

Clarkia springvillensis
(Springville Clarkia)

**5-Year Review
Summary and Evaluation**

**U.S. Fish and Wildlife Service/
Sacramento Fish and Wildlife Office
Sacramento, California**

August 2009

5-YEAR REVIEW
***Clarkia springvillensis* (Springville Clarkia)**

I. GENERAL INFORMATION

I.A. Methodology used to complete the review:

This review was conducted by a staff biologist within the Sacramento Fish and Wildlife Office, U.S. Fish and Wildlife Service (Service), based on peer-reviewed journal articles; California Natural Diversity Database information; personal communications with California Department of Fish and Game, U.S. Forest Service (USFS), and Bureau of Land Management staff; our database that tracks Endangered Species Act (Act) section 7 consultations and other projects; and our files.

I.B. Contacts

Lead Regional or Headquarters Office – Contact name(s) and phone numbers: Pacific Southwest Regional Office, 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 – Contact name(s) and phone numbers: – Sacramento Fish and Wildlife Office, Kirsten Tarp, Recovery Branch, 916-414-6600.

I.C. Background

I.C.1. FR Notice citation announcing initiation of this review:

On July 7, 2005, we announced initiation of the 5-year review for *Clarkia springvillensis* and asked for information from the public regarding the species' status (70 FR 39327). We published a second notice announcing the 5-year review and extending the request for information on November 3, 2005 (70 FR 66842). We received no response to these requests for information.

I.C.2. Listing history

Original Listing

FR notice: 63 FR 49022

Date listed: September 14, 1998

Entity listed: Species (*Clarkia springvillensis*), a listed plant species.

Classification: Threatened

I.C.3. Associated rulemakings: None (e.g., no critical habitat has been designated for this species).

I.C.4. Review History: No status reviews have been conducted since the species was listed in 1998.

I.C.5. Species' Recovery Priority Number at start of review: The recovery priority for this species is 8 (based on a 1 to 18 ranking system where 1 is the highest recovery priority and 18 is the lowest), indicating a full species, moderate level of threats, and high recovery potential.

I.C.6. Recovery Plan or Outline

Draft Recovery Plan for Fifteen Plants from Southern Sierra Foothills, California (in development).

II. REVIEW ANALYSIS

Species Overview

Clarkia springvillensis is a narrowly distributed annual in the evening primrose family (Onagraceae). The California Natural Diversity Database (CNDDDB) has recorded 18 occurrences: Seventeen near Springville and a misidentified occurrence near the town of Three Rivers (CNDDDB 2009) (J. Stebbins, consultant, *in litt.* 2009). Sixteen of these occurrences are presumed extant. Collectively, the occurrences are estimated to occupy a total of 98 hectares (244 acres). The species grows mostly on the uphill slope of roadbanks, on small decomposing granitic domes, and in sunny openings from elevations between 330 and 1,220 meters (1,080 and 4,000 feet) within the *Quercus douglasii* (blue oak) woodland community. The range of *C. springvillensis* lies entirely along the Tule River drainage in the western Sierra Nevada foothills within Tulare County, California. The largest reported occurrence is on the California Fish and Game property known as the Springville Clarkia Ecological Reserve (CNDDDB 2009).

II.A. Application of the 1996 Distinct Population Segment (DPS) policy

II.A.1. Is the species under review listed as a DPS?

 Yes
 X No

The Endangered Species Act defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species if vertebrate wildlife. This definition limits listing as distinct population segments (DPS) 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.

II.B. Recovery Criteria

II.B.1. Does the species have a final, approved recovery plan containing objective, measurable criteria?

Yes
 No. The draft plan is currently under development.

II.C. Updated Information and Current Species Status

II.C.1. Biology and Habitat

II.C.1.a. Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.):

The distribution of *Clarkia springvillensis* today is essentially the same as it was at the time of listing in 1998. Although the CNDDDB considers 17 of the 18 occurrences to be extant (CNDDDB 2009), several additional populations of *C. springvillensis* have been reported from the Springville vicinity (USFS 1996; USFS 1998; C. Sanders and J. Stewart, *in litt.* 2000). However, these populations are intermediate in diagnostic characters, they have not been incorporated into the CNDDDB, and they are not included in this 5-year review because their taxonomic identification is questionable. The type locality, located 2.9 kilometers (1.8 miles) north of Springville Ranger Station on Balch Park Road (Element Occurrence 1), is considered to be extirpated because the species was not found at the described location in a 1987 search. The population at Coffee Camp (Element Occurrence 4) has not been seen since 1967 despite repeated searches (Stebbins and Clark 1992; CNDDDB 2009), but it is not considered to be extirpated (CNDDDB 2009).

An Element Occurrence as defined by CNDDDB is the location record for a site which contains an individual, population, or stand. Populations, individuals, or colonies located within one-fourth of a mile of each other generally constitute a single occurrence (CNDDDB 2009). For the purposes of this review, we distinguish between the terms "element occurrence" or "occurrence" (as defined by the CNDDDB) and "population" (referring to a locality not yet reported to CNDDDB). In general, the CNDDDB definition of "element occurrence" does not necessarily represent a biological (i.e., interbreeding) population, nor do we have definitive information that unreported localities constitute biological populations; rather, these terms are convenient for reference to various parts of the species' range.

One of the occurrences included in CNDDDB (Element Occurrence 2 near Three Rivers and Element) is thought to be a misidentification (J. Stebbins, *in litt.* 2009). Among the 16 presumed extant *Clarkia springvillensis* occurrences (not including the misidentified occurrence), land ownership is reported for 14 occurrences. Ten occurrences are wholly or partially on the Giant Sequoia National Monument administered by the Sequoia National Forest, one occurrence is on Bureau of Land Management (BLM) lands, one occurrence is on California Department of Fish and Game's Springville clarkia Ecological Reserve (CNDDDB 2009), and three occurrences are on private land.

Table 1. Occurrence information for *Clarkia springvillensis* (modified from CNDDDB 2009).

Occurrence Number	Most Recent Date Observer Visited Site	Date last observed	Range of Reported Numbers of Individuals	Presence	Trend	Owner or Manager
1	1987	1963	Extirpated	Extirpated	unknown	Private
3	1993	1993	20 to 100s	Presumed Extant	unknown	Sequoia National Monument
4	1993	1967	Unknown	Presumed Extant	unknown	Sequoia National Monument
5	1993	1993	1,000s to 100,000+	Presumed Extant	unknown	Private, Department of Fish
6	2002	2002	50 to 180	Presumed Extant	unknown	Sequoia National Monument
7	1993	1993	15+ to 300	Presumed Extant	unknown	Private, Tulare County
8	1990	1990	60 and 50	Presumed Extant	unknown	Sequoia National Monument
9	1989	1989	Unknown	Presumed Extant	unknown	Unknown
10	1990	1990	300+	Presumed Extant	unknown	Unknown
12	1993	1993	100s	Presumed Extant	unknown	Sequoia National Monument
13	1993	1993	100s?	Presumed Extant	unknown	Sequoia National Monument
14	1993	1993	150	Presumed Extant	unknown	Sequoia National Monument
15	1993	1993	1,000s	Presumed Extant	unknown	Sequoia National Monument
16	1995	1995	Unknown	Presumed Extant	unknown	BLM
18	2002	2002	2,300	Presumed Extant	unknown	Sequoia National Monument
19	unknown	unknown	5	Presumed Extant	unknown	Sequoia National Monument
20	2005	2005	About 100	Presumed Extant	unknown	Private

Element Occurrence 2 is thought to be misidentified (J. Stebbins *in litt* 2009) and is not included in this table.

The primary area of concentration is the Rancheria/Bear Creek drainage in the watershed of the North Fork of the Tule River (Element Occurrences 5, 12, 13, 14). A secondary area of concentration is the Siphon Canyon-Coffee Canyon area in the watershed of the Middle Fork of the Tule River (Element Occurrences 4, 6, and 18).

II.C.1.b. Abundance, population trends (e.g. increasing, decreasing, stable), demographic features, or demographic trends:

Abundance

As is common in annual plants, population size in *Clarkia springvillensis* can vary enormously from one year to the next due to interactions between the soil seed bank and seasonal weather conditions.

A comprehensive multiyear study was conducted between 2002 and 2005 to document the populations on the Southern California Edison's Lower Tule River Hydroelectric Project "lands subject to normal operational and maintenance impacts" (includes Element Occurrence 18). The 2002 survey revealed 18 colonies consisting of approximately 2,500 individuals. The 2003 survey revealed 23 colonies containing approximately 4,880 individuals. The 2004 survey revealed about 1,800 plants, with most colonies displaying only about one-third as many plants as in the previous years, due to a poor year for precipitation. The 2005 survey, conducted after one of the wettest winters on record, revealed over 10,000 individuals in this one occurrence (Service 2005; Stebbins 2005).

Population Trends

Neither regular nor systematic inventories have been conducted for all occurrences and populations at every location. The CNDDDB (2009) lists the trend of all individual *Clarkia springvillensis* occurrences as "unknown" whereas the California Department of Fish and Game (2001) characterized the species as a whole as "declining" in 1999. In terms of the size of extant occurrences and populations, one available index is the maximum number of plants recorded in a single CNDDDB occurrence. At their maximum size (during the past 20 years), eight occurrences contained between 100 and 300 plants; one (Element Occurrence 15) consisted of "thousands" of individuals; one (Element Occurrence 18) consisted of over 30,000; and one (Element Occurrence 5) consisted of over 100,000 individuals. No estimates are reported for the other occurrences that are presumed to be extant (CNDDDB 2009).

II.C.1.c. Habitat or ecosystem conditions:

At the time of listing, we reported that *Clarkia springvillensis* was found on granitic soils in sunny sites from 360 to 910 meters (1,220 to 3,000 feet) in elevation. *Clarkia springvillensis* grows mostly on the uphill slope of roadbanks, on small decomposing granitic domes, and in openings within the *Quercus douglasii* (blue oak) woodland community in the foothills of the southern Sierra Nevada foothills of Tulare County. It currently occurs in the same habitat, but at elevations from 330 to 1,220 meters (1,080 to 4,000 feet) (CNDDDB 2009).

II.C.1.d. Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):

McCue and Holtsford (1998) conducted a study of the influence of the seed bank on genetic diversity in *Clarkia springvillensis*. They determined that seed banks can have important effects on the amount and distribution of genetic variation, especially in small populations. They found that the presence of a soil seed bank greatly increases the effective population size of this species. For example, based on the number of plants, the effective size of one population averaged 2.4 over a 5-year period. When the density of the seed bank was taken into account, the effective population size increased to 699 (McCue and Holtsford 1998). In April 1993, the density of ungerminated seeds in the soil throughout three populations was estimated at 65 per square meter (6 per square foot), after germination but before seed set. By July 1993, McCue and Holtsford (1998) found a total of 230 seeds per square meter (21 per square foot), indicating that an additional 165 seeds per square meter (15 per square foot) were added during that growing season. Seed densities were approximately two to three times higher in the immediate vicinity of *C. springvillensis* plants than over the entire population area, which included some unoccupied patches.

The authors noted that the capability of the species to establish and maintain a seed bank with seed viability extending for several years buffers the species' genetic diversity. They point out that this both helps to maintain genetic diversity and to slow genetic drift and changes in genetic composition due to selection pressures that only operate in some years. McCue and Holtsford (1998) report that the diversity appears to be maintained at levels reflecting their expectation based on other species that have similar seed banking mechanisms.

Although McCue and Holtsford (1998) study of the affects of the seed bank on *Clarkia springvillensis*, could act as a buffer against the genetic consequences of small population size, there is still a threat to the population if the species is maintained at small population sizes over an extended period of time (Ellstrand and Elam 1993)

II.C.2. Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

III.C.2.a. Present or threatened destruction, modification or curtailment of its habitat or range:

At the time of listing in 1998, the threats to *Clarkia springvillensis* were road maintenance and mowing; development; incidental impacts associated with frequent large nature group walks and livestock grazing (63 FR 49022). Currently, *C. springvillensis* is still threatened by road maintenance and mowing; and residential development.

Prior to listing, residential development affected *Clarkia springvillensis* at two sites. Element Occurrence 5 was damaged, but not destroyed, when an access road, building pad, and well were constructed in the midst of the *C. springvillensis* population (Ashford 1989) for a home that was never built. Mobile home development apparently contributed to the extirpation of Element Occurrence 1. No mobile homes are currently located at that site, but road construction,

maintenance and improvement associated with the former residences are believed to be responsible for its disappearance (J. Stebbins, pers. comm. 2001, J. Stebbins *in litt.* 2002; CNDDDB 2009).

The plants growing on steep banks along roads generally have been safe from grazing animals because fences at the edge of the bank and the steep slopes prevented livestock from entering (J. Shevock, *in litt.* 1985; J. Stebbins, pers. comm. 2001). However, road maintenance and improvements have affected *Clarkia springvillensis* on these banks to some extent (Stebbins 1991, J. Stebbins, *in litt.* 2002; CNDDDB 2009). Road maintenance still is a threat at five occurrences in *Clarkia springvillensis* habitat. The dirt roads along which it grows are maintained by either Tulare County, Pacific Gas and Electric, or Southern California Edison. Road maintenance includes activities such as mowing, grading, spraying herbicide, mechanically removing brush, and clearing culverts (USFS 1996), whereas road improvements are activities such as widening or straightening roads, or installing culverts.

Although this species occurs along some roads administered by the U.S. Forest Service, *Clarkia springvillensis* is not threatened there because the roads require very little maintenance and the species occurs more than 100 meters (300 feet) from the roadside (S. Anderson, *in litt.* 2002). Similarly, although *C. springvillensis* grows near State Highway 190, it is far enough from the roadway that it is not affected by California Department of Transportation maintenance activities (USFS 1996). Mechanical brush removal, which occurs along the Southern California Edison water flume and Pacific Gas and Electric transmission line, is not detrimental if it is done from late summer through autumn when *C. springvillensis* is not actively growing (USFS 1996), and in fact appears to be beneficial to *C. springvillensis* if done during that time (J. Stebbins, pers. comm. 2001). A management plan prepared for Southern California Edison (EA Engineering and Stone 1999) suggests guidelines to avoid effects to *C. springvillensis* during routine maintenance activities.

Residential development is a potential threat to one occurrence of *Clarkia springvillensis*. Element Occurrence 10 is in an area zoned to allow one dwelling per hectare (2.5 acres), as long as the dwellings are occupied by family, employees, or farm laborers. An additional dwelling is allowed for the owner (A. Pacheco *in litt.* 1997)

The California Department of Fish and Game set aside 1.8 hectares (4.5 acres) of habitat in 1987 for *Clarkia springvillensis*, which is now designated as the Springville *Clarkia* Ecological Reserve (Stebbins and Clark 1992). The property has been fenced to protect from grazing; however, competition from introduced grasses and noxious weeds are potential threats at this site (USFS 2003a).

In summary, 11 occurrences are on Federal lands and are protected from the direct affects of development. Road maintenance is still a threat at 5 occurrences and residential development is a threat at one occurrence.

II.C.2.b. Overutilization for commercial, recreational, scientific, or educational purposes:

Overutilization for commercial, recreational, scientific, or educational purposes was not known to be a factor in the 1998 final rule (FR 63 FR 49022) and does not appear to be a threat currently.

II.C.2.c. Disease or predation:

At the time of listing many *Clarkia springvillensis* sites were reported to be grazed by domestic livestock (K. McCue, Missouri Botanical Garden, *in litt.* 1997). We determined that the effects on plants from livestock grazing are highly variable and dependent on many factors, including but not limited to, the type of livestock, timing, intensity, and duration of livestock use. Intensive grazing has been identified as one of the greatest threats to the species and the “basic cause of its rarity” (J. Shevock *in litt.* 1985). Appropriate grazing regimes may benefit *C. springvillensis* in some situations by reducing the abundance of alien plants and thereby lessening competitive pressure on *C. springvillensis* (K. McCue, *in litt.* 1997).

The apparent decline of *Clarkia springvillensis* is likely due to a complex combination of inappropriate livestock grazing (J. Shevock, USFS, *in litt.* 1985; Stebbins 1991, Hansen 1992, USFS 1996), competition from nonnative plants (McCue *et al.* 1996), and altered fire regimes (McCue *et al.* 1996; S. Carter, pers. comm. 2001, J. Stebbins, *in litt.* 2002). Inappropriate grazing practices that apparently contributed to the decline of *C. springvillensis* included (1) repeated consumption of the same plants in a single growing season; (2) grazing late in the season (May or later) so *C. springvillensis* plants did not have time to send up new shoots or set seed before dying back (McCue 1997; J. Stebbins, pers. comm. 2001); and (3) livestock spending long periods in one area, which caused direct trampling of plants, soil compaction, and surface disturbance (Hansen 1992). Concern over grazing peaked in the 1980s, and several occurrences were then fenced to exclude livestock (Stebbins 1991).

To avoid effects to *Clarkia springvillensis* from grazing, the Sequoia National Forest proposed to exclude *C. springvillensis* sites from grazing from April 1 until after seed set by either season of use or by fenced enclosures on the Tule River grazing allotment, which are within the Giant Sequoia National Monument (Service 2006). Currently, within the West Tule Grazing Environmental Assessment, grazing is going to be removed from the Bear Creek allotment, and fencing will be used instead. Although this change has been approved by the Service, but as of 2007 it had not yet been implemented (F. Linton, Sequoia National Forest, pers. comm. 2007).

II.C.2.d. Inadequacy of existing regulatory mechanisms:

At the time of listing we discussed the inadequacy of the California Endangered Species Act (CESA) and California Environmental Quality Act (CEQA) with respect to *Clarkia springvillensis*.

Federal Laws

Endangered Species Act of 1973, as amended (Act): The Act is the primary Federal law providing protection for this species. The Service’s responsibilities include administering the Act, including sections 7, 9, and 10 that address take. Since listing, the Service has analyzed the

potential effects of Federal projects under section 7(a)(2), which requires Federal agencies to consult with the Service prior to authorizing, funding, or carrying out activities that may affect listed species. A jeopardy determination is made for a project that is reasonably expected, either directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing its reproduction, numbers, or distribution (50 CFR 402.02). A non-jeopardy opinion may include reasonable and prudent measures that minimize the amount or extent of incidental take of listed species associated with a project.

Section 9 prohibits the taking of any federally listed endangered or threatened species. Section 3(18) defines “take” to mean “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.” Service regulations (50 CFR 17.3) define “harm” to include significant habitat modification or degradation which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. Harassment is defined by the Service as an intentional or negligent action that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. The Act provides for civil and criminal penalties for the unlawful taking of listed species. Incidental take refers to taking of listed species that results from, but is not the purpose of, carrying out an otherwise lawful activity by a Federal agency or applicant (50 CFR 402.02). For projects without a Federal nexus that would likely result in incidental take of listed species, the Service may issue incidental take permits to non-Federal applicants pursuant to section 10(a)(1)(B). To qualify for an incidental take permit, applicants must develop, fund, and implement a Service-approved Habitat Conservation Plan (HCP) that details measures to minimize and mitigate the project’s adverse impacts to listed species. Regional HCPs in some areas now provide an additional layer of regulatory protection for covered species, and many of these HCPs are coordinated with California’s related Natural Community Conservation Planning program.

With regard to federally listed plant species, section 7(a)(2) requires Federal agencies to consult with the Service to ensure any project they fund, authorize, or carry out does not jeopardize a listed plant species. Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the “take” of federally endangered wildlife; however, the take prohibition does not apply to plants. Instead, plants are protected from harm in two particular circumstances. Section 9 prohibits (1) the removal and reduction to possession (i.e., collection) of endangered plants from lands under Federal jurisdiction, and (2) the removal, cutting, digging, damage, or destruction of endangered plants on any other area in knowing violation of a state law or regulation or in the course of any violation of a state criminal trespass law. Federally listed plants may be incidentally protected if they co-occur with federally listed wildlife species.

Currently there are no completed county-wide Habitat Conservation Plans (HCPs) or State Natural Community Conservation Plans (NCCPs) in Tulare County, thereby leaving populations on private land without protection from these laws.

The National Environmental Policy Act (NEPA) (42 U.S.C. 4321 *et seq.*) requires all Federal agencies to formally document, consider, and publicly disclose the environmental impacts and mitigation alternatives of Federal actions and management decisions affecting the human

environment, but NEPA does not require or guide mitigation for impacts. The Giant Sequoia National Monument (Monument), which supports 10 occurrences of *Clarkia springvillensis*, was created on April 15, 2000, by Presidential Proclamation, designating 1326.44 square kilometers (327,769 acres) within the boundary of the Sequoia National Forest. The Monument is administered by the United States Department of Agriculture, Forest Service, Sequoia National Forest (USFS 2003a). A management plan was finalized for the Monument in 2003 that established management direction in four areas: the protection of communities and other valuable resources from catastrophic fire, ecological restoration, recreation and human use, and transportation (USFS 2008). Two lawsuits were brought forward challenging the management plan due to not complying with the NEPA. In October 2006, Federal District Court Judge Charles Breyer remanded the plan to the Forest Service. In June 2007, the Sequoia National Forest initiated a new planning process to develop a new Giant Sequoia National Monument Management Plan. This new planning process is expected to take two to three years. Therefore the management plan at this point does not exist and they are not expecting to have a completed plan until 2010. The purpose of this management plan, as described by the Forest Service, was to "provide visitor use of the monument (specifically international visitors, and to restore and protect 33 giant sequoia groves and their ecosystems" (USFS 2008). No species management guide exists for *Clarkia springvillensis* on Forest Service land (USFS 2003b; F. Linton, pers. comm. 2007).

California State Laws

The State's authority to conserve plants is comprised of four pieces of legislation: The California Endangered Species Act (CESA), the Native Plant Protection Act (NPPA), the California Environmental Quality Act (CEQA), and the Natural Community Conservation Planning Act (Morey and Ikeda 2001).

Clarkia springvillensis was State-listed as endangered in September 1979. The CESA (California Fish and Game Code, section 2080 *et seq.*) and NPPA (Division 2, Chapter 10, section 1908) prohibit the unauthorized take of State-listed threatened or endangered plant species. Unlike the take prohibition in the Act, the State prohibition includes plants; however, landowners are exempt from this prohibition for plants via habitat modification. As noted in the 1998 Federal rule to list *C. springvillensis*, the landowner is required to notify the California Department of Fish and Game 10 days in advance of changing land use in order to allow salvage of listed plants (NPPA Division 2, Chapter 10, section 1913).

The California Environmental Quality Act (CEQA) (chapter 2, section 21050 *et seq.* of the California Public Resources Code) requires government agencies to consider and disclose environmental impacts of projects and to avoid or mitigate them where possible. Under CEQA, public agencies must prepare environmental documents to disclose environmental impacts of a project and to identify conservation measures and project alternatives. Through this process, the public can review proposed project plans and influence the process through public comment. However, CEQA does not guarantee that such conservation measures will be implemented.

In summary, the Endangered Species Act is the primary Federal law that provides protection for this species since its listing as threatened in 1998. Other Federal and State regulatory

mechanisms provide discretionary protections for the species based on current management direction, but do not guarantee protection for the species absent its status under the Act. Therefore, we continue to believe other laws and regulations have limited ability to protect the species in absence of the Endangered Species Act.

II.C.2.e. Other natural or manmade factors affecting its continued existence:

Other natural or manmade threats cited in the 1998 final rule included susceptibility of populations to extirpation from random demographic, environmental or genetic events. At the time of final listing, we stated that *Clarkia springvillensis* was potentially threatened by loss of fitness and /or genetic variability (FR 63 FR 49022). While we still think *C. springvillensis* could be threatened by loss of fitness and /or genetic variability, we think this is a more minor threat due to buffering of the genetic diversity of *Clarkia springvillensis* by the seed bank. In addition to these threats, current threats include competition from nonnative plants and global climate change.

Extirpation from Random Demographic, Environmental or Genetic Events

The combination of small range and restricted habitat still renders *Clarkia springvillensis* susceptible to extirpation due to random events such as flood, drought, disease, or other factors (Shaffer 1981, 1987; Groom *et al.* 2006).

As discussed in the final listing rule (63 FR 49022), small population size increases the susceptibility of a population to extirpation from random demographic, environmental and/or genetic events (Shaffer 1981, 1987; Lande 1988; Groom *et al.* 2006). In this 5-year review, populations of 200 growing plants (not counting ungerminated seeds) or fewer are considered to be small, in keeping with Menges' (1992) calculation that populations of this size are especially vulnerable to even moderate levels of environmental uncertainty.

Demographic events that may put small populations at risk involve random fluctuations in survival and reproduction of individuals (Shaffer 1981, 1987; Lande 1988; Groom *et al.* 2006). Small populations may also be subject to increased genetic drift and inbreeding (Menges 1991, Ellstrand and Elam 1993). Populations that are continually small in size are particularly susceptible to genetic changes due to drift. However, drift may also cause genetic changes with populations that occasionally fluctuate to small sizes (*e.g.*, undergo population bottlenecks). Increased homozygosity (*i.e.*, reduced genetic variation) resulting from genetic drift and inbreeding in small populations may lead to a loss of fitness (ability of individuals to survive and reproduce). In addition, reduced genetic variation in small populations may make any species less able to successfully adapt to future environmental changes (Ellstrand and Elam 1993). *Clarkia springvillensis* has small population size for at least five occurrences, therefore, it also is susceptible to extirpation due to demographic events, genetic drift, and inbreeding.

Competition with Nonnative Plants

Nonnative plants, especially *Bromus* grass species (brome), may have contributed to the decline of *Clarkia springvillensis* by competing directly for moisture and nutrients (J. Stebbins *in litt.*

2002). Dead stems of nonnative grasses create a build-up of thatch that may have prevented *C. springvillensis* from becoming established in openings, thereby isolating populations (McCue *et al.* 1996; J. Stebbins, pers. comm. 2001). Prolonged grazing may have exacerbated these problems because soil disturbance favors some nonnative plants over native species (Hansen 1992). However, in areas where livestock have been excluded completely, thatch build-up is more severe (J. Stebbins, *in litt.* 2002).

A related problem is that the stems and thatch of nonnative plants contribute to an increased fire frequency. Conversely, fire suppression activities may have inadvertently contributed to the decline of *Clarkia springvillensis* by allowing encroachment of shrubs and trees into the openings where it grows (McCue *et al.* 1996; S. Carter, pers. comm. 2001, J. Stebbins *in litt.* 2002). Lack of fire also would contribute to thatch accumulation (J. Stebbins, *in litt.* 2002).

Currently, the primary threat to the survival of *Clarkia springvillensis* is competition and thatch build-up from nonnative plants (Hansen 1992, McCue 1997, J. Stebbins *in litt.* 2002). Aggressive, nonnative plants such as *Bromus* species, *Brassica* species (wild mustard), *Torilis* species (hedge-parsley), and *Centaurea melitensis* (tocalote) are present at nine occurrences, although they have not been reported as threats at all nine sites. The *Centaurea* species present at the Springville *Clarkia* Ecological Reserve has been incorrectly reported as *C. solstitialis* (yellow star-thistle) (Hansen 1992), but is actually *C. melitensis* (E. Cypher, pers. comm. 2006, 2007; J. Stebbins, pers. comm. 2001). Trees and shrubs, although native, also may be competing with *C. springvillensis* for available water (Martin 1990) or creating too much shade (McCue *et al.* 1996, Bureau of Land Management 1999) at all of the extant sites.

Global Climate Change

Impacts to *Clarkia springvillensis* under predicted future climate change are unclear. A trend of warming in the mountains of western North America is expected to decrease snowpack, hasten spring runoff, and reduce summer stream flows, and increased summer heat may increase the frequency and intensity of wildfires (IPCC 2007). While it appears reasonable to assume that the species may be affected, we lack sufficient certainty on knowing how and how soon climate change will affect the species, the extent of average temperature increases in California, or potential changes to the level of threat posed by drought and fire. The most recent literature on climate change includes predictions of hydrological changes, higher temperatures, and expansion of drought areas, resulting in a northward and/or upward elevation shift in range for many species (IPCC 2007); higher elevation montane habitat could be important to the future conservation of this species. The incidence of wildfires in California will also increase and the amount of increase is highly dependent on the extent of global warming.

II.D. Synthesis

The threats to *Clarkia springvillensis* that led to the listing of the species as threatened in 1998 were urban development, inadequate regulatory mechanisms, heavy livestock grazing, and roadway maintenance activities. Due to its few populations and low numbers, *C. springvillensis* was vulnerable to extirpation from random events.

Currently, the primary threat to *Clarkia springvillensis* is competition and thatch build-up from nonnative plants. Additionally, *C. springvillensis* is still threatened by road maintenance and mowing, residential development, inadequate regulations, and extirpation from random stochastic demographic, environmental or genetic events. We have little new information to suggest that threats to the species have substantially changed since the time of listing.

Among the 16 presumed extant *Clarkia springvillensis* occurrences (not including the misidentified occurrence), land ownership is reported for 14 occurrences. Ten occurrences are wholly or partially on the Giant Sequoia National Monument administered by the Sequoia National Forest, one occurrence is on Bureau of Land Management (BLM) lands, one occurrence is on California Department of Fish and Game's Springville clarkia Ecological Reserve (CNDDDB 2009), and three occurrences are on private land.

Therefore, based on past and threatened destruction or modification of its habitat, the inadequacy of existing regulatory mechanisms, and natural or manmade factors related to that affect its continued existence, and the competition with invasive nonnative plants we conclude that *Clarkia springvillensis* continues to meet the definition of threatened (likely to become endangered in the foreseeable future throughout all or a significant portion of its range).

III. RESULTS

III.A. 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

No change is needed

III.B. New Recovery Priority Number 8

We recommend that the recovery priority number remain 8.

IV RECOMMENDATIONS FOR FUTURE ACTIONS -

- 1 Complete and publish the draft recovery plan, and approve a final recovery plan.
2. Establish reliable baseline data for monitoring plant occurrences. Monitor the status and trend of *Clarkia springvillensis* in order to estimate current population sizes, the number and distribution of populations, the threats to each occurrence, and whether the species is stable, increasing, or declining.

3. Work with the Forest Service, Bureau of Land Management, and California Department of Fish and Game to conduct research on (a) the value of prescribed burning and mechanical brush removal; and (b) study the effects of livestock grazing on *Clarkia springvillensis*.

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**U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Clarkia springvillensis***

Current Classification Threatened

Recommendation resulting from the 5-Year Review

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change is needed

Review Conducted By Sacramento Fish and Wildlife Office staff

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve *Samantha Stone* Date 2/17/09