PLANT BIOLOGICAL ASSESSMENT

Giant Sequoia National Monument Management Plan

Fresno, Tulare and Kern Counties
Sequoia National Forest
Giant Sequoia National Monument

PREPARED By: _: _____ DATE July 19th, 2012

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Summary

Provisions within all alternatives in the Giant Sequoia National Monument (Monument) draft EIS are determined not likely to adversely affect the listed plant species, *Clarkia springvillensis*. The action alternatives will not have any direct effects on Springville Clarkia individuals, seed bank, and suitable habitat. Furthermore, the draft EIS is anticipated to have insignificant indirect and cumulative adverse impacts on Springville Clarkia individuals, seed bank, and suitable habitat. In fact, provisions within all action alternatives could provide benefit for Springville Clarkia. Reintroduction of vegetation disturbance or fire into the ecosystem by means of careful fuels treatment, the timing of controlled burns, or managed wildfire has the potential to benefit this species (McCue et al. 1996, Carter 2001, Stebbins 2002) by reducing competition from other species and improving habitat (Parker 1988).

Introduction

This document was prepared in compliance with Section 7 of the Endangered Species Act (ESA) of 1973 (19 USC 1536 (c), 50 CFR 402) to review and document analysis alternatives in sufficient detail to determine effects on federally listed species and meet Forest Service direction (FSM 2672.42).

This biological assessment documents potential effects from this project on three listed plant species which occur or have potential habitat on the Sequoia National Forest. These are: Springville Clarkia; San Joaquin Adobe Sunburst (*Pseudobahia peirsonii*) and Kecks Checkerbloom. Springville Clarkia is the only species among these that has confirmed populations within the Monument. San Joaquin Adobe Sunburst is listed as Federally Threatened and the nearest population occurs 14 miles west and 1,000 feet lower than the Monument; however, some potential does occur for this species to occur in the Monument. Kecks Checkerbloom is Federally Endangered but there are no known populations or suitable habitat on the Sequoia National Forest. Two of the three designated critical habitat areas are located west of the Sequoia National Forest and project area. No other Federally listed plants are known or expected from the project area. Effects to Forest Service Sensitive plant species are addressed in a separate biological evaluation document (USFS 2009).

Consultation

This biological assessment conforms with legal requirements set forth under Section 7 of the Endangered Species Act (ESA) of 1973 as amended, and follows standards established in Forest Service Manual and Handbook direction (FSM 2671.2 & 2672.42, and R-5 FSH 2609.25) for Threatened, Endangered, and Sensitive species. Informal consultation on the monument planning effort was initiated in February 2010.

A species list was retrieved from the Internet from the Sacramento Field Office of the United States Department of the Interior Fish and Wildlife Service (USFWS) dated October 18th, 2011, that provides proposed and listed threatened and endangered species that may be present on the Sequoia National Forest. Bakersfield Cactus (*Opuntia basilaris var. treleasei*) and Springville Clarkia (*Clarkia springvillensis*) are the only listed species whose ranges include the Sequoia Nation Forest. Kecks Checkerbloom (*Sidalcea keckii*) is listed as having possible suitable on the Sequoia National Forest, west of the project area. No other USFWS proposed or candidate

plant species are found within the range of the Sequoia National Forest (USFWS 2009).

Current Management Direction

Current management direction and desired conditions for threatened, endangered and sensitive species on the Monument can be found in the following documents:

Endangered Species Act (ESA): The Endangered Species Act of 1973 (16 USC 1531 et seq.) requires that any action authorized by a federal agency not be likely to jeopardize the continued existence of a threatened or endangered (TE) species, or result in the destruction or adverse modification of habitat of such species that is determined to be critical. Section 7 of the ESA, as amended, requires the responsible federal agency to consult the USFWS and the National Marine Fisheries Service concerning TE species under their jurisdiction. It is Forest Service policy to analyze impacts to TE species to ensure management activities would not be likely to jeopardize the continued existence of a TE species, or result in the destruction or adverse modification of habitat of such species that is determined to be critical.

E.O. 13112 Invasive Species 64 FR 6183 (February 8, 1999): To prevent and control the introduction and spread of invasive species.

Forest Service Manual and Handbooks (FSMH 2670): Forest Service Sensitive (FSS) species are plant species identified by the Regional Forester for which population viability is a concern. The Forest Service develops and implements management practices to ensure that plants and animals do not become threatened or endangered and to ensure their continued viability on national forests. It is Forest Service policy to analyze impacts to sensitive species to ensure management activities do not create a significant trend toward federal listing or loss of viability. This assessment is documented in a biological evaluation (BE) and is summarized or referenced in this document.

2001 Sierra Nevada Forest Plan Amendment (2001 SNFPA): The Record of Decision (ROD) for the 2001 Sierra Nevada Forest Plan Amendment identified the following direction applicable to Forest Service Sensitive Plants and their habitats:

- Noxious weeds management.
- Wetland and Meadow Habitat.
- Sensitive Plant Surveys (Corrected Errata, April 19, 2005): Conduct field surveys for threatened, endangered, proposed, and sensitive (TEPS) plant species early enough in project planning process that the project can be designed to conserve or enhance TEPS plants and their habitat. Conduct surveys according to procedures outlined in the Forest Service Handbook (FSH 2609.25.11). If additional field surveys are to be conducted as part of project implementation, survey results must be documented in the project file. The standards and guidelines provide direction for conducting field surveys, minimizing or eliminating direct and indirect impacts from management activities, and adherence to the Regional Native Plant Policy (USDA Forest Service 2004).

Sequoia National Forest Land and Resource Management Plan (Forest Plan) (as modified by the 1990 Mediated Settlement Agreement [MSA]): The Forest Plan contains the following management direction applicable to Forest Service Sensitive Plants and their habitats:

- Sensitive Plants: Manage Sensitive plants to prevent the need for federal listing as threatened and endangered.

- Riparian Habitat: Within riparian areas, protect steamcourses and adjacent vegetation to maintain or improve overall habitat and water quality.

- Give preferential consideration to riparian-dependent resources when conflicts among land use activities occur.

- Delineate and evaluate riparian areas prior to implementing any project activity.

Draft Species Management Guide for *Clarkia Springvillensis* (USDA 1996):

- Maintain and enhance viable populations of *Clarkia springvillensis*.

- Preserve and restore habitat conditions which will promote the geographic distribution and genetic diversity of the species.

- Minimize potential, negative impacts of management activities.

***Opuntia basilaris var. treleasei* Section in "Recovery Plan for Upland Species of the San Joaquin Valley, California" (USFWS 1998):**

- Maintain self-sustaining populations in protected areas representative of the former geographic/topographic range and in a variety of appropriate natural communities.

- Unoccupied habitat within metapopulations also should be protected to facilitate movement of pollinators and seed dispersers.

- Avoid fragmentation of the few large metapopulations that remain.

Regional Native Plant Policies (USDA 2008 FSM Chapter 2070):

- Maintain, restore or rehabilitate native ecosystems so that they are self-sustaining, resistant to invasion by non-native invasive species and/or provide habitat for a broad range of species including, threatened, endangered, and rare species.

- Maintain adequate protection for soil and water resources, through timely and effective revegetation of disturbed sites that could not be restored naturally.

- Promote the use of native plant materials for the revegetation, rehabilitation and restoration of native ecosystems.

- Promote the appropriate use and availability of both native and non-native plant materials.

- Cooperate with other federal agencies, state agencies and local governments, tribes, academic institutions and the private sector to increase the knowledge and availability of native plant materials, including developing sources of genetically appropriate plant

materials.

- Increase and disseminate information which will guide the selection, use, and availability of genetically appropriate plant materials.

- Promote the study, planning, and implementation of actions which will maintain, restore and rehabilitate native ecosystems on NFS lands and other lands administered by the Forest Service and in the United States.

Description of Proposal

Below is a description of elements of the six alternatives in the draft EIS considered important to Forest Service sensitive plants and their habitats. A complete description of the Alternatives can be found in Chapter 2 of the draft EIS.

No Action Alternative

The No Action Alternative contains four Standards and Guidelines for Forest Service sensitive plants and their habitats:

- Minimize or eliminate direct and indirect effects from management activities on TEPS plants unless the activity is designed to maintain or improve plant populations.

- Prohibit or mitigate ground-disturbing activities that negatively affect hydrologic processes that maintain water flow, water quality, or temperature critical to sustaining fen ecosystems and the plant species dependent on them. During project analysis, survey, map and protect fens from activities such as trampling by livestock, pack stock, humans, and from wheeled vehicles. Criteria for defining fens include, but are not limited to: presence of sphagnum moss (*Sphagnum spp*.), presence of mosses in

  the genus *Meesia*, presence of sundew (*Drosera ssp*.). Complete initial inventories of fens within active grazing allotments prior to re-issuing permits.

- Conduct field surveys for threatened, endangered, proposed, and sensitive (TES) plant species early enough in the project planning process so that the project can be designed to conserve or enhance TES plants and their habitat. Conduct surveys according to procedures outlined in the Forest Service Handbook. If additional field surveys are conducted as part of project implementation, document the survey results in the project file.

- Ensure that all projects involving re-vegetation (planting or seeding) adhere to regional native plant policies.

Common to All Alternatives (except Alternative E)

In the DEIS, All Action Alternatives (except E) included the same four Standards and Guidelines for Forest Service sensitive plants and their habitat found in the No Action Alternative above.

One of these Standards and Guidelines is now considered to be duplicative of law, regulation, or policy. This item is not included in the FEIS as a standard and guideline, but is now included in the Legal and Regulatory Compliance section. Therefore in the FEIS, all action alternatives (except Alternative E) will only contain three Standards and Guidelines for Forest Service sensitive plants and their habitats:

- Minimize or eliminate direct and indirect effects from management activities on TEPS plants unless the activity is designed to maintain or improve plant populations.

- Prohibit or mitigate ground-disturbing activities that negatively affect hydrologic processes that maintain water flow, water quality, or temperature critical to sustaining fen ecosystems and the plant species dependent on them. During project analysis, survey, map and protect fens from activities such as trampling by livestock, pack stock, humans, and from wheeled vehicles. Criteria for defining fens include, but are not limited to: presence of sphagnum moss (*Sphagnum spp*.), presence of mosses in the genus *Meesia*, presence of sundew (*Drosera ssp*.). Complete initial inventories of fens within active grazing allotments prior to re-issuing permits.

- Conduct field surveys for threatened, endangered, proposed, and sensitive (TES) plant species early enough in the project planning process so that the project can be designed to conserve or enhance TES plants and their habitat. Conduct surveys according to procedures outlined in the Forest Service Handbook. If additional field surveys are conducted as part of project implementation, document the survey results in the project file.

Alternative E

Alternative E contains no standards and guidelines for Forest Service sensitive plants and their habitats. However, it does contain provisions from the Forest Service Manual and Handbooks (FSM/H 2670) for management of sensitive plants.

All action alternatives allow for the reintroduction of vegetation disturbance or fire into the ecosystem by differing combinations of careful fuels treatment, timing of controlled burns, or managed wildfire.

Affected Environment

The Monument encompasses a broad range of habitats and elevations, ranging from Blue Oak Woodland at 1,000 feet to Alpine fell fields at over 10,000 feet. Bedrock geology is dominated by large expanses of granitic plutons with moderate-sized inclusions of meta-volcanic and meta-sedimentary roof pendants. Four major biotic provinces converge on the Sequoia National Forest. The southern Sierra Nevada is a floristic melting pot between the Central Valley and the Mojave Desert and also between the High Sierra and the southern California Mountains. This confluence of diverse floras creates a high density of rare endemic plants and many interesting plant communities.

There are three federally listed plant species that occur or have potential habitat on the Sequoia National Forest: Springville Clarkia (*Clarkia springvillensis*); San Joaquin Adobe Sunburst (*Pseudobahia peirsonii*); and Kecks Checkerbloom, (*Sidalcea keckii*). Springville Clarkia is the only species among these that has confirmed populations within the Monument. San Joaquin

Adobe Sunburst is listed as Federally Threatened and the nearest population of occurs 14 miles west and 1,000 feet lower than the Monument; however, some potential does occur for this species to occur in the Monument. Kecks Checkerbloom is Federally Endangered. Designated critical habitat and historic populations of this species lie 10 miles west and 1,500 feet below the western monument boundary. There are no known populations or suitable habitat of Kecks Checkerbloom on Monument. There are no known populations of San Joaquin Adobe Sunburst. Kecks Checkerbloom and San Joaquin Adobe Sunburst will not be addressed in this environmental analysis.

Species Accounts

As Springville Clarkia is the only listed species found within the Monument, a detailed species account is found below. Species descriptions for the species dismissed earlier (*Psuedobahia personii, Opuntia basilaris var. treleasei,* and *Sidalcea keckii*) are shown in Appendix A.

***Clarkia springvillensis* (Springville clarkia)**

Taxonomy.—Frank Vasek (1964a) described and named *Clarkia springvillensis*; the scientific name has remained unchanged since that time. He suggested that *C. springvillensis* evolved from *C. unguiculata* (elegant clarkia), as did C. exilis (slender clarkia) and C. tembloriensis (Temblor clarkia). Although the four species are closely related, various chromosomal differences and barriers to hybridization maintain their uniqueness (Vasek 1964b, 1977, Holsinger 1985). *Clarkia springvillensis* has only one common name, Springville clarkia; both the common name and specific epithet refer to the Tulare County community of Springville, near where the species is found. The type locality is 2.9 kilometers (1.8 miles) north of the Springville Ranger Station on Balch Park Road (Vasek 1964a). *Clarkia springvillensis* is a member of the Onagraceae (evening primrose family).

Description.—*Clarkia springvillensis* is a rather tall, willowy annual herb with showy four-petaled flowers. The petals are lavender-pink and unusually shaped: the lower half of the petal (i.e., the claw) is very narrow, and the upper half (i.e., the limb) is diamond-shaped. Typically, each petal has a prominent dark purplish spot at the base of the limb (Lewis, 1993).

The upright stems of *Clarkia springvillensis* are up to 1 meter (3.3 feet) tall and typically have several branches. The leaves are lance-shaped, ranging from 2 to 9 centimeters (0.8 to 3.5 inches) long and 0.5 to 2 centimeters (0.2 to 0.8 inch) wide. Both the stems and the leaves are grayish-green and hairless. The flower buds are bent downwards. Each flower has four sepals and four petals. The long, narrow sepals are dark reddish-purple, are hairless or covered with very short hairs, and stay attached at their tips when the flower opens. The petals are approximately 1.5 centimeters (0.6 inch) long, with the claw portion accounting for approximately half the length. The claws are red, whereas the limbs are normally lavender-pink and spotted (Vasek 1964a, Lewis 1993). However, a small percentage of plants lack the purple spot on the petals (Vasek 1977). *Clarkia springvillensis* has eight stamens and a style that is 1.4 to 2 centimeters (0.6 to 0.8 inch) long, which is longer than the stamens. The inferior ovary is 1.0 to 1.7 centimeters (0.4 to 0.7 inch) long, is hairless or covered with very short hairs, and has eight lengthwise grooves. The fruit is a long, narrow capsule with many seeds; because the capsule develops from the ovary, it has the same type of hairs (Vasek 1964a, Lewis 1993). The seeds are tiny, approximately 0.5 millimeter (0.02 inch) wide by 1 millimeter (0.04 inch) long (McCue and Holtsford 1998). The diploid chromosome number of *C. springvillensis* is 18 (Vasek 1964a, 1964b).

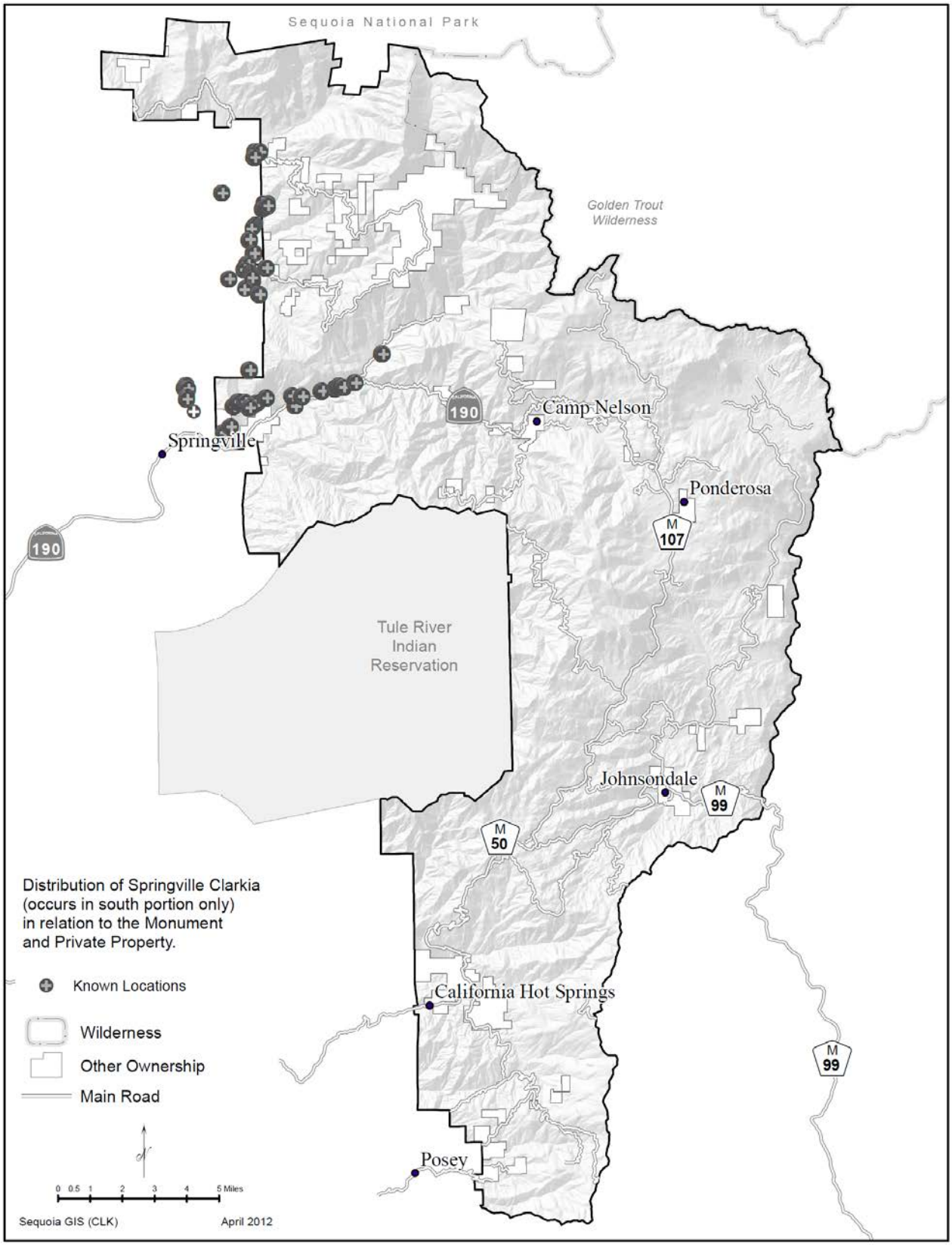
Identification.—The close relatives of *Clarkia springvillensis* differ in the type of hairs on the sepals and ovaries, color of the flower parts, and style length. However, many plants have been observed that have characteristics intermediate between *C. springvillensis, C. unguiculata*, and C. exilis, or that combine the diagnostic characteristics of two or more species, making identification problematic (EA Engineering and Stone 1999, Sanders and Stewart 2000, Stewart 2002). The diagnostic character for *C. unguiculata* is the presence of long hairs on the sepals, ovaries, and capsules in addition to the short hairs, whereas *C. springvillensis* has only short hairs or no hairs on these structures. *C. unguiculata* also has longer petals that range in color from salmon to maroon and usually does not have a spot on the petals, or the spot is smaller than the one in *C. springvillensis*; and has a shorter ovary. Clarkia exilis and *C. tembloriensis* are similar to *C. springvillensis* in that they lack long hairs on the sepals and ovary. However, *C. exilis* has shorter petals with much smaller purple spots than *C. springvillensis*, its leaves are bright green, and the style is no longer than the stamens. *Clarkia tembloriensis* differs from *C. springvillensis* in that the former has greenish sepals rather than reddish-purple and the petals usually are not spotted (Vasek 1964a, 1977, Holsinger 1985, Lewis 1993). Among the closely-related species, only *C. unguiculata* regularly co-occurs with *C. springvillensis* (Stebbins 2002).

Clarkia cylindrica (speckled clarkia) and *C. dudleyana* (Dudley's clarkia), two species that are sympatric with *C. springvillensis*, are easily distinguished from the latter because they have broad, fan-shaped petals without claws (Lewis 1993).

Historical Distribution.—This species was first collected in 1895 north of Springville, but the specific collection locality is unknown. In the late 1950s, Vasek found *Clarkia springvillensis* at the type locality (Vasek 1964a, 1964b). By 1985, the species had been reported from a total of seven sites, all in the vicinity of Springville (Stebbins and Clark 1992). Additional sites were discovered over the next decade (McCue-Harvey and Holtsford 1994, CDFG 2004), bringing the total number of historical occurrences to 15. The California Natural Diversity Data Base (CDFG 2004) actually includes 16 occurrences of *C. springvillensis*, but species experts (Holsinger 1982, Stebbins and Clark 1992, Stebbins 2001) consider Element Occurrence 2 in the Kaweah River watershed of Tulare County to be erroneous. Thus, that occurrence is excluded from this recovery plan even though it was included in the final rule listing this species as endangered (USFWS 1998). Two other reported sightings of this species from recent surveys in the Tule River watershed are unconfirmed (USDA Forest Service 1996b), are not included in the California Natural Diversity Data Base (CDFG 2004), and will not be discussed herein. Conversely, Element Occurrence 16 is considered herein to represent *C. springvillensis* even though the flowers are not typical. The petals range in color from white to maroon but the plants do not have long hairs on the sepals or ovary (U.S. Bureau of Land Management, 1996). The lack of long hairs on the ovary led Holtsford to agree that the plants probably represent *C. springvillensis* (Carter 2001), but the identification must be considered tentative because species experts have not had the opportunity to observe specimens directly (Stebbins 2002).

All 15 historical occurrences of *Clarkia springvillensis* were in the watershed of the upper Tule River in Tulare County. Four were along the Middle Fork of the Tule River, with the others in the watershed of the North Fork of the Tule River, although not along the river itself (CDFG 2004). The total range was approximately 88 square kilometers (34 square miles), with the most distant points of the range approximately 13 kilometers (8 miles) apart. Based on genetic considerations, McCue et al. (1996) speculated that the distribution of *C. springvillensis* plants within their range was more continuous in the recent past and the populations became fragmented approximately 60 years ago (shown in the following map).

Map 1 - Distribution Map of Springville Clarkia



Current Distribution.—The California Natural Diversity Data Base (CDFG 2004) considers 14 of the above 15 historical occurrences of *Clarkia springvillensis* to be extant with only the type locality (Element Occurrence 1) extirpated. However, the population at Coffee Camp (Element Occurrence 4) along the Middle Fork of the Tule River has not been seen since 1967 despite repeated searches (Stebbins and Clark 1992, CDFG 2004) and is most likely extirpated (Stebbins 1991, Stebbins and Clark 1992).

A number of additional populations have been discovered in recent years (USDA Forest Service 1998b, EA Engineering and Stone 1999, Sanders and Stewart 2000, Stewart 2002) that are not catalogued by the California Natural Diversity Data Base (CDFG 2004). The actual number of occurrences is difficult to determine because some are believed to be misidentifications of *Clarkia unguiculata*, some are intermediate in diagnostic characteristics (see "Identification" above), and because some of those reporting new discoveries have considered each individual colony of *C. springvillensis* plants to be a separate population. If the typical approach of the California Natural Diversity Data Base to designating occurrences is applied and their species identifications are accepted, the 20 "localities" reported by EA Engineering and Stone (1999) along the Middle Fork of the Tule River in the vicinity of Siphon Canyon would constitute four occurrences and a site reported along Plano Road in Porterville (Stewart 2002) would be another occurrence. Another site that was found in 2002 near the type locality (Stewart 2002) may be new or could be a rediscovery of Element Occurrence 1, which was presumed to be extirpated.

If 19 *Clarkia springvillensis* occurrences are presumed to be extant (the 6 described in the previous paragraph plus the 13 mentioned in the first paragraph under "Current Distribution") 12 are wholly or partially on Federal lands, 1 is partially on State land, and 3 are partially on county-owned lands. The federally-owned sites include 9 entire occurrences (Element Occurrences 3, 6, and 12 through 15 and three unnumbered elements, 13 and 15 are private and not federal ownership, element 9 is believed to be on federal land) and part of 2 others (Element Occurrence 8 and one unnumbered) on the Sequoia National Forest plus one (Element Occurrence 16) on U.S. Bureau of Land Management. The State-owned Springville Clarkia Ecological Reserve encompasses part of Element Occurrence 5. The Tulare County Department of Education owns another part of Element Occurrence 5, plus parts of Element Occurrences 7 and 11. Element Occurrences 9 and 10, parts of Element Occurrences 5, 7, 8, and 11, and two of the newly-discovered occurrences are in private ownership (EA Engineering and Stone 1999, CDFG 2001, Stewart 2002). Thus, the two largest populations (Element Occurrences 5 and 15 [15 appears to be on private land]) occur mostly or entirely on public land. One of the two of the newly-discovered occurrences on private land is in an area covered by a conservation easement (Stewart 2002). Of the two occurrences that are presumed to be extirpated, one (Element Occurrence 4) is on the Sequoia National Forest and the other (Element Occurrence 1) is in private ownership.

The watershed of the North Fork of the Tule River remains the primary area of concentration with 11 of 19 extant occurrences (57.9 percent); within that watershed, the Rancheria Creek drainage alone supports 7 of the extant occurrences. The Middle Fork drainage of the Tule River contains 7 extant occurrences (36.8 percent), and the other is in the watershed of the lower Tule River in Porterville. Botanists familiar with the species agree that additional, as yet undiscovered, populations of *Clarkia springvillensis* likely occur along the Middle and North Forks of the Tule River (USDA Forest Service 1998c, EA Engineering and Stone 1999, Sanders and Stewart 2000, Carter 2001, Stebbins 2001). Three occurrences of *C. springvillensis* (Element Occurrences 3, 6, and 9) are in the Lower Batholith Subsection of the Sierra Nevada Section. All others are (or were historically) in the Lower Granitic Foothills Subsection of the

Sierra Nevada Foothills Section (USDA Department of Agriculture 1994).

Numerous previously undocumented colonies were discovered after the Coffee Fire (1999) along the SCE flume and Siphon Canyon. The Deep Fire (2004) opened several thousand acres of habitat to possible population expansion or new discovery in the drainages above Coffee camp and Milk Canyon. Prior to the fire the area was inaccessible due to steep terrain and dense brush. The Forest Service hopes to complete informal surveys in the area to determine presence of Clarkia springvillensis.

Reproduction and Demography.—*Clarkia springvillensis* is an annual herb. The seeds of this species typically germinate in late November or early December under field conditions (McCue and Holtsford 1998). Germination may continue into January (USDA Forest Service 1998b), although earlier germination results in greater flower production (McCue 1997). The optimal conditions for germination have not been determined, but high rates of germination were observed in growth chambers under 12 hours of daylight at 22 degrees Celsius (72 degrees Fahrenheit) and 12 hours of darkness at 6 degrees Celsius (42 degrees Fahrenheit) (McCue and Holtsford 1998).

Clarkia springvillensis plants usually begin flowering in May and continue flowering into June (Wise 1987, Martin 1990, 1991, Stebbins 1991, Hansen 1992, Stebbins and Clark 1992, U.S. Bureau of Land Management 1999, CDFG 2004). However, in some years this species may reach peak flowering in April (Martin 1988, 1989, Stewart 2002). *Clarkia springvillensis* seems to bloom somewhat earlier than the sympatric *C. unguiculata*, although their flowering periods do overlap (EA Engineering and Stone 1999). After flowering, *C. springvillensis* plants drop their leaves (Vasek 1977). The fruits mature during June and July (Wise 1987, McCue 1997b) and disperse seeds in July or August (McCue and Holtsford 1998, U.S. Bureau of Land Management 1999). The seeds are dispersed by gravity and have no special adaptations to facilitate dispersal (McCue et al. 1996). Dead plants can remain in place for a year or more; some seeds can be retained inside the capsules even one year after they mature (McCue-Harvey and Holtsford 1994). The only estimate of seed production under natural conditions is from a single population in just one year; there, open-pollinated flowers produced an average of 27 seeds per capsule (McCue 1997b).

Clarkia species are pollinated by bees (superfamily Apoidea) (MacSwain et al. 1973), but the particular species that pollinate *Clarkia springvillensis* have not been determined. Although most of its seeds (approximately 85 to 90 percent) are produced by cross-pollination (Vasek 1977, Holtsford and Ellstrand 1992), *C. springvillensis* is self-compatible. McCue (1997) found that the relative effectiveness of cross-pollination and self-pollination in seed set differed between the two populations she studied, and in two different years. In one population, cross-pollination resulted in greater seed production in the first year, whereas in the second year in that population, and both years in the other population, seed production did not differ between cross-pollinated and self-pollinated flowers. Self-pollination is limited under natural conditions because the male reproductive parts in a given flower mature approximately 3 days before the female parts (Vasek 1977); pollen from another flower on the same plant would have to reach the receptive female parts in order for self-pollination to occur. *Clarkia springvillensis* differs from its close relatives in that five or more flowers on a single plant may be open simultaneously (Vasek 1964a), and thus the potential for self-pollination among flowers on a plant does exist.

Clarkia springvillensis seeds can remain dormant for at least 2 years, and they form a soil seed bank (McCue and Holtsford 1998). The maximum duration of dormancy for seeds in the soil seed bank is unknown. Researchers from the University of Missouri at Columbia have

investigated many aspects of seed longevity and seed bank formation. When stored in coin envelopes at room temperature, 2-month-old seeds had 96 percent viability, and 14-month-old seeds had 90 percent viability. In laboratory germination tests on seeds collected directly from the plants, they found that approximately 6 percent of viable seeds remained dormant after two growing seasons, even after being exposed to conditions favorable for germination. Seeds stored at room temperature for 8 years exhibited 3 percent germination, and none of the seeds that did not germinate were viable (McCue and Holtsford 1998). However, the viability and germination rates for seeds in dry storage are not necessarily indicative of those for seeds that remain in the soil. McCue and Holtsford (1998) also collected soil from within three natural populations in April 1993, after germination but before seed set, and subjected them to suitable germination conditions. Approximately 25 percent of the soil samples produced Clarkia springvillensis seedlings, which must have come from seeds that had gone through at least one growing season without germinating. Soil samples collected after seed set in July 1993 also produced seedlings, which could have come from seeds produced during the growing season of 1993 or from seeds that remained dormant for two or more growing seasons. Standing dead stems from the previous year also harbored some seeds, but their viability was not tested (McCue-Harvey and Holtsford 1994). The density of ungerminated seeds in the soil throughout three populations was estimated at 65 per square meter (6 per square foot) in April 1993, 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 number of above-ground plants is not a good indicator of population status in Clarkia *springvillensis*. The presence of a seed bank greatly increases the effective population size of this species. For example, based on the number of plants seen above-ground, 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). Due to interactions between the seed bank and seasonal weather conditions, above-ground population size can vary enormously from one year to the next. The number of *C. springvillensis* plants present in permanent plots within one population (Element Occurrence 5) was 1,478 in 1987. The population size tripled from by the next year (to 5,328 plants in 1988), doubled again between 1988 and 1989 (to 10,965), then dropped to half of its original size in 1990 (718 plants). The following year, it dropped again to 191, then rebounded to 462 (Hansen 1992). Population size has not been estimated on the permanent plots since 1992 (Hansen 2001).

Rainfall patterns and temperatures during the growing season are thought to influence above-ground population size, but these factors have not been the subject of statistical analyses. Martin (1989) suggested that the amount of precipitation in November and December might be correlated with spring population size in *Clarkia springvillensis*. Hansen (1992) also noted that above-ground population sizes were highest in years when the area received at least 1.3 centimeters (0.5 inch) of rain by the end of December (1987 through 1989), compared to years when that total was not reached until January or later. McCue-Harvey and Holtsford (1994) indicated that above-ground population size seemed to be related to rainfall, but they did not identify particular months.

An index of relative population size is the maximum number of plants recorded in a single occurrence. At their maximum size (all of which occurred within the past 15 years), eight occurrences contained between 100 and 300 plants at their maximum size, one (Element Occurrence 15) contained “thousands,” and one (Element Occurrence 5) contained over

100,000 individuals at its maximum. No estimates are available for the other three occurrences presumed to be extant (CDFG, 2004).

Survival rates have not been well documented in *Clarkia springvillensis*. In a 1994-1995 field trial at two sites, none of 66 seedlings present in March at one site survived to reproduction, and at the second site only 1 of the 75 seedlings survived from March to reproduction (McCue 1997). Most likely, other seedlings died between germination and the first count in March. California ground squirrels (*Spermophilus beecheyi*) were the primary mortality factor in that field study because their burrowing activities buried and uprooted seedlings (Fuller 1995). When seedlings were grown in the greenhouse the following year, 314 of 340 (92.4 percent) survived to reproduction (McCue 1997).

In a study of population genetics, McCue et al. (1996) found that the amount of genetic diversity in *Clarkia springvillensis* was in the range expected for other annual plant species with similar reproductive strategies and narrow geographic ranges. The three different populations they studied were very similar in genetic diversity overall, although one (Element Occurrence 3) had several unique alleles not found at the other sites. McCue and Holtsford (1998) credited the seed bank with maintaining genetic diversity in the species despite the small size of the above-ground populations. Unexpectedly high levels of genetic variation within the individual populations were attributed to genetic drift, but it was not considered to be a severe problem (McCue et al. 1996, McCue 1997). Experimental inbreeding did not reveal any overall detrimental effects on seed germination, seedling survival, or reproduction, although the offspring produced by certain parent plants did suffer inbreeding depression (McCue 1997).

Habitat and Community Associations.—*Clarkia springvillensis* grows in openings within the chaparral and foothill woodland plant communities and the transition zones between them (Stebbins and Clark 1992, U.S. Bureau of Land Management 1996, USDA Forest Service 1998a, 1998b, CDFG 2001, Stebbins 2001). The most favorable sites for *C. springvillensis* seem to be steep slopes that face south or west and where tree and grass cover are sparse (Stebbins 1991, Stebbins and Clark 1992, McCue et al. 1996). However, others have noted that the highest densities of *C. springvillensis* occur where the trees or shrubs provide some afternoon shade (Wise 1987, Martin 1989, 1990, EA Engineering and Stone 1999). Cleared or burned areas in chaparral provide favorable habitat (Stebbins 2002). The chaparral surrounding these openings is dominated by *Adenostoma fasciculatum* (chemise), with other shrubs such as *Arctostaphylos viscida* ssp. *viscida* (whiteleaf manzanita), *Ceanothus cuneatus* (California lilac), *Fremontodendron californicum* (flannelbush), *Lupinus albifrons* (silver lupine), and *Toxicodendron diversilobum* (poison oak). Typical dominants in the woodland communities where *Clarkia springvillensis* (Springville clarkia) occurs are *Quercus douglasii* (blue oak), *Q. Wislizenii* (interior live oak), and *Aesculus californica* (California buckeye) (Stebbins 1991, Stebbins and Clark 1992, USDA Forest Service 1996b, EA Engineering and Stone 1999, CDFG 2004). Openings maintained by human activities along roadsides and utility rights-of-way seem to provide favorable habitat, as do recently burned areas. Sparse woody cover may be present where *C. springvillensis* grows along these corridors and grazing and herbicide spraying often are excluded (EA Engineering and Stone 1999, Stebbins 2002).

The soils that support *Clarkia springvillensis* are loams or sandy loams derived from decomposed granite (U.S. Bureau of Land Management 1999; CDFG 2004). Two separate studies (Wise 1987, Stebbins and Clark 1992) that characterized soil texture at *C. springvillensis* sites found that fine gravel and fine sand are the primary components (approximately 28 percent and 25 to 26 percent, respectively), followed by coarse sand (20 percent), silt and clay (17 to 18 percent combined), and gravel (9 percent). Historically, this

species occurred at elevations ranging from 335 to 1,219 meters (1,100 to 4,000 feet), but the lowest-elevation site that remains extant is at 610 meters (2,000 feet) (CDFG 2004).

Clarkia cylindrica (speckled clarkia), *C. Dudleyana* (Dudley's clarkia), and *C. unguiculata* (fairy fan) can be found growing with *Clarkia springvillensis* (Stebbins and Clark 1992, McCue-Harvey and Holtsford 1994, USDA Forest Service 1996, CDFG 2004). *Clarkia unguiculata* is more likely to co-occur with *C. springvillensis* in foothill woodland sites than in chaparral, and in hotter, drier microhabitats rather than moist microhabitats (EA Engineering and Stone 1999).

Most of the other herbaceous associates of *Clarkia springvillensis* are nonnative species. These include the forbs, *Brassica* and *Sisymbrium* species (wild mustards), *Centaurea melitensis* (tocalote), *Erodium* species, and *Silybum marianum* (milk-thistle), as well as several grasses: *Avena* species (wild oats), *Bromus diandrus* (ripgut), *Bromus hordeaceus* (soft chess), *Bromus madritensis ssp. rubens* (red brome), *Hordeum* species (wild barley), and *Vulpia* species (annual fescues) (Stebbins 1991, Hansen 1992, Stebbins and Clark 1992, USDA Forest Service 1996, EA Engineering and Stone 1999, CDFG 2004).

Reasons for Decline.—*Clarkia springvillensis* apparently declined due to a complex combination of past inappropriate livestock grazing (Shevock 1985, Stebbins 1991, Hansen 1992, USDA Forest Service 1996), nonnative plants (McCue et al. 1996), and altered fire regimes (McCue et al. 1996, Carter 2001, Stebbins 2002). Livestock do not specifically seek out *C. springvillensis* until late in the season when it is the only species still green and growing (Stebbins 2001), but they may consume it incidentally earlier in the season while eating the associated plants (USDA Forest Service 1998). Past 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, Stebbins 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 populations were then fenced to exclude livestock (Stebbins 1991). As of 1993, 8 of the 13 extant occurrences were still subject to grazing; 2 of those on the Sequoia National Forest [13 and 15 are on private land, 12 and 14 have been either fenced or deferred grazing until seed set since 1995.] were judged to have serious grazing problems at that time, whereas the other sites had less severe problems (CDFG 2004).

Nonnative plants, especially *Bromus* species, may have contributed to the decline of *Clarkia springvillensis* by competing directly for moisture and nutrients (Stebbins 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, Stebbins 2001). Prolonged grazing may have exacerbated these problems because soil disturbance favors nonnative plants over native species (Hansen 1992). However, in areas where livestock have been excluded completely, thatch build-up is more severe (Stebbins 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 *C. springvillensis* by allowing encroachment of shrubs and trees into the openings where it grows (McCue et al. 1996, Carter 2001, Stebbins 2002). Lack of fire also would contribute to thatch accumulation (Stebbins 2002).

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

(Shevock 1985, Stebbins 2001). However, road maintenance and improvements affected *Clarkia springvillensis* on these banks to some extent (CDFG 2004, Stebbins 1991, 2002). Road maintenance includes activities such as mowing, grading, spraying herbicide, mechanically removing brush, and clearing culverts (USDA Forest Service 1996), whereas road improvements are activities such as widening or straightening roads, or installing culverts. Mowing most likely reduced seed production because it took place when *C. springvillensis* was flowering; the timing was chosen to remove the annual grasses as soon they stopped growing (Shevock 1985). However, *C. springvillensis* population sizes and seed banks were not being monitored at that time, so effects cannot be quantified. Road improvements apparently extirpated Element Occurrence 1 (Stebbins, 2001) and damaged, but did not eliminate, Element Occurrences 3 (Stebbins and Clark 1992) and 16 (Carter 2001). Additional activity along main roads includes maintenance of firebreaks. Element 3 was affected on an annual basis by construction of a 3 feet wide fuelbreak scraped to bare mineral soil each year. The fuelbreak was repopulated each year, presumably from adjacent seed plants. This practice was modified in 1995 after listing, however, additional coordination/ education may be needed in this area.

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); however, the home was never built (see "Conservation Efforts," p.II-39). 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 (CDFG 2001, Stebbins 2001).

Threats to Survival.—Currently, the primary threat to the survival of *Clarkia springvillensis* is competition and thatch build-up from nonnative plants (Hansen 1992, McCue 1997, Stebbins 2002). Aggressive, nonnative plants such as *Bromus* species, *Brassica* species, *Torilis* species (hedge-parsley), and *Centaurea melitensis* 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* (Hansen 1992), but is actually *C. melitensis* (Cypher 2003, Stebbins 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, U.S. Bureau of Land Management 1999) at all of the extant sites.

Grazing is not currently a threat. Although the U.S. Forest Service does still allow grazing in three allotments within *Clarkia springvillensis* habitat, they have taken steps to prevent cattle from accessing the plants until after seed set (see also "Conservation Efforts" below). One national forest pasture where *C. springvillensis* grows is still grazed by horses, but the animals have not been observed to graze the occupied habitat (Anderson 2002, Stewart 2002). The occurrences on Tulare County Department of Education lands are only lightly grazed (Mitchell 2001) Grazing in several years has been observed to exceed the FS standard of 700 lbs RDM but combined with timing and thatch removal effects do not appear to limit the population (Anderson 2004) and the timing appears to be favorable for *C. springvillensis* (Anderson 2002).

Properly managed grazing, where livestock are removed by April and not allowed to spend too long in any one area, actually could benefit Clarkia springvillensis by helping to control nonnative competitors (McCue 1997, Mitchell 2001, Stebbins 2001, Anderson 2002). Heady (1975) found early season grazing tended to favor greater cover of broad-leaved species by controlling graminoides. Controlled fires also could be used to reduce competition from both nonnative herbs and native tree and shrub species. Thus, fire suppression is a continuing threat for this reason (McCue 1997, Carter 2001). Although creating openings in chaparral would in

itself be beneficial, fire could create another problem by allowing livestock access to *C. springvillensis* plants that otherwise would have been shielded by shrubs (Carter 2001). The effect of opening chaparral with both the potential for exposing new or existing populations to grazing would be mitigated on federal lands by exclosure fencing or timing of use.] In addition, germinating seeds or growing plants of *C. springvillensis* would likely be killed by the heat of fires that occurred during the growing season (California Department of Fish and Game 1990, Carter 2001). One area fenced to exclude livestock in 1999 on NFS lands has been over taken by brush and no longer appears to support *Clarkia springvillensis* (Loehner 2004).

Road maintenance still is a problem 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. Although this species occurs along some roads administered by the U.S. Forest Service, *C. 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 (Anderson 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 (USDA Forest Service 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 (USDA Forest Service 1996), and in fact appears to be beneficial to *Clarkia springvillensis* if done during that time (Stebbins 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.

Grading is a problem only in level areas, which are uncommon adjacent to the roads where this species grows (USDA Forest Service 1996). Of the two such occurrences, one is not likely to be graded again because it is in a remote area and crosses public land; a former incidence of grading was due to miscommunication among agencies (Carter 2001). The other site where *Clarkia springvillensis* grows on the level edge of a road may continue to be affected by periodic grading and dumping of sand (Holtsford 1994).

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 (Pacheco 1997).

Nature walks for large groups conducted on Tulare County Department of Education lands were cited as a threat in the final rule (U.S. Fish and Wildlife Service 1998). However, the director of the educational facility where *Clarkia springvillensis* grows has indicated that the populations are away from the areas where tours are conducted (Mitchell 2001).

Despite the apparently small size of *Clarkia springvillensis* populations, this species does not exhibit all of the detrimental effects common to small populations. McCue and her colleagues determined that the seed bank adequately protects this species from genetic drift and inbreeding depression under current conditions, provided that the individual populations do not become any more fragmented (McCue 1997b). However, catastrophic events such as severe erosion or human activities that removed large quantities of soil could reduce or eliminate the seed bank from a site and lead to extirpation of that population.

Conservation Efforts. - The U.S. Fish and Wildlife Service (1994) proposed that *Clarkia springvillensis* be listed as a federally threatened species and published the final rule listing it as

threatened four years later (U.S. Fish and Wildlife Service 1998). *Clarkia springvillensis* has been listed as an endangered species by the State of California Fish and Game Commission since 1979 (California Department of Fish and Game 1997). The California Native Plant Society considers this species to be "fairly endangered," and includes it on List 1B (Tibor 2001).

The California Department of Fish and Game has made numerous contributions to the conservation and recovery of *Clarkia springvillensis*. In 1986, they used money from the Environmental License Plate Fund to purchase 1.8 hectares (4.5 acres) of habitat (Stebbins 1991, Stebbins and Clark 1992), which is now designated as the Springville Clarkia Ecological Reserve. The property had been partially fenced when purchased, and in 1989 the California Department of Fish and Game fenced the remainder. Since that time, the pre-existing fence was found to have been improperly aligned; thus, the fenced area actually includes some land that is in private ownership, where approximately half the population of *C. springvillensis* grows (Ashford 1989, California Department of Fish and Game 1990, Stebbins 1991). There was extensive trespass grazing on the Reserve by both cattle and horses from adjacent private land until the fence was rebuilt in May of 1999. The California Department of Fish and Game funded annual monitoring of the Springville Clarkia Ecological Reserve population from 1987 through 1992 (Hansen 1992). Funding from the California Endangered Species Tax Check-off paid for preparation of a status survey (Stebbins 1991), which helped to justify the Federal listing of *C. springvillensis*, and an educational booklet for distribution at the Springville Clarkia Ecological Reserve (Stebbins and Kirkpatrick n.d.). The California Department of Fish and Game also sponsored research on *C. springvillensis* population genetics and seed bank dynamics (McCue-Harvey and Holtsford 1994, McCue et al. 1996, McCue 1997, McCue and Holtsford 1998).

The Forest Service and the Bureau of Land Management manage lands supporting *Clarkia springvillensis* and have conducted various activities to further its conservation. The Forest Service prepared management guidelines for the conservation of *C. springvillensis* on the Sequoia National Forest (Anderson 1987). They also instituted various restrictions on grazing in *C. springvillensis* habitat including (1) suspending one grazing permit (Key 1994), (2) installing a fence around one population of *C. springvillensis* to exclude cattle (USDA 1998a, Anderson 2002), (3) surveying unfenced, grazed areas annually, (4) excluding cattle from another pasture until after seed set (Anderson 2002), and (5) requiring that a specified amount of vegetation remain in grazed areas at all times (USDA 1998a). Other Forest Service conservation efforts include monitoring populations on National Forest System (NFS) lands, conducting surveys in potential habitat (Key 1994), and providing educational programs for State and county employees working in the area (Anderson 2002). The Bureau of Land Management also conducted limited surveys for this species in 1995; much potential habitat is difficult to survey due to impenetrable chaparral vegetation (U.S. Bureau of Land Management 1996a, Carter 2001). Both agencies have plans to do controlled burns to benefit this species in cooperation with the California Department of Forestry and Fire Protection and the California Department of Fish and Game (USDA 1998a, USDA Forest Service 1998b, Bureau of Land Management 1999). Wildfires burned portions of element 5 in 1998, portions of unnumbered populations near Coffee Camp in 1998 and potential habitat from Coffee Camp through Milk Canyon in 2004.

Pacific Gas and Electric and Southern California Edison are working cooperatively with the Sequoia National Forest to protect the occurrences that are associated with hydroelectric facilities and power line rights-of-way on NFS land (Stewart 2002). Fencing and warning signs have been erected to forestall accidental disturbance by people working in those areas (Stebbins 1991, Stebbins and Clark 1992, Key 1994, Anderson 2002). *Clarkia springvillensis* plants have spread outside of the fenced areas since their installation in 1987 (McCue-Harvey and Holtsford 1994, USDA Forest Service 1996b, CDFG 2004).

Environmental Effects

Legal and Regulatory Compliance

Endangered Species Act (ESA): The Endangered Species Act of 1973 (16 USC 1531 et seq.) requires that any action authorized by a federal agency not be likely to jeopardize the continued existence of a threatened or endangered (TE) species, or result in the destruction or adverse modification of habitat of such species that is determined to be critical. Section 7 of the ESA, as amended, requires the responsible federal agency to consult the USFWS and the National Marine Fisheries Service concerning TE species under their jurisdiction. It is Forest Service policy to analyze impacts to TE species to ensure management activities would not be likely to jeopardize the continued existence of a TE species, or result in the destruction or adverse modification of habitat of such species that is determined to be critical.

E.O. 13112 Invasive Species 64 FR 6183 (February 8, 1999): To prevent and control the introduction and spread of invasive species.

Forest Service Manual and Handbooks (FSMH 2670): Forest Service Sensitive (FSS) species are plant species identified by the Regional Forester for which population viability is a concern. The Forest Service develops and implements management practices to ensure that plants and animals do not become threatened or endangered and to ensure their continued viability on national forests. It is Forest Service policy to analyze impacts to sensitive species to ensure management activities do not create a significant trend toward federal listing or loss of viability. This assessment is documented in a biological evaluation (BE) and is summarized or referenced in this document.

2001 Sierra Nevada Forest Plan Amendment (2001 SNFPA): The Record of Decision (ROD) for the 2001 Sierra Nevada Forest Plan Amendment identified the following direction applicable to Forest Service Sensitive Plants and their habitats:

- Noxious weeds management.
- Wetland and Meadow Habitat.
- Sensitive Plant Surveys (Corrected Errata, April 19, 2005): Conduct field surveys for threatened, endangered, proposed, and sensitive (TEPS) plant species early enough in project planning process that the project can be designed to conserve or enhance TEPS plants and their habitat. Conduct surveys according to procedures outlined in the Forest Service Handbook (FSH 2609.25.11). If additional field surveys are to be conducted as part of project implementation, survey results must be documented in the project file. The standards and guidelines provide direction for conducting field surveys, minimizing or eliminating direct and indirect impacts from management activities, and adherence to the Regional Native Plant Policy (USDA Forest Service 2004).

Sequoia National Forest Land and Resource Management Plan (Forest Plan) (as modified by the 1990 Mediated Settlement Agreement [MSA]): The Forest Plan contains the following management direction applicable to Forest Service Sensitive Plants and their habitats:

- Sensitive Plants: Manage Sensitive plants to prevent the need for federal listing as threatened and endangered.

- Riparian Habitat: Within riparian areas, protect stream courses and adjacent vegetation to maintain or improve overall habitat and water quality.

- Give preferential consideration to riparian-dependent resources when conflicts among land use activities occur.

- Delineate and evaluate riparian areas prior to implementing any project activity.

Draft Species Management Guide for *Clarkia Springvillensis* (USDA 1996):

- Maintain and enhance viable populations of Clarkia springvillensis.

- Preserve and restore habitat conditions which will promote the geographic distribution and genetic diversity of the species.

- Minimize potential, negative impacts of management activities.

***Opuntia basilaris var. treleasei* Section in "Recovery Plan for Upland Species of the San Joaquin Valley, California" (USFWS 1998):**

- Maintain self-sustaining populations in protected areas representative of the former geographic/topographic range and in a variety of appropriate natural communities.

- Unoccupied habitat within metapopulations also should be protected to facilitate movement of pollinators and seed dispersers.

- Avoid fragmentation of the few large metapopulations that remain.

Regional Native Plant Policies (USDA 2008 FSM Chapter 2070):

- Maintain, restore or rehabilitate native ecosystems so that they are self-sustaining, resistant to invasion by non-native invasive species and/or provide habitat for a broad range of species including, threatened, endangered, and rare species.

- Maintain adequate protection for soil and water resources, through timely and effective revegetation of disturbed sites that could not be restored naturally.

- Promote the use of native plant materials for the revegetation, rehabilitation and restoration of native ecosystems.

- Promote the appropriate use and availability of both native and non-native plant materials.

- Cooperate with other federal agencies, state agencies and local governments, tribes, academic institutions and the private sector to increase the knowledge and availability of

native plant materials, including developing sources of genetically appropriate plant materials.

- Increase and disseminate information which will guide the selection, use, and availability of genetically appropriate plant materials.

- Promote the study, planning, and implementation of actions which will maintain, restore and rehabilitate native ecosystems on NFS lands and other lands administered by the Forest Service and in the United States.

Standards and Guidelines

No Action Alternative

The No Action Alternative contains four Standards and Guidelines for Forest Service sensitive plants and their habitats:

- Minimize or eliminate direct and indirect effects from management activities on TEPS plants unless the activity is designed to maintain or improve plant populations.

- Prohibit or mitigate ground-disturbing activities that negatively affect hydrologic processes that maintain water flow, water quality, or temperature critical to sustaining fen ecosystems and the plant species dependent on them. During project analysis, survey, map and protect fens from activities such as trampling by livestock, pack stock, humans, and from wheeled vehicles. Criteria for defining fens include, but are not limited to: presence of sphagnum moss (*Sphagnum spp*.), presence of mosses in the genus *Meesia*, presence of sundew (*Drosera ssp*.). Complete initial inventories of fens within active grazing allotments prior to re-issuing permits.

- Conduct field surveys for threatened, endangered, proposed, and sensitive (TES) plant species early enough in the project planning process so that the project can be designed to conserve or enhance TES plants and their habitat. Conduct surveys according to procedures outlined in the Forest Service Handbook. If additional field surveys are conducted as part of project implementation, document the survey results in the project file.

- Ensure that all projects involving re-vegetation (planting or seeding) adhere to regional native plant policies.

Common to All Alternatives (except Alternative E)

In the DEIS, All Action Alternatives (except E) included the same four Standards and Guidelines for Forest Service sensitive plants and their habitat found in the No Action Alternative above. One of these Standards and Guidelines is now considered to be duplicative of law, regulation, or policy. This item is not included in the FEIS as a standard and guideline, but is now included in the Legal and Regulatory Compliance section. Therefore in the FEIS, all action alternatives (except Alternative E) will only contain three Standards and Guidelines for Forest Service sensitive plants and their habitats:

- Minimize or eliminate direct and indirect effects from management activities on TEPS plants unless the activity is designed to maintain or improve plant populations.

- Prohibit or mitigate ground-disturbing activities that negatively affect hydrologic processes that maintain water flow, water quality, or temperature critical to sustaining fen ecosystems and the plant species dependent on them. During project analysis, survey, map and protect fens from activities such as trampling by livestock, pack stock, humans, and from wheeled vehicles. Criteria for defining fens include, but are not limited to: presence of sphagnum moss (*Sphagnum spp*.), presence of mosses in the genus *Meesia*, presence of sundew (*Drosera ssp*.). Complete initial inventories of fens within active grazing allotments prior to re-issuing permits.

- Conduct field surveys for threatened, endangered, proposed, and sensitive (TES) plant species early enough in the project planning process so that the project can be designed to conserve or enhance TES plants and their habitat. Conduct surveys according to procedures outlined in the Forest Service Handbook. If additional field surveys are conducted as part of project implementation, document the survey results in the project file.

Direct Effects

This is a programmatic level environmental analysis with no proposed ground disturbing activities and therefore, there are no direct effects to Forest Service threatened and endangered plants and their habitats as a result of choosing any alternative. Potential direct effects will be analyzed during future site-specific analysis.

Indirect Effects

In relation to threatened and endangered plants, all alternatives are the same as to requirements to comply with the Endangered Species Act (ESA). All alternatives, except Alternative E have the same standards and guidelines regarding threatened and endangered plants and their habitats. However, Alternative E contains Forest Service handbook direction for threatened and endangered plants that make this alternative similar. Therefore, all site specific project environmental analysis for Monument plan implementation for all alternatives will include consultation, surveys, and mitigations.

All Alternatives

Under all alternatives, threatened and endangered plants would be protected. As detailed previously, Springville Clarkia (*Clarkia springvillensis*) is the only threatened species that occurs within the Monument. The Forest Service is mandated to maintain the viability of such species. Effects on species listed under the protection of the ESA both adverse and beneficial, are regulated by the USDI Fish and Wildlife Service. Due to the programmatic, non-specific nature of this action, most of the discussion of potential effects to Springville Clarkia is on future habitat potential rather than direct effects on existing populations. Negative impacts to Springville Clarkia and its habitat from forest management activities are minimized by conducting botany surveys prior to project implementation, using flagging and avoidance techniques. Compliance with the Sequoia National Forest weed management guidelines during all management activities minimize the risk for introduction and spread of noxious weeds.

Alternatives A, B, E, and F

Springville Clarkia occurs in annual grassland, blue oak woodland and in small openings within chaparral. It is distributed across the western boundary of the Monument with about 2/3 of occurrences on the Monument and 1/3 on private ground. Given its proximity to private ground, about 1/2 of the occurrences on the monument are within the expansive wildland urban interface (WUI) defense and threat zones that are designated under Alternatives A, B, E, and F. (See the map in affected environment section of this report). This WUI designation provides for the greatest potential for effects from management on Springville Clarkia and its habitat.

Alternatives A, B, E, and F propose to treat more of the WUI (defense and threat zones) with mechanical treatments. Created openings and thinning would create gaps within the chaparral habitat of Springville Clarkia which could enhance habitat for this species. Lack of disturbance (exclusion of fire) results in a dense canopy of shrubs and a heavy layer of duff that suppresses growth of herbaceous plants (including Springvile Clarkia). Springville Clarkia has the potential to be adversely affected by avoiding natural disturbances that maintain openings within the forest, since it depends on natural gaps created by fire, disease, and other factors.

Current (and proposed) standards and guidelines dictate that occupied habitat would not be treated mechanically, but adjacent potential habitat could be. Most of the gaps or openings (created by mechanical disturbance) would be limited to lower gradient slopes available for mechanical treatments adjacent to communities where greater human disturbance may offset habitat improvement for T & E species. Mechanical habitat enhancement (in Alternatives A, B, E and F) in chaparral would not be as effective as the more expansive burning under Alternatives C and D. Use of mechanical treatment increases potential for compaction and displacement of soil in potential habitat and would also increase the chances of introducing and establishing noxious weeds in unoccupied and occupied habitat. Mechanical disturbance has the potential to introduce weed propagules and create moderate to severe soil disturbance for these weeds to become established and thrive (Merriam et al. 2006). Mitigations would be in place for the introduction of noxious weeds, but these are not 100 percent effective in keeping weeds out. This is a possible long-term risk to Springville Clarkia and its habitat.

Alternatives C and D

These alternatives would have the greatest effect on canopy reduction within Springville Clarkia habitat. The expectation of more intense prescribed burns or wildfire, in the absence of soil disturbing mechanical pre-treatment of fuels would almost certainly benefit Springville Clarkia. Mechanical treatments are more conservative under Alternatives C and D than they would be under Alternatives A, B, E, and F. Gaps would likely be a little larger than under these alternatives with more mechanical treatments. The larger openings and greater reduction in canopy closure would be likely to favor Springville Clarkia and its habitat.

Alternatives C and D would also have a much lower chance of introducing and establishing noxious weeds in unoccupied and occupied habitat than Alternatives A, B, E and F.

Cumulative Effects

Past and current activities have altered threatened and endangered plant populations and their habitats. The time frame for determining cumulative effects depends on the length of time that

lingering effects of the past action will continue to negatively affect Springville Clarkia. The effects of past activities are built into this analysis in that they are largely responsible for the existing landscape. This cumulative effects analysis is based on the current information regarding species distribution, ecology, and life history. Standards and guidelines and Forest Service Manual direction included in all Alternatives are designed to eliminate or reduce possible negative cumulative effects by protecting sensitive plant species from direct and indirect effects. Negative direct and indirect effects to Springville Clarkia from Monument management activities will be minimized by conducting botany surveys prior to project implementation, with flagging and avoidance of all rare plant occurrences. Compliance with the Sequoia National Forest Weed Management Guidelines during all management activities minimizes the risk for introduction and spread of noxious weeds. Reducing direct and indirect effects is crucial in reducing cumulative effects to Springville Clarkia.

MacDonald (2000) reports that a critical step in cumulative effects analysis is to compare the current condition of the resource and the projected changes due to management activities (in this case, the management plan for the Giant Sequoia National Monument) with the natural variability in the resources and processes of concern. For species, such as Springville Clarkia which are disturbance tolerant or fire-followers, minimizing on-site changes could be detrimental. This species tolerates and benefits from on-site changes, which result in opening the stand and increasing light reception in the understory.

It is unclear if Springville Clarkia has always been rare or was once more common but currently rare due to past land use practices. Genetic research (McCue 1996) suggests individual populations were once united into larger populations and have been restricted by the exclusion of natural disturbance processes (namely fire). The current population trend for Springville Clarkia is presumed to be stable to slightly decreasing. Ascertaining the population trend of an annual species is difficult to impossible because of the drastic swings in individual numbers of plants in any given year, based on climate (amount and timing of precipitation across the fall, winter, and spring; high and low temperatures during germination).

Past and present forest management activities have caused changes in plant community structure and composition across the range of Springville Clarkia in the Monument. Management activities in the past that have cumulatively affected Springville Clarkia occurrences on the Monument include: fuelwood gathering, fire suppression, livestock grazing, prescribed fire, recreation use, and road construction and maintenance. These cumulative effects have altered the present landscape to various degrees. On the Monument, effects can be minimized by following Forest Service standards and guidelines and by implementing mitigation measures to monitor or offset impacts to sensitive plants species. With these protective measures in place, cumulative effects on the Monument occurrences are less likely to be adverse.

The area of analysis for cumulative effects is greater than the area within the Monument, and consists of the entire range of Springville Clarkia. The types and effects of historic activities on Springville Clarkia populations on private property are similar to the populations on the Monument. On private property these include: fuelwood gathering, fire suppression, livestock grazing, prescribed fire, recreational use, road construction and maintenance, and land clearing for residential development.

Determination

Provisions within all alternatives are determined not likely to adversely affect the listed plant

species, *Clarkia springvillensis*. The action alternatives will not have any direct effects on Springville Clarkia individuals, seed bank, and suitable habitat. Furthermore, this draft EIS is anticipated to have insignificant indirect and cumulative adverse effects on Springville Clarkia individuals, seed bank, and suitable habitat. In fact, provisions within all action alternatives could provide benefits for Springville Clarkia. Reintroduction of vegetation disturbance or fire into the ecosystem by means of careful fuels treatment, timing of controlled burns, or managed wildfire has the potential to benefit this species (McCue et al. 1996, Carter 2001, Stebbins 2002) by reducing competition from other species and improving habitat (Parker 1988).

Literature Cited and References

Anderson, B. 1987. Species management guide for *Clarkia springvillensis* Vasek. Sequoia National Forest, Tule River Ranger District, Springville, California, 10 p.

California Department of Fish and Game. 1990. Sensitive plant status report for *Clarkia springvillensis*. Sacramento, California, 3 p.

California Department of Fish and Game. 1997. The status of rare, threatened, and endangered animals and plants of California. Annual report for 1996. Sacramento, California, 34 p.

California Department of Fish and Game (CDFG). 2009. RAREFIND 3. California Natural Diversity Database (CNDDB). Sacramento.

Carter, Susan. 2001. Personal Communications Botanist, U.S. Bureau of Land Management, Bakersfield, California.

Cypher, Ellen. 2003 Personal Communication. Research Ecologist. Endangered Species Recovery Program. California State University, Stanislaus.

EA Engineering, Science, and Technology; Stone, R.D. 1999. [Draft.] Results of field surveys for the Springville Clarkia (*Clarkia springvillensis* Vasek) for Southern California Edison's Lower Tule River project area (FERC no. 372). Unpublished report on file at: Southern California Edison, 300 N Lone Hill Ave., San Dimas, California, 91773, 17 p.

Fuller, K. 1995. *Clarkia springvillensis* field tour. Notes on file at: U.S. Department of the Interior, Fish and Wildlife Service, 2800 Cottage Way, Room W-2605, Sacramento, CA 95825. 1 p.

Hansen, R. 1992. The 6th annual population studies of Kaweah Brodiaea (*Briodiaea insignis*) and Springville clarkia (*Clarkia springvillensis*). Report for and on file at: California Department of Fish and Game, Region 4, 1234 East Shaw Avenue Fresno, CA 93710-78022 1 p.

Hansen, Rob. 2001. Personal Communication. Vice President, Sierra Los Tulares Land Trust, Visalia, California.

Heady, H.F. 1975. Rangeland management. McGraw-Hill Book Company, New York, NY.

Hickman, J.C., ed. 1993. The Jepson manual: higher plants of California. Berkeley: University of California Press. 1,400 p.

Holsinger, K.E. 1982. Letter to Rick York, California Native Plant Society, Sacramento, CA. On file at: California Native Plant Society 2707 K Street, Suite 1 Sacramento, CA 95816, 1 p.

Holsinger, K.E. 1985. A phenetic study of *Clarkia unguiculata* Lindley (Onagraceae) and its relatives. Systematic Botany 10:155-165.

Holtsford, T.P., and N.C. Ellstrand. 1992. Genetic and environmental variation in floral traits affecting outcrossing rate in *Clarkia tembloriensis* (Onagraceae). Evolution 46:216-225.

Holtsford, Tim. 1994. Personal Communication. Assistant Professor, University of Missouri, Columbia.

Keeley, J. 1991. Seed germination and life history syndromes in the California chaparral. The Botanical Review 57(2): 81-116.

Keeley, J. and S. Keeley. 1987. Role of fire in the germination of chaparral herbs and suffrutescents. Madrono 34(3): 240-249.

Key, S.H. 1994. Letter to Joel Medlin, U.S. Fish and Wildlife Service, Sacramento, California, 4 p.

LeFer, D. 1997. Effect of seasonality of burn, soil moisture and temperature on chaparral vegetation in the Mendocino National Forest. San Francisco State University. San Francisco.

Lewis, H. 1993. Clarkia. Pages 786-793 in The Jepson manual: higher plants of California (J.C. Hickman, editor). University of California Press, Berkeley, California, 1400 p.

Loehner, Joe. 2004 Personal Communication Range Specialist, Tule River Ranger District, Sequoia National Forest.

MacDonald, L.H. 2000. Evaluating and managing cumulative effects: Process and constraints. Environmental Management 26: 299-315.

MacSwain, J.W., P.H. Raven, and R.W. Thorpe. 1973. Comparative behavior of bees and Onagraceae. IV. Clarkia bees of the western U.S. University of California Publications in Entomology 70:1-80.

Martin, F. 1988. The second annual population studies of Kaweah brodiaea (*Brodiaea insignis*) and Springville clarkia (*Clarkia springvillensis*). Report to and on file at: the California Department of Fish and Game, Region 4, 1234 East Shaw Avenue Fresno, CA 93710-78022. 14 p.

Martin, F. 1989. The third annual population studies of Kaweah brodiaea (*Brodiae insignis*) and Springville clarkia (*Clarkia springvillensis*). Report to and on file at: the California Department of Fish and Game, Region 4, 1234 East Shaw Avenue Fresno, CA 93710-78022. 15 p.

Martin, F. 1990. The fourth annual population studies of Kaweah brodiaea (*Brodiaea insignis*) and Springville clarkia (*Clarkia springvillensis*). Report to and on file at: the California Department of Fish and Game, Region 4, 1234 East Shaw Avenue Fresno, CA 93710-78022. 21 p.

Martin, F. 1991. The fifth annual population studies of Kaweah brodiaea (*Brodiaea insignis*) and Springville clarkia (*Clarkia springvillensis*). Report to and on file at: the California Department of Fish and Game, Region 4, 1234 East Shaw Avenue Fresno, CA 93710-78022, 17 p.

McCue, K. 1997a. The ecological genetics of rarity: A study of genetic structure, inbreeding and seed bank dynamics in a rare annual plant. PhD. Dissertation. University of Missouri. Columbia, Missouri.

McCue, K. 1997b. Letter to Wayne White, U.S. Fish and Wildlife Service, Sacramento,

California, 4 p.

McCue-Harvey, K.; Holtsford, T. 1994. Determining the role of the seed bank in maintaining populations of a California annual grassland through prolonged periods of drought. Sacramento: California Department of Fish and Game. 16 p.

McCue, K.A., E.S. Buckler, and T.P. Holtsford. 1996. A hierarchical view of genetic structure in the rare annual plant *Clarkia springvillensis*. Conservation Biology 10:1425-1434.

McCue, K.A., and T.P. Holtsford. 1998. Seed bank influences on genetic diversity in the rare annual *Clarkia springvillensis* (Onagraceae). American Journal of Botany 85:30-36.

Menke, J. 1992. Grazing and fire management for native perennial grass restoration in California grasslands. Fremontia 20(20):20-25.

Merriam KE, Keeley JE, Beyers JL. 2006 Fuel breaks affect nonnative species abundance in Californian plant communities. Ecol Appl. 2006 Apr;16(2):515-27.

Mitchell, Rick. 2001. Personal communication. Rick Mitchell, Administrator, Outdoor School of Science and Conservation, Tulare County Office of Education.

Parker, T. and C. Rogers, 1988. Chaparral burns and management: influence of soil moisture at the time of a prescribed burn on the response of the native vegetation from the seed bank. Report prepared for the Cal. Dept. of Fish and Game, Endangered Plant Project

Pacheco, A. 1997. Fax to Ken Fuller, U.S. Fish and Wildlife Service, Sacramento, California, 3 p.

Sanders, C., and J. Stewart. 2000. Summary, *Clarkia springvillensis* survey, 7 June 2000. Sequoia National Forest, Porterville, California, 1p.

Sawyer, J.; Keeler-Wolf, T. 1995. A Manual of California vegetation. Sacramento: California Native Plant Society. 1,040 p.

Seymour, G. and A. Teclea 2004. Impact of Slash Pile Size and Burning on Ponderosa Pine Forest Soil Physical Characteristics. Journal of the Arizona-Nevada Academy of Science: Vol. 37, No. 2, pp. 74-82.

Shevock, J.R.1985. Letter to Rod Goss, California Department of Fish and Game, Fresno, California, 2 p.

Shevock, J. 1989. Sensitive plant species of Sequoia National Forest and adjacent regions. Sequoia National Forest, 3 p.

Skinner, M.W.; Pavik, B.M., eds. 1994. Inventory of rare and endangered vascular plants of California. Special publication no. 1, 5th edition. Sacramento: California Native Plant Society. 338 p.

Southern California Edison Company. 1998. Lower Tule River Hydroelectric Project (FERC Project No. 372). Application for New License for Major Project - Existing Dam. Draft. Volume 2 of 4, Exhibit E.

Stebbins, J.C. 1991. Population status and management analysis of *Clarkia springvillensis*, *Fritillaria striata* and *Pseudobahia peirsonii* in the San Joaquin Valley, California. Report to the California Department of Fish and Game,1416 9th Street, Sacramento, CA 95814. 26 p.

Stebbins, J.C. 1992. Botanical survey report, 700 acre study area, Tulare County, California. Unpublished report to Ennis Development Corporation, 643 North Westwood Street, Porterville, CA 93257, 24 p.

Stebbins, J.C., and W.A. Clark. 1992. Endangerment status of *Clarkia springvillensis* (Onagraceae), Tulare County, California. Pages 271-278 in Endangered and sensitive species of the San Joaquin Valley, California (D.F. Williams, S. Byrne, and T.A. Rado, editors). California Energy Commission, Sacramento, California, 388 p.

Stebbins, John. 2001 and 2002. Personal Communications President, Sierra Foothill Conservancy, Clovis, California; and Herbarium Curator, California State University, Fresno, California.

Stebbins, J.; Kirkpatrick, K.R. [n.d.]. Springville Clarkia ecological reserve. Unpublished report to the California Department of Fish and Game,1416 9th Street, Sacramento, CA 95814. 4 p.

Stewart, J. 2002 Personal communication Springville Liaison, Alta Peak Chapter, California Native Plant Society, Springville, California.

Tibor, D.P., editor. 2001. California Native Plant Society's inventory of rare and endangered vascular plants of California. Sixth edition. Special Publication No. 1, California Native Plant Society, Sacramento, California, 387 pp.

U.S. Bureau of Land Management. 1996. Results of 1995 field surveys for proposed endangered or threatened plants in the southern Sierra foothills. Internal report, Caliente Resource Area, Bakersfield, California, 2 p.

U.S. Bureau of Land Management. 1999. Biological assessment: Hart vegetation management program prescribed burn project, June 1999. U.S. Bureau of Land Management, Bakersfield, California, 6 p.

USDA Forest Service. 1988. Sequoia National Forest Land and Resource Management Plan, Forest Plan. Sequoia National Forest.

USDA Forest Service. 1990. Mediated Land Management Plan, 1990 Settlement Agreement. Exhibit D Riparian and Wetlands Standards and Guidelines. 1st Mediation Draft Amendments. Sequoia National Forest.

USDA Forest Service. 1990. Forest Service Handbook. R-5 FSH 2609.25 - Threatened and Endangered Plants Program Handbook. San Francisco.

USDA Forest Service. 1995. Forest Service Manual. FSM 2600 - Wildlife, Fish and Sensitive Plant Habitat Management. Chptr. 2670 - Threatened, Endangered, and Sensitive Plants and Animals. Washington D. C.

USDA Forest Service. 1996. Soil Survey of Sequoia National Forest Area, California. National

Cooperative Soil Survey. Pacific Southwest Region.

U.S. Department of Agriculture [USDA], Forest Service. 1997. Draft species management guide for *Clarkia springvillensis* Porterville, CA: Sequoia National Forest. 15 p.

U.S. Forest Service. 1998a. Biological assessment for *Clarkia springvillensis*: Coffee prescribed burn project. U.S. Forest Service, Tule River Ranger District, Sequoia National Forest, Porterville, California, 14 p.

U.S. Forest Service. 1998b. Biological assessment for *Clarkia springvillensis*: Rancheria, West Bear Creek, and Middle Tule Allotments. U.S. Forest Service, Tule River Ranger District, Sequoia National Forest, Porterville, California, 12 p.

U.S. Department of the Interior [USDI], Bureau of Land Management [BLM]. 1996. Results of 1995 field surveys for proposed endangered or threatened plants in the southern Sierra foothills. Internal report on file at: Caliente Resource Area, Bakersfield Field Office, 3801 Pegasus Drive, Bakersfield, CA 93308. 2 p.

U.S. Fish and Wildlife Service. 1998. Endangered and threatened wildlife and plants; determination of threatened status for four plants from the foothills of the Sierra Nevada Mountains in California. Federal Register 63: 49022-49035.

USFWS 1998 *Opuntia basilaris var. treleasei* Section IN: Recovery plan for upland species of the San Joaquin Valley, California. p. 49-54

U.S. Fish and Wildlife Service. 2002 Draft Recovery for 15 plants of the Southern Sierra Nevada Foothills, California. Region 1. U.S. Fish and Wildlife Service. Portland, Oregon

U.S. Fish and Wildlife Service. 2005. Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon. Portland, Oregon. xxvi + 606 pages.

U.S. Fish and Wildlife Service. 2009 Federal Endangered and Threatened Species that Occur in or may be Affected by Projects in the Sequoia National Forest. October 16th, 2009. http://www.fws.gov/sacramento/es/spp_lists/NFActionPage.cfm

Vasek, F.C. 1964a. Two new species related to *Clarkia unguiculata*. Madroño 17:219-221.

Vasek, F.C. 1964b. The evolution of *Clarkia unguiculata* derivatives adapted to relatively xeric environments. Evolution 18: 26-42.

Vasek, F.C. 1977. Phenotypic variation and adaptation in *Clarkia* section Phaeostoma. Systematic Botany 2: 251-279.

Wise, E. 1987. Population studies of Kaweah brodiaea (*Brodiaea insignis*) and Springville clarkia (*Clarkia springvillensis*). Report to the California Department of Fish and Game, Region 4, 1234 East Shaw Avenue Fresno, CA 93710-78022, 13 p.

Appendix A-Species Eliminated from Detailed Analysis

Bakersfield Cactus (*Opuntia basilaris var. treleasei*)

Abundance - The extant occurrences may be grouped into the following areas of concentration; (I) Caliente Creek drainage (Caliente-Bena Hills), (2) Comanche Point. (3) Cottonwood Creek, (4) Fairfax Road - Highway 178 - Highway 184 - Kern Bluffs - Hart Park, (5) Fuller Acres, (6) Granite Station, (7) mouth of Kern Canyon, (8) Oildale - KernRiver Oil Field - Round Mountain Road (separated from area #4 by the Kern River), (9) Poso Creek, (10) Sand Ridge, and (11) Wheeler Ridge - Pleito Hills.

Range/Distribution - Bakersfield cactus is endemic to a limited area of central Kern County' in the vicinity' of Bakersfield. The California Fish & Game consider the pre-1987 reports to represent approximately 33 occurrences.

Trend - Approximately one-third of the historical occurrences of Bakersfield cactus have been eliminated, and the remaining populations are highly fragmented. However, the range was extended to the south when several occurrences were discovered in the late 1980s in south-central Kern County, just north of Wheeler Ridge.

Protection of Occurrences - The one occurrence on Sequoia NF lands is protected at this time, but most known populations of Bakersfield cactus are not formally protected at this time.

Threats - Almost all the known sites are on private land, much of which has commercial value. Residential development constitutes the most serious threat currently, especially in the greater Fairfax Road-Kern Bluff and Round Mountain Road areas. Conversion for either agricultural or residential use is possible near Wheeler Ridge. Inundation could be an intermittent problem for populations in flood plains and is a remote possibility for occurrences near the California Aqueduct; the largest concentration of clumps in the Wheeler Ridge meta-population is situated adjacent to an overflow drain for the Aqueduct, which could lead to flooding if an earthquake occurred anywhere along its length. Even the two protected populations are adjacent to agricultural land and could be impacted by' pesticide drift. Both off road vehicle use and mining continue to degrade the populations mentioned earlier. Direct competition from introduced, annual grasses is believed to threaten the survival of mature Bakersfield cactus plants and to hinder the establishment of new plants. Indirect effects from exotic grasses also may threaten Bakersfield cactus in several ways. First, the dense herbaceous growth may promote a greater fire frequency and intensity than would have occurred with the sparse native vegetation typical in historical times. The effect of repeated fires has not been determined.

However, survival of Bakersfield cactus plants was monitored following single fire events at Sand Ridge and near the Rio Bravo Hydroelectric Plant in Kern Canyon. All Bakersfield cactus clumps survived the fires at both sites, despite browning and wilting of the pads. A lack of genetic diversity may threaten some populations of Bakersfield cactus. Contributing factors to this problem include the small size of many populations and lack of gene flow between populations.

Fragility/habitat specificity - Soils supporting Bakersfield cactus typically are sandy, although gravel, cobbles, or boulders also may be present. Known populations occur on flood plains, ridges, bluffs, and rolling hills. The Bakersfield cactus is a characteristic species of the Sierra-Tehachapi Saltbush Scrub plant community, but populations near Caliente are in Blue Oak

Woodland and the Cottonwood Creek population is in riparian woodland. Many sites for Bakersfield cactus support a dense growth of red brome and other annual grasses. Sand Ridge is characterized by sparse vegetation and a preponderance of native species such as California filago (*Filago californica*) and yellow pincushion (*Chaenactis glabriuscula*). Historical records indicate that the majority of Bakersfield cactus occurred at elevations ranging from 140 to 260 m (460 to 850 ft). The highest-elevation population is at 550 m (1,800 ft) near Caliente and the lowest is at 121 m (396 ft) at Fuller Acres.

Keck's Checkerbloom (*Sidalcea keckii*)

Abundance - This species occurs in at least three locations: the Piedra area of southern Fresno County, Mine Hill east of Porterville, and near the town of White River in southern Tulare County.

Range/Distribution - Keck's checkermallow grows in relatively open areas on grassy slopes of the Sierra foothills in Fresno and Tulare counties.

Trend - The species' low population numbers, particularly at Mine Hill, leave it vulnerable to random environmental events ranging from bad weather to disease to damaging insect infestations. The isolation of remaining population exacerbates these vulnerabilities by precluding recolonization of extirpated populations. Inbreeding depression and loss of genetic variability may also be causes for concern in such small isolated populations.

Protection of Occurrences - The Piedra site is protected as part of the Tivy Mountain Preserve run by Sierra Foothill Conservancy, but the other two occur on private land and are unprotected at this time.

Threats - Keck's checkermallow is threatened by urban development, competition from non-native grasses, and agricultural land conversion. Cattle grazing at the current level does not appear to be detrimental and may be an important factor protecting the plant from encroachment by non-native grasses. Cattle damage plants directly by eating and trampling them. In addition, unmanaged increases in grazing during months of flowering or seed maturation could pose a threat.

Fragility/habitat specificity - The species is associated with gabbro soils. These soils are unusually low in nutrients and high in heavy metals. These soil properties tend to restrict the growth of many competing plants. Because gabbro soils are fairly rare, this limits the range of plants like Keck's checkermallow that are adapted to grow on them.

San Joaquin Adobe Sunburst (*Pseudobahia peirsonii*)

Abundance - Thirty-two (80 percent) of the 40 historical occurrences are presumed to remain extant. The overall extent of the range is still the same, although some of the populations in the center of the range have been extirpated. Population numbers range from 10s to 1,000s.

Range/Distribution - San Joaquin adobe sunburst is restricted to the eastern San Joaquin Valley. Historical occurrences were scattered from northern Kern County to Tulare and Fresno counties. Today the species is limited to a few populations in valleys and flats and at the foot of the Sierra Nevada. Extant populations are concentrated in three areas: the Round Mountain-Wahtoke area in Fresno County, the Porterville-Visalia region in Tulare County, and the Pine Mountain-Woody region in Kern County.

Trend - Unknown

Protection of Occurrences - Most populations occur on private land and are not protected at this time.

Threats - Conversion of natural habitat to residential development is the primary threat to San Joaquin adobe sunburst. In addition, road maintenance projects, recreational activities, competition from nonnative plants, agricultural land development, incompatible grazing practices, a flood control project, transmission line maintenance and other human impacts also may threaten the species. The adobe sunburst grows in grasslands dominated by nonnative annual plants, wild oats (*Avena fatua*), charlock (*Sinapis arvensis*), soft chess (*Bromus hordeaceus*), red brome (*Bromus rubens*) and redstem stork's bill (*Erodium cicutarium*). The intrusive and aggressive nature of these species seems detrimental to the San Joaquin adobe sunburst.

Fragility/habitat specificity - *Pseudobahia peirsonii* grows in grasslands and the transition zone between grassland and blue oak woodland. Grass cover is fairly dense at most sites where *P. peirsonii* occurs, but the optimal habitat is a more sparsely vegetated mixture of annual grasses and forbs. The typical topographic location at the extant sites is on the level or gently sloping areas between low hills at elevations between 119 meters (390 feet) and 792 meters (2,600 feet). Historical localities on the valley floor have been extirpated, but would have been on level sites; the lowest historical elevation was 88 meters (290 feet) near Tulare. San Joaquin adobe sunburst grows in heavy adobe clay soils. These soils may be favored for their ability to hold moisture longer into the summer dry season than other soils.