

Pecos Sunflower *(Helianthus paradoxus)*

Recovery Plan



September 2005

PECOS SUNFLOWER
(Helianthus paradoxus)

RECOVERY PLAN

**Southwest Region
U.S. Fish and Wildlife Service
Albuquerque, New Mexico**

2005

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DISCLAIMER

Recovery plans delineate reasonable actions that are believed to be required to recover and/or protect listed species. Plans are prepared by the U.S. Fish and Wildlife Service (Service), sometimes with the assistance of recovery teams, contractors, State agencies and others. Objectives will be attained and funds expended by any Federal or State agency contingent upon appropriations, priorities and other budgetary constraints. Recovery plans do not necessarily represent the views or the official positions or approvals of any individuals or agencies involved in plan formulation. They represent the official position of the Service only after they have been signed by the Regional Director or Director as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species' status, and completion of recovery tasks. Please check for updates or revisions to this plan at the website below.

LITERATURE CITATION

This plan should be cited as follows:

U.S. Fish and Wildlife Service. 2005. Pecos Sunflower Recovery Plan. Albuquerque, New Mexico. 39 pp.

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ACKNOWLEDGMENTS

The draft of this recovery plan was prepared for the U.S. Fish and Wildlife Service (Service) under a section 6 grant by Bob Sivinski, botanist, New Mexico State Forestry Division. Bob also committed many hours in revising and answering questions in preparation of the final plan. We are grateful for his keen expertise and unwavering commitment to recovery of threatened and endangered plants. The following individuals also generously supplied information and comments on Pecos sunflower: Charlie McDonald (U.S. Forest Service), Bill Radke, Gordon Warrick, Kathryn Kennedy and Bill Ostheimer (formerly with the Service), Dan Baggao (Bureau of Land Management), Gerald Siler (U.S. Department of Agriculture), Mike Matush (NM State Land Office) and John Karges (TNC). Information concerning field surveys and ecological studies was obtained from Jackie Poole (Texas Parks & Wildlife Department) and University of Texas Professor O.W. Van Auken and his students Janice Bush, Chris Coteff, Monica Mendez, Vonney Veit, Cynthia Rellstab, Celina Terrones and G.W. Presses. We especially thank Jackie Poole and O.W. Van Auken for providing peer review of the draft recovery plan. We are grateful to the Laguna Pueblo for their cooperation and for their commitment to conserving and managing Pecos sunflower on their lands. Wendy Brown of the Service provided oversight for the development of this recovery plan, and Martha Balis-Larsen, Tracy Scheffler, Alisa Shull of the Service provided additional agency review. Rawles Williams, formerly of the Service, also provided agency review.

EXECUTIVE SUMMARY

Current Status: Pecos sunflower was listed as threatened on October 20, 1999, with a recovery priority of 8, indicating it has a moderate degree of threat with a high potential for recovery.

Habitat Requirements and Limiting Factors: Pecos sunflower is a wetland plant that grows on wet, alkaline soils at spring seeps, wet meadows, stream courses and pond margins. It has seven widely spaced populations in west-central and eastern New Mexico and adjacent Trans-Pecos Texas. These populations are all dependent upon wetlands from natural groundwater deposits. Incompatible land uses, habitat degradation and loss, and groundwater withdrawals are historic and current threats to the survival of Pecos sunflower.

Recovery Goal: Removal from the Federal list of threatened and endangered species (delist).

Recovery Objective: Protect and manage in perpetuity significant, sustainable populations of Pecos sunflower and habitat within its native range so that the protection of the Endangered Species Act is no longer required for the conservation and survival of the species.

Recovery Criteria:

1. Identify and establish at least one core conservation area for Pecos sunflower in each of four distinct recovery regions that would collectively, if protected, ensure the long-term survival of the species. Each core habitat must occur on wetlands that are not threatened by depletion of the contributing aquifer and have demonstrated a self-perpetuating stand of Pecos sunflower of greater than 5000 individuals for a minimum of seven out of ten years. In addition to the core conservation area, each region should have at minimum one additional isolated stand of protected Pecos sunflowers with greater than 1600 individuals for at least seven out of ten years to protect against catastrophic loss of the regional population.
2. Assure long-term protection of designated core conservation areas and designated isolated stands in perpetuity through the implementation of appropriate management plans, conservation easements, or land acquisition.

Recovery Strategy: Pecos sunflower occurs in seven populations; two occur in west Texas and five are located in New Mexico. Two Texas populations occur on desert springs within the same general Pecos Plain region in west Texas. Two populations occur along the Rio San Jose and one on the Rio Grande in west-central New Mexico, comprising a second distinct region. Finally, there are two distinct populations on the Pecos River in eastern New Mexico, each constituting its own region. Thus, a total of four highly disjunct regional areas contain the entire genomic and ecotypical characteristics of Pecos sunflower. The recovery strategy is to protect and manage a significant, sustainable portion of each of the four regions' Pecos sunflower habitats (termed "core conservation areas") against the threat of future habitat loss and degradation, and as needed, from any other threats to the sunflower. Land uses within these

protected areas would be prescribed by management plans or voluntary deed restrictions that are sensitive to the species.

Scientists are working to delineate the conservation lands that will be the focus of recovery actions. Core conservation areas and isolated stands on private lands may be protected by conservation easements voluntarily granted by landowners or by the purchase of these lands from willing sellers by an agency or conservation organization for the purpose of Pecos sunflower conservation. A Service-approved management plan should guide the conservation of Pecos sunflower on public lands or those owned by a non-government conservation organization (NGO). In addition, research projects that are needed to inform management will be identified and prioritized. Research and management experience will delineate the types of management and land uses that are compatible with this species.

Major Actions Needed:

1. Identify and establish core conservation areas and isolated stands.
2. Identify and address information gaps, compatible uses, and management actions regarding Pecos sunflower distribution, biology and aquifer stability.
3. Protect core conservation areas and isolated stands through landowner education, implementation of management plans, conservation easements, and land acquisition.
4. Monitor Pecos sunflower conservation areas and management actions as needed to satisfy delisting criteria.

Estimated Total Cost of Recovery (\$000's):

<u>Year</u>	<u>Need 1</u>	<u>Need 2</u>	<u>Need 3</u>	<u>Need 4</u>	<u>Total</u>
2006	16.0	65.0	65.0	4.0	150.0
2007	10.0	102.0	17.0	4.0	133.0
2008		75.0	12.0	4.0	91.0
2010		10.0	20.0	8.0	38.0
2012			450.0	8.0	458.0
2014			20.0	8.0	28.0
2016			10.0	8.0	18.0
2018				8.0	8.0
Total	26.0	252.0	594.0	52.0	924.0

Recovery Cost: \$924,000.

Date of Recovery: Delisting could occur as early as 2019.

TABLE OF CONTENTS

	Page
DISCLAIMER	i
ACKNOWLEDGMENTS	ii
EXECUTIVE SUMMARY	iii
LIST OF FIGURESvi
PART I - INTRODUCTION	1
Brief Overview	1
Taxonomy	1
Morphology	3
Distribution and Abundance	4
Habitat.....	6
Population and Reproductive Biology.....	6
Land Ownership.....	7
Impacts and Threats.....	8
Conservation Measures.....	10
PART II - RECOVERY	14
Goal, Objectives and Criteria	14
Recovery Strategy.....	14
Recovery Criteria.....	15
Outline of Recovery Actions	16
Literature Cited.....	24

PART III - IMPLEMENTATION SCHEDULE27

APPENDIX – RESPONSE TO COMMENTS..... A-1

LIST OF FIGURES

	Page
Figure 1. Pecos sunflower illustration	2
Figure 2. Pecos sunflower in bloom	3
Figure 3. Distribution of Pecos sunflower populations	5

PART I – INTRODUCTION

Brief Overview

Pecos sunflower (*Helianthus paradoxus* Heiser) was given threatened species status under the Endangered Species Act of 1973 (ESA), as amended, on October 20, 1999 (64 FR 56582-56590). Critical habitat was not designated for this species because it would provide a map to populations that could be vandalized or impacted by commercial seed collectors. Publication of precise habitat locations would not enhance the recovery of this species and could, potentially, diminish the identified populations. Furthermore, Pecos sunflower populations on Federal lands are already protected from activities that could jeopardize their continued existence by the section 7 consultation requirements of the ESA. The State of New Mexico lists Pecos sunflower as endangered under the regulations of the New Mexico Endangered Plant Species Act (19 NMAC 21.2). This species is also listed as threatened by the State of Texas (31 TAC 2.69(A)).

Pecos sunflower is a wetland plant that was known only from a single population near Fort Stockton, Pecos County, Texas when it was proposed as a candidate for listing as endangered under the ESA on December 15, 1980 (45 FR 82480). Subsequent field surveys for this plant found additional populations in New Mexico and Texas. It is presently known to occur in two widely separated locations in the Pecos River valley in eastern New Mexico, two locations on the Rio San Jose and one on the Rio Grande in west-central New Mexico, and two desert springs in west Texas. These populations occur on a variety of State and Federal lands and several private land holdings. The subsequently discovered populations were also determined to have a moderate degree of threat. Spring seeps, or wet meadow (ciénega) habitats are very rare in the dry regions of New Mexico and Texas. There is evidence these habitats have historically, and are presently, being reduced or eliminated by aquifer depletion, or severely impacted by agricultural activities and encroachment by alien plants (Poole 1992, Sivinski 1996). The southwestern United States is currently experiencing a period of prolonged drought that is exacerbating this habitat degradation. The trend of decreasing habitat availability and suitability justified listing Pecos sunflower as a threatened species. Recovery actions to reverse or stabilize this trend and ensure the long-term sustainability of this species include identifying the ecological parameters of Pecos sunflower habitat, and enlisting the cooperation of the various habitat owners in the long-term conservation of the species.

Taxonomy

Asteraceae (Aster Family)

Helianthus paradoxus Heiser, Rhodora 60:272-283, 1958.

Dr. S.W. Woodhouse, physician and naturalist, was the first person to collect Pecos sunflower on August 26, 1851, while on the Sitgreaves Expedition to explore the Zuni River and the lower Colorado River. The collection locality given was ‘Hay Camp, Rio Laguna’. This site is located on the Rio Laguna (now called the Rio San Jose) near the present-day town of Grants in Cibola

County, New Mexico. Dr. John Torrey, botanist at the New York Botanical Garden, identified this specimen as *Helianthus petiolaris* (prairie sunflower) (Sitgreaves 1853). It was not until a century later that Dr. Charles Heiser recognized this specimen as a new species and named it *Helianthus paradoxus* (Heiser 1958). Heiser's description of this species cited two known specimens, the type specimen collected September 11, 1947 by H.R. Reed from an extant population near Fort Stockton in Pecos County, Texas, and the 1851 Woodhouse specimen collected in New Mexico.

Heiser's (1965) hybridization studies helped resolve doubts about the validity of Pecos sunflower as a species. Prior to Heiser's studies there was some speculation that the plant was a transient hybrid between *Helianthus annuus* (common sunflower) and prairie sunflower. Pecos sunflower is a fertile plant that breeds true. Heiser was able to produce hybrids between Pecos sunflower and both common sunflower and prairie sunflower, but these hybrids were of low fertility. These results support the validity of Pecos sunflower as a true plant species. In 1990, Rieseberg *et al.* published the results of molecular tests on the hypothesized hybrid origin of Pecos sunflower, using enzyme electrophoresis and restriction-fragment analysis to test ribosomal and chloroplast DNA. This work identified Pecos sunflower as a true species of ancient hybrid origin with the most likely parent species being common sunflower and prairie sunflower. Subsequent researchers have found additional genetic and morphological evidence that Pecos sunflower is a distinct, stable species that evolved to occupy a novel habitat (saline wetland) via an ancient hybridization event between common sunflower and prairie sunflower (Lexer *et al.* 2003, Rosenthal *et al.* 2002, Welch and Riesberg, 2002a and 2002b).

There are presently no taxonomic synonyms for *Helianthus paradoxus*. There is a possibility that the type of *Helianthus praetermissus* (lost sunflower) is actually an aberrant specimen of Pecos sunflower. Lost sunflower is known only from the type specimen collected in 1851, also on the Sitgreaves expedition in New Mexico. The locality was the head of the Rio Laguna (now Rio San Jose) at Ojo de la Gallina. There are two Ojo de la Gallinas on the expedition map, both on the north side of the Zuni Mountains. The date was September 27 or 21, 1851. Unfortunately, the collection locality does not match the location of the expedition on either date; it was at Zuni

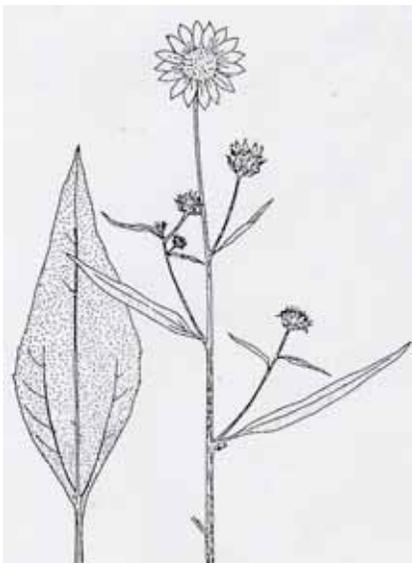


Figure 1. Pecos sunflower (Heiser 1969)

Pueblo on September 21 and near the junction of the Zuni and Little Colorado rivers (in Arizona) on September 27. Heiser *et al.* (1969) did not treat this species in their monograph due to the somewhat fragmentary condition of the only specimen. *Helianthus praetermissus* resembles, and may have been named from, a depauperate specimen of *Helianthus paradoxus*. Molecular analysis of the 152 year-old *H. praetermissus* type specimen may be the only opportunity to resolve this taxonomic question.

There are a number of vernacular names for this plant. Pecos sunflower, puzzle sunflower and paradox sunflower are all names that have appeared in printed literature and all refer to

Helianthus paradoxus. The name 'Pecos sunflower' has been adopted as the standard vernacular name of this species by the Service.

Morphology

Pecos sunflower is an annual, herbaceous plant (Figure 1). It grows 1-3 meters (m) (3.3 - 9.9 feet (ft)) tall and is branched at the top. The leaves are opposite on the lower part of the stem and alternate at the top, lance-shaped with three prominent veins, and up to 17.5 centimeters (cm) (6.9 inches (in)) long by 8.5 cm (3.3 in) wide. The stem and leaf surfaces have a few short, stiff hairs. Flower heads are 5-7 cm (2.0-2.8 in) in diameter with bright yellow rays around a dark purplish brown center (the disc flowers) (Figure 2). Pecos sunflower looks much like the common sunflower seen along roadsides throughout the West, but differs from common sunflower by having narrower leaves, fewer hairs on the stems and leaves, smaller flower heads, and narrower bracts (phyllaries) around the bases of the heads. The prairie sunflower also has narrow leaves and phyllaries, but is distinguished from Pecos sunflower by having a white cilia



Figure 2. Pecos sunflower in bloom (Photo by Bill Radke, USFWS).

in the dark center of the flower head and a branching pattern from the base of the plant that imparts a bushy appearance. Common sunflower and prairie sunflower usually bloom earlier in the season (May to August depending on location) than Pecos sunflower (September and October) and neither occupies the wet, saline soils that are typical of Pecos sunflower habitats.

Pecos sunflower has a highly disjunct distribution, yet there appears to be very little phenotypic variation between populations. One noteworthy mutation occurs within the Bitter Lakes population in southeastern New Mexico. A few small patches of Pecos sunflowers at this location produce bright red ray flowers with yellow tips within the larger population of plants with yellow ray flowers (Bill Radke, USFWS memo, 30 Sept 1999).

Distribution and Abundance

Little is known about the historic distribution of Pecos sunflower. The plant is associated with spring seeps and desert cienegas, and there is evidence these habitats were historically reduced or eliminated by aquifer depletion, or severely impacted by agricultural activities and encroachment by alien plants (Poole 1992, Sivinski 1996). Pecos sunflower is presently known from only seven populations, two in west Texas and five in New Mexico (Figure 3). The type locality (location from which the species was first described) is near Fort Stockton in Pecos County, Texas. This consists of a large population with several hundred thousand plants at the Nature Conservancy's (TNC) Diamond Y Spring Preserve, and a smaller group of plants downstream at a nearby highway right-of-way. A second Texas population occurs at Sandia Spring Preserve (TNC) in the Balmorhea area of Reeves County, Texas. In New Mexico, Pecos sunflower occurs at 11 spring seeps and cienegas in the Roswell/ Dexter region of the Pecos River valley in Chaves County. Three of these wetlands support many thousands of Pecos sunflowers, but the remainder are smaller, isolated occurrences. Springs and cienegas within and near the town of Santa Rosa in Guadalupe County have eight wetlands with Pecos sunflower, one of which consists of a few hundred thousand plants in good years. Two widely separated areas of spring seeps and cienegas in the Rio San Jose valley of western New Mexico each support a population of Pecos sunflower. One occurs on the lower Rio San Jose in Valencia County and the other is in Cibola County in the vicinity of Grants. Neither are especially large populations. Another larger population on the Rio Grande at La Joya in Socorro County occurs near confluence of the Rio Puerco, which has the Rio San Jose as a tributary stream. The Rio San Jose and Rio Grande populations are regionally connected by their close proximity and recently continuous habitat within a continuous watershed basin.

Most Pecos sunflower habitats are limited to less than two hectares (five acres) of wetland. Some are only a small fraction of a hectare, however, one near Fort Stockton and another near Roswell, are considerably more extensive. The number of sunflowers per site varies from less than 100 to several hundred thousand. Because Pecos sunflower is an annual, the number of plants per site can fluctuate greatly from year to year with changes in precipitation and depth to groundwater. Stands of Pecos sunflower can change location within the habitat as well (Sivinski 1992). This sunflower is completely dependent on water-saturated soil conditions within the soil root zone. If a wetland habitat dries out permanently, even a large population of Pecos sunflower would disappear.



Figure 3. Distribution of Pecos sunflower populations.

Habitat

Pecos sunflower is a wetland plant that grows in areas with permanently saturated soils in the root zone. These are most commonly desert springs and seeps that form wet meadows called cienegas. The word 'cienega' or 'cienaga' is derived from the Spanish 'cien aguas' meaning hundred waters, which indicates a large area where water is seeping from the ground in numerous places. These are rare wetland habitats in the arid southwest region (Hendrickson and Minckley 1984). This sunflower also can occur around the margins of lakes, impoundments and creeks. When Pecos sunflowers grow around lakes or ponds, these are usually impoundments or subsidence areas within natural cienega habitats. The soils of these desert wetlands are typically saline or alkaline because the waters are high in dissolved solids and high rates of evaporation leave deposits of salts, including carbonates, at the soils surface. Soils in these habitats are predominantly silty clays or fine sands with high organic matter content. Studies by Van Auken and Bush (1995) and Van Auken (2001) showed that Pecos sunflower grows in saline soils, but seeds germinate and establish best when precipitation and high water tables reduce salinity near the soil's surface. Like all sunflowers, this species requires open areas that are not shaded by taller vegetation.

Plants commonly associated with Pecos sunflower include *Distichlis spicata* (saltgrass), *Sporobolus airoides* (alkali sacaton), *Phragmites australis* (common reed), *Schoenoplectus americanus* (chairmaker's bullrush), *Juncus balticus* (Baltic rush), *Muhlenbergia asperifolia* (alkali muhly), *Limonium limbatum* (southwestern sea lavender), *Flaveria chloraefolia* (clasping yellowtops), *Cirsium wrightii* (Wright's marsh thistle), *Tamarix* sp. (saltcedar), and *Elaeagnus angustifolia* (Russian olive) (Poole 1992, Sivinski 1996). All of these species are indicators of wet, saline or alkaline soils. Pecos sunflowers often occur with saltgrass between the saturated soils occupied by bullrush and the relatively drier soils with alkali sacaton (Van Auken and Bush 1998).

Population and Reproductive Biology

Pecos sunflower is an annual species that must re-establish populations of adult plants each year from seed produced during the previous year or years' reproductive efforts. Habitats with suitable soils and hydrologic condition are typically small areas around springs and ponds. Therefore, populations tend to grow in crowded patches of dozens or even thousands of individuals. Solitary individuals may be found around the periphery of the wetland, but dense, well-defined stands within suitable habitats are more typical. The patches of sunflowers are not static within a cienega. Aggregations of live individuals may occur in different adjacent areas than the patches of dead stalks from the population of the previous year (Sivinski 1992). This suggests seed dispersal or the presence of a persistent soil seed bank (Coteff 2000). Patch densities and locations are determined by a combination of factors including seasonal soil moisture variations, soil salinity, soil oxygen, soil disturbance and competing vegetation (Bush, 2002, Van Auken and Bush 1995, Van Auken and Bush 1997, Jackson 2001, Mendez 2001). Dense stands produce smaller, spindly plants, while more open stands have larger plants

(Sivinski, personal observations 1994-2004). Likewise, experiments to remove competing vegetation, such as alkali sacaton and saltgrass, also produced larger, more floriferous sunflower plants (Van Auken 1997).

Suitable cienega habitats often have a discontinuous distribution of Pecos sunflower within a site. For instance, the Roswell/Dexter population contains at least 11 distinct cienega or lake habitats that are separated by distances of one to 13 kilometers (six-tenths to eight miles) from nearest neighboring habitats (Sivinski 1995). On a regional scale, each of the seven Pecos sunflower populations in New Mexico and west Texas are sufficiently distant (40 to 100 miles) from one another to rule out frequent gene exchange by pollen vectors or seed dispersal.

Pollination vectors for the Pecos sunflower have not been studied. However, most radiate-headed plants in the aster family are generalists in attracting a variety of insect pollinators. Seed production is greatly enhanced in Pecos sunflower by cross-pollination between individual plants. An experiment that excluded pollinators from flower heads produced only five percent viable seed compared to 84 percent viable seed produced by flower heads that were open to insect pollination (Van Auken and Bush 1997). Pecos sunflowers bloom in the months of September and October. Flowering peaks in the second week of September in the northern-most New Mexico populations. The peak flowering time for the southern-most population in West Texas is later in October. Seeds fill and mature during October and November then require a two to three month after-ripening period before germination (Van Auken, 2001). A few seeds remain dormant for longer periods and appear to be insurance for species survival by remaining viable in the soil seed bank (*ibid.*). The duration of seed viability has not yet been studied.

Land Ownership

Various Federal, State, municipal, and private interests own and manage the Pecos sunflower sites. Federal agencies include the Service, Bureau of Land Management (BLM), and National Park Service (NPS). Plants are located on one New Mexico State Park, and on municipal lands in the cities of Grants, Roswell and Santa Rosa. Seven different private individuals or organizations own sites or part of sites. Some plants grow within State or Federal highway rights-of-way.

Five Pecos sunflower habitats occur on properties managed principally for wildlife and endangered species conservation. A major sunflower wetland occurs on Bitter Lake National Wildlife Refuge near Roswell, New Mexico. This refuge is a series of spring-fed seeps and impoundments totaling several hundred hectares in waterfowl ponds and farm fields. There is a small group of sunflowers on an impoundment at Dexter National Fish Hatchery near Dexter, New Mexico, which is also managed by the Service. The Rio Grande population occurs on the La Joya State Waterfowl Management Area, which is owned and managed by the New Mexico Department of Game and Fish. The Nature Conservancy of Texas owns and manages two sunflower wetland habitats in west Texas, the Diamond Y Spring Preserve near Fort Stockton and the Sandia Spring Preserve near Balmorhea. Significant desert springs are the principal

features of these preserves. The Diamond Y Spring Preserve has a large stand of Pecos sunflower.

Impacts and Threats

When Pecos sunflower was listed as threatened in 1999, threats pertaining to each of the ESA's five listing factors (habitat destruction, over-utilization, disease and predation, inadequacy of existing regulatory mechanisms, and other natural or manmade factors) were documented. Threats to the species have not changed significantly since listing, with the exception of the regulatory protection that is now provided under the ESA.

Habitat Destruction, Modification, Curtailment of Habitat and Range

The loss or alteration of wetland habitat is the main threat to Pecos sunflower. The lowering of water tables through aquifer withdrawals for irrigated agriculture and municipal use, diversion of water from wetlands for agriculture and recreational uses, and wetland filling for conversion to dry land uses destroyed or degraded desert wetlands before this sunflower was listed as threatened. An example of filling Pecos sunflower habitat for building sites is evident in the Town of Grants, New Mexico (Sivinski, personal observation, 2000). A large historical desert spring and cienega in Eddy County, New Mexico, which may have been Pecos sunflower habitat, has been destroyed by the creation of Brantley Reservoir. A sunflower cienega near Dexter, New Mexico was dried when a wellhead was placed on the spring and the water diverted for other uses. Springs that fed Pecos sunflower habitats have been converted to swimming pools and fishing ponds in the towns of Roswell and Santa Rosa, New Mexico. Groundwater withdrawals for agriculture in Pecos and Reeves counties in Texas have had an especially severe impact on desert springs. Of the 61 historical desert springs in these two counties, only 13 were still flowing in 1980 (Brune 1981 *in* Poole 1992). Beginning around 1946, groundwater levels fell as much as 120 m (400 ft) in Pecos County and 150 m (500 ft) in Reeves County. Groundwater pumping has lessened in recent years due to the higher cost of removing water from deeper aquifers, but rising water tables and resumption of spring flows are not expected (Brune 1981 *in* Poole 1992). Texas water law provides no protection for the remaining springs, which limits options for addressing this threat.

Over-utilization for Commercial, Recreational, Scientific, or Educational Purposes

Unregulated commercial sale of Pecos sunflower seed was documented in the past (Poole, Texas Parks and Wildlife Department, 1991) as well as seed collection for cross breeding programs to increase salt tolerance in common sunflower cultivars (Seiler *et al.* 1981). Seed samples have been deposited in the national cryogenic seed bank at Fort Collins, Colorado. Occasional collections of seeds for scientific purposes are unlikely to have a significant effect on population densities. Pecos sunflower populations generally have a large number of individual plants that are prolific in seed production. Commercial demand for the seed is very small or non-existent and likely to remain so. The taking or sale of seed for commercial purposes is currently regulated by the Federal government and the States of New Mexico and Texas endangered

species legislation. Unregulated taking of seed for commercial purposes is likely to be uncommon and inconsequential.

Disease and Predation

Desert cienegas are productive ecosystems that are prized for their forage production. Livestock will eat Pecos sunflowers when other green forage is scarce, and when the buds are developing and abundant. Cattle and horses tend to pull off the flower heads, which can reduce seed production (Van Auken and Bush 1992, Bush and Van Auken, 1997). Grazing during non-flowering months may have a beneficial effect on Pecos sunflower populations by decreasing the density and biomass of potentially competing species in these habitats. This sunflower germinates earlier than most associated plants and grows vigorously on wet, bare, highly insolated soils (Sivinski, personal observations, 1994-2004). Actions that remove shading grass cover, such as grazing, appear to enhance growth and reproduction of sunflower plants that are later protected from grazing while they are reproductively maturing. Livestock grazing operations that do not consider the presence of Pecos sunflower presently occur on portions of the Dexter, Grants and Santa Rosa populations in New Mexico. Some general insect herbivores, such as blister beetles, will eat portions of Pecos sunflower ray flowers, but may be simultaneously facilitating pollination of the fertile disc florets (Radke, Service memo, 1999). Stem borers that feed on parts of this plant have also been observed (Van Auken, personal communication, 2003). No insects or diseases that cause mortality have been noted in Pecos sunflower populations.

Inadequate Regulatory Protection

The ESA does not prohibit or control the take of Pecos sunflower on private, tribal, or State lands unless the taking is a consequence of an activity that spends Federal funds, requires a Federal permit, or is in violation of State law, or is for commercial, interstate sale. The New Mexico and Texas threatened and endangered plant regulations also do not protect Pecos sunflower or its habitats on private lands, with the exception of plant collection not authorized by the landowner. Therefore, the best way to protect the species is through conservation agreements such as voluntary easements, deed restrictions, or land acquisition and management plans with private and public landowners.

Other Natural or Manmade Factors

Infestations of exotic plant species also continue to destroy or degrade desert wetlands and riparian areas. High densities of *Tamarix* sp. (saltcedar) can dry out portions of cienegas and further make Pecos sunflower habitats unsuitable by creating an overstory canopy that reduces light in the understory. The sunflowers at Dexter National Fish Hatchery were not apparent until the year following a saltcedar eradication program at the Hatchery (Radke 1997). The number of sunflowers at this site continues to increase every year since the saltcedars were removed. Saltcedars occur in or near all Pecos sunflower populations and without management intervention, will increase in density if these habitats become drier over time. *Elaeagnus angustifolia* (Russian olive) is another aggressive, exotic tree that is increasing in density at the Pecos sunflower habitat at Santa Rosa, New Mexico. Both saltcedar and Russian olive trees

transpire considerable amounts of water from shallow water tables. Many acres of cienega habitats at Santa Rosa have also been plowed and converted to *Festuca pratensis* (meadow fescue) pasture for livestock grazing. *Phragmites australis* (common reed) appears to be encroaching upon some Pecos sunflower habitats, especially Bitter Lake National Wildlife Refuge. Common reed is a native species, but some researchers believe a more aggressive European strain may have been introduced to North America. The presence of an exotic genotype of common reed in Pecos sunflower habitats is suspected, but not yet confirmed.

Pecos sunflower will naturally hybridize with common sunflower. There is concern about the extent to which backcrosses from common sunflower could affect the genetic integrity of small Pecos sunflower populations. Obvious hybrid plants have been found on the drier peripheries of the Pecos sunflower population at Santa Rosa and La Joya, New Mexico. However, the dense stands of Pecos sunflower on wetter habitats appear to remain genetically pure based upon consistent morphology (Sivinski, personal observations, 1994-2004). Populations near agricultural fields might be more severely affected, if those fields were devoted to the production of a commercial crop of a common sunflower cultivar.

Vegetation removal, mowing, and utility trenching have directly impacted some Pecos sunflowers that occur in recreational areas and highway rights-of-ways. A Texas Department of Transportation right-of-way population at the Diamond Y Preserve has been fenced and protected from mowing.

Conservation Measures

Taking and Trade Prohibitions

The ESA prohibits maliciously damaging, destroying, or removing and reducing to possession any threatened or endangered plants from areas of Federal jurisdiction. For other areas of State or private ownership, the ESA prohibits removing, cutting, digging up, or destroying threatened or endangered plants in knowing violation of any State law or regulation, including criminal trespass law [Sec. 9(2)(B)]. The ESA and the Lacey Act of 1900 (16 U.S.C. Sec 701) also prohibit threatened and endangered plant sale, offer for sale, import, export, or commercial transport in interstate or foreign commerce. The ESA provides for permits for otherwise prohibited activities that contribute to the conservation of endangered or threatened species.

Pecos sunflower is listed as an endangered species under the New Mexico Endangered Plant Species Act (9-10-10 NMSA) and is protected by the regulations contained within State code 19 NMAC 21.2. It is also listed as threatened by the State of Texas under regulation 31 TAC 2.69(A). Both States prohibit the taking of endangered plants from their natural public lands habitats or from private lands where criminal trespass is involved. Listed plants can only be collected under State permits for scientific studies or impact mitigation. Texas also allows commercial collection from private lands under permit from the Texas Parks and Wildlife Department.

An ESA permit is required to collect threatened or endangered plants from lands under BLM, NPS, or Service jurisdiction. The BLM and NPS may authorize only those collection activities already approved by the Service.

Section 7 Requirements

Section 7 of the ESA requires Federal agencies to ensure their actions will not jeopardize the continued existence of threatened or endangered species, or destroy or adversely modify any designated critical habitat areas. Consultation with the Service may be informal (requests for lists of species, or discussion of effect of a proposed action) or formal (when a Federal agency determines an action may adversely affect a listed species or critical habitat).

Section 7(a)(1) of the ESA directs Federal agencies to "...utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species..." The ESA not only directs agencies to prevent further declines in listed species through avoidance of adverse impacts, but also directs them to undertake proactive programs to contribute to species recovery.

Federal agencies that issue permits or use Federal funds for projects on private lands are also required to consult with the Service regarding potential effects on threatened or endangered species on those private lands. Otherwise, activities that may affect threatened or endangered plant species on private lands are not within the jurisdiction of the Service.

U.S. Fish & Wildlife Service Conservation Planning and Management

One of the largest Pecos sunflower wetlands occurs on the Bitter Lake National Wildlife Refuge (Bitter Lake) in New Mexico, which is owned and managed by the Service. There is also a small group of plants (<200) at the Service's National Fish Hatchery in Dexter, New Mexico. Projects and management actions on these areas must comply with the National Environmental Policy Act (NEPA), which requires environmental assessments of all Federal activities that may cause adverse impacts to the environment. Activities that may affect the Pecos sunflower must go through a section 7 consultation process with Service biologists. Bitter Lake is currently developing a refuge management plan that will address water and wetlands management for Pecos sunflower. This plan is expected to be completed in 2006.

Bureau of Land Management Conservation Planning and Management

As with other Federal agencies, the BLM must satisfy the requirements of NEPA for any actions on lands within its jurisdiction. The BLM has surveyed all BLM-owned springs in the Pecos River valley of the Roswell District (Milford *et al.* 2001) and found three small spring-seep and cienega habitats with Pecos sunflowers near the town of Roswell, New Mexico. The existing Resource Management Plan directs Roswell BLM to implement special status species habitat management. In addition, site specific plans have been developed, including the Overflow Wetlands ACEC Implementation Plan and grazing allotment management plans that incorporate objectives to protect sunflower habitat. However, no specific plan has yet been developed for the long-term management of Pecos sunflower.

National Park Service Conservation Planning and Management

NPS must also satisfy the requirements of NEPA for any actions on lands within its jurisdiction.

Only one small patch of Pecos sunflower occurs at the northern boundary of the El Malpais National Monument near Grants, New Mexico. It is isolated from any park uses and is not included in the Monument's management plan.

Army Corps of Engineers (COE)

This Federal agency issues permits under section 404 of the Clean Water Act. A landowner must acquire a 404 Permit when filling, draining or altering a wetland. Pecos sunflower is a wetland species that indicates areas of COE jurisdiction requiring section 7 consultation for such projects.

State of New Mexico

The Rare and Endangered Plant Program at the New Mexico Forestry Division in the Energy, Minerals and Natural Resources Department has played a leading role in documenting the distribution of Pecos sunflower in New Mexico. Pecos sunflower occurs along the margins of Lea Lake at Bottomless Lakes State Park near Roswell. There are no State laws that require the New Mexico State Parks Division to preserve this sunflower habitat. However, the Park personnel are aware of this location and voluntarily consult with the Forestry Division Botanist prior to taking actions that may affect this plant. New Mexico State Trust Lands are under the jurisdiction of the State Land Commissioner who has offered to assist in the recovery of Pecos sunflower. Three desert springs or cienegas on State Trust Lands in Chaves, De Baca, and Sandoval counties have been seeded with Pecos sunflower in an attempt to establish and augment populations of this plant. In all cases, seeding was accomplished with wild seed from adjacent populations. Thus far, only the Chaves County seeding has become established with adult, reproductive plants. Pecos sunflower also occurs on the La Joya State Waterfowl Management Area in Socorro County. This refuge is managed by the Department of Game and Fish as a migratory waterfowl habitat, which is compatible with preservation of wetlands for Pecos sunflower. The purchase of this refuge involved Federal funds. Therefore, the State is required to consult with the Service prior to taking actions that may effect the Pecos sunflower population. Finally, the State of New Mexico has acquired the 116-acre Blue Hole Cienega property near Santa Rosa, New Mexico, where a substantial population of sunflower was previously unprotected. This property has been acquired with the assistance of Federal funds.

The Nature Conservancy of Texas (TNC)

This private non-profit organization has purchased the areas containing most of the two known Pecos sunflower populations in west Texas (Figure 3). The Diamond Y Spring Preserve near Fort Stockton in Pecos County contains a large cienega habitat, which is owned and managed by TNC. Sandia Springs Preserve in Reeves County also contains a significant cienega habitat that was recently acquired by TNC. Both properties are managed to protect natural habitat values and preserve threatened and endangered plants and wildlife.

Research

Dr. Van Auken at University of Texas at San Antonio and his graduate students have studied various aspect of Pecos sunflower ecology at the TNC preserve on Diamond Y Spring Preserve near Fort Stockton. These studies include seed germination requirements (Van Auken 2001); effects of salinity on growth of Pecos sunflower, common sunflower and prairie sunflower (Van Auken and Bush 1995); relationships and competitive interactions with other salt marsh plants (Van Auken and Bush 1998); livestock grazing impacts (Bush and Van Auken 1997), light and nutrient requirements (Mendez and Van Auken, oral presentation to Texas Acad. Sci., 1999); competitive interaction with *Sporobolus airoides* (Veit and Van Auken, oral presentation to Texas Acad. Sci., 1997); flowering phenology and fertilization (Van Auken and Bush, oral presentation to Texas Acad. Sci., 1997); effects of burning and tilling within Pecos sunflower habitat (Bush and Van Auken, oral presentation to Southwestern Assoc. of Naturalists, 1997); and soil seed bank (Coteff 2000) and mycorrhizal infections (Presses and Van Auken, oral presentation to Texas Acad. Sci., 1995). Dr. Bush at the University of Texas at San Antonio recently completed a study of salinity and redox soil gradients in Pecos sunflower habitat (Bush 2002).

Summary

Pecos sunflower is currently protected through the regulatory authorities available under the ESA and endangered species legislation in the States of Texas and New Mexico. Significant progress has been made in protecting habitat for the seven populations in which the species is known to occur. Habitat is protected for populations on Federal land at Bitter Lake National Wildlife Refuge, Dexter National Fish Hatchery, and BLM lands in the Roswell-Dexter Region of eastern New Mexico. In the Santa Rosa region of eastern New Mexico, another major sunflower habitat on the Pecos River is protected by the State of New Mexico through a non-traditional section 6 grant awarded in 2004. In the west-central region of New Mexico, a small population is protected on National Park Service land, and a larger, newly discovered population occurs on State Land at La Joya Waterfowl Management Area. In west-Texas, the two significant populations of Pecos sunflower are protected on lands owned by the TNC. Remaining conservation needs include strategic identification and prioritization of core areas for long-term conservation of Pecos sunflower, development of management plans for each area that assure protection against future habitat loss and degradation, protection of additional habitat through landowner education, conservation easements, and acquisition, and additional research on Pecos sunflower distribution, ecology, and aquifer stability.

PART II – RECOVERY

The following section presents a strategy for recovery of the species, including objective and measurable recovery criteria and site-specific management actions to monitor and reduce or remove threats to the Pecos sunflower. This recovery plan addresses the five statutory listing factors (section 4(a)(1) of the ESA (see below)) to the current extent practicable to demonstrate how the recovery strategy and specific actions will ameliorate threats to the Pecos sunflower. The recovery criteria provide benchmarks for recovery such that the Pecos sunflower can be removed from the list of threatened and endangered species. The five listing factors are:

- Listing Factor A** – the present or threatened destruction, modification, or curtailment of its habitat or range;
- Listing Factor B** – overutilization for commercial, recreational, scientific, or educational purposes;
- Listing Factor C** – disease or predation;
- Listing Factor D** – the inadequacy of existing regulatory mechanisms;
- Listing Factor E** – other natural or manmade factors affecting its continued existence.

In the following sections, the listing factors addressed by the recovery criteria and actions are identified by their corresponding letters (A –E).

Goal, Objectives and Criteria

Goal

The goal of this recovery plan is to recommend actions that, if implemented, will allow Pecos sunflower to be considered for removal from the Federal list of threatened and endangered species (delisting).

Objective

The primary threat to Pecos sunflower is habitat loss and modification. Therefore, the objective is to protect and manage in perpetuity significant, sustainable populations of Pecos sunflower and habitat within its native range so that the protection of the ESA is no longer required for the conservation and survival of the species.

Recovery Strategy

There are seven distinct populations of Pecos sunflower, two in west Texas and five in New Mexico. These seven populations can be grouped within four highly disjunct regions that contain the entire genomic and ecotypical characteristics of Pecos sunflower (Figure 3). The west Texas region is comprised of the Fort Stockton and Balmorhea populations. The west-central New Mexico region consists of the populations on the Rio San Jose and the La Joya population on the Rio Grande. Finally, there are two distinct regions in eastern New Mexico within the Pecos River drainage: the Santa Rosa region and the Roswell/Dexter region. The recovery strategy is to protect and manage significant, sustainable portions (termed “core

conservation areas”) of each of the four region’s sunflower habitat against the threat of future habitat loss and degradation, and as needed, from any other threats to the sunflower. In addition, at least one isolated stand of Pecos sunflower should be protected in each region. Core conservation areas and isolated stands could also include presently unoccupied habitats where Pecos sunflower could be successfully reintroduced within its historic range. Such reintroductions should utilize seed from adjacent populations within the region to maintain genetic integrity and optimize the opportunity for successful reintroduction, and follow other guidelines set out in the Policy Regarding Controlled Propagation of Species Listed under the Endangered Species Act (65 FR 56916-56922).

The TNC Element Stewardship Abstract for Pecos sunflower ranks populations with several hundred thousand individuals as ‘excellent’; several thousand as ‘good’; and several hundred as ‘mediocre’ (Ladyman and Poole 1998). All core conservation habitats must contain good or excellent populations. A good population for Pecos sunflower recovery purposes is a stand of at least 5,000 individuals during most (7 out of 10) years.

An estimate of a minimum viable population of 1,566 individuals was developed by Texas botanists (Jackie Poole, personal communication, 2004) using Pavlik’s methodology (Pavlik 1996). Therefore, each isolated stand should contain at least 1,600 individuals during most (7 out of 10) years.

Core conservation areas and isolated stands on private lands may be protected by conservation easements voluntarily granted by landowners or by the purchase of these lands from willing sellers by an agency or conservation organization for the purpose of Pecos sunflower conservation. Research and management experience will identify the types of management and land uses that are compatible with this species. Scientists in New Mexico and Texas are working with the Service to identify and meet research needs and to delineate the core conservation areas in which recovery actions should focus. The Service should use this information to direct available funds to priority research and management needs for the Pecos sunflower. Significant actions related to Pecos sunflower conservation, including establishment of core conservation areas and management plans will be communicated to the public through press releases, information on the Service’s Region 2 website (www.fws.gov/southwest/), and updates to this recovery plan, as appropriate.

Criteria

The criteria for meeting the recovery objective fall within the realms of real estate, land use planning and management. Protection of wetland habitat at risk from incompatible use in areas where suitable habitat currently exists is essential. The following site-specific criteria will accomplish the recovery objective:

1. Identify and establish at least one core conservation area for Pecos sunflower in each of four distinct recovery regions that would collectively, if protected, ensure the long-term survival of the species. Each core habitat must occur on wetlands that are not

threatened by depletion of the contributing aquifer and have demonstrated a self-perpetuating stand of Pecos sunflower of greater than 5000 individuals for a minimum of seven out of ten years. In addition to the core conservation area, each region should have at minimum one additional isolated stand of protected Pecos sunflowers with greater than 1600 individuals for at least seven out of ten years to protect against catastrophic loss of the regional population (Listing Factors A, B, D).

2. Ensure long-term protection of designated core conservation areas and designated isolated stands in perpetuity through the implementation of appropriate management plans, conservation easements, or land acquisition (Listing Factors A, B, C, D, E).

Outline of Recovery Actions

The following site-specific recovery actions are needed to ensure the conservation and survival of the species. Recovery actions are listed in a step-down fashion with broad categories of recovery actions stepped-down to specific tasks. The innermost tasks listed here also appear in the Implementation Schedule (Part III of this plan), in which costs and scheduling are estimated and lead responsibilities for specific tasks are identified.

1. Identify and establish core conservation areas and isolated stands for the long-term survival of Pecos sunflower. Identify a minimum of one Pecos sunflower core conservation area and one isolated stand within each of the four general regions that would collectively, if protected, ensure the long-term survival of the species. Each core habitat must occur on wetland that is not threatened by depletion of the contributing aquifer, and demonstrate a self-perpetuating stand of at least 5,000 Pecos sunflowers for at least seven out of ten years (Listing Factors A, B, D).
 - 1.1 Core Conservation Habitat Priority and Size. The Service should prioritize potential core conservation habitats within the four regions. All core conservation habitats must contain good or excellent populations. A good population for Pecos sunflower recovery purposes is a stand of at least 5,000 individuals during most (7 out of 10) years. Consideration should also be given to possible threats from surrounding land uses, e.g., groundwater pumping for agricultural or municipal use, cultivation of common sunflower nearby that might lead to hybridization, etc. Following is a list of currently known potential Core Conservation Areas, however all existing, newly discovered, or restored stands may be assessed and considered for fulfilling recovery criteria at any time in the future.

Potential Core Conservation Areas

West Texas Recovery Region:

Diamond Y Spring Preserve near Fort Stockton, Pecos County

New Mexico – Dexter/Roswell Recovery Region:

Bitter Lake National Wildlife Refuge, Roswell, Chaves County

Dexter Cienega, 3 miles north of Dexter, Chaves County

New Mexico – Santa Rosa Recovery Region:

Blue Hole Cienega, Guadalupe County

Agua Negra Spring, Guadalupe County

West-Central New Mexico Recovery Region:

La Joya State Waterfowl Management Area, Socorro County

- 1.2 Prioritize Isolated Stands. Isolated stands should be prioritized for protection. Additional isolated stands of Pecos sunflower will contribute to the recovery of this species by protecting additional occupied habitat, genetic diversity, and providing an alternative seed source should core conservation areas experience a catastrophic decline. Isolated stands need not be as large as core conservation areas, and can be protected through inclusion in long-term landowner agreements such as Safe Harbors or Habitat Conservation Plans, as well as through easements or acquisition. Each isolated stand should contain at least 1,600 individuals during most (7 out of 10) years and not be threatened by depletion of the contributing aquifer. Each recovery region should have at least one protected isolated stand in addition to a core conservation area.

Potential Isolated Stands:

West Texas Recovery Region:

Sandia Spring Preserve, Balmorhea, Reeves County

New Mexico – Roswell/Dexter Recovery Region:

Bottomless Lakes State Park, Chaves County

Overflow Wetlands ACEC, Chaves County

Lloyds Canyon, Chaves County

Dexter National Fish Hatchery, Chaves County

New Mexico – Santa Rosa Recovery Region:

West-Side Springs, Santa Rosa, Guadalupe County

Perch Lake City Park, Santa Rosa, Guadalupe County

West-Central New Mexico Recovery Region:

Ojo del Padre Spring, Grants, Cibola County

Grants Salt Flat, Cibola County

- 1.3 Contact Landowners. The owners of identified potential core conservation habitats will be contacted and invited to participate in the recovery of Pecos sunflower on

both government and privately owned lands. Information on the Pecos sunflower, the ESA and its effect on landowner activities, and landowner opportunities and incentives should be tailored to the unique situation of each candidate core habitat or isolated stand owner.

2. Identify and address information gaps, compatible land uses, and management actions. Past studies have revealed much about the biology of Pecos sunflower. Further studies are needed to develop sound management practices for the species (Listing Factors A, C, D, E)

- 2.1 Identify water rights, delineate contributing aquifer boundaries, and verify sustainable aquifer trends. The aquifers that supply water to core Pecos sunflower habitats should be identified and regional uses assessed. A core conservation area should have a stable trend in the surface flow of its aquifer. Groundwater use in the surrounding area should be managed in a way to assure adequate spring flows. This may require additional land acquisition or conservation agreements with landowners surrounding core conservation areas. In general, points of diversion on new water rights should not be allowed on spring sources, but water could be exported after it has passed through Pecos sunflower habitat.

- 2.2 Study phenology and reproduction at regional scales. Time periods for flowering, seed set, germination and growth are different for the west Texas populations of Pecos sunflower than the more northern populations in New Mexico. Therefore, prescriptions for habitat burning, mowing, or flooding will vary among the habitat regions. Soil seed banks and longevity of viable seed must also be locally determined to guide management practices that may temporarily dry or render habitats unsuitable for one or more years.

Pollinators of Pecos sunflower should be studied within the four recovery regions to determine if any populations are reliant upon a single pollinator species or limited pollinator guild for seed set. If any Pecos sunflower populations are found to be visited by few pollinator species, habitat management should also consider pollinator life histories to avoid serious impacts to pollinator populations.

- 2.3 Study habitat substrates. Efforts by the New Mexico Land Office to introduce Pecos sunflower at three desert spring cienegas have been successful at only one cienega (Sivinski, personal observation, 2001-2004). Soil chemistry, texture, or both were unsuitable at the other two locations. Guidelines on habitat suitability for this species would be useful in identifying cienegas that may have historically been Pecos sunflower habitats, and may be potential restoration sites.

- 2.4 Study the effects of fire on Pecos sunflower. Prescribed fire is a common management tool to keep wetlands open, productive and free of exotic woody plants. Pecos sunflower may benefit from occasional burning of its habitat (Sivinski,

personal observation, 1995; Radke, personal communication, 2000). However, the optimal frequency and time of year for burning need further investigation.

- 2.5 Study the relationship of livestock grazing to Pecos sunflower and its habitats. Livestock grazing can damage Pecos sunflower plants. However, removal of competing grass cover and soil disturbance by livestock may help the germination and establishment of sunflower seeds. The effects of grazing season, frequency, intensity and duration need further study to develop recommendations for best management practices.
 - 2.6 Study the effects of soil disturbance in Pecos sunflower habitats. Soil disturbance, such as plowing and levee building in Pecos sunflower habitat may create conditions that have long-term implications for population increases (Sivinski, personal observation, 1994-2004). The severity and frequency of the most beneficial disturbances need further research. The potential of creating disturbance habitats for invasive, exotic species should be included in such studies.
 - 2.7 Investigate the impacts and control of exotic plants in Pecos sunflower habitats. Identify all invasive, exotic plants in Pecos sunflower habitats and assess their level of establishment in all sunflower locations. Habitats that are obviously being degraded by exotic or invasive species should be managed to control or reduce the infestation.
 - 2.8 Search for additional populations. Discovery of new populations of Pecos sunflower would enhance the options for recovering this species.
3. Protect designated core conservation areas and isolated stands through landowner education, implementation of management plans, conservation easements, or land acquisition. Core conservation areas and isolated stands of Pecos sunflower habitat on lands of government jurisdiction will be considered secure when the managing agency has adopted a long-term management plan for wetland habitat preservation and protection of the Pecos sunflower. Private lands with core conservation habitat are secure when the habitat is either owned by a non-profit conservation organization, or a willing owner has donated or sold a conservation easement (in perpetuity) to a non-profit conservation organization or a branch of government that is capable and qualified to monitor and manage the easement. Isolated stands should also be protected through easements or acquisition; however, in some cases landowner incentive programs such as a Safe Harbor agreement that includes Pecos sunflower may be appropriate. Portions of populations that occur within highway rights-of-way should be protected through coordination and formal agreements with State departments of transportation in New Mexico and Texas. Occupied habitats within rights-of-way could be fenced or signed to prevent them from being mowed during the summer and autumn months (Listing Factors A,C, D, E).

- 3.1 Develop and implement management plans to preserve Pecos sunflower habitats. The managing government agencies of core conservation habitat areas should have written management plans to protect those habitats. These plans should include prescriptions to protect Pecos sunflowers from habitat degradation, such as managing exotic species, managing the timing and duration of livestock grazing, prescribed fire, and reducing impacts from recreational development. Compatible and incompatible land uses should be identified as well as any restrictions on existing land uses. Groundwater withdrawals should be identified and managed to assure adequate spring flows. All water rights should be confined to uses within the core conservation areas. Water should not be available for export until after it has passed through the Pecos sunflower habitat. Therefore points of diversion should not be allowed at spring sources or within stands of Pecos sunflower.
- 3.1.1 Bitter Lake National Wildlife Refuge Water Management. This Refuge is potentially an important core conservation area for the Roswell/Dexter Region of New Mexico. The priority need in this population is development and implementation of a management plan. The Refuge must consider Pecos sunflower management in a very complicated setting. The numerous water impoundments on the Refuge are filled and drained on an annual basis. The schedule of this cycle can greatly influence the population of Pecos sunflower. The Refuge should develop a water management plan that maximizes the sunflower population while meeting the other Refuge requirements for waterfowl and aquatic wildlife habitats.
- 3.1.2 Lloyd's Canyon. This is a small area of Pecos sunflower in the Roswell/Dexter region in New Mexico that occurs on BLM property. Federal control of land use activities makes this a suitable isolated stand for this region. BLM Roswell District should develop specific plans for this site that address season and intensity of livestock grazing, prescribed fire, control of exotic plant species, security of the source aquifer, and possible development or diversion of the spring at this location.
- 3.1.3 Overflow Wetland ACEC. This is a large salt flat wetland designated as an Area of Critical Environmental Concern (ACEC) by the BLM. Most of this area is unsuitable habitat, however, there are small, isolated stands of Pecos sunflower in this ACEC. BLM Roswell District should develop specific plans for this area that address season and intensity of livestock grazing and control of exotic plant species.
- 3.1.4 Dexter Fish Hatchery. A small, isolated stand of Pecos sunflower occurs at an impoundment on the Dexter National Fish Hatchery, which is owned and managed by the Service. A management plan should be developed to protect or enhance or expand habitat at this location.

- 3.1.5 Diamond Y Spring Preserve. The Nature Conservancy of Texas owns a large area of habitat for Pecos sunflower within its Diamond Y Spring Preserve near Fort Stockton Texas. The pending Conservation Area Plan for the preserve is scheduled for completion in 2004-2005 and will consider the sunflower and its habitat as a focal conservation target. Objectives are to maintain soil moisture content, and enhancement of habitat for sunflower and three other rare plants in the same community. This management plan should be implemented and revised as new management and stewardship information becomes available.
- 3.1.6 Sandia Spring Preserve. The Nature Conservancy of Texas owns habitat for a population of Pecos sunflower within its Sandia Spring Preserve near Balmorhea, Texas. This preserve should have a management plan that considers security of the source aquifer, and addresses prescribed fire, control of exotic plant species and any potential disturbance activities such as livestock grazing.
- 3.1.7 La Joya State Waterfowl Management Area. This is a potentially important core conservation area for the west-central New Mexico recovery region. Current operation of the Refuge impoundments for waterfowl is not affecting several large stands of Pecos sunflower on the unexcavated wet cienegas. A management plan should protect core habitats within the Refuge from future development and address habitat management issues such as fire and exotic plants.
- 3.1.8 Future preserves. Additional management plans will be necessary if additional core conservation habitats or isolated stands are acquired by purchase or identified on other Federal lands.
- 3.2 Protect habitat through conservation easement or conservation land purchase. Core conservation areas and isolated stands on privately owned lands may be protected by the voluntary donation or sale of a conservation easement by a willing landowner to a qualified non-profit organization or branch of government. The deed of easement should identify compatible and incompatible land uses and the other management considerations for Pecos sunflower. At a minimum, the deed of easement must prohibit habitat conversion to non-wetland uses and diversion of surface springs or seeps above or within Pecos sunflower habitat, and must allow the easement holder to accomplish necessary habitat management actions that are not being accomplished by the landowner. Any private lands purchased in full-fee from a willing seller for Pecos sunflower conservation must be owned by a branch of government or a non-profit conservation organization. A new acquisition of habitat must be covered by a Pecos sunflower management plan.

Priorities for acquisition are as follows:

- 3.2.1 Pecos sunflower habitats at Santa Rosa, New Mexico are all municipal or private properties. Most of the municipal habitats are small and managed for recreation. These habitats occur within the potential core conservation areas identified in 1.1 and isolated stands in 1.2. A non-traditional section 6 grant was awarded to New Mexico in 2004 for acquisition of the Blue Hole Cienega property near Santa Rosa; the acquisition was finalized in July 2005.
- 3.2.2 Pecos sunflower habitats in west-central New Mexico occur on the Rio San Jose and on State land on the Rio Grande. The potential isolated stands identified in 1.2 occur on private property in Cibola County that could be protected through acquisition of conservation easement.
- 3.2.3 The large Dexter/Roswell population of Pecos sunflower occurs on a variety of landownership including Federal and State government. A conservation easement or land purchase within the Dexter Cienega core conservation habitat should be made when, and if, an offer is made by a willing landowner.
- 3.2.4 Both recommended core conservation habitats in Texas are already owned by TNC and managed for conservation purposes. Diamond Y Spring Preserve recently expanded from 1,500 to 4,000 acres.
- 3.3 Monitor management actions and conservation easements. Habitat management actions must be monitored to assess their effectiveness or discover unintended consequences. Assessment of the results of management actions is a prerequisite for substantiating or modifying management plans. Conservation easements must also be monitored by the easement holder to guarantee compliance with the terms of the deed. A minimum schedule of one visual inspection per year should be prescribed by the deed of easement.
- 3.4 Familiarize owners of Pecos sunflower habitats with Federal laws and regulations, pursue opportunities for voluntary conservation partnerships (e.g., Partners for Fish and Wildlife and Landowner Incentive Programs) and educate the public on this species' recovery. Several portions of Pecos sunflower habitat in New Mexico have been filled or drained in violation of the Clean Water Act protections for wetlands. These violations were not intentional and may have been avoided had landowners been aware of the COE requirement to obtain a 404 Permit before filling wetlands. The Service and its State partner agencies should actively engage with private landowners to provide information about the opportunities and incentives for conserving sunflower habitat on private lands through various partnership and grant programs. Education of the general public on Pecos sunflower recovery is also important to gain support and cooperation for recovery actions. The Service and the

States should use their public information sites and local media to emphasize the unique characteristics of the species, its recoverability, and its role as an integral part of the regional biota.

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PART III - IMPLEMENTATION SCHEDULE

The following Implementation Schedule outlines actions and cost for the Pecos sunflower recovery program. It is a guide for meeting the objectives discussed in Part II of the plan. The schedule indicates task priorities, task numbers, task descriptions, duration of tasks, responsible or potential agencies or partners, and estimated costs. These actions, when accomplished, should recover Pecos sunflower and secure core habitat locations. It should be noted that the estimated monetary needs for all parties involved in recovery are identified for the first three years only and, therefore, do not reflect total recovery costs. An estimate of total costs to reach the recovery objectives for this species is provided in the EXECUTIVE SUMMARY, page iv. Costs are estimated to assist in planning and do not obligate any agency to expend the estimated funds. Although work by private landowners and conservation organizations are identified in this plan, no party is obligated to participate or expend any funds for the recovery of this species.

Task Priorities

- Priority 1: An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.
- Priority 2: An action that must be taken to prevent a serious decline in the species population/habitat quality, or some significant negative impacts short of extinction.
- Priority 3: All other actions necessary to meet the recovery objectives.

Abbreviations Used

COE: Army Corps of Engineers
BLM: Bureau of Land Management
ES: Ecological Services Field Office
FWS: U.S. Fish & Wildlife Service
HAT: Hatcheries, FWS
LE: Law Enforcement (FWS)
NM: State of New Mexico
NPS: National Park Service
REF: Refuges, FWS
TNC: The Nature Conservancy
TX: State of Texas

PECOS SUNFLOWER RECOVERY PLAN IMPLEMENTATION SCHEDULE

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (YRS)	RESPONSIBLE PARTY		COST ESTIMATES (\$000)			COMMENTS
				FWS Program	Other	YR1	YR2	YR3	
1	3.4	Familiarize owners of Pecos sunflower habitats on Federal laws and regulations.	3	ES	COE, BLM, NM, NPS, TX	5.0	2.0	2.0	COE 404 Permits
2	1.1	Prioritize core conservation areas	2	ES	NM, TX	3.0			Includes minimum size determination
2	1.2	Prioritize isolated stands	2	ES	NM, TX	3.0			Includes minimum size determination
2	1.3	Contact Landowners	1	ES	NM & TNC	10.0	10.0		
2	2.1	Identify water rights and aquifer trends	1	ES	NM, TX		15.0	15.0	
2	2.2	Phenology studies	2	ES	NM, TX		10.0	10.0	Partially accomplished by TX.
2	2.3	Study habitat substrates	2	ES	NM, TX	15.0	15.0		Partially accomplished by TX.

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (YRS)	RESPONSIBLE PARTY		COST ESTIMATES (\$000)			COMMENTS
				FWS Program	Other	YR1	YR2	YR3	
2	2.4	Prescribed fire studies	3	ES, BL	NM, TX, BLM	15.0	15.0	15.0	Already begun in TX and NM.
2	2.5	Livestock grazing studies	3	ES	TNC, TX	15.0	15.0	15.0	Already begun at Diamond Y Ranch
2	2.6	Soil disturbance studies	3	ES	TNC, TX	15.0	15.0	15.0	Already begun at Diamond Y Ranch
2	2.7	Identify exotic plant infestations	1	ES,	NM, TX		12.0		
2	2.8	Search for new populations	3		NM, TX, BLM	5.0	5.0	5.0	
2	3.1.1	Bitter Lake Refuge management plan	2	ES, REF		10.0	5.0		Under development
2	3.1.2	BLM (Lloyd's Canyon) management plan	1	ES	BLM	10.0			
2	3.1.3	Overflow Wetland ACEC management plans	1	ES	BLM	5.0			
3	3.1.4	Dexter Fish Hatchery management plan	1	ES, HAT		5.0			

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (YRS)	RESPONSIBLE PARTY		COST ESTIMATES (\$000)			COMMENTS
				FWS Program	Other	YR1	YR2	YR3	
2	3.1.5	Diamond Y Spring Preserve management plan			TNC	10.0			Accomplished in 2005
2	3.1.6	Sandia Spring Preserve management plan			TNC	10.0			Accomplished in 2005
2	3.1.7	La Joya Waterfowl Management Area management plan	1	ES	NM	10.0			
2	3.1.	Management plans for future preserves	2	ES	NM		10.0	10.0	
2	3.2.1	Protect core habitat and isolated stands in Santa Rosa region	1	ES	NM			TBD	Blue Hole Cienega offered for sale by landowner and purchase is pending
2	3.2.2	Protect core habitat and isolated stands in West-Central New Mexico	1	ES	NM			TBD	La Joya population on State Lands. Isolated stands on private lands need protection
2	3.2.3	Protect additional core habitat (if needed) and isolated stands in	1	ES	NM			TBD	

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (YRS)	RESPONSIBLE PARTY		COST ESTIMATES (\$000)			COMMENTS
				FWS Program	Other	YR1	YR2	YR3	
		Roswell/Dexter region							
2	3.2.4	Protect core habitat and isolated stands in west Texas region			TNC				Habitat acquired, source aquifer protection remains an issue.
2	3.3	Monitor management actions and easements	3	ES, REF, HAT	NM, TNC,	4.0	4.0	4.0	Perpetual
		TOTALS				150.0	133.0	91.0	

APPENDIX

SUMMARY OF PUBLIC COMMENT AND PEER REVIEW PROCESS FOR PECOS SUNFLOWER RECOVERY PLAN JULY – OCTOBER 2004

We released the Draft Recovery Plan for Pecos Sunflower for a 30-day public comment period on July 2, 2004. We also requested and received peer review from two independent specialists with expertise regarding Pecos sunflower and closely related species, Ms. Jackie Poole, botanist, Texas Parks and Wildlife Department, and Dr. O. W. Van Auken, Professor, University of Texas. During the comment period, we received letters from seven individuals and organizations, including both peer reviewers. We also received two requests to extend the public comment period; one from the Texas Department of Transportation and one from the Pueblo of Laguna. In response, we re-opened the comment period for an additional 30 days from September 14, 2004 to October 14, 2004. We did not receive any additional comments during that time. We conducted government-to-government consultation with the Pueblo of Laguna per Secretarial Order 3206. All comment letters are kept on file at the New Mexico Ecological Services Field Office in Albuquerque.

This recovery plan also received internal review by Service staff at the Austin, Texas and Albuquerque, New Mexico Ecological Services Field Offices and the Washington office. We reviewed all internal comments and those received during both comment periods. Comments ranged from editorial suggestions to recommending specific changes and providing new information. We have tried to incorporate all applicable comments into this Final Recovery Plan. A summary of substantial comments and our responses follow:

Summary of Significant Comments and Service Responses

COMMENT: Pecos sunflower is listed as threatened by the State of Texas, and this listing provides some protection from collection in that State.

RESPONSE: We have added information regarding Texas statutes for endangered plants to the Plan (pages 1, 11).

COMMENT: A map showing the State and county boundaries, major drainages, and locations of Pecos sunflower populations and regions would be helpful.

RESPONSE: We have added a map to the Plan (Figure 3).

COMMENT: The draft plan does not adequately address the threat of lowering water tables through aquifer withdrawals for irrigated agriculture and municipal use, and should discuss groundwater law.

RESPONSE. We have noted that the lack of groundwater regulation limits our ability to address this threat (page 11). The recovery criteria state that core conservation areas must not be threatened by depletion of the contributing aquifer. Recovery actions 2.1, 3.1, 3.2 and 3.4 specifically address identification of water rights and verification of sustainable aquifer trends for core conservation areas, development of management plans that assure available water for sunflower habitat, assuring sustainable water use in deed restrictions, and working with landowners to avoid detrimental water use practices.

COMMENT: Consideration of possible threats from surrounding land uses should be given in selection of core conservation habitats.

RESPONSE: We have added language addressing this concept to recovery action 1.1.

COMMENT: The source of seed for any past or future reintroductions of Pecos sunflower should be clarified in the plan.

RESPONSE: We have done so in the Conservation Measures (page 17) and Recovery Strategy (page 20) sections of the plan.

COMMENT: A numerical estimate of what constitutes a “self-perpetuating stand” of Pecos sunflower should be provided, and time constraints could be added.

RESPONSE: We have adopted the Ladyman and Poole (1997) assessment of population quality for the recovery plan. Recovery criteria state that core populations should have at least 5,000 individual plants in seven out of ten years, constituting a “good” population by this method.

COMMENT: The timeline for listing the species is unclear.

RESPONSE: We have added the date when the species was proposed for listing to the introduction (page 1).

COMMENT: Pecos sunflower has been documented to reach heights of 3 m in wet years, the Plan describes plants as 1 – 2 m tall.

RESPONSE: We have changed the description to acknowledge that plants can reach 3 m in height (page 4).

COMMENT. Construction of fiber optic fiber cables in highway rights-of-way can impact populations existing in these rights-of-way.

RESPONSE: We have incorporated trenching for installation of utilities as a potential threat to the species (page 13).

COMMENT: Protecting a minimum of one core conservation area within each of the four general regions seems to keep the species at or below its present status... and does not seem like recovery. The species should not be considered recovered until at least an equivalent number of self-sustaining populations to those known at the time of listing are protected and there is a self-sustaining, protected population in each of the four core conservation areas. In addition, several populations have been extirpated over the last 100 years and an additional number of populations to those lost should be established and protected for full recovery.

RESPONSE: Restoration of historic population levels, while desirable, is often indefinable and unachievable, and it is not required to consider recovery achieved under the ESA. This species is listed as threatened, and the recovery criteria and actions must address the threats to known populations that could cause the species to become endangered. The primary threats are degradation and loss of habitat to these populations, which we believe are adequately addressed through the conservation and protection of substantial core populations in each recovery region. Meeting the criteria will assure protection of sunflower habitat in perpetuity in several areas that are currently at risk. Additionally, in this final plan, we have added the requirement of protecting an isolated stand of at least 1600 plants in each recovery region to provide as a buffer against catastrophic loss of any core conservation population. These isolated stands will protect additional habitat.

COMMENT: Water conservation and salt cedar control should be encouraged in Pecos sunflower habitats.

RESPONSE: We agree, and consider that water use, timing, and conservation, as well as exotic species control will be components of management plans required for core conservation areas.

COMMENT: Land acquisition and conservation easements from willing participants are ideal, but not always attainable. Other opportunities for conservation such as Safe Harbor, Partners for Fish and Wildlife, and Landowner incentive programs should be explored.

RESPONSE: We believe that core conservation areas are best protected through land acquisitions or conservation easements with management plans that address the threats to Pecos sunflower in perpetuity, and for this species, it appears to be attainable. However, we have provided additional language to the recovery actions 1.2 and 3.0 that specifically encourages landowner incentives and participation in protection of isolated stands and other Pecos sunflower populations.

COMMENT: Seed banking should be added as a recovery criterion.

RESPONSE: The Seed Storage Lab in Fort Collins, Colorado presently stores seed for the Diamond Y population in Texas. We do not believe that seed banking is necessary for New Mexico populations. The existing core populations contain large numbers of individual plants

that are prolific seeders. No New Mexico populations are currently threatened with sudden drying by aquifer depletion.

COMMENT: Education should be one of the recovery criteria.

RESPONSE: Recovery criteria are objective, measurable standards by which we can determine whether a species can be downlisted or delisted. Generally these criteria are population based, habitat based, or both. Education, however important, is difficult to quantify. Education is included as an important recovery action (3.4).

COMMENT: The plan does not address the surface extent of currently known populations, nor the potential for enhancement of additional surface either within present conservation areas or onto adjacent un-protected lands.

RESPONSE: Because Pecos sunflower is an annual that responds to environmental fluctuations, it is difficult to reliably delineate surface extent. However, we have identified those populations with the greatest potential as possible core conservation areas, and amended the recovery criteria to include the protection of isolated stands outside of core conservation areas. Recovery action 2.8 is to search for additional populations, and actions 3.1 – 3.4 address the need to work with landowners to enhance current preserves and protect additional populations.

COMMENT: Seed/flower averages should be studied to evaluate reproductive potential.

RESPONSE: We have addressed phenology and germination studies in recovery action 2.2, however, we believe that because reproductive output is tied to habitat quality it is too variable to be of value to reproductive studies.

COMMENT: Expand the concept of desert wetlands to include riparian areas and distinguish between them.

RESPONSE: Comment incorporated into plan.

COMMENT: Include concept of joint counterpart ESA section 7 consultation to help with streamlining consultation.

RESPONSE: Counterpart regulations are a type of informal consultation, this comment is considered outside the scope of this recovery plan.

COMMENT: BLM now has three known populations on public lands and one experimental population within the Overflow Wetlands Area of Critical Environmental Concern.

RESPONSE: Comment incorporated into recovery plan.

COMMENT: The recovery plan does not acknowledge the management objectives already developed for Pecos sunflower on BLM lands in the Roswell Approved Resource Management Plan and Record of Decision. In essence, occupied and potential habitat for the sunflower are already incorporated in a “management plan”.

RESPONSE: We have incorporated language that addresses these objectives and site-specific plans on BLM lands into the section on BLM Conservation Planning and Management. However, the plans do not specifically prescribe management practices for Pecos sunflower. A specific management plan that addresses Pecos sunflower recovery goals and tasks including assessment for exotic plant infestations and proposals for control, season of grazing for minimum impact on flowering sunflowers, timing of controlled burns, water management, and a schedule for monitoring Pecos sunflower populations on BLM lands should be developed.

COMMENT: The terms recovery regions, populations, core conservation areas need clarification.

RESPONSE: We have clarified these terms and illustrated the regions and core conservation areas with a map (Figure 3).

COMMENT: The core conservation areas designated in the plan may limit the selection of other occupied or potential habitat that could be valuable for Pecos sunflower conservation.

RESPONSE: The potential core conservation areas are not intended to exclude other locations that may present better options for the future. It is intended to reflect *potential* best known sites at this time – all existing stands, or restored stands of Pecos sunflower may be assessed for viability and considered for fulfilling the recovery criteria. We have added language on page 21 to clarify this intent.

COMMENT: Cite all studies pertaining to the sunflower, including “Spring Vegetation and Aquatic Invertebrate Survey 2000 Conducted through BLM Contract by the New Mexico Natural Heritage Program and the Pecos River Riparian Monitoring Program Final Report 2001”.

RESPONSE: We have cited the Spring Vegetation Survey. The Riparian monitoring report does not include any usable information on Pecos sunflower.

COMMENT: Include monitoring of groundwater levels in the stepdown outline. BLM has established monitoring sites at Lloyds Canyon and Flat Draw.

RESPONSE: BLM is to be commended for accomplishing this work. The recovery plan prescribes a general aquifer assessment task. Groundwater monitoring wells may be suitable at some locations and not necessary at others. Site specific management plans will determine if an assessment of aquifer reliability should require monitoring wells.

COMMENT: BLM would be glad to participate in studies dealing with the effects of fire on Pecos sunflower, and impacts and control of exotic plants in Pecos sunflower habitat.

RESPONSE: The Service appreciates this commitment to Pecos sunflower and we have added BLM to this task in the implementation schedule.

COMMENT: The Laguna Pueblo (Pueblo) is concerned that the Service has not adequately coordinated with the Pueblo regarding Pecos sunflower on a government-to-government basis per Secretarial Order 3206. Specifically: (a) the Service should invite the Pueblo to participate on the recovery team; (b) the Pueblo does not want the sunflower population on their lands to be identified as a potential core conservation area; (c) the Pueblo is concerned that there is implied intent to acquire such lands from the Pueblo (d) the Service should consider whether or not the Pecos sunflower is a species that should be given priority for recovery planning; (e) the Service has not established that inclusion of the Laguna population in recovery planning is necessary to recover the species; (f) the Plan should recognize the potential beneficial effects of livestock grazing on Pecos sunflower; (g) the Service incorrectly Stated that the Laguna Pueblo has not developed a management plan for the sunflower and the sunflower is thus not adequately protected; (h) the Service misstated the role of the BIA in NEPA consultation on Pueblo lands; and (i) the Service should consider ways to assist in protecting Pecos sunflower on Pueblo lands by addressing development and associated groundwater effects on private lands adjacent to the Laguna Pueblo.

RESPONSE: The Service apologizes for lack of adequate coordination with the Pueblo. The Service met with the Pueblo on a government-to-government basis per Secretarial Order 3206 on September 30, 2004 and agreed to re-open the comment period. The Service did not establish a recovery team for the Pecos sunflower, however, if for any reason the Service deems a recovery team necessary in the future, the Laguna Pueblo will be invited to participate (a). During the September 30, 2004 government-to-government meeting, the Service learned that the Pueblo has developed a draft management plan for the sunflower. The Service recognizes the Pueblo's commitment to conservation of the Pecos sunflower and other threatened and endangered species, and agrees to provide technical assistance to the Pueblo to finalize or implement that management plan at their request. Because the Pueblo is developing a management plan for Pecos sunflower, and the Pueblo prefers that their lands are not considered as a core conservation area in this Recovery Plan, the Service has removed reference to this population in the Plan (b). Acquisition of lands from the Pueblo for Pecos sunflower conservation was not intended, only to work cooperatively with the Pueblo to conserve the sunflower (c). The Service does not believe it is essential to include the Laguna population in core conservation areas for recovery planning, however, the Service believes that development of a recovery plan will benefit the Pecos sunflower and facilitate its removal from the list of threatened and endangered species (d, e). Both the potential beneficial and detrimental effects of livestock grazing are acknowledged in the "Threats and Reasons for Listing" section of this Plan, but not enough is known about either to make definitive statements. Investigating the relationship between livestock grazing and Pecos sunflower has been identified as an action in the recovery outline (action 2.5) (f). The

Service appreciates that a draft plan for management of Pecos sunflower has been developed by the Pueblo, and looks forward to assisting the Pueblo in any way possible to finalize and implement the plan (g). The Service acknowledges that BIA may not always be the lead agency in consultation on Pueblo lands (h); and the Service will continue to consider the effects of groundwater development in any consultation on lands that may affect Pecos sunflower (i).

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September 2005

