

PLANT BIOLOGICAL EVALUATION

Giant Sequoia National Monument Management Plan

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

PREPARED BY:



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Summary

It is determined that the Monument management plan:

May affect undiscovered individuals but is not likely to result in a trend toward federal listing or loss of viability for:

Species Occurring in Riparian/Meadow/Aquatic Habitats: *Botrychium crenulatum*, *Botrychium minganense*, *Botrychium montanum*, *Bruchia bolanderi*, *Hydrotheria venosa*, *Meesia triquetra*, and *Meesia ulignosa*.

Species in Drier, Upland and Forest Habitats: *Astragalus shevockii*, *Brodiaea insignis*, *Calochortus westonii*, *Cryptantha incana*, *Hulsea brevifolia*, *Leptosiphon serrulatus*, and *Mimulus gracilipes*.

Species Associated with Rock Outcrops, Cliffs, and other Special Geologic or Soil Features: *Carlquista muirii*, *Delphinium inopinum*, *Dicentra nevadensis*, *Dudleya cymosa* ssp. *costifolia*, *Erigeron aequifolius*, *Eriogonum twisselmanii*, *Erythronium pusaterii*, *Heterotheca monarchensis*, *Lewisia congdonii*, *Lewisia disepala*, *Monardella linoides* ssp. *oblonga*, *Oreonana purpurascens*, *Petrophyton caespitosum* ssp. *acuminatum*, and *Streptanthus fenestratus*.

Other plant species listed on the Sequoia National Forest as Forest Service sensitive do not have habitat within the Monument, and therefore will not be affected.

Introduction

The Monument and surrounding Sequoia National Forest provide habitat for a number of rare plant species. The Clinton proclamation states: "The great elevational range of the monument embraces a number of climatic zones, providing habitats for an extraordinary diversity of plant species and communities. The monument is rich in rare plants and is home to more than 200 plant species endemic to the southern Sierra Nevada mountain range" (2000, p. 24096). The desired condition is that lands within the Monument continue to provide a diverse range of habitats. Riparian areas, montane meadows, and late succession forest are areas of particular concern.

This biological evaluation (BE) documents analysis of programmatic direction (long term goal and objective based management) rather than individual projects under the Monument management plan. A determination is made on potential effects on plant species listed as Sensitive by the Regional Forester, Pacific Southwest Region, USDA Forest Service for the Sequoia National Forest. Site-specific documentation will occur for all individual projects carried out under this programmatic direction.

Threatened, endangered, or proposed for listing (listed species) under the Endangered Species Act (ESA) by the U.S. Department of Interior, Fish and Wildlife Service (USDI FWS) are addressed in a biological assessment forwarded to the FWS. FWS species of concern, candidates for listing under the ESA are included with Forest Service Sensitive species in this document where there is reason for additional concern regarding viability and maintenance of

diversity.

This biological evaluation (BE) was prepared in accordance with Forest Service Manual (FSM) direction 2672.42.

Current Management Direction

Current management direction and desired conditions for 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 effects 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 (FSM/H 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 effects 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 Chapter.

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 (Standards and Guidelines 36-49): See the nonnative invasive species report.
- Wetland and Meadow Habitat (Standard and Guideline 70): See hydrology report.
- Riparian Habitat (Standard and Guideline 92): See Hydrology report.

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. (Management Standard and Guideline 125). The standards and guidelines provide direction for conducting field surveys,

minimizing or eliminating direct and indirect effects 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 (Ch.4, p.30): Manage Sensitive plants to prevent the need for federal listing as threatened and endangered.
- Riparian Habitat (Ch.4, p.30):
- Within riparian areas, protect streams 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 *Calochortus westonii* (USDA 1998):

- Maintain and enhance viable populations of *Calochortus westonii*.
- Preserve or restore habitat conditions which will promote the geographic distribution and genetic diversity of the species.
- Minimize potential, negative effects of management activities.

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 spp.*). 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 spp.*). 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.

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. Some of the more unusual rock types like limestone/marble and gabbro create unique soil environments, which support one or more rare plant species.

Four major biotic provinces converge on the Sequoia National Forest and Monument. 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 unique plant communities.

The Sequoia National Forest maintains two different lists of rare plants. One is the Sensitive Plant List which contains Federally Threatened, Federally Endangered, and plants in danger of becoming Federally Threatened/Endangered. The other is the Watch List which has rare plants that are not in as much danger of becoming Federally Threatened/Endangered. There are 64 sensitive and 29 watch list plant species currently designated on the Sequoia National Forest (93 in total). A majority of these have known occurrences on the Forest; however, some are only suspected to occur at this point in time, as potential habitat may exist, and occurrences are found nearby. An occurrence refers to a relatively discreet group of individuals, separated from

the next nearest group of the same species by at least ¼ mile. Many of these species require special management attention to ensure their continued viability, and they have been included on either the Sequoia National Forest sensitive plant list or watch list.

Of the 93 species designated on the Forest, 32 are known to or potentially occur within the Giant Sequoia national Monument and are listed below:

Table 1 Region 5 Sensitive Plant Species Reviewed for Inclusion in the Monument BE and Working Papers

| SPECIES | HABITAT TYPE / SOILS | POPULATIONS IN GSNM | ANALYSIS INCLUDED |
|--|--|---------------------------------|--------------------------|
| Little Kern River Milk-Vetch <i>(Astragalus shevockii)</i> | Pine Needle Duff in Upper Montane Jeffrey Pine Forest Sandy, Granitic Soil | Potential, No Known Occurrences | Yes |
| Scalloped Moonwort <i>(Botrychium crenulatum)</i> | Among Thick Grass and Herbs in Wet Meadows Moist Fine Sediment and Peaty Soils | Potential, No Known Occurrences | Yes |
| Mingan Moonwort <i>(Botrychium minganense)</i> | Among Thick Grass/Herbs in Meadows within Conifer Forest Moist Fine Sediment and Peaty Soils | Known Occurrence | Yes |
| Mountain Moonwort <i>(Botrychium montanum)</i> | Among Thick Grass/Herbs in Meadows within Conifer Forest Moist Fine Sediment and Peaty Soils | Potential, No Known Occurrences | Yes |
| Kaweah Brodiaea <i>(Brodiaea insignis)</i> | Grassy Slopes of Foothill Blue Oak Savanna Loamy Clay Soils in Granitic Substrate | Potential, No Known Occurrences | Yes |
| Bolander's Bruchia Moss <i>(Bruchia bolanderi)</i> | Upper Montane Streambanks of Small Meandering Creeks Moist Fine Sediment and Peaty Soils | Known Occurrence | Yes |
| Shirley Meadow Star-tulip <i>(Calochortus westonii)</i> | Meadow Edges or Openings in Mixed Conifer/Black Oak Woodland Deep Loamy or Shallow Rocky derived from Granitics or Metamorphics | Known Occurrences | Yes |

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|---|---|--|-----|
| Muir's Raillardella <i>(Carlquistia muirii)</i> | Openings in Chaparral, Ponderosa Pine, or Mixed Coniferous Forest Granite Ledges/Cracks or Gravelly/Sandy Flats | Potential, No Known Occurrences | Yes |
| Springville Clarkia <i>(Clarkia springvillensis)</i> | Disturbed Areas in Grassland, Blue Oak Woodland, & Chamise Chaparral Loose Sandy Granitic Soils | Known Occurrences Federally Endangered | Yes |
| Tulare Cryptantha <i>(Cryptantha incana)</i> | Openings in Lower Mixed Conifer Forest & P-J Woodland Gravelly Soils | Known Occurrences | Yes |
| Unexpected Larkspur <i>(Delphinium inopinum)</i> | Open Rock Outcrops & Ridges in Conifer and Red Fir Forest Metamorphic Substrates (Granite Occasionally) | Known Occurrences | Yes |
| Tulare County Bleeding Heart <i>(Dicentra nevadensis)</i> | Sandy, Gravelly Slopes or Crevices in Lodgepole & Sub-Alpine Forest Decomposed Granite Soil | Known Occurrences | Yes |
| Pierpoint Springs Liveforever <i>(Dudleya cymosa ssp. costafolia)</i> | Rock Outcrops within in Canyon Live Oak Woodland & Chaparral Metamorphic Carbonate Substrate (Limestone & Marble) | Known Occurrences | Yes |
| Hall's Daisy <i>(Erigeron aequifolius)</i> | Steep, Rocky, Crevices in Conifer Forest & Pinyon-Juniper Woodland Granitic Substrate (Carbonate or Basalt Occasionally) | Known Occurrences | Yes |
| Twisselmann's Buckwheat <i>(Eriogonum twisselmannii)</i> | Rocky Openings Jeffrey Pine-Red Fir Forests Shallow Rocky Soil Derived from Metamorphic and Granitic Substrate | Known Occurrences | Yes |

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| <p>Kaweah Fawn Lily <i>(Erythronium pusaterii)</i></p> | <p>Rockfields, Ledges, and Steep Canyon Walls in Montane Conifer Forest</p> <p>Outcrops and Talus Fields of Metamorphic Rock (Granite Occasionally)</p> | Known Occurrences | Yes |
| <p>Striped Adobe Lily <i>(Fritillaria striata)</i></p> | <p>Open Areas in Grassland and Blue Oak Savanna</p> <p>Pockets or Islands of Heavy Adobe Clay (Granitic or Metamorphic)</p> | Low Potential, No Known Occurrences | No |
| <p>Sequoia False Goldenaster <i>(Heterotheca monarchensis)</i></p> | <p>South-Facing Ledges and Cracks on Cliffs Surrounded by Chaparral</p> <p>Carbonate Outcrop (Limestone or Marble)</p> | Known Occurrences | Yes |
| <p>Short-Leaved Hulsea <i>(Hulsea brevifolia)</i></p> | <p>Openings in Lower and Upper Montane Conifer Forest</p> <p>Soils Formed in Decomposed Granite or Volcanic Pumice</p> | Known Occurrences | Yes |
| <p>Water Fan Lichen <i>(Hydrothyria venosa)</i></p> | <p>Attached to Rocks in Small Streams within Montane Coniferous Forest</p> <p>Streams that are Fed by Cold Springs and/or Groundwater</p> | Known Occurrences | Yes |
| <p>Madera Linanthus <i>(Leptosiphon serrulatus)</i></p> | <p>Open Areas in Blue Oak Savanna to Lower Mixed Conifer Forest</p> <p>Rocky Bare Areas</p> | Historic Occurrences | Yes |
| <p>Congdon's Bitterroot <i>(Lewisia congdonii)</i></p> | <p>Rocky Cliffs and Ledges within Chaparral and Conifer Forest</p> <p>Rock, Talus and Sand derived from Granite or Metamorphic Rock</p> | Known Occurrences | Yes |
| <p>Yosemite Bitterroot <i>(Lewisia disepala)</i></p> | <p>Gravel Shelves in Rock Outcrops within Conifer Forest</p> <p>Decomposed Granite Deposits</p> | Known Occurrences | Yes |

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|---|--|--------------------------------------|-----|
| Three-Ranked Hump-Moss <i>(Meesia triquetra)</i> | Meadows within Conifer Forest with <u>Sphagnum</u> , <u>Drosera</u> , & <u>Vaccinium</u> Cold Spring-Fed Acidic Fens (Organic Meadow Soils) | Known Occurrences | Yes |
| Broad Nerved Hump-Moss <i>(Meesia uliginosa)</i> | Short-Grass Meadows within Conifer Forest Spring-Fed meadows that are permanently wet | Potential, No Known Occurrences | Yes |
| Slender-Stalked Monkeyflower <i>(Mimulus gracilipes)</i> | Openings in Burned chaparral, Oak Savanna, and Lower Conifer Forest Granitic soil in cracks in granite | Potential, No Known Occurrences | Yes |
| Flax-like Monardella <i>(Monardella linoides ssp. oblonga)</i> | Rocky Openings within Subalpine Conifer Forest Talus Slopes and Boulders in Metamorphic or Granitic substrates | Potential, No Known Occurrences | Yes |
| Purple Mountain-Parsley <i>(Oreonana purpurascens)</i> | Open Areas within Lodgepole-Red Fir Forest Dry Sandy Gravelly Soils in Granitic or Metamorphic Substrates | Known Occurrences | Yes |
| San Joaquin Adobe Sunburst <i>(Psuedobahia peirsonii)</i> | Valley Grassland or Oak Savanna Heavy Adobe Clay Derived from Metamorphic Substrate (Ophiolite) | Low Potential, No Known Occurrences | No |
| Marble Rockmat <i>(Petrophyton caespitosum ssp. acuminatum)</i> | Rock Outcrops within Montane Conifer Forest Rock Cliffs & Ledges in Carbonate (Limestone/Marble) or Granite Areas | Known Occurrences | Yes |
| Keck's Checkerbloom <i>(Sidalcea keckii)</i> | Valley Grassland and Open Areas in Blue Oak Savanna Heavy Red Clay Soils in Mafic Intrusive (Gabbro) Substrate | Low Potential, No Known Occurrences | No |
| Tehipite Valley Jewel-Flower <i>(Streptanthus fenestratus)</i> | Rocky Areas within Conifer Forest Rock Cliffs and Ledges in Carbonate or Carbonate-Influenced Substrate | High Potential, No Known Occurrences | Yes |

Springville clarkia, Bakersfield cactus, Keck's checkerbloom, and San Joaquin Adobe Sunburst are addressed in the biological assessment.

There are two plant species that are entirely endemic to the Monument and found nowhere else in the world. These are: Twisselmans buckwheat, (*Eriogonum twisselmanii*), Pierpoint Springs Liveforever (*Dudleya cymosa* ssp. *costafolia*). In addition, there are seven plant species that are endemic to the Sequoia National Forest and adjacent federal [Bureau of Land Management (BLM), and National Park Service (NPS)] or private lands. These are: Kaweah Brodiaea (*Brodiaea insignis*), Shirley Meadow Star-tulip (*Calochortus westonii*), Springville Clarkia (*Clarkia springvillensis*), Tulare County Bleeding Heart (*Dicentra nevadensis*), Tehipite Valley Jewel-Flower (*Streptanthus fenestratus*), Kaweah Fawn Lily (*Erythronium pusaterii*) and Purple Mountain-Parsley (*Oreonana purpurascens*).

Rare Plant Habitat Guilds

While the rare plant species known or suspected to occur in the analysis area vary widely in their ecological requirements and life history characteristics, many occur in similar broad habitat types. For the purposes of this analysis, the rare plant species being considered have been grouped into rare plant habitat guilds by their ecological requirements for soil type, moisture regime, and/or canopy closure as well as vulnerability to management effects.

In many cases, the habitat requirements for rare plant species are poorly defined, and there are typically several other factors affecting their occurrence other than simply the vegetation community. Plants are grouped by their ecological requirements for soil type, moisture regime, and/or canopy closure as well as vulnerability to management effects. The following rare plant habitat guilds have been selected to represent the species being addressed in the analysis:

Species occurring in riparian/meadow/aquatic habitats; Species in drier, upland and forest habitats; and Plants associated with rock outcrops, cliffs, and other special geologic or soil features.

Detailed species accounts are shown by rare plant habitat guilds for plants with known populations or potential to occur in the Monument.

Species Occurring in Riparian/Meadow/Aquatic Habitats

These species include *Botrychium crenulatum*, *Botrychium minganense*, *Botrychium montanum*, *Bruchia bolanderi*, *Hydrotheria venosa*, *Meesia triquetra* and *Meesia ulignosa*.

***Botrychium crenulatum*, scalloped moonwort**

Botrychium crenulatum is limited to the western United States, scattered from California to Montana. In California, this species is known to exist in Butte, Colusa, Los Angeles, Nevada, Modoc, Mono, Placer, Plumas, Tehama, Tulare, San Bernardino, Shasta, and Sierra Counties.

Botrychium crenulatum is often associated with water in California, where it is most often found on the lip of creek banks or on their sides, many times within coniferous forest habitats. Specific limiting factors for this plant species abundance and distribution are not known. All *Botrychium* spp. have strong fungus host requirements that may be a factor in limiting distribution.

Soil disturbance can be very detrimental, especially if it is occurring on a regular basis. Soil

disturbance includes grazing and trampling by livestock and off-highway vehicle (OHV) use, where a little disturbance and compaction is tolerated but heavy disturbance will kill individuals. Changes in the hydrologic regime (from erosion, roads, grazing, etc.) may also threaten occurrences. Hot fires have been shown to be detrimental, especially if the soil conditions are very dry during the burn. Some occurrences of the species are near campgrounds or trails, so visitors could be a potential threat.

***Botrychium minganense*, Mingan Moonwort**

In California, there are only 13 confirmed occurrences of *Botrychium minganense*, 11 of these occurrences are located within the Lassen National Forest, and one occurrence is known to each, Plumas and Sequoia National Forests. In addition, there is also one unconfirmed reported location on the Modoc National Forest, and a few historical occurrences in Butte County, and a report from the Sequoia National Park. Occurrences often consist of only a few plants, so overall plant numbers in California are low. It is known to Butte, Fresno, Plumas, Tehama and Tulare Counties in California; and scattered locations throughout Arizona, Idaho, Nevada, Oregon, Utah, and Washington. All occurrences have few individuals. Actual trends in these occurrences are hard to determine since the sporophytes do not appear above ground every year.

Botrychium minganense was recently listed as a sensitive species for the Forest Service in Region 5, and it is also listed as a sensitive species in Region 6 and is state listed as sensitive in Idaho.

This species is found in small streams, fins, or riparian areas, which generally have some form of streamside or wetlands management protection during vegetation management activities, but otherwise are not specifically protected. These habitats are not highly unusual, so the specific limiting factors for this plant species' abundance and distribution are not known. All *Botrychium* spp. have strong mycorrhizal requirements, which may be a factor. Riparian habitats are subject to grazing and hydrologic alterations, and conifer stands are subject to vegetation management.

Soil disturbance can be very detrimental, especially if it is occurring on a regular basis. Soil disturbance includes grazing and trampling by livestock and OHV, where a little disturbance and compaction is tolerated but heavy disturbance will kill individuals. An Oregon study found light trampling seemed to benefit some species of Botrychiums including *B. minganense*. However, untrampled areas in *B. minganense* occurrences displayed low numbers of individuals while heavily trampled areas completely lost *Botrychium* individuals. Changes in the hydrologic regime (from erosion, roads, grazing, etc.) may also potentially threaten occurrences. Hot fires have been shown to be detrimental, especially if the conditions are very dry during the burn.

***Botrychium montanum*, Mountain Moonwort**

Botrychium montanum is one of the rarest of the *Botrychium* spp. in California. At this time, there are only 13 confirmed occurrences of *Botrychium montanum* in California. The Lassen National Forest has 15 occurrences but only 10 of these have been located since 1985. The Plumas National Forest has two confirmed occurrences and the Modoc has only one known occurrence. In addition, there are a few historic occurrences, which have not been confirmed in recent years within Butte County. In July 2005, Don Farrar confirmed a location in the Greenhorn Mountains, Sequoia National Forest in Kern County. Known occurrences often consist of only a few plants, so overall plant numbers in California are low. *B. montanum* is limited to scattered locations from British Columbia, to California, Montana, Oregon, and

Washington. In California, this species has been found in Butte, Modoc, Plumas, Shasta and Tehama Counties. Actual trends in the populations are unknown, since sporophytes do not appear above ground every year, and all known occurrences have very few individuals recorded.

Botrychium montanum is currently listed as a sensitive species by the Forest Service in Region 5, and is listed as rare in Oregon. In addition, this species is considered Forest Service Sensitive in Oregon. Interim management prescriptions on several forests require the protection of individuals and their associated habitat. In other areas, *B. montanum* will be provided additional protection since it is found in riparian areas, which generally have some form of streamside or wetlands management protection during timber harvest activities on Forest Service lands. Soil disturbance has been shown to be very detrimental especially if on a regular basis. This includes grazing and trampling by livestock and OHV, where a little disturbance and compaction is tolerated but heavy disturbance will kill individuals. An Oregon study found light trampling seemed to benefit some species of Botrychiums including *B. montanum*. However, untrampled areas in *B. montanum* occurrences displayed low numbers of individuals while heavily trampled areas were devoid of *Botrychium* individuals. Changes in the hydrologic regime (from erosion, roads, grazing, etc.) may also potentially threaten occurrences. Hot fires have been shown to be detrimental, especially if the soil conditions are very dry during the burn.

Botrychium montanum grows in varied wet habitats from marshes/meadows to coniferous forest/montane streamside areas. In California, it has primarily been found along shady streams in mixed coniferous forests. These habitats are not highly unusual, so specific factors that limit the plants' abundance and distribution are not known. All *Botrychium spp.* have strong mycorrhizal requirements, which may be a factor. Riparian habitats are subject to grazing and hydrologic alterations, and conifer stands are subject to timber harvesting.

***Bruchia bolanderi*, Bolander's bruchia moss**

Bruchia bolanderi is endemic to the Sierra Nevada of California in meadow habitats in the mixed conifer zone. Its distribution ranges from Yosemite National Park (type locality) southward to the Sequoia National Forest in Tulare County.

This Bolander's bruchia moss occupies a specialized habitat within Sierran meadows. It seems to prefer the vertical soil banks of small streams that meander through meadows. Trampling of the banks and increased erosion are threats to the species habitat.

Sierran meadows receive a wide range of activities that can have a direct effect on this moss species.

***Hydrotheria venosa*, water lichen**

Hydrotheria venosa is known from only a few occurrences in California. It is found in cold, unpolluted streams in mixed conifer forests along the western slope of the Sierra Nevada on the Sequoia, Sierra, and Stanislaus National Forests. The California occurrences are disjunct or separate from other U.S. populations.

According to the occurrences in California documented to date, this species occurs in streams that are fed by cold-water springs. The water is very clear and peak flows are not of the intensity that would lead to scouring. The streamlets have a rich aquatic bryophyte flora. The streams are rarely more than eight inches in depth. Increased sedimentation may impact occurrences. This

lichen is a foliose species with a rather delicate thallus. The species cannot tolerate too much physical disruption.

Many recreation activities take place in riparian areas, increasing the likelihood of local effects. Threats include activities that change the water chemistry, alter the stream channel, or excessively alter riparian vegetation, thereby increasing water temperature or increasing flows that scour the gravels and rocks on which the lichen is attached.

***Meesia triquetra*, three-ranked hump moss**

In California, *Meesia triquetrum* is currently restricted to Sierran meadows that are acidic. Occurrences are known in the Sierra and Sequoia National Forests and Sequoia National Park.

This species seems to prefer acidic meadows with moss, sundew, and huckleberry, as associates. Cold springs in the meadow also seem to be essential. This moss requires permanent saturation and will not occur in meadows that dry out.

Primary threats are activities that alter meadow hydrology. Based on recent field observations, grazing has impacted some populations. Status in the Monument is not fully known.

***Meesia uliginosa*, broad-nerved hump moss**

The range for *Meesia uliginosa* is disjunct, but occurs from Siskiyou County south to Tulare. Most occurrences are in the southern Sierra Nevada.

Meesia uliginosa prefers saturated meadows generally in the upper level of the mixed conifer through subalpine forests. The meadow must be permanently wet, primarily spring fed. Occurrences do not seem to be as restricted to a particular type of meadow, except that the short-grass variety is a likely place to search. Primary threats are activities that alter meadow hydrology.

Species in Drier, Upland, and Forest Habitats

These species include: *Astragalus shevockii*, *Brodiaea insignis*, *Calochortus westonii*, *Cryptantha incana*, *Hulsea brevifolia*, *Leptosiphon serrulatus*, and *Mimulus gracilipes*.

These species occur within forest and chaparral habitats and are ecologically adapted to fire. All of these plants are either perennials that die back to the root crown during fire season or annuals that go to seed and die during fire season, making them tolerant of fire.

***Astragalus shevockii*, Little Kern River Milk Vetch**

Little Kern River Milk Vetch is known from approximately 16 occurrences. Plants are scattered over roughly 1800-1900 acres along both sides of the lower Little Kern River. *Astragalus shevockii* is endemic to a six mile stretch along the lower and middle portions of the Little Kern River drainage on Sequoia National Forest, in Tulare County. All known occurrences are in the Golden Trout Wilderness.

Threats include Livestock grazing and pack stock use.

Astragalus shevockii is found in open Jeffrey pine forest with sandy, granitic soils, and pine needle duff, at approximately 6,100 to 6,700 feet elevation.

***Brodiaea insignis*, Kaweah brodiaea**

Kaweah brodiaea is a showy, herbaceous perennial in the Lily family (Liliaceae). From a fibrous bulb, it produces several linear leaves which are crescent-shaped in cross-section, and a leafless stalk topped by a cluster of rose-purple to pink tubular flowers. It forms pink carpets in May and June within blue oak savanna. *Brodiaea insignis* is generally found on grassy, mostly west-facing slopes of foothill blue oak woodland habitat, on loamy clay soils over granitic substrate. Elevation ranges from approximately 800 to 1,600 feet.

This species was found historically in the lower Kaweah River drainage and in the lower Tule River drainage, in Tulare County. Some Kaweah brodiaea occurrences, known from the 1980s around Three Rivers, along South Fork Road, and along Grouse Valley Road (primarily on private and some California Department of Fish and Game lands), may have been extirpated. Historical occurrences and a re-introduced site in Tule

River Canyon between Lumreau and Coffee Camp Campgrounds (Sequoia National Forest) did not have plants when last visited by forest staff in 1999.

The species appears to be very sensitive to soil disturbance and habitat changes, making populations vulnerable to impact and possible extirpation from commonly occurring urban activities. Threats include urban development, road maintenance, and potentially over-grazing.

***Calochortus westonii*, Shirley Meadow star tulip**

There are over 1,200 acres of known habitat for *Calochortus westonii*. Occurrences may fluctuate, depending on varying habitat conditions. At least 20 to 30 extant occurrences are currently known, most with dozens to thousands of plants each. Known range and abundance have expanded greatly in the past fifteen years. The currently known range is approximately 50 miles (north-south) by 16 miles (east-west) in the Tule, Kaweah, and Kern River drainages of Tulare and Kern Counties. Occurrences may be either small, apparently isolated pockets of plants or large, contiguous colonies scattered from as far north and west as Case Mountain to just below Mountain Home State Forest and the Camp Nelson area, east to Baker Point Road and the Vincent/Dry/Tyler Meadows area, and south to the type locality at Shirley Meadows and Cooks Peak. The Case Mountain population is on Bureau of Land Management land, and a few tracts of private land within the Sequoia National Forest include occurrences. The majority of *Calochortus westonii* populations and habitat; however, exist on National Forest System lands (Sequoia National Forest).

After it was collected and tentatively identified in 1927, *Calochortus westonii* was initially thought to be highly localized and endemic to the area around Shirley Peak in the Greenhorn Mountains. In 1984, a species management guide was developed to provide protection, primarily in relation to timber harvest, and ensure long-term conservation of the species. Just before the Stormy Fire burned over 24,000 acres of the area, five more occurrences were discovered in 1990. Approximately 115 acres of additional occurrences were found throughout the burned area during post-fire surveys (1991). These areas were flagged and excluded from salvage timber harvest, according to a 1990 agreement with USFWS. However, many of those occurrences did not persist in post-fire years in burned habitat where ecological conditions were not suitable for the species. Apparently established occurrences have been found in many

areas north of the burn since then (1992-1996).

Typical habitat for *Calochortus westonii* is partially open, mixed conifer/black oak and associated dry meadow edges, from approximately 5,000 to 7,200 feet elevation. Soils may be granitic or metamorphic and are moderately loamy and deep when occurring in or adjacent to meadows and dry out early in the season. They may also be somewhat shallower and rockier on steeper forest slopes (usually less than 40 percent slope).

Populations appear to be able to tolerate moderate disturbance (the species is a bulbiferous, perennial herb) and have the potential to colonize new sites when habitat conditions are suitable.

Since 1990, the Forest Service has implemented a "flag and avoid" policy for *Calochortus westonii*, according to an agreement with the USFWS. The 1984 Species Management Guide was updated in 1997 to incorporate new demographic information and propose similar, additional recommendations for enhancing suitable habitat and protecting and promoting the species. Potential threats may include mechanical equipment use and related activities, trampling, and competition from larger, more aggressive species. Species appears to populate skid trails after disturbance. A study on grazing effects to this species was inconclusive due to low grazing pressure. The highest threat appeared to be herbivory by wildlife.

***Cryptantha incana*, Tulare Cryptantha**

Only 3 occurrences of Tulare Cryptantha are listed in California Natural Diversity Database (CNDDB), all of which are historical and there is no information on population size. It occurs in lower montane coniferous forest (gravelly or rocky substrate); pinyon woodland 1,700-2,250 meters (5,800-7,440 ft).

It is distributed on southwestern Kern Plateau and eastern Greenhorn Mountains. Three known locations are: 1) 5,800' on Ninemile Ck, 2) Grey Meadow, 3) Upper Peppermint Ck (Kern Plateau). The Ninemile Creek occurrence is on Inyo NF, and the others are on the Sequoia National Forest. The Ninemile Creek and Grey Meadow occurrences are in National Forest Wilderness.

***Hulsea brevifolia*, Short-leaved hulsea**

Hulsea brevifolia is found in the Sierra Nevada from Grant Grove where Dorst Creek crosses the Generals Highway in Sequoia National Park (Tulare County), northward through Yosemite National Park (Fresno, Madera, Mariposa Counties), to Tuolumne County. Its elevation range is between 5,000 and 9,000 feet.

Hulsea brevifolia is found in granitic or volcanic soils in openings as well as in the shade of canopy in Upper Montane Coniferous Forest. Potential threats include OHV use, timber harvesting, road maintenance, and possibly prescribed burning if done in spring or early summer. Most of these threats are for populations outside of the Monument.

***Leptosiphon serrulatus*, Madera Linanthus**

Madera Linanthus occurs on dry slopes in cismontane woodland and lower montane coniferous forest, mostly in decomposed granite soils, but occasionally in serpentine soils. Sites apparently vary from well-vegetated areas in blue oak woodland to more open, rocky sites. Although most

are documented from blue oak woodland at lower elevations (below 3,500 feet), at least 2 are known from mixed conifer forest above 5,000 feet where winter snow remains for several months.

Madera Linathus historically documented from at least 20 occurrences, few of which have been seen in the last several decades. One occurrence at Millerton Lake in Fresno County (CNDDDB Element Occurrence No. 9) was extant within the last few years (pers. comm., Christopher Winchell). York records an occurrence that appears to correspond with CNDDDB EO No. 11, collected during the late 1990s as part of his study of flora of the Kings River Basin. Historic locations are documented from southern Mariposa County southward to Kern County, with occurrences in Madera, Fresno, and Tulare Counties. Elevations range from 260 to over 5,000 feet.

The population trend is unknown, but possibly declining based on unsuccessful attempts to relocate several historic occurrences. As most fall outside of public lands, protection varies from none for private land to some protection on National Forest System lands by virtue of the requirement for environmental analysis prior to ground-disturbing projects.

Potential threats include private land development, road maintenance or reconstruction, competition from invasive non-native species, overgrazing and trampling by livestock, and OHV use. The higher elevation populations could be damaged by vegetation treatment and fuels reduction projects.

***Mimulus gracilipes*, Slender-Stalked Monkeyflower**

Slender-Stalked Monkeyflower is found on open sandy and gravelly flats in chaparral, foothill woodland, and lower mixed conifer forest, as well as burned areas in chaparral, foothill woodland, and lower coniferous forest. It is known from fewer than 20 occurrences. Size of populations varies dramatically in relation to disturbance and rainfall. 1998 was an exceptional year, known and newly discovered populations numbered in the thousands.

It occurs in Mariposa, Tuolumne, and Fresno counties, in the Tuolumne, Merced, Fresno, Kings, and San Joaquin watersheds. Found in the Sierra NF and Yosemite National Park and in several locations downslope and off the Forest in the vicinity of Bootjack and Wawona, also as far south as Miramonte near the Fresno/Tulare county boundary. Elevation ranges from 1,500 to at least 4,500 feet.

The trend is presumably stable, but it is only conspicuous in above-average rainfall years.

All populations occur on public land and it will receive consideration during NEPA process on National Forest System lands. Potential threats are: residential development (near Wawona), competition from noxious weeds (Carpenteria Botanical Area); road maintenance; ill-timed fuels or vegetation treatments, possibly lack of fire, since this Monkeyflower appears to behave as a "fire follower" (fire annual).

Plants Associated with Rock Outcrops, Cliffs, and Other Special Geologic or Soil Features

These species include *Carlquistai muirii*, *Delphinium inopinum*, *Dicentra nevadensis*, *Dudleya cymosa* ssp. *costifolia*, *Erigeron aequifolius*, *Eriogonum twisselmanii*, *Erythronium pusaterii*,

Heterotheca monarchensis, *Lewisia congdonii*, *Lewisia disepala*, *Monardella linoides* ssp. *oblonga*, *Oreonana purpurascens*, *Petrophyton caespitosum* ssp. *acuminatum*, and *Streptanthus fenestratus*.

***Carlquistia muirii*, Muir's raillardella**

Carlquistia muirii occupies roughly a 200-mile range along the length of the southern Sierra Nevada from Fresno to Kern counties, and there is one disjunct population 160 miles to the west in the Ventana Wilderness of the Los Padres National Forest. Elevations range from 4,000 to 8,000 feet. The Monument is within its range and has suitable habitats for this plant, but none of the known populations are within the Monument.

This species occupies granite ledges and cracks, gravelly, or sandy flats within openings in chaparral, ponderosa pine, or mixed conifer forest. Threats include occurrences next to trails or near lookouts (Baker Point). Foot or livestock traffic or trail maintenance could impact populations.

***Delphinium inopinum*, unexpected larkspur**

Delphinium inopinum is found in disjunct populations mostly in the Sequoia National Forest (the majority on the Monarch Divide, on Slate Mountain, and in the Piutes), the Sierra National Forest (Monarch Divide), and the Los Padres National Forest (Mt. Pinos). It is also found in Sequoia National Park and on BLM land near Lamont Peak, from Fresno County through Tulare, Inyo, Kern and Ventura Counties.

Delphinium inopinum inhabits dry rock outcrops and open rocky ridges in pine and red fir forests, at approximately 6,000 to 8,800 feet in elevation. It is often found in association with *Eriogonum twisselmannii*, *E. breedlovei* var. *breedlovei*, and *Oreonana purpurascens*. The more rugged sites along the Monarch Divide are relatively stable, but the saddle along the top of Slate Mountain and the Piute habitats may be vulnerable to disturbances. Potential threats include the use of mechanical equipment, mining, and recreation.

***Dicentra nevadensis*, Tulare County bleeding heart**

Dicentra nevadensis is known to have approximately 10 occurrences on the Hume Lake and Tule River Ranger Districts of the Sequoia National Forest and one occurrence on the Sierra National Forest, with the remainder in Sequoia National Park.

The species occupies sandy, gravelly crevices and openings in usually dry, granitic soils from approximately 7,500 to over 10,000 feet elevation.

Threats include trampling, road maintenance, and plant collecting in areas of heavy recreation use (e.g., on the Hume Lake Ranger District and in Sequoia National Park).

***Dudleya cymosa* ssp. *costifolia*, Pierpoint Springs liveforever**

There are two confirmed locations on a formerly private tract of land acquired by the Sequoia National Forest in the Tule River drainage of Tulare County. Potential habitat exists on similar outcrops, but no other occurrences have been found to date.

Rockiness and surrounding vegetation make the site relatively inaccessible to people and

livestock. *Dudleya cymosa* ssp. *costifolia* is found on a rocky, limestone outcrop in the canyon live oak woodland/mixed chaparral vegetation type, at approximately 4,800 to 5,200 feet elevation. Habitat may be sensitive to disturbance but is relatively inaccessible.

***Erigeron aequifolius*, Hall's daisy**

Erigeron aequifolius is found primarily from the Needles and the Golden Trout Wilderness of the Kern and Little Kern River drainages of Tulare County to the Kings River drainage of Fresno County. Most recorded occurrences are on the Sequoia National Forest (10), with one each on the Sierra National Forest (found in 1995), the Inyo National Forest, and Kings Canyon National Park. One disjunct population is also known to occur on BLM land in Kern County (Owens Peak). Additional occurrences are likely to exist throughout the range but may never be seen because of the ruggedness and inaccessibility of the habitat.

Erigeron aequifolius is found only in steep, rocky, granitic crevices with little or no competition from other species. It is generally found on dry ridges, approximately 5,200 to 8,000 feet in elevation, in mixed conifer forests. Populations are relatively stable due to steep, rugged nature of the habitat, making them inaccessible for timber harvest, grazing and most recreation.

The only potential threat for known *Erigeron aequifolius* populations is from hikers and rock climbers.

***Eriogonum twisselmannii*, Twisselmann's buckwheat**

Eriogonum twisselmannii is endemic to the Slate Mountain area (roughly 5 miles by 6 miles) of the Monument in Tulare County. Twisselmann's buckwheat is found on dry, granitic outcrops in Jeffrey pine/red fir forests, at approximately 8,000 to 9,000 feet elevation. The species is often found in association with *Arctostaphylos nevadensis*, *Delphinium inopinum*, and *Oreonana purpurascens*.

***Erythronium pusaterii*, Kaweah Fawn Lily**

Erythronium pusaterii is found in dry, rocky, granitic or metamorphic soils, rock outcrops, ledges, and steep canyon walls of upper montane conifer (fir-pine) forests, approximately 7,300 to 9,100 feet elevation.

Kaweah Fawn Lily occurs roughly along 18 miles (north-south) in Tulare County from the Kaweah River watershed in Sequoia-Kings Canyon NP down through the Tule River watershed in Sequoia National Forest. Known locations include Hocket Lakes in Sequoia NP, and Moses Mountain, Jordan Peak, Slate Mountain on the Sequoia National Forest. Seven occurrences are known, most with at least several hundred to several thousand plants each.

The trend of this species is stable to increasing. Most occurrences are protected by the inaccessibility of the steep, rocky habitat. No threats are anticipated, due to the inaccessibility of the steep, rocky habitat.

***Heterotheca monarchensis*, Sequoia false goldenaster**

Heterotheca monarchensis is locally common on limestone formation northeast of Horseshoe Bend on the Kings River near Boyden Cave. To date, it is known only from this area in the Monarch Wilderness on both the Sequoia and Sierra National Forests. This is a remote, rugged

area of the wilderness with little to no human effects.

This species is found scattered on south-facing slopes of limestone in cracks, ledges and flats, with higher densities of plants seen in the coarse sandy flats at the base of cliffs, from 3,650 to 6,000 feet in elevation. The only discernible threat may be competition from exotic annual grasses.

***Lewisia congdonii*, Congdon's bitterroot**

Lewisia congdonii has a disjunct distribution between the Kings River Canyon and the Merced River Canyon 50 miles to the north. All but one population are in the Merced River drainage. Elevation ranges from 1,900 to 7,000 feet.

On the Sierra National Forest, one population is in the Devil Peak Botanical Area, three are in remote seldom-visited areas, and one extends down from an abandoned barite mine, where it seems to have re-colonized well, to Highway 140. On the Stanislaus National Forest, the only occurrence is at Trumbull Peak, with no visible threats. The only occurrence on the Sequoia National Forest is directly next to Highway 180.

Plants are found on rock faces, cracks, and ledges in rocky areas, on talus and scree, and on spoil piles of the abandoned barium mine. The Kings River population grows on granitics, the other populations are found on metamorphics. Plant communities range from chaparral to coniferous forest.

Most populations face few to no threats. The populations that extend down to the roadside at Highway 180 and Highway 140 are known about by Caltrans and the Forest Service, and protective measures are taken when highway maintenance is proposed. The Highway 140 population is included in a 1994 Memo of Understanding for protection of rare species in the Merced Canyon (signing parties are the Forest Service, the BLM, Pacific Gas and Electric, Caltrans, and the California Department of Fish and Game).

***Lewisia disepala*, Yosemite bitterroot**

Lewisia disepala species is found in Mariposa, Madera, Fresno, Tulare, and Kern Counties, from 4,400 to 7,800 feet elevation.

This species grows in pans and shelves of granite gravel found on and next to outcrops surrounded by coniferous forest. Plants emerge in the winter and bloom and set fruit very early in the spring, in many cases before access roads are clear of snow. Once seeds are dispersed, the plants are nearly impossible to find. Botanical surveys over the past years have completely missed this plant because it is only identifiable for such a brief period.

Some effects could result from hiking or camping near outcrops that are accessible to the public. Effects from mechanical equipment or fuelbreak construction are possible, since the plants are not visible during the normal field season.

***Monardella linoides* ssp. *oblonga*, Flax-like Monardella**

Flax-like Monardella occurs in the southern Sierra Nevada and Tehachapi Mountains from Tulare County to Kern and Ventura Counties. It is known from about 20 occurrences.

Monardella linoides ssp. *oblonga* has a disjunct distribution with plants found in the southern

Sierra Nevada and western Transverse Range. Occurrences found on the Los Padres National Forest are well distributed across areas of suitable habitat and there is no apparent decline in the abundance and distribution of the species relative to its historic distribution. Monitoring of occurrences has shown that plants are tolerant of current and anticipated levels of livestock grazing and that plants are adapted to surviving fire events. The known occurrences of *Monardella linoides* ssp. *oblonga* on National Forest System lands appear to be stable or increasing in size.

Monardella linoides ssp. *oblonga* grows among rock outcrops and general openings in mixed conifer forests, yellow pine forests, pinyon-juniper woodlands, and desert scrub habitat. It is distributed in several highly restricted occurrences but currently is not considered to be at risk of extinction.

This taxon is known to respond positively to wildfire events; however, some occurrences are vulnerable to road/trail maintenance and OHV activity

***Oreonana purpuracens*, purple mountain parsley**

The distribution of *Oreonana purpuracens* stretches along a series of prominent ridges through the northern portion of the Sequoia National Forest (Hume Lake and Western Divide Ranger Districts) and the Sequoia and Kings Canyon National Parks in the southern Sierra Nevada of Tulare County (roughly 50 miles). Purple mountain parsley is found on ridge tops and rock outcrops or gravelly openings of decomposed granitic or metamorphic soils in red fir forests, approximately 7,900 to 9,400 feet elevation.

Both the soils and plants are vulnerable to impact from major activities, such as mechanical equipment or road/trail construction or maintenance.

***Petrophyton caespitosum* ssp. *acuminatum*, Marble Rockmat**

Petrophyton caespitosum ssp. *acuminatum* occurs on lower and upper montane coniferous forest, on carbonate or granitic, rocky substrates between 1,200-2,300 meters. Marble rockmat occurs in Fresno, Inyo, and Tulare Counties. Kings River Canyon near Boyden Cave (Sequoia National Forest); west of Independence, Symmes Creek (Inyo National Forest); Big Arroyo, Tulare County (Sequoia Kings National Parks). It grows within lower and upper montane coniferous forest, on carbonate or granitic, rocky substrates between 1,200-2,300 meters. There are occurrences reported in CNDDDB; no other information available.

The population trend is unknown. No likely threats to the Inyo or Sequoia National Forests occurrences. Inyo NF occurrence near Wilderness boundary is growing on cliff across creek from trail, and is somewhat inaccessible.

***Streptanthus fenestratus*, Tehipite valley jewel flower**

All occurrences of *Streptanthus fenestratus* are in Fresno County, mostly in Kings Canyon National Park. One population was recently found on the Monarch Divide between the Sequoia and Sierra National Forests, and a large population was discovered in the Sequoia National Forest near Boyden Cave. The entire worldwide distribution of this rare plant is contained within an area of 100 square miles. The Boyden Cave population is in or near the Monument.

The most vigorous and dense populations are found on carbonate soils, but populations are

also found in granitic soils. Most occurrences face no threats, but some are along trails or in areas where groups may be likely to set up camp. Two occurrences in the Monarch Wilderness are far from trails.

Environmental Effects

Legal and Regulatory Compliance

Current management direction and desired conditions for 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 effects 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 (FSM/H 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 effects 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 Chapter.

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 (standards and guidelines 36-49): See the nonnative invasive species report.
- Wetland and Meadow Habitat (standard and guideline 70): See Hydrology report.
- Riparian Habitat (standard and guideline 92): See Hydrology report.

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. (Management Standard and Guideline 125). The standards and guidelines provide direction for conducting field surveys, minimizing or eliminating direct and indirect effects 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 (Ch.4, p.30): Manage Sensitive plants to prevent the need for federal listing as threatened and endangered.
- Riparian Habitat (Ch.4, p.30):
- Within riparian areas, protect streams 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 *Calochortus westonii* (USDA 1998):

- Maintain and enhance viable populations of *Calochortus westonii*.
- Preserve or restore habitat conditions which will promote the geographic distribution and genetic diversity of the species.
- Minimize potential, negative effects of management activities.

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 spp.*). 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.

Analysis Assumptions and Methodology

Measures and Factors Used to Evaluate Alternatives

The TES plant strategy standards and guidelines are nearly identical for all of the action alternatives. The standards and guidelines provide a protection-based approach for TES plants and their habitat. Effective implementation of these standards and guidelines conserve individuals, populations, and habitat of TES plants. However, no prevention method is 100 percent effective; the more ground disturbing activity the more potential that TES plant individuals, populations, and habitat will be affected.

The alternatives are evaluated based on the potential for Forest Service management activities to change or successfully contain and reverse invasive nonnative species infestations. Factors were used to compare the effects of management of TES plants. The six alternatives were evaluated for their effects on TES plants, by habitat guilds, based in part on the following factors:

Relative risk of wildfire (wildfire acres projected to burn annually)

Acres of annual mechanical fuels treatments and placement or pattern of treatments on the landscape
Acres of annual prescribed fire

Determining Cumulative Effects

The cumulative effects analysis evaluates the six alternatives in context with past, present and reasonably foreseeable actions that when taken collectively might influence TES plants. The cumulative effects of past management activities are incorporated within the existing condition in the Monument.

Past and current activities have altered sensitive plant populations and their habitats. The effects of past activities are built into this analysis in that they are largely responsible for the

existing landscape. It is unclear if all of the sensitive species included in this analysis have always been rare or were once more common but currently rare due to past land use practices. Very little is known about population dynamics and metapopulations (a population of populations) of sensitive species such as how long individuals live, how long colonies persist, how often are new colonies formed, and how long seeds persist in the seed bank. A thorough understanding of species population dynamics and metapopulations would be necessary to accurately assess the cumulative effects of past, present, and future projects on a species. This cumulative effects analysis is based on the best available science known regarding species distribution, ecology, and life history. Standards and guidelines or 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. The following discussion provides an explanation of why this type of management is effective in reducing cumulative effects to sensitive plants.

MacDonald (2000) reports that a critical step in cumulative effects analysis is to compare the current condition of the resource (in this case sensitive plants) and the projected changes due to management activities (in this case, the management plan for the Monument) with the natural variability in the resources and processes of concern. This is difficult for sensitive plants since long-term data are often lacking, and many sensitive plant habitats have a long history of disturbance. In some cases, an undisturbed area where a plant exists is often lacking. For some species, particularly those which do not tolerate disturbance or are found under dense canopy conditions, minimizing on-site changes is an effective way of reducing cumulative effects. "If the largest effect of a given action is local and immediate, then these are the spatial and temporal scales at which the effect would be easiest to detect. If one can minimize the adverse effects at this local scale, it follows that there would be a greatly reduced potential for larger-scale effects" (MacDonald 2000, p. 311). For other species, particularly those which are disturbance tolerant or fire-followers, minimizing on-site changes could be detrimental. These species tolerate or benefit from on-site changes, which result in opening the stand and increasing light reception in the understory. Thus, the response of sensitive plant species to the management activities is species-dependent.

Climate change may cause changes in the distribution of TES Plants. The precise effects of climate change on individual species are difficult to predict and will not be addressed in the effects analysis. For a more detailed description of how climate change may impact the Monument, see the effects on air resources section in chapter 4 of the draft EIS.

Direct Effects

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

Indirect Effects

All alternatives, except E have the exact same standards and guidelines regarding Forest Service sensitive plants and their habitats. However, Alternative E contains Forest Service Handbook direction for TES Plants that make this alternative similar to the others in the respect. Therefore, all site-specific project environmental analysis for Monument plan implementation for all alternatives will include surveys and mitigations.

All Alternatives

Under all alternatives, TES Plant species would be protected. The Forest Service is mandated to maintain the viability of such species. Effects on species listed under the protection of the Endangered Species Act (ESA), both adverse and beneficial, are regulated by the USDI Fish and Wildlife Service. These effects are detailed in the biological assessment. Due to the programmatic, non-specific nature of this action, most of the discussion of potential effects to TES plant species in this document is directed toward effects on future habitat potential rather than direct effects on existing populations. Negative direct and indirect effects to rare plants and their habitats from Forest management activities are 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. TES plant species would also be protected during weed management activities by using integrated pest management (IPM). IPM is a combination of invasive non-native species control methods (mechanical, chemical, and biologic) designed in project level planning to achieve maximum control of invasive non-native species with minimal adverse consequences on resources (in this case, TES plant species).

Most plant TES plant species within the Monument are at risk due to limited distribution and low population levels rather than proposed management. Most of the terrestrial species occupy rock outcrops, cliffs, or unique habitats related to poor soils with little competing vegetation. Species adapted to rock outcrops include *Carlquistia muirii*, *Delphinium inopinum*, *Dicentra nevadensis*, *Dudleya cymosa ssp. costifolia*, *Erigeron aequifolius*, *Eriogonum twisselmanii*, *Erythronium pusaterii*, *Heterotheca monarchensis*, *Lewisia congdonii*, *Lewisia disepala*, *Monardella linoides ssp. oblonga*, *Oreonana purpurascens*, *Petrophyton caespitosum ssp. acuminatum*, and *Streptanthus fenestratus*. Mechanical treatments designed to reduce fuels are unlikely to target these areas and the effect of fire on these habitats is considered minimal.

Aquatic and riparian associated species include: *Botrychium crenulatum*, *Botrychium minganense*, *Botrychium montanum*, *Bruchia bolanderi*, *Hydrotheria venosa*, *Meesia triquetra* and *Meesia uliginosa*. Effects on these species would vary little since all alternatives incorporate the riparian conservation strategy from the 2001 SNFPA. Grazing would still be allowed as discussed and subject to standards and guidelines. Species found in riparian habitats are divided into meadow species and meadow edge/riparian/streambank species. Species in the meadow, bog, and fen habitats are unlikely to be affected by changes in management proposed in this plan. Provisions for protection of these species are provided in the 2001 SNFPA riparian conservation strategy that is carried through the Monument alternatives.

Habitat for riparian/meadow edge/streambank species might be limited under alternatives that constrain opportunities for gap creation within riparian conservation areas (streamside management zones). Grazing guidelines address methods to retain vegetation where grazing may eliminate younger age classes within riparian forests.

Species that utilize small openings in forest, woodland, or shrub communities would have the greatest potential for effects from management proposed in the alternatives. These species include: *Astragalus shevockii*, *Brodiaea insignis*, *Calochortus westonii*, *Cryptantha incana*, *Hulsea brevifolia*, *Leptosiphon serrulatus*, and *Mimulus gracilipes*. For these species, lack of disturbance (exclusion of fire) might result in a dense canopy (of overstory trees or shrubs) and or a heavy layer of duff that suppresses growth of herbaceous plants within these communities.

Disturbance from natural or management intent might create openings that are too large and expose the plants to stress from wind and sun.

Some species might be adversely affected by avoiding natural or managed disturbances that maintain openings within the forest, since they depend on natural gaps created by fire, disease, and other factors. These species include: *Brodiaea insignis*, *Calochortus westonii*, and *Hulsea brevifolia*.

All alternatives would provide benefits of reduced potential for stand-replacing wildfires and the creation of small openings that support an herbaceous understory.

No Action Alternative (Alternative A)

Species that benefit from general openings would be likely to benefit under Alternative A. However, benefits might be offset by the priority for creating openings adjacent to communities, where increased disturbance may offset gains in potential habitat.

Alternatives C and D

Alternative C and D would have the greatest effect on canopy reduction in the short term. The expectation of more intense prescribed burns or wildfire, in the absence of mechanical pre-treatment of fuels, might benefit gap species such as *Calochortus westonii*, *Monardella linoides*, and possibly *Oreonana purpurascens*, *hulsea brevifolia*, and *Carlquistia muirii*. Gaps would likely be a little larger than under other alternatives, but still fine-grained disturbances within the Monument. The larger openings and greater reduction in canopy closure would be likely to favor the above species. However, the benefit would be offset slightly by a greater chance of escaped fires with higher intensity.

Alternatives B, E, and F

Mechanical treatments are more conservative under Alternatives C and D than under Alternatives B, E, and F. Created openings and thinning could benefit gap phase species such as *Calochortus westonii*, *Monardella linoides*, and possibly *Oreonana purpurascens*, *Hulsea brevifolia*, and *Carlquistia muirii*, but not as much as a more intensive burning program. These species appear to benefit from disturbance, including mechanical treatments, although under current (and proposed) standards and guidelines occupied habitat of either species would not be treated intentionally using mechanical means. Based on observations by Forest Service staff, *Calochortus westonii* appears to colonize old skid roads, roadbeds, and other areas of repeated low-level disturbance. Most of the gaps or openings would be limited to lower gradient slopes available for mechanical treatments and adjacent to communities where greater human disturbance may offset habitat improvement for species at risk. Use of mechanical treatment gives greater control to avoid known populations but increases the potential for compaction and displacement of soil in potential habitat.

These alternatives provide a greater risk of introducing invasive nonnative species through increased mechanical treatments. Mitigations would be in place to avoid the introduction, but these are not 100 percent effective in keeping invasive nonnative species out. If invasive nonnative species were introduced and become established, this could negatively affect the species utilizing small openings in forest, woodland, or shrub communities which include: *Astragalus shevockii*, *Brodiaea insignis*, *Calochortus westonii*, *Cryptantha incana*, *Hulsea brevifolia*, *Leptosiphon serrulatus*, and *Mimulus gracilipes*.

Cumulative Effects

Past and present forest management activities have caused changes in plant community structure and composition across the Monument. Management activities that have cumulatively impacted sensitive plant occurrences on the forest include: historic timber harvest, fire suppression, prescribed fire, recreation use, and road construction. These cumulative effects have altered the present landscape to various degrees. However, cumulative, direct and indirect effects can be minimized by following Forest Service standards and guidelines and by implementing mitigation measures to monitor or offset effects to sensitive plants species. With these protective measures in place, cumulative effects are less likely to be adverse.

The area of analysis for cumulative effects is greater than the Monument, and consists of the entire range of each Region 5 sensitive plant species that occurs, or has potential to be found, within the Monument. The current conditions (population trends) of these Region 5 sensitive species are either presumed stable or unknown. Comprehensive ecological information does not exist for most Region 5 sensitive plants on the Monument, but aspects of plant ecology can be deduced from substrate and plant community preference.

The time-frame for determining cumulative effects depends on the length of time that lingering effects of the past action will continue to negatively impact the species in question. This will vary widely among species because some rare plants require and tolerate disturbances that would harm others. Past actions that occurred in the area of each sensitive plant occurrence are included in this evaluation if information is available. Where site-specific information is lacking, the general discussion of cumulative effects addresses the effects of disturbances likely to have occurred.

The majority of sensitive plants that are addressed have distributions outside the Monument onto the adjacent Sequoia National Forest, Sequoia National Park, Sierra National Forest, or the Los Padres National Forest. Where these plants occur on National Forests, they are protected by the same (or similar) standards and guidelines as within the Monument. Occurrences within Sequoia National Park are protected by similar restriction on activities which could affect these TES plants and their habitats. Therefore, negative cumulative effects to rare plants and their habitats from Forest management activities (outside of the Monument) will be minimized by conducting botany surveys prior to project implementation, with flagging and avoidance of all rare plant occurrences. Only a small portion of the species considered have distributions that extend onto private land, with little if any protection offered.

Plants with significant populations that occur on private land are *Brodiaea insignis* and *Leptosiphon serrulatus*. The cumulative effects of livestock grazing on these populations is unknown at this time because information and access is limited.

Plants that have distributions limited to adjacent Federal Lands are: *Delphinium inopinum*, *Dicentra nevadensis*, *Erigeron aequifolius*, *Erythronium pusaterii*, *Heterotheca monarchensis*, *Monardella linoides* ssp. *oblonga*, *Oreonana purpurascens*, *Petrophyton caespitosum* ssp. *acuminatum*, *Streptanthus fenestratus*, *Astragalus shevockii*, *Calochortus westonii*, *Cryptantha incana* and *Hulsea brevifolia*, and *Mimulus gracilipes*.

Two plants are entirely endemic to the Monument: *Dudleya cymosa* ssp. *costafolia*, and *Eriogonum twisselmannii*.

Determination for all Sensitive Species

It is determined that the Monument management plan:

May affect undiscovered individuals but is not likely to result in a trend toward federal listing or loss of viability for:

Species Occurring in Riparian/Meadow/Aquatic Habitats: *Botrychium crenulatum*, *Botrychium minganense*, *Botrychium montanum*, *Bruchia bolanderi*, *Hydrotheria venosa*, *Meesia triquetra* and *Meesia uliginosa*.

Species in Drier, Upland, and Forest Habitats: *Astragalus shevockii*, *Brodiaea insignis*, *Calochortus westonii*, *Cryptantha incana*, *Hulsea brevifolia*, *Leptosiphon serrulatus*, and *Mimulus gracilipes*.

Species Associated with Rock Outcrops, Cliffs, and other Special Geologic or Soil Features: *Carlquista muirii*, *Delphinium inopinum*, *Dicentra nevadensis*, *Dudleya cymosa ssp. costifolia*, *Eriogonum twisselmanii*, *Erythronium pusaterii*, *Heterotheca monarchensis*, *Lewisia congdonii*, *Lewisia disepala*, *Monardella linoides ssp. oblonga*, *Oreonana purpurascens*, *Petrophyton caespitosum ssp. acuminatum*, and *Streptanthus fenestratus*.

Other plant species listed on the Sequoia National Forest as Forest Service sensitive do not have habitat within the Monument, and therefore will not be impacted by the plan.

Literature Cited and References

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

USDA Forest Service 2004 Forest Service Manual - FSM 2070 - Native Plant Materials
USDA Forest Service 2005 Forest Service Manual - FSM 2070 - Native Plant Materials

U.S. Department of Agriculture [USDA], Forest Service. 1998c. Draft species management guide for *Calochortus westonii*. Porterville, CA: Sequoia National Forest. 23 p.

USDA Forest Service 1996 Draft Species Management Guide for *Clarkia springvillensis*
Porterville, CA: Sequoia National Forest 17 p.

USDA Forest Service 1988 Sequoia National Forest Land and Resource Management Plan
USDA Forest Service 2001 Sierra Nevada Forest Plan Amendment. Pacific Southwest Region, Forest Service

USDI Fish & Wildlife Service 1998 Listing for Springville *Clarkia* in 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 September 14, 1998)

Appendix A-Species Eliminated from Detailed Analysis

Striped Adobe Lily, *Fritillaria striata*

Striped Adobe Lily occurs in the Southern Sierra Nevada foothills from southern Tulare County (east of Porterville) to northern Kern County (east of Bakersfield). Previously more widespread along eastern edge of the San Joaquin valley. All known occurrences are on private lands, mostly in Kern County. Six occurrences are located near the southwestern boundary of Sequoia National Forest. Twenty occurrences reported on California Natural Diversity Database (CNDDDB) from 1980s to 1990, with wide range of population size from 0 to 100,000. A number of historical populations have been extirpated.

The trend is declining from historical distribution and abundance; current status unknown.

Most Kern County populations occur on lands utilized for grazing, where current practices do not appear to be harmful to the species' viability. Most Tulare County populations have been extirpated or greatly reduced by urbanization and agriculture. The species currently has some protection under state law, according to its threatened status and has limited protection as a federally proposed species. No populations are currently known to occur on National Forest System lands or other federal lands, where they would have further protection, according to the species federal status. Threats are agriculture, urbanization, and possible over-grazing.

Fritillaria striata is found on small "pockets" or "islands" of heavy, "adobe" clay soils in blue oak woodlands and grasslands. Elevation ranges from less than 1,000 feet to under 5,000 feet (mostly 1,000 to 2,000 feet). Several known occurrences are located on private land near the southwestern tip of Sequoia National Forest, where a limited amount of potential habitat exists. The distinctive clay soil with which the species is associated is found on limited, scattered sites too small to be detected or included on soil survey maps of the area (possibly as a remnant from uplifted metamorphic deposits which was not eroded away). No adobe soils have been found on Sequoia National Forest lands to date. However, the area identified as potential habitat has not been fully surveyed, and the possibility remains that some may occur there.