# Purple Amole
# (*Chlorogalum purpureum*)

# Five-year Review:
# Summary and Evaluation



**U.S. Fish and Wildlife Service**
**Ventura Fish and Wildlife Office**
**Ventura, California**

**September 2008**

**FIVE-YEAR REVIEW**
**Purple Amole (*Chlorogalum purpureum*)**

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**Cover photographs**

**Upper left:** Purple amole *Chlorogalum purpureum* var. *purpureum* on Fort Hunter Liggett, Monterey County, California. The photograph shows the species in its natural habitat. (Photo courtesy of the U.S. Army at Fort Hunter Liggett).

**Upper center:** Purple amole *Chlorogalum purpureum* var. *purpureum* on Camp Roberts, San Luis Obispo County, California. (Photo courtesy of the California Army National Guard at Camp Roberts).

**Upper right:** Camatta Canyon amole *Chlorogalum purpureum* var. *reductum* in San Luis Obispo County, California. (Photo courtesy of the California Native Plant Society).

**Lower center:** Purple amole *Chlorogalum purpureum* var. *purpureum* on Fort Hunter Liggett, Monterey County, California. The photograph shows a basal cluster of 10 elongate leaves with wavy edges, in early spring prior to stem production. (Photo courtesy of the U.S. Army at Fort Hunter Liggett).

**FIVE-YEAR REVIEW**
**Purple Amole (*Chlorogalum purpureum*)**

## 1.0 GENERAL INFORMATION

### 1.1 Reviewers

**Lead Regional Office:** Region 8, California and Nevada: Diane Elam, Deputy Division Chief for Listing, Recovery, and Habitat Conservation Planning, and Jenness McBride, Fish and Wildlife Biologist; 916-414-6464

**Lead Field Office:** Ventura Fish and Wildlife Office: Christopher Kofron, Fish and Wildlife Biologist, 805-644-1766 x 303; and Connie Rutherford, Listing and Recovery Coordinator, 805-644-1766 x 306

### 1.2 Methodology used to complete the review

This review was completed by staff in the Ventura Fish and Wildlife Office, U.S. Fish and Wildlife Service (Service). Information was gathered from Service files, agency reports, available literature, and discussions with individuals who survey for, manage, and conduct research on this species. The most important sources of new information consisted of survey and monitoring reports by the U.S. Army at Fort Hunter Liggett, Monterey County, California, and the California Army National Guard at Camp Roberts, Monterey and San Luis Obispo counties, California.

### 1.3 Background

#### 1.3.1 Federal Register notice citation announcing initiation of this review

The U.S. Fish and Wildlife Service announced in the Federal Register (FR) initiation of the five-year review for *Chlorogalum purpureum* and asked for information from the public regarding the species status on February 14, 2007 (72 FR 307064). This notice initiated a 60-day request for information period which closed on April 16, 2007. No information was received as a result of this request.

#### 1.3.2 Listing history

| | |
|---|---|
| FR notice: | 65 FR 14878 |
| Date listed: | The final rule was published on March 20, 2000, and became effective on April 19, 2000. |
| Entity listed: | Species *Chlorogalum purpureum*. This species comprises two varieties, *Chlorogalum purpureum* var. *purpureum* (purple amole) and *Chlorogalum purpureum* var. *reductum* (Camatta Canyon amole). |
| Classification: | Threatened. |

### 1.3.3 Associated rulemakings

Critical habitat was designated on October 24, 2002 (67 FR 65414, Service 2002). A correction to the final designation of critical habitat was made on April 24, 2003 (68 FR 20083, Service 2003).

### 1.3.4 Review History

A five-year review has not been conducted previously. However, we reviewed the status of the species during the designation of critical habitat.

### 1.3.5 Species' Recovery Priority Number at start of five-year review

The species was assigned a recovery priority number of 8. This indicates that the species has a moderate degree of threat with a high potential for recovery.

### 1.3.6 Recovery Plan or Outline

A recovery plan has not been prepared.

## 2.0 REVIEW ANALYSIS

### 2.1 Application of the 1996 Distinct Population Segment (DPS) policy

The Endangered Species Act defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate wildlife. This definition limits listings as distinct population segments (DPS) only to vertebrate species of fish and wildlife. Because the species under review is a plant and the DPS policy is not applicable, the application of the DPS policy to the species' listing is not addressed further in this review.

### 2.2 Recovery Criteria

### 2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria?

_____ Yes
___X___ No

### 2.3 Updated Information and Current Species Status

### 2.3.1 Biology and Habitat

**Description and Taxonomy**

The genus *Chlorogalum* comprises five plant species in the lily family (Liliaceae; Jernstedt 2007) which inhabit western North America from southern Oregon to Baja California, Mexico.

Brandegee (1893) named *Chlorogalum purpureum* on the basis of specimens collected in the "Santa Lucia Mountains" near Jolon, Monterey County, California (Holland 2004).

*Chlorogalum purpureum* is the only member of the genus with flowers that are blue or purple in color; the other members of the genus have flowers that are white or pink (Hoover 1940, Jernstedt 2007). Two varieties of *Chlorogalum purpureum* are recognized (Hoover 1940, Jernstedt 2007): *Chlorogalum purpureum* var. *purpureum* and *Chlorogalum purpureum* var. *reductum*. There have been no changes or proposed changes in nomenclature since the species was listed in 2000 (Jernstedt 2007). However, the International Plant Names Index (2005) places the genus *Chlorogalum* in the hyacinth family (Hyacinthaceae), while recent comparative molecular studies support the inclusion of the genus in the agave family (Agavaceae; Bolger et al. 2006).

*Chlorogalum purpureum* is a perennial lily with a basal cluster of bright green leaves, which are elongate, with a wavy margin, and with a thickened midrib (Service 2002, Holland 2004, Guretzky et al. 2005). The basal leaves typically range from 1 to 8 in number (Woodbury 2005b), but as many as 14 have been recorded (Guretzky et al. 2005), with a width of 2 to 5 millimeters (mm) (0.1 to 0.2 inch (in)). The bulb is ovoid, 2.5 to 3.0 centimeters (cm) (0.98 to 1.2 in) long, white to brown in color, and occurs in the upper few inches of soil (Service 2002, Holland 2004). The flower cluster is borne on a single stem with multiple branches. The flowers are deep blue or purple with bright yellow anthers. The fruits are capsules, each with three chambers containing one or two black, ovoid seeds (Jernstedt 1993).

Hoover (1964) named *Chlorogalum purpureum* var. *reductum* and diagnosed it from the nominate variety *Chlorogalum purpureum* var. *purpureum* by its smaller size: *Chlorogalum purpureum* var. *reductum*, 10 to 20 centimeters (cm) (4 to 8 in) tall; and *Chlorogalum purpureum* var. *purpureum*, 20 to 40 cm (8 to 16 in) tall. Hoover (1964) referred to *Chlorogalum purpureum* var. *reductum* as the "dwarf variety."

The common name purple amole has been used in reference both to the species *Chlorogalum purpureum* (e.g., Service 2007a, Jernstedt 2007) and to the nominate variety *Chlorogalum purpureum* var. *purpureum* (e.g., Service 2001, Guretzky et al. 2005). The common name Camatta Canyon amole has been used in reference only to *Chlorogalum purpureum* var. *reductum* (e.g., Jernstedt 2007). For clarity and to avoid confusion, hereafter in this document the common name purple amole is used only in reference to the nominate variety *Chlorogalum purpureum* var. *purpureum*.

## Distribution

All locations for the purple amole and the Camatta Canyon amole are in semiarid environments and have a Mediterranean climate. The summers are hot and dry, and the winters are cool and wet. Overall, the purple amole variety accounts for approximately 90 percent of all known occurrences (i.e. area of occupied habitat) of the species: purple amole, approximately 486 ha (1,201 ac); Camatta Canyon amole, approximately 52 ha (129 ac).

***Purple Amole***

The purple amole *Chlorogalum purpureum* var. *purpureum* is endemic to the Santa Lucia Range of Monterey and San Luis Obispo counties, California. The taxon is known from two properties: several localities on Fort Hunter Liggett, southern Monterey County; and one locality on Camp Roberts in northern San Luis Obispo County (Map 1). A distance of approximately 31 kilometers (km) (19 miles (mi)) separates the locality on Camp Roberts from the nearest locality on Fort Hunter Liggett (Holland 2004). Fort Hunter Liggett is a training installation of the U.S. Army, and Camp Roberts is a training installation of the California Army National Guard.

When *Chlorogalum purpureum* was listed as threatened in 2000, the *Chlorogalum purpureum* var. *purpureum* taxon was known only from three localities on Fort Hunter Liggett. Although a thorough survey has not been completed, the purple amole occurs scattered over approximately 399 hectares (ha) (986 acres (ac)) on Fort Hunter Liggett in the following areas: the Cantonment; and Training Areas 10, 13B, 13E, 13W, 22, 23, 24, 25, and 27 (U.S. Army 2004a, 2004b; Service 2005; Clark 2007b). Surveys along the eastern boundary of Fort Hunter Liggett suggested that the species may occur on the adjacent private properties (Wilken 2000).

Later in 2000, shortly after listing, a population of purple amole was discovered on Camp Roberts. This population occupies approximately 87 ha (215 ac) north of the Nacimiento River in Training Areas O2 and O3 on the western side of the installation. The plants grow in open grassland and grassland surrounded by scattered oak woodland (California Army National Guard 2001a, 2001b).

The purple amole occurs in the rain shadow of the Santa Lucia Range (California Army National Guard 2001a, National Park Service 2007). The taxon is known from the lower elevations on the eastern side of the range, at approximately 213 to 407 meters (m) (700 to 1,336 feet (ft)) elevation. Northwest of Fort Hunter Liggett, Junipero Serra Peak rises to 1,571 m (5,155 ft) elevation. The mean annual rainfall at Fort Hunter Liggett is 35.5 cm (14.0 in), and it occurs primarily between December and February (California State Military Museum 2007). West of Camp Roberts, Pine Mountain rises to 1,095 m (3,594 ft) elevation. The mean annual rainfall at Camp Roberts is 28.5 cm (11.2 in), and it occurs primarily between October and May (White et al. 2000).

***Camatta Canyon Amole***

The Camatta Canyon amole *Chlorogalum purpureum* var. *reductum* is endemic to the La Panza Range in central San Luis Obispo County (Map 2). The type locality for the Camatta Canyon amole is 18 miles east of Creston on La Panza road, San Luis Obispo County, California. The taxon is known only from a small geographic area. The main population is approximately 0.8 km (0.5 mi) east of the southern end of Camatta Canyon.

The Camatta Canyon amole occurs approximately 61 km (38 mi) southeast of the population of purple amole on Camp Roberts and 92 km (57 mi) southeast of the nearest site for purple amole on Fort Hunter Liggett. One site for the Camatta Canyon amole is at the intersection of State Highway 58 (Carissa Highway) and Red Hill Road (NF-29s15). The Service (2002) reported

that this site comprises 3 ha (7.5 ac) of land south of the highway and probably less north of the highway. Most of this site is in the Los Padres National Forest; the site continues on either side of State Highway 58 within a right-of-way of the California Department of Transportation, and then northward (Edell in litt. 2007a, Edell pers. com. 2007) and also likely southward onto private lands (Edell pers. com. 2007). The second site is approximately 6.5 km (4 mi) south of the first. The Service (2000, 2002) reported that this second site comprises approximately 0.1 ha (0.25 ac) of private land.

In 2002, the U.S. Forest Service believed that the entire population of the Camatta Canyon amole existed on approximately 4 to 5 ha (10 to 12 ac) of land, and approximately one-half of that area was within the Los Padres National Forest (Simpson pers. com. 2006). The California Department of Fish and Game (2007) reports the total area inhabited by the Camatta Canyon amole to comprise 51 ha (127 ac). Because surveys have not been conducted, the precise extent of the population across the several properties is not known. As of 2007, neither the U.S. Forest Service (Simpson pers. com. 2007) nor the California Department of Fish and Game (Koch pers. com. 2007) knew of any additional locations for the Camatta Canyon amole.

The Camatta Canyon amole occurs in the rain shadow of the La Panza Range. The taxon is known from the lower elevations on the eastern side of the range, at approximately 570 to 633 m (1,870 to 2,077 ft) elevation. Immediately to the west, Black Mountain rises to 1,104 m (3,622 ft) elevation. We do not know the amount of rainfall at the Camatta Canyon amole sites. However, the mean annual rainfall at the La Panza Ranch (approximately 10.1 km (6.3 mi) to the east) is 15.6 cm (6.2 in), and it occurs primarily between October and April (Buttle and Tuttle 2007). The mean annual rainfall at the Camatta Canyon amole sites is likely several centimeters more and occurring also primarily between October and April.

## Habitat Requirements

Cryptogamic crusts consist of nonvascular photosynthetic plants (primarily cyanobacteria, lichens, mosses, and fungi) that form a layer on the soil surface (Beymer and Klopatek 1992). They are important elements of arid and semiarid ecosystems (Beymer and Klopatek 1992) because they enhance the habitat conditions by performing functions such as stabilizing the soil against wind and water erosion, fixing atmospheric nitrogen, contributing to soil organic matter (Eldridge and Green 1994), retaining soil moisture, discouraging annual weed growth (Belnap et al. 2001), and providing favorable sites for the growth of vascular plants (e.g. Lesica and Shelly 1992). The purple amole (e.g., Guretzky et al. 2005; Woodbury 2006) and the Camatta Canyon amole (E.L. Painter in litt. 1998) have been reported to grow in association with cryptogamic crusts.

### *Purple Amole on Fort Hunter Liggett*

On Fort Hunter Liggett, cryptogamic crusts with a dominant component of cyanobacteria are common (E.L. Painter pers. com. in Service 2002). The purple amole has been observed to grow on undisturbed soils that are cryptogamic or with cryptogamic crusts (E.L. Painter pers. com. in Service 2002; Guretzky et al. 2005). During 2004, survey quadrats with cryptogamic crusts had an average of 23 purple amole plants per square meter, while quadrats without cryptogamic

crusts averaged 6 plants per square meter (Woodbury 2005a). In 2006, 89 percent of the purple amole plants were in quadrats with cryptogamic crusts (Woodbury 2006).

On Fort Hunter Liggett, there are hundreds of discontinuous patches of purple amole in grassland, oak savanna, and oak woodland communities where they occur in association with gravelly, clay soils. The purple amole grows in both undisturbed sites and sites that were formerly highly disturbed by military activities, but the taxon is largely absent from areas that were subject to row-crop cultivation by discing (U.S. Army 2004a, 2004b).

In general, the plants on Fort Hunter Liggett occur in scattered clusters on both deep and relatively thin soils. Most of the soils are loamy, underlain by clay, and with fine gravel generally less than 0.5 cm (0.2 in) in diameter on the surface (Wilken 2000). During surveys in 1999, most sites (78 percent) where the species occurred were associated with flat topography or had slopes of less than 10 percent. A few populations occurred along ridge-top terraces (H. Crowell pers. com. in Service 2002; Wilken 2000).

On Fort Hunter Liggett, the purple amole generally occurs where other vegetation is sparse (Woodbury 2005a). Cover analysis in 2004 showed that the purple amole occurred more frequently in survey quadrats with less total herbaceous cover, with less non-native herbaceous cover, and with more bare ground. The purple amole typically occurs in association with low-growing, annual, native plants such as: rusty popcornflower (*Plagiobothrys nothofulvus*), miniature lupine (*Lupinus bicolor*), and California goldfields (*Lasthenia californica*); and with non-native plants such as soft brome (*Bromus hordeaceus*), and stork's bill (*Erodium* sp.). The congeneric wavyleaf soap plant (*Chlorogalum pomeridianum*) is also a frequently-occurring associate.

The Service (2002) first reported that the purple amole on Fort Hunter Liggett occurs at 305 to 625 m (1,000 to 2,050 ft) elevation. However, having reviewed all the information, we now report the known records for the purple amole on this installation to be at 271 to 407 m (890 to 1,336 ft) elevation.

***Purple Amole on Camp Roberts***

On Camp Roberts, the purple amole occurs predominately in soils with a high concentration of pebbles or gravel underlain by hard-packed clay. These soils are frequently cryptogamic (California Army National Guard 2001a). The cryptogamic crusts on Camp Roberts are composed primarily of cyanobacteria (E.L. Painter pers. com. in Service 2001).

On this installation, the purple amole grows across the sloping flat surface of an old alluvial fan. The vegetation type is predominantly grassland, while the surrounding slopes are oak woodland dominated by blue oak (*Quercus douglasii*). The purple amole grows primarily on northeast exposures with a slope less than 10 percent, attaining its highest density at the perimeter of the alluvial fan.

The purple amole on Camp Roberts seldom occurs under oak canopies or in stands of tall grass. Rather, the purple amole is usually among low grasses and herbs, especially the native small

sixweeks grass (*Vulpia microstachys*; Holland 2005). Little cover by other plants is present where the purple amole occurs.

Three native plant species occurred in at least 75 percent of the purple amole plots at Camp Roberts: the yellowflower tarweed (*Holocarpha virgata*), 95 percent; the annual agoseris (*Agoseris heterophylla*), 82 percent; and the bigflower agoseris (*Agoseris grandiflora*), 79 percent. The yellowflower tarweed and the bigflower agoseris together comprised 75 percent of the total plant cover within these plots.

The Service (2002) reported the purple amole on Camp Roberts to occur at 244 to 256 m (800 to 840 ft) elevation. However, having additional data Holland (2004) more precisely reported the purple amole at this installation to occur at approximately 213 to 274 m (700 to 900 ft) elevation.

***Camatta Canyon Amole***

Painter (in litt. 1998) visited the Camatta Canyon amole site in the Los Padres National Forest during late June 1998. She reported that the "plants generally seem to be associated with cryptobiotic [i.e., cryptogamic] crust."

Most reports state that the taxon grows in serpentine soil (Hoover 1964; Jernstedt 1993, 2007; Holland 2004; California Department of Fish and Game 2005, 2007; California Native Plant Society 2007), including Safford et al. (2005) who listed the taxon as a "strict endemic" to serpentine soil. However, the Service (2002) reported the Camatta Canyon amole to grow in "well-drained red clay soils" with a large amount of gravel and pebbles. In addition, the San Luis Obispo Chapter of the California Native Plant Society (2007) states that "the soil is a supermature lateritic (David Chipping) (not serpentine as in Munz or Miocene redbeds of others) with very little nutrient value, hard and red when dry." The U.S. Forest Service (2005a) described the soil type as "unique and … found nowhere else."

To clarify the soil type, we communicated with Dr. David Chipping, a hydrogeologist at California Polytechnic State University in San Luis Obispo, California. Dr. Chipping (in litt. 2007, 2008) stated the following: "The Red Hill Road populations are on an alluvial fan associated with the Paso Robles formation, dominated by pebbles and cobbles in a red sandy matrix which is iron enriched due to considerable age and erosion…there is absolutely no serpentine."

In sum, the soil type for the Camatta Canyon amole is not serpentine. The original report for the Camatta Canyon amole in serpentine soil was Hoover (1964), who was simply quoting the data by the collector as indicated by Hoover's quotation marks: "Camatta Road, three-eighths mile east of Honey Bee Mine, Upper Camatta Canyon, occasional in open areas in hard, dry serpentine soil," May 27, 1955, Twisselmann 2039. Apparently the subsequent and erroneous reports referring to the Camatta Canyon amole in serpentine soil stem from Hoover (1964).

The Service (2001, 2002) reported the Camatta Canyon amole to occur at 305 to 625 m (1,000 to 2,050 ft) elevation. However, others (e.g., Jernstedt 1993, 2007; California Department of Fish and Game 2007; California Native Plant Society 2007) reported elevations from 579 to 630 m

(1,900 to 2,067 ft). To clarify the elevation, we re-examined the known records: the known locations for the taxon range from 570 to 633 m (1,870 to 2,077 ft) elevation.

The California Department of Fish and Game (2007) reported that the Camatta Canyon amole in the Los Padres National Forest grows in open areas on a ridgetop in blue oak savannah and annual grassland. The Service (2002) previously reported the Camatta Canyon amole to grow in open areas in grassland and woodland. Associated native plant species include the crown brodiaea (*Brodiaea coronaria*), winecup clarkia (*Clarkia purpurea*), sand pygmyweed (*Crassula erecta*), bluedick (*Dichelostemma capitatum*), sanicle (*Sanicula* sp.), goldfields (*Lasthenia* sp.), and gilia (*Gilia* sp.). Associated non-native plant species include slender oats (*Avena barbata*), common Mediterranean grass (*Schismus barbatus*), and stork's bill (*Erodium* sp.). The California Department of Transportation (Edell in litt. 2007a) reported that the plants on the highway right-of-way along State Highway 58 typically grow away from dense grasses and in hard-packed soil, either in low vegetated areas or in open areas around chamise (*Adenostoma fasciculatum*).

## Life History

Establishment of new individuals is accomplished almost entirely by seed. The inflorescence develops during early spring. Flowering and fruit development occurs during May and June for the purple amole and from April to June for the Camatta Canyon amole. As the fruits mature, the leaves wither and the inflorescence dries and turns brown. The plant is then dormant as a bulb during the summer and fall.

### *Purple Amole*

Wilken (in litt. 2007) grew purple amole in a screen house at the Santa Barbara Botanic Garden. Although the plants were self-compatible, they did not set seed unless pollinated, with full seed set occurring with manipulation by insects or by hand. Some plants flowered at three years following germination, and all plants had flowered at four years following germination. Most plants died between the fifth and seventh year following germination.

In a three-year study on Fort Hunter Liggett, Niceswanger (2002) recorded what she believed to be a high survival rate for mature plants, but a low reproductive success rate. In addition, she observed that only 17 percent of the plants that she tracked over three years actually emerged above ground during all three years. Thus, most of the plants experienced an underground dormancy period of at least one year during the three-year study. Woodbury (2005a) found dormancies of one to three years to be common, with one plant having been dormant six years and another for five years.

For seed-producing plants at Fort Hunter Liggett, the number of seeds produced per plant was highly variable, with a recorded range of 1 to 386 seeds per plant and a recorded mean of 28 seeds per plant (Niceswanger 2002). Although the number of years required to grow from seed to maturity and subsequently flower was not determined, Niceswanger (2002) reported that it requires more than one year. Guretzky et al. (2005) estimated the dormancy rate of purple amole to be 23 percent of the population per year.

Based upon annual monitoring at Fort Hunter Liggett from 2000 to 2006, 12 percent of the purple amole individuals produced seeds (a range of 5 percent to 24 percent per year; Woodbury 2006), which comprised 55 percent of the plants that attempted reproduction (i.e., produced a stalk, flowers, capsules, or seeds). Guretzky et al. (2005) estimated the mortality rate of purple amole to be 10 percent of the population per year. Guretzky et al. (2005) found a positive correlation between the percentage of plants that flowered and total precipitation in the preceding few months, ranging from 13 to 63 percent flowering plants annually from 1998 to 2004.

At Camp Roberts in 2006, the mean number of purple amole observed per square meter during March was 10.4 plants, but by May the mean number observed per square meter was 5.6 plants (Holland 2007). This decline in observed density presumably reflected the event of individual plants entering into summer dormancy without flowering. In addition, Holland (2005) observed that many purple amole plants had lost one or more leaves in the time from February to May. Thus, contrary to the methods employed by other researchers (Niceswanger 2002, Guretzky et al. 2005, Woodbury 2005a), Holland (2005) concluded that the number of leaves cannot be used to determine the age of individual plants.

### *Camatta Canyon Amole*

The Camatta Canyon amole grows extremely slowly and requires years to mature and produce seeds (California Department of Fish and Game 2005). Small bees are common pollinators of the Camatta Canyon amole, including sweat bees (Halictidae; Center for Plant Conservation 2007b). The California Department of Fish and Game initiated a research project in 1995 in which 360 seeds of the Camatta Canyon amole were collected, planted on-site, and then monitored. After twelve years, only one of these has reached sexual maturity and produced seed, in April 2007. The soil at the site is very hard, and very few Camatta Canyon amole had flowered in April 2007 during drought conditions (Koch pers. com. 2007).

## Abundance

### *Purple Amole on Fort Hunter Liggett*

At the time of listing, only three localities for the purple amole were known, all on Fort Hunter Liggett. One locality contained scattered patches of the plant, with estimates suggesting several thousand individuals. The second locality contained at least 400 to 500 plants and possibly several thousand. The third locality contained an estimated 10,000 plants (Service 2000).

Annual censusing and long-term monitoring of individuals of the purple amole on Fort Hunter Liggett have contributed greatly to our understanding of population dynamics over time. Although a total population estimate of the taxon on Fort Hunter Liggett has not been made, the purple amole occurs in patches that range from a few plants to more than 10,000 individuals per ha (4,047 individuals per ac) at the densest locations. Woodbury (2006) recorded 11.8 purple amole plants per square meter in her study area.

In 2007, the U.S. Army considered the status of the purple amole on Fort Hunter Liggett to be "stable to increasing" (Clark in litt. 2007b). This determination was based upon the following:

(1) the U.S. Army examined the past several years of monitoring data, and the population appeared to be stable through time, with expected fluctuations between years; and (2) at one particular site in an area near but outside where the purple amole was known to occur, the U.S. Army used a ball-and-chain to reduce heavy fuel accumulations in chemise chaparral. This particular site, which comprises approximately 78 ha (191 ac), now likely has the densest population of purple amole on Fort Hunter Liggett. The ball-and-chain method typically involves an anchor chain and a large metal ball which are towed by one or two tractor(s)/bulldozer(s) to smash down standing vegetation (Kucera and Mayer 1999).

Woodbury (2006) described one incident on Fort Hunter Liggett where a vehicle had disturbed a purple amole study plot. During the following three years, she observed reduced numbers of plants (49 percent, 64 percent, and 93 percent) relative to the pre-disturbance number in the plot. However, by year four, there was no substantial difference from the pre-disturbance number. In another incident, a controlled fire in 2000 that burned in a purple amole plot before seed capsule maturity resulted in the loss of all seeds (Niceswanger 2002).

Niceswanger (2002) and Woodbury (2005a, 2005b) suggested that purple amole individuals respond favorably to fire at certain times of the year, probably due to the removal of competing plant species. However, the fire data collected at Fort Hunter Liggett need to be re-analyzed because first-year surveyors in 2002 erroneously recorded some sites as burned when they were actually covered by a cyanobacterial crust (Clark in litt. 2007a). More study is needed to determine the effects of fire on purple amole at Fort Hunter Liggett, including the frequency and seasonality of fire and its effects on purple amole survival, growth, and reproduction.

***Purple Amole on Camp Roberts***

In 2000, the purple amole population at Camp Roberts was estimated to comprise 10,000 individuals. However in 2001, this population was intensively censused and mapped, which resulted in the documentation of over 250,000 purple amole plants on approximately 87 ha (215 ac) (California Army National Guard 2001a, 2001b; Holland 2005).

In 2005, the number of purple amole at Camp Roberts ranged from 3 to 16 individuals per square-meter plot (Holland 2005). The California Army National Guard believes the population to be stable (Olson pers. com. 2007). In 2007, the California Army National Guard conducted the third year of its monitoring protocol for the flowering stage of the purple amole. In this particular study, the California Army National Guard established nine transects through the habitat, each with 20 plots. Various quantitative and qualitative data were collected in each plot. The data for Camp Roberts (Holland 2007) suggest that purple amole respond favorably to controlled burns during certain times of the year. Although not tested statistically, the purple amole in burned plots appeared to be taller and with increased reproductive vigor (i.e., more flowers, more fruits, and more seeds) than in unburned plots. However, the unburned plots contained a greater number of the purple amole plants in flower than the burned plots. More study is needed to determine the effects of fire on purple amole at Camp Roberts, including the frequency and seasonality of fire and its effects on purple amole survival, growth, and reproduction.

***Camatta Canyon Amole***

Various agencies have provided different population estimates for the Camatta Canyon amole. In 1996, the population in the Los Padres National Forest was estimated to contain "tens of thousands of individuals" (California Department of Fish and Game 2005). Although they have not conducted a survey, the U.S. Forest Service believes the population likely comprises "thousands of individuals" and "not tens of thousands" (Simpson pers. com. 2007). However, one record in the California Natural Diversity Data Base (California Department of Fish and Game 2007) reports approximately 500,000 Camatta Canyon amole at the site in 1991. The Center for Plant Conservation (2007) states that as many as 100,000 Camatta Canyon amole may exist, with most of these plants on approximately 2 ha to 3 ha (5 ac to 7 ac) of land. However, records of the California Department of Fish and Game (2007) state that the location comprises 51 ha (127 ac). Apparently the number of individuals in the population and its extent need to be clarified. Based upon general observations, the California Department of Fish Game has not observed the Camatta Canyon amole to be decreasing over the past ten years (Koch pers. com. 2007).

The highway right-of-way along State Highway 58 has been confirmed to be occupied by the Camatta Canyon amole, and it is managed by the California Department of Transportation. In 2005, 306 Camatta Canyon amole plants were recorded on the right-of-way, and most of these were in two locations: approximately 62 m (203 ft) west of the junction with Red Hill Road, 194 plants; and approximately 1.4 km (0.9 mi) east of the junction with Red Hill Road, 100 plants (Edell in litt. 2007a). The California Department of Fish and Game (2007) reported the area occupied by the Camatta Canyon amole to be 0.5 ha (1.3 ac). In 2001, 299 Camatta Canyon amole were recorded in the location west of the junction with Red Hill Road (Edell in litt. 2007a).

The area on private land approximately 6.5 km (4 mi) south of State Highway 58 that is known to be occupied by the Camatta Canyon amole comprises less than 0.1 ha (0.2 ac). The California Native Plant Society (2007) estimated that "perhaps several hundred plants" occupy the site. Although the Camatta Canyon amole was observed to occur sporadically on private land north of the highway right-of-way along State Highway 58, no estimate could be made (Edell pers. com. 2007). The taxon likely occurs sporadically also on private land south of the State Highway 58 right-of-way (Edell pers. com. 2007).

### 2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

We have a good amount of information regarding the status of the purple amole on Fort Hunter Liggett and Camp Roberts. However, we have less information regarding the status of the Camatta Canyon amole on the Los Padres National Forest, on the highway right-of-way along State Highway 58 managed by the California Department of Transportation, and on privately-owned lands. Approximately 99 percent of the occupied habitat occurs on Federal lands (51 ha/127 ac), 1 percent on State rights-of-way (0.5 ha/1.3 ac), and less than 1 percent on private lands (0.1 ha/0.2 ac).

***Purple Amole***

At the time of listing, the purple amole was known only on Fort Hunter Liggett in southern Monterey County, California (65 FR 14878, Service 2000). At that time, the following were identified as the primary threats to the taxon:

1. loss, fragmentation, and alteration of habitat;
2. direct loss of plants from construction and use of military training facilities;
3. direct loss of plants from military field training activities;
4. displacement by non-native, annual grasses;
5. potentially, alteration of fire cycles due to military training; and
6. potentially in the future, livestock grazing and associated habitat changes if grazing is resumed.

***Camatta Canyon Amole***

At the time of listing, the Camatta Canyon amole was known only from two sites (Los Padres National Forest and a private parcel of land) in a small geographic area in the La Panza region in central San Luis Obispo County, California (65 FR 14878, Service 2000). At that time, the following were identified as the primary threats to the taxon:

1. illegal vehicle trespass in the National Forest;
2. road maintenance;
3. displacement by non-native annual grasses; and
4. livestock grazing (depending upon the intensity).

**2.3.2.1 Factor A, Present or threatened destruction, modification or curtailment of its habitat or range**

**Land Use, Historic and Current**

***Purple Amole on Fort Hunter Liggett***

The property comprising Fort Hunter Liggett has a long history of settlement and use by "Europeans," dating back to 1771, which has affected the current distribution of the purple amole. On Fort Hunter Liggett, the purple amole is nearly absent from areas that were previously cultivated by disking. The taxon is most abundant in areas that were not previously disked, including areas where intensive military training has been common since 1941 (U.S. Army 2004a, 2004b).

Since the species was listed in 2000, the U.S. Army (2004a) has included the purple amole in its Integrated Natural Resources Management Plan for Fort Hunter Liggett (fiscal years 2004 to 2008). The U.S. Army (2004b) consulted with the Service under section 7 of the Endangered Species Act regarding its ongoing activities at Fort Hunter Liggett and their effects on the purple amole, which resulted in the Service (2005, 2007b) issuing programmatic biological opinions. The cumulative loss of purple amole areas by excavations or other subsurface ground disturbance will not exceed 0.4 ha (1 ac) per year under the programmatic biological opinion for activities conducted at the installation. Monitoring and research of the purple amole are

conducted annually (Service 2005, 2007b). Substantial numbers of purple amole occur in three Sensitive Resource Protection Areas which are protected from military and ground-disturbing activities. In particular, Sensitive Resource Protection Area 1 comprises 52 ha (128 ac) and is managed as a purple amole management area. The U.S. Army terminated cattle grazing at Fort Hunter Liggett in 1991 (Service 2000, Holland 2004). This activity is no longer a threat to the purple amole on this property.

***Purple Amole on Camp Roberts***

The California Army National Guard ceased conducting military activities in the purple amole area in 2000, with exception of road use for four weeks in 2001 and 2003 and occasional use of the tank trail where the taxon does not occur. Sheep grazing and hunting in the purple amole area also ceased in 2000 (Olson in litt. 2007). The California Army National Guard (2001a) included the purple amole in its draft Integrated Natural Resources Management Plan for Camp Roberts (fiscal year plan period 2002-2006), which it is currently updating.

Threats identified by the California Army National Guard include: (1) competition by invasive plant species; (2) feral pigs (*Sus scrofa*) eating the bulbs; and (3) possibly a lack of fire [to reduce competing plants]. The California Army National Guard is consulting with the Service under section 7 of the Endangered Species Act regarding its ongoing activities and the effects on the purple amole. Several actions that may benefit the purple amole are being discussed, such as: (1) controlled goat or sheep grazing during January and February to remove invasive plant species; (2) controlled burning to remove competing plant species; and (3) controlled hunting to remove feral pigs (Olson pers. com. 2007).

***Camatta Canyon Amole***

Most of the known population of the Camatta Canyon amole occurs on the Los Padres National Forest. In managing National Forests, the intention of the U.S. Forest Service (2005a) is to enable multiple uses to occur in ways that promote long-term sustainability (social, economic, and ecological). The particular unit of the National Forest with the Camatta Canyon amole supports livestock grazing, motorized recreation, mountain biking, hiking, camping, picnicking, stargazing, botanizing, mining, hunting, power lines, apiaries, and filming locations. The varieties and intensities of use create conflicts which challenge the U.S. Forest Service in managing for recreation, permitted activities, and resource protection.

The area occupied by the Camatta Canyon amole on the Los Padres National Forest is in the Navajo Allotment where the permittee is authorized to graze cattle between February and May. Because the Camatta Canyon amole flowers and develops fruit from April to June, we believe that cattle grazing is likely adversely affecting the taxon by trampling, soil compaction, and possibly herbivory. The U.S. Forest Service is aware of these likely adverse effects and said they intend to address the issue (Simpson pers. com. 2006). Threats identified by the California Department of Fish and Game include: (1) cattle grazing on the Los Padres National Forest; (2) trespass by motorcyclists on the Los Padres National Forest; and (3) competition by invasive plant species (Koch pers. com. 2007).

The intended use of the highway right-of-way along State Highway 58 is for transportation purposes. A two-lane highway right-of-way is typically comprised of a 40-ft wide strip of land: a paved road, 24 ft wide; then a shoulder on each side, each 4 ft wide; and then another 4 ft of ground on each side. In the location with the Camatta Canyon amole, the plants are usually growing "sporadically" along the fenceline boundary with the adjacent private properties (Edell pers. com. 2007). The California Department of Transportation has designated the right-of-way with the Camatta Canyon amole as a botanical management area. Because of this designation, the California Department of Transportation conducts occasional monitoring and gives greater scrutiny when construction or maintenance occurs in the area (Edell in litt. 2007a, 2007b). The California Department of Transportation does very little maintenance and management in this particular area of the right-of-way (Edell pers. com. 2007).

One parcel of private property that is occupied by the Camatta Canyon amole is registered with The Nature Conservancy in a private land protection program (California Department of Fish and Game 2007). The other private property with the taxon north of the right-of-way along State Highway 58 is sometimes used for grazing cattle (Edell pers. com. 2007). We do not know the precise number of private properties on which the Camatta Canyon amole occurs.

**Summary of Factor A**

***Purple Amole***

The purple amole is known to occur on two properties, and these are managed as two separate populations: one at Fort Hunter Liggett managed by the U.S. Army; and the other at Camp Roberts managed by the California Army National Guard. Both installations have a completed or draft Integrated Natural Resources Management Plan that provides for conservation of the purple amole. The U.S. Army has consulted with the Service under section 7 of the Endangered Species Act regarding the effects of its ongoing activities on the purple amole, and the California Army National Guard is currently consulting with the Service regarding its ongoing activities. The U.S. Army monitors the population at Fort Hunter Liggett, and the California Army National Guard monitors the population at Camp Roberts. In sum, the two known populations of purple amole are presently secure from destruction, modification, and curtailment of its habitat and known occupied range.

***Camatta Canyon Amole***

One population of the Camatta Canyon amole is known, which occurs in a small geographic area on lands with several types of ownership. Most of the population occurs on the Los Padres National Forest; however, it also extends onto the adjacent right-of-way of State Highway 58 managed by the California Department of Transportation and onto nearby private properties.

The Camatta Canyon amole area is in the Pozo-La Panza unit of the Los Padres National Forest. The unit “is best known for its variety of OHV [off-highway vehicle] opportunities that require advanced skill levels.” The OHV routes, which include an unofficial staging area near the Camatta Canyon amole area, are heavily used (U.S. Forest Service 2005). In addition to off-

highway motorized recreation, the unit supports four grazing allotments, including the Navajo Allotment in the Camatta Canyon amole area.

The taxon is at risk of destruction, modification, and curtailment of its habitat and known range due to illegal vehicle trespass and cattle grazing in the Camatta Canyon amole area on the Los Padres National Forest. Off-highway vehicles and cattle grazing can cause physical damage to the Camatta Canyon amole, compact the soil, stimulate soil erosion, damage cryptogamic crusts, reduce the presence of native plants, and increase the presence of invasive plants (e.g. Fleischner 1994, Service 2000, Belnap and Eldridge 2001).

#### 2.3.2.2 Factor B, Overutilization for commercial, recreational, scientific, or educational purposes

We are not aware of any injury or mortality being caused to the purple amole or the Camatta Canyon amole for these purposes at this point in time. This risk factor is not a known threat to either taxon.

#### 2.3.2.3 Factor C, Disease or predation

We do not know of any disease or natural predation that threatens the purple amole or the Camatta Canyon amole. At the time of listing, livestock grazing was identified as a potential threat to the purple amole and an existing threat (depending upon intensity) to the Camatta Canyon amole (Service 2000). More information is needed to determine the effects of gophers (*Thomomys bottae*) and feral pigs, which may eat the plants and also impact the habitat.

***Purple Amole on Fort Hunter Liggett***

Cattle grazing ceased at Fort Hunter Liggett in 1991 (Service 2000, Holland 2004). Because the U.S. Army at Fort Hunter Liggett consults with the Service regarding the effects of its actions on federally listed species, livestock grazing is not likely to resume in purple amole habitat except by consultation with the Service.

Niceswanger (2002) reported that "gophers (or possibly other rodents) tunneled through the sites and ate the leaves and flowering stems." Woodbury's (2005a, 2005b, 2006) data suggested that gophers may forage on the leaves of purple amole, with little or no interest in the bulbs. Woodbury (2006) stated that gophers displace the soil and the bulbs. From 2003 to 2006, the amounts of quadrats with gopher activity within 1 m were 41 percent, 32 percent, 26 percent, and 23 percent, respectively.

Niceswanger (2002) observed a fungus affecting the purple amole at two transects during 2000, causing the plants to whither and rot. This is the only report of any disease affecting the purple amole.

***Purple Amole on Camp Roberts***

Sheep grazing ceased in the purple amole area on Camp Roberts in 2000 (Olson in litt. 2007), shortly after the taxon was discovered there. Because the California Army National Guard at Camp Roberts consults with the Service regarding the effects of its actions on federally listed species, livestock grazing is not likely to resume in purple amole habitat except by consultation with the Service.

Olson (pers. com. 2007) stated that the purple amole at Camp Roberts appears to "do well" in soil that has been disturbed by gophers. Holland (2007) observed pervasive soil disturbance by feral pigs in the purple amole habitat. Although Holland (2007) reported the effects to the purple amole to be unknown, Olson (pers. com. 2007) informed us that feral pigs eat the bulbs.

***Camatta Canyon Amole***

The U.S. Forest Service allows cattle grazing in the Camatta Canyon amole area between February and May (Simpson pers. com. 2006). Like the purple amole (Hazebrook and Clark 1997), the Camatta Canyon amole is likely sensitive to disturbances between February and June because this is when the plants develop above-ground structures, including stems, flowers, and fruits.

Koch (pers. com. 2007) stated that the Camatta Canyon amole appears to "do well" in soil that has been disturbed by gophers. Previously, Borchert (pers. com. in Service 2001) observed a substantial amount of gopher activity surrounding, but not within, the Camatta Canyon amole population on the Los Padres National Forest, suggesting that the hard soils where the plant occurs are difficult for gophers to move through.

**2.3.2.4 Factor D, Inadequacy of existing regulatory mechanisms**

The purple amole is not listed by the State under the California Endangered Species Act (CESA). The Camatta Canyon amole was State-listed as "rare" in 1978, which helps to conserve the taxon on non-federal lands. State protections such as CESA, the California Environmental Quality Act, and the Native Plant Protection Act provide for disclosure of potential project impacts and potential mitigation for those impacts on non-federal lands. The impacts to sensitive and listed species from agricultural operations, including grazing, are exempted from these laws (Morey and Ikeda 2001).

***Purple Amole***

Existing regulatory mechanisms and their implementation are adequate for maintaining the two populations on Fort Hunter Liggett and Camp Roberts at their current levels at this point in time. These include the completed or draft Integrated Natural Resources Management Plan for each installation (U.S. Army 2004a, California Army National Guard 2001a) and the programmatic biological opinion for activities conducted at Fort Hunter Liggett (Service 2007b). Other Federal laws, including the National Environmental Policy Act, have ensured that the conservation of the

purple amole is being considered during project planning and implementation on the two installations.

The Service (68 FR 20083, 2002) designated critical habitat for the purple amole on approximately 620 ha (1,532 ac) of private land adjacent to occupied habitat on Fort Hunter Liggett. The habitat on the adjacent private properties contains the characteristics that are essential for the taxon, and it is probably occupied (Service 2002). Both Fort Hunter Liggett and Camp Roberts were excluded from the critical habitat designation. Fort Hunter Liggett was excluded because the benefits of exclusion outweighed the benefits of the designation (impacts to the training mission and adverse economic impacts were cited). The U.S. Army completed the Integrated Natural Resources Management Plan for Fort Hunter Liggett in 2004, which provides for conservation of the taxon. Subsequently the Service has issued programmatic biological opinions regarding activities at Fort Hunter Liggett and their effects on the purple amole (Service 2005, 2007b). Camp Roberts was excluded from critical habitat designation because the California Army National Guard had prepared a draft Integrated Natural Resources Management Plan that provides for conservation of the taxon (Service 2002).

***Camatta Canyon Amole***

Several existing Federal regulatory mechanisms and policies apply to the conservation of listed and other sensitive species, including the Camatta Canyon amole, on the Los Padres National Forest. These include the Forest Service Manual (section 2670) which states that the U.S. Forest Service will: (1) develop and implement management practices to ensure that species do not become threatened or endangered because of U.S. Forest Service actions; (2) maintain viable populations of all native . . . plant species in their habitats distributed throughout their geographic range on the National Forests; and (3) develop and implement management objectives for populations and habitat of sensitive species (Powell 2001). The U.S. Forest Service (2005a) has recently prepared a new land management plan for the Los Padres National Forest. In it, they established the Camatta/Red Hill Road Special Interest Area, which comprises 22 ha (55 ac). Although specific management prescriptions for the area are unspecified at this time, the plan stated a desire to eliminate adverse effects to the vegetation.

The Endangered Species Act requires that the U.S. Forest Service consult with the Service on its actions that may affect the Camatta Canyon amole, and the National Environmental Policy Act (NEPA) requires it to provide information to public officials and citizens on the environmental impacts of its proposed actions before decisions affecting land use are made. The U.S. Forest Service authorizes cattle grazing, including on the Navajo Allotment within the Camatta Canyon amole area, through a discretionary Special Use Permit program, renewable every ten years. We are unable to verify the terms of the current permit at this point in time. The U.S. Forest Service has designated trails for off-highway vehicle recreation in areas outside of, but adjacent to, the Camatta Canyon amole area. The nearby proximity of these trails, along with campground facilities, makes it difficult for the U.S. Forest Service to control illegal vehicle trespass into the Camatta Canyon amole area (e.g. U.S. Forest Service 2005b).

The Service (68 FR 20083, 2002) designated critical habitat for the Camatta Canyon amole on approximately 2,443 ha (5,910 ac) of land: 1,324 ha (3,271 ac) on private land; 441 ha (1,089

ac) on the Los Padres National Forest; and 7 ha (18 ac) on State land. We are not aware of the current status of the Camatta Canyon amole on private lands or on the State land managed by the California Department of Transportation. Based upon the best available information, the Camatta Canyon amole is at risk on the Los Padres National Forest (California Department of Fish and Game 2007).

#### 2.3.2.5 Factor E, Other natural or manmade factors affecting its continued existence

Non-native annual grasses and other invasive plant species continue to be a threat to the purple amole at Fort Hunter Liggett and Camp Roberts and to the Camatta Canyon amole on the Los Padres National Forest. The invasive plant species may have the ability to displace the *Chlorogalum purpureum* by outcompeting and monopolizing limited resources (growing space, sunlight, soil nutrients, water; Stephenson and Calcarone 1999), with the potential effects of preventing growth and recruitment (U.S. Army 2004b). The invasive plant species may also have the ability to alter characteristics of the fire regime, such as frequency, intensity, and seasonality of fires (Brooks et al. 2004). We have no information on the site-specific presence of non-native plants in purple amole occurrences on Fort Hunter Liggett and Camp Roberts, or the effects that non-native competitors have on the frequency and seasonality of fire.

The frequency of fires in California is increasing (Syphard et al. 2007), and fires at certain times of the year have the ability to prevent annual reproductive success of the purple amole (Niceswanger 2002) and also of the Camatta Canyon amole. The *Chlorogalum purpureum* are susceptible to damage by fire when the living structures, including the seeds, are above ground or near the soil surface. However, fires at certain times of the year may potentially benefit the *Chlorogalum purpureum* by removing other competitive plants, both native and invasive species. The *Chlorogalum purpureum* may also respond favorably to fire in other ways. For example, *Chlorogalum pomeridianum* is a fire-adapted species that exhibits fire-stimulated flowering: plants flower in the first growing season after fire, with flowering virtually absent beforehand (Reeves 2006).

Niceswanger (2002) believed that the population of purple amole on Fort Hunter Liggett is highly vulnerable to stochastic events, especially catastrophes affecting mature plants such as fire. She therefore recommended protection and management of the habitat by administrative regulations, including prohibitions against physical disturbances during the reproductive stage.

## 2.4 Synthesis

### *Purple Amole*

Since its listing in 2000, the purple amole is now known to occur in substantially greater numbers, over a substantially greater total area of land, over a larger geographic area, and on a second property. Livestock grazing no longer occurs in any area that is known to support the purple amole. The purple amole is currently protected from construction, military training, and ongoing activities on Fort Hunter Liggett and Camp Roberts. Both installations have a completed or draft Integrated Natural Resources Management Plan and monitoring programs that help conserve the taxon and minimize further loss, fragmentation, and alteration of the known,

existing habitat. The U.S. Army intends to prepare an endangered species management plan for the purple amole on Fort Hunter Liggett, which will become part of its Integrated Natural Resources Management Plan. The California Army National Guard is updating its draft Integrated Natural Resources Management Plan for Camp Roberts, and it is considering several management actions that may potentially benefit the purple amole.

The threat posed by non-native, annual grasses is recurring; however, this threat can possibly be minimized by adaptive management actions. Fires have removed the non-native annual grasses in some areas during some years. The effect of the alteration of fire cycles on the purple amole remains largely unknown. However, because of the clumped and limited distribution of the purple amole in a semiarid environment, a wildfire could destroy a substantial portion of the population.

The long-term prospects for survival and recovery would be enhanced if additional localities or populations are found in nearby potentially-suitable habitat. To this end, the Service in partnership with the U.S. Army at Fort Hunter Liggett and the California Army National Guard at Camp Roberts is seeking funding to search for the purple amole on nearby private properties.

***Camatta Canyon Amole***

The Camatta Canyon amole is still known to occur only within a small geographic area, and there is no new information regarding its status on the Los Padres National Forest. The U.S. Forest Service (2005a) has prepared a new land management plan for the Los Padres National Forest. In it, they established the Camatta/Red Hill Road Special Interest Area, with a stated desire to eliminate adverse effects to the vegetation, but we have no information to indicate this has been implemented. The Camatta Canyon amole has been confirmed to occur on the right-of-way along State Highway 58 near Red Hill Road, which is managed as a botanical management area by the California Department of Transportation. We have been informed that the taxon occurs on private property immediately to the north of the right-of-way along State Highway 58 near Red Hill Road. However, we do not know the status of the taxon on this private property or on the other private property approximately 6.4 km (4 mi) south.

We currently identify the primary threats to the Camatta Canyon amole as the following: cattle grazing in the Camatta Canyon amole area on the Los Padres National Forest; illegal trespass by motorcycles into the Camatta Canyon amole area on the Los Padres National Forest; and displacement by non-native annual grasses. In addition, because of the clumped and limited distribution of the Camatta canyon amole in a semiarid environment, a wildfire could destroy a substantial portion of the population.

Since listing, little has changed regarding the status of the Camatta Canyon amole. The Camatta Canyon amole remains threatened because of the above threats, and because the known occurrences are restricted to a small geographic area. The long-term prospects for survival and recovery will be enhanced when the U.S. Forest Service implements a management and monitoring program for the Camatta Canyon amole, and if additional localities or populations are found.

**Conclusion**

As noted when the species was listed, it is likely that *Chlorogalum purpureum* historically had a much greater geographic distribution. The purple amole is now known to occur only on two military installations. We are hopeful of securing funding and permissions to search in potentially-suitable habitat on nearby private properties. The Camatta Canyon amole is now known only from a small geographic area. The full extent to which *Chlorogalum purpureum* could be adversely affected by fire and invasive plant species is largely unknown. In consideration of the limited geographic distribution and the identified threats, we conclude that *Chlorogalum purpureum*, including both varieties discussed herein, still meets the Endangered Species Act definition of threatened. Therefore, we recommend no status change at this point in time. Below in "Recommendations for Future Actions" we list management, monitoring, and research actions that, if implemented over the next 5 years, would provide information that may allow us to consider recommending delisting the purple amole (*Chlorogalum purpureum* var. *purpureum*) at our next 5-year review.

## 3.0 RESULTS

### 3.1 Recommended Classification

____ Downlist to Threatened

____ Uplist to Endangered

____ Delist (Indicate reasons for delisting per 50 CFR 424.11):

____ Extinction

____ Recovery

____ Original data for classification in error

_X__ No change is needed

### 3.2 Recovery Priority Number

We recommend that the recovery priority number remain at 8 (no change).

## 4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

***Purple Amole on Fort Hunter Liggett***

1. We recommend that the U.S. Army search for the purple amole in potentially-suitable habitat on nearby private properties and at additional localities on Fort Hunter Liggett.

2. We recommend that the U.S. Army complete its endangered species management plan for the purple amole on Fort Hunter Liggett as soon as possible.

3. In light of the known error by first-year surveyors in 2002 (Clark in litt. 2007a), we recommend that the U.S. Army re-analyze its data regarding fire and the purple amole on Fort Hunter Liggett. Further, we recommend that the U.S. Army conduct research regarding the effects of fire (frequency, seasonality) and invasive plants to the purple amole.

4. We recommend that the U.S. Army actively manage the known occupied localities for the benefit of the purple amole. In particular, we recommend that the U.S. Army evaluate and consider conducting activities that may potentially benefit the purple amole on Fort Hunter Liggett, including controlled burns to remove invasive plants, the removal of feral pigs, and the use of the ball-and-chain method to remove competing plants in potential habitat.

5. We recommend that the U.S. Army conduct research to determine the effects of gophers and feral pigs on the purple amole, and the relationship between the purple amole and cryptogamic crusts.

***Purple Amole on Camp Roberts***

1. We recommend that the California Army National Guard search for the purple amole in potentially-suitable habitat on nearby private properties and at additional localities on Camp Roberts.

2. We recommend that the California Army National Guard complete the process of updating its draft Integrated Natural Resources Management Plan for Camp Roberts and consulting with the Service regarding it and the ongoing activities that may affect the purple amole.

3. We recommend that the California Army National Guard statistically analyze its data regarding the effects of fire on the purple amole at Camp Roberts. Further, we recommend that the California Army National Guard conduct research regarding the effects of fire (frequency, seasonality) and invasive plants to the purple amole.

4. We recommend that the California Army National Guard actively manage the known occupied localities for the benefit of the purple amole. In particular, we recommend that the California Army National Guard evaluate and consider conducting activities that may potentially benefit the purple amole on Camp Roberts, including controlled burns to remove invasive plants, controlled grazing by goats or sheep to remove invasive plants, and the removal of feral pigs.

5. We recommend that the California Army National Guard conduct research to determine the effects of gophers and feral pigs on the purple amole, and the relationship between the purple amole and cryptogamic crusts.

***Camatta Canyon Amole***

1. We recommend that the U.S. Forest Service prepare and implement a management plan for the Camatta Canyon amole on the Los Padres National Forest, including surveys and a monitoring program.

2. We recommend that the U.S. Forest Service implement measures to prevent trespass by vehicles, in particular motorcycles, into the Camatta Canyon amole area and designated critical habitat on the Los Padres National Forest. We recommend that the effectiveness of any implemented measures be monitored and then adaptive management actions taken.

3. We recommend that the U.S. Forest Service consult with the Service regarding its activities that may affect the Camatta Canyon amole and its designated critical habitat on the Los Padres National Forest, in particular cattle grazing.

4. We recommend that the U.S. Forest Service conduct research to determine the effects of gophers and feral pigs on the Camatta Canyon amole, and the relationship between the Camatta Canyon amole and cryptogamic crusts.

5. We recommend that the California Department of Transportation conduct surveys to determine the distribution of the Camatta Canyon amole along State Highway 58 (and adjacent private properties if possible) and submit a report of the survey results to the Service.

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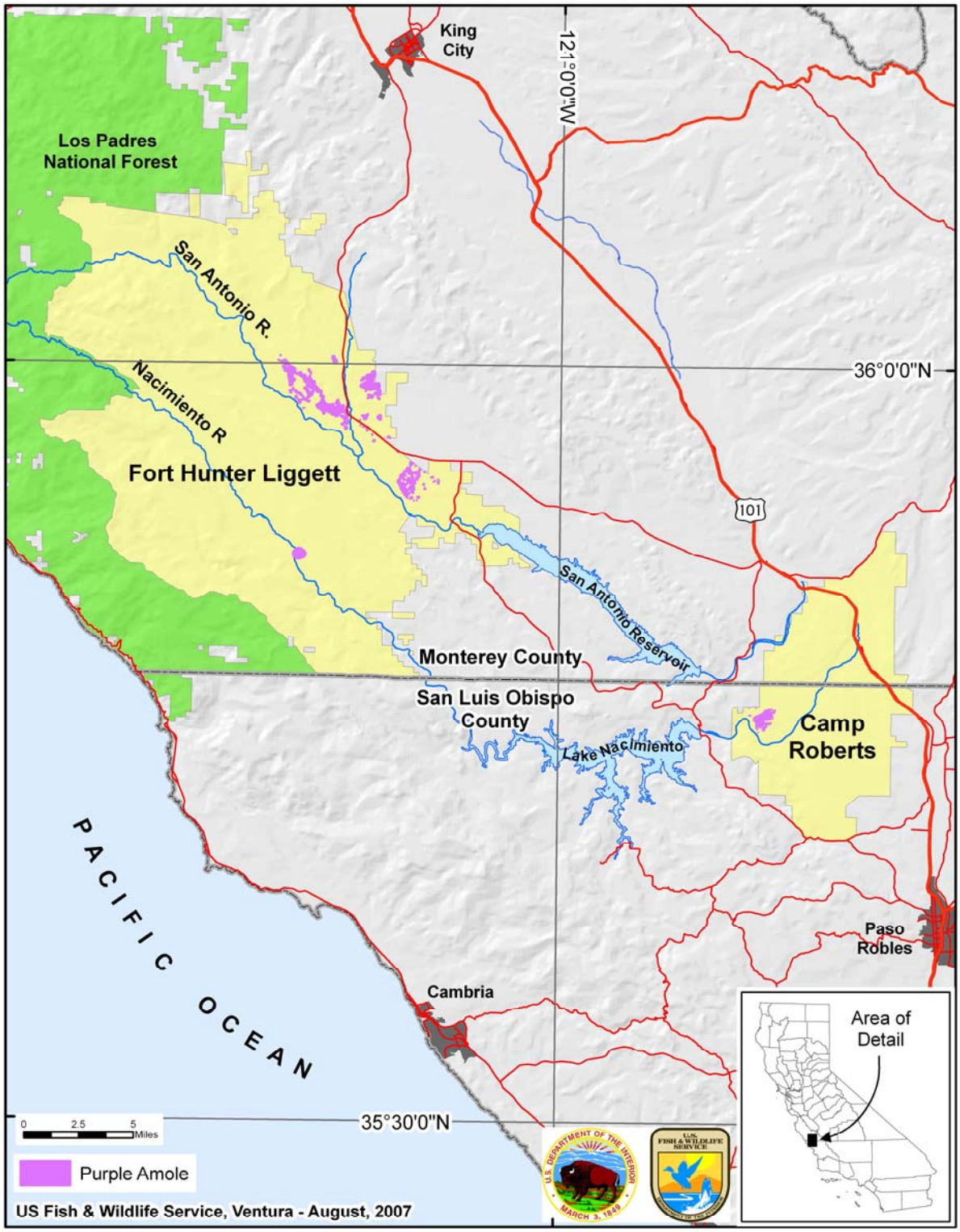
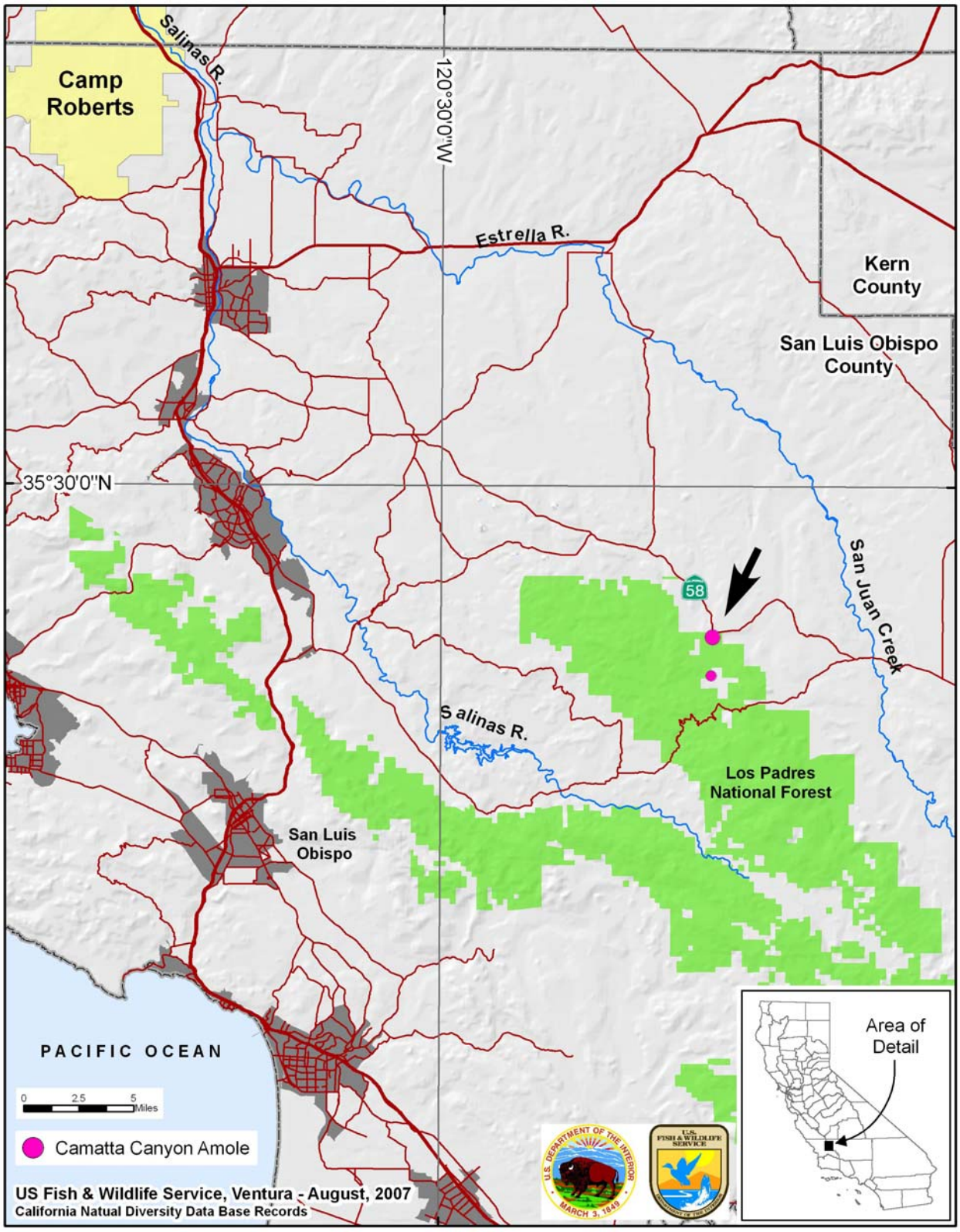
Map 1. Occurrence records for the purple amole (*Chlorogalum purpureum* var. *purpureum*).



Map. 2. Occurrence records for the Camatta Canyon amole (*Chlorogalum purpureum* var. *reductum*).



**U.S. FISH AND WILDLIFE SERVICE**
**5-YEAR REVIEW of Purple Amole (*Chlorogalum purpureum*)**

**Current Classification**: Threatened

**Recommendation Resulting from the 5-Year Review**:

____ Downlist to Threatened

____ Uplist to Endangered

____ Delist

_X_ No change needed

**Appropriate Listing/Reclassification Priority Number, if applicable:** N/A

**Review Conducted By**: Christopher Kofron

**FIELD OFFICE APPROVAL:**

Lead Field Supervisor, Fish and Wildlife Service

Approve Diane K. Noda Date 9/29/08

**REGIONAL OFFICE APPROVAL:**

Lead Regional Director, Fish and Wildlife Service

Approve Michael Fris Date 9/30/08