

MONITORING REPORT

MANCOS MILKVETCH (*ASTRAGALUS HUMILLIMUS*: FABACEAE)

SAN JUAN COUNTY, NEW MEXICO

1990 – 2018



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Prepared for the
U.S. Fish & Wildlife Service, Region 2
Albuquerque, NM

INTRODUCTION

Mancos milkvetch (*Astragalus humillimus* A. Gray ex Brand) is only known from the Four Corners region of New Mexico and Colorado. The species is a member of the Colorado Plateau ecoregion, one of seven ecoregions represented in the state of New Mexico (Griffith et al. 2006, Level III). It occurs primarily on Navajo Nation lands, with small populations on Bureau of Land Management and State Trust lands in New Mexico, and Ute Mountain tribal lands in southwestern Colorado.

Mancos milkvetch grows only on rimrock outcrops of the Point Lookout member of the Mesa Verde series of sandstone with flat or gently sloping surfaces at elevations between 5,200 and 6,000 feet (Figure 1). Within this range the species is confined to large sloping sheets of exfoliating whitish-tan colored sandstone. In San Juan County, New Mexico, this habitat extends southward from the Colorado border to the end of the Hogback, about 20 miles south of the San Juan River. In all, fifteen population sites are known to occur in New Mexico, and four populations in adjacent Colorado. The majority of populations are located on Navajo Nation lands (Roth 2008, USFWS 2011). Within its restricted range Mancos milkvetch forms highly localized populations; occupied habitat ranges from 1.5 to 7.6 hectares in size, where plants could historically be concentrated in densities as high as 40 plants per square meter (Sivinski 2008). The largest and best known site is Slickrock Flats on the Navajo Nation (and partial BLM). Mancos milkvetch is usually found on large nearly flat sheets of sandstone in small depressions (tinajas) on bedrock, in cracks or fissures in sandstone, or at the base of gentle slickrock inclines (Figures 1 & 3).

The density within populations can vary dramatically, depending on rainfall and habitat suitability (Sivinski 2008). Optimum habitat conditions are large nearly flat surfaces with cracks and tinajas that accumulate soil and water. The majority of plants within a population tend to be seedlings and juvenile plants, indicating a high level of reproductive effort within populations (Sivinski 2008).

Mancos milkvetch was listed endangered under the federal Endangered Species Act on June 27, 1985 (50 FR 26568-26572). Primary reasons for listing included a very limited distribution combined with low disturbance tolerance, and close proximity to powerline corridors, roads, and oil wells (energy development). A recovery plan to guide recovery efforts was completed in 1989 (USFWS 1989). Monitoring populations and their habitat to document trends and threat impacts was identified as an action that must be taken to prevent a significant decline in species population and habitat quality. It is one of the primary actions needed to remove the species from the list of threatened and endangered species. To date, two monitoring sites have been established for Mancos milkvetch, located on NM State Trust lands (Sleeping Rocks) and lands managed by the Bureau of Land Management (Slickrock Flats). A summary of the results from 1990 to 2018 is presented here.



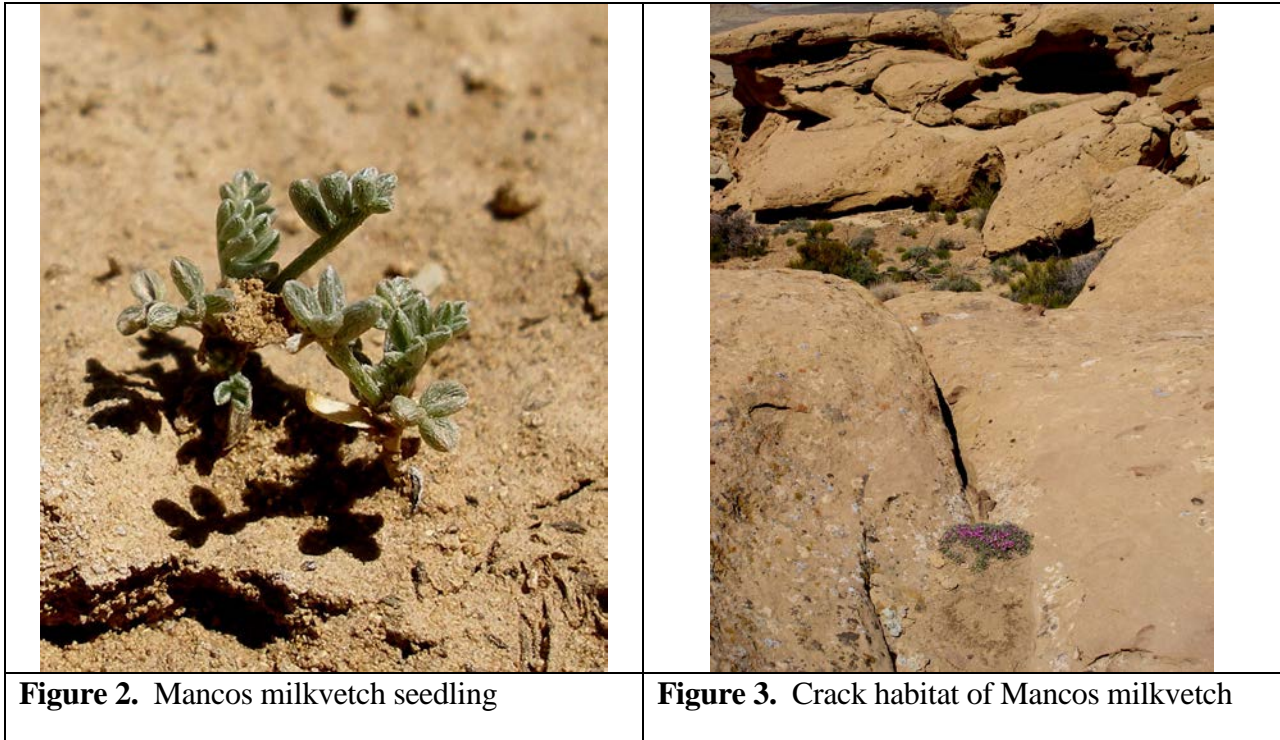
Figure 1. Mancos milkvetch habitat, Hogback area, San Juan County, NM.

METHODS

In 1990 five monitoring plots were established on State Trust land at Sleeping Rocks and five plots were established at Slickrock Flats on the northwest BLM boundary with the Navajo Reservation. Study plots are monitored during the first 2 weeks of June, annually between 1990 and 1999, and infrequently since then (2002, 2008, 2014, 2016, 2018).

Each of the 10 monitoring plots represents a specific piece of Mancos milkvetch habitat, such as a single tinaja or crack segment with its own small individual watershed. Each is a different size island habitat separated from other island habitats by an interval of unoccupied sandstone surface. The plots are read by bisecting them with a measuring tape and locating all Mancos milkvetch plants growing between 2 permanently placed rebar stakes, and tracing individuals on a mm graph paper within a sketch of the habitat feature. This method allows for the documentation of changes in foliar cover over time and is therefore a reflection of overall health and population trend. Documenting changes in live plant cover is considered more indicative of the overall vigor of a population than reporting plant density fluctuations. Counting individual plants is difficult for Mancos milkvetch because plants coalesce into one large, pulvinate mass as they mature and can no

longer be recognized as individuals (Sivinski 2008, Figure 7). However, to ensure better consistency and ease of data collection through time, cover is estimated since 2016 by taking one measurement along the widest axis and one measurement along the narrowest live part of adult plants (cm). In addition to plant cover, the number of seedlings within each monitoring plot is recorded. Any plant smaller than 2 cm in diameter is considered a seedling (Figure 2).



RESULTS

When plots were established in 1990, it was apparent that each population had suffered significant mortality during the previous drought year. Recently dead plants could readily be distinguished from old remains by their color and lack of decay. By counting the living and the remains of recently dead plants in each sample plot it was determined that the loss of mature plants was 60 percent of the total. This loss varied greatly between habitats which have different water holding capacities. It is thought that habitats consisting of deep cracks in the bedrock generally fare better than the tinajas or narrow cracks with only a shallow reservoir of soil and limited water holding capacity. Some tinaja habitats experienced 100 percent mortality during the drought of 1989. Therefore, it is thought that the more permanent habitats for mature plants are those that occur on deep cracks in the sandstone. This may also be true for the germination and establishment of seedlings. The majority of seedlings have been found in cracks. In 2016 only 4 seedlings were found in all 10 monitoring plots (Figure 5). All 4 seedlings were found in cracks at the Sleeping Rocks monitoring site and represents the lowest count of seedlings since plots were established in

1990. In 2018 a total of 31 seedlings were found at the two sites. The majority were found in cracks at the Sleeping Rocks monitoring site (26 plants). Five seedlings were found in one tinaja at the Slickrock Flats site.

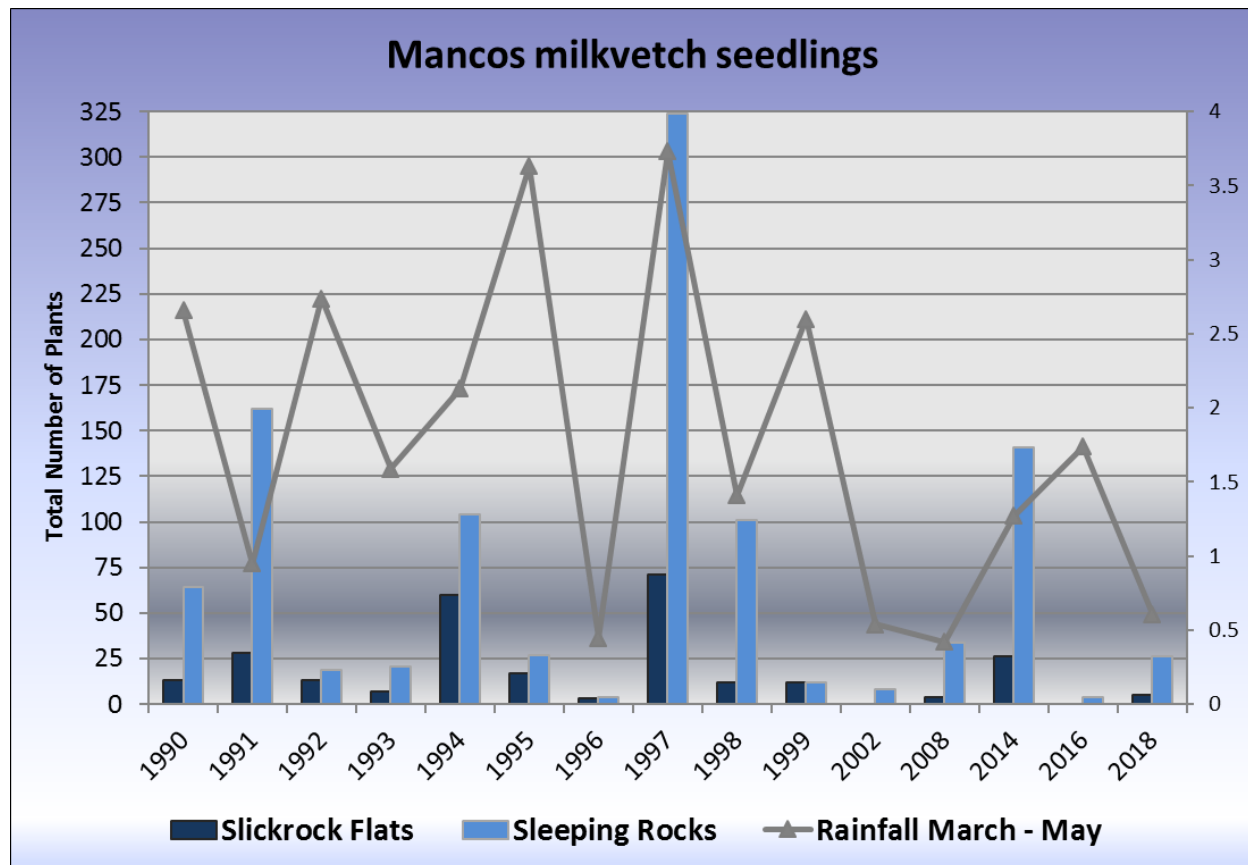


Figure 4. Density of Mancos milkvetch seedlings at Sleeping Rocks and the Slickrock Flats monitoring sites near Waterflow, NM. Rainfall from the Farmington AG Science Center (WRCC 2019).

Establishment and maturation of the Mancos milkvetch is slow compared to other perennial species of *Astragalus*. The establishment period is usually two full growing seasons, with maturation and flowering occurring during the third or fourth spring. A high rate of mortality has been documented in young plants during germination and establishment. Seedlings likely germinate in March at which point enough rainfall needs to fall to support the establishment of seedlings until monsoons arrive in July. This is demonstrated by plots NM1 and NM2 which were established in May of 1990. The other eight plots were established in July of 1990 and plots NM1 and NM2 were reread to document any mortality during the intervening dry period. Of the 205 seedlings found in these two plots in May, only 62 (30%) had survived through the dry early summer month of June.

Some adult plants are very large (>15 cm in diameter) and appear to be many years old (Figure 7). Mortality of old plants appears to increase during drought years. Plants weakened by dry conditions are often infested by spider mites which hastens the demise of older individuals. While

initially there was some mortality of older, more established plants, the general trend at both sites was increasing cover of Mancos milkvetch between 1990 to 1994 (Figure 6). Both monitoring sites began to decline thereafter. In response to the highest rainfall year within the study period, Mancos milkvetch cover increased significantly between 1997 and 1998, and seedling density was highest in 1997 for the entire study period, especially at the Sleeping Rocks site (Figures 4, 5 & 6). The wet year of 1997 caused the total foliar cover of Mancos milkvetch to increase by 1998, continuing into 1999, after which seedling counts and cover values declined (Figures 4, 5 & 6). No monitoring occurred after 2008, until 2014. Although more seedlings were found in the monitoring plots in 2014 over the previous years since 1997, the overall cover of plants decreased significantly over previous recorded values (Figures 4 & 6). In 2014 only 11 adult plants were found in the 10 monitoring plots, 9 in the Sleeping Rocks plots, and only 2 adults in the 5 Slickrock Flats plots. However, a total of 167 seedlings were found at the two sites. The majority of seedlings (141) were found in the Sleeping Rocks plots. Four monitoring plots (40%) had no plants whatsoever (2 plots at Sleeping Rocks, 2 plots at Slickrock Flats). Although dead plants can persist for several years, few dead plants were documented in the monitoring plots. Therefore, mortality likely occurred several years prior to 2014, presumably during the drought years of 2009 and 2012 (Figure 5). Despite an excellent rainfall year in 2015 and a good rainfall year in 2016, only 4 seedlings were documented in all 10 monitoring plots in 2016, all of which were in 2 plots at the Sleeping Rocks site (Figures 4 & 5). However, some of the 2014 seedlings had made it into adulthood. In 2016, cover of adult plants had increased significantly at both sites. Fifty-four adults were documented in the 10 monitoring plots, 18 at the Sleeping Rocks site, and 36 at the Slickrock Flats site. By 2018 the number of adult plants had declined to 21 plants, the majority of which were located at the Sleeping Rocks site (18 plants). Thirty-two seedlings were documented, also primarily from Sleeping Rocks (26 plants). Cover values once again declined significantly, especially at Slickrock Flats, which had the lowest cover values recorded.

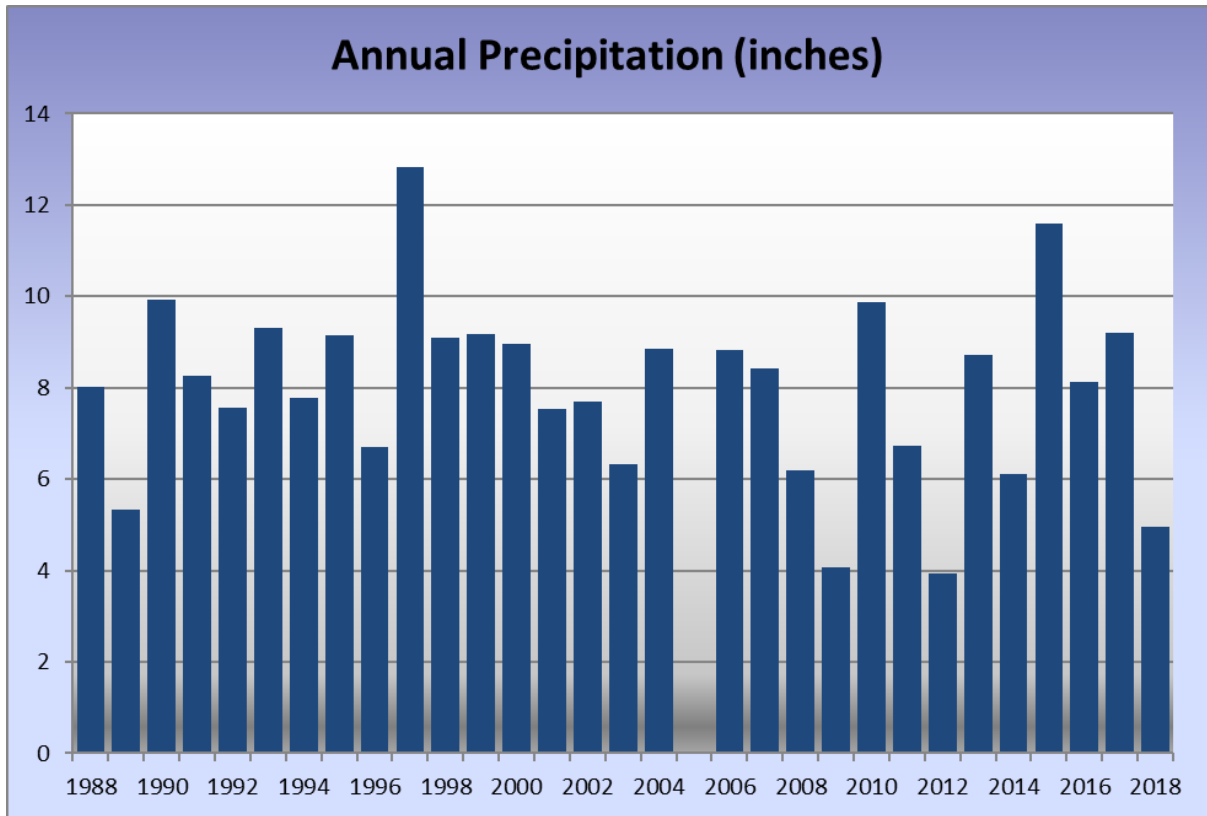


Figure 5. Annual precipitation at the AG Science Center near Farmington, NM, from 1988 to 2018 (WRRC 2019).

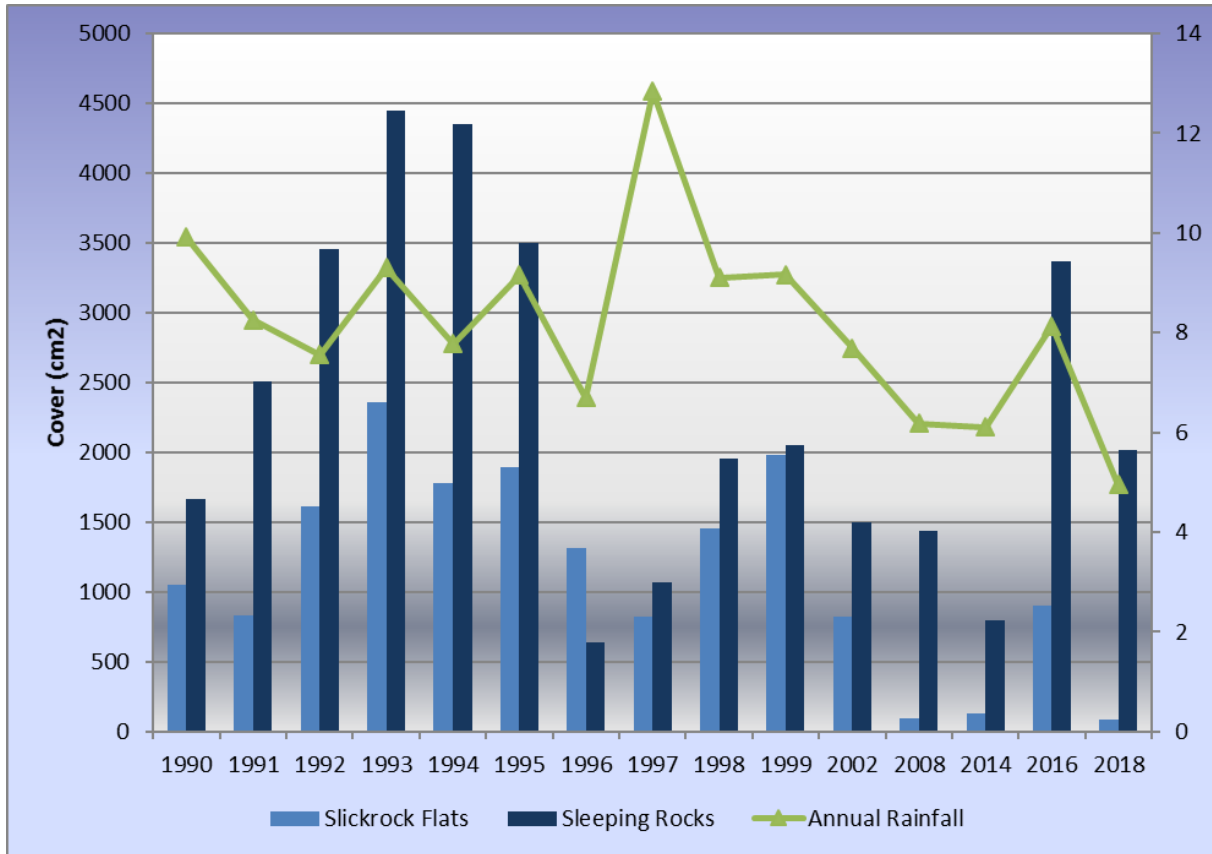


Figure 6. Total cover (cm²) of Mancos milkvetch plants at the Sleeping Rocks and the Slickrock Flats monitoring sites near Waterflow, NM.



Figure 7. Adult live plant of Mancos milkvetch next to a dead adult and multiple seedlings.
DISCUSSION

After 28 years of monitoring population trends at the 2 study sites near Waterflow, the overall trend continues to be a decline, despite increased cover values in 2016. Seedlings were at an all-time low in 2016, despite favorable weather conditions. Although the two populations appeared to be recovering in 1998 and 1999 from a sharp decline experienced in 1996 and 1997, by 2014 the overall cover was at an all-time low. Similar declines were documented in 2008 from all sites on the Navajo Nation (Roth 2008). Although it is likely that this species experiences normal boom and bust years with variable climatic conditions, severe and prolonged drought conditions brought on by climate change may impact the persistence of Mancos milkvetch more than previously thought. 2009 and 2012 were the lowest rainfall years on record since 1978 in nearby Fruitland, NM, likely causing further decline of plants at the monitoring sites. Although there were more seedlings documented in 2014 than during the past 4 monitoring years, seedling survival and establishment are crucial to maintaining persistent and viable populations. It is thought that germination and initial survival of seedlings is positively related to the death of older plants and the subsequent increase of precipitation (Sivinski 2008). Above average rainfall was recorded in 2010, 2013, 2015, and 2016, likely resulting in increased germination of seedlings, documented in 2014, but not in 2016. Any seedlings germinating following the above average rainfall year of 2010 apparently did not get established in significant numbers, or did not survive the drought year of 2012. Very few adult plants were recorded in 2014. Although some of the surviving 2014 seedlings were able to establish a new cohort of adult reproductive plants, very few seedlings were documented in 2016, which may be the result of March rainfall amounts, which were lowest in 2016 over the preceding 2 years. Overall plants in the Sleeping Rocks monitoring site are faring better than those at the Slickrock Flats site. This is likely due to the fact the 4 of the 5 transects at Sleeping Rocks are in cracks, while 4 of 5 monitoring transects are in tinajas at the Slickrock Flats site. This is supporting the concept that cracks provide a more stable and supportive habitat for Mancos milkvetch. The 1989 recovery plan lists Slickrock Flats as one of largest populations of Mancos milkvetch, containing nearly 8,000 plants. In 2018 the Slickrock Flats monitoring site had the lowest cover of adult plants since monitoring began in 1990 and only contained a hand full of seedlings. If this sample is indicative of the overall population trend for the Slickrock Flats area, then this population is in serious decline and perhaps so is the entire species. Significant declines were also recorded on all Navajo Nation sites in 2008 (Roth 2008).

Despite the reprieve in rainfall amounts between 2013 and 2016, predicted ongoing drought conditions may limit establishment and therefore the reproduction and seed banking of the species, leading to the observed slow decline. Four of the 10 monitoring plots had no plants in 2014 and 2018 (2 plots at each monitoring site). Six of the 10 plots had no adult plants in 2014 and half of the 10 plots had no adults in 2018. As there are fewer adult reproducing plants at each plot, fewer seeds are stored in the seedbank. If seedlings cannot establish themselves as reproductive adults, the population will slowly decline and eventually go locally extinct. We may already document this decline in the monitoring plots. Considering the current trend at the monitoring sites and the apparent rangewide decline, it is highly recommended that monitoring of the 2 sites occurs more frequently than previously, preferably annually. In addition, a census of the all populations and rangewide surveys in suitable habitat to update the overall status of the species is essential to

understand current trends and threats. Establishing additional monitoring plots over the entire range of the species will help to determine whether the observed declines impact the entire species. Mancos milkvetch should be seed banked for ex-situ conservation efforts and possible population augmentation purposes.

ACKNOWLEDGEMENTS

This report was adapted from the 2008 progress report written by Bob Sivinski, former botanist for the NM State Forestry Division. Data collected by Bob Sivinski from 1990-2008 were used to generate figures and tables to determine trends for this progress report.

Funding for this project has been provided by the U.S. Fish and Wildlife Service, Region 2, Albuquerque, NM, through Section 6 Endangered Species grants, received from 1990 through 2018.

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