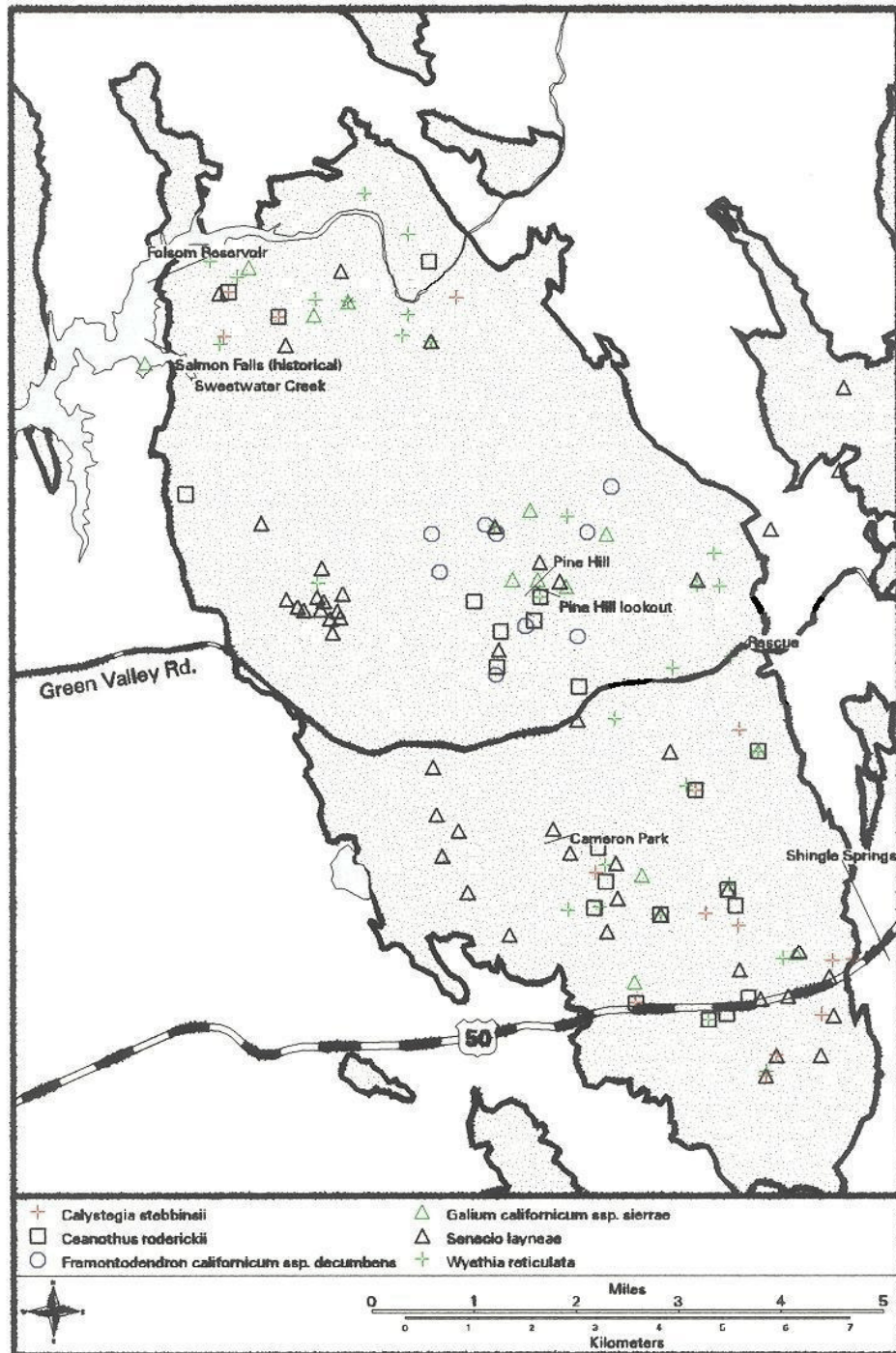


Figure II-5. Distribution of gabbro plants on the Pine Hill formation. Data from California Natural Diversity Database (1998)

described *F. californicum* ssp. *decumbens* as *F. decumbens* based on the type specimen he collected in May 1964 from "California, El Dorado Co., Pine Hill, ca. 3 kilometers north of Rescue." Munz (1968) reduced *F. decumbens* to a subspecies of *F. californicum*. Kelman (1991), in his revision of *Fremontodendron*, recognized *F. californicum* ssp. *decumbens* as a full species based upon morphological variation. This taxon currently is known as *Fremontodendron californicum* ssp. *decumbens* (Whetstone and Atkinson 1993).

Description - *Fremontodendron californicum* ssp. *decumbens*

(Figure II-6) is a branched spreading shrub of the cacao family (Sterculiaceae) growing to 1.3 meters (4 feet) tall. Dense star-shaped hairs cover the leaves and the younger twigs and branchlets. Its leaves are elliptic-ovate to ovate, shallowly or deeply palmately lobed with 5 to 7 lobes. *Fremontodendron californicum* ssp. *decumbens* produces flower buds in late winter. Showy light-orange to reddish-brown flowers appear from late April to early July. Its fruit is a capsule. *Fremontodendron californicum* ssp. *decumbens* can be distinguished from *F. californicum* ssp. *californicum* and *F. mexicanum* (Mexican flannelbush) by its decumbent growth habit (stems lying on the ground and growing upward only at the tip), its relatively long peduncles (stalks that support the inflorescence), and its copper-orange flowers.

Historical and Current Distribution - *Fremontodendron californicum* ssp.

decumbens occurs on scattered rocky outcrops in chaparral on and in the vicinity of Pine Hill and in the black oak woodland on Pine Hill (L. Eng *in litt.* 1999). Community associates are *Pinus ponderosa* (ponderosa pine), *P. sabiniana* (foothill pine), *Adenostoma fasciculatum* (chamise), *Heteromeles arbutifolia* (toyon), and *Arctostaphylos glauca* (bigberry manzanita) (Kelman 1991, Boyd 1996). It is only known from one localized area near Pine Hill in western El Dorado County, scattered within an area of approximately 2,000 hectares (5,000 acres) (Figure II-5). Although there are some reports of *F. californicum* ssp. *decumbens* occurring in some small scattered populations in Yuba or Nevada County, other reports describe these individuals as aberrant *F. californicum* ssp. *californicum* (California flannelbush). Most occurrences of *Fremontodendron californicum* ssp. *decumbens* are on private land (California Natural Diversity Data Base 1998). One occurrence is on Bureau of Land Management land and

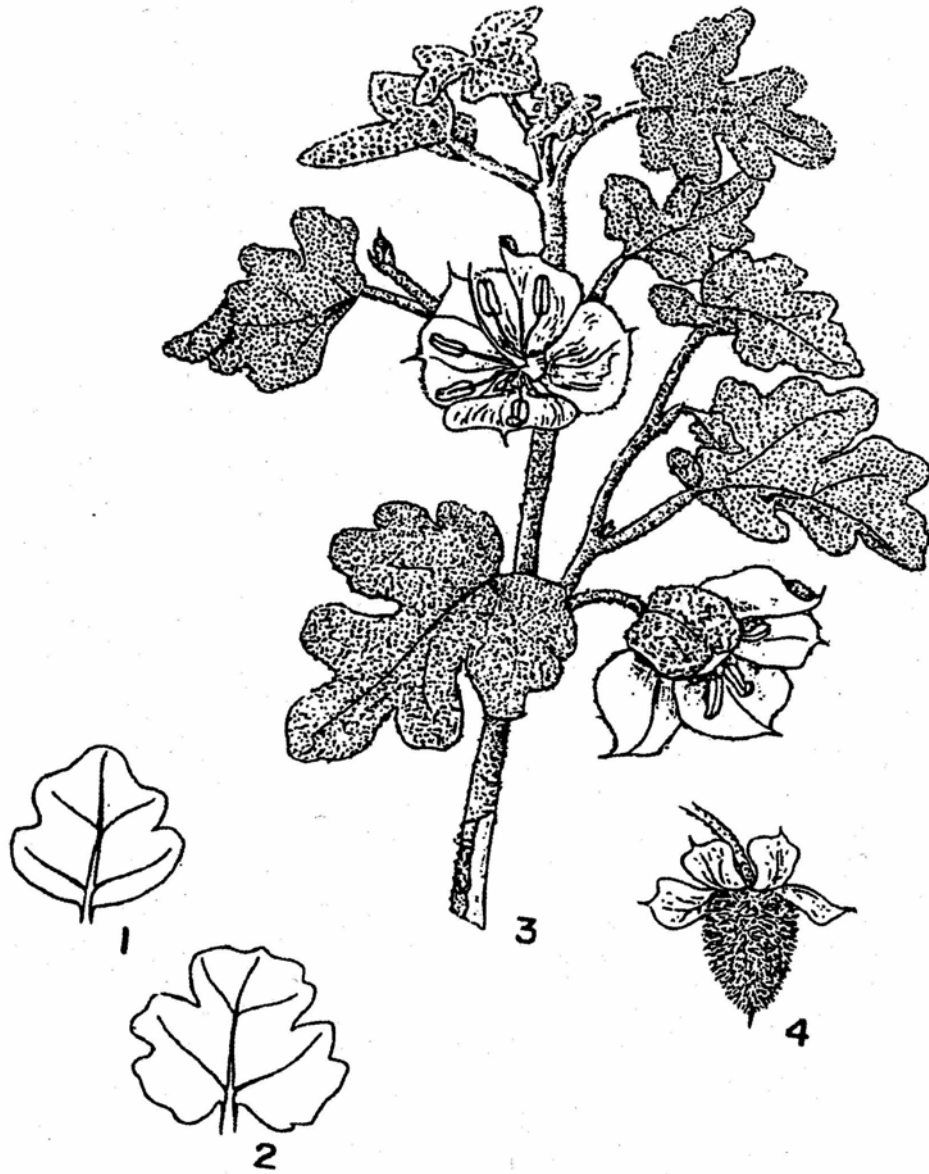


Figure II-6. Illustration of *Fremontodendron californicum* ssp. *decumbens* (Pine Hill flannelbush), from Lloyd (1965). Reprinted with permission from *Brittonia*, figures 1-4, p. 383, vol. 17 no. 4, copyright 1965, The New York Botanical Garden.

one occurrence is on California Department of Fish and Game and California Department of Forestry and Fire Protection lands (California Natural Diversity Data Base 1998). Presently, the majority of the *F. californicum* ssp. *decumbens* individuals are located on the parcel managed by the California Department of Forestry and Fire Protection on Pine Hill, and on a nearby private parcel (L. Eng *in litt.* 1999).

4. *Galium californicum* ssp. *sierrae* (El Dorado Bedstraw)

Taxonomy - The type specimen for *Galium californicum* ssp. *sierrae* was collected 1.7 kilometers (1 mile) north of Pine Hill Lookout in western El Dorado County, California. Dempster and Stebbins (1968) described *G. californicum* ssp. *sierrae*.

Description - *Galium californicum* ssp. *sierrae* (Figure II-7) is a softly hairy perennial herb in the coffee family (Rubiaceae). Four narrow leaves are arranged at each node. The pale yellow flowers, which are clustered at the tips of stems, appear in May and June. Minute hairs cover the fleshy fruit. *Galium aparine* (stickywilly), *G. bolanderi* (Bolander's bedstraw), *G. divericatum* (Lamarck's bedstraw), *G. porrigens* var. *tenue* (graceful bedstraw), *G. parisiense* (wall bedstraw), and *G. pubens* (limestone bedstraw) also occur on gabbro-derived soils in the Pine Hill area (Wilson 1986). *Galium californicum* ssp. *sierrae* is not easily confused with any other species of *Galium* (Dempster 1977) and can be distinguished from other subspecies of *G. californicum* by its very narrow leaves.

Historical and Current Distribution - *Galium californicum* ssp. *sierrae* is restricted to the Pine Hill formation in the north, central, and south areas (Figure II-5). *Galium californicum* ssp. *sierrae* inhabits oak woodland areas, including sites with *Pinus ponderosa* (ponderosa pine) and *Pinus sabiniana* (foothill pine) (Wilson 1986). It occurs within black oak woodland on Pine Hill and Cameron Park and within live oak woodland in Shingle Springs and Salmon Falls (L. Eng *in litt.* 1999). At the time of listing *Galium californicum* ssp. *sierrae* occurred primarily on private land. The Bureau of Land Management manages at least one population. One occurrence is located on two parcels that are separately owned by the California Department of Forestry and Fire Protection and the California Department of Fish and Game but jointly managed by both agencies.

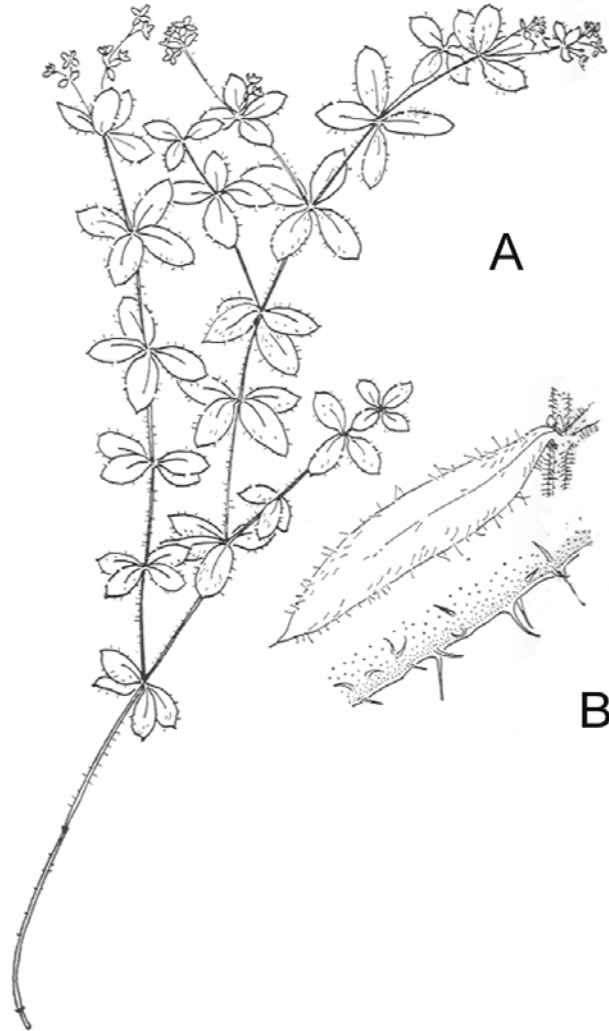


Figure II-7. Illustration of *Galium californicum* ssp. *sierrae* (El Dorado Bedstraw) (from Dempster and Stebbins 1968, with permission). A. Whole plant. B. Closeup of leaf.

5. *Senecio layneae* (Layne's Butterweed)

Taxonomy - Kate Layne-Curran collected the type specimen for *Senecio layneae* in May 1883 from El Dorado County, California, on Sweetwater Creek, not far from Folsom. Edward L. Greene first described *S. layneae* in 1883 (Greene 1883). Although Asa Gray (1884) reduced *S. layneae* to a variety of *S. fastigiatus*, it currently is known as *S. layneae* (Barkley 1993). *Senecio layneae* is a member of the aureoid group of *Senecio* that is united by most of the following characters: perennial herbs arising from creeping rootstocks or a stout caudex; well developed basal leaves with cauline (arising from the upper part of the stem) leaves progressively reduced upward; leaf margins without callose denticles (hard teeth); thin branching fibrous roots; and haploid chromosome numbers 22 or 23, or derived from these numbers (Barkley 1988). The aureoid group of *Senecio* is now known by some as the genus *Packera*. The type population of *S. layneae* is now thought to be extirpated due to inundation by Folsom Lake.

Description - *Senecio layneae* (Figure II-8) is a perennial herb of the aster family (Asteraceae) that sprouts from a rootstock. Its mostly basal lance-shaped leaves are 8 to 24 centimeters (3 to 10 inches) long. The several flower heads are 4 to 6 centimeters (2 to 3 inches) wide. Each flower head has 5 to 8 orange-yellow ray flowers (the flowers usually located on the edge of the inflorescence of members of the aster family) and numerous yellow disk flowers (flowers in the center portion of an inflorescence of a member of the aster family). *Senecio aronicoides* (rayless groundsel), *S. flaccidus* var. *douglasii* (Douglas' groundsel), and *S. vulgaris* (common groundsel) also occur on gabbro-derived soils in the Pine Hill area (Wilson 1986). These *Senecio* species can variously be differentiated from *S. layneae* by a combination of life form, type of flower, number of flower heads, flower color, and pubescence.



Figure II-8. Illustration of *Senecio layneae* (Layne's butterweed) (from Abrams and Ferris 1960, with permission).

Historical and Current Distribution - *Senecio layneae* grows in open rocky areas within chaparral plant communities, primarily on gabbro soil formations and occasionally on serpentine soils. Most known sites are scattered within a 16,200-hectare (40,000-acre) area in western El Dorado County that includes the Pine Hill formation and adjacent serpentine (Figure II-3). A few other colonies occur in the Eldorado National Forest in El Dorado County, in the Bureau of Land Management Red Hills Management Area in Tuolumne County, and on Bureau of Land Management managed land in Yuba County (BioSystems Analysis, Inc. 1984, A. Franklin pers. comm. 1997) (Figure II-2). At the time of listing, *Senecio layneae* primarily occurred on privately owned land. As of 1998, one site on the Pine Hill formation was managed by the California Department of Forestry and Fire Protection and California Department of Fish and Game; and two sites on the Pine Hill formation were managed by the Bureau of Land Management (California Natural Diversity Data Base 1998). Additional sites are now under BLM management. At Traverse Creek on the Eldorado National Forest, *Senecio layneae* occurs on serpentine soil within chaparral associated with *Ceanothus cuneatus* (buckbrush), *Quercus dumosa* (blue oak), and *Pinus sabiniana* (foothill pine) (California Natural Diversity Data Base 1998). In other parts of the National Forest, *S. layneae* is also associated with *Umbellularia californica* (California bay).

6. *Wyethia reticulata* (El Dorado Mule-ears)

Taxonomy - Kate Layne-Curran collected the type specimen for *Wyethia reticulata* in July 1883 from “Sweetwater Creek,” El Dorado County, California. Edward L. Greene first described *W. reticulata* in 1884 (Greene 1884).

Description - *Wyethia reticulata* (Figure II-9) is a clonal perennial in the aster family (Asteraceae) that grows to 1 meter tall (3.3 feet). *Wyethia reticulata* spreads extensively by underground rhizomes and has populations dominated by a few large individuals (Ayres and Ryan 1995, 1997a). Its leaves are cauline, ovate lanceolate to deltoid (triangular); the largest are 5 to 20 centimeters (2 to 8 inches) long and 8 to 12 centimeters (3 to 4.5 inches) wide. The one to four yellow flower heads are 2.5 to 4 centimeters (1 to 1.6 inches) wide. The fruits (achenes) may be dispersed by water or wind (P. Zedler *in litt.* 1999). *Wyethia*



Figure II-9. Illustration of *Wyethia reticulata* (El Dorado mule-ears) (from Abrams and Ferris 1960, with permission).

angustifolia (California compassplant), *W. boldanderi* (Bolander's mulesears), and *W. helenioides* (whitehead wyethia) also occur on gabbro-derived soils in the Pine Hill area (Wilson 1986). *Wyethia reticulata* can be differentiated from other *Wyethia* that occur in the area by its cauline, deltoid leaves (Wilson 1986).

Historical and Current Distribution - *Wyethia reticulata* is restricted to the Pine Hill gabbro formation in western El Dorado County where it grows in open rocky areas within chaparral plant communities on gabbro soil formations (Figure II-5). Sites are patchily distributed within the chaparral community (Ayres and Ryan 1997b). *Wyethia reticulata* primarily occurs on privately owned land. Some populations of *W. reticulata* also occur on Federal land managed by the Bureau of Land Management. One site occurs on two parcels that are owned separately by the California Department of Forestry and Fire Protection and the California Department of Fish and Game but jointly managed by both agencies. *Wyethia reticulata* occurs in chaparral, cismontane woodland, and lower montane coniferous forest on stony red clay and gabbroic soils at 370 to 460 meters (1,200 to 1,500 feet) (California Natural Diversity Data Base 1998).

B. Demography and Ecology

1. *Calystegia stebbinsii* (Stebbins' Morning-glory)

Calystegia stebbinsii is a perennial herb that flowers from May through June. *Calystegia stebbinsii* appears to emerge from a dormant seed bank or rootstock after disturbance. The plants grow and begin to flower in the year following germination or re-emergence. While an above-ground shoot may appear in the same spot for only several years, other portions of this plant's extensive root system might survive much longer (L. Eng *in litt.* 1999). The plant re-establishes a seedbank before disappearing (Nosal 1997). *Calystegia stebbinsii* seems to be shade intolerant and does not occur beneath a closed canopy of vegetation (Baad and Hanna 1987).

Nosal (1997) studied *Calystegia stebbinsii* focusing on seed germination requirements, pollination, and reproductive potential. His study was conducted at three sites--two in El Dorado County (near Shingle Springs and Salmon Falls) and

one in Nevada County near Grass Valley (Nosal 1997). *Calystegia stebbinsii* seeds were tested to find out their response to the following seven treatments: potting soil, charred wood, Secca series soil, Rescue series soil, scarification (cutting or abrasion), heat (5 minutes at 100 degrees Centigrade [212 degrees Fahrenheit]), and cold stratification (ways to germinate seeds) (Nosal 1997). Seeds germinated readily only after either scarification or heat treatments. Treatments using cold stratification, charred wood, Secca series soils (the type of soil at the Nevada County location), and Rescue series soils (the type of soil at the El Dorado County locations) resulted in 0 to 5 percent germination rates. Scarification resulted in 100 percent, and heat treatment 81 percent, germination rates (Nosal 1997).

Pollination studies showed that animal vectors were needed for successful seed set. None of the bagged flower buds produced fruit. Seed set in unbagged plants varied from 25 percent at Grass Valley to 50 percent at Salmon Falls and 65 percent in Shingle Springs. Observations showed that *Calystegia stebbinsii* is only pollinated by insects. Eighty percent of all visits were made by Hymenoptera, the Halictidae (solitary bees) and Apidae (honey bees) being the most important families (Nosal 1997).

At each site, data were collected on the number of flowering plants, number of non-flowering plants, number of stems per flowering plant, and number of seed capsules produced on stems within each plot sampled. Seed production ranged from an average of 20.6 seeds per square meter (1.9 seeds per square foot) at Grass Valley to 380 seeds per square meter (35.3 seeds per square foot) at Salmon Falls. Plant density ranged from an average of 1.09 plants per square meter (0.10 plant per square foot) at Grass Valley to 12.1 plants per square meter (1.1 plants per square foot) at Salmon Falls. The average number of stems per plant ranged from 1.59 to 2.07. Recruitment (the number of non-flowering plants) varied from 0.038 plant per square meter (0.0035 plant per square foot) per year at Grass Valley to 0.97 plant per square meter (0.09 plant per square foot) per year at Shingle Springs (Nosal 1997).

Troutwine (1996) conducted a preliminary isozyme study of the genetic diversity among and within three populations of *Calystegia stebbinsii*. The

genetic diversity of *Calystegia stebbinsii* was also compared with two common species, *Calystegia occidentalis* ssp. *occidentalis* (western morning-glory) and *Convolvulus arvensis* (common field bindweed). Samples of leaf tissue of *Calystegia stebbinsii* were obtained from three sites--two in El Dorado County (near Shingle Springs and Salmon Falls) and one in Nevada County near Grass Valley. The preliminary data showed no genetic differentiation among the three *Calystegia stebbinsii* populations (Troutwine 1996). It must be emphasized that this study is based on only four loci from four enzymes, and a more detailed study is needed before any conclusions can be drawn about genetic variation within and among populations of *Calystegia stebbinsii*.

2. *Ceanothus roderickii* (Pine Hill Ceanothus)

Ceanothus roderickii is a shrub that flowers from May to June. It does not resprout from its crown after a fire as do most chaparral shrub species, and therefore depends on re-establishment from seeds after a fire. After a fire, *C. roderickii* sprouts and proliferates before the formation of overgrowth from *Arctostaphylos viscida* (whiteleaf manzanita) and *Adenostoma fasciculatum* (chamise) (James 1996). Other obligate seeding *Ceanothus* species need to be about 25 years old before fire for enough seeds to accumulate in the seedbank to replace the population (V. Parker pers. comm. 1998). If fire occurs frequently, the seedbank may be insufficient for population replacement. Reported population sizes for *C. roderickii* vary from 3 plants to over 1,000 plants (California Natural Diversity Data Base 1998). No data are available on the genetic structure (*i.e.*, which populations are most genetically variable or how genetic variation is distributed among populations) of this species.

James (1996) conducted a demographic and ecological study of *Ceanothus roderickii* focusing on germination requirements, pollination biology, and reproductive potential. His study was conducted at sites near Shingle Springs, Cameron Park, and Pine Hill on the Pine Hill formation.

One-year-old and 2-year-old *Ceanothus roderickii* seeds were subjected to a variety of hot and cold treatments and lighting conditions to determine the effect on seed germination from the treatments. Little or no germination was observed

in the heat treated or control seeds. The seeds treated with a combination of heat and cold had the best germination rate (86.6 percent germination). Seeds treated only with cold had a 20 percent germination rate. One-year-old seeds germinated at a rate significantly lower than 2-year-old seeds (James 1996).

Pollination studies showed that animal pollinators were required for reproductive success. The pollination of *Ceanothus roderickii* is primarily by insects from the orders Diptera (flies and gnats) and Hymenoptera (bees and wasps). The pollinators were not specific only to *C. roderickii* and were observed visiting other plants (James 1996).

The effects of shading by canopy species on the reproductive potential of *Ceanothus roderickii* was studied on the south and east facing slopes of Pine Hill on the Pine Hill formation in western El Dorado County. One focus of the study was to determine whether there might be a decrease in the reproductive potential of *C. roderickii* as time passes after a fire or other disturbance from shading by other canopy species. Canopy shading was shown to affect flower and fruit production in *C. roderickii*. The highest flower and fruit production was correlated with high solar intensity in the morning. However, no correlation existed between high intensity afternoon solar intensity and increased flower or fruit production (James 1996).

3. *Fremontodendron californicum* ssp. *decumbens* (Pine Hill Flannelbush)

Fremontodendron californicum ssp. *decumbens* is a perennial shrub that flowers from late April to early July (California Native Plant Society 1994). Boyd and Serafini (1992) summarized the life cycle of *F. californicum* ssp. *decumbens*. Plants start producing flower buds in late winter. By the time the flowers open, most of the flower buds have been destroyed (Boyd and Serafini 1992). Native solitary bees pollinate the flowers (Boyd 1994). Seventy percent of the developing fruit is destroyed by insects prior to maturing. The remaining fruit dehisces (opens up) during summer and releases seeds onto the soil. The seeds are eaten by rodents and dispersed by harvester ants (*Messor andrei*) (Boyd 1996). The total number of individuals of *F. californicum* ssp. *decumbens* is about 500 (Horenstein and Ehrgott 1997).

Boyd and Serafini (1992) studied predehiscence attrition (loss of flower buds, flowers, and immature fruits prior to the fruit opening); postdehiscence attrition (seed predation); seed germination; seed longevity; seed establishment and survival; and population structure of *Fremontodendron californicum* ssp. *decumbens*. In studying reproductive attrition (decrease in the number of reproductive structures, flowers, fruits, seeds), Boyd and Serafini (1992) found the production of seeds in *F. californicum* ssp. *decumbens* was severely limited by insect predation. Over 98 percent of flower buds failed to produce fruit because of predation by insects. In addition, rodents destroyed 90 percent of seeds under shrubs within 8 to 10 months (Boyd and Serafini 1992). Boyd and Serafini (1992) also found that *F. californicum* ssp. *decumbens* cannot establish seedlings without fire. They concluded that over a time span longer than at least a few decades, sexual reproduction may be necessary in order to maintain genetic diversity and establish plants at new locations within the boundaries of the current populations (Boyd and Serafini 1992).

Effects on seed germination of scarification by heat or mechanical methods, stratification, inhibitors in the seed coat, and the presence of *Adenostoma fasciculatum* (chamise) were examined (Boyd and Serafini 1992). Seven treatments were used: (1) no treatment; (2) stratifying seeds at 5 degrees Celsius (41 degrees Fahrenheit) for 3 weeks; (3) scarifying seeds by rubbing them on sand paper; (4) scarifying and stratifying the seeds (a combination of treatments 2 and 3); (5) removing the seed coat completely; (6) heating the seeds at 100 degrees Celsius (212 degrees Fahrenheit) for 5 minutes; and (7) heating the seeds as in treatment 6, but then planting the seeds in ground charcoal and ash from *A. fasciculatum*. Treatments that disturbed the seed coat (scarifying, heating) increased germination rates 18 to 26-fold over untreated seeds. The highest germination rate, 72.2 percent, was obtained when heat treated seeds were planted in ash from *A. fasciculatum* (Boyd and Serafini 1992).

Two experiments on seed longevity of *Fremontodendron californicum* ssp. *decumbens* were performed and established that *F. californicum* ssp. *decumbens* seeds are able to survive for years in the soil (Boyd and Serafini 1992). One set of experiments used plants from the University of California Davis' arboretum; the second set used plants from Pine Hill. In the first

experiment, seeds from *F. californicum* ssp. *decumbens* arboretum plants were put in sleeves and covered with mesh cloth (to protect them from predation by rodents), placed on the soil surface, and covered with leaf litter in 1982. The sleeves were recovered in June 1989 and the number of intact seeds was counted and seed viability of any remaining seeds was checked. In the second experiment, seeds from dehisced fruit and seed bank seeds (older seeds from the soil) around the *F. californicum* ssp. *decumbens* plants on Pine Hill were used. The seeds were set out in the field in 1983, in a similar manner as the first experiments, and recovered in 1989. Again, the intact seeds and seed viability were checked. The viability of the arboretum seeds after nearly 7 years was 96 percent. The survival rates of the fresh and seed bank seeds from Pine Hill were not significantly different from each other (about 83 percent).

In studying seedling establishment and survival, Boyd and Serafini (1992) found that none of the 12 natural seedlings that were found, nor the seedlings that were planted in pots, survived. Most of the seedlings were destroyed by predators. Those that had escaped predation eventually died from drought.

Fremontodendron californicum ssp. *decumbens* plants at two sites on Pine Hill were mapped and measured to determine population structure (Boyd and Serafini 1992). Site 1 shrubs were mapped in 1982 and measured in 1986. Site 2 shrubs were mapped and measured in February 1984. Both sites contained a large proportion of small shrubs. Almost all of the shrubs were multi-stemmed. Some of the small shrubs were associated with recent human disturbance (Boyd and Serafini 1992).

Boyd (1994) studied pollination biology of *Fremontodendron californicum* ssp. *decumbens*. Basic information on importance of floral visitors to seed production, limitations to reproduction from pollen availability, and behavior of floral visitors was obtained. Studies showed that insects were required for pollination. Almost all of the floral visits were made by native solitary bees. The primary floral visitor to the flowers was an anthrophorid bee (*Tetralonia stretchii*) (89.4 percent of the visits). The second most frequent floral visitor (8.7 percent of the visits) was a megachilid bee (*Callanthidium illustre*) (Boyd 1994). Hand pollination did not increase the amount of fruit set, but

almost doubled the number of seeds per fruit (Boyd 1994). Studies on seed dispersal for *F. californicum* ssp. *decumbens* documented that seeds were dispersed by harvester ants. Seeds were carried up to 12 meters (39 feet) from the *F. californicum* ssp. *decumbens* shrubs (Boyd 1996).

4. *Galium californicum* ssp. *sierrae* (El Dorado Bedstraw)

Galium californicum ssp. *sierrae* is a perennial herb flowering from May to June (California Native Plant Society 1994). Population sizes have only been reported for 2 of the 10 occurrences. One occurrence had about 50 plants, the other from 11 to 50 plants (California Natural Diversity Data Base 1998). Very little is known about the biology or ecology of *G. californicum* ssp. *sierrae* (California Department of Fish and Game 1992). Details of the reproductive biology and demography of the species are not available.

5. *Senecio layneae* (Layne's Butterweed)

Senecio layneae is a perennial herb that flowers from April to July (California Native Plant Society 1994). Population size records vary from 10 to over 1,000 individuals (California Natural Diversity Data Base 1998). Observations suggest that *S. layneae* is an early successional species that occupies temporary openings on gabbro or serpentine soils and is eliminated as vegetation grows up around it (Baad and Hanna 1987). More information is needed on the reproductive biology and demography of this species.

Marsh (2000) studied the genetic structure of *Senecio layneae* at four populations representing the species range and conducted a preliminary investigation of the breeding system of *S. layneae*. Samples for the genetic analysis were collected from near Brownsville in Yuba County, Pine Hill and Cameron Park in El Dorado County, and the Red Hills in Tuolumne County. Random amplified polymorphic DNA and inter-simple sequence repeat DNA markers were used to determine the genetic structure within and between the populations. Results showed that although most of the genetic variation was found within the populations, almost one-third of the genetic variation was found between populations (Marsh 2000). Additionally, it was determined that the El

Dorado and Tuolumne County populations were more similar to each other than to the Yuba County population (Marsh 2000).

Twenty-two plants from Cameron Park were used to determine whether the predominant breeding system was self-fertilizing or outcrossing (mating not involving inbreeding). Pollinators were excluded from the flower heads with fine mesh fabric. Open pollinated flower heads had an 8-fold increase in potentially viable seeds over flower heads where the pollinators had been excluded, indicating that the predominant breeding system for *Senecio layneae* is outcrossing (Marsh 2000).

6. *Wyethia reticulata* (El Dorado Mule-ears)

Wyethia reticulata can reproduce vegetatively by sending new above-ground stems off of its spreading root system. *W. reticulata* flowers late in the spring, is pollinated chiefly by native bees, and is self-incompatible (Ayres and Ryan 1997b). Recruitment from seed is very poor.

The genetic structure and spatial pattern of genetic variation of *Wyethia reticulata* was studied at four sites on the Pine Hill formation: Cameron Park, Rescue, and two sites at the northern part of the species range in Salmon Falls (Ayres and Ryan 1997b). Using isozyme and DNA markers, researchers determined that individuals of *W. reticulata* can spread vegetatively over wide areas (up to 360 square meters [3,875 square feet]) and that apparently large populations of *W. reticulata* were actually composed of few genetic individuals; a few of the individuals were estimated to be several hundred years old. Additionally, *W. reticulata* was found to be highly genetically diverse, with most of the genetic diversity occurring within populations (Ayres and Ryan 1997b).

7. Fire Ecology

Boyd (1987) conducted a study in 1983 on the effects of controlled burning on *Fremontodendron californicum* ssp. *decumbens*, *Ceanothus roderickii*, and *Wyethia reticulata*. Boyd found that each of the three species was adapted to naturally occurring fires and required fire to stimulate reproduction.

F. californicum ssp. *decumbens* produced additional individuals by fire-stimulated germination of the seedbank and production of sprouts from the roots of established plants (Boyd 1987). The proportion of rootsprouts on mature individuals was significantly higher in the burned area than in the unburned area. A summary of species response to fire is in Table II-3.

Ceanothus roderickii does not resprout after fire, and therefore depends on re-establishment from seeds. The burned plots and the unburned plots in Boyd's study were similar in the number of plants present before the controlled burn, and none of the mature *C. roderickii* resprouted following the controlled burn (Boyd 1987). A 22-fold difference in seedling production was observed the spring following the controlled burn (Boyd 1987). Additionally, the survival of *C. roderickii* seedlings was significantly greater on burned plots than on unburned plots at all census times during the 3-year study.

Wyethia reticulata was not harmed by the controlled burn and has fire-stimulated flowering. Although it does not need fire to stimulate the seed bank, plants reproduced vegetatively the second season after a controlled burn and had 7.5 times the number of flowering heads (Boyd 1985). The underground stems of this species survive fire and produce abundant flowering stems the first year or two after fire, and then flowering declines (D. Ayres *in litt.* 1999).

In experimental fires, buried seeds of *Wyethia reticulata* survived where temperatures did not exceed 79 degrees Celsius (174 degrees Fahrenheit), but no seedlings were found after fire, suggesting the absence of a long-lived seed bank. Due to limited seed dispersal, the seedlings occur within the existing *Wyethia* stand where they grow poorly and die because of intense competition with other plants (D. Ayres *in litt.* 1999). Seeds sown into the ash of a fire, away from existing *Wyethia* stands, survive and grow well. Seedlings growing on cleared, unburned sites, away from dense canopies of *Wyethia* also survived well (D. Ayres *in litt.* 1999). In experimental plots, *Calystegia stebbinsii* achieved a density of approximately 25 seedlings per square meter (2.3 per square foot) the spring following fire. The density of *C. stebbinsii* declined to 5 plants per square meter (0.5 per square foot) 2 years following fire and increased by vegetative

Table II-3. Summary of species responses to fire.

Species	Response to Fire	Between fire period
<i>Calystegia stebbinsii</i> Stebbins' morning-glory	Fire or disturbance needed for germination of seeds (Nosal 1997). Fire needed for recruitment of seedlings (D. Ayres <i>in litt</i> 1999).	Plants will die out due to shading; <i>Calystegia stebbinsii</i> present in seed bank only (D. Ayres <i>in litt.</i> 1999).
<i>Ceanothus roderickii</i> Pine Hill ceanothus	Plant is killed by fire, but there is a 22-fold increase in seedlings. Without fire, germination is low (Boyd 1987).	Survival and growth of seedlings under shrub canopy is poor (D. Ayres <i>in litt.</i> 1999).
<i>Fremontodendron californicum</i> ssp. <i>decumbens</i> Pine Hill flannelbush	Produces additional individuals by fire stimulated germination of the seedbank and production of sprouts from the roots of established plants. In absence of fire only 2 percent of seeds germinate (Boyd 1987).	Maintains as a shrub.
<i>Galium californicum</i> ssp. <i>sierrae</i> El Dorado bedstraw	Unknown	Unknown
<i>Senecio layneae</i> Layne's butterweed	Disturbance needed for recruitment (Baad and Hanna 1987), but role of fire is unknown.	Unknown
<i>Wyethia reticulata</i> El Dorado mule-ears	Fire may be essential for seed set and appears to stimulate flowering, but is probably not essential for the maintenance of the populations (D. Ayres <i>in litt.</i> 1999).	Long intervals between fires are not harmful. Effect of short interval fire is unknown, but since the plants' annual stems normally die back each year, removal by fire should do no harm to regenerating abilities of the rhizome provided the fires occur during late summer or fall (D. Ayres <i>in litt.</i> 1999).

growth to about 10 plants per square meter (0.9 per square foot) in the third year (D. Ayres *in litt.* 1999). Over 50 percent of the 3-year-old plants flowered (D. Ayres *in litt.* 1999).

Fire is necessary for some of these species (Table II-3). Imitating disturbance by scraping may be beneficial to some of the species in this recovery plan, but the effects of this management tool for the long-term sustainability of the plants and their habitat are unknown. Research is needed regarding the potential for use of scraping as a management tool. When scraping is used in place of burns, we have concerns about the long-term effects on nutrient cycling, topsoil removal, seed bank integrity, altered microtopography, and soil chemistry. These species are obligates to depauperate soils and alterations to soil characteristics may allow other species to out-compete these species.

C. Reasons For Decline and Threats To Survival

Historically, gold rush activities and clearing for agriculture reduced and fragmented habitat in western El Dorado County. More recently, vegetation on the Pine Hill formation has changed significantly due to commercial and residential development, road construction, and fragmentation. Between 1960 and 1990, the human population in El Dorado County increased 428 percent (California Department of Finance 1998). Nearly 23 percent of the gabbro formation is urbanized (J. Horenstein unpublished data 1994). Commercial or residential developments have partially or completely destroyed occurrences of all of the species (California Natural Diversity Data Base 1998; California Department of Fish and Game 1990*a*, 1990*b*; G. Clark *in litt.* 1993).

Habitat loss, habitat fragmentation, alteration of natural fire regime, and suppression of disturbance (all mainly due to urbanization) are the major threats facing *Calystegia stebbinsii*, *Ceanothus roderickii*, *Fremontodendron californicum* ssp. *decumbens*, *Galium californicum* ssp. *sierrae*, *Senecio layneae*, and *Wyethia reticulata*. Proposed residential or commercial development within the Pine Hill formation threatens most of the remaining sites within the Pine Hill formation and adjacent serpentine in western El Dorado County, and either directly or indirectly will adversely affect most of the range of all six taxa. The

local water purveyor, El Dorado Irrigation District, is attempting to get additional water from the South Fork of the American River through purchase of PG&E's Hydroelectric Project 184 and a storage contract with the Bureau of Reclamation utilizing Folsom Reservoir. This water is most likely to be used for developments in the extreme western part of El Dorado County, where the gabbro soil plants are found (A. Howard *in litt.* 1999). Nearly all the remaining occurrences of these species that are not on preserves are threatened by destruction of habitat through residential or commercial development. El Dorado County, which has a projected population growth of 60 percent between 2000 and 2020, is one of the most rapidly growing counties in California (California Department of Finance 2001a). From 1990 to 2000, the county's population grew by 22 percent (California Department of Finance 2001b). Western El Dorado County is becoming a "bedroom community" as it is easily accessible by freeway from several nearby cities including Sacramento. Most of the new residential growth in El Dorado County is expected to occur within western El Dorado County near Highway 50 (Jones and Stokes Associates 1992), which crosses the southern portion of the Pine Hill formation. Although El Dorado County's General Plan is currently being litigated, we anticipate that the growth in El Dorado County will occur predominantly within western El Dorado County because that is where the infrastructure exists.

The subsequent induced growth from water acquisitions would affect all six species on the Pine Hill formation and adjacent serpentine, either by further fragmenting the habitat (as discussed below) or by directly destroying habitat. The increasing number of people and changes in land uses will continue to place an increasing strain on undeveloped areas through activities such as off-road vehicle traffic, unauthorized garbage dumping, and changes in the pattern of wildfires.

The effects of residential and commercial activities extend beyond direct impacts to habitat. Habitat fragmentation and edge effects significantly affect gabbro plants. Habitat fragments are more susceptible to being burned in their entirety, with shorter than natural intervals between fires, relative to larger tracts of habitat. If an entire preserve burns more often than the natural fire frequency, the seed bank of certain chaparral shrub species may not be adequate to replace

the population. An occurrence of a rare species of *Ceanothus* in San Diego County was extirpated in this manner (Zedler *et al.* 1983, Zedler 1992). Habitat fragments may be too small to protect from being burned all at once. Additionally, habitat fragments may be too small to support viable populations of animals serving as pollinators or seed dispersal agents for the listed plant taxa and species of concern covered in this recovery plan. Animals may be unable to move among isolated habitats, potentially resulting in the loss of these species from habitat fragments. Such effects at the scale of individual populations can cumulatively result in local extirpation or extinction of an entire taxon. Hunter and Horenstein (1991) characterized vegetation structure on the Pine Hill formation and estimated the median patch size to be only 11 hectares (27 acres). This degree of fragmentation is significant within chaparral because plant species will disappear from fragments between 10 and 100 hectares (25 to 250 acres) in size due to persistent disturbance and potentially due to change in fire frequency (Soulé *et al.* 1992).

Edge effects, which occur at the interfaces of any two or more habitat types, typically increase with habitat fragmentation and are more pronounced for natural communities bordered by human disturbances. Edge effects reduce the integrity of a site as habitat fragments get smaller. Fragmentation splits habitat into smaller, more isolated units and has two primary effects. First, habitat fragmentation may alter the physical environment, changing the amount of incoming solar radiation, water, wind, or nutrients for the remnant vegetation (Saunders *et al.* 1991). Second, most of these fragmented natural areas are subject to influences from external factors (*e.g.*, additional development, lawn and garden watering, herbicide drift, and off-road vehicular use) that disrupt natural ecosystem processes. Additionally, there is a higher risk of displacement of native plant species by nonnative species in habitat fragments (L. Eng *in litt.* 1999). Current and future land use changes such as commercial and residential development and road construction continue the habitat fragmentation process.

Changes in fire frequency threaten *Calystegia stebbinsii*, *Ceanothus roderickii*, *Fremontodendron californicum* ssp. *decumbens*, and *Wyethia reticulata* (see also Table II-3). These plants occur within a fire-adapted plant community, either within chaparral or on the ecotone between chaparral and

woodland. Fire suppression policies have altered natural processes within several plant communities in California. Before the advent of fire suppression policies, chaparral stands may have burned at a frequency of roughly 3 to 5 times per 100 years (Boyd 1985). Excessive fire frequency also potentially threatens *Ceanothus roderickii* and *F. californicum* ssp. *decumbens*. These plants need sufficient time between burns to set enough seed to replenish the soil seedbank. Mature plants of *F. californicum* ssp. *decumbens* also need to build up carbohydrate reserves to be able to resprout after a fire (Boyd 1985). Longer than normal fire frequencies leads to the loss of some plant species from the chaparral plant community. Some chaparral species grow and reproduce most vigorously in the first decades following a fire and in later years may be “shaded out” (L. Eng *in litt.* 1999). Their seeds often germinate at a much higher rate when exposed to chemicals in ash and heat from fire. Their seeds may only be viable for a limited number of years or largely decayed or eaten if the fire interval is too long. Some of the rare gabbro plants (*e.g.*, *Calystegia stebbinsii*) appear to be susceptible to shading out as they are much less abundant or missing entirely in older stands of chaparral on appropriate soils (L. Eng *in litt.* 1999).

Mitigation for development often is by small "set asides" (small natural areas within the development), which increase habitat fragmentation, are difficult to manage for fire, and are subject to edge effect problems. Land development and multiple ownership complicate the planning and implementation of controlled burns at the appropriate fire frequency necessary for maintenance of chaparral. Suitable "pristine" habitat remaining for a preserve system is limited, especially in the southern portion of the range (within the Pine Hill formation). Twelve potential preserve sites were identified as the best remaining habitat for the five federally listed plants on the Pine Hill formation and adjacent serpentine (EIP Associates 1991). As of 1992, within these 12 sites, at least 11 residential or commercial projects have been proposed (Appendix B). The 11 projects were distributed among 6 sites; 4 sites contained more than one proposed project.

Lesser threats include road widening and maintenance, off-road vehicle use, garbage dumping, horse paddocking, mining, competition with invasive nonnative vegetation, and other human-caused conditions associated with

increased development. These activities variously threaten individual occurrences of some of these species within their respective ranges.

Road widening occurs near development within El Dorado County, and this activity is known to have extirpated one occurrence of *Senecio layneae* and threatens an additional five sites (California Natural Diversity Data Base 1994). Road-widening also threatens the habitat of *Ceanothus roderickii* at one site (California Natural Diversity Data Base 1994). Road maintenance and herbicide spraying potentially threaten a *Calystegia stebbinsii* site that occurs along a road cut (California Natural Diversity Data Base 1994). Another *Calystegia stebbinsii* occurrence was adversely affected by grading. Off-road vehicle use has adversely affected the habitat of *Calystegia stebbinsii* at one site (California Natural Diversity Data Base 1994) and the habitat of *Ceanothus roderickii* at three sites in the northern part of the Pine Hill formation. Several hills are scarred with off-road vehicle tracks. Erosion promoted by scarring adversely modifies the habitat. Intensive off-road vehicle use threatens two occurrences of *S. layneae* (California Natural Diversity Data Base 1994). One of these *S. layneae* sites, in the northern part of the Pine Hill formation, is affected by heavy off-road vehicle use and has been fragmented by the many roads that traverse the entire area. A southern site of *S. layneae* that occurs across 89 hectares (221 acres) was graded and grubbed in preparation for development and is subject to off-road vehicle use over part of the site (California Natural Diversity Data Base 1994).

Habitat degradation from garbage dumping on ridge-tops around Pine Hill and on undeveloped parcels surrounded by higher density development degrades the habitat and is a minor threat to *Fremontodendron californicum* ssp. *decumbens* (J. Wilson pers. comm. 1993, L. Eng *in litt.* 1999).

Horse paddocking in rural residential areas within the central and northern portions of the Pine Hill formation threatens *Calystegia stebbinsii*, *Galium californicum* ssp. *sierrae*, and *Senecio layneae*. The horses, when confined, severely graze or trample most available vegetation. The herbaceous gabbro plants are especially likely to be grazed (J. Van Ess pers. comm. 1993).

Three known occurrences of *Senecio layneae* are found on the Eldorado National Forest in El Dorado County. A fourth occurrence was extirpated by rural development in 1994. Human related activities that have affected or may affect the three remaining occurrences include road maintenance and construction, mining, powerline maintenance, and recreation activities (D. Rodriguez *in litt.* 1998). Habitat for *S. layneae* within the Traverse Creek Botanical Area in the Eldorado National Forest historically was fragmented by serpentine quarrying (M. Foster pers. comm. 1993). Although commercial claims have been withdrawn, recreational mining for semiprecious stones and gold still occurs at the Traverse Creek Botanical Area on the Eldorado National Forest (D. Rodriguez pers. comm. 1998).

Activities often associated with rural residential areas, such as clearing chaparral for fire protection around houses, bulldozing land (grading for houses or barns), planting fruit trees, and irrigation also have modified the habitat within western El Dorado County (J. Jokerst pers. comm. 1993, J. Van Ess pers. comm. 1993). The ongoing repetitive clearing of chaparral destroys the habitat. Irrigation involved with lawn maintenance also adversely affects these species (J. Van Ess pers. comm. 1993, J. Jokerst pers. comm. 1993). Some land owners in this area clear entire 2- to 4-hectare (5- to 10-acre) parcels in the name of fire prevention, resulting in a significant loss of habitat and potentially of rare plant populations (L. Eng *in litt.* 1999).

D. Conservation Efforts

Pine Hill Ecological Reserve - Attempts to set up an ecological reserve have been ongoing for more than 20 years. In the fall of 1977, the California Native Plant Society learned of plans to dispose of surplus California Department of Forestry and Fire Protection lands located on Pine Hill in El Dorado County (Howard 1979). Beginning in late fall of 1977, the California Native Plant Society united with other environmental groups to encourage the State of California to begin a coordinated effort to preserve significant natural areas. Through 1978 and into 1979, a multi-constituent committee, including the California Native Plant Society, Audubon Society, and California Resources Agency, met to set up a significant natural area for Pine Hill. Pine Hill

Ecological Reserve (97 hectares [240 acres]) was established in 1979 to protect the gabbro plants located on the summit of Pine Hill.

State Listings - The State of California listed *Fremontodendron californicum* ssp. *decumbens*, *Galium californicum* ssp. *sierrae*, and *Senecio layneae* as rare in 1979. *Calystegia stebbinsii* was listed as endangered by the State of California in 1981 and *Ceanothus roderickii* was listed as rare in 1982 (California Department of Fish and Game 1992). In 1987, a management plan was written for the Pine Hill Ecological Reserve (Baad and Hanna 1987).

EIP Report - In the late 1980's, the California Department of Fish and Game brought to the attention of El Dorado County that many of the development projects in western El Dorado County would likely have significant direct or cumulative effects on eight rare plant species (Economic & Planning Systems, Inc. 1997). At the same time, the development community became aware of the California Department of Fish and Game's concerns regarding these plants. Private developers and El Dorado County contracted a report to determine potential preserve sites.

The California Natural Diversity Data Base, James Wilson's masters thesis (Wilson 1986), survey reports prepared by environmental consultants, interviews with local botanists, and EIP Associates' field surveys were used to determine the location of clusters of rare plants occurring on the Pine Hill formation (EIP Associates 1991). Twenty-two clusters of rare plant species were initially identified. Ten of these sites were rejected after review of additional data and aerial photographs because they had been developed.

The remaining 12 sites were evaluated by a set of scored criteria. The criteria used to rank the potential preserves included: the number of target species present; the abundance of each target species present; the area of the potential preserve; the distance from the boundary of the potential preserve to target species; preserve shape; condition of the site; presence of managed natural areas near the site; presence of rare plants on more than one soil type within the potential preserve site; and/or presence of plants thought to be gabbro endemics

on non-gabbro soil (EIP Associates 1991). This study, completed in November 1991, identified 12 potential preserve sites (EIP Associates 1991) (Table II-4).

Agency Memorandum of Understanding - In 1992, the California Department of Fish and Game, Bureau of Land Management, and Bureau of Reclamation signed a memorandum of understanding to protect the gabbro plant habitat along the South Fork of the American River (California Department of Fish and Game 1992).

Rare Plant Advisory Committee - In 1992, following an El Dorado County Board of Supervisors's hearing and an informational workshop, the El Dorado County Board of Supervisors requested the formation of the El Dorado County Rare Plant Advisory Committee, consisting of members from the development community, various agencies (California Department of Fish and Game, Bureau of Land Management, U.S. Fish and Wildlife Service), El Dorado County planning staff, California Native Plant Society, Center for Sierra Nevada Conservation (formerly Friends Aware of Wildlife Needs), American River Conservancy, and others. This committee was established to identify feasible preserve sites, funding mechanisms, and management strategies for these preserves. The Rare Plant Advisory Committee used evaluations from the EIP Associates 1991 report and recommendations from California Department of Fish and Game, and overlaid land use considerations on the biological information to arrive at their own set of recommendations to the Board of Supervisors.

The Rare Plant Advisory Committee recommended three main preserve sites--Salmon Falls, Pine Hill, and Cameron Park/Shingle Springs--and two smaller satellite preserve areas--Martel Creek and Penny Lane. The total acreage of the five preserves that the Rare Plant Advisory Committee proposed was approximately 1,416.6 hectares (3,500 acres) (Table II-5). In addition to the six species covered in this recovery plan, the Rare Plant Advisory Committee also included *Helianthemum suffrutescens* (Bisbee Peak rushrose) and *Chlorogalum grandiflorum* (Red Hills soaproot). Five preserve sites were identified to protect more than one population of each species, to protect against catastrophic loss at any one site, maintain genetic diversity within the rare plant species, and preserve a representation of the geographic range, diversity of plant associations, and other

potentially important site-specific conditions associated with the rare plants (Horenstein and Ehr Gott 1997). Mechanisms identified to acquire the Salmon Falls preserve, Pine Hill preserve, and Cameron Park/Shingle Springs Preserve were density transfers, sales or donations of easements by willing parties, and purchase of land, respectively (Appendix C). The recommendations of the Rare Plant Advisory Committee were presented to the El Dorado County Board of Supervisors in February 1993. The Board of Supervisors approved, in concept, four of the preserves, but eliminated the large Cameron Park southern preserve site. At that point, the Board of Supervisors did not address local funding for financing the acquisition or maintenance of the four preserves they did adopt.

Section 6 Grant - In 1993, the California Department of Fish and Game applied for and received a section 6 grant from us to investigate funding mechanisms for land acquisition. A draft economic feasibility study for acquiring the rare plant preserves, prepared by Economic & Planning Systems, Inc., was published in 1997.

Interim Water Contract Renewal - Our February 27, 1995, biological opinion on the interim renewal by Bureau of Reclamation of 67 water service contracts on the Central Valley Project (including water contracts for El Dorado County) identified implementation of a preserve system for the five federally listed gabbro plants as a critical need (U.S. Fish and Wildlife Service 1995). A critical need was defined as those actions needed immediately to avoid extinction or preclusion of recovery. The critical needs analysis for these plants specifically noted the importance of a preserve in the southern zone (Cameron Park) of the Pine Hill formation. During meetings held for technical review of the draft critical needs plan from the February 27, 1995, biological opinion for the Central Valley Project Interim Water Contract renewals, invited experts recommended all five of the preserves identified by the Rare Plant Advisory Committee as the critical need for the five federally listed gabbro species (which were proposed at the time of the meeting

Table II-4. Summary of potential preserve sites on the Pine Hill formation (EIP Associates 1991).

Preserve number	Total score	Size in hectares	Size in acres	Public land	Locality	<i>Calystegia stebbinsii</i>	<i>Ceanothus roderickii</i>	<i>Galium californicum</i> ssp. <i>sierrae</i>	<i>Fremontodendron californicum</i> ssp. <i>decumbens</i>	<i>Senecio layneae</i>	<i>Wyethia reticulata</i>
1	11	25.33	62.6	none	Southern					+ or ++	+ or ++
2	6-7	29.9	73.88	none	Southern	+++++				++	
3	21	44.66	110.37	partly County	Southern	++++ or +++++				++	+
4	56-58	>258.07	>637.68	none	Southern	+++++	++++	++++		+++	++
5	33	29.5	72.9	none	Southern		++++			++	+
6	9	>61	>150	none	Southern					++	
7	34	+/- 72.85	+/- 180	none	Central		++++			+++	++
8	14-16	8.1	20	part BLM	Central					+	+
9	16-26	>125.9	>311.2	part BLM	Central			?		?	++
10	22	212.26	524.49	none	Northern						++
11	79-81	606.37	1498.33	40 acre CDFG	Northern	+++++	++++	++++		++ or +++	++
12	39-41	299	738.7	part BLM	Northern			++ or +++	++ or +++	+	

Total score indicates conservation value of sites based on ranking criteria discussed in text. The number of “+” represents a relative abundance for each species; S = Southern (South of Green Valley Road); N =Northern - North of Sweetwater Creek; C= Central Pine Hill area- North of Green Valley Road, South of Sweetwater Creek; BLM=Bureau of Land Management; CDFG= California Department of Fish and Game; > means “ greater than”; +/- means “about”.

Table II-5. El Dorado County Rare Plant Advisory Committee recommendations for the preserve system.

Proposed Preserve	Recommended Preserve Size¹	Land Publicly held or Acquired as of June 2002
Salmon Falls	714.4 hectares (1,765 acres)	488 hectares (1,205 acres) (123 hectares [305 acres] CDFG, 352 hectares [871 acres] BLM, 12 hectares [29 acres] BOR)
Pine Hill	283.3 hectares (700 acres)	154 hectares (380 acres) (97 hectares [240 acres] CDFG, 32 hectares [80 acres] CDF, 24 hectares [60 acres] BLM)
Martel Creek	161.9 hectares (400 acres)	179 hectares (442 acres)
BLM Satellite Site (Penny Lane Ridge)	74.9 hectares (185 acres)	67 hectares (166 acres)
Cameron Park	182.1 hectares (450 acres)	184 hectares (454 acres)
Total	1,416.6 hectares (3,500 acres)	1,071 hectares (2,647 acres)

BLM- Bureau of Land Management

CDFG- California Department of Fish and Game

CDF- California Department of Forestry and Fire Protection

¹ Recommended Preserve size based upon El Dorado County's Board of Supervisors agenda transmittal dated February 26, 1993 (El Dorado County Planning Staff 1993).

Federal Listing - On October 18, 1996, *Calystegia stebbinsii*, *Ceanothus roderickii*, *Fremontodendron californicum* ssp. *decumbens*, and *Galium californicum* ssp. *sierrae* were federally listed as endangered, and *Senecio layneae* was federally listed as threatened (U.S. Fish and Wildlife Service 1996).

Acquisition of Additional Preserve Lands - From 1990 to 1996, California Department of Fish and Game and the American River Conservancy purchased approximately 123 hectares (305 acres) in the Salmon Falls area for \$1,600,000. In 1990, the Wildlife Conservation Board approved the purchase of a 16.2-hectare (40-acre) parcel near Salmon Falls with Proposition 70 funds. Proposition 117 funds were used to acquire 16.2 hectares (40 acres) in the Salmon Falls area in 1991 (California Department of Fish and Game 1992). An additional six parcels totaling about 91 hectares (225 acres) in the Salmon Falls Area have been purchased from willing sellers with grant funds raised by the American River Conservancy and the California Department of Fish and Game, as well as funding from mitigation for a private development in Cameron Park. The grant funding sources included the Habitat Conservation program administered by the California Department of Parks and Recreation, the Environmental Enhancement and Mitigation program administered by the California Department of Transportation, and the Wildlife Conservation Board. These properties are managed by California Department of Fish and Game.

Since 1993, attempts have been made by the American River Conservancy and California Department of Fish and Game to obtain funding for the preserves through the Land and Water Conservation Fund and by a ballot bond proposition. Attempts at obtaining funding through bond propositions have so far been unsuccessful. However, El Dorado County has recently been successful in obtaining \$8 million from the Land and Water Conservation Fund.

In 1993 and 1996, the American River Conservancy proposed a multi-agency funding program with funds variously coming from: (1) the El Dorado Irrigation District (with repayment through a water meter and delivery surcharge); (2) the Bureau of Reclamation's Central Valley Project Improvement Act (b)(1) "other" program; (3) development impact fees collected by the El Dorado

Planning Department; (4) the Bureau of Land Management through a land exchange program; (5) the Wildlife Conservation Board through specific funding authorizations; and (6) grant funding through the Environmental Enhancement and Mitigation Program and the Habitat Conservation Program administered by the State of California (Horenstein and Ehrgott 1997).

From 1997 through January 2002, 184 hectares (454 acres) were purchased in the Cameron Park area through a multi-agency effort (Table II-6). The American River Conservancy and California Department of Fish and Game submitted a proposal in February 1997, requesting funds from the Central Valley Project Improvement Act (b)(1)“other” program to assist in the acquisition of habitat within the Cameron Park area. In October 1997, the El Dorado County Board of Supervisors approved El Dorado County’s participation in the purchase of 47 hectares (117 acres) in the Cameron Park area to protect rare plants. Also in October 1997, the El Dorado County Board of Supervisors approved in concept the adoption of a rare plant mitigation in-lieu fee that would include all new development within the El Dorado Irrigation District Sphere of Influence, excluding the City of Placerville, to help pay for part of the acquisition of the Cameron Park Preserve (El Dorado County 1998).

El Dorado County Fee Program - During May 1997, the El Dorado County Board of Supervisors approved an agreement with Economic & Planning Systems to prepare an economic feasibility study for their approved ecological preserve program. On July 28, 1998, the El Dorado County Board of Supervisors adopted Ordinance 4500, which established an ecological preserve mitigation requirement or an in-lieu fee for certain development projects in western El Dorado County. El Dorado County is currently implementing this impact fee program to augment the funds needed to fund the acquisition and administration of the preserve system (El Dorado County 1998). The fees range from \$885 to \$386 per dwelling unit equivalent (El Dorado County 1998). El Dorado County also has successfully lobbied the El Dorado Irrigation District to jointly participate with the County to help fund the acquisition of the Cameron Park Preserve (El Dorado County 1998).

Table II-6. Summary of Cameron Park acquisitions as of June 2002.

Former Property Owner	Size in hectares (acres)	Date acquired	Cost	Funding Source	Land holder
Smith	47 (117)	1998	\$1,000,000 \$893,000 \$893,000 \$100,000	CVPIA (b)(1) other ¹ El Dorado County El Dorado Irrigation District National Fish and Wildlife Foundation	Bureau of Land Management
Smith	25.4 (62.8)	11/20/1998	\$500,000 \$500,000 \$500,000	CVPIA (b)(1) other El Dorado County El Dorado Irrigation District	El Dorado County
Ponderosa 50	36.7 (90.66)	12/21/2000	\$750,000 \$900,000 \$152,000	CVPIA (b)(1) other California State Wildlife Conservation Board National Fish and Wildlife Foundation	Bureau of Land Management
Lloyd Gabbert	19.9 (49.08)	3/15/2001	\$250,000 \$646,400	U.S. Bureau of Reclamation Land and Water Conservation Funds	Bureau of Land Management
Smith & Gabbert	54.2 (134)	1/11/2002	\$3,362,000	Land and Water Conservation Funds	Bureau of Land Management

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¹ Central Valley Project Improvement Act (b)(1) other funds are joint funds from the U.S. Bureau of Reclamation and the U.S. Fish and Wildlife Service.

Congressional Appropriations - With Congressman John Doolittle's support, Congress appropriated \$5,000,000 of Land and Water Conservation Fund money to be administered starting in fiscal year 2001 by the Bureau of Land Management. In fiscal year 2002, an additional \$3,000,000 of Land and Water Conservation Fund money were allocated. As shown in Table II-6, \$4,008,400 of Land and Water Conservation Funds have been used for land acquisition in the Cameron Park area as of January 2002.

Management Agreement - In 2001, a cooperative management agreement for the Pine Hill Preserve in El Dorado County was signed by three Federal agencies (Bureau of Land Management, U.S. Fish and Wildlife Service, and U.S. Bureau of Reclamation), two State agencies (California Department of Fish and Game and California Department of Forestry and Fire Protection), El Dorado County, El Dorado Irrigation District, and the American River Conservancy. With this agreement, the signatories agreed to pool their resources to conserve the rare plant species and ecosystems that they inhabit. The primary goal of the Pine Hill Preserve is the preservation in perpetuity of the rare plant species and communities of the western El Dorado County gabbro formation. By separate agreement, El Dorado County and the Bureau of Land Management, have created funding to employ an interim preserve manager.

III. RECOVERY

A. Objectives

The overall objectives of this recovery plan are to (1) protect and restore sufficient habitat and numbers of populations and (2) ameliorate both the threats that caused five of the gabbro soil plants to be listed and any other newly identified threats in order to (3) warrant delisting of *Calystegia stebbinsii*, *Ceanothus roderickii*, and *Senecio layneae* and downlisting of *Fremontodendron californicum* ssp. *decumbens* and *Galium californicum* ssp. *sierrae*, and (4) ensure the long-term conservation of *Wyethia reticulata*, a species of concern covered in this recovery plan.

Interim goals include stabilizing and protecting populations, conducting research necessary to refine reclassification and recovery criteria, and reclassifying to threatened (*i.e.*, downlisting) *Calystegia stebbinsii* and *Ceanothus roderickii*, species currently federally listed as endangered. Reclassification is appropriate when a taxon is no longer in danger of extinction throughout a significant portion of its range. Because data upon which to base decisions about reclassification and recovery for the gabbro soil plants are mostly lacking, downlisting and recovery criteria in this recovery plan are necessarily preliminary.

“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). More 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 re-evaluation when additional data become available.

B. Recovery and Conservation Strategies

1. Multi-species Strategy

Recovery and long-term conservation tasks emphasized in this recovery plan are (1) habitat protection and management, (2) surveying and monitoring, (3) research, and (4) public participation, outreach, and education. Specifics of each strategy are given in this chapter and in the Stepdown Narrative (Chapter IV).

All species covered in the recovery plan are threatened by loss and fragmentation of gabbro habitat, especially in western El Dorado County. Therefore, the highest priority task for recovery is the protection of areas currently or potentially occupied by the species. We have developed a recommended preserve system for western El Dorado County that we feel will provide the best achievable protection for the six species covered in the recovery plan in this area (Figure III-1, Table III-1). Not shown on the map is a special preserve in the southern portion of the Pine Hill formation to protect *Galium californicum* ssp. *sierrae*; planning of this 24-hectare (60-acre) preserve has been complicated by uncertainty in precise species localities and the subdivision of the area into small parcels with various owners. The location of the preserve will be determined in the future pending confirmation of localities of the species and availability of willing sellers. Additional areas outside of the Pine Hill formation in western El Dorado County will also be necessary for protection of those species that also occur outside of the Pine Hill formation. Although the exact boundaries of these areas have not yet been determined, their general locations are identified in Chapter IV, the Stepdown Narrative.

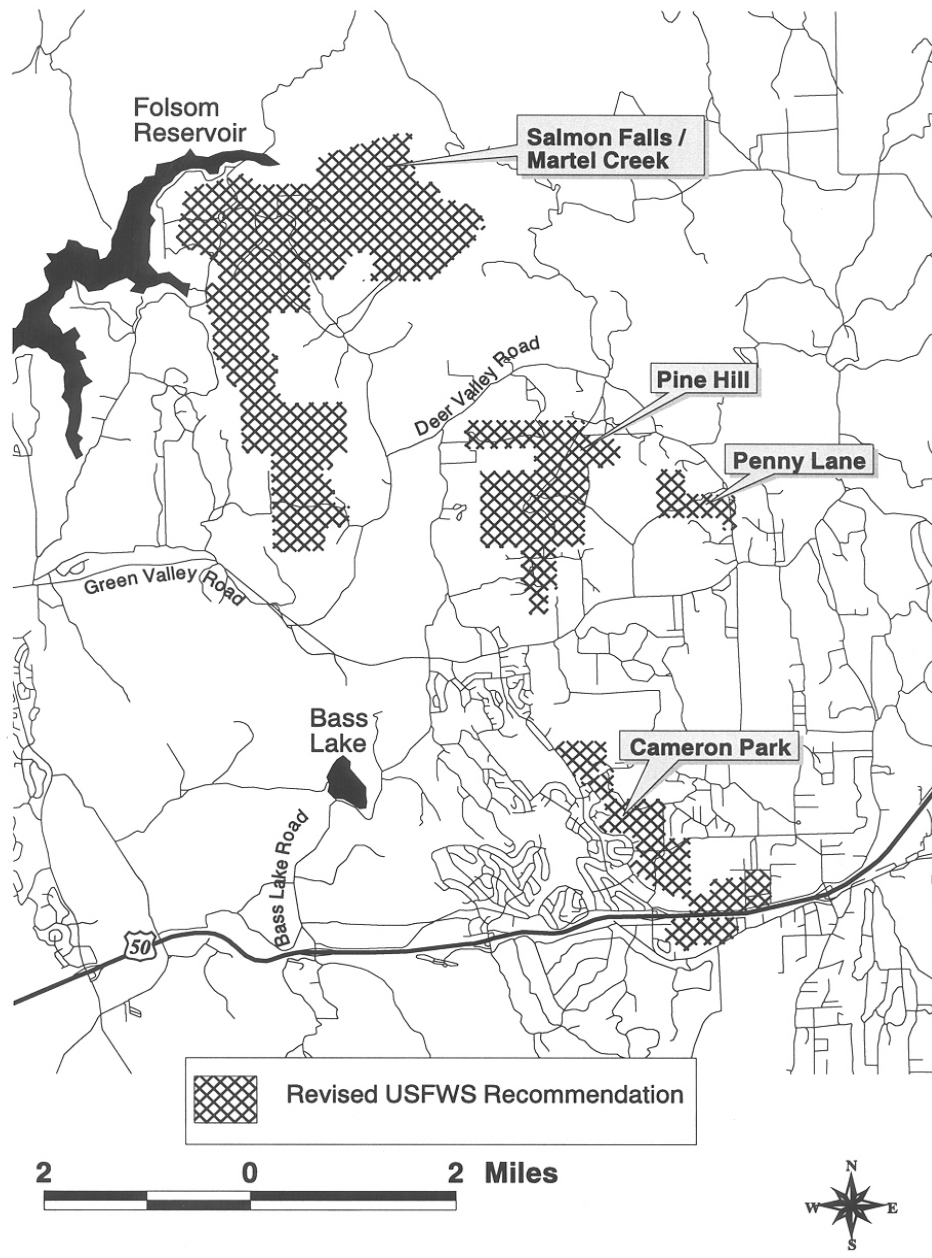


Figure III-1. U.S. Fish and Wildlife Service preserve recommendation for the Pine Hill formation.

Table III-1. Approximate size of preserves included in the U.S. Fish and Wildlife Service recommendation for the Pine Hill formation in western El Dorado County.

Preserve area	Total preserve size (hectares)*	Total preserve size (acres)*
Salmon Falls/Martel Creek	1,247	3,082
Pine Hill	395	975
Penny Lane	67	166
Cameron Park	291	718
<i>Galium</i> Specialty Preserve	24	60
Total	2,024	5,001

*Preserve sizes were calculated in the Geographic Information System analysis. Preserve boundaries were mapped based on the best available data. Because some error may be present in the data, preserve sizes are approximate.

The recommended preserve system for the Pine Hill formation in western El Dorado County results from a Geographic Information System analysis (described in Appendix D). In selecting areas needed for protection of the gabbro endemic plants covered in this recovery plan, we gave first priority to areas identified in the California Natural Diversity Data Base as occupied by several of the covered species. After areas occupied by more than one species had been identified, we evaluated whether protection of those areas with several species would provide the best achievable protection for each species individually. Where the identified multi-species preserves would not provide adequate protection, preserve areas were added to provide additional protection for individual species (*e.g.*, *Galium californicum* ssp. *sierrae*). Preserve areas were refined by applying basic principles of preserve design from conservation biology, including the need for linkages between preserves, large preserve areas, and representation of each individual species in more than one preserve and in preserves throughout their entire ranges (see also Habitat Considerations section

below). Sometimes, the need to protect large, contiguous areas resulted in the inclusion of lands that are not currently occupied by the plants covered in this recovery plan, but that provide suitable potential habitat for the plants. Preserve areas were also selected to maximize use of current public lands. Because the current extent of public land is insufficient for recovery of the species, it was also necessary to include private lands in our preserve recommendation.

The preserve recommendation identifies the Rare Plant Advisory Committee preserve areas as the priority areas for protection, for the most part (Figure III-2). This overlap is not surprising because, as the Rare Plant Advisory Committee recognized, these areas are occupied by several species and contain the most occurrences in the least fragmented areas remaining within the three zones or areas on the Pine Hill formation. However, we feel that the preserve system of roughly 1,400 hectares (3,500 acres) recommended by the Rare Plant Advisory Committee is not adequate to achieve recovery of some of the target species. Our Geographic Information System analysis showed that even if all five preserve areas identified by the Rare Plant Advisory Committee are protected, more than 50 percent of the acreage estimated from California Natural Diversity Data Base records would be lost for some target species. Therefore, we have recommended a larger preserve area, covering approximately 2,024 hectares (5,001 acres) on the Pine Hill formation, that will be necessary to best protect or recover the target species (see analysis summary in Appendix D). The total acreage of California Natural Diversity Data Base occurrences of *Calystegia stebbinsii*, *Ceanothus roderickii*, *Senecio layneae* and *Wyethia reticulata* protected by our preserve design is at least 20 percent greater than that protected by the Rare Plant Advisory Committee preserve recommendation. In addition, depending on the precise location of the *Galium* specialty preserve, the increase in percent total acreage protected for *Galium californicum* ssp. *sierrae* could be nearly 20 percent as well. The map in Figure III-1 shows our preserve recommendation for the Pine Hill formation with the exception of the specialty preserve for *G. californicum* ssp. *sierrae*. Species benefitted by the preserve recommendation, compared to the Rare Plant Advisory Committee recommendation, are *Calystegia stebbinsii*, *Ceanothus roderickii*, *G. californicum* ssp. *sierrae*, *S. layneae*, and *W. reticulata*.

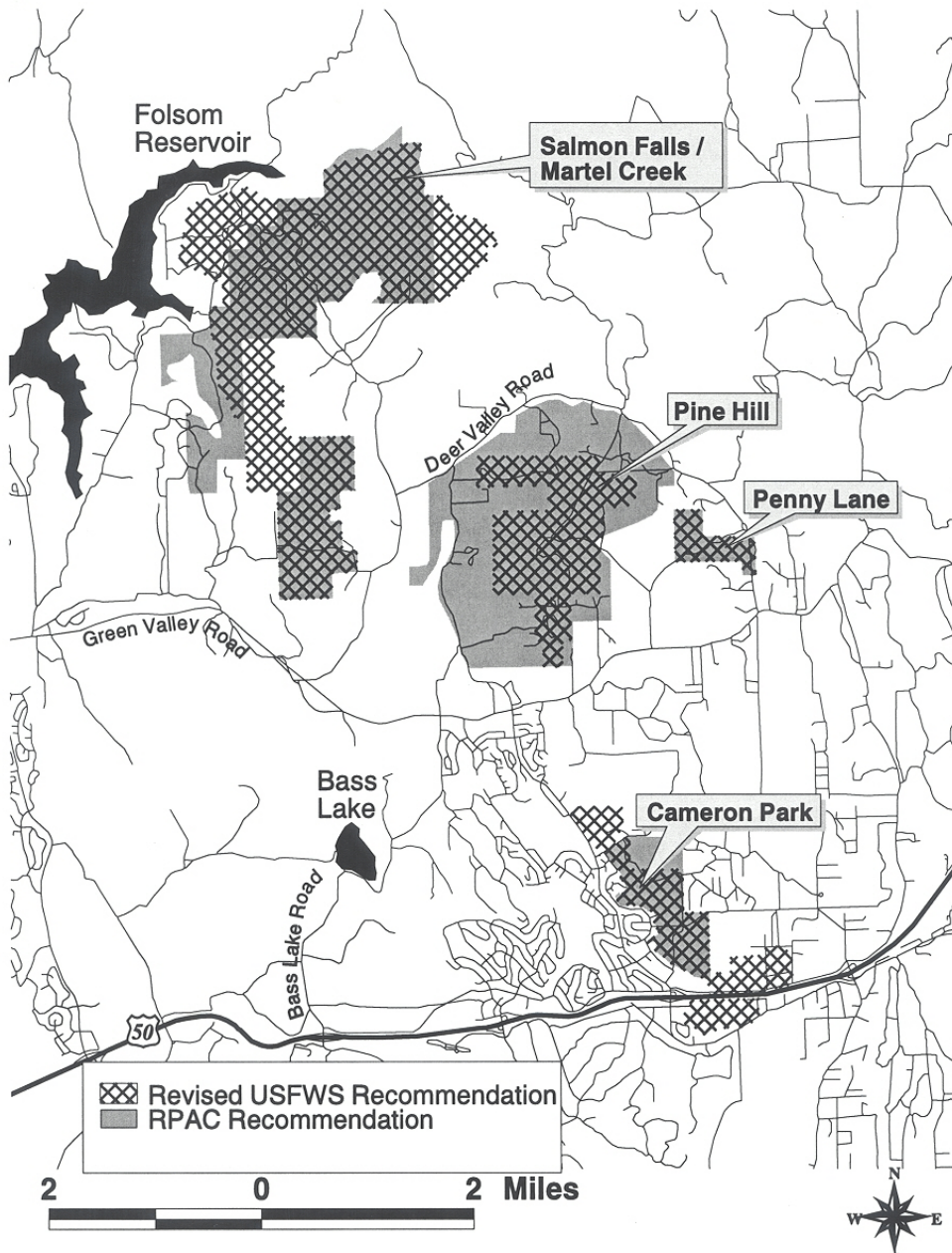


Figure III-2. Comparison of the U.S. Fish and Wildlife Service preserve recommendation for the Pine Hill formation to the Rare Plant Advisory Committee (RPAC) recommendation. Map of the RPAC preserve recommendation is our best interpretation of what the committee intended. In the Pine Hill area (center of map), RPAC did not recommend protection of the entire area shown. RPAC recommended protection of 283 hectares (700 acres) within the mapped area (approximately 30 percent of the area shown here).

The preserve design for western El Dorado County given in the draft recovery plan is compared with the recommended design in Figure III-3. While the text of the draft recovery plan identified approximately 2,064 hectares (5,100 acres) of preserved lands, the mapped area given in Figure II-10 of the draft plan was mistakenly closer to 2,833 hectares (7,000 acres). The revised design in our Amendment (U.S. Fish and Wildlife Service 2000) eliminated the original mapping errors and refined the original design. We have not changed our preserve design and recommendations since issuing the amendment. The area recommended for preservation in the final design is approximately 2,024 hectares (5,001 acres). Where possible, public lands have been substituted for private lands in our recommendation. The approximate areas of public and private lands in the preserve recommendation are given in Figure III-4 and Table III-2. In addition, we have used information provided by El Dorado County and by our own aerial photo analysis (see Appendix D) to eliminate developed lands from the preserve recommendation to the greatest extent possible. Despite our best efforts, it is possible that some existing extensively developed lands (*e.g.*, high density development) are still included in the recommendation. We will continue to refine the recommendation to exclude existing (Year 2000) high density development as these areas are identified during recovery plan implementation. All potential preserve areas should be evaluated based on current mapping information and ground-truthed before they are purchased to confirm their value for recovery.

To provide for additional flexibility in acquisition of property, if other parcels of comparable value are identified, we will consider them. For a parcel to be considered of comparable conservation value, the parcel will need our approval and must (a) be within the same preserve area (*e.g.*, Pine Hill preserve area or Salmon Falls preserve area), (b) be on the appropriate soils, (c) protect the same mix of plants, (d) have equivalent or better buffer areas, (e) result in no decrease in the distribution and range of any of the covered species, and (f) meet the recovery acreage criteria and goals in this recovery plan. For example, a small portion of the public land recently purchased in the Salmon Falls area (see Figure III-4) is outside our recommended preserve boundary but is considered to be of comparable conservation value.

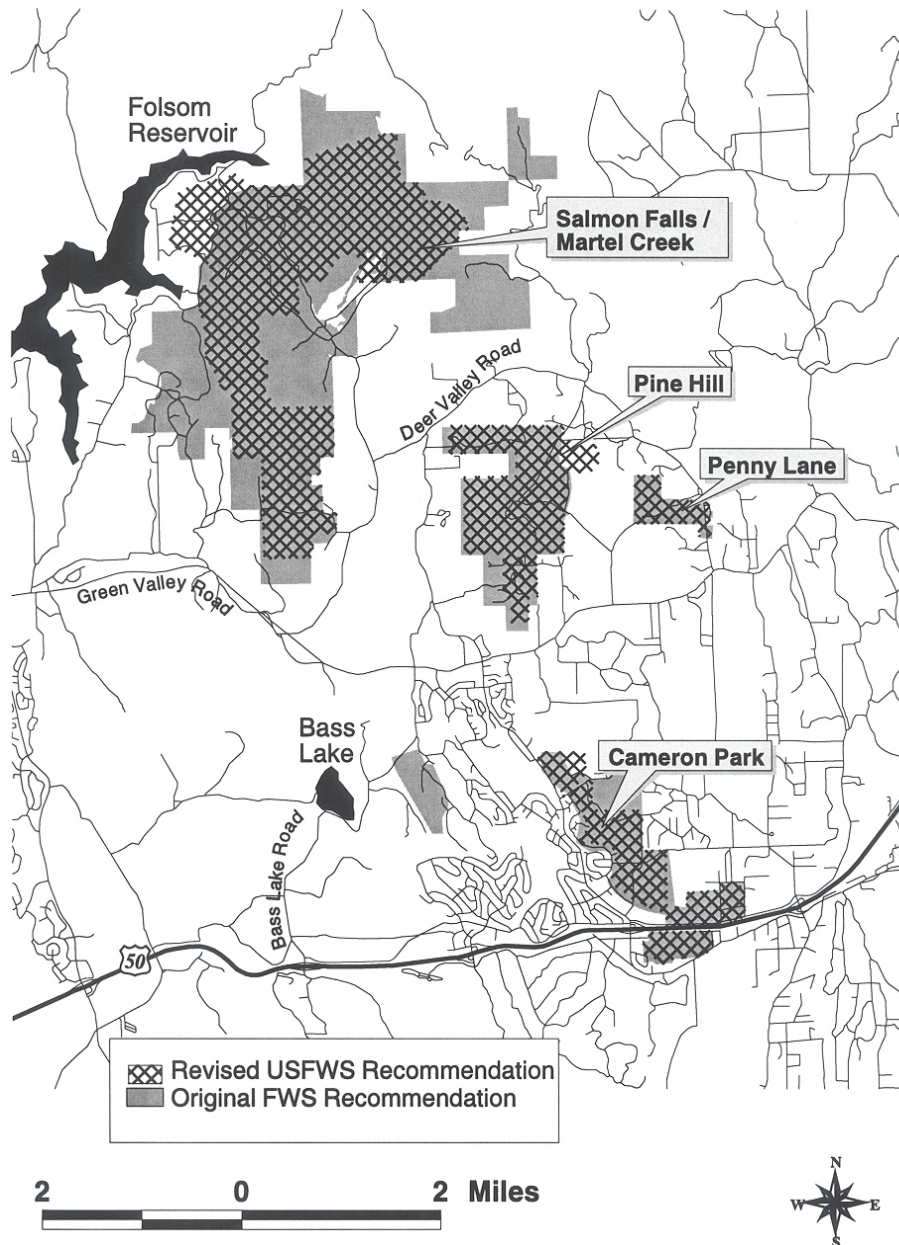


Figure III-3. Comparison of the revised U.S. Fish and Wildlife Service preserve recommendation for the Pine Hill formation to the U.S. Fish and Wildlife Service recommendation presented in the draft recovery plan.

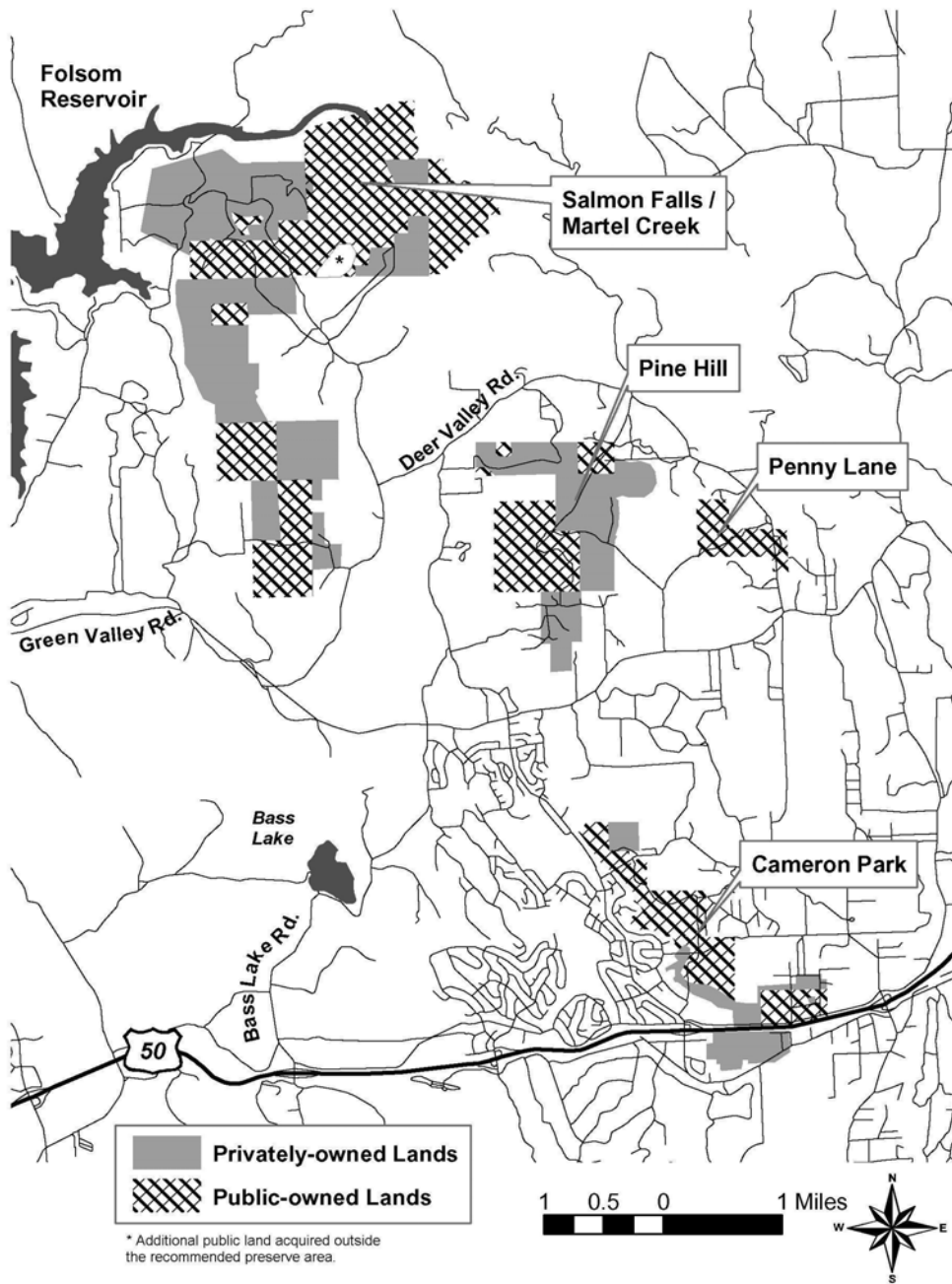


Figure III-4. Distribution of public and private lands within the U.S. Fish and Wildlife Service preserve recommendation for the Pine Hill formation.

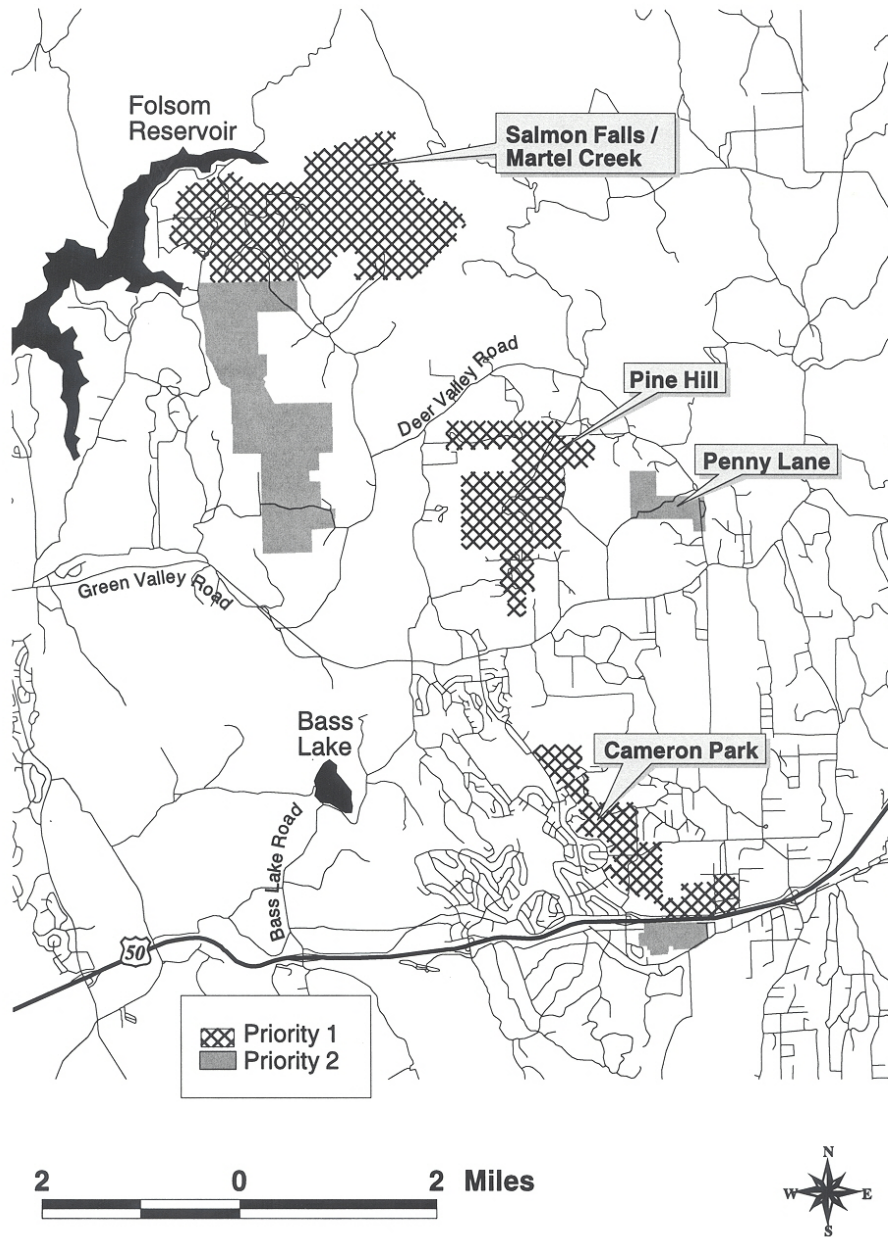


Figure III-5. Priority 1 and 2 lands within the U.S. Fish and Wildlife Service preserve recommendation for the Pine Hill formation.

Table III-2. Approximate areas of public and private lands included in the U.S. Fish and Wildlife Service recommendation for preserves on the Pine Hill formation in western El Dorado County.

Preserve area	Public Land in hectares (acres)*	Private Land in hectares (acres)**
Salmon Falls/Martel Creek	667 (1,647)	581 (1,435)
Pine Hill	154 (380)	241 (595)
Penny Lane	67 (166)	0 (0)
Cameron Park	184 (454)	107 (264)
<i>Galium</i> Specialty Preserve	0 (0)	24 (60)
Total	1,071 (2,647)	953 (2,354)

* Estimated area of public land is based, to the extent possible, on actual parcel sizes using California Lands Commission data.

**Area of private lands was calculated in the Geographic Information System analysis. Preserve boundaries were mapped based on the best available data. Because some error may be present in the data, preserve sizes are approximate.

Protection of some preserve areas identified in our recommendation is considered necessary to prevent extinction or prevent the species from declining irreversibly in the foreseeable future (Priority 1 Tasks). Other areas are considered necessary to prevent a significant decline in the species population or habitat quality, or some other significant negative impact short of extinction (Priority 2 Tasks). The distribution of Priority 1 and 2 lands in our preserve recommendation is shown in Figure III-5 and Table III-3. Areas identified as Priority 1 for protection are those that include a high number of the species covered in this recovery plan (*i.e.*, with high species richness) or those with high conservation value for a particular species, especially for *Galium californicum* ssp. *sierrae*. Priority 2 areas are those that include fewer of the species covered in this recovery plan or are not necessary to prevent the extinction or irreversible decline of a particular covered species. One exception is the preserve area just south of Highway 50. It is designated Priority 2 despite a high species richness because it is separated from the remainder of the Cameron Park preserve area by the highway. Both Priority 1 and Priority 2 areas are important for recovery of the species covered in this plan.

Within identified preserve areas, occurrences on private land should be protected by land acquisition, conservation easements, or other means. For occurrences on public land, protection will require that the California Department of Fish and Game, Bureau of Land Management, and El Dorado County prepare and implement management plans to ensure the long-term survival of the species on their lands. Wherever possible, protection should first focus on larger blocks of land and on publicly owned lands. However, because gabbro habitat is naturally and artificially limited in area and patchy in distribution, some smaller parcels and cooperation from private individuals and entities will be necessary to ensure recovery and long-term conservation of the species covered in the recovery plan. Cooperation may involve selling of land, selling or granting of easements, or voluntary cooperation in programs to maintain and/or enhance habitat values for gabbro species. Because some areas, such as Pine Hill, are divided into many small parcels, we expect conservation of land within certain preserve areas to involve less land acquisition and more granting of easements and voluntary cooperative agreements.

Table III-3. Approximate area of Priority 1 and Priority 2 lands included in the U.S. Fish and Wildlife Service recommendation for preserves on the Pine Hill formation in western El Dorado County.

Preserve area	Priority 1 in hectares (in acres)*	Priority 2 in hectares (in acres)*
Salmon Falls/Martel Creek	758 (1,874)	489 (1,208)
Pine Hill	395 (975)	0 (0)
Penny Lane	0 (0)	67 (166)
Cameron Park	244 (602)	47 (116)
<i>Galium</i> Specialty Preserve	24 (60)	0 (0)
TOTAL	1,421 (3,511)	603 (1,490)

*Preserve boundaries and boundaries for priority 1 and 2 areas were mapped based on the best available data. Because some error may be present in the data, the areas indicated are approximate.

In addition to protection of areas currently or potentially occupied by the species, management activities and certain types of specific research are also high priority actions for the gabbro soil plants. The development and implementation of sound monitoring protocols and management plans for protected gabbro lands is essential. Monitoring protocols for species and habitat need to be developed to evaluate the success of management activities, to determine trends of the rare plant populations, and to monitor threats. Habitat monitoring protocols need to be developed to evaluate the degree of habitat fragmentation, shifts in vegetation type, and the establishment and extirpation of plant occurrences on the landscape. The management plans need to include provisions for fire management and scientifically defensible standardized monitoring programs. Management plans need to be prepared for each preserve and need to discuss species specific as well as habitat management and monitoring actions. Management plans also need to include strategies to minimize known threats at the preserves and also to identify new threats as they may appear. If new threats are identified or other new information becomes available, management plans will need to be re-evaluated and revised.

In many cases, effective habitat management and restoration techniques are undeveloped for species covered in the recovery plan. Therefore, management must be “adaptive” or flexible based on new data, research, or observed outcomes of ongoing management. Whenever possible, until the consequences of management actions are better understood, management actions should be conducted in the context of statistically valid management experiments. There should be control and experimental treatments, and thorough pre- and post-experiment monitoring.

Fire management is a high priority management strategy for all of the preserve sites. Studies determining the appropriate timing of fires (*i.e.*, length of time between fires and seasonal timing) are critical for management. These studies need to include seed production and survival in soil in order to determine the appropriate fire return interval. The efficacy of other types of disturbance regimes for species and habitat (*e.g.*, clearing) should be studied. The long-term impact and sustainability of these various strategies on individual species and their habitat should be evaluated.

Additionally, studies performed on the restoration/enhancement potential of habitat are needed. Restoration refers to the process of repairing damage to the diversity and dynamics of ecosystems (Falk *et al.* 1996). Enhancement is the addition of individuals to an existing population, with the aim of increasing population size or diversity (Falk *et al.* 1996). Important, but lower priority research includes general surveys of all areas proposed for preservation to determine potential areas for enhancement, repatriation, or introduction of populations; and the development of propagation techniques for species where repatriation or introduction is appropriate. See Individual Species Considerations section below for species specific recovery actions.

2. Habitat Considerations

The habitat in which these plants occur is naturally and artificially limited in area and patchy in distribution. As discussed in Chapter II, these plants have different responses to fire. In some cases, the species will grow, and then be outcompeted by surrounding vegetation. These species will appear to die out at a site, but may be present in a long persistent seedbank. Later after a disturbance, these plants will grow again at a site provided that the disturbance is of an appropriate type and intensity and within an appropriate timeframe. These species will appear to be patchy in their distribution both temporally (through time) and spatially depending on size and location of disturbance.

The habitat of these species is patchy across the landscape due to a combination of factors including soil type, aspect, and fire history. These species depend on disturbance. Species that depend on early seral habitats or transient habitats require the maintenance of multiple populations within a shifting mosaic of local habitats (McEachern *et al.* 1994). Additionally, the processes that maintain the landscape mosaics (mixtures of different plant communities within an area) must be considered in the recovery of these species (McEachern *et al.* 1994). To achieve recovery it will be necessary to consider not only what is occurring within individual occurrences, but also what is occurring at the landscape level with metapopulations.

The term “metapopulation” is used to describe a series of populations (or population subdivisions described as local subpopulations) with dynamic patterns of local extinctions and recolonizations (Fiedler and Jain 1992). Metapopulation dynamics refers to the patterns of the evolutionary extinctions and recolonizations of the subpopulations within a larger metapopulation (Fiedler and Jain 1992). Metapopulation theory can provide a framework for connecting landscape processes (such as disturbance or changes in patchiness) with population changes, which is necessary in understanding how species persist in changing environments (McEachern *et al.* 1994). Understanding natural disturbances and changes in patchiness is important because some species and communities depend on periodic natural disturbances; preserve design should consider the spatial and temporal characteristics of natural disturbance regimes (White 1987).

Studies performed on *Pedicularis furbishiae* (Furbish’s lousewort) (Menges 1990) and *Cirsium pitcheri* (Pitcher’s thistle) (McEachern *et al.* 1994), species that depend on disturbance, have shown that protection of unoccupied habitat for these species to colonize in the future is very important for species persistence. Not all habitat for a species is likely to be occupied at any given point in time. It is necessary to protect suitable but vacant habitat as well as occupied habitat (Givens 1994). We have included suitable but apparently unoccupied habitat within our preserve design (apparently unoccupied habitat because the seedbank has not been tested to determine whether the early seral species, for example *Senecio layneae* or *Calystegia stebbinsii*, are present as seeds). This apparently unoccupied habitat is necessary for recovery of these species. The failure to protect vacant habitat patches can reduce metapopulation size and viability as surely as will destruction of an existing population (Givens 1994). Unoccupied habitat is also important because it will allow land managers sufficient space to maintain the habitat mosaic (a combination of woodland and chaparral habitats) as well as different seral stages (a combination of early, middle, and late seral stages) that will be necessary to sustain these species over the long-term.

Within the Pine Hill formation in western El Dorado County, the six rare gabbro plants occur in three zones or areas (see Figure I-2). Each of these three zones (north, central, south) contains important habitat for the recovery of these

species. Neither all the zones, nor all the potential unfragmented habitat that could serve as preserve sites, are occupied by all the species; therefore, different complements of preserves are needed to protect each species. Considerations regarding the number of preserves and size of preserves are discussed below.

Number of preserves. Many separate preserves are desirable to reduce the possibility that a natural catastrophic or human event will eliminate most or all of the populations of a species. Species protected at only a few sites are especially vulnerable to extinction from events such as repetitive fires that occur at too short an interval for the plants to replenish their seedbank, insect infestations or disease, extended drought, or competition with introduced nonnative vegetation. Having several preserves throughout the range of a species increases the probability that genetic diversity within the species will be protected. Protection of this diversity is important because genetic diversity is thought to help a species survive changing conditions.

Size of preserves. It is important to have large preserves for these particular species because four of the five federally listed plants live in a fire-adapted plant community near an urban interface. A preserve needs to be large enough to make controlled fire feasible, and also large enough to minimize the possibility of the entire preserve burning at one time. Additionally, large preserves have a smaller perimeter to area ratio. The outer boundary of the preserve is smaller relative to the area of a preserve as the preserve increases in size. Therefore there is less effect to the interior of a larger preserve from external factors such as nonnative vegetation or urban runoff. Small fragments of habitat may not maintain proper ecosystem functioning and often lose native species so the diversity of native vegetation is reduced. Factors that need to be considered in determining the appropriate size of preserves include, but are not restricted to: (1) the area needed for establishment, expansion, and buffering of several subpopulations of these species within each zone in which they occur; (2) the area needed to minimize edge effects from nonnative plants, different environmental conditions along the edge of the management area, and chance catastrophic events; (3) the area needed to manage periodic burns for maintenance of the gabbroic mixed northern chaparral plant community; (4) the current and potential future land uses of surrounding land; (5) the shape of the preserves (circular or square

preserves are more beneficial than preserves that are long and narrow); (6) the area needed to support the interactions of key community members including dispersal vectors and pollinators; and (7) currently unoccupied habitat to allow for plant populations to shift through time.

Our goal is to have a large preserve as well as smaller noncontiguous satellite preserves in the southern zone (*Galium* specialty preserve and Cameron Park south of Highway 50) and central zone (Penny Lane preserve), and a large preserve in the northern zone. Until research shows otherwise, preserves should target securing populations containing a minimum of 40 hectares (100 acres) of habitat (but preferably more). Occupied as well as unoccupied habitat is needed within the preserves.

3. Individual Species Considerations

Calystegia stebbinsii - In El Dorado County, *Calystegia stebbinsii* occurs in two localized areas. Most occurrences are discontinuously scattered within two population centers in the northern and southern portions of the Pine Hill formation. *Calystegia stebbinsii* does not occur at the center of the formation on Pine Hill. It also occurs sparsely scattered along a narrow band over a distance of approximately 5.6 kilometers (3.5 miles) in Nevada County. Our current preserve recommendation would protect *C. stebbinsii* throughout its range at the Salmon Falls/Martel Creek preserve in the north, and in the south at the Cameron Park preserve north of Highway 50 and the Cameron Park preserve south of Highway 50. Additionally, the Nevada County occurrences would be preserved.

Calystegia stebbinsii appears to be an early successional species that occupies temporary openings on gabbro or serpentine and is eliminated as vegetation grows up around it. Preserves must include sufficient habitat to allow for expansion or shifts in occupied habitat. In addition to securing and protecting habitat, maintenance of the metapopulation dynamics will be important for survival and recovery. Unless the metapopulation analysis shows otherwise, at least two very large occurrences each greater than 128 hectares (315 acres); seven medium occurrences each between 4 and 40 hectares (10 and 100 acres); and four small occurrences each smaller than 4 hectares (10 acres), are to be maintained at

any given time throughout the northern and southern portions of the Pine Hill formation. In addition at least one medium and five small occurrences are to be maintained at any given time at the metapopulation near Grass Valley in Nevada County.

In addition to securing and protecting habitat, directed surveys for *Calystegia stebbinsii* should be conducted on gabbro and serpentine soils in Nevada County. If plants (or additional populations) are discovered in Nevada County, they should be secured through land acquisition, conservation easements, or other means. In addition, unoccupied habitat that might provide space for expansion of the populations and habitat for pollinators and seed dispersers must be protected along with sufficient adjacent unoccupied habitat for fire management, and a 150-meter (500-foot) buffer for fire safety.

High priority recovery actions for *Calystegia stebbinsii* include demographic studies determining limiting life stages. Other important but lower priority recovery actions for *C. stebbinsii* include genetic studies and the collection and banking of seed in Center for Plant Conservation-certified botanic gardens for the disjunct populations of *C. stebbinsii*. In addition, research on propagation techniques will be necessary if repatriation/enhancement are determined to be necessary.

Ceanothus roderickii - *Ceanothus roderickii* is restricted to the Pine Hill formation. It occurs on gabbro-derived soil in openings in chaparral or less frequently on disturbed sites within chaparral (Wilson 1986). Known extant occurrences are discontinuously scattered in the Pine Hill formation. Our preserve recommendation would protect *C. roderickii* at the Salmon Falls/Martel Creek preserve in the north, the Pine Hill preserve in the center, and in the south at the Cameron Park preserve north of Highway 50 and the Cameron Park preserve south of Highway 50.

Ceanothus roderickii does not appear to be an early seral species; however survival and growth of seedlings under shrub canopy is poor. Without fire, seed germination is poor. In addition to securing and protecting habitat, maintenance of the metapopulation dynamics will be important for survival and recovery. Unless

future metapopulation analyses show otherwise, a minimum of two very large occurrences each greater than 80 hectares (200 acres); two large occurrences greater than 40 hectares (100 acres); six medium occurrences each between 4 and 40 hectares (10 and 100 acres); and seven small occurrences each smaller than 4 hectares (10 acres), are to be maintained at any given time throughout the range of the species.

High priority recovery actions for *Ceanothus roderickii* include demographic studies determining limiting life stages. Other important but lower priority recovery actions for *C. roderickii* include systematics research, and genetic studies and the development of propagation techniques if it is determined that repatriation introductions are necessary.

Fremontodendron californicum ssp. decumbens - *Fremontodendron californicum ssp. decumbens* only occurs in the central part of the Pine Hill formation within 1.25 kilometers (2 miles) of Pine Hill. Fire is needed to maintain habitat for this species. Preservation of the pollinating fauna (native solitary bees) and dispersal fauna (ants) is also important to the survival and recovery of *F. californicum ssp. decumbens*. The total population is estimated to comprise only 500 individuals. Our current preserve recommendation would protect *F. californicum ssp. decumbens* on the Pine Hill preserve in the central part of the Pine Hill formation. Additionally, we are recommending that *F. californicum ssp. decumbens* be introduced on appropriate habitat within the Salmon Falls/Martel Creek preserve. The decumbent *Fremontodendron* within Nevada and Yuba Counties should also be secured and protected unless it is determined not to be the listed *Fremontodendron*.

Fremontodendron californicum ssp. decumbens is a shrub that persists through a fire cycle and requires fire for seed germination. In addition to securing and protecting habitat, maintenance of the metapopulation dynamics is important to the survival of the species. Unless future metapopulation analyses show otherwise, at least one very large occurrence greater than 130 hectares (320 acres); three medium occurrences each between 4 and 40 hectares (10 and 100 acres); and four small occurrences each smaller than 4 hectares (10 acres) are to be maintained at any given time throughout the range of the species on the Pine Hill formation.

A high priority recovery task for *Fremontodendron californicum* ssp. *decumbens* is the collection and banking of seed in Center for Plant Conservation certified botanic gardens. Collections are prudent to guard against extinction of the species from chance catastrophic events and to provide potential material for enhancement efforts in existing populations, repatriations (returns to locations formerly occupied), and/or introductions to new sites.

The Salmon Falls/Martel Creek preserve area should be surveyed to determine suitable areas for introduction. Suitability for introduction depends 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.

Certain types of research are also necessary for recovery. These research topics include: (1) identification of the decumbent *Fremontodendron* in Nevada and Yuba Counties; (2) assessing and reducing, if necessary, the threat of disease; (3) demographic studies determining limiting life stages for either Nevada County or Yuba County specimens should they be identified as *Fremontodendron californicum* ssp. *decumbens*; (4) directed surveys in Nevada and Yuba Counties should the decumbent *Fremontodendron* be identified as the listed *Fremontodendron*; and (5) development of seed germination and propagation techniques.

Galium californicum* ssp. *sierrae - *Galium californicum* ssp. *sierrae* is endemic to and quite rare within the Pine Hill formation. The role, if any, of fire for the species persistence is unknown. Loss of one occurrence would result in a significant impact to its viability as a species. The goal is to protect all of the occupied habitat on public land and as much habitat on private land as is possible through sale of fee title, conservation easement from willing sellers at fair market value, or if a landowner is not interested in selling title or easement, through the voluntary conservation by landowners of this species on their land. We expect that, should the preserves develop as described here, *G. californicum* ssp. *sierrae* would be protected in the Salmon Falls/Martel Creek preserve, the Pine Hill preserve, the Cameron Park preserve north of Highway 50, and a specialty preserve in the southern portion of the Pine Hill formation.

In addition to securing and protecting habitat, maintenance of the metapopulation dynamics will be important for survival. Unless the future metapopulation analyses show otherwise, at least one large occurrence greater than 35 hectares (85 acres); six medium occurrences each between 4 and 35 hectares (10 and 85 acres); and five small occurrences each smaller than 4 hectares (10 acres) are to be maintained at any given time throughout the range of the species.

A high priority recovery task for *Galium californicum* ssp. *sierrae* is the collection and banking of seed in Center for Plant Conservation-certified botanic gardens. Collections are prudent to guard against extinction of the species from chance catastrophic events and to provide potential material for enhancement efforts in existing populations, repatriations (returns to locations formerly occupied), and/or introductions to new sites.

Directed surveys for *Galium californicum* ssp. *sierrae* will need to be conducted in the Cameron Park area to refine the location of the *Galium* specialty preserve, and northwest of Salmon Falls and at Martel Creek to verify historical or reported locations. High priority recovery actions for *G. californicum* ssp. *sierrae* include: demographic studies determining limiting life stages, reproductive biology research, and genetic studies.

The above measures constitute a significant improvement in the protection and management of *Galium californicum* ssp. *sierrae* throughout its range. Completing these actions would substantially increase the security of the species. However, our best available data suggest this species should not be considered for delisting in the foreseeable future. To the best of our knowledge, the large population in the southern part of its range has been extirpated. We do not consider the remaining habitat sufficient for recovery.

Senecio layneae - *Senecio layneae* grows in open rocky areas within chaparral plant communities, primarily on gabbro-derived soils and occasionally on serpentine-derived soils. Most known sites are scattered within the Pine Hill formation and adjacent serpentine primarily on private land. A few other colonies occur in the Eldorado National Forest in El Dorado County, the Bureau of Land

Management Red Hills Management Area in Tuolumne County, and on Bureau of Land Management managed land in Yuba County (BioSystems Analysis, Inc. 1984, A. Franklin pers. comm. 1997).

Senecio layneae appears to be an early successional species that occupies temporary openings on gabbro or serpentine and is eliminated as vegetation grows up around it. Preserves should include sufficient habitat to allow for expansion or shifts in occupied habitat. Our current preserve recommendation would protect *S. layneae* throughout its range at the Salmon Falls/Martel Creek preserve in the north, the Pine Hill preserve in the center, the Penny Lane preserve in the center, and in the south at the Cameron Park preserve north of Highway 50 and the Cameron Park preserve south of Highway 50. Additionally, all known populations on Bureau of Land Management and Eldorado National Forest land would be secured and protected from incompatible uses. Land Management agencies should use their administrative processes to help secure and protect the areas (*e.g.*, Bureau of Land Management designating occurrences on its land as Areas of Critical Environmental Concern).

In addition to securing and protecting habitat, maintenance of the metapopulation dynamics will be important for survival and recovery. Unless the future metapopulation analyses show otherwise: (1) at least 1 very large occurrence greater than 80 hectares (200 acres), 1 large occurrence greater than 40 hectares (100 acres), 7 medium occurrences between 4 and 40 hectares (10 and 100 acres), and 24 small occurrences each smaller than 4 hectares (10 acres) are to be maintained at any given time throughout the Pine Hill formation; (2) at least 1 large, 2 medium, and 5 small occurrences are to be maintained at any given time in western El Dorado County off of the Pine Hill formation; (3) at least 2 medium and 4 small occurrences are to be maintained at any given time in Tuolumne County; and (4) at least 2 small occurrences are to be maintained at any given time in Yuba County.

Directed surveys for *Senecio layneae* should be conducted on (1) serpentine soil areas off the Pine Hill formation in western El Dorado County, (2) Mildred soil series areas in Yuba County, and (3) serpentine soils near Red Hills in Tuolumne County. If new populations of *S. layneae* are discovered, their

importance to recovery of the species should be evaluated to determine whether their protection and management is necessary.

Other studies important for recovery include: (1) studying the effects of a range of treatments simulating fire on the germination of *Senecio layneae* seed; (2) determining the effects of grazing; (3) studies regarding the influence of disturbance and fire on seedling establishment; (4) reproductive studies identifying pollinators; (5) genetic studies; (6) the collection and banking of seed in Center for Plant Conservation certified botanic gardens for the disjunct populations of *S. layneae*; and (7) demographic studies identifying limiting life stages.

Currently, we do not think that additional knowledge of propagation techniques is needed for *Senecio layneae*. We do not anticipate we will be introducing or repatriating *S. layneae* populations. If at some point in the future it is determined that introducing or repatriating *S. layneae* populations is necessary for recovery, then propagation techniques should be developed.

Wyethia reticulata - *Wyethia reticulata* grows in open rocky areas within chaparral plant communities, on gabbro-derived soils. All known sites are scattered within the Pine Hill formation. Currently, *W. reticulata* occurs primarily on privately owned land. Providing unoccupied potentially suitable habitat allows for plant succession, which is necessary for the long-term conservation of this species. *W. reticulata* is a clonal species that can grow to be very large and old, with some individuals estimated to be several hundred years old. Recruitment from seed is very poor in *W. reticulata*. Because of the importance of irreplaceable large clones to the population viability of this species, *W. reticulata* needs to be protected where it currently occurs (D. Ayres *in litt.* 1999). Our current preserve recommendation would protect *W. reticulata* at the Salmon Falls/Martel Creek preserve in the north, the Pine Hill preserve in the center, the Penny Lane preserve in the center, and in the south at the Cameron Park preserve north of Highway 50 and the Cameron Park preserve south of Highway 50.

In addition to securing and protecting habitat, maintenance of the metapopulation dynamics will be important for conservation of the species. Unless future metapopulation analyses show otherwise, at least 1 very large

occurrence greater than 80 hectares (200 acres); 2 large occurrences each greater than 40 hectares (100 acres); 10 medium occurrences each between 4 and 40 hectares (10 and 100 acres); and 19 small occurrences each smaller than 4 hectares (10 acres), are to be maintained at any given time throughout the range of the species.

Studies important for the conservation of *Wyethia reticulata* include: (1) reproductive studies identifying pollinators, and (2) demographic studies identifying limiting life stages.

Currently, we do not think that additional knowledge of propagation techniques is needed for *Wyethia reticulata*. We do not anticipate we will be introducing or repatriating *W. reticulata* populations. If at some point in the future it is determined that introducing or repatriating *W. reticulata* populations is necessary for conservation of the species, then propagation techniques should be developed.

C. Recovery and Conservation Criteria

The recommended preserve strategy for the Pine Hill formation is summarized in Table III-4. Recovery criteria for federally listed species and criteria for long-term conservation of *Wyethia reticulata* are given in Table III-5. The number and size of occurrences that need to be preserved for each species are listed in Table III-5 and discussed above in §III.B.3 (Individual Species Considerations). In addition to preserving occurrences, the recovery criteria call for the securing and protection of preserves. Within the southern zone (Figure I-1), where there has been a significant amount of habitat fragmentation, the goal is to protect approximately 315 hectares (778 acres) of habitat in three or more preserves, including a 24-hectare (60-acre) specialty preserve for *Galium californicum* ssp. *sierrae*. The primary southern preserve should comprise approximately 244 contiguous hectares (602 contiguous acres). In the central zone the goal is to preserve one large preserve (395 hectares [975 acres]) surrounding

Table III-4. Size of preserves needed to meet recovery criteria within the Pine Hill formation.

Preserve area	Zone	Primary Preserve	satellite preserve hectares (acres)	Total
Salmon Falls/ Martel Creek	north/central	1,247 (3,082)	0 (0)	1,247 (3,082)
Pine Hill	central	395 (975)	0 (0)	395 (975)
Penny Lane	central	0 (0)	67 (166)	67 (166)
Cameron Park	south	244 (602)	47 (116)	291 (718)
<i>Galium</i> Specialty Preserve	south	0 (0)	24 (60)	24 (60)
TOTAL		1,886 (4,659)	138 (342)	2,024 (5,001)

Table III-5. Recovery criteria for federally listed plants and conservation criteria for *Wyethia reticulata*. Though not explicitly stated, delisting criteria include meeting all of the downlisting criteria.

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 objective	III. Monitoring in all recommended preserves shows:	IV. Other actions
<i>Calystegia stebbinsii</i> (Stebbins' morning-glory)	downlist	(a) Cameron Park preserve north of Highway 50; (b) Cameron Park preserve south of Highway 50; (c) Salmon Falls/Martel Creek preserve (see Table III-4 for acreage figures of preserves); (d) occurrences in Nevada County; along with sufficient adjacent unoccupied habitat for fire management and a 150-meter (500-foot) buffer.	For all populations recommended for protection and any adjacent areas identified as necessary for continued survival and recovery (see previous column).	(a) Populations stable or increasing over one fire cycle (about 30 years) (subject to modification depending on results of fire management studies). (b) Habitat monitoring shows a mosaic of multi-age -class stands and habitat fragmentation has not appreciably increased (less than 5 percent) within any preserve over current (2000) conditions. (c) Spatially and temporally, the establishment of occurrences must be greater than the extirpation of occurrences.	(a) Ameliorate or eliminate threats (see Appendix H); (b) Fire management studies; (c) Research on genetics of Nevada County population; (d) Seeds of disjunct populations stored in at least two Center for Plant Conservation certified facilities; (e) Research on propagation techniques if repatriation, enhancement, or restoration are determined to be necessary (f) Maintain metapopulation dynamics of at least 2 very large, 7 medium, and 4 small occurrences throughout the northern and southern portions of the Pine Hill formation; and of at least 1 medium and 5 small occurrences near Grass Valley in Nevada County. See also Individual Species Considerations (§III.B.3).

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 objective	III. Monitoring in all recommended preserves shows:	IV. Other actions
<i>Calystegia stebbinsii</i> (Stebbins' morning-glory)	delist		For all occurrences and any adjacent areas identified as necessary for continued survival and recovery.	<p>(d) No population decline after downlisting during two additional fire cycles (about 60 years); if declining, determine cause and reverse trend.</p> <p>(e) Habitat monitoring continues to show a mosaic of multi-age class stands and habitat fragmentation has not appreciably increased (less than 5 percent) within any preserves over current (2000) conditions.</p> <p>(f) Spatially and temporally, the establishment of occurrences must continue to be greater than the extirpation of occurrences.</p>	(g) Ameliorate or eliminate threats (see Appendix H).

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 objective	III. Monitoring in all recommended preserves shows:	IV. Other actions
<p><i>Ceanothus roderickii</i> (Pine Hill ceanothus)</p>	<p>downlist</p>	<p>(e) Cameron Park preserve north of Highway 50; (f) Cameron Park preserve south of Highway 50; (g) Pine Hill preserve; Salmon Falls/Martel Creek preserve; (h) sufficient adjacent unoccupied habitat for fire management and a 150-meter (500-foot) buffer (see Table III-4 for acreage figures of preserves).</p>	<p>For preserves and any adjacent occupied or unoccupied habitat identified as necessary for continued survival and recovery (see previous column).</p>	<p>(g) Populations stable or increasing over one fire cycle (about 30 years) (subject to modification depending on results of fire management studies). (h) Habitat monitoring of recommended preserves shows a mosaic of multi-age class stands and habitat fragmentation has not appreciably increased (less than 5 percent) within any preserves over current (2000) conditions. (i) Spatially and temporally, the establishment of occurrences must be greater than the extirpation of occurrences.</p>	<p>(h) Ameliorate or eliminate threats (see Appendix H); (i) Fire management studies; (j) Research on propagation techniques if repatriation, enhancement, or restoration are determined to be necessary; (k) Maintain metapopulation dynamics of at least 2 very large, 2 large, 6 medium, and 7 small occurrences throughout the range of the species. See also Individual Species Considerations section (§III.B.3).</p>

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 objective	III. Monitoring in all recommended preserves shows:	IV. Other actions
<i>Ceanothus roderickii</i> (Pine Hill ceanothus)	delist		For all occurrences and any adjacent areas identified as necessary for continued survival and recovery	<p>(j) No decline after downlisting during two additional fire cycles (about 60 years); if declining, determine cause and reverse trend</p> <p>(k) Habitat monitoring of recommended preserves shows a mosaic of multi-age class stands and habitat fragmentation has not appreciably increased (less than 5 percent) within any preserves over current (2000) conditions</p> <p>(l) Spatially and temporally, the establishment of occurrences must be at least 10 percent greater than the extirpation of occurrences</p>	(l) Ameliorate or eliminate threats (see Appendix H); Research on propagation techniques if repatriation, enhancement, or restoration are determined to be necessary

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 objective	III. Monitoring in all recommended preserves shows:	IV. Other actions
<p><i>Fremontodendron californicum</i> ssp. <i>decumbens</i> (Pine Hill flannelbush)</p>	<p>downlist²; actions shown are to aid survival of the species</p>	<p>(i) Pine Hill preserve and occupied habitat along with sufficient adjacent unoccupied habitat for fire management and a 150-meter (500-foot) buffer at 8 known sites. See Table III-4 for acreage of preserves.</p> <p>(j) The decumbent <i>Fremontodendron</i> within Nevada and Yuba Counties should be secured and protected unless determined not to be the listed <i>Fremontodendron</i>.</p>	<p>For all sites and any adjacent occupied or unoccupied habitat identified as necessary for continued survival (see previous column).</p>	<p>(m) Stable or increasing over 60 years (two fire cycles or longer if suggested by results of demographic monitoring).</p> <p>(n) Habitat monitoring of recommended preserves shows a mosaic of multi-age class stands and habitat fragmentation has not appreciably increased (less than 5 percent) within any preserves over current (2000) conditions.</p> <p>(o) Spatially and temporally, the establishment of occurrences must continue to be greater than the extirpation of occurrences.</p>	<p>(m) Ameliorate or eliminate threats (see Appendix H);</p> <p>(n) Fire management studies;</p> <p>(o) seeds stored in at least two Center for Plant Conservation certified facilities;</p> <p>(p) research on seed germination and propagation techniques;</p> <p>(q) successful introduction onto Salmon Falls/Martel Creek preserve.</p> <p>(r) Maintain metapopulation dynamics of at least 1 very large, 3 medium, and 4 small occurrences on the Pine Hill formation. See also Individual Species Considerations section (§III.B.3).</p>

² Not to be considered for delisting unless additional populations are found outside the Pine Hill formation. Specific criteria for this hypothetical case cannot be developed at this time.

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 objective	III. Monitoring in all recommended preserves shows:	IV. Other actions
<i>Galium californicum</i> ssp. <i>sierrae</i> (El Dorado bedstraw)	downlist actions shown are to aid survival of the species ³	(k) Pine Hill preserve, Salmon Falls/Martel Creek preserve; (l) Cameron Park preserve north of Highway 50; and (m) Specialty <i>Galium</i> preserve and occupied habitat; along with adjacent unoccupied habitat and a 150-meter (500-foot) buffer at all known sites. (see Table III-4 for acreage of preserves).	For all populations and any occupied or unoccupied habitat identified as necessary for survival (see previous column).	(p) Stable or increasing with evidence of natural recruitment for a period of 60 years (or longer if suggested by the results of demographic monitoring). (q) Habitat monitoring of recommended preserves shows a mosaic of multi-age class stands and habitat fragmentation has not appreciably increased (less than 5 percent) over current (2000) conditions. (r) Spatially and temporally, the establishment of occurrences must be greater than the extirpation of occurrences.	(s) Ameliorate or eliminate threats (see Appendix H); (t) Ecological studies; (u) seeds stored in at least two Center for Plant Conservation certified facilities; (v) research on seed germination and propagation techniques; (w) effects of fire studied; (x) successful enhancement, repatriation, or introduction at Salmon Falls/Martel Creek. (y) Maintain metapopulation dynamics of at least 1 large, 6 medium occurrences, and 5 small occurrences at any given time throughout the range of the species See also Individual Species Considerations section (§III.B.3).

³ Not delistable unless vigorous natural occurrences of *Galium californicum* ssp. *sierrae* are found off the Pine Hill formation that are not threatened, and can be secured and protected. Specific criteria for this hypothetical case cannot be developed at this time

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 objective	III. Monitoring in all recommended preserves shows:	IV. Other actions
<p><i>Senecio layneae</i> (Layne's butterweed)</p>	<p>delist</p>	<p>Populations representing the range of the species including: (n) Cameron Park preserve south of Highway 50, (o) Cameron Park preserve north of Highway 50, (p) Pine Hill preserve, (q) Penny Lane preserve, (r) Salmon Falls/Martel Creek preserve, (see Table III-4 for acreage of preserves) (s) occupied habitat on BLM lands in Yuba and Tuolumne Counties, and (t) occupied habitat on the Eldorado National Forest; along with adjacent unoccupied habitat and a 150-meter (500-foot) buffer.</p>	<p>For all populations and any occupied or unoccupied habitat identified as necessary for survival and recovery (see previous column).</p>	<p>(s) Stable or increasing with evidence of natural recruitment for a period of 60 years that includes normal disturbance. (t) Habitat monitoring of recommended preserves shows a mosaic of multi-age class stands and habitat fragmentation has not appreciably increased (less than 5 percent) within any preserves over current (2000) conditions. (u) Spatially and temporally, the establishment of occurrences must be at least 10 percent greater than the extirpation of occurrences.</p>	<p>(z) Ameliorate or eliminate threats (see Appendix H); (aa) Study importance of fire for management; (bb) seeds of disjunct populations stored in at least two Center for Plant Conservation certified facilities. (cc) Maintain metapopulation dynamics of at least 1 very large, 1 large, 7 medium, and 24 small occurrences throughout the Pine Hill formation; of at least 1 large, 2 medium and 5 small in western El Dorado County; of at least 2 medium and 4 small in Tuolumne County; and of at least 2 small in Yuba County. See also Individual Species Considerations section (§III.B.3).</p>

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 objective	III. Monitoring in all recommended preserves shows:	IV. Other actions
<p><i>Wyethia reticulata</i> (El Dorado mule-ears)</p>	<p>conserve</p>	<p>(u) Cameron Park preserve south of Highway 50, (v) Cameron Park preserve north of Highway 50, (w) Pine Hill preserve, (x) Penny Lane preserve, (y) Salmon Falls/ Martel Creek preserve; along with sufficient adjacent unoccupied habitat for fire management and a 150-meter (500-foot) buffer (see Table III-4 for acreage of preserves).</p>	<p>For all populations and any occupied or unoccupied habitat identified as necessary to species conservation (see previous column).</p>	<p>(v) Stable or increasing over 60 years (two fire cycles or longer if suggested by results of demographic monitoring). (w) Habitat monitoring of recommended preserves shows a mosaic of multi-age class stands and habitat fragmentation has not appreciably increased (less than 5 percent) within any preserves over current (2000) conditions. (x) Spatially and temporally, the establishment of occurrences must be greater than the extirpation of occurrences.</p>	<p>(dd) Perform status review to determine whether listing the species is warranted if tasks specific to the needs of <i>Wyethia reticulata</i> are not undertaken within 5 years of approval of this recovery plan. (ee) Maintain metapopulation dynamics of at least 1 very large, 2 large, 10 medium, and 19 small occurrences throughout the range of the species. See also Individual Species Considerations section (§III.B.3).</p>

Pine Hill and one satellite preserve (totaling approximately 67 hectares [166 acres]). In the northern zone, where less development has occurred and habitat is not as fragmented, the goal is to preserve approximately 1,247 hectares (3,082 acres) in a large contiguous area. For species whose distribution also occurs off the Pine Hill formation, protection of those occurrences with sufficient adjacent unoccupied habitat for fire management and a 150-meter (500-foot) buffer will also be needed (see Table III-5).

Listed Plant Species - In general, downlisting criteria for federally listed endangered plant species and delisting of *Senecio layneae* are based on (1) securing and protecting the preserves including the acreages listed in Table III-4; (2) protection and adaptive management in perpetuity of currently known sites or habitat; (3) evidence that occurrences within these sites are stable or increasing over a number of years (how many years depends on the life history of the individual species and the need for fire management); (4) evidence that a mosaic of multi-age-class stands of vegetation exists and that habitat fragmentation has not appreciably increased (less than 5 percent) within any preserve over current (2000) conditions; (5) evidence that, spatially and temporally, the establishment of occurrences is greater than the extirpation of occurrences on the landscape; (6) storage of seed in Center for Plant Conservation certified facilities for selected species or occurrences; (7) development of reliable seed germination and propagation techniques for the species for which repatriation or introduction may be appropriate; and (8) ameliorating or eliminating threats.

Protection of sites should first target the lands within our preserve recommendation that were also recommended by the El Dorado Rare Plant Advisory Committee, including the largest possible blocks of land and a buffer of 150 meters (500 feet). Protection should involve populations throughout the known range of the species. Populations should be monitored at appropriate time intervals. Until research shows otherwise, recovery should target securing populations containing a minimum of 40 hectares (100 acres) of habitat (but preferably more).

Delisting generally involves meeting the above criteria as well as (1) the sustainability of the species and habitat over multiple fire (or possibly other disturbance) regimes; (2) finding, repatriating, or introducing several additional populations of the species. However, because repatriation and creation of populations are expensive and experimental, surveying historical sites and potential habitat within the historical range to find currently unknown populations is the preferred strategy. Once delisting criteria have been attained, a status review must be conducted to determine whether reclassification is appropriate. Our best available information indicates *Fremontodendron californicum* ssp. *decumbens* and *Galium californicum* ssp. *sierrae* should not be considered for delisting in the foreseeable future due to their limited distribution within an area that is extensively developed.

Multiple criteria are necessary for monitoring to determine when recovery is achieved. No single criterion will be adequate for determining recovery. Measuring only the number of populations, or the number of individuals in a population, or the density of a population, does not give a complete picture. Without knowing information regarding when the last disturbance occurred and multiple monitoring criteria, we cannot know whether the metapopulation dynamics will be able to continue in perpetuity. The multiple monitoring protocols have yet to be determined, but at a minimum should include: photopoints, estimates of acreage occupied, density, co-occurring species including nonnative plants, time since last disturbance, and some estimate of seedbank dynamics.

Plant Species of Concern - Ensuring long-term conservation of *Wyethia reticulata* involves meeting criteria similar to those given above for reclassifying the listed plant species: (1) securing and protecting the preserves, including the acreages listed in Table III-4; (2) protection and adaptive management in perpetuity of currently known sites or habitat; (3) evidence that occurrences within these sites are stable or increasing over a number of years; (4) evidence that a mosaic of multi-age-class stands of vegetation exists and that habitat fragmentation has not appreciably increased (less than 5 percent) within any preserve over current (2000) conditions; (5) evidence that, spatially and temporally, the establishment of occurrences are greater than the extirpation of

occurrences on the landscape; and (6) ameliorating or eliminating threats. These criteria assume that long-term conservation has been achieved if populations remain throughout the historical range, are not declining, and are secure from threats.

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 the 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 often ranked for each species individually, wherever possible this recovery plan focuses on multi-species 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. Develop and implement a cooperative program and participation plan.

A cooperative program is needed to coordinate local public and private land use planning with State and Federal land use and recovery planning for gabbro species. A cooperative program needs to be developed focusing on western El Dorado County. A participation plan produced from this program will increase the chances of recovery for listed species and ensure the long-term conservation of the species of concern covered in this recovery plan.

- 1.1 Establish a cooperative program with participants from the public and private sector (Priority 2).

Interested parties in local, State, and Federal government and in the private sector should be identified, and their willingness to participate in a cooperative program determined. A program should be initiated.

- 1.2 Develop and implement a participation plan.

A participation plan should include: (1) outreach to enhance public understanding of rare species in general and of gabbro endemic species in particular, and (2) economic incentives for conservation of rare species. A participation plan could take the form of one or more Memoranda of Agreement.

- 1.2.1 Develop and implement an outreach plan (Priority 1).

An outreach plan should focus on providing information to interested and affected landowners about: (1) species covered in the plan, (2) what is meant by recovery, (3) how recovery can be achieved, and (4) the need for fire management for habitat maintenance. Private landowners

should become familiar with rare gabbro plant 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 1.2.2). 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 must 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.

The outreach should also include community education regarding the need for re-establishing natural burn cycles in the preserves.

- 1.2.2 Develop and implement economic or other incentives for conservation and recovery on private lands through the cooperative program and other groups (Priority 2).

Support and assistance of private landowners in conserving and recovering species covered in this recovery plan may be gained through economic and other incentive programs. We should work with nonprofit organizations (such as land trusts) to foster conservation efforts. Support and assistance of private landowners in conserving and recovering species covered in this recovery plan may be gained by developing economic and other incentive programs (including relief from taxes).

2. Protect and secure existing populations.

Natural lands that contain species covered in this recovery plan need to be protected in perpetuity. Protection of these lands includes identification

and minimization of threats in perpetuity and application of appropriate and adaptive management (see Task 3) to ensure species survival and recovery. Natural lands that need protection can be categorized into two types: (1) blocks of land that contain occupied or potential habitat for *two or more* species covered in the recovery plan (Table IV-1) and (2) blocks of land that contain occupied or potential habitat for *one* species covered in the recovery plan (Table IV-2). The geographic areas targeted for protection of two or more species on the Pine Hill formation of El Dorado County are identified in Figures III-1 and III-5. All potential preserve areas should be evaluated based on current mapping information and ground-truthed prior to purchase to confirm their value for recovery.

2.1 Protect and secure areas important for recovery/conservation of two or more species covered in the recovery plan.

Table IV-1 lists blocks of land that contain occupied or potential habitat for two or more species covered in the recovery plan.

Public and conservation lands should be managed to support listed and other sensitive species. Private lands will need to either be acquired at fair market value or protected through conservation management agreements, easements, or other mechanisms and then managed to support listed and other sensitive species (See Task 3 below).

Table IV-1. Geographic areas targeted for protection of two or more species covered in the recovery plan. See Figures II-3, II-5, III-1, and III-5 for locations of geographic areas.

Task #	Location	Listed Taxa and Species of Concern (Listed taxa and species of concern are separated by dashed line)	Landowner / Comments	Priority
EL DORADO COUNTY				
2.1.1	Cameron Park, North of Highway 50 (Figure III-5)	<i>Calystegia stebbinsii</i> <i>Ceanothus roderickii</i> <i>Galium californicum</i> ssp. <i>sierrae</i> <i>Senecio layneae</i> ---- <i>Wyethia reticulata</i>	- approximately 244 hectares (602 acres) - private, Bureau of Land Management - fire management needed - in rapidly developing area - 183.7 hectares (454 acres) already acquired, 158.2 hectares (391 acres) currently owned by Bureau of Land Management, and 25.5 hectares (63 acres) owned by El Dorado County	1
2.1.2	Cameron Park, South of Highway 50 (Figure III-5)	<i>Calystegia stebbinsii</i> <i>Ceanothus roderickii</i> <i>Senecio layneae</i> ---- <i>Wyethia reticulata</i>	- approximately 47 hectares (116 acres) - across Highway 50 from preserve in Task 2.1.1 - private - fire management needed - nonnative plant control needed	2

Task #	Location	Listed Taxa and Species of Concern (Listed taxa and species of concern are separated by dashed line)	Landowner / Comments	Priority
2.1.3	Pine Hill	<i>Ceanothus roderickii</i> <i>Fremontodendron californicum</i> ssp. <i>decumbens</i> <i>Galium californicum</i> ssp. <i>sierrae</i> <i>Senecio layneae</i> ----- <i>Wyethia reticulata</i>	- California Department of Fish and Game, California Department of Forestry, Bureau of Land Management; includes 154 hectares (380 acres) public land and approximately 241 hectares (595 acres) private land - private land should be acquired or protected either through fee title or conservation easements from willing sellers - fire management needed - star thistle needs to be eradicated near radio towers - contains the majority of known locations of <i>Fremontodendron californicum</i> ssp. <i>decumbens</i> - potential enhancement site for <i>Galium californicum</i> ssp. <i>sierrae</i>	1
2.1.4	Penny Lane	<i>Senecio layneae</i> ----- <i>Wyethia reticulata</i>	- approximately 67 hectares (166 acres) - Bureau of Land Management - fire management needed	2

Task #	Location	Listed Taxa and Species of Concern (Listed taxa and species of concern are separated by dashed line)	Landowner / Comments	Priority
2.1.5	Salmon Falls/Martel Creek preserve, North portion (Figure III-5)	<i>Calystegia stebbinsii</i> <i>Ceanothus roderickii</i> <i>Galium californicum</i> ssp. <i>sierrae</i> <i>Senecio layneae</i> ----- <i>Wyethia reticulata</i>	- private, Bureau of Land Management, California Department of Fish and Game - approximately 758 hectares (1,874 acres) - approximately 271 hectares (669 acres) private land and 488 hectares (1,205 acres) public land - fire management needed - potential enhancement site for <i>Galium californicum</i> ssp. <i>sierrae</i> and introduction site for <i>Fremontodendron californicum</i> ssp. <i>decumbens</i> - contiguous with the 489 hectares (1,208 acres) referred to in Task 2.1.6	1
2.1.6	Salmon Falls/Martel Creek preserve, South portion (Figure III-5)	<i>Senecio layneae</i> ----- <i>Wyethia reticulata</i>	- approximately 489 hectares (1,208 acres) - approximately 310 hectares (766 acres) private and 179 hectares (442 acres) Bureau of Land Management - contiguous with the 758 hectares (1,874 acres) referred to in Task 2.1.5	2

2.2 Protect and secure areas important for recovery/conservation of single species covered in the recovery plan.

Table IV-2 lists areas that contain occupied or potential habitat for single species covered in the recovery plan. Public and conservation lands will need to be managed to support listed and other sensitive species. Private lands need to be either acquired at fair market value or protected through conservation management agreements, easements, or other mechanisms and then managed to support listed and other sensitive species (see Task 3 below).

Table IV-2. Geographic areas targeted for protection of single species covered in the recovery plan. See Figures II-3 and II-5 for locations of geographic areas.

Task #	Location	Listed Taxon or Species of Concern (Listed taxa and species of concern are separated by a dashed line)	Landowner / Comments	Priority
EL DORADO COUNTY				
2.2.1	Specialty preserve for <i>Galium californicum</i> ssp. <i>sierrae</i>	<i>Galium californicum</i> ssp. <i>sierrae</i>	<ul style="list-style-type: none"> - should target dense oak woodland on Rescue series soils - approximately 24 hectares (60 acres) - exact location to be determined pending confirmation of localities and availability of willing sellers 	1

Task #	Location	Listed Taxon or Species of Concern (Listed taxa and species of concern are separated by a dashed line)	Landowner / Comments	Priority
2.2.2	Eldorado National Forest	<i>Senecio layneae</i>	- three occurrences of <i>Senecio layneae</i> - Eldorado National Forest - other species that might benefit, but are not the target of this recovery plan: <i>Eriogonum tripodium</i> (tripod buckwheat), <i>Allium sanbornii</i> var. <i>congdonii</i> (Congdon's onion), and <i>Allium sanbornii</i> var. <i>sanbornii</i> (Sanborn's onion)	2
NEVADA COUNTY				
2.2.3	Grass Valley	<i>Calystegia stebbinsii</i> decumbent <i>Fremontodendron</i>	- private and Bureau of Land Management - northernmost occurrence for <i>Calystegia stebbinsii</i> - decumbent <i>Fremontodendron</i> unless it is determined not to be the listed <i>Fremontodendron</i>	1
YUBA COUNTY				
2.2.4	Southwest of Brownsville	<i>Senecio layneae</i> decumbent <i>Fremontodendron</i>	- Bureau of Land Management and private - decumbent <i>Fremontodendron</i> unless it is determined not to be the listed <i>Fremontodendron</i>	1
TUOLUMNE COUNTY				
2.2.5	Red Hills	<i>Senecio layneae</i>	- Bureau of Land Management - represents southern range	1

3. Manage Habitat

Managing habitat is essential to the recovery of the listed species and the long-term conservation of the species of concern included in this recovery plan. Habitat management includes preparation and implementation of management plans for all areas inhabited by special status species being proposed for preservation, and periodic monitoring of populations in each of these areas. Within western El Dorado County, a multi-constituent committee should be formed to oversee the management of preserves located on the Pine Hill formation. The preserve management committee should include, at a minimum, representatives from the California Department of Fish and Game, U.S. Fish and Wildlife Service, Bureau of Land Management, El Dorado County, California Department of Forestry and Fire Protection, California Native Plant Society, American River Conservancy, and a private landowner representative.

- 3.1 Establish a funding mechanism to cover the cost of the ongoing long-term maintenance and management of the preserves on the Pine Hill formation (Priority 1).

An endowment fund for the long-term maintenance or management needs to be established. Potential sources of funding the endowment fund include an ecological preserve fee, water rate surcharges, increased water connection charges, or a combination of State and Federal grants. Because of the role of fire for the maintenance of the preserves and the need for the community to understand the role for re-establishing natural burn cycles, the endowment also needs to provide money for community education.

- 3.2 Hire a preserve manager for Pine Hill formation preserves in El Dorado County (Priority 1).

The preserve manager needs to 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 from the preserve oversight committee; (2) conducting or coordinating monitoring of rare plant populations; (3) coordinating with staff involved in managing the California Department of Fish and Game Pine Hill Ecological Reserve, Bureau of Land Management lands, and Eldorado National Forest; (4) coordinating with public or private groups that are interested in visiting the preserves; and (5) enlisting and supervising volunteers who can help with preserve monitoring and maintenance activities.

3.3 Prepare management plans and implement appropriate management in areas inhabited by special status species (Priority 1).

Management plans need to be developed and implemented for areas identified in Tables IV-1 and IV-2 that are inhabited by special status species. Management plans must include strategies to ameliorate or minimize threats to special status species including the threats that caused the species to be listed (see Appendix H). To reduce the threat of short interval fires, management plans need to address the control of weedy annual grasses.

Management plans should be regularly reviewed. If new threats are identified or other new information becomes available, management plans need to be re-evaluated and revised. Additionally, management plans also should include an operations and maintenance schedule for the completion of ongoing routine tasks and one-time tasks. 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 5) should also be considered in adaptive management schemes.

3.4 Establish monitoring protocols for the species and habitats covered in this recovery plan.

3.4.1 Establish monitoring protocols for the species covered in this recovery plan (Priority 1).

Monitoring protocols need to be developed to evaluate the success of management activities, to determine trends of the rare plant populations, and to monitor threats. Standardized protocols are needed to ensure consistency of monitoring performed between people and over time.

Monitoring must be based on multiple criteria. No single criterion would reliably measure trend. Monitoring protocols for population trends should include at a minimum photopoints, estimates of acreage occupied, density, co-occurring species including nonnative plants, time since last disturbance, and some estimate of seedbank dynamics.

3.4.2 Establish a protocol for habitat monitoring (Priority 1).

Monitoring protocols need to be developed to evaluate the degree of habitat fragmentation, shifts in vegetation type, and the establishment and extirpation of plant occurrences on the landscape. Aerial photographs may be used in ascertaining some of this information.

3.5 Perform baseline monitoring at all areas identified for preservation (Priority 1).

Baseline monitoring, a standard by which future change is measured, is necessary at all areas identified for preservation. As preserve areas or conservation easements are acquired, baseline monitoring is needed to determine current conditions. Multiple

criteria need to be monitored including, but not limited to, estimates of acreage occupied, density, co-occurring species including nonnative plants, time since last disturbance, and some estimate of seedbank dynamics.

- 3.6 Develop and implement monitoring plans for special status species populations and for habitat in all areas being proposed for preservation (Priority 2).

Monitoring plans need to be developed and implemented for all areas inhabited by populations of listed species and the species of concern that are proposed for preservation. These populations need to be monitored at time intervals appropriate for each species. Monitoring efforts for co-occurring species (*e.g.*, at Pine Hill) should be coordinated to increase efficiency and reduce costs. Population monitoring should continue where currently underway and should begin, wherever possible, for all other populations regardless of whether management plans have been developed or formal protection has been secured. Monitoring is also necessary to determine the condition of the preserves, and to determine the need to conduct maintenance activities.

Habitat monitoring for change in degree of habitat fragmentation, for shifts in vegetation types, and for tracking occurrence establishment and extirpation also needs to be performed.

4. 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 may often require relocating historic 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 repatriation. Suitability of historical locations for repatriation 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 gabbro or serpentine habitat to determine whether undiscovered populations may exist. If new populations are discovered, they need to be protected and managed as discussed above. During the surveys, potential introduction sites should also be identified.

Specific locations that need to be surveyed for one or more species covered in the recovery plan are given in Table IV-3. To increase efficiency and reduce costs, integrated programs involving several species in the same geographic area should be implemented where possible.

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

Botanical surveys need to follow a standard protocol.

- 4.2 Conduct general and directed surveys.

General surveys of potential gabbro and serpentine habitat in each geographic area are needed as well as directed surveys of historical locations and other areas that are especially likely to contain species covered in the recovery plan.

- 4.2.1 Conduct general surveys.

General surveys of all areas being proposed for preservation are needed to determine potential areas for introduction or expansion of populations. The general surveys need to be performed during the time of year when the gabbro plant species are apparent and identifiable. All apparently unoccupied habitat within the preserve boundaries must also be surveyed.

Table IV-3. Directed survey needs of historical and potential habitat by geographic area. See Figures II-3 and II-5 for locations of specific geographic areas.

Task #	Location	Listed Taxa and Taxa of Concern	Comments	Priority
EL DORADO COUNTY				
4.2.2.1	Cameron Park area	<i>Galium californicum</i> ssp. <i>sierrae</i>	- to refine specialty preserve	1
4.2.2.2	Northwest part of Salmon Falls	<i>Galium californicum</i> ssp. <i>sierrae</i>	- to relocate historical occurrence	1
4.2.2.3	Martel Creek	<i>Galium californicum</i> ssp. <i>sierrae</i>	- to locate reported occurrence	2
4.2.2.4	Serpentine soil areas	<i>Senecio layneae</i>	- for areas off the Pine Hill formation	2
NEVADA COUNTY				
4.2.2.5	Serpentine and Gabbro soil areas	<i>Calystegia stebbinsii</i> possibly <i>Fremontodendron californicum</i> ssp. <i>decumbens</i>	- possibly <i>Fremontodendron californicum</i> ssp. <i>decumbens</i> if decumbent <i>Fremontodendron</i> in Nevada or Yuba County identified as the listed <i>Fremontodendron</i>	2
YUBA COUNTY				
4.2.2.6	Private and public land Mildred soil series	<i>Senecio layneae</i> possibly <i>Fremontodendron californicum</i> ssp. <i>decumbens</i>	- possibly <i>Fremontodendron californicum</i> ssp. <i>decumbens</i> if decumbent <i>Fremontodendron</i> in Nevada or Yuba County identified as the listed <i>Fremontodendron</i>	2
TUOLUMNE COUNTY				
4.2.2.7	Serpentine near Red Hills	<i>Senecio layneae</i>		2

4.2.2 Conduct directed surveys.

Needs for directed surveys (*i.e.* for specific species in specific areas) are given in Table IV-3.

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

Table IV-4 compiles research needs by geographic area for species covered in the recovery plan. Research on habitat management and population biology is important as the basis for adaptive management (see Task 3 above) and to guide repatriation or introduction efforts (see Task 6 below). A summary of research needs for each species is given in Appendix E.

Table IV-4. Research needs by geographic area. Additional information given in individual species accounts (Chapter II). See Figures II-3 and II-5 for locations of geographic areas.

Task #	Location	Tasks and Target Species	Comments	Priority
5.1	(not applicable)	- develop propagation techniques for listed plant species and plant species of concern for which enhancement, repatriation, or introductions would be appropriate	- not thought to be appropriate for <i>Wyethia reticulata</i> or <i>Senecio layneae</i> at this time	2
EL DORADO COUNTY				
5.2	County-wide: selected habitat	<p>Fire studies including:</p> <ul style="list-style-type: none"> - effects of fire on <i>Galium californicum</i> ssp. <i>sierrae</i>, <i>Senecio layneae</i>, <i>Chlorogalum grandiflorum</i>, and <i>Helianthemum suffrutescens</i>. - fire management techniques for all species - seed production and survival in soil to determine appropriate fire return interval for all species - germination studies for <i>Senecio layneae</i> determining effects on seed germination from a variety of treatments simulating fire conditions - studies regarding what happens when areas next to disturbed vegetation are burned including tracking nonnative vegetation. 	<ul style="list-style-type: none"> - test a variety of methods experimentally across sites and years - results should be quantifiable - other species of concern should be included in fire effects study in order to ensure fire does not threaten these species 	1

Task #	Location	Tasks and Target Species	Comments	Priority
5.3	County-wide: selected habitat	<ul style="list-style-type: none"> - determine the feasibility of restoring habitat by burning areas of dense chaparral that occur on selected Rescue series soil types for all covered species - determine efficacy of other types of disturbance regimes for the long term maintenance of the habitat and species for all covered species 	<ul style="list-style-type: none"> - test a variety of methods experimentally across sites and years. Results should be quantifiable. - evaluate long-term impact and sustainability of the various other types of disturbance regimes on individual species and their habitat 	2
5.4	Cameron Park preserve	<ul style="list-style-type: none"> - demographic studies determining limiting life stages for <i>Calystegia stebbinsii</i>, <i>Ceanothus roderickii</i>, <i>Galium californicum</i> ssp. <i>sierrae</i>, <i>Senecio layneae</i>, and <i>Wyethia reticulata</i> - influence of disturbance and fire on seedling establishment (<i>Senecio layneae</i>) 		1
5.5	Cameron Park preserve	<ul style="list-style-type: none"> - genetics of <i>Senecio layneae</i> - genetics of <i>Calystegia stebbinsii</i> - systematics of <i>Ceanothus roderickii</i> - genetics of <i>Ceanothus roderickii</i> if introduction or repatriation determined necessary 	<ul style="list-style-type: none"> - need to clarify the relationship of El Dorado and Nevada County populations of <i>Calystegia stebbinsii</i> 	2

Task #	Location	Tasks and Target Species	Comments	Priority
5.6	Pine Hill preserve	<ul style="list-style-type: none"> - demography, reproductive biology, and genetics of <i>Galium californicum</i> ssp. <i>sierrae</i> - demographic studies determining limiting life stages for <i>Ceanothus roderickii</i>, <i>Senecio layneae</i>, and <i>Wyethia reticulata</i> - influence of disturbance and fire on seedling establishment (<i>Senecio layneae</i>) 	<ul style="list-style-type: none"> - potential enhancement or repatriation site for <i>Galium californicum</i> ssp. <i>sierrae</i> 	1
5.7	Pine Hill preserve	<ul style="list-style-type: none"> - genetic study of <i>Senecio layneae</i> - systematics of <i>Ceanothus roderickii</i> - genetics of <i>Ceanothus roderickii</i> if introduction or repatriation determined necessary - study of diseases on <i>Fremontodendron californicum</i> ssp. <i>decumbens</i> 	<ul style="list-style-type: none"> - determine the level of genetic diversity between and among populations of <i>Senecio layneae</i> - assess threat from disease. If disease is still a threat conduct research into all pathogens including ways to prevent their spread; provide management recommendations and techniques for preventing the spread of disease 	2

Task #	Location	Tasks and Target Species	Comments	Priority
5.8	Salmon Falls/Martel Creek preserve	<ul style="list-style-type: none"> - demographic studies determining limiting life stages for <i>Calystegia stebbinsii</i>, <i>Ceanothus roderickii</i>, <i>Galium californicum</i> ssp. <i>sierrae</i>, <i>Senecio layneae</i>, and <i>Wyethia reticulata</i> - demography, reproductive biology, and genetic studies for <i>Galium californicum</i> ssp. <i>sierrae</i> - influence of disturbance and fire on seedling establishment (<i>Senecio layneae</i>) 	<ul style="list-style-type: none"> - controlled burns should be performed on dense chaparral on Bureau of Land Management Lands to manage for <i>Calystegia stebbinsii</i> 	1
5.9	Salmon Falls/Martel Creek preserve	<ul style="list-style-type: none"> - genetic study of <i>Calystegia stebbinsii</i> - genetic study of <i>Senecio layneae</i> - systematics study of <i>Ceanothus roderickii</i> - pollination studies for <i>Senecio layneae</i> and <i>Wyethia reticulata</i> - genetics of <i>Ceanothus roderickii</i> if introduction or repatriation determined necessary 	<ul style="list-style-type: none"> - need to clarify the relationship of El Dorado and Nevada County populations of <i>Calystegia stebbinsii</i> - need to determine the level of genetic diversity between and among populations of <i>Senecio layneae</i> 	2
NEVADA COUNTY				
5.10	Grass Valley	<ul style="list-style-type: none"> - decumbent <i>Fremontodendron</i> should be identified. If it is <i>Fremontodendron californicum</i> ssp. <i>decumbens</i>, then demographic studies of the limiting factors of its life cycle at this location should be studied 	<ul style="list-style-type: none"> - identification unknown at this location 	1
5.11	Grass Valley	<ul style="list-style-type: none"> - genetic study of <i>Calystegia stebbinsii</i> 	<ul style="list-style-type: none"> - need to clarify El Dorado County and Nevada County populations of <i>Calystegia stebbinsii</i> 	2

Task #	Location	Tasks and Target Species	Comments	Priority
TUOLUMNE COUNTY				
5.12	Red Hills Management Area	- effects of different grazing regimes on <i>Senecio layneae</i>		2
5.13	Red Hills Management Area	- genetic study of <i>Senecio layneae</i>	- need to determine the level of genetic diversity between and among populations of <i>Senecio layneae</i>	2
YUBA COUNTY				
5.14	Southwest of Brownsville	- identification of decumbent <i>Fremontodendron</i> . If it is <i>Fremontodendron californicum</i> ssp. <i>decumbens</i> , then demographic studies of the limiting factors of its life cycle at this location should be studied.	- identification unknown at this location	1
5.15	Southwest of Brownsville	- genetic study of <i>Senecio layneae</i>	- need to determine the level of genetic diversity between and among populations	2

6. Undertake artificial enhancement, repatriation, or introduction efforts where necessary.

Where it is deemed necessary, artificial enhancement, repatriation, or introduction efforts for sensitive plants should be undertaken. Prior to repatriation or introduction of sensitive plants, genetics studies are needed (see Task 5) to ensure that new populations will not disrupt unique local gene complexes. Plant repatriation or introduction efforts should be undertaken using collected seeds or plant propagules.

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

Because they occur in very few locations, collection and banking of seed of the following four 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. Seed collection guidelines have been published by the Center for Plant Conservation (1991). Plant taxa for which seed banking is necessary are given in Table IV-5. Priority 1 is given to taxa known from one or two locations. Priority 2 is given to the disjunct populations of plants that occur off the Pine Hill formation.

Table IV-5. Plant taxa for which seeds need to be stored.

Task #	Taxa	Priority
6.1.1	<i>Fremontodendron californicum</i> ssp. <i>decumbens</i> <i>Galium californicum</i> ssp. <i>sierrae</i>	1
6.1.2	disjunct populations of <i>Calystegia stebbinsii</i> in Nevada County	2
6.1.3	disjunct populations of <i>Senecio</i> <i>layneae</i> in Yuba and Tuolumne Counties	2

6.2 Initiate enhancement, repatriation, or introductions where appropriate (Priority 2).

Artificially propagated plants, or collected seeds, can provide potential material for enhancement efforts in existing populations, repatriation of former sites, and/or introductions to new sites.

Surveys of appropriate gabbro and serpentine habitat (see Task 4) should identify suitable sites for repatriations or introductions. Enhancement of populations of species should occur within acquired preserves.

7. Determine possible prescribed burning management strategies and incorporate the strategies into the management plans (Priority 1).

Possible prescribed burning management strategies need to be evaluated, peer reviewed, and incorporated into management plans (see Task 3.3 above).

8. Perform metapopulation-type analyses for each species included in this recovery plan (Priority 2).

The results of a metapopulation-type analysis may be useful in clarifying uncertainties, data needs, and research, management priorities, and delisting criteria. Metapopulation-type analyses should be based on the results of monitoring (Tasks 3.5 and 3.6) and research (Task 5).

9. Periodically review the status of the species of concern (Priority 3).

Listing of *Wyethia reticulata* may be necessary if tasks specific to the needs of this species are not undertaken within 5 years of recovery plan approval.

V. IMPLEMENTATION SCHEDULE

The following implementation schedule outlines actions and estimated costs for this recovery plan. It is a guide for meeting the objectives discussed in Chapter III. 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.

Total costs of ongoing and continual actions are based on an estimated time to recovery of 90 years. If recovery criteria are met, *Calystegia stebbinsii*, *Senecio layneae*, and *Ceanothus roderickii* could be delisted and *Galium californicum* ssp. *sierrae* and *Fremontodendron californicum* ssp. *decumbens* could be downlisted after approximately this period of time.

Key to Acronyms used in the Implementation Schedule:

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 the 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.

† Task expected to be necessary until delisting of species.

‡ Continued implementation of task expected to be necessary after delisting.

Total costs:

TBD To be determined

Responsible parties:

ARC	American River Conservancy
BRD	Biological Resources Division
BLM	Bureau of Land Management
BOR	Bureau of Reclamation
CDFG	California Department of Fish and Game
CDF	California Department of Forestry and Fire Protection
Caltrans	California Department of Transportation
CNPS	California Native Plant Society
ELD	El Dorado County
EID	El Dorado Irrigation District
ENF	Eldorado National Forest
FERC	Federal Energy Regulatory Commission
NEV	Nevada County
OWN	Private landowners or parties
RSABG	Rancho Santa Ana Botanic Garden
UCB	University of California Berkeley
USFWS	U.S. Fish and Wildlife Service

* Primary responsible partner: a partner likely to take the lead on, or have an especially large role in, implementing the recovery task.

ACEC Area of Critical Environmental Concern

Implementation Schedule for the Gabbro Soil Plants Recovery Plan

Task Priority	Task Number	Task Description	Task Duration	Responsible Parties	Cost Estimate (in \$100,000 units)					Comments/Notes
					Total Costs	FY 1	FY 2	FY 3	FY 4	
1	1.2.1	Develop and implement outreach plans.	ongoing†	USFWS*	TBD					Total costs depend on scope of future outreach needs. In 2000 a \$55,900 section 6 grant to CDFG was used to fund outreach & education.
1	2.1.1	Protect and secure approximately 244 hectares (602 acres) of the Cameron Park preserve for multiple species (North of Highway 50).	5 years	BOR* ELD* USFWS* BLM CDFG EID FERC OWN	37	7.4	7.4	7.4	7.4	184 hectares (454 acres) acquired from 1997 to June 2002. Cost estimate is for securing and protecting an additional approximate 60 hectares (148 acres).
1	2.1.3	Protect and secure Pine Hill preserve for multiple species.	10 years	ELD* USFWS* BLM CDF CDFG OWN	38.7	3.87	3.87	3.87	3.87	About 154 hectares (380 acres) in public ownership. Cost estimate is for securing and protecting approximately 241 hectares (595 acres).

Implementation Schedule for the Gabbro Soil Plants Recovery Plan

Task Priority	Task Number	Task Description	Task Duration	Responsible Parties	Cost Estimate (in \$100,000 units)					Comments/Notes
					Total Costs	FY 1	FY 2	FY 3	FY 4	
1	2.1.5	Protect and secure Salmon Falls/Martel Creek preserve for multiple species (Northern portion).	10 years	BOR* ELD* USFWS* BLM CDFG EID FERC OWN	40.1	4.01	4.01	4.01	4.01	About 488 hectares (1,205 acres) in public ownership. Cost is estimate to secure and protect an additional approximate 271 hectares (669 acres).
1	2.2.1	Protect and secure specialty preserve for <i>Galium californicum</i> ssp. <i>sierrae</i> .	10 years	BOR* USFWS* BLM CDFG EID ELD FERC OWN	15	1.5	1.5	1.5	1.5	Cost is to secure and protect approximately 24 hectares (60 acres) in southern part of Pine Hill formation.

Implementation Schedule for the Gabbro Soil Plants Recovery Plan

Task Priority	Task Number	Task Description	Task Duration	Responsible Parties	Cost Estimate (in \$100,000 units)					Comments/Notes
					Total Costs	FY 1	FY 2	FY 3	FY 4	
1	2.2.3	Protect and secure Grass Valley preserve for <i>Calystegia stebbinsii</i> and decumbent <i>Fremontodendron</i> .	10 years	NEV* USFWS* BLM OWN	TBD					Preserved area should include decumbent <i>Fremontodendron</i> , unless it is determined not to be the listed <i>Fremontodendron</i> . Cost will depend on taxonomic findings.
1	2.2.4	Protect and secure area southwest of Brownsville for <i>Senecio layneae</i> and decumbent <i>Fremontodendron</i> .	3 years	BLM* USFWS OWN	0.75	0.25	0.25	0.25		Estimated cost is the cost for designating land as an ACEC, preserved area should include decumbent <i>Fremontodendron</i> , unless it is determined not to be the listed <i>Fremontodendron</i> .
1	2.2.5	Protect and secure Red Hills for <i>Senecio layneae</i> .	3 years	BLM* USFWS	0.75	0.25	0.25	0.25		Estimated cost is the cost for designating land as an ACEC.

Implementation Schedule for the Gabbro Soil Plants Recovery Plan

Task Priority	Task Number	Task Description	Task Duration	Responsible Parties	Cost Estimate (in \$100,000 units)					Comments/Notes
					Total Costs	FY 1	FY 2	FY 3	FY 4	
1	3.1	Establish a funding mechanism for long-term maintenance and management of the Pine Hill formation preserves in perpetuity.	ongoing‡	ELD* USFWS* BOR BLM CDFG CDF ARC EID	TBD					Federal and state partners will assist in 30 percent of management costs. Costs will depend on management needed, frequency of fire, details of management plan in Task 3.3.
1	3.2	Hire preserve manager for the Pine Hill formation.	ongoing‡	ELD* USFWS	90	1	1	1	1	
1	3.3	Prepare management plans and implement appropriate management in areas inhabited by special status species.	ongoing‡	BLM* CDFG USFWS ELD ENF CNPS ARC NEV	TBD					Plan development currently in progress (scoping meetings) led by BLM. Cost will depend on research results, frequency and type of management needed.

Implementation Schedule for the Gabbro Soil Plants Recovery Plan

Task Priority	Task Number	Task Description	Task Duration	Responsible Parties	Cost Estimate (in \$100,000 units)					Comments/Notes
					Total Costs	FY 1	FY 2	FY 3	FY 4	
1	3.4.1	Establish monitoring techniques and protocol for all species covered in this recovery plan.	4 years	USFWS* CDFG* BLM* ENF ELD	8	2	2	2	2	
1	3.4.2	Establish monitoring techniques and protocol for habitat monitoring.	2 years	USFWS* CDFG* BLM* ENF ELD	4	2	2			
1	3.5	Perform baseline monitoring at all areas identified for preservation.	10 years	USFWS CDFG* BLM* ENF ELD	TBD					Baseline monitoring will be done during the closest appropriate field season to acquisition of habitat/conservation easement, but it may take 10 years to acquire the habitat. Costs depend on which lands are acquired and need monitoring.

Implementation Schedule for the Gabbro Soil Plants Recovery Plan

Task Priority	Task Number	Task Description	Task Duration	Responsible Parties	Cost Estimate (in \$100,000 units)					Comments/Notes
					Total Costs	FY 1	FY 2	FY 3	FY 4	
1	4.2.2.1	Conduct surveys for <i>Galium californicum</i> ssp. <i>sierrae</i> in Cameron Park area.	2 years	USFWS BLM* CDFG	0.2	0.1	0.1			
1	4.2.2.2	Conduct surveys for <i>Galium californicum</i> ssp. <i>sierrae</i> northwest of Salmon Falls.	2 years	USFWS BLM CDFG ELD	0.2	0.1	0.1			Lead party dependent on land ownership in area
1	5.2	Conduct county wide research on fire including effects of fire, fire management techniques, seed production and survival in soil and selected germination studies.	continual† (total costs estimated based on one 30-yr fire cycle; further work may be needed)	CDF* BLM* USFWS CDFG ENF ELD	60+	2	2	2	2	Effects of fire on <i>Galium californicum</i> ssp. <i>sierrae</i> , <i>Senecio layneae</i> , <i>Chloragalum grandiflorum</i> , and <i>Helianthemum suffrutescens</i> ; fire management and seed production soil survival for all species; germination studies for <i>Senecio layneae</i>

Implementation Schedule for the Gabbro Soil Plants Recovery Plan

Task Priority	Task Number	Task Description	Task Duration	Responsible Parties	Cost Estimate (in \$100,000 units)					Comments/Notes
					Total Costs	FY 1	FY 2	FY 3	FY 4	
1	5.3	Determine feasibility of habitat restoration.	continual†	USFWS* CDFG* CDF* BLM* ELD*	TBD					<i>Calystegia stebbinsii</i> ; <i>Senecio layneae</i> . Cost and timing dependent on land acquisition, survey results.
1	5.4	Conduct necessary demographic studies at the Cameron Park preserve.	8 years	USFWS CDFG BLM*	4	0.5	0.5	0.5	0.5	<i>Senecio layneae</i> , <i>Ceanothus roderickii</i> , <i>Galium californicum</i> ssp. <i>sierrae</i> , <i>Wyethia reticulata</i> .
1	5.6	Conduct necessary demographic, reproductive, and fire research at the Pine Hill preserve.	8 years	USFWS CDFG * CDF*	4	0.5	0.5	0.5	0.5	Demographics- <i>Galium californicum</i> ssp. <i>sierrae</i> , <i>Ceanothus roderickii</i> , <i>Senecio layneae</i> , <i>Wyethia reticulata</i> Reproduction - <i>Galium californicum</i> ssp. <i>sierrae</i> Fire and disturbance - <i>Senecio layneae</i>

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Implementation Schedule for the Gabbro Soil Plants Recovery Plan

Task Priority	Task Number	Task Description	Task Duration	Responsible Parties	Cost Estimate (in \$100,000 units)					Comments/Notes
					Total Costs	FY 1	FY 2	FY 3	FY 4	
1	5.8	Conduct necessary studies at the Salmon Falls preserve.	8 years	USFWS* CDFG* BLM*	4	0.5	0.5	0.5	0.5	Demographics- <i>Calystegia stebbinsii</i> , <i>Galium californicum</i> ssp. <i>sierrae</i> , <i>Ceanothus</i> <i>roderickii</i> , <i>Senecio</i> <i>layneae</i> , <i>Wyethia</i> <i>reticulata</i> . Reproduction - <i>Galium</i> <i>californicum</i> ssp. <i>sierrae</i> . Fire and disturbance - <i>Senecio layneae</i> .
1	5.10	Identify decumbent <i>Fremontodendron</i> located at Grass Valley (Nevada County).	2 years	USFWS CDFG* BLM	0.02	0.01	0.01			Study ongoing. If <i>Fremontodendron californicum</i> ssp. <i>decumbens</i> , demographic studies should be performed.

Implementation Schedule for the Gabbro Soil Plants Recovery Plan

Task Priority	Task Number	Task Description	Task Duration	Responsible Parties	Cost Estimate (in \$100,000 units)					Comments/Notes
					Total Costs	FY 1	FY 2	FY 3	FY 4	
1	5.14	Identify decumbent <i>Fremontodendron</i> located in Yuba County.	2 years	USFWS BLM CDFG*	0.02	0.01	0.01			Study ongoing. If <i>Fremontodendron californicum</i> ssp. <i>decumbens</i> , demographic studies should be performed.
1	6.1.1	Collect and store viable seed for <i>Fremontodendron californicum</i> ssp. <i>decumbens</i> and <i>Galium californicum</i> ssp. <i>sierrae</i> .	5 years	USFWS* CDFG BLM UCB* BOR* RSABG	0.75	0.15	0.15	0.15	0.15	Contract has been transferred to BOR Central Valley Project Conservation Program.
1	7	Determine possible prescribed burning management strategies.	1 year	USFWS* CDFG* CDF* BLM*	0.1	0.1				Strategies should be peer reviewed
2	1.1	Establish cooperative programs with participants from the public and private sector.	ongoing‡	USFWS* CDFG*	TBD					Cost depends on interest and availability of partners

Implementation Schedule for the Gabbro Soil Plants Recovery Plan

Task Priority	Task Number	Task Description	Task Duration	Responsible Parties	Cost Estimate (in \$100,000 units)					Comments/Notes
					Total Costs	FY 1	FY 2	FY 3	FY 4	
2	1.2.2	Develop and implement economic and other incentives.	ongoing†	USFWS* CDFG* ELD* NEV* OWN*	TBD					Cost depends on scope and nature of incentives
2	2.1.2	Protect and secure approximately 47 hectares (116 acres) of the Cameron Park Preserve for multiple species (South of Highway 50).	10 years	BOR* USFWS* BLM CDFG EID ELD FERC OWN	40.6	4.06	4.06	4.06	4.06	
2	2.1.4	Protect and secure Penny Lane Preserve for multiple species	3 years	BLM* USFWS	0.75	0.25	0.25	0.25		Estimated cost is the cost for designating land as an ACEC.

Implementation Schedule for the Gabbro Soil Plants Recovery Plan

Task Priority	Task Number	Task Description	Task Duration	Responsible Parties	Cost Estimate (in \$100,000 units)					Comments/Notes
					Total Costs	FY 1	FY 2	FY 3	FY 4	
2	2.1.6	Protect and secure approximately 489 hectares (1,208 acres) of the Salmon Falls/Martel Creek Preserve for multiple species (Southern portion).	10 years	BOR* ELD* USFWS* BLM CDFG EID FERC OWN	46.0	4.6	4.6	4.6	4.6	About 179 hectares (442 acres) in public ownership. Cost is estimate of securing and protecting an additional approximately 310 hectares (766 acres).
2	2.2.2	Protect and secure occurrences of <i>Senecio layneae</i> on the Eldorado National Forest.	3 years	ENF* ELD USFWS	0.75	0.25	0.25	0.25		Cost is for Eldorado National Forest to protect occurrences through their administrative processes.

Implementation Schedule for the Gabbro Soil Plants Recovery Plan

Task Priority	Task Number	Task Description	Task Duration	Responsible Parties	Cost Estimate (in \$100,000 units)					Comments/Notes
					Total Costs	FY 1	FY 2	FY 3	FY 4	
2	3.6	Develop and implement monitoring plans for special status species populations and habitat in all areas being proposed for preservation.	continual	USFWS* CDFG* BLM*	TBD					Implementation costs depend on land acquisition, survey methods identified in monitoring plan and adaptively updated in response to management
2	4.1	Establish a survey program and protocols for all species covered in the recovery plan.	4 years	USFWS* CDFG* BLM* ENF*	4	1	1	1	1	

Implementation Schedule for the Gabbro Soil Plants Recovery Plan

Task Priority	Task Number	Task Description	Task Duration	Responsible Parties	Cost Estimate (in \$100,000 units)					Comments/Notes
					Total Costs	FY 1	FY 2	FY 3	FY 4	
2	4.2.1	Conduct general surveys.	Unknown	USFWS* CDFG* BLM*	TBD					These surveys will be conducted as preserves are acquired. Habitat acquisition may take 10 or more years for some sites; costs depend on timing and area acquired. Included in implementation of task 3.6
2	4.2.2.3	Survey potential habitat at Martel Creek for <i>Galium californicum</i> ssp. <i>sierrae</i> .	2 years	USFWS CDFG BLM*	0.2	0.1	0.1			
2	4.2.2.4	Survey historic and potential habitat on serpentine soils for <i>Senecio layneae</i> (El Dorado County).	4 years	USFWS* CDFG* BLM*	0.6	0.15	0.15	0.15	0.15	

Implementation Schedule for the Gabbro Soil Plants Recovery Plan

Task Priority	Task Number	Task Description	Task Duration	Responsible Parties	Cost Estimate (in \$100,000 units)					Comments/Notes
					Total Costs	FY 1	FY 2	FY 3	FY 4	
2	4.2.2.5	Survey potential habitat on serpentine and gabbro soils in Nevada County.	4 years	USFWS CDFG BLM*	0.8	0.2	0.2	0.2	0.2	For <i>Calystegia stebbinsii</i> and possibly <i>Fremontodendron californicum</i> ssp. <i>decumbens</i> .
2	4.2.2.6	Survey potential habitat for <i>Senecio layneae</i> in Yuba County.	4 years	USFWS CDFG BLM*	0.8	0.2	0.2	0.2	0.2	And possibly for <i>Fremontodendron californicum</i> ssp. <i>decumbens</i> .
2	4.2.2.7	Survey potential habitat in Tuolumne County for <i>Senecio layneae</i> .	4 years	USFWS CDFG BLM*	0.6	0.15	0.15	0.15	0.15	
2	5.1	Throughout the species' range: Develop plant propagation techniques for listed species and species of concern for which repatriation or introductions would be appropriate.	10 years	USFWS CDFG ELD RSABG* BLM	6	0.6	0.6	0.6	0.6	Currently not thought to be appropriate for <i>Wyethia reticulata</i> or <i>Senecio layneae</i> .

Implementation Schedule for the Gabbro Soil Plants Recovery Plan

Task Priority	Task Number	Task Description	Task Duration	Responsible Parties	Cost Estimate (in \$100,000 units)					Comments/Notes
					Total Costs	FY 1	FY 2	FY 3	FY 4	
2	5.5	Conduct necessary genetic and systematic studies at Cameron Park preserve.	3 years	USFWS* CDFG* BLM	0.21	0.07	0.07	0.07		Genetics- <i>Calystegia stebbinsii</i> , <i>Senecio layneae</i> and potentially <i>Ceanothus roderickii</i> ; Systematics - <i>Ceanothus roderickii</i> .
2	5.7	Conduct necessary research at the Pine Hill preserve.	3 years	USFWS* CDFG* BLM	0.3	0.1	0.1	0.1		Genetics- <i>Senecio layneae</i> and potentially <i>Ceanothus roderickii</i> ; Systematics - <i>Ceanothus roderickii</i> ; disease assessment and study- <i>Fremontodendron californicum</i> ssp. <i>decumbens</i> .

Implementation Schedule for the Gabbro Soil Plants Recovery Plan

Task Priority	Task Number	Task Description	Task Duration	Responsible Parties	Cost Estimate (in \$100,000 units)					Comments/Notes
					Total Costs	FY 1	FY 2	FY 3	FY 4	
2	5.9	Conduct necessary genetic, systematic, and pollination biology studies at the Salmon Falls/Martel Creek preserve.	3 years	USFWS* CDFG* BLM	0.21	0.07	0.07	0.07		Genetics- <i>Calystegia stebbinsii</i> , <i>Senecio layneae</i> , and potentially <i>Ceanothus roderickii</i> ; Systematics - <i>Ceanothus roderickii</i> Pollination biology - <i>Senecio layneae</i> , <i>Wyethia reticulata</i> .
2	5.11	Conduct genetic study of <i>Calystegia stebbinsii</i> at Grass Valley.	2 years	USFWS* CDFG*	0.012	0.006	0.006			
2	5.12	Conduct grazing study on <i>Senecio layneae</i> on the Red Hills Management area.	5 years	BLM*	0.5	0.1	0.1	0.1	0.1	
2	5.13	Conduct genetic study of <i>Senecio layneae</i> on the Red Hills (Tuolumne County).	2 years	USFWS* CDFG* BLM	0.012	0.006	0.006			
2	5.15	Conduct genetic study on <i>Senecio layneae</i> southwest of Brownsville (Yuba County).	2 years	USFWS* BLM* CDFG	0.012	0.006	0.006			

Implementation Schedule for the Gabbro Soil Plants Recovery Plan

Task Priority	Task Number	Task Description	Task Duration	Responsible Parties	Cost Estimate (in \$100,000 units)					Comments/Notes
					Total Costs	FY 1	FY 2	FY 3	FY 4	
2	6.1.2	Collect and store seeds for disjunct populations of <i>Calystegia stebbinsii</i> .	5 years	USFWS* CDFG UCB* RSABG	0.3	0.06	0.06	0.06	0.06	
2	6.1.3	Collect and store viable seeds for disjunct populations of <i>Senecio layneae</i> .	5 years	USFWS* BLM CDFG UCB* RSABG	0.3	0.06	0.06	0.06	0.06	

Implementation Schedule for the Gabbro Soil Plants Recovery Plan

Task Priority	Task Number	Task Description	Task Duration	Responsible Parties	Cost Estimate (in \$100,000 units)				Comments/Notes	
					Total Costs	FY 1	FY 2	FY 3		FY 4
2	6.2	Initiate enhancement, repatriation, or introductions where appropriate.	unknown	USFWS CDFG BLM	TBD					Costs dependent on determined need for action. Lead party will depend on local land ownership.
2	8	Perform metapopulation-type analysis.	1 year	USFWS BRD*	0.2					
3	9	Periodically review the status of the species of concern.	ongoing	USFWS*	4.4				0.20	Review every 4 years or as needed.
Total Estimated Cost to Date of Recovery: \$41,514,600 + additional costs that cannot be determined at this time										

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Costs per acre are estimates based on our limited knowledge of current land prices in each area.

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VII. APPENDICES

Appendix A. Priorities for Recovery of Threatened and Endangered Species

Degree of Threat	Recovery Potential	Taxonomy	Priority	Conflict ⁴
High	High	Monotypic Genus	1	1C 1
	High	Species	2	2C 2
	High	Subspecies	3	3C 3
	Low	Monotypic Genus	4	4C 4
	Low	Species	5	5C 5
	Low	Subspecies	6	6C 6
Moderate	High	Monotypic Genus	7	7C 7
	High	Species	8	8C 8
	High	Subspecies	9	9C 9
	Low	Monotypic Genus	10	10C 10
	Low	Species	11	11C 11
	Low	Subspecies	12	12C 12
Low	High	Monotypic Genus	13	13C 13
	High	Species	14	14C 14
	High	Subspecies	15	15C 15
	Low	Monotypic Genus	16	16C 16
	Low	Species	17	17C 17
	Low	Subspecies	18	18C 18

⁴C - conflict with human activities

**Appendix B. Analysis of potential preserve sites
(El Dorado County Planning Staff 1992)**

1. Site 1 (Shingle Springs Area Plan)

Total Acreage: 62.6

Zoning

Site: RE-5

Surrounding: R1A/RE-5 - North

RE-5 South, East, West

Land Use

Site: Low Density Residential (1 du/5-9.9A)

Surrounding: Medium Density/Low Density - North

Low Density - South, East, West

Public Lands: None

Number of Parcels: 10

3 - structure(s)

7 - land

Acreage Range: 2.0 to 10.5 acres

Projects: None

Score in Rare Plants Study: 11

Rare Plants Present: Stebbins' morning-glory

Layne's butterweed

El Dorado mule-ears

2. Site 2 (Shingle Springs/Barnett Ranch Area Plans)

Total Acreage: 73.88

Zoning

Shingle Springs

Site: R1A

Barnett Ranch

Site: CPO-DC/CG-DC

Surrounding Zoning: CPO-DC/CG-DC - North

I-DC - South

R1A/RE-5 - East

I-DC - West

Land Use

Shingle Springs

Site: Medium Density (1du/1-4.9A)

Barnett Ranch

Site: Commercial Professional Office/Industrial-DC

Surrounding Use: Commercial Professional. Office - North
Industrial-DC - South
MD/Low Density (1du/5.0-9.0 A) - East
CPO/Industrial-DC - West

Public Lands: None

Number of Parcels: 30

5 structure(s) (I commercial, I apartment complex)

25 land (at least 13 parcels within Barnett Business Park)

Acreage Range: 0.57 to 24.4 acres

Projects: None

Score in Rare Plant Study: 6-7

Rare Plants Present: Stebbins' morning-glory
Layne's butterweed
Red Hills soaproot

3. Site 3 (Shingle Springs/Cameron Park/Barnett Ranch Area Plans)

Total Acreage: 110.37

Zoning

Shingle Springs

Site: RE-5/R2-PD

Cameron Park

Site: Industrial/Planned Commercial

Barnett Ranch

Site: RE-5

Surrounding Zoning: Highway 50 - North
I/RE-5/I-DC - South
RE-5 - East
CP - West

Land Use

Shingle Springs

Site: Multi-family residential

Cameron Park

Site: Industrial/Commercial

Barnett Ranch

Site: Commercial Professional Office/Industrial

Surrounding Use:

Highway 50 - North

Industrial/SFRLD - South

Multifamily Res. (5.1-20 du/A) - East

Commercial - West

Public Lands: None

Number of Parcels: 13 (all land)

2 County Owned

Acreage Range: 0.57 to 50.1 acres

Projects: None

Score in Plant Study: 21

Rare Plants Present: Stebbins' morning-glory

Pine Hill ceanothus

Layne's butterweed

El Dorado mule-ears

Red Hills soaproot

4. Site 4 (Shingle Springs/Cameron Park Area Plans)

Total Acreage: 637.68 (plus 6 subdivision lots of indeterminate acreage)

Zoning

Shingle Springs

Site: RE-5

Cameron Park

Site: RE-10-PD/RE-10/R1/R2-PD/C

Surrounding Zoning.: RE-10/R1/RIA/RE-5 - North

Highway 50/RT/C/RM - South

RE-5 - East

R1 - West

Land Use

Shingle Springs

Site: Low Density (1 du/5-9.9 A)

Cameron Park

Site: HD-PD (4.2 du/A)/HD (1.1-3 du/A)
/MFR/Comm.

Surrounding Use: SFRHD (1.1-3 du/A)/SFRLD - North
Multifamily Res. (3.2-20 du/A)/
Highway 50/SFRHD/C - South
SFRLD/SFRMD - East
SFRHD - West

Public Lands: None

Number of Parcels: 37

8 - structure (s)

29 - land (6 parcels within Cameron Park Unit 6)

Acreage Range: subdivision lots to 151.9 acres

Projects:

TM 89-1156 (Ponderosa 50; on hold)

TM 90-1214 (The Pinnacles; on hold)

P90-18 (approved parcel map)

Score in Plant Study: 56-58

Rare Plants Present: Stebbins' morning-glory

Pine Hill ceanothus

El Dorado bedstraw

Layne's butterweed

Red Hills soaproot

El Dorado mule-ears

5. Site 5 (Cameron Park Area Plan)

Total Acreage: 72.9

Zoning

Site: RE-10/RI

Surrounding: R2/R1 - North

CPO/R1 - South

RE-10/RI - East

CP/CG - West

Land Use:

Site: SFRHD
Surrounding: SFRHD - North, East
SFRHD/Commercial - S
Commercial - West

Public Lands: None

Number of Parcels: 2 (land only)
Acreage Range: 2.5 to 70.4 acres

Projects: TM 89-1153 (Sunset Heights) - pending
TM87-1073 (Cameron Ridge) - approved (2.5 acre
parcel is only a small portion of the approved
subdivision)

Score in Rare Plant Study: 33

Rare Plants Present: Stebbins' morning-glory
Pine Hill ceanothus
Layne's butterweed
El Dorado mule-ears
Red Hills soaproot

6. Site 6 (El Dorado Hills/Cameron Park Area Plans)

Total Acreage: 523.8 (plus 9 subdivision lots of indeterminate size)

Zoning

El Dorado Hills
Site: R1
Cameron Park
Site: R1/RE-5
Surrounding Zoning: R1/RE-5 - North, East
RI - South, West

Land Use

El Dorado Hills
Site: SFRHD (5 du max/A)
Cameron Park
Site: SFRHD
Surrounding Use: SFRHD - North, South, East, West

Public Lands: None

Number of Parcels: 26
4 - structure(s)
22 - land
Acreage range: subdivision lots to 261.5 acres

Projects: TM89-1164 (Bass Lake Estates) - on hold
TM88-1104 (Woodleigh Ridge) - approved

Score in Rare Plant Study: 9

Rare Plants Present: Stebbins' morning-glory
Pine Hill ceanothus
Red Hills soaproot
Bisbee Peak rush rose
Layne's butterweed
El Dorado mule-ears

7. Site 7 (Rescue Area Plan)

Total Acreage: +/- 180

Zoning

Site: RE (Estate Residential, 5 A minimum)
Surrounding: RE - North, South, West
RE-10 - East

Land Use

Site: Residential Agriculture, 5 A minimum
Surrounding: Res. Agriculture., 5 A minimum - North, South,
West
Res. Agriculture., 10 A minimum - East

Public Lands: DFG Pine Hill preserve located adjacent to north

Number of Parcels: Entire site is comprised of approved subdivision
TM88-1122 (Fremont's Peak)

Score in Rare Plant Study: 34

Rare Plants Present: Pine Hill ceanothus
Layne's butterweed
El Dorado mule-ears
Red Hills soaproot

8. Site 8 (Rescue Area Plan)

Total Acreage: 20

Zoning

Site: RE-1/A

Surrounding: A - North

RE-10 - South, East, West

Land Use

Site: Residential Agriculture, 10 A minimum

Surrounding: Parks - North

Res. Agriculture, 10 A - South, East, West

Public Lands: BLM land encompasses far northern portion of site some large BLM holdings to the north and east

Number of Parcels: 2 (both with structure(s))

Acreage Range: Both 10 acres

Projects: None

Score in Plant Study: 14-16

Rare Plants Present: Layne's butterweed

El Dorado mule-ears

9. Site 9 (Rescue/El Dorado Hills Area Plans)

Total Acreage: 311.2 (plus 3 BLM parcels of indeterminate size)

Zoning

Rescue

Site: RE-10

El Dorado Hills

Site: RE-10/OS

Surrounding Zoning: RA-20 - North

RE-10 - South

RE-5/RA-20 - East

RE-10/RE, 5 A min . - West

Land Use

Rescue

Site: Res. Agriculture., 10 A minimum

El Dorado Hills

Site: LDR (I du/5.9.9A)

Surrounding Use: SFRLD - North, West
Res. Agriculture., 10 A - South, East

Public Lands: Large portion of site comprised of BLM land

Number of parcel: 16 (all land)
3 BLM parcels
Acreage range: 4.0 to 40 acres

Score in Plant Study: 16-26

Rare Plants Present: El Dorado Bedstraw
Layne's butterweed
El Dorado mule-ears
Red Hills soaproot

10. Site 10 (El Dorado Hills Area Plan)

Total Acreage: 524.49

Zoning

Site: RA-20/RE-1/RF/RE-5
Surrounding: RA-20/R3A/RE-5/RF/R1A - North
RE-10 - South
RA-20 - East
RE-10/RE-5 - West

Land Use

Site: RRA/MDR (1 du/1.0-4.9A)/Parks & Recreation
Surrounding: RRA/MDR/P&R - North
RRA - South
LDR - East
RRA/LDR - West

Misc.: Adjacent to Site 11 on east

Public Lands: None

Number of Parcels: 13
3 - structure (s)
10 - land
Acreage range: 0.79 to 264.8

Projects: Proposed Sweetwater project on site (project has no been filed with County)

Score in Plant Study: 79-81

Rare Plants Present: El Dorado mule-ears
Bisbee Peak rush rose
historic occurrences of:
Pine Hill ceanothus
Layne's butterweed
Red Hills soaproot

11. Site 11 (El Dorado Hills/Cool-Pilot Hill Area Plans)

Total Acreage: 1498.33

Zoning

El Dorado Hills

Site: RA-20/RE-1/RE-5

Cool/Pilot Hill

Site: RF/RA-40

Surrounding Zoning: RF/RE-10/RE-5 - North
RA-20/RE-10 - South
RF/RE-10 - East
RE-5/R3A/RA-20 - West

Land Use

El Dorado Hills

Site: RRA/LDR/P&R

Cool/Pilot Hill

Site: RRA/P&R

Surrounding: P&R/SFRLD - North
RRA/SFRLD - South
Res. Agriculture., 10 A - East
SFRLD/SFRMD/RRA - West

Public Lands: 40 acre DFG piece within preserve site; BLM land adjacent to site on north

Number of Parcels: 35

8 - structure (s)

27 - land

Acreage range: 4.1 to 474 acres

Projects: TM91-1246P (Kanaka Valley)

Score in Plant Study: 79-81

Rare Plants Present: Stebbins' morning-glory

Pine Hill ceanothus

El Dorado bedstraw

Layne's butterweed

Red Hills soaproot

Bisbee Peak rush rose

El Dorado mule-ears

12. Site 12 (Rescue Area Plan)

Total Acreage: 738.7

Zoning

Site: RE-10/RE

Surrounding: RE-10/RE - North, South, East, West

Land Use

Site: Residential Agriculture, 10 A/ Res Agriculture., 5 A

Surrounding: Res. Agriculture., 5 A/Res Agriculture., 10 A -

North, South, East, West

Public Lands: BLM piece within preserve site

Number of Parcels: 56

33 - structure (s)

23 - land

Acreage range: 5.0 to 120 acres

Projects: P89-18 (approved)

P89-161 (approved)

Score in Plant Study: 39-41

Rare Plants Present: Pine Hill flannelbush

El Dorado bedstraw

El Dorado mule-ears

Layne's butterweed.

Red Hill soaproot

**Appendix C. Land Characteristics of Four of the Five Rare Plant Preserves
(Economic & Planning Systems, Inc. 1997)¹**

LAND CHARACTERISTICS

El Dorado County has experienced rapid population growth since the 1970s and is projected to grow at an average annual rate of approximately 2.8 percent through the next twenty years (*El Dorado County General Plan Public Review Draft*, December 1993). The recent increase in population in El Dorado County has been primarily caused by relocations from other parts of California, including the extended Bay Area, Sacramento County, and southern California, though this form of relocation is less significant today. Most new home buyers are buying primary residences. In January 1994, the population in El Dorado County was 144,002 (Department of Finance Annual Population and Housing Reports). The part of western El Dorado County which contains the rare gabbroic and serpentine soils is mainly a rural area, although it includes the community of Cameron Park. Historically, many rural homesteads have been created in a patchwork fashion by lot splits. With rapid employment growth in the Sacramento Region in the 1980s (a 3.5 percent annual growth rate between 1980 and 1990) western El Dorado County, which is within a reasonable commute distance of the State capital and other major employment bases in eastern Sacramento County, became a popular location for households seeking a more rural ambiance and access to outdoor recreation. There follows a discussion of the ownership, land uses and characteristics of each of the Ecological Preserves.

Cameron Park Preserve

Cameron Park is located approximately 18 miles east of Sacramento County on Highway 50. This preserve may consist of one or more sites that preserve a total of approximately 400 acres south of Green Valley Road. It is considered necessary to maintain some representation of the rare plant species and their associated habitats in the southern half of the gabbro soil formation.

¹Portion of report covering land characteristics only.

The single site that was proposed by the advisory committee (see page 1-4) primarily consists of five adjacent parcels ranging in size from 17.3 to 152.0 acres. It stretches from 0.5 to 1.5 miles north of Interstate 50 at the Cameron Park Drive exit, and its western border varies from approximately 0.1 to 0.25 miles east of Cameron Park Drive. All five parcels are represented by a single landowner. The land is presently zoned RE10 or residential estate with 10 acre minimum lot size. Under the recently adopted General Plan, the majority of the acreage is designated for high density, single family residential development (1-5 units per acre). The southernmost parcel (68 acres) is designated for a wide mix of uses that can include single family residential, multi-family residential, offices and commercial development.

The dominant features are the open, predominantly undisturbed slopes overlooking Cameron Park. These slopes rise up from a low elevation of 1,400 feet to a high point of 1,760 feet. The surrounding land uses are medium to high density residential with commercial and professional land uses to the south and to the north.

It should be noted that although the proposed Cameron Park Preserve is surrounded by established residential and commercial neighborhoods, the parcels recommended for acquisition are the last remaining large parcels that host dense populations of rare plant species in the southern area of the gabbro soils range. DFG believes that acquisition and protection of the proposed Cameron Park Preserve is important for the preservation of six of the eight target plant species. It is particularly critical to Stebbins' morning glory because the greatest number of colonies of this species occurs south of Green Valley Road. Stebbins' morning glory does not occur on the Central Ecological Preserve Areas (Martel Creek, Pine Hill, and Penny Lane Ridge). Although this species does occur in the proposed Salmon Falls Preserve, it is important that the species be protected at more than one location to avoid loss of the species due to a catastrophic event (*e.g.*, outbreak of a plant disease, fungus or herbivorous insect population). Selected for its particularly fine examples of gabbroic habitat and the greatest variety of rare plant life, creation of the Cameron Park Preserve would create an excellent educational opportunity for local and regional schools and colleges

conducting botany and biology classes. It is the site most suitable for public access and the creation of an interpretive trail.

Salmon Falls Preserve

Salmon Falls Preserve is the most northerly and remote Ecological Preserve, located just south of the Folsom State Recreation Area. The proposed Ecological Preserve is slightly east of Salmon Falls Road and mostly south of the South Fork of the American River. Most of the area is west of Kanaka Valley Road. Access is available only on private dirt roads and there are few public services available. Salmon Falls offers the best opportunity for protecting large contiguous areas of rare plant habitat in the northern half of the Rare Soils Study Area. Approximately 656 acres within the Salmon Falls Preserve are in public ownership (BLM and DFG) and are being managed for the protection of rare plants and other natural resources through a Memorandum of Understanding (MOU) between BLM, DFG, and the Bureau of Reclamation (the latter agency controls surface rights on some BLM lands in the vicinity of Salmon Falls).

Of the remaining private land in the proposed Ecological Preserve, the parcels range in size from 4.57 to 229.0 acres and there are over 20 separate ownerships. Most parcels are zoned either residential agricultural or agricultural and some others are zoned residential estate. The land use designation under the proposed General Plan is primarily low density residential (LDR - 5 to 10 acres per unit). The predominant land uses in the Salmon Falls Preserve are vacant rural residential and rural sub-economic units.

The site is characterized by several large undeveloped parcels in a relatively remote rural setting. The property has a rolling terrain and steep slopes varying from 850 to 1,266 feet in elevation. The dominant feature is an officially unnamed peak, often referred to as Morning Glory Hill (elevation 1,266 feet), it is one mile southeast of the Salmon Falls Bridge. The hill and surrounding ridges and slopes form a core area of rare plant density. A low depression to the south of Morning Glory Hill forms a seasonal pond and wetlands area. This site is not suitable for regular public access. Access would be for management purposes or

educational or research projects scheduled through an Ecological Preserve Manager.

Most of the private land in the Salmon Falls area is expected to be dedicated in return for clustered development rights on lands outside of the Ecological Preserve. The *El Dorado County General Plan*, adopted January 23, 1996, sets out the following policies and objectives relating to clustered development:

Policy 2.2.2.4A "The Ecological Preserve overlay designation shall be combined with a basic land use designation that is appropriate for the area. The overlay will enable the land use densities or building intensities for a discretionary project to be transferred to other lands, clustered, or otherwise mitigated to maintain the Preserve."

Policy 7.4.1.1B "Development of mechanisms for the establishment of preserve site(s) such as clustered development, transfers of development rights, mitigation banking, and conservation easements."

Objective 8.1.5 Cluster Development "The County shall encourage cluster development, or grouping together of allowable dwelling units in agricultural districts or lands zoned for agricultural districts, instead of the dispersal of such dwelling units on larger parcels."

Martel Creek Preserve

The Martel Creek Preserve is located 1.5 miles directly west of Pine Hill. The proposed Martel Creek Preserve is slightly west of Deer Valley Road and slightly east and to the south of a bend in Sweetwater Creek. Approximately 200 acres within the Martel Creek Preserve are in public ownership (BLM) and are being managed for the protection of rare plants and other natural resources.

The parcels under private ownership in the proposed Ecological Preserve are rural residential parcels, with an average size of 25.9 acres and a range of 4.0 to 40.0 acres. There are over ten separate ownerships in this unit. Current zoning

in this area includes vacant rural residential, residential mobile homes, and rural improved residential. Proposed future land use designations under the General Plan include low density residential (LDR) and rural residential (RR - 10 to 40 acres per unit). The predominant land uses in the proposed Martel Creek Preserve are vacant rural residential and residential mobile home.

The dominant feature in the Martel Creek Preserve is a series of ridges running in a north-south orientation with elevations at the highest point of between 1,200 and 1,381 feet. It is these ridgelines to the north and east of Sweetwater Creek that form a core area of rare plant density in the Martel Creek Preserve. The two creeks, Martel and Sweetwater, provide riparian zones with a year-round flow. Because much of the land in the proposed Ecological Preserve is likely to remain private land with conservation easements held by a local or state agency or a private conservation organization, public access would not be available. The holder of the conservation easement would have access to the site for management purposes with prior notification to the landowner.

Pine Hill Preserve

Pine Hill is located 10 miles east of Folsom and four miles north of Cameron Park. The area is bounded on the north and east by Deer Valley Road, the west by Starbuck Road, and to the south by Green Valley Road. This Ecological Preserve is dominated by a CDF lookout and radio towers on the summit of 2,059 foot high Pine Hill. The map for this Ecological Preserve shows a much larger area than the proposed 700 acre Ecological Preserve. The outline shows an area with a high concentration of rare plant species. The goal is to purchase conservation easements covering a total of 340 acres of rare plant habitat within this area to add to the 360 acres of public land. Funds to purchase conservation easements from willing sellers would be obtained through the funding mechanisms described in Chapter II of this report.

This proposed Ecological Preserve is characterized by many small rural residential parcels and a limited number of roads at the base of the Hill. The average parcel size is 10.62 acres and parcels range in size from 5.0 to 120.0 acres. There are over 100 separate ownerships in this proposed Ecological

Preserve. Current zoning in this area is primarily residential estate with 10-acre minimum parcel size; the proposed future land use designation under the General Plan is low density residential (LDR) for all the parcels. The predominant land uses in the proposed Pine Hill Preserve are vacant rural residential, rural improved residential, and residential mobile home. The surrounding lands have mostly been developed into 10-acre rural residential estates.

Approximately 360 acres of the proposed Pine Hill Preserve are already in public ownership. On Pine Hill itself, 240 acres are owned by DFG and 80 acres are owned by CDF. Forty acres are owned by BLM on a ridge one mile northeast of Pine Hill. The BLM land is being managed for the protection of rare plants and other natural resources through a MOU with DFG.

Because much of this Ecological Preserve is to remain private land with conservation easements to be held by a local or state agency or a private conservation organization, public access would not be available. The holder of the easement would be able to access the site for management purposes with prior notification to the landowner. The public lands are currently accessible by appointment only, or to communication facility operators that hold a lease from CDF. This would continue to be the access policy.

Six of eight target species are found on the prominent ridgelines that extend from Pine Hill east, northeast, west, and south. Other significant populations of target species are found on a second ridgeline three-quarters to one mile north of Pine Hill separated by the headwaters of Sweetwater Creek, which runs east to west. This second ridge maintains an elevation of 1,700 to 1,800 feet. Pine Hill and the nearby slopes are one of the two sites in the world that contain Pine Hill flannelbush. The other site is on serpentine soil in Nevada County. This is one of the rarest plants in California, with a total species population of approximately 2,000 plants.

Appendix D. Methods used in the Geographic Information System (GIS) Analysis to Develop Preserve Recommendation

In developing our recommendations for preserves on the Pine Hill formation in western El Dorado County, we performed a Geographic Information System analysis. We used information from the following sources for our analysis:

- A. *California Natural Diversity Data Base.* The California Natural Diversity Data Base is a computerized inventory with information from a variety of sources on the location and condition of special status plants, animals, and natural communities. The database is maintained by the California Department of Fish and Game.
- B. *El Dorado County's vegetation map of the Pine Hill formation.* This map originally was developed in the preparation of *Preserve Sites and Preservation Strategies for Rare Plant Species in Western El Dorado County* (EIP Associates 1991). Polygons delineating the vegetation types listed in Table VII-1 were drawn by EIP associates from aerial photographs taken on June 6, 1990.
- C. *Soil maps for the Pine Hill formation and adjacent serpentine.* Scott Phillips, with the Endangered Species Recovery Program in Fresno, California, digitized these maps from the third order soil survey for El Dorado County (U.S. Department of Agriculture, Soil Conservation Service 1974).
- D. *Public land ownership information.* We obtained information from the Bureau of Land Management, the California Lands Commission, the California Department of Fish and Game, the Bureau of Reclamation, and our own files.
- E. *Our understanding of the El Dorado County Rare Plant Advisory Committee recommendations.* Through meetings and conversations with El Dorado County Planning Department staff and members of the Rare

Table VII-1. Vegetation classification for the Pine Hill formation, showing potential to support the gabbro soil plants.

Vegetation Classification for the Pine Hill Formation		
Element	Legend meaning	good potential to support the gabbro soil plants
Chaparral	Cm - Dense chaparral, predominantly manzanita	yes
	cm - Open chaparral, predominantly manzanita	yes
	Cc - Dense chaparral, predominantly chamise	yes
	cc - Open chaparral, predominantly chamise	yes
	C - Dense chaparral, mixed or unidentified species	yes
	c - Open chaparral, mixed or unidentified species	yes
Woodland	Wo - Dense Woodland, predominantly blue and live oak	no
	wo - Open Woodland , predominantly blue and live oak	no
	Wm - Dense Woodland, mixed or unidentified species	yes
	wm - Open Woodland, mixed or unidentified species	yes
Chaparral/Woodland	CW - Dense Chaparral/Woodland	yes
	cw - Open Chaparral/Woodland	yes
Woodland/Chaparral	Wc - Dense Woodland /Chaparral	yes
	wc - Open Woodland/Chaparral	yes
Grassland/Pasture	G - Grassland	no
Water	W - Water	no
Riparian/Wetland	R - Riparian	no
Urban	U - Urban	no
Bare	B- Bare rock	no

Plant Advisory Committee (see also p. VII-23, # 5 below), we determined there are inconsistencies between the Rare Plant Advisory Committee's mapping and acreage figures. Therefore, our mapping of the Rare Plant Advisory Committee's preserves represents our best interpretation of the intended preserve design (Figure III-2). The acreage of land we have mapped, using Geographic Information System analysis, as Rare Plant Advisory Committee preserves is approximately 1,472 hectares (3,638 acres) instead of 1,416 hectares (3,500 acres). Note that the mapped extent of the Pine Hill Preserve (Figure III-2) is an outer boundary within which the Rare Plant Advisory Committee proposed a much smaller preserve of 283 hectares (700 acres).

- F. *National Aerial Photography Program.* We used 46-by-46 centimeter (18-by-18 inch) National Aerial Photography Program photographs available from the Earth Resources Observation Systems Data Center in Sioux Falls, South Dakota. The aerial photographs were flown on August 16, 1998, and the approximate scale of the 46-by-46 centimeter (18-by-18 inch) prints is 1:20,000. The resolution of the prints is nominally in the 1-meter (3-foot) range. We purchased the most recent aerial photography and used it to refine our preserve recommendation by looking for developed areas within our preserve recommendation.
- G. *Parcel map information provided by El Dorado County.* The El Dorado County Planning Department provided Geographic Information System layers during the public comment period on the draft plan. Because of the way these layers were constructed, they could not be overlain with the other layers that we needed to use in the analysis (e.g., California Natural Diversity Data Base). Therefore, their overall use in the analysis was quite limited. We attempted to correct the problem by contracting with the Bureau of Reclamation to "geo-reference" and "transform" the layers. Geo-referenced data are mapped data that are tied to real-world geographic coordinates such as latitude and longitude. Once the layers were geo-referenced, they could more legitimately be overlain with the other layers used in the analysis. However, to avoid introducing errors into our analysis, we exercised caution when using the layers.

- H. *Salmon Falls Preserve Administrative Draft Environmental Impact Report* (Pacific Municipal Consultants 1999). This Environmental Impact Report describes a potential development project in the Salmon Falls area.
- I. “*Groundtruthing.*” To determine whether or not land within our preserve recommendation was developed, we drove to as many questionable areas as possible without trespassing on private land or traveling on private roads.
- J. *Meetings and conversations.* We had meetings with Steven Hust, Susan Varner, and Conrad Montgomery of El Dorado County Planning; Julie Horenstein of California Department of Fish and Game; and Alan Ehrgott of American River Conservancy to discuss the Rare Plant Advisory preserve recommendation maps. We had additional conversations with Alan Ehrgott, Julie Horenstein, Kyle Smith, and Al Franklin regarding the Rare Plant Advisory Committee recommendations; and Debra Ayres regarding the location of *Fremontodendron californicum* ssp. *decumbens*.

Using the Geographic Information System layers and the information listed previously we:

1. *Identified clusters of the six plant species covered by this recovery plan.* To find clusters of the six plant species covered by this recovery plan, we used electronic point and specific polygon locality information from the California Natural Diversity Data Base. In our Geographic Information System analysis each point was buffered to 20.2 hectares (50 acres) and each specific polygon was buffered by 150 meters (492 feet) (*i.e.*, 150 meters were added to the edge of each polygon). The buffering around each location builds into the analysis a safe buffer for fire management and reduces the effect of outside influences on the plants (*i.e.*, edge effects).
2. *Estimated the extent of “occupied” habitat for the gabbro plant species on the Pine Hill formation.* To determine “occupied” habitat of the six covered species on the Pine Hill formation, we used the vegetation layer from El Dorado County. We intersected the buffered California Natural Diversity

Data Base points and polygons with chaparral and woodland vegetation types from El Dorado County's vegetation map. These vegetation types provide potential habitat for the plants covered in this recovery plan. The categories of vegetation included in this category are listed in Table VII-1. Table VII-1 is based upon information developed in the preparation of *Preserve Sites and Preservation Strategies for Rare Plant Species in Western El Dorado County* (EIP Associates 1991). We eliminated urban, riparian, grassland, and other woodland habitats that are not considered good habitat for gabbro soil plants. The resulting Geographic Information System layer showed areas where: (a) habitat still existed when the vegetation layer was developed *and* (b) the six plants covered in this recovery plan have been documented to occur.

3. *Drew preserve boundaries that optimized inclusion of the six covered species as well as met habitat connectivity and preserve size requirements necessary for fire management.* In drawing preserve boundaries, we concentrated first on areas where more than one target species occurred and on areas where land is already publicly owned. We identified areas occupied by more than one species using an analysis of richness (number of species) within the "occupied" habitat (as defined in #2 above).
4. *Analyzed how well our preliminary preserve design protected species individually.* Having drawn preserve boundaries based on areas occupied by more than one covered species, we asked whether each species individually was adequately protected by the preliminary design. To do this, we first calculated the acreage of each covered species on the Pine Hill formation (total acreage). These acreages were the sum of the areas of specific polygons, nonspecific polygons, and 80-meter (262-foot) circles for each species individually from the California Natural Diversity Data Base. We eliminated the 0.32-, 0.96-, and 1.6-kilometer² circles from our calculations because we felt the actual location and occupied area of the covered species within these circles were not well enough known to include in the analysis. Next, we intersected the California Natural Diversity Data Base locations for

²1/5-, 3/5-, and 1-mile

each species with the preliminary preserve design and calculated the acreage of each species that fell within the preserve boundaries (acreage within preserves). As before, we eliminated the less precise locations (0.32-, 0.96-, and 1.6-kilometer circles)³. Finally, for each species, we calculated the proportion of the total acreage on Pine Hill formation that was within our preliminary preserve recommendation (*i.e.*, acreage within preserve divided by total acreage). For all species except *Fremontodendron californicum* ssp. *decumbens*, the proportion of each species that would be protected by our preliminary preserve design was at least 20 percent greater than would be protected by the Rare Plant Advisory Committee preserve recommendation.

5. *Refined preliminary preserve design.* Having developed a preliminary preserve recommendation, we refined the preserve design by: (a) meeting with Julie Horenstein of the California Department of Fish and Game to further evaluate the design and (b) visiting a few questionable sites where we could do so without trespassing on private lands or traveling on private roads. Using Julie's familiarity with the properties and distribution of the covered species on the Pine Hill formation, we eliminated some areas that were either already developed or impractical to target as preserves because of high concentrations of very small parcels. For example, the area known as Eastwood Park, an approximately 40-hectare (100-acre) parcel to the north of the main body of the Cameron Park preserve, has been developed. By visiting or driving by a few sites, we were able to determine that they should remain in the preliminary design because the sites are undeveloped and potential habitat remains (*e.g.*, the property south of Highway 50).

In the process of refining the preserve design, we deleted some areas that had been recommended by the Rare Plant Advisory Committee. These areas were deleted because: (a) they were already developed (*e.g.*, Eastwood Park), (b) we felt they did not substantially contribute to protection of the species or to a defensible preserve design, and/or (c) lands of approximately equal conservation value that were already publicly owned could be

³1/5-, 3/5-, and 1-mile

substituted for private lands recommended by the Rare Plant Advisory Committee.

6. *Conducted further analysis of the preserve design by overlaying it with 1998 aerial photographs and conducting additional site visits.* We refined our initial recommendations further by purchasing the most recent aerial photographs available and comparing the preserve areas to them. We overlaid Mylar transparencies of our preserve recommendation onto the National Aerial Photography Program 46-by-46 centimeter (18-by-18 inch) photographs. Again, we were looking for developed areas that should be eliminated from the preserve design. We searched for heavily developed areas such as buildings, lawns, landscaped areas, intensive agricultural areas, and other lands that we felt would not contribute to gabbro plant conservation. Those areas that were heavily developed were eliminated from the recommendation. Where we still were uncertain about the status of certain areas, we visited those areas (*i.e.*, “groundtruthed” them) if we could reach them without trespassing on private lands or traveling on private roads. Because of private property and roads, we were unable to confirm the status of some questionable areas. In the absence of complete information indicating these areas should be eliminated from the design, we left them in the preserve recommendation. Some developed areas may also remain in the preserve recommendation due to inaccuracies inherent in Geographic Information System analyses. We will continue to refine the recommendation as nonhabitat areas are identified during implementation of the recovery plan.

REFERENCES FOR APPENDIX D

A. Literature Cited

- EIP Associates. 1991. Preserve sites and preservation strategies for rare plant species in western El Dorado County. Unpublished report, 54 pp. + appendices.
- Pacific Municipal Consultants. 1999. Administrative Draft Environmental Impact Report for Salmon Falls Preserve, El Dorado County, CA. 404 pp.+.
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B. Personal Communications

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- Franklin, Al. 1999. Bureau of Land Management, Folsom Resource Area, Folsom, California
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Appendix E. Major Research and Management Needs for Species Covered in the Recovery Plan

Species	Research				Management
	Habitat Surveys	Reproduction and Demography	Systematics and Genetics	Other Research Needs	Management Actions Needed
<i>Calystegia stebbinsii</i> (Stebbins' morning-glory)	Nevada County on gabbro and serpentine soils.	Yes, including determining limiting life stages, seed production, and survival in soil to determine appropriate fire return period.	Genetics	Propagation techniques; fire management techniques; metapopulation analysis; determine efficacy of other types of disturbance regimes for species and habitat management; feasibility of habitat restoration/enhancement.	Burning; general surveys; baseline monitoring; monitoring for trends of populations, success of management actions, and threats at all populations identified for protection; monitoring for habitat fragmentation, major shifts in vegetation type, and tracking of occurrence establishment, and extirpation; seed banking for disjunct populations.
<i>Ceanothus roderickii</i> (Pine Hill ceanothus)	None	Yes, including determining limiting life stages, seed production, and survival in soil to determine appropriate fire return period.	Systematics, genetic studies if repatriation is determined to be necessary.	Propagation techniques; fire management techniques; metapopulation analysis; determine efficacy of other types of disturbance regimes for species and habitat management; feasibility of habitat restoration/enhancement.	Burning; general surveys; baseline monitoring; monitoring for trends of populations, success of management actions, and threats at all populations identified for protection; monitoring for habitat fragmentation, major shifts in vegetation type, and tracking of occurrence establishment, and extirpation.

Species	Research				Management
	Habitat Surveys	Reproduction and Demography	Systematics and Genetics	Other Research Needs	Management Actions Needed
<i>Fremontodendron californicum</i> ssp. <i>decumbens</i> (Pine Hill flannelbush)	Serpentine and Gabbro soil areas in Nevada and Yuba Counties if decumbent <i>Fremontodendron</i> is determined to be the listed <i>Fremontodendron</i>	Yes, including age of seed banks for determining when to burn, limiting life stages if Nevada County specimen is determined to be the listed <i>Fremontodendron</i> , seed production and survival in soil to determine appropriate fire return period.	Yes (identify Yuba County and Nevada County material)	Propagation techniques; fire management techniques; metapopulation analysis; determine efficacy of other types of disturbance regimes for species and habitat management; feasibility of habitat restoration/enhancement; study of disease if necessary.	Burning; general surveys; baseline monitoring; monitoring for trends of populations, success of management actions and threats at all populations identified for protection; monitoring for habitat fragmentation, major shifts in vegetation type, and tracking of occurrence establishment, and extirpation; assessment of disease as threat; introduction; seed banking.
<i>Galium californicum</i> ssp. <i>sierrae</i> (El Dorado bedstraw)	Cameron Park Area, northwest part of Salmon Falls, and Martel Creek	Yes, including determining limiting life stages and reproductive biology, seed production and survival in soil to determine appropriate fire return period.	Genetics	Effects of fire; fire management techniques; germination requirements and propagation techniques; metapopulation analysis; determine efficacy of other types of disturbance regimes for species and habitat management; feasibility of habitat restoration/enhancement.	General surveys; baseline monitoring; monitoring for trends of populations, success of management actions, and threats at all populations identified for protection; monitoring for habitat fragmentation, major shifts in vegetation type, and tracking of occurrence establishment, and extirpation; enhancement and introduction; seed banking.

Species	Research				Management
	Habitat Surveys	Reproduction and Demography	Systematics and Genetics	Other Research Needs	Management Actions Needed
<i>Senecio layneae</i> (Layne's butterweed)	Serpentine soil areas off the Pine Hill formation in El Dorado County; Serpentine and Gabbro areas in Nevada County; Serpentine near Red Hills in Tuolumne	Yes, including determining limiting life stages, seed production and survival in soil to determine appropriate fire return period, reproductive studies identifying pollinators, seed germination studies.	Genetics	Influence of disturbance and fire on seedling establishment; effects of grazing; metapopulation analysis; effects of fire; fire management techniques; determine efficacy of other types of disturbance regimes for species and habitat management; feasibility of habitat restoration/enhancement.	Disturbance/ burning; general surveys; baseline monitoring; monitoring for trends of populations, success of management actions and threats at all populations identified for protection; monitoring for habitat fragmentation, major shifts in vegetation type, and tracking of occurrence establishment, and extirpation; seed banking for disjunct populations.
<i>Wyethia reticulata</i> (El Dorado mule-ears)	None	Yes, including determining limiting life stages, pollination biology, seed production and survival in soil to determine appropriate fire return period.	None	Fire management techniques; metapopulation analysis; determine efficacy of other types of disturbance regimes for species and habitat management; feasibility of habitat restoration/enhancement.	Burning; general surveys; baseline monitoring; monitoring for trends of populations, success of management actions, and threats at all populations identified for protection; monitoring for habitat fragmentation, major shifts in vegetation type, and tracking of occurrence establishment, and extirpation.

Appendix F. Agency and Public Comments on the Draft Recovery Plan for Gabbro Soil Plants of the Central Sierra Nevada Foothills

I. Summary of Agency and Public Comments on the Draft Recovery Plan for Gabbro Soil Plants of the Central Sierra Nevada Foothills

In March, 1999, we (the U.S. Fish and Wildlife Service) released the Draft Recovery Plan for Gabbro Soil Plants of the Central Sierra Nevada Foothills (draft plan) for a 90-day comment period for Federal agencies, State and local governments, and members of the public (Federal Register 64:11035). The comment period was extended to 120 days and closed on July 7, 1999. Debra Ayres, Robert Boyd, Jon Keeley, and Paul Zedler were asked to provide peer review of the draft plan. Comments were received from the four peer reviewers.

We also released an Amendment to the Draft Recovery Plan for the Gabbro Soil Plants of the Central Sierra Nevada Foothills on November 29, 2000. The amendment was a revision of and correction to the preserve recommendation maps in the draft plan and the associated supporting text. A 60-day comment period was open from November 29, 2000, to January 29, 2001, to provide time for comments to be submitted on this amendment. The same peer reviewers were asked to provide peer review of the amendment. Comments were received from three of the four reviewers.

This section provides a summary of general information about the comments we received, including the number of letters from various sources. A complete index of commenters, by affiliation, is available from the U.S. Fish and Wildlife Service, Ecological Services, Sacramento Fish and Wildlife Office, 2800 Cottage Way, Suite W-2605, Sacramento, California 95825-1846. All comment letters are kept on file in the Sacramento Fish and Wildlife Office.

In addition to the peer reviewers, we received 48 letters. The following is a breakdown of the number of comment letters received from various sources:

Federal agencies–1
State agencies–1
local governments–3
business/industry–6
environmental/conservation organizations–4
individual citizens–32
academia/professional (including peer review letters)–8

Peer review comments on the draft plan were generally very supportive. Comments emphasized the importance of adaptive management and the ecosystem multi-species approach used in the plan. Reviewers found the plan to be scientifically accurate and biologically sound. Although there were numerous detailed comments and editorial suggestions, the two shortcomings identified by individual peer reviewers were: (a) that some kind of metapopulation model should be performed to clarify uncertainties, data needs, and research and management priorities; and (b) that some possible prescribed burning management strategies should be discussed and evaluated within the plan. These two comments are addressed below in comments 59 and 60, respectively.

Three peer reviewers provided comments on the amendment. One peer reviewer provided comments on the GIS analysis that have been incorporated within the text. Another peer reviewer endorsed the preserve design, especially in its expansions beyond the design suggested by the Rare Plant Advisory Committee. The third peer reviewer found that the amendment “does a good job laying out the conservation needs for the listed and threatened species”. This peer reviewer also stated that the focus on habitat protection is warranted and the proposed tasks are very necessary.

We received 55 comment letters. Each letter contained one or more comments. Many letters raised similar issues. Some letters provided new information or suggestions for clarity. Several commenters provided substantive and detailed information, such as corrections to the maps, information on recent development, or information on known populations of the plants. Many comments were incorporated into the final version of the

recovery plan. Information and comments not incorporated into the recovery plan were considered and noted, and may be useful in the future. Major comments that were not incorporated or that require clarification in addition to their incorporation are addressed below.

II. Summary of Comments and U.S. Fish and Wildlife Service Responses

General

Comment 1: Several commenters noted there were errors in the maps in the draft plan and wanted the maps to be corrected and the recovery plan recirculated for public comment. Other commenters were concerned that areas that had been included within the draft plan had already been developed. El Dorado County Planning Department, in their comments on the amendment, reiterated their prior recommendation that an entirely revised document be re-released and re-recirculated prior to any effort to finalize the recovery plan.

Response: We corrected the maps and released an amendment to the draft plan. Due to the change in location of some of the preserves we agreed that an amendment should be recirculated for public comment and peer review. In our amendment, we excluded preserve 6 near Bass Lake, and part of the northern part of the Cameron Park preserve because these areas now have high density housing.

All interested parties have had two opportunities to comment on the recovery plan, including a 120 day comment period for the draft plan and a separate 60 day comment period for the amendment. Since we received no substantive new information regarding the inadequacy of the revised preserves, we will not be re-recirculating the recovery plan. Because production of a finalized recovery plan influences funding available from a variety of sources and because no changes have been made to the maps since the amendment, we do not think further delay caused by circulating another version of the recovery plan is warranted.

Comment 2: Many private landowners questioned spending any money for protecting the gabbro plants and some questioned the prudence of saving endangered species. Other commenters had different priorities on how to spend money.

Response: The recovery of listed species is mandated by law. Congress found in 1973 that various species of fish, wildlife, and plants in the United States have been rendered extinct. Other species have been so depleted in numbers that they are in danger of extinction. For some species there is an imminent threat that they will become extinct very soon. Congress also found that these species are of value to the Nation and its people. For this reason they enacted the Endangered Species Act. The Endangered Species Act reflects the value Congress and the American people place upon the natural resources of the United States and their diversity. The Endangered Species Act directs us to conserve endangered and threatened species and the ecosystems upon which they depend.

Comment 3: A few commenters asked questions regarding (a) El Dorado County General Plan processes, (b) real estate appraisals, and (c) specific section 7 consultation questions.

Response: Many of these issues are beyond the scope of this recovery plan. To the extent these issues are relevant to the recovery plan they are addressed below. Other comments will be addressed in a different forum with the individuals who raised these issues.

Comment 4: In response to the amendment, or possibly to local news, seven commenters wrote in support of the acquisition of the nature preserve in the Cameron Park area. Two of the commenters stated that there was no reason to delay acquiring the land now that there was funding.

Response: The United States Government must pay the fair market value of the property and is not allowed to pay a higher or lower amount. Thus the timing of land acquisition is dependent on landowners' willingness to sell their property at the fair market value. Even though money has been

allocated through the Land and Water Conservation Funds by the Congress for purchasing rare plant habitat on the Pine Hill formation, unless there is a willing seller, the government cannot purchase the land.

Comment 5: One commenter stated that both the Endangered Species Act and the National Environmental Policy Act require Federal agencies to review and consider custom, culture, and economic stability of a region and wanted us to provide the details of this analysis.

Response: The Endangered Species Act does not require Federal agencies to consider custom, culture, and economic stability of a region. The National Environmental Policy Act requires disclosure of project effects to cultural resources and an analysis of socioeconomic impacts. We have determined that recovery plans are categorically excluded from National Environmental Policy Act requirements for Environmental Assessments or Environmental Impact Statements during the development and approval process. This exclusion is based on the fact that recovery plans are broad planning documents that list all the tasks we believe may contribute to the recovery of species and set general policies and priorities for management and treatment of species. Recovery plans cover tasks that may involve actions by us, other Federal agencies, State and local governments, the private sector, or a combination of these parties. However, recovery plans are advisory documents only and do not impose an obligation on any agency, entity, or person to implement the tasks listed in the recovery plan.

While a recovery plan does not require National Environmental Policy Act analysis for development and approval, actual implementation of actions outlined in the plan may. National Environmental Policy Act analysis (and the preparation of any needed Environmental Assessments or Environmental Impact Statements that may be required) must be done by any Federal agency as they prepare to implement particular recovery actions, if appropriate.

Comment 6: One commenter stated that having a community-level strategy for recovery and conservation may not be the most effective means to

achieve the established goals and is inconsistent with the Endangered Species Act. The commenter further stated that the recovery plan appears to place less emphasis on protecting listed species in favor of developing potential habitat for recovery and places nonlisted or lower priority plants on the same footing as endangered species.

Response: We disagree. The proposed community-level strategy is based upon analyzing preserve system strategies that protect all five listed species included in the recovery plan (see Appendix D and Chapter III for more detail on the analysis). The recovery plan does not emphasize the development of potential habitat for recovery, but emphasizes preserving occupied habitat as well as habitat that is necessary for fire management and for the survival and recovery of these species. We place equal weight on the survival and recovery of listed species. Planning for both conservation and survival of listed species is mandated by law under section 4(f)(1) of the Endangered Species Act.

The proposed community-level strategy is not inconsistent with the Endangered Species Act. 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. Additionally our policy (U.S. Fish and Wildlife Service and National Marine Fisheries Service 1994) calls for the development and implementation of recovery plans for threatened and endangered species in a manner that restores, reconstructs, or rehabilitates the structure, distribution, connectivity and function of the ecosystems upon which those listed species depend. Our policy states that recovery plans shall be developed and implemented in a manner that conserves the biotic diversity (including the conservation of candidate species, other rare species that may not be listed, unique biotic communities, etc.) of the ecosystems upon which the listed species depend. Such actions may prevent future listing of some species that are currently species of concern, such as the El Dorado mule-ears.

Comment 7: A few commenters wanted to know how El Dorado County could be responsible for implementing any recovery activities.

Response: Recovery plans are advisory documents that provide guidance on how to recover species. We need to work with many Federal and non-Federal agencies to achieve recovery for any listed species. Most of the occurrences of these plants are on private land in El Dorado County, and El Dorado County, as the local land use authority over much of the habitat needed to recover the gabbro plants, is an essential partner in the recovery process. The implementation table of the recovery plan identifies recovery tasks that we and other agencies will work with El Dorado County to implement. While the recovery plan itself does not require commitments from El Dorado County, it is unlikely that recovery can be achieved and the plants eventually downlisted or delisted unless El Dorado County and many other partners identified in the recovery plan work together to implement recovery tasks.

Comment 8: A few commenters wanted us to specify within the recovery plan what was needed to satisfy a section 7 consultation. El Dorado County stated that the draft plan should clearly state whether or not Priority 1 Tasks correspond to what the U.S. Fish and Wildlife Service would require in a section 7 consultation. El Dorado Irrigation District also asked some specific questions regarding the water consultation with the Bureau of Reclamation.

Response: Section 7 of the Endangered Species Act requires Federal agencies to consult with us when an action they fund or authorize affects listed species. The end result of this consultation is our biological opinion as to whether the agency action will jeopardize the continued existence of any listed species. To “jeopardize the continued existence of” means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). We base our jeopardy/no jeopardy determination on our analysis of the effects of the Federal action

agency's proposed action, including any conservation measures, the baseline and status of the species, and the effects of foreseeable non-Federal actions within the area affected by the agency action.

Approved recovery plans describe what actions are needed for the recovery of species. Recovery plans should be used by Federal agencies when they engage in the section 7 process to identify conservation measures they may need to implement to comply with section 7(a)(1) and 7(a)(2) of the Endangered Species Act. Which recovery measures the agency implements depends on the effects of the agency action in addition to the other previously mentioned factors that we evaluate in rendering a biological opinion.

The comments from El Dorado Irrigation District regarding the section 7 consultation on the water contract are beyond the scope of this recovery plan. We will meet with them to discuss their issues.

Comment 9: Several commenters thought the recovery plan was not specific enough and should provide parcel-specific information.

Response: The purpose of the recovery plan is to provide guidance and direction on the actions needed to protect gabbro plant habitat and the associated endemic species, so that they are no longer endangered or threatened. It is not intended to provide specific and rigid instructions for these activities. To the extent possible, we included parcel information from El Dorado County. Unfortunately, difficulties with their Geographic Information System parcel layers limited their utility as described in Appendix D.

Comment 10: A few commenters thought that the recovery plan was legally binding or was a law. One commenter also stated that "one person has the power to simply sign the plan and it becomes law" and wanted to know where the due process guaranteed by the Constitution of the United States was.

Response: We want to clarify that recovery plans are not regulations or laws. They are advisory documents that are approved by either our Director, Regional Director, or California/Nevada Operations Manager. The approval of a recovery plan does not mean that the recovery plan becomes law or is legally binding. An approved recovery plan outlines our best recommendations for tasks that we believe to be required to recover and/or protect listed species. Within the recovery planning process, every effort is made to provide the public ample opportunity to participate, and provide comments during the public comment period.

Comment 11: One commenter thought there had been inadequate public involvement.

Response: We disagree that there have been inadequate opportunities for public involvement. Over 500 copies of the draft plan were sent to affected or interested parties. Copies were also distributed to local libraries. A public comment period was open for 120 days. We also gave two presentations on the draft plan at public meetings of the El Dorado County Board of Supervisors on May 25, 1999, and at an El Dorado County Planning Commission meeting on June 24, 1999. In addition, we hosted an open house on May 27, 1999, to provide the public an opportunity to discuss the gabbro soil plants and the recovery plan with U.S. Fish and Wildlife Service, California Department of Fish and Game, Bureau of Land Management, and California Department of Forestry and Fire Protection personnel.

We also released an amendment to the draft plan based on comments received during the public comment period on the draft plan. Over 700 copies of the amendment were sent to affected or interested parties. Copies were also distributed to local libraries. The public comment period was reopened for 60 days to allow for public input on the amendment. In addition we gave a presentation on the amendment at a public El Dorado County Planning Commission meeting on November 30, 2000, and again at an El Dorado County Board of Supervisor's meeting on December 12, 2000.

Comment 12: Several commenters suggest that the recovery plan recommendations for a preserve system on the Pine Hill formation constitute a seizure of private land.

Response: We developed a recommended preserve system for western El Dorado County to provide the best achievable protection for the six species covered by the recovery plan. In developing the recommended preserve areas, we concentrated on maximizing the use of current public lands and eliminating, where possible, developed lands from the recommendation. Because the current extent of public lands is insufficient for recovery of the listed species, however, we also included private lands in the preserve recommendation.

While private lands are depicted in the preserve area, the recovery plan does not contemplate that those lands will be acquired by governmental taking. The recovery plan is a guidance document and thus the preserve areas outlined within the recovery plan are recommendations, without the force of law. While the document may be used to guide future decision making by El Dorado County or by Federal agencies engaging in consultation with us concerning Federal actions under section 7 of the Endangered Species Act, the recovery plan does not predetermine the outcome of those decisions and consultations. For the private lands that we consider necessary for the recovery of the listed species, we recommend protection through several voluntary mechanisms, including programs of land acquisition with willing sellers, conservation easements, or cooperation in programs to maintain and/or enhance habitat valued for gabbro species.

Comment 13: A few landowners in the area of the recovery plan were concerned that the market value of the land they hold in the area of a recommended recovery preserve will be affected by the need to conserve the listed species found there. One commenter noted that nowhere in the recovery plan was taking private property advocated, but that El Dorado County has passed Ordinance 4500 in response to the recovery plan, and that we are responsible for the devaluation of his property.

Response: As discussed in Chapter II, El Dorado County Ordinance 4500 established an ecological preserve mitigation requirement or an in-lieu fee for certain development projects in western El Dorado County to help pay for the acquisition and management of plant preserves. The commenter is correct in stating that nowhere does the recovery plan advocate taking private property without payment. We do not advocate these actions, which is one of the reasons that the cost estimated for recovery is so high. All land acquired by the government for preserves must be purchased from willing sellers. We do not acquire property without full payment of fair market value, based on real estate appraisal, in compensation for the conveyance of the property or an interest in the property to the government. The United States Government must pay the fair market value of the property or easement.

Comment 14: One organization asked what happens if the plants become extinct.

Response: If the species become extinct they would no longer be afforded the protection under the Endangered Species Act. The species would be delisted once we were sure the plant had gone extinct. Because several of these species need fire, they could appear to be extirpated from a given site, but actually could be present as seeds. Therefore, determining that these species had gone extinct could be difficult.

Comment 15: The proposal to obtain additional lands for endangered plant habitat is dependent on partnerships. What happens if no “partners” step up? What would be the result of this scenario?

Response: The result is that the recovery plan would not be fully implemented. Some of the species would likely go extinct; the other species would likely not be recoverable and would remain federally listed.

Comment 16: One organization stated that El Dorado County could propose to the U.S. Fish and Wildlife Service exactly which species would be covered by the recovery plan.

Response: This understanding is incorrect. We determine which species are covered in recovery plans.

Comment 17: The Rare Plant Advisory Committee's recommendations, as subsequently endorsed, modified and adopted by El Dorado County represent a scientific consensus as to what is necessary to avoid the extinction of these species.

Response: The Rare Plant Advisory Committee was not a scientific committee, but would more accurately be described as a "stakeholders" committee. It consisted of members from the development community, various agencies (California Department of Fish and Game, Bureau of Land Management, U.S. Fish and Wildlife Service), El Dorado County planning staff, California Native Plant Society, Center for Sierra Nevada Conservation (formerly Friends Aware of Wildlife Needs), and the American River Conservancy. The findings of the Rare Plant Advisory Committee were never peer reviewed by a third party.

Comment 18: One commenter wanted to know what analysis had been done to evaluate the best use of the lands.

Response: The "highest and best use" of land is determined during real estate appraisals. As the recovery plan is implemented, real estate appraisals will be performed for land acquisitions. During the time these real estate appraisals are performed the highest and best use of the land will be determined.

Comment 19: Two commenters had questions regarding whether we would release real estate appraisals.

Response: No. Real estate appraisals commonly contain information that is confidential, such as commercial and financial information, or marketing strategies. Federal law, the Privacy Act, and the Freedom of Information Act provide for the withholding of information that is intended to be kept confidential and where release may constitute an unwarranted invasion of

personal privacy or private property rights. These Federal laws include several of the Government's accepted privileges from discovery, including the privileges for expert appraisal reports, and deliberative material.

Comment 20: One commenter wanted to know why the entire acquisition and maintenance costs of the rare plant preserves was not being funded through sale of timber from Federal lands such as in the El Dorado National Forest.

Response: The U.S. Forest Service is already charged through section 7 with protecting these species where they occur on their land. Additionally, aside from funds (Knudsen-Vandenburg Brush Disposal and Salvage Funds) used for actions such as slash clean-up and reseedling, all the funds from the sale of timber from Forest Service lands go back to the United States Treasury. The funds would need to be appropriated by Congress to be used for acquisition and maintenance of rare plant preserves.

Comment 21: One commenter asked why after 20 years of knowledge of gabbro plants did the U.S. Fish and Wildlife suddenly decide these plants were valuable, need to be saved, and were in decline?

Response: We assume the commenter is referring to the length of time it took for five of these species to be federally listed. We did not suddenly decide that the listed plants in this recovery plan warranted listing. On December 15, 1980, we published a Notice of Review including these species as candidates for Federal listing (45 FR 82480). On October 13, 1982, we found that the petitioned listing of *Calystegia stebbinsii*, *Fremontodendron californicum* ssp. *decumbens*, *Galium californicum* ssp. *sierrae*, and *Senecio layneae* was warranted but precluded by other pending listing actions due to inadequate funding and staffing (49 FR 2485).

Comment 22: Two commenters wanted to know what restrictions would be put on their land from the recovery plan. The commenters also asked a series of questions on what restrictions there would be on the land if a conservation easement was acquired.

Response: This recovery plan does not impose restrictions on private landowners. This recovery plan provides recommendations and criteria for how to recover the gabbro plant species and has recommended recovery tasks including land acquisition or protection via other means such as conservation easements. The involvement of private landowners in the implementation of this recovery plan is voluntary. There may be State or local requirements affecting property use, however, concerning the construction of buildings and the development of property and the State and local planning agencies should be contacted regarding their requirements.

If we secure easements on land from willing landowners, they would be paid for the development rights of their property and there would be restrictions within the easement land. Although the details of the conservation easement would need to be determined, any action that is incompatible with the protection of the special status plants would be prohibited. Some of the actions that we consider incompatible with the protection of the special status plants include paving or otherwise covering of the conservation property with concrete, asphalt, or any other impervious paving material; erecting buildings on the conservation property; and excavating, dredging or removing of loam, gravel, soil, rock, sand or other material on the conservation property. We can provide our conservation easement template language to interested parties.

Comment 23: Another commenter asked, “Why does your plan totally ignore El Dorado County’s historical involvement in protecting these plants? The County sought assistance from all State and Federal agencies in Environmental Impact Reports done for the Rescue, Cameron Park, and Shingle Springs area (this was also pointed out at the presentation before the Planning Commission).”

Response: Some of these referred documents pre-date the Federal Endangered Species Act’s protection for the gabbro plant species. Because we are not a lead agency on California Environmental Quality Act documents, we are not required to retain administrative records related to whether we received or responded to Environmental Impact Reports. We do

not have such records for Environmental Impact Reports that pre-date 1990, and may never have received copies of these documents. Thus, we lack information about older County actions that may be related to these plants. However, the recovery plan does not ignore historical involvement, and we have made every attempt to incorporate all available information. We have discussed County involvement with the EIP Report, the Rare Plant Advisory Committee, and obtaining funding for preserves.

Comment 24: One commenter stated there were other plants in El Dorado County that could possibly be listed and several animals that are under consideration for listing. This commenter wanted to know at what point listing species stops.

Response: Listing is the formal process through which we add species to the Federal List of Endangered and Threatened Wildlife and Plants. We are required under section 4 of the Endangered Species Act [50 CFR §402.02] to determine if species should be added to the Federal List of Endangered and Threatened Wildlife and Plants, based on our analysis of the threats to the species' survival. If we determine based on this analysis that listing a species may be appropriate, we will formally publish in the Federal Register a proposed rule to list the species, consider any new information obtained during a public comment period, and make our final determination of whether to list the species.

Comment 25: Two commenters had concerns regarding whether the information had been peer reviewed.

Response: We have followed our policy for having this recovery plan peer reviewed. See the beginning of this Appendix (page VII-30) for additional information.

Introduction

Comment 26: One peer reviewer thinks *Calystegia stebbinsii* and *Ceanothus roderickii* both have a high recovery potential because several

robust populations of each exist, and once these populations are secured and managed, recovery should follow.

Response: We disagree. We think the recovery potential is lower because of the experimental nature of adaptive management and the intensive management that will be needed for use of fire near an urban interface.

Species Accounts

Comment 27: Two commenters believed that there are no threats to these plants. One commenter stated that having a reduced growing area does not constitute proof of decline. A fourth commenter stated that the threats to existing populations in the recovery plan are overstated and outdated.

Response: We disagree. A species may be determined to be endangered or threatened due to one or more of the five factors described in section 4(a)(1) of the Endangered Species Act: (1) the present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) inadequacy of existing regulatory mechanisms; and (5) other natural or manmade factors affecting its continued existence.

The best information available was used to evaluate threats to species covered in the recovery plan. In many cases, populations on private land cannot be surveyed to verify or update population sizes, threats, or other information. The reasons for decline and threats to survival of these species are discussed in Chapter II section C.

Comment 28: Two commenters wanted to know where the information substantiating the listing and threats stated in the listing package is. One commenter wanted to know whether the threat information regarding gold rush activities, clearing for agriculture, population growth between 1960 and 1990, and the percentage of the gabbro formation that was developed was conjecture.

Response: Our Federal Register documents [Federal Register 61: 54346-54358 (October 18, 1996)] listing species are just a summary of the information. The substantiating information is within our administrative records in our office and available upon request. The threat information is not conjecture, but is based on the best available scientific information.

Comment 29: One commenter wanted to know whether the Mule-ear daisy is really rare.

Response: Some species of mule-ears are common, but the mule-ears that is covered in this recovery plan is rare. The El Dorado mule-ears (*Wyethia reticulata*) is only known on the Pine Hill formation in western El Dorado County. Additionally three other common types of mule-ears also occur on gabbro derived soils in the Pine Hill area-- *Wyethia angustifolia* (California compassplant), *W. boldanderi* (Bolander's mulesears), and *W. helenioides* (whitehead wyethia).

Comment 30: One commenter mentioned that the introduction of nonnative turkeys has adversely affected the reproduction of the gabbro soil plants, but provided no information to substantiate this claim.

Response: We are unaware of any scientifically verified threat posed by wild turkeys to the gabbro plants. We will consider any additional relevant data provided by interested parties. Monitoring of the plant populations is included as a task within the recovery plan (see Task 3.4). Should wild turkeys be decreasing the reproductive capability of the plants, actions to minimize the threat will be taken (see Task 3.3).

Recovery

Comment 31: El Dorado Irrigation District and other commenters questioned why additional acreage, beyond the 1,400 hectares (3,500 acres) of preserves recommended by the El Dorado Rare Plant Advisory Committee, has been proposed in the draft plan. El Dorado County stated that the draft plan frequently prescribes measures that run counter to the

County's Rare Plant Preservation Program and that with a better understanding of the County's program the recovery plan would be very different. A few commenters felt that there had been a deal struck and to come out with a higher recommendation was a breach of good faith.

Response: Our recovery analysis for the draft plan and for this final plan concluded that additional areas outside the 1,400 hectares (3,500 acres) identified by the El Dorado County Rare Plant Advisory Committee are needed to conserve the species. We reached this conclusion because significant portions of several of the plant species are outside the 1,400-hectare (3,500-acre) preserve system. We have determined that additional lands need to be secured and managed to provide for the long-term survival of the gabbro plants. The five plants are distributed unevenly throughout the gabbro soils formation, and not all preserves proposed by the Rare Plant Advisory Committee protect all, or even a substantial portion of some species populations. The Rare Plant Advisory Committee preserve system, which El Dorado County has adopted in part, protected only 25 to 45 percent of five of the six target species and omitted critical plant occurrences and habitat that our analysis concluded were necessary for the long-term survival of one or more of the rare plants. See Appendix D and Chapter III for additional details on our analyses.

The purpose of the Rare Plant Advisory Committee was not to recover the listed species, but to develop a program to aid in resolving the conflict between urban development and protection of rare species and natural habitats within western El Dorado County. Recovery is the process by which the decline of an endangered or threatened species is arrested and reversed and threats to its survival neutralized so that its long-term survival in nature can be ensured.

We supported the concept of a preserve system to protect these species. At the time of the Rare Plant Advisory Committee, these species were not federally-listed or federally-proposed species. In 1997, when we had meetings with El Dorado County and El Dorado Irrigation District regarding the importance of Cameron Park for conservation of these species, we stated

that the acquisition of the Cameron Park preserve was very important for the recovery of these species, but we did not say that 160 hectares (400 acres) for the Cameron Park Preserve was enough. We had not performed an analysis to determine what was needed for the recovery of these species until we started preparing the recovery plan in 1998. The analysis found that approximately 2,000 hectares (5,000 acres) of preserves in El Dorado County were necessary to allow for recovery. We did not state that protection of 1,400 hectares (3,500 acres) was sufficient to allow recovery of these species.

Comment 32: One commenter stated that the draft plan called for 500-foot buffers around preserves, but did not incorporate this buffer except as a written goal.

Response: The draft plan called for 150-meter (500-foot) buffers around plant occurrences. This buffer has been incorporated during our analysis, so preserves indicated on the maps in this plan include the 150-meter (500-foot) buffer. Please see page VII-21 for additional information.

Comment 33: One commenter, commenting on the draft plan, wanted to know the percent of occurrences that our proposed preserve system protects.

Response: Our analysis of the preserve design was discussed within the amendment, and is described above in Appendix D.

Comment 34: One commenter stated that to accomplish the draft plan's goal within the central Pine Hill area, virtually every property within the target area would have to be acquired, and many of them are already developed with houses.

Response: The preserves identified in the recovery plan are our best recommendation at this time. To provide for additional flexibility in acquisition of property, if other parcels of comparable value are identified, we will consider them. For a parcel to be considered of comparable conservation value, the parcel will need our approval and must (a) be within

the same preserve area (*e.g.*, Pine Hill preserve area or Salmon Falls preserve area), (b) be on the appropriate soils, (c) protect the same mix of plants, (d) have equivalent or better buffer areas, (e) result in no decrease in the distribution and range of any of the covered species, and (f) meet the recovery acreage criteria and goals in this recovery plan (see Tables III-4 and III-5).

Comment 35: A few commenters felt that the Cameron Park preserve south of Highway 50 should be dropped as a preserve, citing the cost to acquire the land. One commenter, commenting on the amendment said that because of the size, shape, and location of the southern portion of the Cameron Park preserve to Highway 50, this property does not warrant inclusion as a preserve.

Response: We disagree. The criteria for our preserve design included essential elements of conservation biology (including adequate habitat patch size and connectivity and buffers; minimized edge effect and other effects of fragmentation; provisions for ecosystem processes such as fire; and representation throughout the geographic range) combined with the existing situation, to the best of our knowledge, in the way of suitable habitat and extent of development.

We were aware that the general plan designation for the Cameron Park preserve south of Highway 50 is commercial. This fact does not change our analysis. We buffered the plant occurrences to allow for ecosystem processes to occur. The cost of the land is not a factor in our analysis.

Comment 36: One commenter, commenting on the draft plan, provided a very detailed list of changes to acreage goals identified for preservation, and requested that the acreages for most of our recommended preserves be reduced in size. Additionally, this commenter wanted us to increase the size of the Salmon Falls preserve by adding additional public lands.

Response: Acreage figures for some of these preserves changed as a result of our Geographic Information System analysis (see Appendix D). We

maintain that the preserve system developed for the amendment should be implemented. Preserve sizes within the Amendment were calculated in the Geographic Information System analysis. Preserve boundaries were mapped based on the best available data, and were not always parcel based. Because some error may be present in the data, the acreages are approximate and may not match parcel information. Preserve 6, near Bass Lake, has been deleted from the recovery plan (see Comment 45).

We disagree with adding the additional public lands that the commenter wished to see added to the Salmon Falls preserve to meet Priority 1 acreage goals. We have already selected preserve areas to maximize use of current public lands. (See Comment 55 for more detail).

Stepdown narrative

Comment 37: One commenter stated that the Nevada County population of *Fremontodendron californicum* ssp. *decumbens* has been recognized for years and that the recovery plan should include this species. The commenter attached a letter from Dr. Lloyd, one of the species experts on *Fremontodendron*, as supporting documentation. The commenter additionally thought *Calystegia stebbinsii* should be included for Nevada County in the recovery plan.

Response: The recovery plan does include the decumbent *Fremontodendron* in Nevada County. Clarification is still needed regarding the identification of the decumbent *Fremontodendron* in Nevada County as well as in Yuba County. The occurrences near Grass Valley were listed as *Fremontodendron californicum* and not as *Fremontodendron californicum* ssp. *decumbens* in Walter Kelman's treatment (Kelman 1991). Additionally, the range of *Fremontodendron californicum* ssp. *decumbens* is listed as Pine Hill in El Dorado County (Whetstone and Atkinson 1993). The letter that the commenter submitted from Dr. Lloyd suggested that the Nevada County occurrence could be a small population of *Fremontodendron californicum* ssp. *decumbens* or a hybrid. Dr. Lloyd stated that before a final decision

was made it would be appropriate to obtain information on chromosome number as well as protein electrophoresis.

This research on the identity of the decumbent *Fremontodendron* in Nevada and Yuba Counties is ongoing. We had hoped that the research would be complete by the time we wrote the final recovery plan. It is not. We still do not know the identity of the decumbent *Fremontodendron* in Nevada and Yuba Counties. We have changed the recovery plan to include protection of the decumbent *Fremontodendron* in Nevada and Yuba Counties unless it is determined not to be the listed *Fremontodendron*.

The decumbent *Fremontodendron* and *Calystegia stebbinsii* are included in the recovery plan for Nevada County (see Tasks 2.2.3, 4.2.2.5, 5.10, 5.11, 6.1.2 in Chapter IV and recovery criteria on pages III-28 to III-35).

Although the recommended preserve areas for Nevada County do not show on the maps, the recovery plan calls for protection of the occurrences of *C. stebbinsii* in Nevada County and the protection of the decumbent *Fremontodendron* within Nevada and Yuba Counties unless it is determined not to be the listed *Fremontodendron*.

Comment 38: Two commenters provided very detailed lists of changes to Task Priorities and thought that the recovery plan's Priority 1 Tasks should correspond to El Dorado County's Rare Plant Preserve Program, and that none of the recovery plan's additional tasks should be Priority 1. One commenter additionally stated that refining preserve boundaries should not be a Priority 1 Task and should be done before the recovery plan is adopted.

Response: We disagree. The areas we identified as Priority 1 for protection are those that include a high number of the species covered in this recovery plan or those with high conservation value for a particular species, especially for *Galium californicum* ssp. *sierrae*. In fact, many of these Priority 1 lands do correspond to lands identified by the Rare Plant Advisory Committee. However, we have based Priority 1 land acquisitions upon the species richness and not on the lands designated within El Dorado County's Rare Plant Program. In addition to land acquisition, several other tasks are

needed to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future. Management of the acquired habitat is essential to the plants' continuance. Parts of the proposed preserves have not burned for over 50 years, and require active management at this point. Research needed to properly manage or track the effects of management on the species is also considered Priority 1.

We have deleted the task to refine the preserve boundaries from the recovery plan because we have completed this task to the best of our ability with the information available. Based on our analysis, we issued an amendment to the draft plan that showed the refinements in the preserve boundaries.

Comment 39: One commenter stated, "It will be critical for there to be an ongoing management endowment fund that not only provides for study and implementation of the natural fire ecology on the Gabbro soils but also money for community education regarding the need for reestablish natural burn cycles in the preserves. This will also take coordinating with the Air Resources Board and California Department of Forestry and Fire Protection."

Response: We agree. Ongoing public education regarding the need for reestablishing natural burn cycles is important. Tasks 1.2.1 and 3.1 have been modified to incorporate this comment. It is likely that the lead agency for controlled burns will coordinate with the Air Resources Board and California Department of Forestry and Fire Protection.

Comment 40: One commenter felt that granting a tax break (which would stay with the land) for or buying easements, swapping desired land for other Federal lands, and swapping development rights for dedication of habitat acreages are techniques that should be emphasized strongly.

Response: We have clarified the development and implementation of economic or other incentives as a task (see Task 1.2.2), and have clarified Tasks 2.1 and 2.2 to include swapping of development rights for dedication

of habitat acreage. We intend that private landowners participating in the recovery of these species will be compensated.

Swapping desired land for other Federal lands is not excluded, and is one of many options that can be used for financing part of the acquisition of the preserves. It must be recognized, however, that within the Pine Hill formation the existing Federal lands identified in our preserve recommendations either already provide occupied habitat, potential habitat, or buffer areas.

Therefore, these lands would not be suitable for land trades. Additionally, other uses for Federal lands (*e.g.*, providing habitat for other listed species, watershed protection, or use for grazing) need to be considered in determining appropriate lands for swapping.

Comment 41: One commenter asked if any money was being spent on a “regional, cooperative public/private plan implementation team? If consistent commitment from private and volunteer organizations is a goal, then you need to provide a financial incentive.”

Response: A Memorandum of Agreement has been developed with several parties in El Dorado County (Bureau of Land Management, California Department of Fish and Game, U.S. Fish and Wildlife Service, El Dorado County, California Department of Forestry and Fire Protection, El Dorado Irrigation District, U.S. Bureau of Reclamation, and American River Conservancy) for management of the Pine Hill Preserve, which includes all preserve areas on the Pine Hill formation, and a preserve manager has been hired. This effort is specific to the Pine Hill area, and has not expanded to address broader regional planning outside El Dorado County.

Comment 42: Two commenters thought the Ponderosa 50 lands need to be a high priority for purchase due to their valuable rare plant habitat.

Response: We agree. This property has now been purchased as rare plant preserve habitat.

Comment 43: One commenter listed properties that they thought were not justified for inclusion as Priority 2 land acquisition. The lands identified included Martel Creek preserve, preserve 5 (now included as part of Cameron Park Priority 1 land acquisition), preserve 3 (now included in Cameron Park Priority 2 land acquisition), and preserve 6 located near Bass Lake.

Response: We have eliminated preserve 6, because it has largely been developed. The other areas noted by the commenter are included in the preserve system because current information indicates that they include a high number of species covered in this recovery plan or they have high conservation value for a particular species covered in the recovery plan. We have received no substantive biological information to suggest that the preserve system identified in the amendment should not be implemented as proposed.

Comment 44: One commenter stated that the deletion of the proposed preserve nearest Bass Lake (preserve 6 in the draft plan) is contrary to the recovery objective of protect and restore and the concept of many separate preserves, and there was not adequate explanation why this area was deleted. The commenter further stated that there is abundant land near Bass Lake with both the existing plants and potential habitat that could be acquired if timely action were taken.

Response: We were unaware that about half of the area for preserve 6 was already developed at the time we released the draft plan. Additional development has occurred between the time the draft plan was released and the time the amendment was released. Most of the area identified as a preserve near Bass Lake has now been developed or has received Federal permitting for development. Unfortunately, we do not think that the habitat that remains (approximately 16 hectares [40 acres]) is adequate for a preserve. The habitat is fragmented and only supports *Senecio layneae*. For these reasons, we felt the area was less important to recovery of the species than other areas in the preserves. We have therefore deleted this area as a preserve.

Comment 45: One commenter asked a series of questions regarding the recommended preserve staffing and management including what will be: (a) the number of staff, educational qualifications, and annual salaries of preserve staff; and (b) the planned contracts; the capital improvements required or envisioned; and the required assets and expendables. Another commenter stated that the recovery plan needs to clearly document how funds are proposed to be used under each cost estimate and show the calculations within the implementation schedule. A third commenter stated that our financial analysis was weak, and that a detailed analysis of options and analysis seems prudent.

Response: Recovery plans are meant to be advisory documents that provide a framework for items needed for recovery. It is not the intended purpose of recovery plans to provide specific and rigid instructions for these activities. Rather than dictating such details in this recovery plan, we prefer to work with El Dorado County, the Bureau of Land Management, California Department of Fish and Game, etc. in the course of implementation to identify the most appropriate approach.

Recovery plans provide estimates of costs. The purpose of a recovery plan is not to provide a detailed financial analysis. We have performed a detailed analysis for determining preserve recommendations. The analysis is summarized in Appendix D and Chapter III.

Comment 46: One commenter thought that emphasizing enhancing, repatriations, or introductions of species could save millions of dollars by making land purchases unnecessary. Another commenter wanted an explanation of why there is such a strong emphasis on protecting species where they grow as opposed to planting them in other open space areas or botanical gardens or relying on seed storage.

Response: We disagree that emphasizing enhancing, repatriations, or introductions of species could save millions of dollars by making land purchases unnecessary. We do not rule out repatriations or introduction of plant populations in suitable habitat within their historic ranges, but consider

the protection of existing populations to be a higher priority. The lower priority of repatriation and introduction is based on the uncertainty and difficulty associated with these strategies (Falk *et al.* 1996). Repatriations and introductions should be considered experimental because “the reintroduction of any species is inherently complex” and because “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 determining the outcome takes time (certainly years and perhaps decades), and planning and long-term commitment are essential (Falk *et al.* 1996).

Additionally, the purpose of the Endangered Species Act is to “provide a means whereby the ecosystems upon which endangered and threatened species depend may be conserved”. Protecting the ecosystem upon which these plants occur is necessary for recovery and is mandated by law. Although the draft plan identified a task regarding artificial enhancement, repatriation, or introduction of sensitive plants, there must be suitable protected natural land upon which these activities are conducted. Reliance on planting these plants in botanical gardens or on seed storage does not protect the plants in their natural habitat.

Comment 47: One commenter stated, “Based on ongoing discussions with the project proponent and resource agencies about the design of a specific residential project in the Salmon Falls area, it is our understanding that there is general agreement that properly designed residential development is possible within some preserves.”

Response: We do not consider building residential developments on preserves to be an activity consistent with the recovery of the plants. Building residential developments on preserves further fragments the habitat and makes the habitat more difficult to manage. Residential developments within preserve boundaries may limit management options such as conducting prescribed burns. In some areas, especially on Pine Hill, low density rural development (*e.g.*, one house per 4-hectare[10-acre] parcel)

already exists. Within these areas we recommend conservation easements to protect the portion of the property that is not already developed.

Comment 48: One commenter wanted to know why we were not recommending limiting preserves to the most prolific areas instead of recommending five expensive areas to preserve.

Response: We have identified areas to preserve based on habitat quality and presence of the listed species. See Appendix D and Chapter III for a discussion of our analysis.

Comment 49: One commenter suggested that smaller areas (8 to 16 hectares [20 to 40 acres]) with community stewardship should be pursued, and that with fewer and larger sites, restoration efforts would be more likely to be impaired by other human factors.

Response: We disagree. We consider the acquisition of larger preserves necessary for recovery and less likely to be affected by external factors. The criteria we used for determining size of preserves are discussed on pages III-17 and III-18. We recognize there is ongoing development, and that we may need to resort to acquiring smaller preserves. At the point we need to resort to acquiring smaller preserves it would be for a species' survival and not for its recovery.

Comment 50: Two commenters think the recovery plan should emphasize strategies that minimize the financial burden on El Dorado County's citizens including: preserving plant occurrences outside of El Dorado County and preserves on public lands or introductions. Another commenter wanted to know the justification for not trading Forest Service lands, Bureau of Land Management lands, or Bureau of Reclamation land to cover all costs in the acquisition of the plant preserves.

Response: To the extent possible we have maximized the use of public land in our preserve recommendation. Because the current extent of the plants on public land is insufficient for recovery of the species, it is also necessary to

include private lands in our preserve recommendation. The financial burden to El Dorado County, where most of the plant occurrences are, is being minimized by providing Federal and State funding to help in the acquisition of the plant preserves. As of June 2002, \$8 million have been allocated from the Land and Water Conservation Fund, \$2,907,800 have been provided by the Bureau of Reclamation's Central Valley Project Conservation Program and the Central Valley Project Improvement Act Habitat Restoration Program, and \$1,691,000 have been provided by the California State Wildlife Conservation Board and California Department of Fish and Game to help in the acquisition of preserves in western El Dorado County.

Trading Bureau of Land Management lands, Forest Service lands, or Bureau of Reclamation lands to cover all the costs of the acquisition of the plant preserves is either impractical or infeasible. The administrative boundary for the Eldorado National Forest does not extend far enough west to include the Pine Hill formation and land exchanges need to be performed within the administrative boundaries that have been set by Congress. Because the property near Shingle Springs and Cameron Park is expensive and most of the land that Bureau of Land Management has is so much less costly, it is infeasible to trade Bureau of Land Management lands to cover all of the costs of acquisition of the preserves. All Bureau of Reclamation lands were bought for specific project purposes (reservoirs, dams etc.). These lands are being used for the project purposes and therefore are not tradeable.

In addition to being impractical or infeasible, it is also likely that it will not satisfy developers' needs to trade land that has development rights or is located near existing infrastructure for land that does not have development rights and is not near existing infrastructure.

Please see Comment 47 for use of transplantation and Comment 35 for suitability of alternative sites.

Comment 51: One commenter thought to reduce the threat of short interval fires, weedy annual grasses should be controlled and the preserves protected against arson.

Response: We agree that control of weedy annual grasses is one approach that might decrease the threat of short interval fires.

Comment 52: One commenter stated that fires can promote invasion of exotic species. Some of the research should be directed to questions about what happens when areas next to disturbed vegetation are burned.

Response: We agree, and have added this topic as part of the task on fire research (see Task 5.2 in Chapter IV).

Comment 53: Two commenters expressed concerns regarding the use and the need for controlled burns on the preserves.

Response: We are required to make recommendations regarding the tasks needed to recover species. Most of these plants are adapted to fire and require fire for various parts of their life cycles. We recognize that controlled burns will be need to be performed in a manner that both protects human life and property as well as promoting the recovery of these plants. Any effort to implement the recovery tasks will take into account the priority of human safety.

Comment 54: One commenter identified 340 hectares (850 acres) of additional public lands in the vicinity of Salmon Falls preserve to serve as potential future habitat or set asides as buffers and wanted this acreage to meet the acreage goals of Priority 1.

Response: We reanalyzed the preserves and maps from the draft plan and issued a revision in the amendment. The recommendation for the final has not changed from the amendment. We selected preserve areas to maximize use of current public lands. Because the current extent of public land is insufficient for recovery of the species, it was also necessary to include private lands in our preserve recommendation. We maintain that the lands identified in the amendment and the final plan are needed for preservation.

Almost all of the acreage identified by the commenter either did not occur on the appropriate soils (either gabbro derived or serpentine) or support suitable habitat and would not be appropriate for the conservation of these plants. The lands being proposed by the commenter would not be appropriate to substitute for private lands recommended by the Rare Plant Advisory Committee because they are not of equal conservation value to lands recommended by the Rare Plant Advisory Committee.

Comment 55: One commenter stated that acquisition of all regions outside of El Dorado County should be Priority 1 because they enormously extend the range of populations.

Response: We agree and have modified the stepdown outline and implementation schedule.

Comment 56: One organization stated that adaptive management is an open ended trial and error project that can be an endless demand for taxpayer dollars. This organization also wanted to know what the return on the investment of adaptive management is.

Response: This process of evaluating and adjusting management as needed is termed “adaptive management”. With adaptive management, objectives are developed to describe the desired condition on the preserve; management is designed to meet the objectives; the response of the resource is monitored to determine if the objective is being met; and management is changed if the objectives are not met (Elzinga *et al.* 1998). Results of new biological research (see Task 5) are considered in adaptive management. The cost of the adaptive management will not become an endless demand for taxpayer dollars because the cost for the management is covered through an endowment fund. The return on the investment of adaptive management is better and more efficient management for the species.

Comment 57: One commenter wanted to know who would be responsible for maintenance of the preserves and who would be responsible for the burning in a residential area.

Response: Task 3.3 identifies Bureau of Land Management, California Department of Fish and Game, El Dorado County, U.S. Fish and Wildlife Service, Eldorado National Forest, California Native Plant Society, American River Conservancy, and Nevada County as responsible parties for the preparation and implementation of management plans. Additionally Task 3.1 sets up a funding mechanism for the long-term maintenance and management of the Pine Hill formation preserves in perpetuity. The California Department of Forestry and Fire Protection and the local land management agencies would be responsible parties for conducting a burn.

Comment 58: One commenter stated, “It has been noted that the objective of the draft plan is to include properties that have a moderate to low economic value.”

Response: This is not our stated objective of the recovery plan. The objectives of the recovery plan are stated on pages v and vi of the Executive Summary. To repeat, the long-term objective is to: (1) protect and restore sufficient habitat and numbers of populations and (2) ameliorate both the threats that caused five of the gabbro soil plants to be listed and any other newly identified threats in order to (3) warrant delisting of *Calystegia stebbinsii*, *Ceanothus roderickii*, and *Senecio layneae*, and downlisting of *Fremontodendron californicum* ssp. *decumbens*, and *Galium californicum* ssp. *sierrae*, and (4) ensure the long-term conservation of *Wyethia reticulata*. Interim goals include stabilizing and protecting populations, conducting research necessary to refine reclassification and recovery criteria, and reclassifying to threatened (*i.e.*, downlisting) *Calystegia stebbinsii* and *Ceanothus roderickii*, species currently federally listed as endangered.

Comment 59: One peer reviewer suggested that we include metapopulation modeling as a task.

Response: We have added a task to conduct a metapopulation analysis (see Task 8) based upon monitoring and research gained through other tasks.

Comment 60: One peer reviewer thought there is sufficient information to propose some possible prescribed burning management strategies and evaluate their feasibility.

Response: Although there may be sufficient information to propose some possible prescribed burning management strategies and evaluate their feasibility, we do not have the expertise to do this for the final recovery plan. We have added it as a task (see Task 7) and will work with knowledgeable people and agencies to design burn management strategies for the preserves.

Comment 61: One peer reviewer questioned the emphasis placed on genetic studies in the draft plan thinking the genetic aspect is valuable, but not of highest priority.

Response: With the exception of genetic studies for *Galium californicum* ssp. *sierrae*, all genetic studies were given a Priority of 2. Genetic studies for *G. californicum* ssp. *sierrae* were given a Priority of 1. Because *G. californicum* ssp. *sierrae* is the species we would be most likely to reintroduce, prior to any reintroduction efforts we must understand the genetic structure of the population to prevent problems with either inbreeding or outbreeding depression. Inbreeding depression is the loss of viability and/or fecundity associated with mating among relatives. Outbreeding depression is the reduction in fitness that occurs when individuals that are genetically very different, such as individuals from widely separated populations breed.

Implementation schedule

Comment 62: One commenter stated that the draft plan projects a total cost of its recommendations at over \$49 million. It also recommends the responsible parties for each priority task, with the total effort scheduled over only 4 years.

Response: The Total Cost column of the Implementation Schedule reflects costs for tasks ranging from 2 to 30 years. Only the first 4 years are shown in detail because they represent a more precise budget cycle.

Comment 63: A few commenters questioned our putting a cost for acquiring the Salmon Falls preserve in the implementation schedule when all of the acquisition of this land can be achieved for free (*i.e.*, through the donation of the conservation easement in receipt of density transfer).

Response: The cost of acquiring land by donation of a conservation easement from a landowner in receipt of density transfers for a project is not free. There is a cost to the landowner of donating the conservation easement. The implementation schedule needs to reflect the cost of the land. Additionally, this strategy relies on a project being built. The landowner has changed and El Dorado County's original strategy of acquiring the land through this means may no longer be available.

Comment 64: One commenter stated that the draft plan does not mention the need for a preserve manager or the cost. The need for a preserve manager and cost sharing should be identified in the recovery plan.

Response: The recovery plan mentions the need for a preserve manager and the cost in Task 3.2.

Comment 65: One commenter stated that the recovery plan needs to acknowledge that additional local funding may not be feasible, and that recovery is not feasible without immediate and adequate State and Federal funding. Unless State and Federal agencies and/or private foundations provide a very significant portion of needed monies for the project, recovery will continue to be problematic.

Response: The recovery plan acknowledges that its stated objectives may not occur without adequate funding. The recovery plan states on the Disclaimer Page that objectives will be attained and any necessary funds made available subject to budgetary and other constraints affecting the

parties involved, as well as the need to address other priorities. As discussed in the Conservation Efforts section in Chapter II, additional funds from State and Federal agencies continue to be used to help recover these species.

Appendices

Comment 66: In reference to paragraph 6 on page VII-3 of the amendment (now paragraph 7 page VII-22), one commenter wanted to know whether the Geographic Information System layers from the El Dorado County were actually corrected.

Response: To the best of our ability we corrected the Geographic Information System layer from El Dorado County. Even though we corrected the Geographic Information System layer from El Dorado County, some error still exists. The corrected Geographic Information System layer is most accurate near Highway 50; accuracy decreases with distance from Highway 50.

Comment 67: One commenter wanted to know where the maps were for Appendix C. Land Characteristics of Four of the Five Rare Plant Preserves.

Response: These maps did not reproduce well, and therefore were not included in Appendix C, but are available in the original report. The citation for the report is:

Economic & Planning Systems, Inc. 1997. Final Report. Economic feasibility study for the El Dorado County Ecological Preserves. Prepared for the California Department of Fish and Game. 57 pp + appendices.

REFERENCES FOR APPENDIX F

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Kelman, W.M. 1991. A Revision of *Fremontodendron* (Sterculiaceae).
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Endangered and threatened wildlife and plants: Notice of interagency cooperative policy for the ecosystem approach to the Endangered Species Act. Federal Register 59:34273-34274 (July 1, 1994).

Whetstone, R. D. and T. A. Atkinson. 1993. Sterculiaceae. Pages 1077-1078 *In*:
The Jepson Manual Higher Plants of California. James C. Hickman (ed.).
University of California Press. Berkeley, California.

Appendix G. Glossary of Technical Terms

<i>Term</i>	Definition
<i>achene</i>	a dry fruit, with one seed
<i>annual</i>	living less than 1 year and completing the entire life cycle from seed germination to seed production in a single growing season
<i>anthropogenic</i>	human-caused
<i>bract</i>	small leaf- or scale-like structures associated with an inflorescence
<i>callose denticles</i>	hard teeth
<i>capsule</i>	a dry fruit, generally with many seeds
<i>caudex</i>	a short, thick, vertical or branched perennial stem usually subterranean, or at ground level
<i>cauline leaves</i>	leaves on the stem
<i>clonal</i>	all members of a population derived asexually from a single individual by vegetative reproduction
<i>congeners</i>	other species of the same genus, other related species
<i>decumbent</i>	stems lying on the ground and growing upward only at the tip
<i>dehisce</i>	open up
<i>deltoid</i>	triangular shaped
<i>demography</i>	the study of populations, such as of growth rates and number or percentage of individuals in each age group
<i>disjunct</i>	removed from; distinctly separated

Term	Definition
<i>disk flower</i>	flower in the center portion of the head of a member of the aster family
<i>elliptic-ovate</i>	shaped like a flattened circle
<i>endemic</i>	prevalent in or peculiar to a particular locality
<i>enhancement</i>	addition of individuals to an existing population
<i>entire</i>	with smooth edges, as in entire leaves
<i>enzyme</i>	any of a very large class of complex proteinaceous substances that are produced by living cells
<i>extant</i>	currently existing, not extirpated or destroyed
<i>extirpated</i>	locally extinct
<i>fecundity</i>	production of offspring
<i>genus (plural: genera)</i>	next taxonomic classification above species
<i>germinate</i>	begin to grow
<i>haploid</i>	single set of chromosomes
<i>igneous rocks</i>	rock formed by solidification of a molten magma
<i>inbreeding depression</i>	loss of viability and/or fecundity associated with mating among relatives
<i>inflorescence</i>	entire cluster of flowers and associated structures
<i>intrusive igneous rocks</i>	molten magma forced into cavities or cracks or between layers of other rock
<i>mafic</i>	group of minerals characterized by magnesium and iron and usually by their dark color
<i>margin</i>	edge

Term	Definition
<i>metapopulation</i>	a series of populations (or population subdivisions described as local subpopulations) with dynamic patterns of local extinctions and recolonizations
<i>metapopulation dynamics</i>	the evolutionary patterns of extinctions and recolonizations of the subpopulations within a larger metapopulation
<i>morphological</i>	of or related to form or structure
<i>oblanceolate</i>	narrowly elongate and widest at the tip
<i>obligate</i>	limited; bound to a restricted environment
<i>occurrence</i>	defined by California Natural Diversity Data Base as a location separated from other locations of the species by at least one-fourth mile; may contain one or more populations
<i>outbreeding depression</i>	reduction in fitness that occurs when individuals that are genetically very different, such as individuals from widely separated populations breed
<i>ovate-lanceolate</i>	egg-shaped; from 6 times long as wide to 3 times as long as wide
<i>palmately lobed</i>	shaped like an open palm
<i>pedicel</i>	stalk of an individual flower or fruit
<i>peduncle</i>	stalk of an individual flower or inflorescence
<i>perennial</i>	persisting or living for several years with a period of growth each year
<i>post dehiscent attrition</i>	seed predation
<i>predehiscence attrition</i>	loss of flower buds, flowers, and immature fruits prior to the fruit opening

Term	Definition
<i>ray flower</i>	the flowers usually located on the edge of the head of members of the aster family
<i>recruitment</i>	the number of non-flowering plants
<i>repatriation</i>	return to a location formerly occupied site
<i>reproductive attrition</i>	decrease in the number of reproductive structures, flowers, fruits, seeds
<i>restoration</i>	process of repairing damage to the diversity and dynamics of ecosystems
<i>scarification</i>	cutting or abrasion
<i>seed bank</i>	viable dormant seeds that accumulate in or on the soil
<i>self-compatible</i>	capable of self-fertilization
<i>self-incompatible</i>	not capable of self-pollination
<i>serpentine</i>	soils formed from weathered ultramafic rocks such as serpentinite, dunite, and peridotite; generally having (1) low calcium/magnesium ratio, (2) a lack of essential nutrients such as nitrogen, potassium, and phosphorous, and (3) high concentrations of heavy metals
<i>stepdown</i>	hierarchical outline of recovery tasks
<i>stratification</i>	ways to germinate seeds
<i>taxon (plural: taxa)</i>	a group that is sufficiently distinct to be considered a separate unit; <i>e.g.</i> family, species, subspecies, variety

Term	Definition
<i>third order soil survey</i>	An extensive soil survey used in community planning with a minimum resolution of from 1.6 to 16 hectares. This order of soil survey is appropriate with map scales of 1:20,000 to 1:63,360, which is the scale of most County soil survey maps
<i>type locality</i>	the exact geographic location from which the specimen(s) used to describe a taxon was (were) collected
<i>type specimen</i>	a specimen or series of specimens chosen when the taxon is described and considered representative of the species, subspecies or variety
<i>ultramafic</i>	extremely basic, very low in silica and rich in ferromagnesian minerals
<i>viable</i>	living (as in viable seeds); capable of persistence (as in viable population)
<i>xeric</i>	dry or arid

**Appendix H. Threats to the Listed Gabbro Soil Plants and Steps Within
the Recovery Plan for Threat Reduction or Elimination**

VII-70

SPECIES	LISTING FACTOR	THREAT	STILL A THREAT?	TASK NUMBERS	RECOVERY CRITERIA
<i>Calystegia stebbinsii</i>	A	Destruction of habitat through residential or commercial development	yes	1.1, 2.1.1, 2.1.2, 2.1.5, 2.2.3, 3.1, 3.2, 3.3, 3.4.1, 3.4.2, 3.5, 3.6	I(a), I(b), I(c), I(d)
	A	Habitat fragmentation	yes	2.1.1, 2.1.2, 2.1.5, 2.2.3, 3.1, 3.2, 3.3, 3.4.1, 3.4.2, 3.5, 3.6, 8	II, III(b), III(e)
	A	clearing of chaparral	yes	1.2.1, 3.3	II, IV(a), IV(g)
	A	irrigation associated with lawn maintenance	yes	1.2.1, 3.3	II, IV(a), IV(g)
	B	None	N/A	N/A	N/A
	C	Overgrazing by horses	yes	1.2.1, 3.3	II, IV(a), IV(g)
	D	Inadequacy of CEQA and CESA	yes	Beyond scope of recovery plan; would take legislative action to change	N/A
	D	small set-asides as project mitigation	yes	1.2.2, 2.1.1, 2.1.2, 2.1.5, 2.2.3	I(a), I(b), I(c), I(d)
	E	Altered periodicity of fire (either too frequent or fire suppression)	yes	1.2.1, 3.1, 5.2, 5.3, 7	II, III(a), III(c), III(d), III(f), IV(b), IV(f)

SPECIES	LISTING FACTOR	THREAT	STILL A THREAT?	TASK NUMBERS	RECOVERY CRITERIA
<i>Calystegia stebbinsii</i>	E	competition with invasive alien vegetation	yes	3.3, 5.2	II, IV(a), IV(g)
	E	herbicide spraying	yes	1.2.1, 3.3	II, IV(a), IV(g)
	E	unauthorized dumping	yes	3.3	II, IV(a), IV(g)
	E	increased risk of extinction due to environmental, demographic, or genetic random events	yes	4.1, 4.2.1, 4.2.2.5, 5.1, 5.3, 5.4, 5.5, 5.8, 5.9, 5.11, 6.1.2, 6.2, 8	II, III(a), III(c), III(d), III(f), IV(c), IV(d), IV(e), IV(f)
<i>Ceanothus roderickii</i>	A	Destruction of habitat through residential or commercial development	yes	1.1, 2.1.1, 2.1.2, 2.1.3, 2.1.5, 3.1, 3.2, 3.3, 3.4.1, 3.4.2, 3.5, 3.6	I(e), I(f), I(g), I(h)
	A	Habitat fragmentation	yes	2.1.1, 2.1.2, 2.1.3, 2.1.5, 3.1, 3.2, 3.3, 3.4.1, 3.4.2, 3.5, 3.6, 8	II, III(h), III(k)
	A	clearing of chaparral	yes	1.2.1	II, IV(h), IV(l)
	A	irrigation associated with lawn maintenance	yes	1.2.1, 3.3	II, IV(h), IV(l)
	B	None	N/A	N/A	N/A
	C	None	N/A	N/A	N/A
	D	Inadequacy of CEQA and CESA	yes	Beyond scope of recovery plan; would take legislative action to change	N/A

SPECIES	LISTING FACTOR	THREAT	STILL A THREAT?	TASK NUMBERS	RECOVERY CRITERIA
<i>Ceanothus roderickii</i>	D	small set-asides as project mitigation	yes	1.2.2, 2.1.1, 2.1.2, 2.1.3, 2.1.5	I(e), I(f), I(g), I(h)
	E	Altered periodicity of fire (either too frequent or fire suppression)	yes	1.2.1, 3.1, 5.2, 5.3, 7	II, III(g), III(i), III(j), III(l), IV(i), IV(k)
	E	herbicide spraying	yes	1.2.1, 3.3	II, IV(h), IV(l)
	E	trash dumping	yes	3.3	II, IV(h), IV(l)
	E	increased risk of extinction due to environmental, demographic, or genetic random events	yes	5.1, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 6.2, 8	II, III(g), III(i), III(j), III(l), IV(j), IV(k); IV(l)
<i>Fremontodendron californicum</i> ssp. <i>decumbens</i>	A	Destruction of habitat through residential or commercial development	yes	1.1, 2.1.3, 2.2.3, 2.2.4, 3.1, 3.2, 3.3, 3.4.1, 3.4.2, 3.5, 3.6	I(i), I(j)
	A	Habitat fragmentation	yes	2.1.3, 2.2.3, 2.2.4, 3.1, 3.2, 3.3, 3.4.1, 3.4.2, 3.5, 3.6, 8	II, III(n)
	A	clearing of chaparral	yes	1.2.1	II, IV(m)
	A	irrigation associated with lawn maintenance	yes	1.2.1, 3.3	II, IV(m)
	B	None	N/A	N/A	N/A
	C	wilt disease a potential threat	yes	5.7	II, IV(m)
	D	Inadequacy of CEQA and CESA	yes	Beyond scope of recovery plan; would take legislative action to change	N/A

SPECIES	LISTING FACTOR	THREAT	STILL A THREAT?	TASK NUMBERS	RECOVERY CRITERIA
<i>Fremontodendron californicum</i> ssp. <i>decumbens</i>	D	small set-asides as project mitigation	yes	1.2.2, 2.1.3, 2.2.3, 2.2.4	I(i), I(j)
	E	Altered periodicity of fire (either too frequent or fire suppression)	yes	1.2.1, 3.1, 5.2, 5.3, 7	II, III(m), III(o), IV(n), IV(r)
	E	garbage dumping	yes	1.2.1, 3.3	II, IV(m)
	E	increased risk of extinction due to environmental, demographic, or genetic random events	yes	4.1, 4.2.1, 4.2.2.5, 4.2.2.6, 5.1, 5.10, 5.14, 6.1.1, 6.2, 8	II, III(m), III(o), IV(o), IV(p), IV(q), IV(r)
<i>Galium californicum</i> ssp. <i>sierrae</i>	A	Destruction of habitat through residential or commercial development	yes	1.1, 2.1.1, 2.1.3, 2.1.5, 2.2.1, 3.1 3.2, 3.3, 3.4.1, 3.4.2, 3.5, 3.6	I(k), I(l), I(m)
	A	Habitat fragmentation	yes	2.1.1, 2.1.3, 2.1.5, 2.2.1, 3.1 3.2, 3.3, 3.4.1, 3.4.2, 3.5, 3.6, 8	II, III(q)
	A	clearing of chaparral	yes	1.2.1	II, IV(s)
	A	irrigation associated with lawn maintenance	yes	1.2.1, 3.3	II, IV(s)
	B	None	NA	N/A	N/A
	C	Overgrazing by horses	yes	1.2.1, 3.3	II, IV(s)
	D	Inadequacy of CEQA and CESA	yes	Beyond scope of recovery plan; would take legislative action to change	N/A

SPECIES	LISTING FACTOR	THREAT	STILL A THREAT?	TASK NUMBERS	RECOVERY CRITERIA
<i>Galium californicum</i> ssp. <i>sierrae</i>	D	small set-asides as project mitigation	yes	1.2.2, 2.1.1, 2.1.3, 2.1.5, 2.2.1	I(k), I(l), I(m)
	E	increased risk of extinction due to environmental, demographic, or genetic random events	yes	4.1, 4.2.1, 4.2.2.1, 4.2.2.2, 4.2.2.3, 5.1, 5.4, 5.6, 5.8, 6.1.1, 6.2, 8	II, III(p), III(r), IV(t), IV(u), IV(v), IV(x), IV(y)
	E	altered periodicity of fire (possible threat, research needed)	yes	1.2.1, 3.1, 5.2, 5.3, 7	II, III(p), III(r), IV(s), IV(w)
<i>Senecio layneae</i>	A	Destruction of habitat through residential or commercial development	yes	1.1, 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.2.2, 2.2.4, 2.2.5, 3.1, 3.2, 3.3, 3.4.1, 3.4.2, 3.5, 3.6	I(n), I(o), I(p), I(q), I(r), I(s), I(t)
	A	Habitat fragmentation	yes	2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.2.2, 2.2.4, 2.2.5, 3.1, 3.2, 3.3, 3.4.1, 3.4.2, 3.5, 3.6, 8	II, III(t)
	A	clearing of chaparral	yes	1.2.1	II, IV(z)
	A	irrigation associated with lawn maintenance	yes	1.2.1, 3.3	II, IV(z)
	A	mining claims on Forest Service land	yes	3.3	II, IV(z)
	B	None	NA	N/A	N/A
	C	Overgrazing by horses	yes	1.2.1, 3.3, 5.12	II, IV(z)

SPECIES	LISTING FACTOR	THREAT	STILL A THREAT?	TASK NUMBERS	RECOVERY CRITERIA
<i>Senecio layneae</i>	D	Inadequacy of CEQA and CESA	yes	Beyond scope of recovery plan; would take legislative action to change	N/A
	D	small set-asides as project mitigation	yes	1.2.2, 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.2.2, 2.2.4, 2.2.5	I(n), I(o), I(p), I(q), I(r), I(s), I(t)
	E	Altered periodicity of fire (either too frequent or fire suppression)	yes	1.2.1, 3.1, 5.2, 5.3, 5.4, 7	II, III(s), III(u), IV(aa)
	E	Roadside spraying	yes	1.2.1, 3.3	II, IV(z)
	E	competition from invasive alien vegetation	yes	3.3, 5.2	II, IV(z)
	E	shading from native tree and shrub species	yes	3.3	II, IV(z)
	E	increased risk of extinction due to environmental, demographic, or genetic random events	yes	4.1, 4.2.1, 4.2.2.4, 4.2.2.6, 4.2.2.7, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 5.13, 5.15, 6.1.3, 8	II, III(s), III(u), IV(bb), IV(cc)