



## United States Department of the Interior

FISH AND WILDLIFE SERVICE  
New Mexico Ecological Services Field Office  
2105 Osuna NE  
Albuquerque, New Mexico 87113  
Phone: (505) 346-2525 Fax: (505) 346-2542

April 25, 2008

Cons. #22420-2008-F-0050

Jacque Buchanan, Acting Forest Supervisor  
Lincoln National Forest  
Federal Building  
1101 New York Avenue  
Alamogordo, New Mexico 88310-6992

Dear Ms. Buchanan:

This responds to your request for formal consultation with the U.S. Fish and Wildlife Service under section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.). This consultation concerns the effects of authorizing the continued use, operation and maintenance of the existing water transmission pipelines and water collection facilities and structures in Fresnal, La Luz, and Maruche Canyons, located on the Sacramento Ranger District of the Lincoln National Forest, on the endangered Sacramento prickly poppy (*Argemone pleiacantha* ssp. *pinnatisecta*).

We appreciate the excellent coordination and information provided by your staff throughout this consultation process, as well as your efforts to minimize adverse effects to the Sacramento prickly poppy. We also commend your close coordination and cooperation with the City of Alamogordo as applicants to this consultation.

In future communication regarding this project, please refer to consultation #22420-2008-F-0050. If you have any questions about this biological opinion, please contact Dr. Patricia Zenone at the letterhead address or at (505) 761-4718.

Sincerely,

Wally Murphy  
Acting New Mexico State Administrator

Enclosure





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## SUMMARY

BIOLOGICAL OPINION ON THE EFFECTS TO  
THE SACRAMENTO PRICKLY POPPY FROM THE COMPLETED ACTION OF  
AUTHORIZING THE CONTINUED USE, OPERATION AND MAINTENANCE OF THE  
EXISTING WATER TRANSMISSION PIPELINES AND WATER COLLECTION  
FACILITIES AND STRUCTURES IN FRESNAL, LA LUZ, AND MARUCHE CANYONS,  
LOCATED ON THE SACRAMENTO RANGER DISTRICT OF THE  
LINCOLN NATIONAL FOREST, NEW MEXICO

Cons. #22420-2008-F-0050

Date of the biological opinion: April 25, 2008

Action agency: Lincoln National Forest

Project: This consultation concerns the effects on the Sacramento prickly poppy (*Argemone pleiakantha* ssp. *pinnatisecta*) of authorizing the continued use, operation and maintenance of the existing water transmission pipelines and water collection facilities and structures in Fresnal, La Luz, and Maruche Canyons on approximately 15.3 acres, or about 7 miles, of a 20-foot wide corridor located on the Sacramento Ranger District of the Lincoln National Forest. Authorization would be accomplished through issuance of a new Special Use Permit to the City of Alamogordo for a term of 25 years.

Species affected: Sacramento prickly poppy (*Argemone pleiakantha* ssp. *pinnatisecta*)

Biological opinion: The completed action would not be likely to jeopardize the Sacramento prickly poppy.

Incidental take statement: Sections 7(b)(4) and 7(o)(2) of the Endangered Species Act generally do not apply to listed plant species. However, limited protection of plants from take is provided to the extent that the Endangered Species Act prohibits the removal and reduction to possession of federally listed endangered plants or the malicious damage of such plants on areas under Federal jurisdiction, or the destruction of endangered plants on non-Federal areas in violation of State law or regulation or in the course of any violation of a State criminal trespass law (19 NMAC 21.2).

Conservation recommendations: Implementation of conservation recommendations is discretionary. Four conservation recommendations are provided.





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April 25, 2008

Cons. #22420-2008-F-0050

Jacque Buchanan, Acting Forest Supervisor  
Lincoln National Forest  
Federal Building  
1101 New York Avenue  
Alamogordo, New Mexico 88310-6992

Dear Ms. Buchanan:

Thank you for your October 3, 2007, request for formal section 7 consultation under the Endangered Species Act of 1973, as amended, on the Fresnal, La Luz, and Maruche Water Pipeline Special Use Project. This document transmits the U. S. Fish and Wildlife Service's (Service) concurrence and biological opinion on this project, which is located on the Sacramento Ranger District of the Lincoln National Forest, U.S. Forest Service in New Mexico. The purpose of the proposed project is to authorize the continued use, operation and maintenance of the existing water transmission pipelines and water collection facilities and structures in Fresnal, La Luz, and Maruche Canyons on approximately 15.3 acres, or about 7 miles of a 20-foot wide corridor, of Forest Service land. Authorization would be accomplished through issuance of a new Special Use Permit to the City of Alamogordo for a term of 25 years. Reissuing the permit to the City for a new term would allow the delivery of water to the City's municipal water system to continue for approximately 40,000 people. The Service received your biological assessment for the proposed action on October 5, 2007. The biological assessment determined that this project "may affect, is likely to adversely affect" the Sacramento prickly poppy (*Argemone pleiacantha* ssp. *pinnatisecta*); "may affect, is not likely to adversely affect" the Mexican spotted owl (*Strix occidentalis lucida*), and would have "no effect" on critical habitat for the Mexican spotted owl.

The Service concurs with your determination that this project "may affect, is not likely to adversely affect" the Mexican spotted owl based on the following rationale provided in your assessment and on the terms of use that would be included in the Special Use Permit to the City of Alamogordo:

## Rationale

- Any activities within a Mexican spotted owl Protected Activity Center (PAC) on Forest Service land will not occur during the breeding season. Exception to this may occur if current year monitoring has indicated that nesting is not occurring.
- Only 1 percent of the Maruche PAC is within the project area, and this area consists of foraging habitat, not nesting habitat. Pinyon-juniper foraging habitat within the Maruche

PAC may be directly impacted by maintenance or planned repair of the pipeline. In some cases, foraging habitat may have to be removed to maintain the line within the Maruche PAC. No mixed conifer will be affected by the proposed action. The proposed action will not remove any trees 9 inches or greater in diameter within the PAC, as recommended by the Mexican Spotted Owl Recovery Plan (U.S. Fish and Wildlife Service 1995). Any effects associated with the proposed action will be brief in time and extremely limited in scope and can be considered insignificant and discountable.

- Emergency repairs on the segment of the pipeline within the Maruche PAC will not occur due to the low amount of water collected at that location.
- Mexican spotted owl surveys will follow Region 3 protocol standards.

#### Terms of Use

- Any pipeline activities in a Mexican Spotted Owl PAC during the breeding season from April 1 through August 31 will require clearance by the Forest Service.
- Access to Forest Service lands for inspection purposes is limited to what has been identified on an updated map provided annually.
- Access may be severely limited during extreme fire danger.
- Access for road/trail maintenance will require site-specific approval from the Forest Service before any work is performed.
- Specific guidelines and procedures may be set by the Forest Service that include, but are not limited to, specifying the type of equipment to be used, and actions necessary to minimize impacts to Forest Service lands and resources such as soil, water, wildlife, and plants.
- When transporting supplies to work sites the City will coordinate with the Forest Service to help determine the best access and mode of transportation to minimize impacts to plants, animals and their habitat. This may include limiting access to horseback, mules, helicopters or walking.
- Steps shall be taken to protect the environment and clean the site of all debris (such as old pipeline) upon completion of work.
- All areas of ground disturbance will be re-vegetated as appropriate with a Forest Service-approved, weed-free seed mixture, except as noted below in Sacramento prickly poppy habitat.

The remainder of this biological opinion concerns the effects of actions associated with re-issuance of the Fresno, La Luz, and Maruche Water Pipeline Special Use Permit on the federally endangered Sacramento prickly poppy. The Forest Service has determined that this proposed project "may affect, is likely to adversely affect" the Sacramento prickly poppy. Critical habitat is not designated for this species.

This biological opinion is based on information provided in the October 3, 2007, biological assessment, telephone conversations and meetings with Forest Service staff, comments provided by the applicant, and other sources of information. A complete administrative record of this consultation is on file at the New Mexico Ecological Field Office in Albuquerque, New Mexico.

## **BIOLOGICAL OPINION CONSULTATION HISTORY**

On January 29, 2007, the Service received your request to initiate formal section 7 consultation on the biological assessment for the Fresno, La Luz, and Maruchi Water Pipeline Special Use Project. We assigned this consultation number 22420-2007-F-0047. On February 27, 2007, after we reviewed the assessment submitted by the Forest Service, we sent a request for additional information for this consultation to the Lincoln National Forest.

On June 11, 2007, the City of Alamogordo, Otero County, Forest Service, and the Service met in Alamogordo to discuss this project. The City invited us to annually survey their water pipeline right-of-way on non-Forest Service lands for Sacramento prickly poppy plants.

On September 14, 2007, the City of Alamogordo, Forest Service, and the Service met with members of the Sacramento Mountains Watershed Restoration group to discuss new survey information provided by the watershed group that located additional Sacramento prickly poppy plants in the action area for this project. Because of this new information, the Forest Service withdrew the previous consultation, number 22420-2007-F-0047, on September 20, 2007, in order to further analyze the new information under the National Environmental Policy Act. The Lincoln National Forest submitted a new biological assessment to the Service on October 5, 2007, and it was assigned consultation number 22420-2008-F-0050.

On October 29, 2007, the Service and a species expert from the University of New Mexico accompanied the City of Alamogordo to survey the water pipeline right-of-way from west of the High Rolls tunnel to the confluence of La Luz and Fresno Canyon for poppy plants. Approximately 30 to 35 adult Sacramento prickly poppy plants were located within and adjacent to the City of Alamogordo right-of-way.

On November 19, 2007, the Service was copied on a letter to the Forest Service from the Domenici Law Firm, which is representing the City of Alamogordo for this consultation. The City has been granted applicant status in this consultation, and they are requesting that the Forest Service change their section 7 determination to "may affect, is not likely to adversely affect" the Sacramento prickly poppy. The City based this request on their conclusion that the likelihood of adverse effects would be discountable because emergency repairs to the water pipeline would be rare.

On November 23, 2007, the Service received notification that the Forest Service was opening a second 30-day comment period on this proposed action under the National Environmental Policy Act.

On February 5, 2008, the Service transmitted a draft biological opinion to the Lincoln National Forest for the Fresno, La Luz, and Maruchi Water Pipeline Special Use Project and requested submission of comments by February 19, 2008.

Jacque Buchanan, Acting Forest Supervisor

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On February 18, 2008, the Service received the "Environmental Assessment for City of Alamogordo Fresnal, La Luz, and Maruche Canyon Water Pipelines Special Use Permit" on the Sacramento Ranger District, Lincoln National Forest. The cover letter contained notification that the Lincoln National Forest was opening a third 30-day public comment period for this project under the National Environmental Policy Act.

On March 5, 2008, the Service received a preliminary written response to our draft biological opinion requesting clarification of and modification to some of our Conservation Recommendations. A February 19, 2008, letter from the applicant in this consultation, the City of Alamogordo, was attached, which requested no changes to our draft opinion.

On March 27, 2008, the Service received written notification from the Lincoln National Forest that their National Environmental Policy Act analysis indicated that there would be no change in effects to the Sacramento prickly poppy and Mexican spotted owl from those already considered in the February 5, 2008, draft biological opinion.

## **DESCRIPTION OF THE PROPOSED ACTION**

The Fresnal, La Luz, and Maruche Water Pipeline Special Use Project Area is located within the northwest portion of the Sacramento Ranger District of the Lincoln National Forest, Otero County, New Mexico. It includes approximately 26.4 miles of pipeline that runs through private, City, and Forest Service lands. In 1948, the City obtained its first Special Use Permit from the Forest Service to operate and maintain the water conveyance system located in Fresnal and La Luz Canyons. This original permit was modified and reissued in 1953, 1956, and 1983. The 1983 permit was amended in 1993 and 1997 to reference segments of the system on Forest Service lands in Maruche Canyon and the east end of La Luz Canyon, and in 2002, to extend the permit by 1 year. The City has applied for renewal of its expired Special Use Permit with no change to project location or upgrade of facilities. An Operation and Maintenance Plan for the segments of the water conveyance system occurring on Forest Service lands was finalized in August 2007.

The expired Special Use Permit authorized the City to use and maintain the water pipeline located in Fresnal, La Luz and Maruche Canyons, which ranges in size from 1 to 18 inches in diameter, and its associated facilities and structures, for conveyance of up to 16 cubic feet per second (cfs) of water. The permit includes a remotely operated emergency waste valve radio located on Mill Ridge, and several spring boxes, diversions and collection facilities. The water conveyance system has been in place for over 40 years, and in its current configuration for 10 years. The entire length of pipeline is accessed year round for repair and maintenance as needed, by pedestrian and vehicular access on and across Forest Service lands. For this consultation, the Forest Service analyzed 30 feet on either side of the pipeline, encompassing 45 acres, on the 7 miles located on their lands. There are approximately 18 access points to the pipeline for inspection and maintenance located on Forest Service lands. Of the 18 access points, 8 are inspected or maintained by vehicle access on or parallel to 1.28 miles of Forest Service roads.

The City of Alamogordo is responsible for ensuring that all proposed activities on the water conveyance system, including use, maintenance, repair, and improvement, occurring on Forest Service lands each year are planned, communicated, and approved by the Forest Service, as specified in the 2007 Operation and Maintenance Plan. This includes, but is not limited to, the following: Any ground disturbing activities; addition and/or replacement of facilities and structures; securing of applicable Federal, State, and local permits; cleaning and removal of any hazardous materials; anticipated and planned routine maintenance and repairs; and any activities that may not be in compliance with the National Environmental Policy Act, Endangered Species Act, and National Historic Preservation Act.

The City will notify the Forest Service within 24 hours of any emergency situation that requires immediate actions that involve ground disturbance, new access, and/or use of heavy equipment. Emergencies involving the water conveyance system include the occurrence of one the following activities occurring on Forest Service lands: A break or leak in the pipeline, where 15 gallons of water per minute are being released; failure of a diversion, spring box, well or water meter, such that water is not able to flow or be measured; damage caused by natural disasters, such as floods, tornados, earthquakes, fire, etc.; and any unforeseen combination of circumstances that calls for immediate action to ensure the integrity and continued operation of the water conveyance syste. Activities scheduled, agreed to, or approved at the annual meeting each December will not be considered emergencies and will require no notification of the Forest Service by the City prior to initiation, unless the annual agreement calls for the Forest Service to perform activities prior to initiation, such as survey and flag resources that should be avoided.

The City may meet and confer with the Service annually, and accompany the Service during periodic access to those lands owned by the City and those lands on which the City holds easements or rights-of-way for the water conveyance system in Fresnal, La Luz and Maruche Canyons. Any such access will be for the purpose of conducting surveys for the Sacramento prickly poppy or its habitat where it occurs on those lands. If updated maps are produced showing locations of Sacramento prickly poppy plants and/or its occupied habitat as a result of these surveys, the City may utilize them in planning and implementing operation and maintenance of the water conveyance system to avoid impacts to the plant where it occurs on these lands.

#### Conservation Measures for the Sacramento prickly poppy

In addition to the terms of use listed above for concurrence with the Mexican spotted owl determination of effects, the following Conservation Measures are also incorporated into the proposed action to minimize impacts to the Sacramento prickly poppy and its habitat from the effects of inspection and maintenance of the water conveyance system on Forest Service lands:

- Sacramento prickly poppy plants (adults, juveniles, and seedlings) found during water conveyance system inspections and maintenance surveys will be flagged to avoid impacts or disturbance to the plants.

- If at any time during routine operation and maintenance of the water conveyance system, unforeseen changes in work activities are required, the Forest Service will be informed of those changes as soon as possible. The Forest Service will provide approval in writing to the City before implementation.
- When the water conveyance system is being inspected from a road, any parking or pulling off the road will not occur in known Sacramento prickly poppy locations. These locations are identified on the updated map showing areas of threatened and endangered plants and animals and their habitat provided at the annual December meeting.
- During emergency situations, if the Forest Service is not able to respond in a timely manner to identify specific Conservation Measures, the City shall not be required to implement specific Sacramento prickly poppy Conservation Measures. If the actions fall within the Special Use Permit definition of maintenance, then all Sacramento prickly poppy conservation measure actions must be implemented.
- If emergency repair of the water conveyance system is necessary, the Forest Service will be notified within 24 hours. The Forest Service will contact the Service to inform and consult as appropriate on needed actions and documentation. In no case shall response to an emergency be delayed due to the Forest Service's inability to contact the Service.
- Natural re-vegetation will be the preferred re-vegetation method for disturbed areas in Sacramento prickly poppy habitat. If natural re-vegetation does not occur or the erosion rate exceeds Forest Service standards, then the Service will be contacted to discuss reseeding of the disturbed area(s) with a Forest Service-approved weed-free seed mixture.

## STATUS OF THE SPECIES

### Species Description

The poppy was first described in George Ownbey's monograph of the North and Central American species of *Argemone* (U.S. Fish and Wildlife Service 1994). The botanical description of the poppy is based on a specimen collected by George and Findley Ownbey, on August 12, 1953, 9.6 miles west of Cloudcroft, at an altitude of 6,600 feet, in Otero County, New Mexico. The poppy is endemic only to several canyons in the Sacramento Mountains of Otero County, in south-central New Mexico (U.S. Fish and Wildlife Service 1994).

The Service listed the poppy as an endangered species under the Act, on August 24, 1989. No critical habitat has been designated for the poppy. The Sacramento Prickly Poppy Recovery Plan (Recovery Plan) was signed on August 31, 1994. The poppy has a recovery priority of 3, based on the high degree of threat and high recovery potential for the subspecies (U.S. Fish and Wildlife Service 1994). The Endangered Species Act prohibits the malicious damage, destruction, or removal and reduction to possession of listed plants on areas under Federal jurisdiction. For all other areas, the Endangered Species Act prohibits removing, cutting, digging up, damaging or destroying listed plants in knowing violation of any State law or regulation, or in the course of any violation of a State criminal trespass law. The Endangered Species Act and the Lacey Act also prohibit any person subject to the jurisdiction of the United States from selling, offering for sale,

importing, exporting, or transporting in interstate or foreign commerce in the course of a commercial activity, any listed plant species.

The poppy is a New Mexico state endangered plant species listed in New Mexico Natural Heritage Program Rule 85-3 of the New Mexico State Endangered Plant Species Act. The law prohibits the taking, possession, transportation and exportation, and selling or offering for sale any listed plant species (U.S. Fish and Wildlife Service 1994).

The Sacramento prickly poppy is an herbaceous plant that commonly grows to a height of 20 to 60 inches. The leaves are long and narrow with box-shaped sinuses between spine-tipped lobes. The prickly poppy displays attractive flowers with numerous yellow stamens and 6 white petals, 1.2 to 1.6 inches long and as wide (U.S. Fish and Wildlife Service 1989). The prickly poppy is endemic to several canyons in the Sacramento Mountains of Otero County in south-central New Mexico.

The Sacramento prickly poppy is distinguished from the typical subspecies by its white milky sap, as opposed to the typical yellow-orange sap color, its deeply divided leaves, and its simple capsule spines. No other species of *Argemone* occurs within the range of the *Argemone pleiacantha* ssp. *pinnatisecta*.

### **Distribution and Abundance**

The Sacramento prickly poppy occurs along the western face of the Sacramento Mountains between La Luz Creek and Escondido Canyon. The species' historic range covers 10 canyons in seven canyon systems of the Lincoln National Forest. Populations have been found in Fresnal Canyon, including Salado and La Luz canyons; Dry Canyon; Alamo Canyon, including Caballero Canyon; Mule Canyon; San Andres Canyon; Dog Canyon; and Escondido Canyon (U.S. Fish and Wildlife 1994). The subspecies is also known to occur on Bureau of Land Management lands, private lands, Oliver Lee State Park, and State and city right-of-ways. The entire range is estimated at 90 square miles (230 square kilometers). Although past surveys have not found prickly poppies on the Mescalero Apache reservation, the area has been identified in the Recovery Plan as potential habitat for Sacramento prickly poppy. Additional surveys are needed to determine whether this species actually occurs on the reservation.

Prior to listing, a survey conducted between May and July of 1987 identified 1,290 plants on 6,331 acres of Federal, State, City of Alamogordo, and private lands (Malaby 1987). High mean annual precipitation levels are believed to have contributed to the success of prickly poppy germination and establishment during those years. In 1989, approximately 1,313 plants were known to occur in 10 canyons of the Sacramento Mountains. The limits of the species' range were La Luz Canyon and Dog Canyon.

A partial survey was conducted in 1999 in Alamo and Caballero Canyons. The survey covered two-thirds of the prickly poppy suitable habitat, locating 402 plants. This survey estimated 603 plants within the entire prickly poppy habitat (Sivinski 1999). Further studies in 2002 and 2003 identified a combined total of 548 plants across the canyons historically reported as supporting the Sacramento prickly poppy. During the spring of 2004, 345 poppies were found in Alamo and

Caballero Canyons (U.S. Fish and Wildlife Service 2004). In June of 2004, 62 adults and 4 seedlings were counted at the mouth of Alamo Canyon, including 5 adults dead or dying and 32 adults with a disease on the stems (J. Martinez, 2004, unpublished data). This marked the first discovery of a disease in Alamo Canyon (E. Hein, 2004, unpublished data). During a cursory field visit in September 2004, seven poppies were counted in Fresno Canyon, and one healthy poppy and three dying poppies were found in Dog Canyon (B. Sivinski, 2004, unpublished data). No poppies were found in Salado Canyon in 2004 (U.S. Fish and Wildlife Service 2004). The population of Sacramento prickly poppies range-wide has been in decline for several years. As of November 30, 2004, 388 seedlings were tallied throughout the Alamo Canyon system (L. Barker, 2005, unpublished data). The stronghold of the poppy, Alamo Canyon and its tributary, Caballero Canyon, contained 73 percent of all Sacramento prickly poppies found on all ownerships in 1987, according to the Recovery Plan, and 72 percent of the plants known on Forest Service lands in 1999 (U.S. Forest Service 2004). The Alamo/Caballero system once supported 954 individuals (Malaby 1987). In 2006, surveyors found 488 plants, not counting seedlings. This drop of 49 percent indicates a precipitous decline in the population over 19 years. The 2006 survey was not able to relocate Sacramento prickly poppy occurrences in Dry and Escondido Canyons, and this further supports the declining status of this endangered plant. However, in Fresno and Dog Canyons, while some recent losses have occurred there, overall numbers appear to be down only 13 percent from those in 1987. In comparison with the Alamo/Caballero population, this population appears to be better able to survive the long drought that occurred in New Mexico. Much of Fresno Canyon was surveyed in stages over 2006 and 2007, and 150 Sacramento prickly poppy plants were detected (Tonne 2007).

The Dog Canyon bench population appeared to have reached at an all-time low when only a single plant was found in 2002 (Worthington 2002). However, recent monitoring in Dog Canyon found a number of surviving plants from the 2006 cohort and new recruits since that time, indicating that this population may be increasing following an extended period of drought. Recent discoveries about dormancy in the Sacramento prickly poppy reveal that even when adults are not visible above ground, some can resprout from their substantial root system with increased precipitation. Surveys following periods of drought likely overlook dormant adults, which appear deceased above the soil surface (Tonne 2007).

While some flooding appears to benefit the poppy by contributing additional water, silt, and nutrients for increased germination and establishment, the 2006 floods were so large that they may have resulted in a net loss of habitat (Tonne 2007). Intense floods removed almost all of the vegetation and soils from portions of the arroyos that provide habitat for the Sacramento prickly poppy. The flooding likely destroyed the seed bank within long stretches of the arroyo bottom. However, significant seedling establishment has been observed in some areas following these floods, such as the Dog Canyon bench and bajada and the San Andres bajada (Tonne 2007).

The distribution of the Sacramento prickly poppy appears to be more constricted than it was 20 years ago when the southern boundary was in Escondido Canyon. Recent surveys failed to find any plants in this area. If this population is no longer extant, it would move the southern boundary approximately 5 kilometers (3.1 miles) north. With a total north-south distribution of 26 kilometers

(16.1 miles), this would be a significant reduction in the known distribution. Recent surveys failed to locate plants in the once occupied Dry, Mule, and Escodido Canyons. The main population in San Andres was in decline in 2002, and could not be relocated this year. Recent surveys in Dog Canyon have shown that individuals or small populations may go dormant during periods of drought and re-appear when precipitation increases. Therefore the disappearance of poppies from these areas during relatively wet years is of concern (Tonne 2007).

If Dry Canyon no longer contains occupied habitat, the loss in plant numbers is relatively small. However, this is a potentially important gene distribution corridor. Dry Canyon is, like most canyons on the western escarpment of the Sacramento Mountains, oriented in a generally east-west direction, but higher up this canyon switches to a north-south trend. Previously occupied habitat in Dry Canyon spans over half the distance between the Fresnal/La Luz and the Caballero/Alamo Canyon systems. The loss of such a corridor could decrease opportunities for gene flow between these two main population centers. Likewise, the loss of the Mule Canyon population and the Cottonwood Springs location in San Andres Canyon would remove two of the stepping stones available to pollinators and seed dispersers within the occupied escarpment (Tonne 2007).

### Habitat

The Sacramento prickly poppy occurs in steep, rocky canyons between the pinyon/juniper zone of the Chihuahuan Desert Scrublands and Grasslands (4,300 ft), and the lower edge of the ponderosa pine community of the Great Basin Conifer Woodlands (7,100 ft). Habitats vary from xeric uplands to mesic sites, and may include arid canyon bottoms, dry terraces above riparian areas, and along streams, springs, and seep areas (U.S. Forest Service 2004). Plants grow directly in the rocks and gravel of stream beds, on vegetated bars of silt, gravel, and rock, on cut slopes, and on terraces above stream channels (U.S. Fish and Wildlife 2004).

Habitat for the Sacramento prickly poppy extends through a variety of communities, but can be characterized in very general terms as Chihuahuan Desert Scrub and Mixed Arroyo Shrubland. Upper reaches of habitat occur within Alligator Juniper-Pinon Woodland and a varied arroyo-riparian zone with upper-elevation dominant species that include velvet ash (*Fraxinus velutina*), red mahonia (*Mahonia haematocarpa*), Wright silktassel (*Garrya wrightii*), one-seed juniper (*Juniperus monosperma*), skunkbush sumac (*Rhus trilobata*), toughleaf sumac (*Rhus virens*), blue grama (*Bouteloua gracilis*), sleepygrass (*Achnatherum robustum*), and Apache plume (*Fallugia paradoxa*). Lower reaches of occupied habitat are more xeric and while they may contain some of the species above, they are likely to be dominated by desert willow (*Chilopsis linearis*), Apache plume (*Fallugia paradoxa*), shrubby poreleaf (*Porophyllum scoparium*), splitleaf brickellbush (*Brickellia laciniata*), skeletonleaf goldeneye (*Viguiera stenaloba*), honey mesquite (*Prosopis glandulosa*), mariola (*Parthenium incanum*) creosotebush (*Larrea tridentata*), and occasionally tarbush (*Flourensia cernua*). These arroyos range from forested woodlands to arroyo riparian shrublands to barren rock/cliff wash habitat. While primarily arroyo-riparian, there are stretches of riparian dominated by obligate riparian broad-leaf species, including Rio Grande cottonwood (*Populus deltoides* ssp. *wislizeni*) and ash, occasionally associated with hackberry (*Celtis laevigata*) or hophornbeam (*Ostrya knowltonii*) (Tonne 2007).

The Sacramento prickly poppy is an early succession plant, which occupies disturbed habitat. This subspecies favors conditions of enhanced soil moisture, but does not grow directly in saturated soils. Soils are primarily derived from limestone, and may contain sandstone and gypsum. Habitat sites that collect surface water are considered favorable for seedling establishment, yet mature plants are often observed in more xeric sites (U.S. Forest Service 1992). Sacramento prickly poppies favor habitat ranging from full exposure to 50 to 75 percent shaded (Malaby 1987).

The western slope of the Sacramento Mountains has wide fluctuations in diurnal and seasonal temperatures. Temperatures average above 90 degrees Fahrenheit from mid-May to mid-September, and drop as low as 16 degrees Fahrenheit in the winter (U.S. Soil Conservation Service 1981). Annual precipitation averages 15 inches (38 cm), with most rains occurring from July through October.

### Life History

The Sacramento prickly poppy is an herbaceous perennial that lives approximately 7 to 9 years. The subspecies dies back to the root crown each year. Mature plants have been known to be large and vigorous for multiple years, and then observed to remain dormant in a subsequent year (U.S. Forest Service 2004).

Germination has been observed to occur between October and November through late winter and spring, and successful recruitment into the population requires sufficient moisture for the establishment of seedlings. Seedlings grow slowly, producing a juvenile rosette the first year. Seedlings are delicate, susceptible to desiccation, and may be dislodged by floods. Young plants occupy open, disturbed habitat with minimal competing vegetation (U.S. Fish and Wildlife Service 2004).

Generally, plants bloom during the second year, if moisture availability has allowed for sufficient growth. Flowering begins in May and continues throughout the summer depending on elevation and moisture conditions. The flowers have a variety of pollinators that include carpenter bees (*Xylocopa californica arizonensis*), honey bees (*Apis mellifera*), bumblebees (*Bombus ssp.*), soldier beetles (*Cantharidae*), lizard beetles (*Liguriidae*), flies (*Diptera*), and butterflies (*Lepidoptera*) (U.S. Forest Service 2004). Studies of pollination biology and subsequent fruit set and seed production show that prickly poppies will set little or no fruit unless visited by pollinators. Self-pollination, either within one flower or among flowers of the same plant, results in significantly fewer fruits and fewer seeds per fruit (Tepedino 1992). Fruits mature and shed seeds throughout the flowering season. Prickly poppy seeds have a waxy coating and pitted vesicles on the surface. Seed dispersal occurs by water flow, soil movement, birds, or insects.

The Sacramento prickly poppy becomes established in relatively limited areas and undergoes inter- and intra-annual population fluctuations. While prickly poppy has been shown to produce a relatively large amount of seed, germination rates and seedling success are strongly influenced by available moisture. Following germination, young plants have insufficient roots to survive a prolonged dry spell. Lack of sufficient moisture at the optimal time during germination is likely to result in wide fluctuations in poppy occurrence from year to year (U.S. Fish and Wildlife Service

2004). The Sacramento prickly poppy is an early successional species, but the optimal type and amount of disturbance for maintenance of populations are not known. Cold treatment is needed to allow for successful germination. The tumbling action of the water and gravel is believed to provide scratching or scarification of the seed coat, which has been found to enhance germination (Sivinski 1992).

### **Reasons for Listing/Threats to Survival**

At the time of listing in 1989, approximately 1,313 Sacramento prickly poppy plants were identified from canyons in the Sacramento Mountains occurring on Bureau of Land Management, Lincoln National Forest, Oliver Lee State Park, Otero County Highway rights-of-way, and private lands (U.S. Fish and Wildlife Service 1989). In 1989, major threats to the prickly poppy were water diversion and pipeline construction, road construction and maintenance activities, drought, flooding, and livestock grazing (U.S. Fish and Wildlife Service 1994). By the time the Sacramento Prickly Poppy Recovery Plan was completed in 1994, off-highway vehicle use was added as a threat (U.S. Fish and Wildlife Service 1994). By 2005, an undetermined disease with symptoms similar to those of a stem canker had been added to the list of threats. Reasons for the recent substantial decline in Sacramento prickly poppy numbers are not fully understood, but may involve the interaction of a variety of factors, including drought, disease, water diversion, and livestock impacts (U.S. Fish and Wildlife Service 2004; Tonne 2007). Although genetic studies have not been performed on this subspecies, the threat of decreasing genetic diversity is a growing concern, as numbers of individuals and occupied canyon habitats decline (U.S. Fish and Wildlife 2004).

Current threats to the Sacramento prickly poppy include natural stochastic events, such as drought, disease, and flooding; livestock grazing; water extraction; off-highway vehicle use; and road and pipeline maintenance activities. Management concerns for the Sacramento prickly poppy center on activities that might prevent seedling establishment or destroy adult plants. With the present low number of plants, it is crucial to have successful seedling recruitment and maintain seed-producing adult plants (U.S. Forest Service 2004).

Drought and a fungal mold in the genus *Alternaria* have adversely affected the prickly poppy within the past few years, and together may be primarily responsible for the low to nonexistent current population numbers for some canyons (U.S. Fish and Wildlife Service 2004). A link between decreased water availability and increased cases of disease may exist, as drying may weaken a plant's resistance to disease.

Flash flooding has been recognized as a threat to arroyo populations of the Sacramento prickly poppy. Flooding can destroy many plants and its effects have been exacerbated by historic overstocking of cattle in portions of the poppy's range (U.S. Fish and Wildlife Service 2004). However, flooding can also create habitat for the plant species and transport scarified seeds.

Livestock grazing and trampling have been identified as threats to the Sacramento prickly poppy and its habitat, possibly causing reduction in recruitment rates (U.S. Fish and Wildlife Service 1989; U.S. Fish and Wildlife Service 1994). Monitoring has indicated that cattle will sometimes graze

adult Sacramento prickly poppies in the spring; however, grazed adult plants have been known to survive such herbivory (U.S. Forest Service 2004). A greater concern is that grazing and trampling can kill young seedlings, particularly during drought when forage is limited and along water sources where cattle tend to concentrate. Trampling by livestock may also degrade prickly poppy habitat by exposing it to encroachment by weedy species and/or increasing the rate of soil erosion. The overlap of ongoing high forage utilization with the yearly germination and establishment of the poppy may have created cumulative impacts upon the species and likely played a large role in its current declining status (U.S. Fish and Wildlife Service 2004).

Via pipelines, one system of which is the subject of this biological opinion, the City of Alamogordo withdraws water at the head of Alamo and Caballero canyons, and mid-way down in Fresnal and La Luz Canyons, reducing water flow to prickly poppy habitat (e.g., see November 2008). Water rights to these springs predate the establishment of the National Forest and the listing of the species. Sacramento prickly poppy seedlings are very sensitive to drying until they develop their taproot. If seed germination continues to occur without plant establishment, the soil seed bank could become depleted. Prolonged drought, extending beyond the 7 to 9 year lifespan of the plant, could prevent successful recruitment, eliminate the adult plants, and lead to a population crash. Thus, drought conditions and water extraction have a significant impact on the plant's survival.

Unauthorized off-highway vehicles and heavy equipment associated with road and pipeline maintenance can crush individual prickly poppy plants and threaten the health of poppy habitat. Off-highway vehicles can destabilize or compact soils, which affect seed germination and plant growth.

Decreasing genetic diversity is an indirect threat capable of extirpating the limited populations of poppies. Populations composed of smaller numbers of plants with narrow distributions are more susceptible to elimination from stochastic events, such as flooding or drought, or demographic fluctuations, such as reduced numbers of adults or diminished seed banks, than are larger, more widely distributed populations. A loss of populations or individuals may contribute significantly to a reduction in the gene pool and the ability of the species to adapt to environmental changes. With fewer, more widely spaced plants, out-crossing may become more difficult, which Tepedino (1992) has shown reduces fruit and seed set and could preclude population recovery.

Finally, global climate change may be a threat to the Sacramento prickly poppy over the 25-year life of this proposed project. The global average temperature has risen by approximately 0.6 degrees Celsius during the 20th Century (Intergovernmental Panel on Climate Change 2001). Warming temperatures have been documented in recent decades in the southwestern United States. In New Mexico, mean annual temperature has increased by 0.6 degree per decade beginning in 1970, and warming is greatest in spring (Lenart 2005). Higher temperatures lead to higher evaporation rates which may reduce the amount of runoff, groundwater recharge, and consequently spring discharge (Stewart et al. 2004).

High elevation environments influenced by snow, such as the Sacramento Mountains, and the uppermost limits of vegetation and other complex life forms, are among the most sensitive to

climate changes occurring on a global scale (Thompson 2000). Studies have shown that since 1950, the snowmelt season in some watersheds of the western United States has advanced by about 10 days (Dettinger and Cayan 1995, Dettinger and Diaz 2000, Stewart et al. 2004). Such changes in the timing and amount of snowmelt are thought to be signals of climate-related change in high elevations (Smith et al. 2000, Reiners et al. 2003). The impact of climate change is the intensification of natural drought cycles and the ensuing stress placed upon high elevation montane habitats (Intergovernmental Panel on Climate Change 2001, Cook et al. 2004, Breshears et al. 2005, Mueller et al. 2005). This change in mountain hydroclimate would have the effect of drying out historically moist high elevation habitats. Increased warming could result in the shrinkage or disappearance of high elevation habitats that currently support the Sacramento prickly poppy and exacerbate drought effects on this subspecies.

### Conservation Measures

A Recovery Plan for the Sacramento prickly poppy was completed in 1994. It outlines recovery actions to protect and manage habitats necessary for sustaining healthy populations of the Sacramento prickly poppy. These recovery actions include: 1) Ensure long-term protection from human threats, including designation of special management areas or zones, of poppy populations on Forest Service, City of Alamogordo, and Bureau of Land Management lands; 2) determine requirements for the germination and establishment of new individuals; and 3) study genetic variability within the subspecies to help determine how many populations are required to maintain sufficient variability (U.S. Fish and Wildlife Service 1994). The Recovery Plan also contains a detailed description of the Recovery Criteria that need to be met to allow reclassification of the Sacramento prickly poppy from endangered to threatened status. Among the criteria is maintaining reproducing populations of Sacramento prickly poppies within each of the ten historically occupied canyons on the western slope of the Sacramento Mountains.

Extensive surveys have been conducted to determine the distribution and abundance of Sacramento prickly poppies within its range (U.S. Fish and Wildlife Service 1994, U.S. Forest Service 2004, Tonne 2007). Past surveys and monitoring have identified declining population trends. Since 2002, surveying has become more intensive. In 2002, contracted surveys were conducted for plants in five of the seven canyons historically occupied by the subspecies: Mule, Dry, San Andres, Dog, Escondido Canyons, Salado in the Fresno Canyon system, and Deadman Canyon south of Dog Canyon (U.S. Forest Service 2004). In August 2003, National Forest System lands in Fresno Canyon were searched by Forest Service personnel. By mid-June 2004, ten monitoring visits by the Forest Service had been made in the two major population areas, the Alamo and Fresno Canyon systems. In 2006 and 2007, additional extensive surveys for Sacramento prickly poppy plants were conducted throughout the subspecies' range by the New Mexico Natural Heritage Program, the Forest Service, the New Mexico Energy, Minerals, and Natural Resources Department, the Service, and other botanists in New Mexico.

A "nursery" for the Sacramento prickly poppy was established in 1987 along a City of Alamogordo water pipeline in Alamo Canyon. The nursery has provided useful biological information about

Sacramento prickly poppy germination and seedling establishment (U.S. Fish and Wildlife Service 2005).

In 1996, Sacramento prickly poppy seeds were gathered under permit issued by the Service to the Desert Botanical Garden in Phoenix, Arizona. Germination trials for the plant were unsuccessful at this time (J. Martinez, 2004, unpublished data).

In early February of 2004 and 2005, livestock were removed from the Alamo Pasture of the Sacramento Grazing Allotment to avoid grazing and trampling impacts to germinating poppies and poppy seedlings (U.S. Fish and Wildlife Service 2004). This winter pasture contains Alamo and Caballero Canyons, which currently have the largest number of remaining poppy plants. Traditionally, the winter grazing period runs from November 1 through May 15, but early removal of cattle protected the poppy through the sensitive phase of seed germination and seedling growth, which can occur as early as October and November, and possibly even earlier in the year. To continue applying Conservation Measures, the Forest Service committed to implementing 40 percent allowable forage utilization in winter (U.S. Fish and Wildlife Service 2004). However, pre- and post-season monitoring in the Alamo pasture was not conducted in the 2004 to 2005 grazing season (Forest Service 2007). Minimizing the negative impacts of cattle would help ensure that the status of the subspecies in Alamo Canyon within the Sacramento Allotment does not further decline due to direct or indirect effects of grazing activities and may increase the ability of the Sacramento prickly poppy to recover in its historic stronghold.

In September 2004, the State Botanist, under permit from the Service, collected Sacramento prickly poppy seeds to begin investigating captive propagation and restoration techniques. In January 2005, the New Mexico Energy, Minerals, and Natural Resources Department, the New Mexico Natural Heritage Program, the Forest Service, the Service, and other botanists in New Mexico met to discuss the development of a captive propagation program for the poppy. Under the supervision of the New Mexico Natural Heritage Program at the University of New Mexico, poppy seeds are surviving in the University greenhouse, with 50 percent rate of germination success (P. Tonne, 2005, unpublished data). These activities will provide information concerning germination and seedling requirements. The captive propagation will be conducted with the intent of preserving the genetic and ecological distinctiveness of the poppy, minimizing risks to existing populations, and ensuring the long-term viability of the species (U.S. Fish and Wildlife Service 2004).

The identity and potential vectors of the fungus affecting the Sacramento prickly poppy have been under investigation by mycologists Don Natvig and Andrea Porras at the University of New Mexico. Identifying the plant pathogen that destroys *Argemone* tissue and possibly leads to death in some plants has been a priority for this taxon since its discovery in the mid-1990's. Porras identified the pathogen in 2005 as a fungal mold in the genus *Alternaria* (U.S. Fish and Wildlife Service 2007). Plant mortality due to the fungus appears to occur, but is not well documented (Sivinski 1999). Field observations suggest that this fungus is most problematic when the plants are stressed by lack of water during drought. *Alternaria* may only kill plants that are already under stress or it may be restricted to the aerial portion of the plant and never affects the roots. It is unclear whether plants that die back are able to re-sprout (U.S. Fish and Wildlife Service 2007).

The specific relationship of this fungus to its endangered host requires further investigation.

Further investigation into population genetics within and between taxa is also warranted. A new study at New Mexico State University is being conducted to add to our understanding of genetic diversity within and between some congeners that occur in New Mexico. The preliminary data have grouped *A. p. pinnatisecta* distinctly together as a taxonomic group and quite different from the typical subspecies, *pleiacantha* (U.S. Fish and Wildlife Service 2007).

In 2005, the Forest Service agreed to implement the following Conservation Measures for the Sacramento prickly poppy:

Conservation Measure #1: Annually protect newly emerging seedlings from trampling on National Forest System lands.

Conservation Measure #2: Within the mission and capability of the Forest Service, participate with State and Federal agencies, Forest Service research and others (e.g., Universities) to identify genetic factors essential to future reintroduction efforts and improve our collective understanding of the poppy's ecology in relation to habitat improvement and species recovery.

Conservation Measure #3: On National Forest System lands limit off-highway vehicle use to established routes.

Conservation Measure #4: To the extent feasible within the mission and capabilities of the Forest Service assist in the propagation and reintroduction of the Sacramento prickly poppy.

## **ENVIRONMENTAL BASELINE**

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area; the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation; and the impact of State and private actions that are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

### **Status of the Species within the Action Area**

In the 1987 range-wide survey, the Fresno/La Luz/Salado Canyon population of the Sacramento prickly poppy was the second-largest population documented, after that in the Alamo/Caballero Canyon (Malaby 1987, U.S. Forest Service 2004). On 6,331 acres of Federal, State, City of Alamogordo and private land, 1,290 Sacramento prickly poppy plants were located range-wide during this survey (Malaby 1987). Approximately 73 percent of the 1,290 plants were found in Alamo and Caballero Canyons. Of the 1,290 plants, approximately 1,112 plants, or 86 percent, were found on Forest Service lands. This survey counted 167 plants in the Fresno/La Luz/Salado drainage on both National Forest System and other ownerships. Of the 1,112 plants recorded by Malaby's 1987 survey, 80 plants, or .07 percent, were found within the Fresno and La Luz Canyons

on Forest Service lands. The 80 plants were not all located within the pipeline corridor that is the subject of this analysis. The subspecies also occurs in the Fresnal Canyon reach of this drainage, including four plants found during the 1987 survey in the lower Salado Canyon within the Fresnal Pasture (Malaby 1987).

Malaby's 1987 survey may have occurred during a peak in recorded population levels. The summer of 1987 represented the culmination of a string of 18 years of above mean annual precipitation (19.79 inches  $\pm$  4.86 inches), with only five scattered years, including 1970, 1973, 1975, 1977 and 1980, having below mean precipitation. These data are based on a minimum of 62 years of precipitation records collected in Mountain Park, New Mexico, in upper Fresnal Canyon at an elevation of approximately 6,700 feet. In addition, the winter of 1986 to 1987 and spring of 1987 precipitation totals were 1.55 inches and 2.67 inches, respectively, above the 86-year means for those two seasons (Malaby 1987).

Historically, the Fresnal/La Luz Canyon system had perennial flows, but the flow has declined or disappeared through the recent drought period. Surveys indicate that young plants occur primarily on open disturbed sites and their recruitment is tied to higher moisture conditions (U.S. Forest Service 2005). Recruitment is typically limited (U.S. Fish and Wildlife Service 1994, U.S. Forest Service 2005).

Surveys in 1991 on Forest Service and other lands within Fresnal Canyon found 33 plants. Another survey in 1992, covering 2.85 miles of the pipeline corridor within Fresnal Canyon, located 57 on Forest Service lands and 12 on non-Forest Service lands within the project analysis area. No plants have been located within the La Luz Canyon drainage above its junction with Fresnal Canyon.

In 2003, the South La Luz Allotment in lower Fresnal Canyon had 62 plants on National Forest System lands, which is similar to the 80 plants reported in the Recovery Plan. Adult flowering plants and smaller plants without flowering stalks were located, but none were believed to have germinated that year. Approximately 20 of the poppy plants found were located on steep slopes below the U.S. Highway 82 tunnel above Fresnal Creek. The plants identified in this survey were not all located within the pipeline corridor (U.S. Forest Service 2004).

In 2006 and 2007, Fresnal Canyon was surveyed in part on various dates by the New Mexico Energy, Minerals, and Natural Resources Department, the New Mexico Natural Heritage Program, the Forest Service, the Service, and other botanists in New Mexico. The main survey efforts consisted of a U.S. Highway 82 survey in June 2006 and water pipeline surveys in 2007. Lincoln National Forest personnel surveyed Forest Service land on September 4, 2007. Additional pipeline surveys were conducted on October 29, 2007, as a cooperative effort among the City of Alamogordo, the New Mexico Natural Heritage Program, Forest Service, and Fish and Wildlife Service (Tonne 2007).

The survey conducted on Forest Service lands within the project analysis area in 2007 detected approximately 76 plants within the pipeline corridor. Of the 76 plants along the pipeline corridor, 44 were adults and 32 were seedlings. None were located within the vicinity of the eight vehicle

access points for pipeline inspection and maintenance that occur within suitable habitat on Forest Service lands. This survey also identified 62 plants adjacent to the project area just outside the pipeline corridor on Forest Service lands. The 2007 survey on City right-of-way lands found approximately 35 plants in addition to the numbers identified above. These totals exceed the number of Sacramento prickly poppy plants identified in these areas in 1987. The results are indicative of the high moisture conditions that existed for germination and recruitment of seedlings over the past 12 to 13 months.

In 2006 and 2007, although survey coverage was not exhaustive and parts of the site were surveyed during the off-season, 150 Sacramento prickly poppies were located. Though the location of colonies has shifted, the numbers in this canyon are roughly the same as Malaby found 20 years ago (Malaby 1987). Recent survey efforts are difficult to compare to Malaby's results due to survey timing, area covered, and the checkerboard nature of ownership in this area. Though speculative, this area does not appear to be in steep decline, and the population is down approximately 13 percent from 1987 (Tonne 2007). Given the broken terrain and heavy brush in most of the survey area, some individual target plants almost certainly went undetected. The late emergence of a portion of re-sprouting adults could also contribute to the probability that some plants were undetected (Tonne 2007).

According to the 1987 Malaby survey, scattered populations of poppies occurred within 8 acres of habitat within the Fresno and La Luz Canyons. Within the 8 acres of occupied habitat, 72 plants were found in Fresno Canyon and 8 plants were found in La Luz Canyon on Forest Service lands. These two populations comprise 8 percent of the total plants found by Malaby on Forest Service lands and 6 percent of the total numbers on all land ownerships combined. The 2007 survey concentrated within the pipeline corridor and access points located on Forest Service lands in suitable habitat. This survey found approximately 76 plants on Forest Service lands and 35 plants on City right-of-way lands within proximity of the pipeline.

### **Factors Affecting the Species within the Action Area**

Fresno and La Luz Canyons contain approximately 11 miles of pipeline along with diversions structures, valves, meters, and water troughs for the Fresno, La Luz, and Maruche Water Pipeline Special Use Project occurring within occupied Sacramento prickly poppy habitat for all land ownerships. Of the 11 miles of pipeline, approximately 2.75 miles are located on Forest Service lands and 8.25 miles are located on other land ownerships.

Segments of the Water Pipeline Special Use Project that occur on Forest Service lands fall within three Sixth Order HUC watersheds (Fresno #130500031501, La Luz #130500031502, and Lost River 130500031503). Portions of these three watersheds (approximately 30,330 acres) occur on Forest Service lands. Elevation within these watersheds ranges from 5,040 feet to 9,560 feet. All three watersheds drain west into the closed Tularosa Basin. The entire water conveyance system falls within a range of elevation between 5,040 to 6,920 feet.

Vegetation

The vegetation or habitat types on Forest Service lands within the three applicable Sixth Code watersheds are represented in Table 1.

Table 1. Watershed area vegetation types

<b>Vegetative or Habitat Types</b>	<b>Acres</b>
Desert Scrub	7,486
Grass	641
Mixed Conifer	11,025
Pinon/Juniper woodlands	9,757
Ponderosa Pine	1,103
*Riparian	315
**Wetland	3

\* The Project Analysis Area (30ft buffer) contains 3 acres of riparian habitat.

\*\* The 3 acres of wetland are within the Project Analysis Area.

Streams

La Luz Creek covers approximately 11.5 miles from its headwaters at approximately 8,600 feet to an elevation of 5,000 feet at its confluence with Fresno Creek. Approximately 4.5 miles of the La Luz Creek stream channel occur on Forest Service lands, while 5.5 miles are on private or City-owned lands and 1.0 mile on Mescalero Apache Indian Reservation lands (U.S. Forest Service 2006).

Maruche Creek covers approximately 4.7 miles from an elevation of 8,000 feet at its headwaters to approximately 5,760 feet at its confluence with La Luz Creek. The headwaters and approximately 1.2 miles of the Maruche Creek stream channel occur on Mescalero Apache Indian Reservation lands. There are approximately 2.1 miles of the Maruche Creek stream channel on Forest Service lands, and the remaining 1.4 miles of the Maruche Creek stream channel lie on private lands (U.S. Forest Service 2006).

Fresno Creek covers approximately 13.4 miles from its headwaters at an elevation of 8,680 feet to the point it crosses the boundary of the Lincoln National Forest at approximately an elevation of 4,880 feet. Approximately 5.7 miles of the Fresno Canyon stream channel lies within the Lincoln National Forest, and 7.7 miles are on non-Forest Service lands (U.S. Forest Service 2006).

Springs

Lincoln National Forest GIS information indicates that there are approximately 71 springs found within the project area. Of these, 30 (42%) are located on Forest Service lands. The majority of springs found in the La Luz Canyon are located near the drainages. Maruche Canyon contains several springs that are located above and away from major drainages. Springs in Fresno Canyon are also found away from drainages and are found along road cuts or along roads (U.S. Forest Service 2006).

Within the action area, the Sacramento prickly poppy is primarily threatened by drought, livestock grazing, water extraction, and ongoing surface-disturbing activities such as road and pipeline maintenance. In recent years, the area occupied by the Sacramento prickly poppy has been under drought conditions. Unlike the above-average precipitation received during the 1970s and 1980s, in the 1990's and early 2000's, 7 of 10 years received less than the 54-year mean annual precipitation (Western Regional Climate Center 2003). These precipitation levels led to low soil moisture conditions that killed seedling Sacramento prickly poppy plants and severely curtailed recruitment into the population (U.S. Fish and Wildlife Service 2004; Tonne 2007).

Livestock grazing has been identified as a potential threat to the poppy (U.S. Fish and Wildlife Service 2005). Sixty-four livestock are currently permitted within occupied poppy habitat in Fresno Pasture from November 8 through January 31. Seedlings have been described as delicate and not tolerating disturbance well until they have had a chance to establish their taproot (Wood, 1992). Fall germination has not been documented in the Fresno Pasture, but has been found in Alamo, Caballo and Dog Canyons. Therefore, herbivory and/or trampling of seedlings may also occur in Fresno Canyon. The Salado Pasture will be grazed from January 31 through May 10 but does not contain historic sites for the poppy. Monitoring in recent years has indicated a 2-inch and 4-inch minimum leaf length on blue grama and sideoats grama, respectively. Poppy plants, in the Fresno/La Luz Canyon drainage, are most often found on benches and slopes above the creek bottom, and along roadsides of the unpaved road in and adjacent to the canyon bottom. The majority of the occupied and potential habitats in the unfenced canyon bottom are not under the jurisdiction of the Forest Service. The riparian zones in Fresno Canyon are rocky and rough, produce limited forage for livestock, and are not used extensively. These sites appear to support habitat more favorable to poppy seedling establishment. Based on topography and forage production about 3,214 acres of the approximately 5,620 acres on the South La Luz Grazing Allotment, are accessible to grazing by livestock. Occupied and potential poppy habitat is not fenced to exclude livestock.

Via pipelines, one system of which is the subject of this biological opinion, the City of Alamogordo maintains water pipelines that withdraw water at the head of Alamo and Caballero canyons, and mid-way down in Fresno and La Luz Canyons, reducing water flow to prickly poppy habitat (e.g., see November 2008). The water rights for these systems pre-date the Lincoln National Forest. The pipelines in Alamo, Caballero, and Fresno Canyons, canyons occupied by Sacramento prickly poppy, have been replaced over time as the pipes become cemented in with calcium carbonate. The new pipelines no longer leak water along their route through the canyon bottoms, as they historically have, and, consequently, no longer provide water to limited areas that may have supported poppies in the past (U.S. Forest Service 2004). Municipal use of canyon water has changed the natural hydrology, making upland areas and canyons much drier, perhaps reducing prickly poppy habitat. Pipeline repair, replacement, and maintenance are ongoing in four canyons. These pipelines and associated activities continue to impact the suitability of prickly poppy habitat. Heavy equipment used to transport, excavate, position, and remove large sections of steel pipe may damage or destroy plants if not carefully controlled and monitored. The Forest Service has surveyed, consulted upon, and monitored these activities when informed of them in advance.

In 1988, sections of the La Luz pipeline were dug up during repair, and six Sacramento prickly poppy plants growing along the right-of-way were removed for transplant to a nursery. A year later thirteen new plants were found growing on this site, indicating that the species can re-establish and increase within a year of disturbance (Malaby and Wood, unpublished report).

While some recent losses have occurred in the Fresno/La Luz population, overall numbers appear to be down only 13 percent from those in 1987. While still a decrease, in comparison with the Alamo/Caballero population, this population appears to be better able to handle the long drought and climatic changes that have occurred in this area. Some long-lived Sacramento prickly poppy occurring in the U.S. Highway 82 right-of-way were killed by the New Mexico State Highway and Transportation Department in 2007 through indiscriminate application of herbicide (U.S. Fish and Wildlife Service 2007). Further losses in this population have occurred on Forest Roads 162 and 162B where some individuals and populations have been lost due to road maintenance and widening in this area (U.S. Fish and Wildlife Service 2007). Despite these losses the population appears relatively healthy overall. The Lincoln National Forest performs road maintenance on approximately 523 kilometers (325 miles) of roads each year. Additional maintenance is conducted on Federal, State, and County non-National Forest System roads (U.S. Forest Service 2004). In Fresno Canyon, road maintenance by the Otero County Road Maintenance Department has resulted in the loss of prickly poppy plants along an unpaved National Forest System road. In addition, State Highway Department maintenance work along US Highway 82 has resulted in impacts to this subspecies.

Road construction and maintenance activities, including herbicide use and mowing, may threaten the poppy. Although the poppy is adapted to disturbed habitats, and, therefore, could benefit from some ground-disturbing activities, blading along drainage ditches and the shoulders of unpaved roads has destroyed some poppy plants (U.S. Forest Service 2004). The effect of mowing on the Sacramento prickly poppy is not known. Invasive plants such as Russian thistle, tamarisk, spotted knapweed, and Russian knapweed occur in the poppy's habitat. At present, the Forest Service and New Mexico State Highway and Transportation Department coordinate efforts at weed control and implement spraying of infested sites along the highways. Because plant competition may be a limiting factor to the distribution of the poppy based on the poppy's preference for sites that are more open and less densely vegetated, eliminating invasive plants may be beneficial for the poppy (U.S. Fish and Wildlife Service 1994). However, any spraying performed near poppy individuals still may pose a threat to the survival of this species. The Lincoln National Forest has completed consultation on their Noxious Weed Control Plan for treatments of noxious weeds in the vicinity of the prickly poppy.

## **EFFECTS OF THE ACTION**

The effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, as well as the effects of interrelated and interdependent activities. Interrelated actions are actions that are part of a larger action and depend on the larger action for their justification. Interdependent actions are actions having no independent utility apart from the proposed action.

Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

### **Beneficial Effects**

Beneficial effects are effects of an action that are wholly positive without any adverse effects to listed species or designated critical habitat. Conducting surveys in conjunction with flagging of adult, juvenile, and seedling Sacramento prickly poppy plants in order to avoid impacts or disturbance to the plants during routine operation and maintenance of the water conveyance system will benefit the subspecies. Not parking or pulling off the road in known Sacramento prickly poppy locations when the water conveyance system is being inspected will also benefit the poppy. Allowing disturbed areas to re-vegetate naturally in Sacramento prickly poppy habitat should also benefit the subspecies at many sites.

### **Direct Effects**

#### Pipeline Inspection, Maintenance, and Planned Repair

Conservation Measures for all actions associated with the pipeline and other parts of the water conveyance system in the Operations and Maintenance Plan will be incorporated into the terms of the Special Use Permit. Conservation Measures for the Sacramento prickly poppy in the Operations and Maintenance Plan should limit adverse effects to known Sacramento prickly poppy plants from inspection, maintenance, and planned repair of the water conveyance system on Forest Service lands. Some actions associated with these activities may create light to intermediate ground disturbance to suitable habitat of this subspecies. However, all ground disturbing activities will be approved in writing by the Forest Service prior to implementation, and disturbance to known poppy plants and their habitats will be limited. Therefore, the Conservation Measures listed in the plan should limit adverse effects to known individual poppy plants on Forest Service land. Furthermore, any light to moderate ground-disturbing activities could have beneficial effects to poppy habitat by creating early succession microhabitats that are favorable for seedling establishment.

Adverse effects are still likely to result to individual Sacramento prickly poppy plants that were not detected during surveys. Seedlings can be missed because of being covered by other vegetation. Plants can be missed because they appear deceased above the soil line, when they are actually dormant underground, ready to emerge again under more favorable conditions (Tonne 2007). For example, the height and density of grasses, forbs, and shrubs prevented a complete survey in the Dog Canyon bench in 2007. Prickly poppies were entangled within or below the thick growth of other species, making it difficult to detect young plants (Tonne 2007). The Fresno Canyon surveys of 2006 and 2007 likely missed plants because of heavy brush and the later emergence of a portion of re-sprouting adults (Tonne 2007).

#### Emergency pipeline repair

Emergency situations associated with the water conveyance system are defined as "situations that require immediate actions (within 24 hours) that involve ground disturbance, new access, and/or use of heavy equipment." Emergencies include the occurrence of the following: 1) A break/leak in the

pipeline where 15 gallons of water per minute are being released; 2) failure of a diversion, spring box, well or water meter such that water is not able to flow or to be measured; 3) damage caused by natural disasters such as floods, tornados, earthquakes, fire, etc.; and 4) any unforeseen combination of circumstances that calls for immediate action to ensure the integrity and continued operation of the water conveyance system. Where urgency of the repair does not allow survey or flagging of known plants and/or the avoidance of disturbance, it is foreseeable that adult or seedling plants could be destroyed.

The City has indicated that over the past 5 years, they have had to conduct emergency repairs along the Fresno pipeline about 2 to 3 times a year. To date, the vast majority of the emergency repairs have been to fences and gates on non-Forest Service lands, and not directly on the pipeline (Mark Threadgill and Brian Cesar, City of Alamogordo, personal communication, 2007).

Although the likelihood of an emergency repair in occupied Sacramento prickly poppy habitat is low, if an emergency requiring immediate repair of the water conveyance system occurs within occupied habitat, Sacramento prickly poppy plants could be harmed. The biological assessment for this project indicated that the loss of poppy plants in similar emergency situations is known to have occurred in the past along the City's water conveyance system located in Alamo Canyon. It is not possible to predict when and where such an emergency situation may occur, and the duration and scope of any work required for the repair would be specific to the circumstances of the emergency incident. Therefore, planning ahead to minimize effects for this type of emergency situation is not feasible. However, because of the low probability of an emergency repair harming Sacramento prickly poppy plants, adverse effects from this part of the proposed project are expected to be low.

#### Water withdrawal

The City of Alamogordo withdraws water mid-way down in Fresno and La Luz Canyons, reducing water flow to Sacramento prickly poppy habitat. Municipal use of canyon water has changed the natural hydrology, making upland areas and canyons much drier, and perhaps reducing prickly poppy habitat (e.g., see November 2008). Because poppy reproduction, germination and growth appear to correlate closely with precipitation amounts and because municipal water withdrawal began prior to detailed poppy surveys, it is difficult to quantify the significance of this adverse effect to the Sacramento prickly poppy.

#### **Indirect Effects**

##### Pipeline Inspection, Maintenance and Planned Repair

The actions associated with the inspection, maintenance and repair of the entire conveyance system may produce ground-disturbing activities in Sacramento prickly poppy habitat. However, project Conservation Measures should reduce adverse effects to poppy populations or its habitat. Soil disturbance can also produce conditions that favor germination of poppies. Furthermore, disturbance of the soil could reduce competition from other species, and create conditions of an early successional microhabitat favorable to seedling establishment.

Emergency pipeline repair

Potential indirect effects to the poppy can result from emergency pipeline repair by removing the seed source within the area. If adult plants are removed or destroyed by heavy equipment before they produce seeds without allowing dispersal, then population numbers may be reduced.

**Interrelated and Interdependent Actions**

The maintenance and operation of water pipelines by the City of Alamogordo on their rights-of-way are considered interrelated to the implementation of the Fresno, La Luz, and Maruche Water Pipeline Special Use Project. The Sacramento prickly poppy may be adversely affected on private and City lands by such maintenance. A greater extent of the pipeline occurs on City rights-of-way than on Forest Service lands, and approximately 35 plants were found there in 2007. To reduce adverse effects from these activities, in their Operations and Maintenance Plan, the City has committed that they:

“may meet and confer with the Fish and Wildlife Service annually, and accompany the Fish and Wildlife Service during periodic access to those lands owned by the City and those lands on which the City holds easements or rights-of-way for the water conveyance system in Fresno, La Luz and Maruche Canyons. Any such access will be for the purpose of conducting surveys for the Sacramento prickly poppy or its habitat where it occurs on those lands. If updated maps are produced showing locations of Sacramento prickly poppy plants and/or its occupied habitat as a result of these surveys, the City may utilize them in planning and implementing operation and maintenance of the water conveyance system to avoid impacts to the plant where it occurs on these lands.”

In addition, the City may also allow the Service or the Forest Service to flag Sacramento prickly poppies for the City's use in planning regularly scheduled maintenance activities to minimize impacts to the subspecies. Furthermore, because landscape characteristics and private lands preclude the use of heavy machinery along much of the City's right-of-way, the majority of activities will likely involve hand tools and not machinery (Mark Threadgill and Brian Cesar, City of Alamogordo, personal communication, October 29, 2007). Use of hand tools would help avoid adverse impacts to known individual poppy plants on City rights-of-way.

Because the implementation of these Conservation Measures is not certain, it is not feasible to quantify the adverse effects from these inter-related activities. In addition, as described for Forest Service lands, if flagging is permitted on City rights-of-way, Sacramento prickly poppy seedlings may be missed and not flagged due to cover by other vegetation, and adult plants may be missed due to dormancy and/or later re-sprouting. However, implementation of all of these Conservation Measures would significantly reduce these adverse effects.

The use of access roads and vehicles in the project areas are considered interrelated with the implementation of the current project. Although the majority of vehicles will likely stay on roads and trails, effects of the project from interrelated actions may result in poppies being harmed or killed by trampling or crushing of individual plants by vehicles that do not use roads or trails.

## **CUMULATIVE EFFECTS**

Cumulative effects include the effects of future State, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The Sacramento prickly poppy may also be adversely affected on State, private, and local lands by the following non-Federal activities: 1) Livestock grazing, 2) noxious weed treatment, 3) land clearing, 4) maintenance of local unpaved roads, 5) road construction and maintenance activities performed by the New Mexico State Highway and Transportation Department and the Otero County Road Department, and 6) herbicide use and mowing along State Highway 82 and local unpaved roads where plants occur in the rights-of-way.

## **CONCLUSION**

After reviewing the current status of the Sacramento prickly poppy, the environmental baseline for the action area, the effects of the proposed Fresnal, La Luz, and Maruche Water Pipeline Special Use Project, and the cumulative effects, it is the Service's biological opinion that the re-issuance of the permit, as proposed, is not likely to jeopardize the continued existence of the poppy. No critical habitat has been designated for this species; therefore, none will be affected.

We reached this conclusion for the following reasons: 1) The relatively low level of anticipated harm to the poppy; and 2) the minor effects to poppy habitat.

The conclusions of this biological opinion are based on full implementation of the project as described in the "Description of the Proposed Action" section of this document, including any Conservation Measures that were incorporated into the project design.

## **INCIDENTAL TAKE STATEMENT**

Section 7(b)(4) and 7(o)(2) of the Endangered Species Act generally do not apply to listed plant species. However, limited protection of plants from take is provided to the extent that the Endangered Species Act prohibits the removal and reduction to possession of Federally listed endangered plants or the malicious damage of such plants on areas under Federal jurisdiction, or the destruction of endangered plants on non-Federal areas in violation of State law or regulation or in the course of any violation of a State criminal trespass law (19 NMAC 21.2).

## **CONSERVATION RECOMMENDATIONS**

Section 7(a)(1) of the Endangered Species Act directs Federal agencies to use their authorities to further the purposes of the Endangered Species Act by carrying out conservation programs

for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The recommendations provided here relate only to the proposed action and do not represent complete fulfillment of the agency's section 7(a)(1) responsibility for this species. We recommend the following conservation recommendations be implemented for the proposed Fresno, La Luz, and Maruche Water Pipeline Special Use Project:

1. Record locations and protect against disturbance or damage all Sacramento prickly poppy plants identified through annual surveys of occupied and suitable habitat during the flowering season, typically May to September, and report this information to the New Mexico Ecological Services Field Office. Protection of poppy plants will facilitate increased likelihood of seed production and seedling establishment, and survey data will provide population trend information and contribute to the overall knowledge of this species.
2. Work with the City of Alamogordo to assist them in applying the Conservation Measures in the 2007 Operation and Maintenance Plan for the Fresno, La Luz, and Maruche Water Pipeline Special Use Project on the City's rights-of-way for the pipeline.
3. In cooperation with other agencies and research groups, continue to provide support through funding and staff assistance to research and monitoring activities on Sacramento prickly poppy populations and report this information to the New Mexico Ecological Services Field Office annually.
4. Work with the City of Alamogordo to construct and maintain Forest Service and City of Alamogordo boundary fences within the South La Luz Grazing Allotment. New Mexico Ecological Services Field Office biologists will be available to help identify areas to fence when on-site annually to assist with Sacramento prickly poppy surveys.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, we request notification of the implementation of any of these Conservation Recommendations.

#### REINITIATION - CLOSING STATEMENT

This concludes formal consultation on the re-issuance of a Special Use Permit and its effects on the Sacramento prickly poppy and informal consultation on the Mexican spotted owl.

As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this consultation; (2) the agency action is subsequently modified in a manner that causes an effect

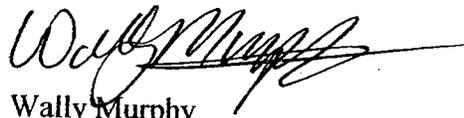
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to listed species or critical habitat not considered in this consultation; or (3) a new species is listed or critical habitat designated that may be affected by the action.

The Service appreciates the coordination efforts and information provided by your staff throughout this consultation process, as well as efforts to minimize adverse effects to listed species. In future communication regarding this project, please refer to consultation #22420-2008-F-0050. If you have any questions about this biological opinion, please contact Dr. Patricia Zenone at the letterhead address or at (505) 761-4718.

Sincerely,



Wally Murphy  
Acting New Mexico State Administrator

cc:

District Ranger, U.S. Department of Agriculture, Forest Service, Lincoln National Forest,  
Sacramento Ranger District, Cloudcroft, New Mexico  
Field Supervisor, U.S. Fish and Wildlife Service, Arizona Ecological Services Field Office,  
Phoenix, Arizona

### LITERATURE CITED

- Breshears, D.D., N.S. Cobb, P.M. Rich, K.P. Price, C.D. Allen, R.G. Balice, W.H. Romme, J.H. Kastens, M.L. Floyd, J. Belnap, J.J. Anderson, O.B. Myers, and C.W. Meyer. 2005. Regional vegetation die-off in response to global-change-type drought. *Proceedings of the National Academy of Sciences* 102(42):15144-15148.
- Cook, E.R., C.A. Woodhouse, C.M. Eakin, D.M. Meko, and D.W. Stahle. 2004. Long-term aridity changes in the western United States. *Science* 306:1015-1018.
- Dettinger, M.D. and D.R. Cayan. 1995. Large scale atmospheric forcing of recent trends toward early snowmelt runoff in California. *Journal of Climate* 8:606-623.
- Dettinger, M.D. and H.F. Diaz. 2000. Global characteristics of streamflow seasonality and variability. *Journal of Hydrometeorology* 1:289-310.
- Intergovernmental Panel on Climate Change. 2001. *Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change* [Houghton, J.T., Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell, and C.A. Johnson (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, New York. 881pp. Available at <http://www.ipcc.ch/>.
- Lenart, M. 2005. Is global warming creeping into Southwest forests? *Southwest Climate Outlook*. University of Arizona, pages 2-5.
- Malaby, S.M. 1987. Survey report: *Argemone pleiakantha* (ssp. *pinnatisecta*). U.S. Forest Service, Lincoln National Forest, Alamogordo, New Mexico.
- Mueller, R.C., C.M. Scudder, M.E. Porter, R.T. Trotter III, C.A. Gehring, and T.G. Whitham. 2005. Differential tree mortality in response to severe drought: Evidence for long-term vegetation shifts. *Journal of Ecology* 93(6):085-1093.
- November, L.J. 2008. Dependence of hillslope moisture content on downhill saturation. *Water Resources Research*, submitted for review, 8pp.
- Reiners, W.A., W.L. Baker, J.S. Baron, D.M. Debinski, S.A. Elias, D.B. Fagre, J.S. Findlay, L.O. Mearns, D.W. Roberts, T.R. Seastedt, T.J. Stohlgren, T.T. Veblen, and F.H. Wagner. 2003. Natural Ecosystems I: The rocky mountains (pp. 145-184). *In* Wagner, F.H. (Ed.), *Preparing for Climate Change: Rocky Mountain/Great Basin Regional Assessment Team for the U.S. Global Change Research Program*. Utah State University. 240pp.
- Sivinski, R.C. 1992. Section 6 Progress Report to U.S. Fish & Wildlife Service. *Argemone pleiakantha* ssp. *pinnatisecta*. Albuquerque, New Mexico.

- Sivinski, R.C. 1999. Section 6 progress report to the U.S. Fish and Wildlife Service: Sacramento prickly poppy habitat study during 1998 and 1999.
- Smith, S.J., T. Wigley, and J.A. Edmonds. 2000. "A new route toward limiting climate change?" *Science* 290(5494):1109-1110.
- Stewart, I.T., D.R. Cayan, and M.D. Dettinger. 2004. Changes in snowmelt runoff timing in western North America under a "business as usual" climate change scenario. *Climate Change* 62: 217-232.
- Tepedino, V. J. 1992. Final research report for U.S. Fish and Wildlife Service endangered species subpermit PRT-676811.
- Thompson, L.G. 2000. Ice core evidence for climate change in the tropics: Implications for our future. *Quaternary Science Reviews* 19:19-35.
- Tonne, P. 2007. Results of Sacramento Prickly Poppy Studies, Surveys, and Monitoring, 2006 and 2007. Prepared for U.S. Fish and Wildlife Service, Albuquerque. Natural Heritage New Mexico, Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico. 54pp.
- U.S. Fish and Wildlife Service. 1989. Federal Register 50 CFR Part 17. Endangered and Threatened Wildlife and Plants; Final Rule to Determine *Argemone pleiakantha* ssp. *Pinnatisecta* (Sacramento prickly poppy) to be an Endangered Species. Volume 54, Number 163.
- U.S. Fish and Wildlife Service. 1994. Sacramento Prickly Poppy (*Argemone pleiakantha* ssp. *pinnatisecta*) Recovery Plan. Albuquerque, New Mexico. 41pp.
- U.S. Fish and Wildlife Service. 2004. Final biological opinion: Proposed reauthorization of livestock grazing on the Sacramento Grazing Allotment, Sacramento Ranger District, Consultation number 2-22-00-F-473, Lincoln National Forest, New Mexico. New Mexico Ecological Services Field Office, Albuquerque, New Mexico. 87pp with attachment.
- U.S. Fish and Wildlife Service. 2007. Draft 5-Year Review: Summary and Evaluation. Sacramento Prickly Poppy (*Argemone pleiakantha* ssp. *Pinnatisecta*, G.B. Ownbey) Albuquerque, New Mexico. 23pp.
- U.S. Forest Service. 1992. Draft interim management plan for *Argemone pleiakantha* ssp. *pinnatisecta* (Sacramento prickly poppy). Forest Service, Lincoln National Forest, Alamogordo, New Mexico.

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U.S. Forest Service. 2005. Biological Assessment for the Pumphouse and South La Luz Grazing Allotments, Consultation number 2-22-05-F-0501, Lincoln National Forest, Alamogordo, New Mexico.

U.S. Forest Service. 2006. Hydrologic Analysis for the La Luz, Fresnal and Maruche Watersheds. Lincoln National Forest, Alamogordo, New Mexico.

U.S. Soil Conservation Service. 1981. Soil Survey of Otero Area, New Mexico: Parts of Otero, Eddy, and Chaves counties. U.S. Department of Agriculture.

Western Regional Climate Center. 2003. Historical climate information.  
<http://www.wrcc.dri.edu/index.html>. Desert Research Institute. Reno, Nevada.

Worthington, R.D. 2002. Final Report: Prickly-poppy survey. Southwestern Research and Professional Services, El Paso, Texas.

