

**DRAFT**  
**PECOS SUNFLOWER**  
**(*Helianthus paradoxus*)**  
**RECOVERY PLAN**

**Prepared by**

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**for**

**Region 2**  
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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.

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## **EXECUTIVE SUMMARY**

Current Status: Pecos sunflower is listed as threatened.

Habitat Requirements and Limiting Factors: Pecos sunflower is a wetland plant that grows on wet, alkaline soils at spring seeps, wet meadows and pond margins. It has six widely spaced populations in west-central and eastern New Mexico and adjacent Texas. These populations are all dependent upon wetlands from natural groundwater deposits. Incompatible land uses, habitat degradation, 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 core conservation areas for Pecos sunflower in each of the four distinct regions where it occurs. Each core habitat must be on reasonably stable wetland that is not trending downward from agricultural or municipal use of the contributing aquifer, and have demonstrated a self-perpetuating stand of Pecos sunflower for at least 10 years.
2. Identify information gaps, compatible land uses, and management actions needed to protect core conservation areas from degradation.
3. Protect designated core conservation areas through implementation of appropriate

management plans, conservation easements, or land acquisitions.

Recovery Strategy: Pecos sunflower occurs in six population centers: two occur in west Texas and four are located in New Mexico. Two Texas populations occur on desert springs within the same general region in west Texas. Two populations occur along the Rio San Jose in western 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. Therefore, the recovery strategy is to protect and manage a significant, sustainable portion of each of the four region's 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 core conservation habitats that will be the focus of recovery actions. Core conservation areas 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. 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. Work with owners of Pecos sunflower habitats to better manage water resources.
2. Conduct research on Pecos sunflower biology and aquifer stability.
3. Identify core conservation areas and develop long-term management plans for each.
4. Identify and acquire conservation easements on privately owned cienega habitats or pursue full fee purchase of these habitats for Pecos sunflower conservation purposes.
5. Monitor Pecos sunflower core conservation areas as needed to satisfy delisting criteria.

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

Year	Need 1	Need 2	Need 3	Need 4	Need 5	Total
2004	5.0	60.0	24.0	22.0	4.0	115.0
2005		97.0	20.0	12.0	4.0	133.0
2006		70.0	10.0	402.0	4.0	486.0
2008			10.0		8.0	18.0
2010		8.0			8.0	16.0
2012					8.0	8.0
2014					8.0	8.0
2016					8.0	8.0
Total	5.0	235.0	64.0	436.0	62.0	792.0

**Recovery Cost:** \$792,000.

**Date of Recovery:** Delisting could occur as early as 2017.

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## **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). The species is not listed by the state of Texas.

Pecos sunflower is a wetland plant that was known only from a single population near Fort Stockton, Texas when it was proposed as a candidate for listing as endangered under the ESA. 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 in western New Mexico and two desert springs in west Texas (64 FR 56582-56590). These populations occur on a variety of State and Federal lands and several private land holdings. The new populations were also determined to have a moderate degree of threat. Spring seeps, or wet meadow (cienega) habitats are very rare in the dry regions of New Mexico and Texas. There is evidence these habitats have historically, and are presently, being eliminated by aquifer depletion, or severely impacted by agricultural activities and encroachment by alien plants (Poole 1992, Sivinski 1996). The southwest 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 will require efforts to identify the ecological parameters of Pecos sunflower habitat, and to enlist 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 true 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 hybrid origin with the most likely parent species being common sunflower and prairie sunflower.

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 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



Figure 1. Pecos sunflower (Heiser 1969).

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 1-2 meters (m) (3.3-6.5 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 (Figure 2). The prairie sunflower also has narrow leaves and phyllaries, but is distinguished from Pecos



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

sunflower by having white cilia 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 variability 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**

Pecos sunflower is presently known from only six population centers, two in west Texas and four in New Mexico. The type locality is near Fort Stockton in Pecos County, Texas. This consists of a large population with several hundred thousand plants at Diamond Y Spring, and a smaller group of plants at a nearby highway right-of-way. A second Texas population occurs at Sandia spring 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 8 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.

In May 2004, a population of sunflower that may be Pecos sunflower was reported at La Joya

State Waterfowl Management area in the Middle Rio Grande Valley of New Mexico.

Confirmation of whether this population is in fact Pecos sunflower, and its extent, will be completed in fall 2004 (B. Sivinski, pers. comm.). If confirmed, this population may contribute towards recovery goals or provide an opportunity for reintroduction in nearby habitat.

Most Pecos sunflower habitats are limited to less than 2 hectares (5 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 ground water and 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, even a large population of Pecos sunflower would disappear.

### **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) show 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 are variable, but important to productivity. Dense stands produce smaller, spindly plants, while more open stands have larger plants (Sivinski, personal observation). 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 within a site. For instance, the

Roswell/Dexter population contains at least 11 distinct cienega or lake habitats that are separated by distances of 1 to 13 kilometers (0.6-8 miles) from nearest neighboring habitats (Sivinski 1995). On a regional scale, the each of the six 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 5% viable seed compared to 84% 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, oral presentation to Texas Acad. Sci., 1997). 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.*).

### **Land Ownership**

Various Federal, State, Tribal, 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. The Laguna Indian Tribe owns and manages one site. Seven different private individuals or organizations own sites or part of sites. Some plants grow within State or Federal highway rights-of-way.

Four 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. Other threatened or endangered species at this refuge include Pecos gambusia, least tern, and bald eagle. Three mollusks (Koster's tryonia, Pecos assiminea snail, Roswell pryg) and Noel's amphipod are candidate species for endangered status. There is a small group of sunflowers on an impoundment at Dexter Fish Hatchery near Dexter, New Mexico, which is also managed by the SERVICE. The Nature Conservancy of Texas owns and manages two sunflower wetland habitats in west Texas, one near Fort Stockton and the other near Balmorhea. Large desert springs are the principal features of these preserves. The Diamond Y Spring near Fort Stockton has a large stand of Pecos sunflower as well as two species of endangered fish and three endemic snail species.

### **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 the species 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). 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. Ground water 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, ground water levels fell as much as 120 m (400 ft) in Pecos County and 150 m (500 ft) in Reeves County. Ground water 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.

#### 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 breeding programs to increase salt tolerance in common sunflower cultivars (Seiler *et al.* 1981). Occasional collections of seeds for scientific purposes are unlikely to have a significant effect on population densities. Repeated harvests of seeds for commercial use could significantly impact population densities, especially in areas with few plants.

#### Disease and Predation

Desert cienegas are productive ecosystems that are prized by ranchers for their forage production. Livestock will eat Pecos sunflowers when other green forage is scarce. Both cattle and horses tend to pull off the flower heads, which can reduce seed production. 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 observation). 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 affecting pollination of the fertile disc florets (Radke, USFWS memo, 1999). Stem bores that feed on parts of this plant have also been observed (Van Auken, personal observation). 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, State or Tribal 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. The New Mexico Endangered Plant Species Act also does not protect Pecos sunflower or its habitats on private lands, with the exception of plant collection not authorized by the landowner. Pecos sunflower and its habitats are not protected by statute or regulation in the State of Texas or the Laguna Indian Reservation.

#### Other Natural or Manmade Factors

Infestations of exotic plant species also continue to destroy or degrade desert wetlands. 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 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 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.

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, New Mexico. However, the dense stands of Pecos sunflower on wetter habitats appear to remain genetically pure based upon consistent morphology (Sivinski, personal observation). Populations near agricultural fields might be more severely effected, if those fields were devoted to the production of a commercial crop of a common sunflower cultivar.

Vegetation removal and mowing directly impact some Pecos sunflowers that occupy highway rights-of-way at Grants and Santa Rosa, New Mexico, and along the margins of recreational ponds in Santa Rosa.

### **Conservation Measures**

#### Taking and Trade Prohibitions

The Endangered Species Act of 1973, 50 CFR 17, 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. The State of New Mexico prohibits 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 permit for scientific studies or impact mitigation.

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 move these species towards recovery.

Federal agencies that issue permits or use Federal funds for projects on private lands are also required to consult with SERVICE regarding potential effects on threatened or endangered species on those private lands. Otherwise, activities that may effect 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 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 this refuge 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.

#### Bureau of Indian Affairs Conservation Planning and Management

The Federal Government holds tribal lands in trust for Indian tribes, which are responsible for oversight and management of activities using Federal funds within reservation boundaries. The Bureau of Indian Affairs (BIA) in the U.S. Department of Interior is the lead agency for NEPA and ESA compliance on reservations. Management of threatened and endangered plants on Tribal trust land is presently limited to actions that initiate a NEPA review process. Compliance with NEPA requires botanical surveys for projects proposed within Pecos sunflower habitats. If this sunflower is expected to be adversely affected by a federally sponsored project, BIA must initiate a formal Section 7 consultation with the Service. The Laguna Tribe has not independently developed a Pecos sunflower management plan for the reservation population of this plant.

#### 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 two small cienega habitats with Pecos sunflowers near the Town of Roswell, New Mexico. These sites were recently discovered and will be added to the management plan of BLM's Roswell District during a future revision of that document.

#### 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

This Federal agency has 404 Permit authorities under 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 Army Corps 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. Thus far, only the Chaves County seeding has become established with adult, reproductive plants.

### 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. The Diamond Y Ranch near Fort Stockton in Pecos County contains a large cienega habitat, which is owned and managed by TNC. Sandia Springs 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 graduate students have studied various aspect of Pecos sunflower ecology at the TNC preserve on Diamond Y Ranch 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); 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, unpub. PhD dissertation, UTEP, 2002).

## **PART II - RECOVERY**

### **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 Endangered Species Act is no longer required for the conservation and survival of the species.

#### Recovery Strategy

There are six distinct population centers of Pecos sunflower, two in west Texas and four in New Mexico. These six population centers can be grouped within four highly disjunct regions that contain the entire genomic and ecotypical characteristics of Pecos sunflower. The west Texas region is comprised of the Fort Stockton and Balmorhea populations. The Rio San Jose region consists of the two populations at Laguna and Grants in western New Mexico. 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. Core conservation areas could also include presently unoccupied habitats where Pecos sunflower could be successfully reintroduced within its historic range.



Core conservation areas 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 to identify research needs and to delineate the core conservation areas in which recovery actions will focus.

### Criteria

The criteria for meeting the recovery objective are entirely within the realms of real estate, land use planning and management. Because Pecos sunflower is a wetland-dependent annual plant with extreme fluctuations in numbers in response to annual climatic and habitat conditions, criteria related to population size and numbers are not useful. Protection of wetland habitat at risk from incompatible use in areas where suitable habitat currently exists is essential. The following site-specific man criteria will accomplish the recovery objective:

1. Identify and establish core conservation areas for Pecos sunflower in each of the four distinct regions where it occurs. Each core habitat must be on reasonably stable wetland that is not trending downward from agricultural or municipal use of the contributing aquifer, and have demonstrated a self-perpetuating stand of Pecos sunflower for at least 10 years.
2. Identify information gaps, compatible land uses, and management actions needed to protect core conservation areas from degradation.
3. Protect designated core conservation areas through implementation of appropriate long-term management plans, conservation easements, or land acquisition.

### Outline of Recovery Actions

The following is an outline of the site-specific recovery actions needed to attain 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. 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 for the long-term survival of Pecos sunflower.

Identify a minimum of one Pecos sunflower core conservation area 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 reasonably stable wetland that is not trending downward from agricultural or municipal use of the contributing aquifer, and demonstrate a self-perpetuating stand of Pecos sunflower for at least 10 years.

- 1.1 Core Conservation Habitat Priority and Size. The Service will prioritize potential core conservation habitats within the four regions. The minimum size and extent of core habitat(s) necessary to perpetuate the sunflower in a particular region needs to be determined; this may require multiple core conservation areas per region.

#### **Potential Core Conservation Areas**

##### *Texas Populations:*

Diamond Y Spring near Fort Stockton, Pecos County (TNC)

Sandia Spring, Balmorhea, Reeves County (TNC)

##### *New Mexico – Dexter/Roswell Population:*

Bitter Lake National Wildlife Refuge, Roswell, Chaves County (USFWS)

Bottomless Lakes State Park, Roswell, Chaves County (State of NM)

Lloyd's Canyon Cienega, Roswell, Chaves County (BLM)

Dexter Cienega, 3 miles north of Dexter, Chaves County (private ownership)  
Dexter Fish Hatchery (USFWS)

*New Mexico – Santa Rosa Population:*

Blue Hole Cienega, Guadalupe County (private ownership)  
Agua Negra Spring, Guadalupe County (private ownership)

*New Mexico – Middle Rio Grande Population* (this potential population needs to be evaluated to determine whether it can contribute to recovery of Pecos sunflower).

*New Mexico – Rio San Jose Populations:*

Rio San Jose Box, Valencia County (Laguna Pueblo)  
Rancho del Padre Spring, Grants, Cibola County (private ownership)  
Grants Saltflat, Cibola County (private ownership)

- 1.2 Contact Landowners. The owners of identified potential core conservation habitats will be contacted and asked to participate in the recovery of Pecos sunflower on both government and privately owned lands. Information on the Pecos sunflower, the Act and its effect on landowner activities should be compiled for the unique situation of each candidate core habitat owner.
  
2. Identify 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.
  - 2.1 Identify water rights and verify sustainable aquifer trends. The aquifers that supply water to core Pecos sunflower habitats should be identified and the regional uses assessed. A core conservation area should have a stable trend in the surface flow of

its aquifer. 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 germination 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.
- 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). Soil chemistry, texture, or both were unsuitable at the other two locations. Guidelines on what is or is not suitable habitat for this species would be useful in identifying cienegas that may have historically been Pecos sunflower habitats.
- 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; Radke, personal communication). However, the optimal frequency and time of year for burning need further investigation.
- 2.5 Study the effects of livestock grazing on 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.

- 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). The severity and frequency of the most beneficial disturbances need further research. The potential of creating disturbance habitats for other invasive, exotic species should be included in such studies.
  - 2.7 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 alien species should be managed to control or reduce the infestation.
3. Protect designated core conservation areas through landowner education, implementation of management plans, conservation easements, or land acquisition. Core conservation areas 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 the easement.
    - 3.1 Develop and implement management plans to preserve Pecos sunflower habitats. At a minimum, 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 eliminating exotic species, managing the timing and duration of livestock grazing, and reducing excavations for recreational development. Compatible and

incompatible land uses should be identified as well as any restrictions on existing land uses. 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 management plans. It 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 core conservation area for Pecos sunflower in the Roswell/Dexter region in New Mexico that occurs on Department of Interior – Bureau of Land Management property. Federal control of land use activities makes this a suitable core population 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 alien plant species, and possible development or diversion of the spring at this location.
- 3.1.3 Diamond Y Preserve. The Nature Conservancy of Texas owns a large core conservation habitat for Pecos sunflower within its Diamond Y Preserve near Fort Stockton Texas. The current management plan for the sunflower at this location should be implemented and revised as new management and stewardship

information becomes available.

- 3.1.4 Sandia Spring Preserve. The Nature Conservancy of Texas owns a core population of Pecos sunflower within its Sandia Spring Preserve near Balmorhea, Texas. This preserve should have a management plan for prescribed fire, control of alien plant species and any potential disturbance activities such as livestock grazing.
- 3.1.5 Future preserves. Additional management plans will be necessary if additional core conservation habitats are acquired by purchase or identified on other Federal lands.
- 3.2 Conservation easement or conservation land purchase. Core conservation areas 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 identified in 2. 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.
- 3.2.2 Pecos sunflower habitats along the Rio San Jose are predominantly private and Tribal lands. These habitats occur within the potential core conservation areas identified in 1.1.
- 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 The Nature Conservancy and managed for conservation purposes.
- 3.3 Monitor management actions and conservation easements. Habitat management actions must be monitored to assess their effectiveness or discover unintended consequences. The experience gained by knowing 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, and opportunities for voluntary conservation partnerships. 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 Army Corps of Engineers' requirement to obtain a 404 Permit before filling wetlands. The Service 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.

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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**

- ACE: Army Corps of Engineers  
BIA: Bureau of Indian Affairs  
BLM: Bureau of Land Management  
FWS: U.S. Fish & Wildlife Service  
BL: Bitter Lake Refuge  
ES: Ecological Services Field Office

LE: Law Enforcement (FWS)

NM: State of New Mexico

NPS: National Park Service

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	YEAR 1	YEAR 2	YEAR 3	
1	3.4	Familiarize owners of Pecos sunflower habitats on Federal laws and regulations.	3	ES	ACE, BIA, BLM, NM, NPS	5.0			Army Corps of Engineers 404 Permits
2	1.1	Prioritize core conservation areas	2	ES	NM, TX	4.0			Includes minimum size determination
2	1.2	Contact Landowners	1	ES	NM & TNC	10.0			
2	2.1	Identify water rights and aquifer trends	1	ES	NM		15.0	15.0	
2	2.2	Phenology studies	2	ES	NM, TX		10.0	10.0	
2	2.3	Study habitat substrates	2	ES	NM, TX	15.0	15.0		Already partially accomplished by TX.
2	2.4	Prescribed fire studies	3	ES, BL	NM, TX	15.0	15.0	15.0	

2	2.5	Livestock grazing studies	3	ES	TNC, TX	15.0	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	15.0	Already begun at Diamond Y Ranch
2	2.7	Identify exotic plant infestations	1	ES	NM, TX		12.0			
2	3.1	Develop and implement management plans	3	ES, BL	BIA, BLM, NM, TNC					
2	3.1.1	Bitter Lake Refuge management plan	2	ES		10.0	10.0			
2	3.1.2	BLM (Lloyd's Canyon) management plan	1	ES	BLM	10.0				
2	3.1.3	Diamond Y Preserve management plan			TNC					Accomplished
2	3.1.4	Sandia Spring Preserve management plan			TNC					Accomplished
2	3.1.5	Management plans for future preserves	2	ES	NM		10.0	10.0	10.0	
2	3.2	Develop conservation easements or acquisitions	3	ES	NM & TNC	10.0	10.0	10.0	400.0	Anticipates buying 2-3 easements or land at \$100-\$200K each. Appraisal and survey costs at about \$100K

2	3.2.1	Protect core habitat in Santa Rosa region	1	ES	NM				TBD	Blue Hole Cienega offered for sale by landowner
2	3.2.2	Protect core habitat in Rio San Jose region	1	ES	NM				TBD	
2	3.2.3	Protect additional core habitat (if needed) in Roswell/Dexter region	1	ES	NM				TBD	
2	3.2.4	Protect core habitat in west Texas region			TNC					Accomplished
2	3.3	Monitor management actions and easements	3	ES, BL	NM, TNC	4.0	4.0	4.0	4.0	Perpetual
		TOTALS				113.0	131.0	484.0		