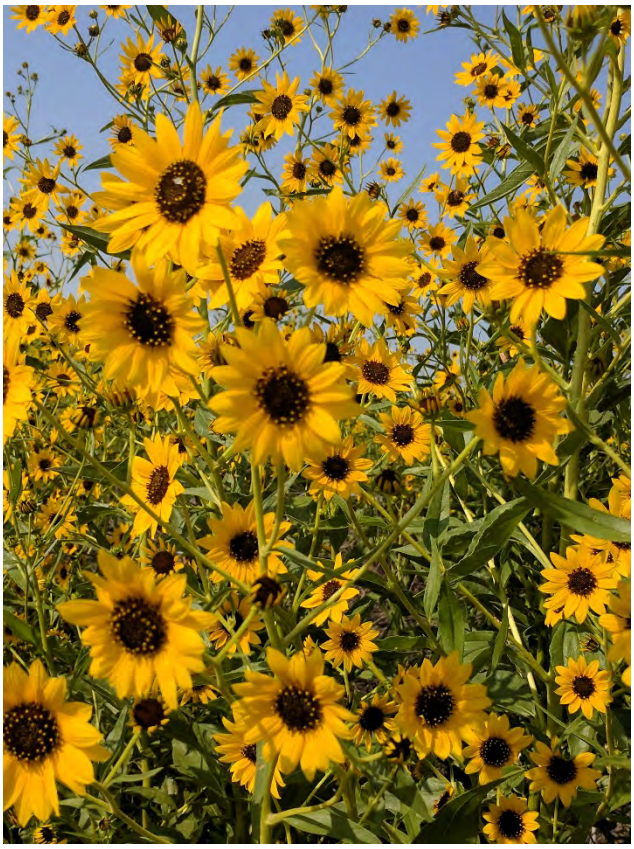
Pecos Sunflower

(*Helianthus paradoxus*)

2013 - 2017 Monitoring Report

Blue Hole Cienega Nature Preserve
Santa Rosa, NM



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INTRODUCTION

Pecos sunflower (*Helianthus paradoxus* Heiser) is a wetland plant that grows on wet, alkaline soils in spring seeps, wet meadows, and along stream courses and pond margins (USFWS 2005). It has seven widely spaced populations in west-central and eastern New Mexico, and adjacent Trans-Pecos Texas. Incompatible land uses, habitat degradation and loss, and groundwater withdrawals are historic and current threats to the survival of Pecos sunflower.

sunflower was listed Threatened under the Endangered Species Act of 1973 (ESA), as amended, on October 20, 1999 (64 FR 56582-56590). The U.S. Fish and Wildlife Service (USFWS) designated Blue Hole Cienega as Critical Habitat for Pecos sunflower in 2008 (73FR 17762-17807). In addition, the State of New Mexico lists Pecos sunflower as endangered under the New Mexico Endangered Plant Species Act (19 NMAC 21.2), and it is listed threatened by the State of Texas (31 TAC 2.69(A)).

The USFWS Recovery Plan grouped the seven populations of Pecos sunflowers into 4 disjunct recovery regions, including the Santa Rosa region in eastern New Mexico (USFWS 2005). The recovery strategy is to protect and manage significant, sustainable portions (termed “core conservation areas”) of each of the four region’s sunflower habitats against the threat of future habitat loss and degradation. At least one core conservation area and one isolated stand of Pecos sunflower need to be protected in each region to meet the recovery criteria. 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. Blue Hole Cienega Nature Preserve was identified as a core conservation area for the Santa Rosa Recovery Region (Figure 1).

Figure 1. Distribution of Pecos sunflowers and location of the USFWS Santa Rosa Recovery Region (USFWS 2005).

Blue Hole Cienega Nature Preserve (Cienega)

The 116-acre Blue Hole Cienega Nature Preserve in Santa Rosa was acquired by the New Mexico Forestry Division in 2005 with funds from a USFWS Recovery Land Acquisitions grant and a mitigation settlement from the NM Department of Transportation. It is managed by the Forestry Division for the sole purpose of protecting and enhancing the Pecos sunflower population and other rare and endangered wetland plants. Management actions and associated research inform the types of management and land uses that are compatible with this species on Blue Hole Cienega, including the removal of livestock, the ongoing management of invasive woody species (tamarisk, Siberian elm, Russian olive) through cut and herbicide treatments, and prescribed fires.

Description

Pecos sunflower is an annual, herbaceous plant, up to 10 ft tall (USFWS 2005). 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 6.9 inches long by 3.3 in wide. The stem and leaf surfaces have a few short, stiff hairs. Flower heads are 2.0-2.8 in in diameter with bright yellow rays around a dark purplish brown center. Pecos sunflowers flower during the monsoon season, from late August to October.

Associated species include *Distichlis spicata* (saltgrass), *Sporobolus airoides* (alkali sacaton), *Phragmites australis* (common reed), *Sorghastrum nutans* (Indiangrass), *Schoenoplectus americanus* (chairmaker's bullrush), *Juncus balticus* (Baltic rush), *Muhlenbergia asperifolia* (alkali muhly), *Apocynum cannabinum* (dogbane), *Baccharis salicina* (Great Plains

seep-willow), *Limonium limbatum* (southwestern sea lavender), *Flaveria chlorifolia* (clasping yellowtops), and *Solidago canadensis* (goldenrod). Other rare and endangered plants include *Cirsium wrightii* (Wright's marsh thistle) and *Spiranthes magnicamporum* (Great Plains ladies tresses).

Habitat

Pecos sunflower is a wetland plant that grows in areas with permanently saturated soils in the root zone (USFWS 2005). These are most commonly desert springs and seeps that form wet meadows called cienegas. This sunflower also can occur around the margins of lakes, impoundments and creeks. The soils of these desert wetlands are typically saline or alkaline and are predominantly silty clays or fine sands with high organic matter content. Although Pecos sunflowers grow in saline soils, seeds germinate and establish best when high water tables and precipitation reduce salinity near the soils' surface (Van Auken and Bush 1995).

Distribution

Pecos sunflower has a highly disjunct distribution, is known from only seven populations, two in west Texas and five in New Mexico (USFWS 2005). There are at least 8 wetland sites with documented Pecos sunflowers in the Santa Rosa Recovery Region in Guadalupe County, at least one of which consists of a few hundred thousand plants in good years (Blue Hole Cienega Nature Preserve). Most Pecos sunflower habitats are limited to less than 2 hectares (5 acres) of wetland. The number of sunflowers per site varies from a few plants to several hundred thousand. Because Pecos sunflower is an annual plant, the number of plants per site can fluctuate greatly from year to year with changes in precipitation and depth to ground water levels during early spring when plants germinate and establish.

METHODS

In response to observed declines in the number of Pecos sunflower plants following a massive hailstorm in June of 2013, the Forestry Division established 11 monitoring transects distributed throughout the 116-acre Cienega, wherever plants occurred (Figure 2). Each transect measures 30 m x 2 m and is permanently marked by a metal t-post on either end. All permanent markers were mapped using a Garmin Monterra GPS. Annual monitoring occurs during the first 2 weeks

of October, after the majority of sunflowers are done flowering and plants are senescent. Within each transect the number of plants are recorded. Annual observations may include the observance of predators (insects, deer) or diseases, and the general vigor of plants in the transect, measured by average height of the plants. In addition, the perimeter of contiguous stands of sunflowers associated with the monitoring transects were walked in 2013, 2015, 2016, and 2017, using the tracking function of a Garmin Montana or Monterra GPS, to get a better understanding of population fluctuations between years. A stand is considered contiguous if plants are 5m or less apart from each other. Following the prescribed burn in 2017, all contiguous stands of Pecos sunflowers were delineated on Blue Hole Cienega. In addition, a photopoint was established on the southwestern boundary of the Cienega at the Knights of Columbus Center parking area, to provide visual documentation of sunflower abundance and distribution through time. Photos were taken in 2004, prior to the purchase and restoration of the Cienega, in 2015, following several years of restoration treatments, and in 2017, after a prescribed burn. Other monitoring activities on Blue Hole Cienega include rainfall (since July 2016), groundwater fluctuations (since 2014; LeJeune 2018), and population trend monitoring of the endangered Wright's marsh thistle (*Cirsium wrightii*)(since 2017). Monitoring results will inform our understanding of sunflower population fluctuations in response to management activities, rainfall, and groundwater fluctuations. Since monitoring was initiated in 2013, the following management actions have been implemented on Blue Hole Cienega:

October 2013: Retreatment (cutting and spraying of Russian olive, tamarisk, and Siberian elm)
October 2014: Retreatment (cutting and spraying of Russian olive, tamarisk, and Siberian elm)
February 2017: Prescribed burn
October / November 2017: Retreatment (cutting and spraying of Russian olive, tamarisk, and Siberian elm)

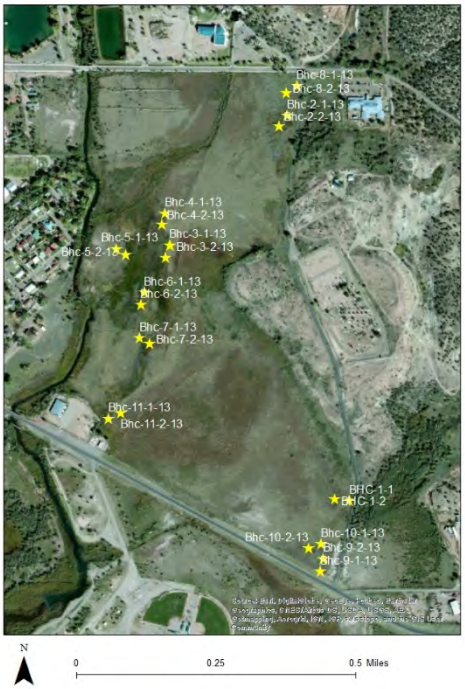

Figure 2. Locations of permanent Pecos sunflower transects at the Blue Hole Cienega Nature Preserve in Santa Rosa.

RESULTS

The number of sunflowers within the 11 transects varied widely over the 5 years of monitoring, ranging from a low of 1,731 plants in 2013 to 8,064 in 2017 (Figure 3). Following the prescribed burn in February of 2017, the density of plants within the transects increased by 39% over the highest number counted during the previous 4 years (2014). This was likely due to increased germination and establishment in response to the prescribed burn in the winter of 2017 and high amounts of rainfall during August and September of the same year. No comprehensive data is available on the exact distribution of sunflowers on the Cienega prior to the burn, but popuation perimeters were mapped surrounding the sunflower stands associated with monitoring transects in 2013, 2015 and 2016 (Figure 4). These document a significant increase in continuous sunflower stands in the vicinity of the monitoring transects, linking some of the previously documented individual stands into one large stand.

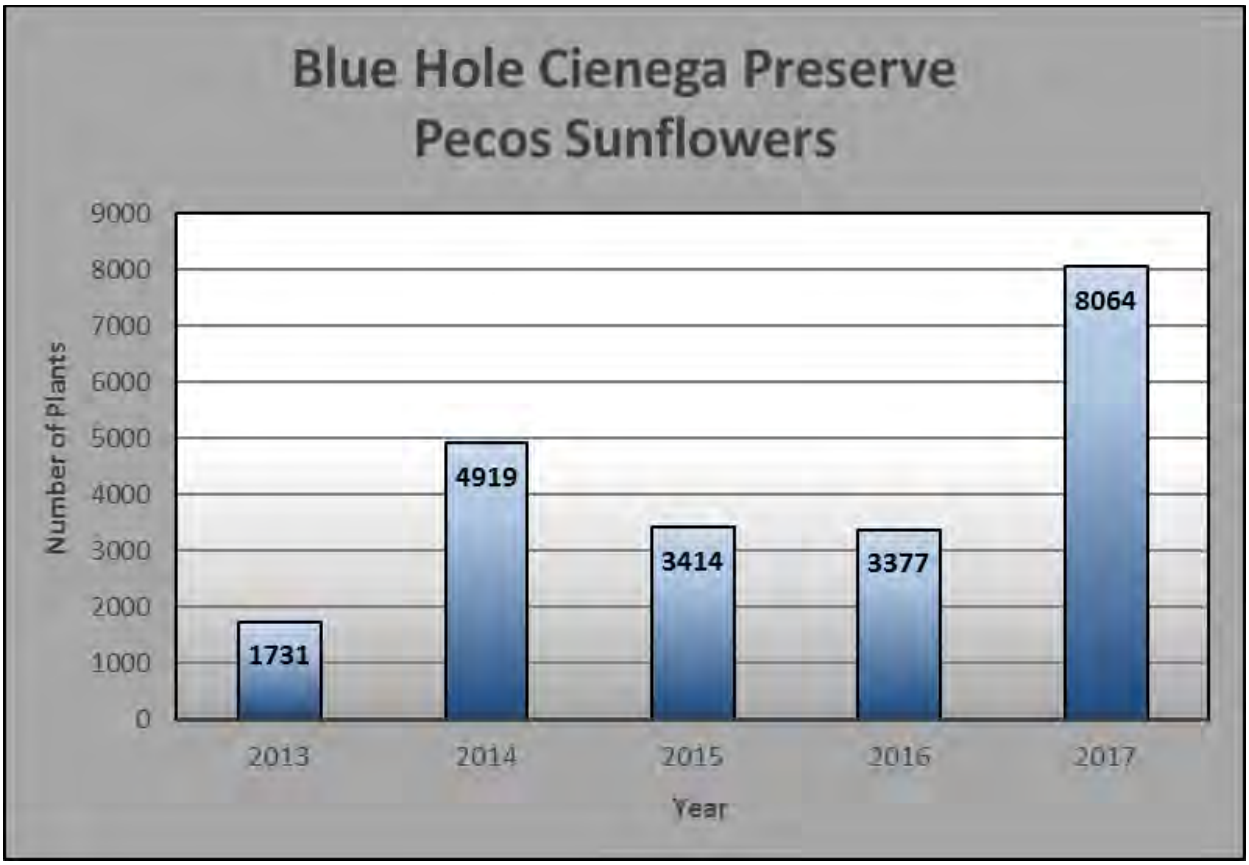

Figure 3. The total number of flowering Pecos sunflower plants between 2013 and 2017, in 11 monitoring transect at Blue Hole Cienega Nature Preserve in Santa Rosa, NM.

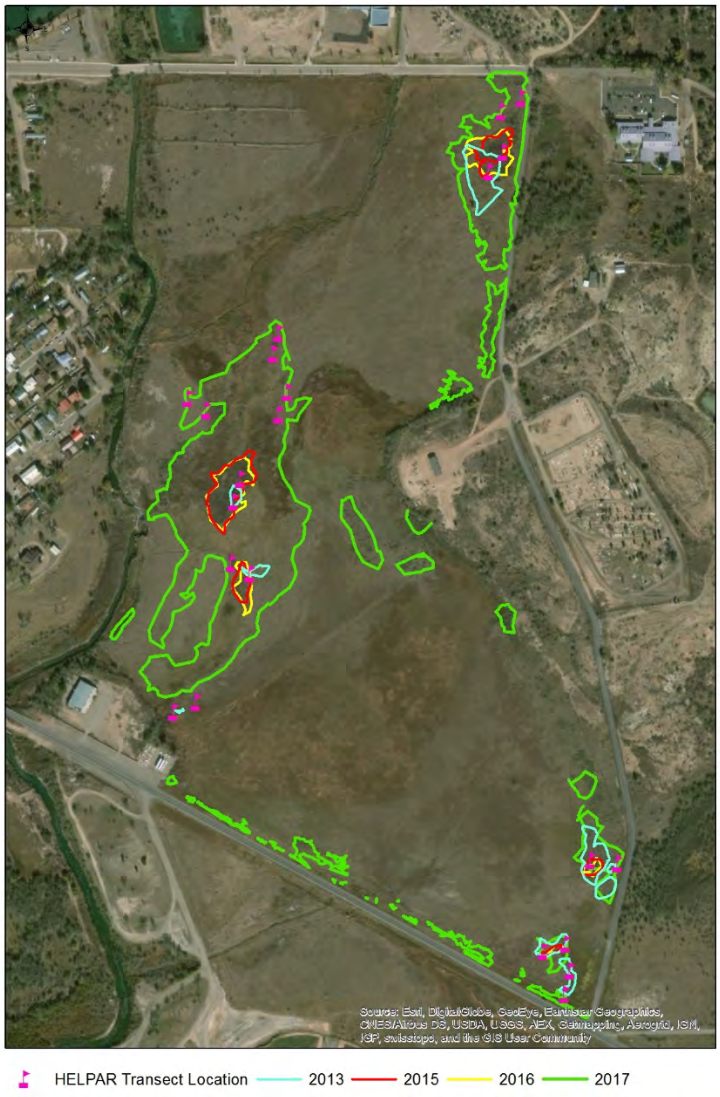

Figure 4. Distribution of Pecos sunflowers surrounding the monitoring transects, 2013 – 2016, and throughout BHC in 2017.

Repeat Photography

Despite extensive restoration efforts, including the initial removal of large stands of Russian olives and other invasive woody plants, and a prescribed fire in 2008, 7 years after initial restoration treatments sunflower abundance appeared to be significantly lower in 2015, when compared to 2004 (Figure 5). In 2017, following a prescribed burn at the beginning of February, sunflower abundance and distribution appeared similar to those observed in 2004, or more.

Figure 5. Sunflower abundance at Blue Hole Cienega Nature Preserve in Santa Rosa, NM, before treatments (2004), after treatments (2015), and after prescribed fire (2017).

DISCUSSION

Although Pecos sunflowers can be locally abundant, they are globally rare and are known from only seven isolated populations in New Mexico and Texas. The main factors limiting density and growth of plants include water availability, competition with other species, grazing, and other disturbances. These factors do not act independently. Water availability and salinity combined with disturbances control the growth of Pecos sunflowers (Van Auken and Bush 1995). Annual plants are often found in disturbed areas where there is little competition from perennial plants. Pecos sunflowers appear to respond favorably to certain types of disturbance such as fire and tilling, but negatively to grazing (Van Auken and Bush 2004). The number of sunflowers on the Cienega has fluctuated widely from one year to the next, primarily driven by water availability, but also in response to disturbances, such as hail storms and prescribed fires. Reduced competition in combination with increased availability of soil nutrients following the fire likely contributed to the germination and establishment of seedlings in the spring following the fire of 2017. Abundant rainfall increased survival of established plants and contributed to abundant flowering in August and September of 2017. Although Pecos sunflowers are palatable to livestock and livestock impacts can be detrimental to sunflowers, the impacts of grazing as a ground disturbing treatment during the dormant season has not been studied.

Seed banks of annual plants are important to the reestablishment of populations after periods of unfavorable environmental conditions including climatic variability, salinity, and drought (Van Auken 2001). Although the majority of Pecos sunflower seeds have shown to germinate within 4 to 6 months after dispersal, some remain dormant and act as an insurance for species survival in response to adverse environmental conditions by remaining viable in the seedbank (Van Auken 2001). In the Santa Rosa area, sunflower populations flower in early- to mid-September and seed dispersal occurs through October. Seeds germinate in March, after the potential for killing frosts is low, the water table is at or near the surface, and longer daylight hours and temperatures favor germination and establishment of seedlings.

Photopoint monitoring may lead to conclude that restoration efforts have little or inconclusive response from the sunflower populations. However, competition from other species is just one part of what drives sunflower abundance on the Cienega. In years of good rainfall competition

for essential resources, such as water, may not impact the abundance of sunflowers as it would during drought years. 2004 was an exceptional wet year in the Santa Rosa area, producing more than 6 inches above average rainfall values (WRCC 2018). Therefore, the abundant sunflower population in the 2004 photo may be a product of ample moisture, not influenced by the strong presence of competing invasive woody species. No reliable rainfall data is available for Santa Rosa after 2009 and we have no photos or population data on how sunflower abundance may have responded to rainfall amounts following herbicide treatments and a prescribed burn in 2008. However, similar high amounts of total annual rainfall were recorded in 2004 and in 2015 in Tucumcari, located approximately 60 miles to the east, with similar large rainfall events in the spring for both recording years. An automated rain gauge installed at the Cienega in July of 2016 may give us better insights on how localized rainfall influences the abundance of sunflowers. The highest number of sunflower since 2013 was recorded in 2017. Significantly more sunflowers were recorded in the 11 monitoring transect over any of the previously recorded years. This is likely the response to the prescribed burn in early February of 2017, approximately 1 month before these sunflowers germinate. In addition, August and September of 2017 incurred unusually large amounts of rainfall, likely contributing the survival of plants established in the spring. This was also true during 2004, but not during 2015 (August or September). More likely than not, sunflower abundance is driven by multiple environmental factors, including the height of the water table in the spring, rainfall amounts during the monsoons, and the type and degree of disturbance within the habitat of the species.

LITERATURE CITED

LeJeune, C. 2018. Blue Hole Cienega Nature Preserve, Santa Rosa, New Mexico Groundwater Monitoring Project Final Report FY 2016-2017. Unpublished report prepared for EMNRD - Forestry Division, Santa Fe, NM, by Wetwater Environmental Services, Albuquerque, NM.

USDI-Fish & Wildlife Service. 2005. Pecos sunflower (*Helianthus paradoxus*) recovery plan. Albuquerque, New Mexico.

Van Auken, O.W. and J.K. Bush. 1995. Factors affecting the growth and distribution of *Helianthus paradoxus*. Performance Report for Section 6 Grant No. E-1-7, Project No. 60, Texas Parks and Wildlife Department, Austin.

Van Auken. 2001. Germination requirements of seeds of *Helianthus paradoxus* (Asteraceae). Texas Journal of Science 53(2):157-170.

Van Auken, O.W. and J.K. Bush. 2002. Growth of Helianthus paradoxus, the puzzle or Pecos sunflower (Asteraceae) in response to disturbances. Proceedings of the 2002 Texas Plant Conservation Conference, Lady Bird Johnson Wildflower Center, Austin, TX.

Western Regional Climate Center. 2018. Precipitation listings, New Mexico, monthly totals. Accessed online on 03/26/2018 at https://wrcc.dri.edu/summary/Climsmnm.html