Lee's Pincushion Cactus

(*Escobaria sneedii var. leei*)

Post-fire Monitoring Report 2015

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Region 2, Albuquerque

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INTRODUCTION

Lee's pincushion cactus (*Escobaria sneedii var. leei*) is endemic to New Mexico were it is restricted to the Carlsbad Caverns National Park area in the Guadalupe Mountains of Eddy County. It occurs primarily in cracks of limestone outcrops, in areas of broken terrain and steep slopes in Chihuahuan desert scrub communities between 4,000 and 5,000 ft in elevation (Figure 1).

Figure 1. Habitat of Lee's pincushion cactus at Carlsbad Caverns National Park.

Lee's pincushion cactus was listed as a threatened species under the Federal Endangered Species Act on October 25, 1979 (44 FR 61554 61556). The primary reasons for listing were illegal collection and road construction. Fire was not listed as a threat in 1979, nor in the 1986 recovery plan. In fact, the recovery plan considered fire a potential positive impact on plants, due to the elimination of competing vegetation (USFWS 1986). However, the recovery plan listed studying the impacts of fire on Lee's pincushion cactus as an action that must be taken to prevent a significant decline in the species' population or habitat quality.

Since 2010, multiple fires have burned 23,867 acres of the land within Carlsbad Cavern National Park, including a significant portion of occupied habitat of Lee's pincushion cactus. In 2011, the Loop Fire burned 8,221 acres of desert lands within the Park, including a large number of these

rare cacti. Limited data on the status of a small population of cacti immediately post-fire is available, but we do not know the long-term impacts on survival, reproduction, vigor, and recruitment in response to fire (NPS 2011, NHNM 2012). Ongoing drought and predicted increases in severity and frequency of fires in the Southwest have caused serious concerns about the continued survival of these cacti. The primary objective of this study is to document the response of Lee's pincushion cactus to fire, with the goal of documenting post-fire recovery and providing long-term population trend information.

METHODS

60 monitoring plots were established in an area burned in the 2011 Loop Fire and 60 monitoring plots were established in an adjacent unburned area in the Rattlesnake Canyon area. Monitoring plots are 1 m in radius and contain at least one plant (dead or alive). The center of each monitoring plot is marked with a metal tag fastened on a nail (Figure 2). Monitoring plot locations were mapped using a Trimble GPS. All cacti rooted inside each monitoring plot were tagged with individually numbered round metal tags (Figure 3). Annual data collected includes the overall vigor of each plant in each plot (1 = excellent, 2 = good, 3 = fair, 4 = poor, 5 = dead), the estimated number of living and dead stems, and the number of reproductive structures of each plant (flowers, fruits). Monitoring plot locations in burned and unburned areas were chosen from a sample of previously recorded cacti. Locational data for these cacti was provided by Natural Heritage New Mexico (NHNM 2012) and/or the Carlsbad Cavern National Park (NPS 2011). Annual spring monitoring occurred in 2015 from April 28 through April 30.

Figure 2. Center of monitoring plot (rectangular metal tag) behind a burned Lee's pincushion plant.

Figure 3. Tagged individual of Lee's pincushion cactus.

RESULTS

The 60 plots established in the unburned area contained a total of 87 cacti, 75 of which were alive in the spring of 2015. One plant died since 2014 and one plant previously recorded as dead recovered and was considered in fair condition in 2015. No new plants were found in the unburned plots. The 60 circular plots in the burned areas contained a total of 86 cacti, 60 of which were alive in the spring of 2015. Three plants had died since 2014, all of which were partially burned in 2010. One new plant was recorded in the burned monitoring plots.

In 2015, 76% of the live plants in the unburned plots were reproductive, containing flowers or fruits (Figure 4). Forty-eight percent of live plants in the burned plots were reproductive. The total number of stems recorded for the 75 live cacti in unburned area was 3,015, including approximately 13% dead stems. The total number of stems recorded for the 60 live cacti in the burned area was 2,303, including approximately 14% dead stems. The majority of plants in burned and unburned areas were considered in excellent or good condition (Figure 5).

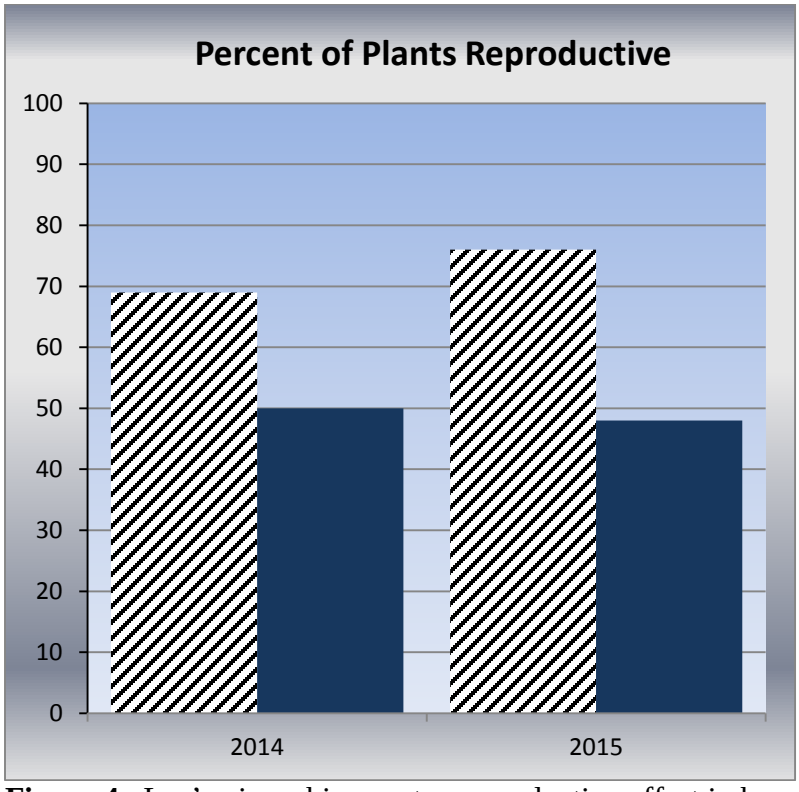

Figure 4. Lee's pincushion cactus reproductive effort in burned and unburned monitoring plots at Carlsbad Caverns National Park, New Mexico.

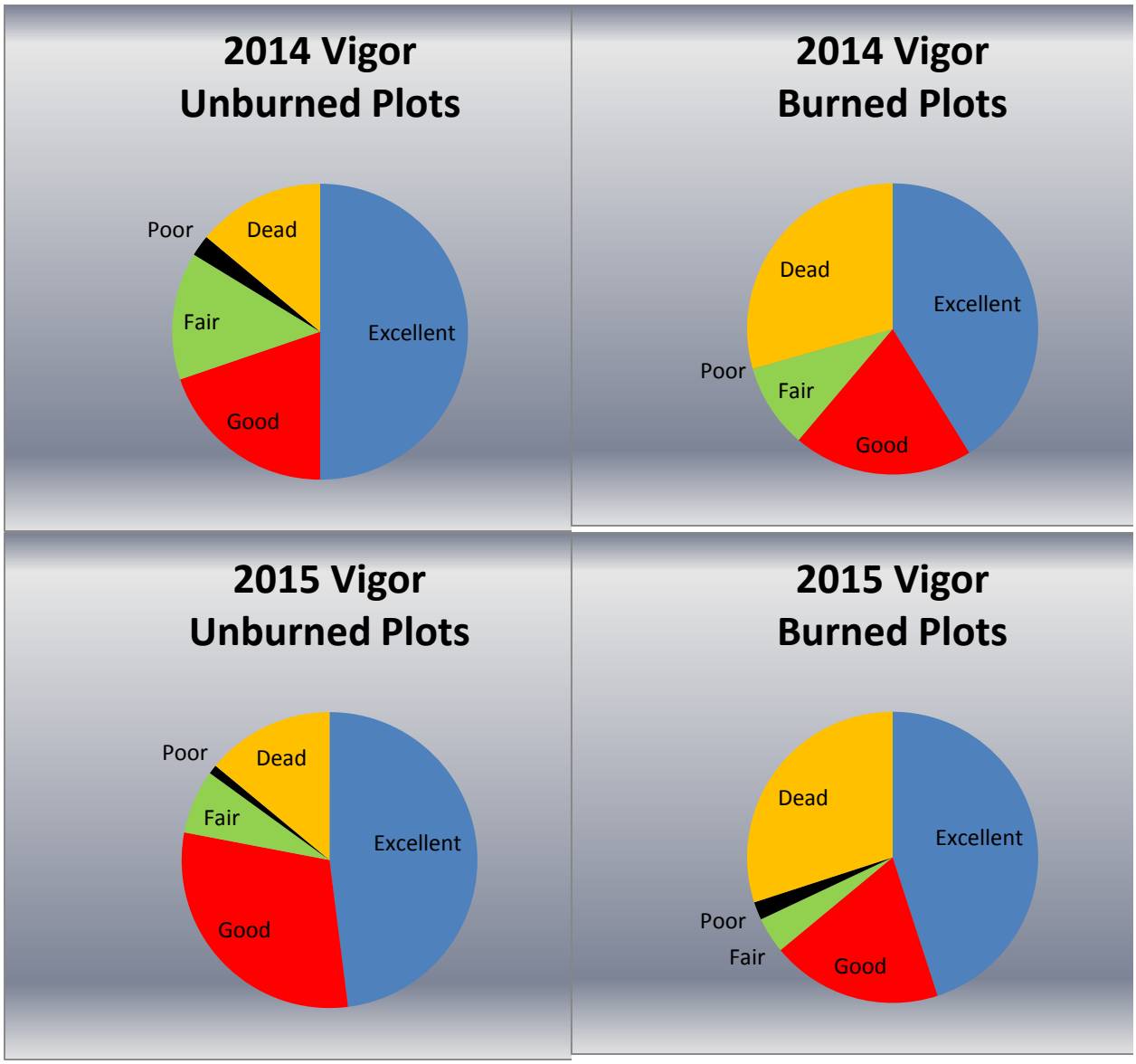

Figure 5. Vigor of Lee's pincushion cactus plants in burned (n = 86) and unburned (n = 87) monitoring plots at Carlsbad Caverns National Park, New Mexico

Sixty-three of the 86 plants recorded in the 60 burned monitoring plots were plants that were also recorded in 2011 (NPS 2011) and 2012 (NHNM 2012) (Table 1). Six of the 10 plants found dead in 2011 showed no signs of recovery and were still considered dead in 2014. Four of the plants found dead in 2011 had recovered some live stems in 2014. Five additional plants had died between 2011 and 2012 and seven additional plants died between 2012 and 2014. All 18 of the plants found dead in 2014 and the three dead plants found in 2015 were recorded as partially burned in 2011.

Table 1. Number of plants found alive or dead immediately after the 2011 Loop Fire, in 2012, and 2014.

	NPS 2011	NHNM 2012	EMNRD 2014
Live	37	43	45
Dead	10	17	18
Unknown Status	12	3	0
Total Number of Plants	**59**	**63**	**63**

DISCUSSION

A total of 28 plants of the 86 plants recorded in the burned area were found dead in 2015. Twentyone of these were documented as partially burned or dead and burned in 2011. The remaining seven plants that were found dead in the monitoring plots had no previous records and therefore we do not know for certain whether they were burned in 2011 or not. Fires burn patchy and not all cacti inside the fire perimeter were burned during the 2011 Loop Fire (NPS 2011, NHNM 2012). In addition, some plants did not burn because they were growing on rocky outcrops were the fire did not impact them (Muldavin et al. 2013). The initial rate of mortality among 131 plants located inside the Loop Fire was estimated at 40.5 % two growing seasons after the fire (Muldavin et al. 2013). Although it is likely that these 7 cacti also died as a consequence of the fire, by 2014 it was difficult to estimate where microsites had burned and impacted the cacti because the habitat was largely recovered (Figure 6). Mortality in the unburned areas was likely caused by drought conditions. Plants were still present, but showed no signs of damage or predation (Figure 7). Plants are covered by dense spines and therefore it can be difficult to determine whether a plant is dead or alive, especially if the stems remain after the plants died from drought or insect predation (stems hollowed out). Dead stems can remain on site for several years. In addition, it can take a cactus several years to succumb to injury sustained by fire or other disturbances. Even after a plant has been removed by fire or predation, it can apparently resprout from the root or reestablish from the seedbank which is expected to be densest right around the area where the parent plant once grew. Therefore any recovery is likely to occur in areas immediately adjacent to dead plants. Long-term monitoring of the established monitoring plots surrounding dead and live cacti will document recruitment and post-fire recovery. The percentage of reproductive effort remains significantly larger among unburned area vs. the burned plants. This is likely a result of having fewer mature live stems present in the burned areas, as these plants are recovering from fire damage and many stems may be too young to be reproductive, even four years after the fire.

Monitoring burned and unburned areas for a minimum of 5 years will not only document the recovery of the population within the Loop Fire perimeter, but will also document how long it will take for a population to restore full reproductive capacity. Long term monitoring will provide land managers with documentation of recovery and provide baseline information of

overall population trends, which will help guide appropriate management actions in response to future wildfires and inform proper planning for prescribed fires and other management activities. In addition, population monitoring and studying the impacts of fires on this federally listed species are key tasks that need to be accomplished for the recovery of Lee's pincushion cactus (USFWS 1986).

Figure 6. Recovering habitat of Lee's pincushion cactus, 3 years after the Loop Fire.

Figure 7. Dead Lee's pincushion cactus plant in the unburned area.

LITERATURE CITED

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