

**Conservation Plan for Chapin Mesa milkvetch (*Astragalus schmolliae*) at Mesa Verde National Park**



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**September 2018**

Citation: Mesa Verde National Park (MEVE), 2018. Conservation Plan for Chapin Mesa milkvetch (*Astragalus schmolliae*) at Mesa Verde National Park. Division of Research and Resource Management. Mesa Verde National Park, Colorado. National Park Service

## Introduction

### A. Purpose and Goal

This plan identifies conservation actions that Mesa Verde National Park (MVNP) will take to conserve the population and habitat of Chapin Mesa milkvetch within MVNP. Chapin Mesa milkvetch is an extremely rare, endemic plant found only on the Mesa Verde cuesta both within MVNP and on Ute Mountain Ute Tribal lands. It is a candidate species under review for listing under the Endangered Species Act. It is in need of conservation due to multiple threats that make it vulnerable to decline and increase its risk of extinction.

### B. Objectives of this Plan

The objectives of this plan are to use conservation actions to support a viable, stable population of Chapin Mesa milkvetch within intact habitat at Mesa Verde National Park within its known range. A viable population is conserved when threats and stressors are ameliorated and the population is well represented, resilient and redundant.

Representation is the conservation of the species within a range of ecological conditions found within the species' habitat. Resilience is the ability of a species population to persist despite variation in demographic, stochastic and environmental conditions. Small populations are less resilient and have less genetic representation and are more vulnerable extinction due to inbreeding depression and genetic drift. Redundancy is needed to ensure there are adequate numbers of populations in case of catastrophic events.

## Species Biology

- A. Species Description: Chapin Mesa milkvetch is a showy perennial legume, 30 to 60 centimeters (cm) (12 to 24 inches (in.)) tall usually having several stems originating from an underground root crown. Its leaves and stems appear to be ash-colored (cinereous) attributed to the density of short simple appressed hairs on both sides of the leaf surface. Each compound leaf has 11 to 20 small leaflets. Flowers are large and creamy white (ochroleuchous), widely spaced on upright stalks that extend above the leafy stems. Mature plants can produce 10-28 flowers along one terminal raceme. The fruit is a pendulous, decurved pod, 3 to 4 cm (1 to 1.5 in.) long, covered with flat, stiff hairs (Barneby 1964). The deep taproot grows to at least 40 cm (16 in.) (Friedlander 1980). Chapin Mesa milkvetch plants without flowers or fruit strongly resemble herbaceous plants of a similar species, *Astragalus wingatanus* (Fort Wingate milkvetch) (Wender 2012) which also grow abundantly in Chapin Mesa milkvetch habitat.

- B. Taxonomy: *Astragalus schmolliae* was first collected in Montezuma County, southwestern Colorado, in 1890 by Alice Eastwood but it was first formally described as a species in 1945, by C.L. Porter who named it after Dr. Hazel Marguerite Schmoll (Porter 1945, Barneby 1964, Isely 1998). *Astragalus schmolliae* is a member of the Fabaceae (legume family), and was previously known by the common name Schmoll's milkvetch. The new common name of Chapin Mesa milkvetch replaced the common name, Schmoll's milkvetch in 2015 to better describe the species affinity to its specific locality (USFWS 2016). Genetic analysis has not been conducted on the species. The species classification as a separate species is not disputed.
- C. Habitat: Chapin Mesa milkvetch preferred habitat is the partially shaded understory of intact old-growth pinyon juniper woodland canopy with deep, loess soils on Chapin Mesa (Rondeau et al 2016). Associated groundcover species in intact PJ is very sparse but the associated species are important for attracting pollinators (*Astragalus wingatanus*, *Physaria rectipes*, *Penstemon linearoides*, *Polygonum sawatchense*, *Lupinus ammophilus*, *Pedicularis centranthera*, *Petradoria pumila*, *Cordylanthus wrightii* and *Poa fendleriana*; Freidlander 1980, Spector, personal observation 2017). Many shrubs also characterize intact Pinon-Juniper woodland habitat including *Purshia tridentata*, *Yucca baccata*, and *Amelanchier utahensis* (Freidlander 1980, Spector, personal observation 2017). Total occupied habitat within Mesa Verde National Park is 2012 acres which is about half of Chapin Mesa milkvetch's suspected range of about 4000 acres (USFWS 2016). Chapin Mesa milkvetch is also found on Chapin Mesa spur and Park Mesa but these populations are small and peripheral comprising just under 60 acres. Current habitat conditions also include former pinyon-juniper woodlands that have been converted to persistent grasslands from recent stand replacing fires. Of the 2013 acres of occupied Chapin Mesa milkvetch habitat at Mesa Verde National Park, 762 acres (37.8%) have been recently burned and converted to weedy grasslands. These open habitat conditions consist of full sun with no tree canopy and high density of competitive groundcover species, mostly grasses, many of which are non-native species. Non-native grasses especially cheatgrass (*Bromus tectorum*) dominate the burned area habitat. Annual precipitation averages about 18 inches per year with annual variations from 7.8 in to 30 in per year. This high variability in interannual precipitation amounts is characteristic of southwestern Colorado. June is usually the driest month with August being the wettest.

Chapin Mesa milkvetch is also found on slope ledges below the mesa rims where mesa top soils has accumulated. The abundance of plants found in these locations is low.

Seemingly suitable but unoccupied habitat exists elsewhere in MVNP especially on Park and Wetherill Mesas. Reasons that the species is not found in apparently suitable habitat adjacent to and within its current range are unknown.

- D. Range and Distribution: Chapin Mesa milkvetch has a very limited range which is suspected to be about 4000 acres mostly on Chapin Mesa with about half of its habitat (2012 acres) within Mesa Verde National Park and the other half within Ute Mountain Ute Tribal Park. The species occurs at elevations of 6500 to 7500 ft. The extent and distribution on Ute Tribal land remains unknown. Chapin mesa milkvetch was previously thought to occur only on Chapin Mesa but a small number of plants has been found on two nearby mesas, Park Mesa and Chapin Mesa spur. Plant density is highest in the center of its range approximately near the boundary between Mesa Verde National Park and Ute Mountain Ute Tribal Park.
- E. Life History: Chapin Mesa milkvetch are long lived-perennials that emerge in late March from a winter dormancy period. Plants may not sprout every year depending on rainfall and available moisture which are suspected to play a role in emergence. Winter precipitation is the best indicator of plant emergence density (Rondeau 2017). Plants start blooming mid to late April and continue through early-June. Chapin Mesa milkvetch is xenogamous, as such pollination is necessary to produce viable seed. Primary pollinators are many species of bees although lepidopterans have also been observed on flowers of Chapin Mesa milkvetch. Seeds are ripe with pods drying and opening by late June. Leaf and stem senescence start in late summer or early fall. Seedling survival is significantly higher in intact, unburned areas than in burned areas (Rondeau 2016). Seedling emergence coincides with spring rains beginning in May through June (Rondeau 2016) which does not occur every year. The life span of the species is unknown but plants may be at least 5 to 10 years old before plants begin to reproduce. Large multi-stemmed individuals may be at least a couple decades old.
- F. Population status: The last population estimate for the species was in 2001 prior to the Long Mesa Fire (2002) when the population was estimated to be close to 500,000 plants within 858 acres of MVNP. Since that survey 761.7 acres of Chapin Mesa milkvetch habitat has burned in the Long Fire (Anderson 2001) converting habitat to a grassland dominated by invasive species and potentially reducing the number of plants. In addition, outlying populations on Chapin Mesa spur and Park Mesa have been found but those occurrences are very small with most less than 150 plants and the largest at 6000 plants on Park Mesa (MEVE survey 2017; Anderson 2001). Chapin Mesa milkvetch emergence is dependent on winter precipitation, mainly in the form of snow thus can fluctuate

substantially annually. Although initially responding positively to recent burned conditions, the longer term response of Chapin Mesa milkvetch population is a population decrease in burned areas versus unburned areas where the pinyon-juniper habitat is more stable.



Figure 1: Population density trends for Chapin Mesa milkvetch. From Rondeau 2018

G. Population Structure: Chapin Mesa milkvetch shows difference stage class structure in recently burned and unburned, intact areas (Figure 2). Burned areas have more adults and fewer seedlings or yearlings than unburned areas. This structure corresponds to increased flowering and recruitment within a couple of years after wildfires followed by a significant decrease in reproductive effort and recruitment over the longer time frame. Unburned pinyon-juniper woodlands show a more balanced and stable population structure.

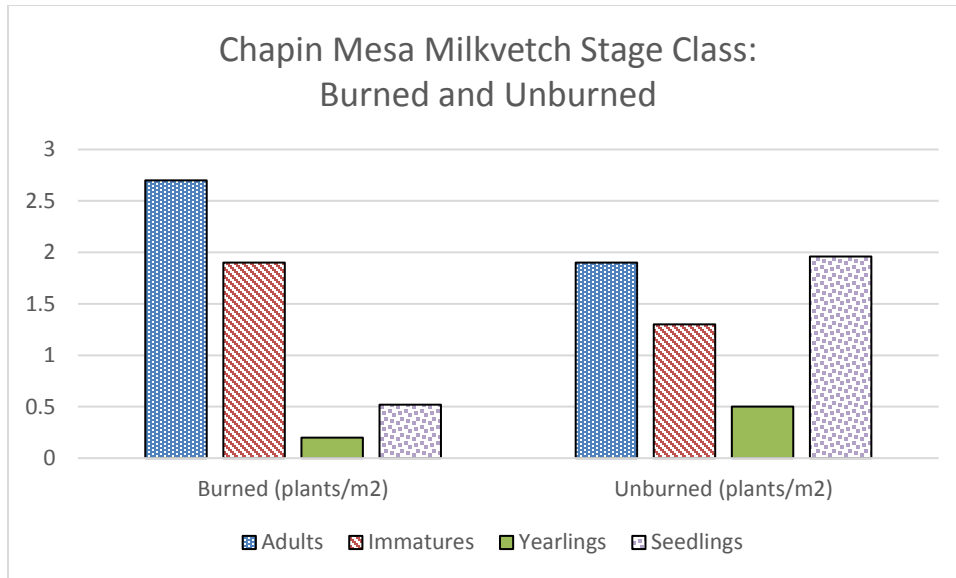


Figure 2: Stage classes for Chapin Mesa milkvetch in 2016 in burned and unburned transects. There were 4 times as many seedlings in the unburned transects than in the burned transects. Data taken from Rondeau 2017

## Discussion of Threats

### A. Wildfire and Post-Wildfire Actions

An unprecedented frequency of extreme wildfires occurred at MVNP from 1996 to 2003, affecting thousands of acres of Colorado Plateau Pinyon-Juniper Woodland and Rocky Mountain Gambel Oak-Mixed Montane Shrubland. In only a two-year period, over 55% of MVNP burned in the Long Mesa Fire (2002), Pony Fire (2000), and Bircher Fire (2000), burning 2,256, 4,739, and 22,406 acres, respectively. The Long Mesa Fire was the only fire that burned within Chapin Mesa milkvetch habitat and it burned 761.7 acres of Chapin Mesa milkvetch habitat as a crown and stand replacing fire. The park's pinyon-juniper woodlands are not fire-adapted and neither Colorado pinyon pine (*Pinus edulis*) nor Utah juniper (*Juniperus osteosperma*) are capable of surviving high-severity fire or of regenerating from stump or root sprouts. Consequently, severe fires in the park's pinyon-juniper Woodlands have resulted in complete overstory mortality and widespread conversion to a graminoid-dominated plant community, which may eventually transition to shrubland over several decades and eventually back into pinyon-juniper woodlands after a century. Chapin Mesa milkvetch remains vulnerable to future large scale wildfires. One wildfire has the potential to convert the remaining intact pinyon-juniper woodland habitat into a weedy grassland with no canopy overstory.

Wildfires have already eliminated the canopy cover of pinyon-juniper in burned areas of Chapin Mesa milkvetch habitat. Canopy cover is important for the species in that it provides shade that moderates soil temperatures (Brashears et al 1998) and retains snow cover which are important for soil moisture especially in arid environments. Forest canopy cover retains snow on the ground longer than forest openings (Varhola et al 2010). Since the emergence of Chapin Mesa milkvetch is highly correlated to winter precipitation and temperatures (Rondeau 2017), pinyon-juniper canopy cover plays an important role in retaining winter snow and moderating soil temperatures for Chapin Mesa milkvetch. Burned areas lack canopy cover and are more vulnerable to soil temperature extremes and more rapid melting of snow cover (T. Spector, personal observation). This especially affects seedling survival which is significantly lower in the burned areas most likely due to rapid soil drying and high soil temperatures (Rondeau 2017).

A majority of Chapin Mesa milkvetch plants did not emerge in the spring of 2002 prior to the Long Mesa Fire. The root crown remained submerged underground and thus mostly insulated from the fire. Although overall Chapin Mesa milkvetch density declined in the year after the fire, Chapin Mesa milkvetch responded positively in the burned area the following spring after the Long Mesa Fire by emerging abundantly. Recruitment occurred in the first year following the fire thus initially increasing the density in the burned areas in comparison with the intact pinyon-juniper woodlands (Anderson 2004). This flush of recruitment and higher density was not sustained and the trend has since reversed. Within a couple of years after the fire non-native cheatgrass (*Bromus tectorum*) established and expanded rapidly. Cheatgrass expansion correlates with significantly reduced seedling survival and reduced reproductive effort by adults in comparison with intact pinyon-juniper habitat (Rondeau 2017). All stage classes have higher survival in the unburned areas with intact pinyon-juniper woodland (Figure 3; Rondeau 2018).

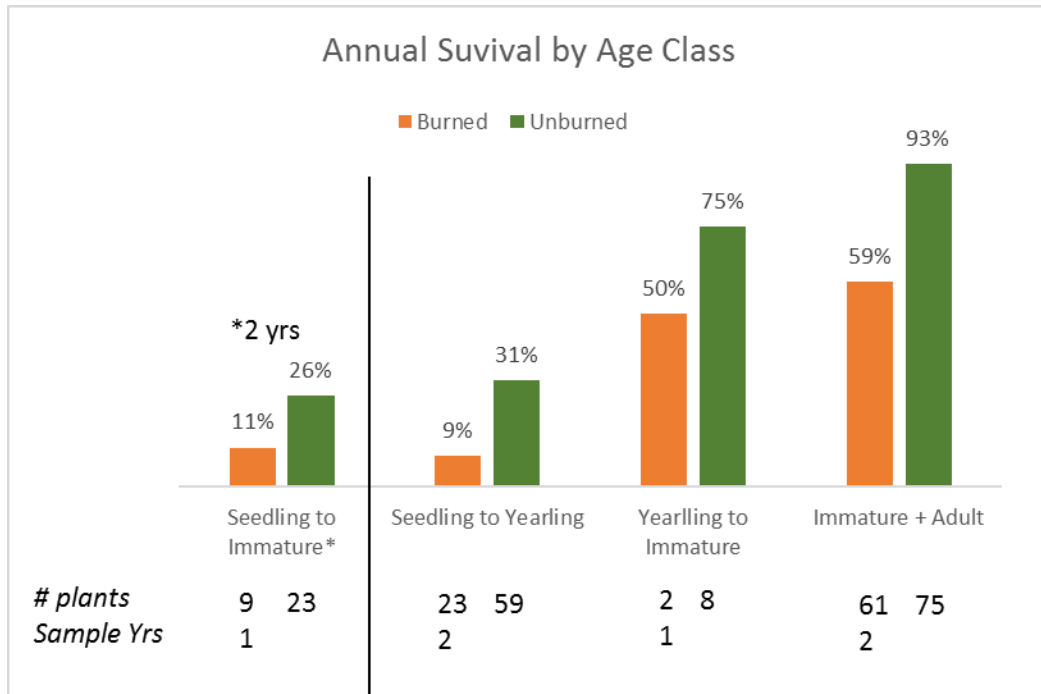


Figure 3: All stage classes had higher survival in the unburned areas versus the burned areas. From Rondeau 2018.

By 2015 cheatgrass cover was documented at more than 50 percent (58%) in areas burned in the Long Mesa fire and 0 percent in the intact pinyon juniper communities (Rondeau 2016). Densities of Chapin Mesa milkvetch that have been tracked since 2001 are now declining in the burned areas in comparison to unburned, intact pinyon-juniper woodlands (Figure 1; Rondeau 2018) thus reducing the resiliency, redundancy and representation of the species.

The ability for pinyon-juniper woodlands to recover overtime within the burned areas may be impeded by non-native species invasion especially cheatgrass. The post-fire trajectory of the burned areas within Chapin Mesa milkvetch habitat is expected toward a pinyon-juniper woodland community, and if so, then recovery may take at least 100 years if not hundreds of years (Moench 2002, Romme et al. 2003). However, where post-fire native grass and forb establishment has been less successful, cheatgrass has emerged as one of the most dominant species, which may result in a more frequent fire regime that could inhibit recruitment of pinyon and juniper seedlings. Pinyon and juniper recruitment in the recently burned areas is extremely low to almost non-existent (Spector et al. 2017). The long period for habitat recovery reduces the resiliency, representation and redundancy of the species.

Lack of canopy cover as a result of stand replacing wildfires has led to higher soils temperatures especially in the spring and summer where soil temperatures at 10 cm in



depth can be 7° F warmer than under pinyon-juniper woodland canopy. These higher temperatures can significantly affect the survival of seedlings and correlates with the difference in Chapin Mesa milkvetch seedling survival between burned and unburned areas where seedling survival is significantly higher in unburned areas (41 percent in unburned areas and 4 percent in burned areas; Rondeau 2017). Higher soil temperatures can also affect seedlings from other species such as shrubs and Pinyon-Juniper trees which shade soils and serve as nurse plants for increasing the recruitment of seedlings. Lack of canopy cover in burned areas reduces the resiliency of the species.

Herbivory has increased in the burned areas as compared to the unburned areas with observations of increase in pocket gopher (*Thomomys bottae*) activity (Rondeau 2017b). Pocket gophers are suspected to contribute to adult mortality (See discussion under trampling and herbivory). Increased loss of multiple individuals in burned areas to herbivory reduces the representation of the species since the genetics of those individuals will be lost to the population.

*Summary- Past and future wildfires are a high threat to Chapin Mesa milkvetch as it degrades habitat conditions in the short and long term, reduces plant fitness and survival, and affects an extensive area of occupied habitat. In addition, the threat of large-scale wildfires may occur during any year where precipitation is below average. The effects of wildfires reduces the resiliency, representation and redundancy of the population.*

- Resiliency is reduced from degraded habitat including lack of canopy cover, low soil moisture, increased soil temperatures, low plant survival, reduced fecundity, and dominant invasive, non-native species cover as a result of wildfires. The long timeframe for recovery to a scattered overstory pinyon-juniper woodland from a degraded burned condition also reduces the species' resiliency.
- Redundancy is reduced as the habitat is degraded thus it is no longer able to support the species across its range. The extent of recent wildfires cover 37.8% (761.3 acres) of Chapin Mesa milkvetch habitat at Mesa Verde National Park which is a significant portion of the population threatening the redundancy across the range of the species.
- Representation is reduced due to the declining population in the burned areas thus genetic diversity among individuals is no longer represented in the population. Recovery of burned areas may take over 100 years if environmental conditions and invasive non-native plants do not modify the successional trajectory. Changes in environmental conditions affects the species resiliency to additional environmental or stochastic changes.
- Vulnerability- Remaining intact pinyon-juniper habitat is also vulnerable to wildfires which would degrade intact habitat for Chapin Mesa milkvetch and further reduce resiliency, redundancy and representation of the species.

## B. Invasive non-native plants and their control

Invasive, non-native species are one of the largest threats to biodiversity globally including at Mesa Verde National Park. Invasive, non-native plants can modify habitat, and compete with native species for resources, especially water. Multiple species of invasive, non-native plants occur within Chapin Mesa milkvetch habitat, especially within the areas burned in the Long Mesa Fire. Invasive, non-native species are either not present or are very low in abundance in intact pinyon-juniper woodland habitat where Chapin Mesa milkvetch occurs. Cheatgrass, musk thistle (*Carduus nutans*), Canada thistle (*Cirsium arvense*), mullein (*Verbascum thapsis*), smooth brome (*Bromus inermis*) and red fillaree (*Erodium cicutarium*) are the most abundant and invasive non-native plants found within Chapin Mesa milkvetch habitat occurring mostly in the burned areas. Other non-native species in Chapin Mesa milkvetch habitat include Russian knapweed (*Arcroptilon repens*), Cutleaf vipergrass (*Scorzonera lacianata*), Russian thistle (*Salsola tragus*), prickly lettuce (*Lactuca serriola*), tall tumble mustard (*Sisymbrium altissimum*), wild alysum (*Alyssum simplex*) and salsify (*Tragopogon dubius*).

Cover of non-native plants within Chapin Mesa milkvetch habitat in the burned area has increased. In 2014 non-native species cover in occupied Chapin Mesa milkvetch habitat was documented at almost 25% dominated by cheatgrass. By 2015 cheatgrass cover increased to 58%. Cheatgrass cover naturally fluctuates depending on environmental conditions and was documented to be 38% in 2016. Cheatgrass is an effective competitor that reduces native plant seedling establishment and plant vigor. Cheatgrass can reduce native forb biomass by 50-91% (Parkinson et al 2013). Almost complete control of cheatgrass is needed in order to successfully restore native plant communities (Rafferty and Young 2002, Aguirre and Johnson 1991). Cheatgrass is a winter annual and is especially efficient in competing for water in the spring when Chapin Mesa milkvetch is emerging and germinating. Chapin Mesa milkvetch seedling survival in the burned areas are significantly lower than those in the intact pinyon-juniper woodland habitat likely due to a number of factors including dominance of cheatgrass and high soil temperatures.

Cheatgrass increases the risk of reoccurring fires, further modifying habitat. Climate change models also predict an increase in wildfires in this region with increasing hot and dry conditions and less winter snow. Cheatgrass greatly exacerbates the wildfire risk caused by climate change. Increased fire risk increases the chances that intact pinyon-juniper woodland will burn and prevents areas previously burned in the Long Mesa Fire from recovering to a pinyon juniper woodland.

Control of cheatgrass is very challenging especially in sensitive species habitat. Herbicide treatment has mixed results providing short term control of cheatgrass but also harming native species including Chapin Mesa milkvetch. Native species may not germinate for several years after treatment thus allowing for cheatgrass expansion in the interim and longer term (Garmoe et al. 2010; Schrage pers. comm. 2017). Seeding with native plants has helped native species compete with cheatgrass but cheatgrass can outcompete native plant seedlings, reducing their success (Aguirre and Johnson 1991; Rafferty and Young 2002; Parkinson et al 2013). A new bio-pesticide containing a strain of the naturally occurring soil bacteria *Pseudomonas fluorescens*, effective in controlling cheatgrass, is undergoing EPA review and are expected to be available soon. These two bio-pesticides are extremely selective controlling only cheatgrass, medusa head and jointed goatgrass (Tranel et al 1993 Gealy et al 1996; Kennedy et al 2001; Kennedy et al 2015; Kennedy et al no date(a)) and not harming non-target native species (Kennedy et al 2001; Stubbs et al 2014; Kennedy et al no date(a)). Research on the effectiveness of these strains of *Pseudomonas fluorescens* in the climate of Mesa Verde is unknown. As of now there is no effective control of cheatgrass that would also prevent non-target damage to other forbs including Chapin Mesa milkvetch and other flowering plants.

Other species such as musk and Canada thistle and mullein are lower in abundance and cover than cheatgrass they also compete for resources with Chapin Mesa milkvetch and other native wildflowers on which pollinators of Chapin Mesa milkvetch also depend. Reproductive effort of Chapin Mesa milkvetch is reduced in the burned areas in comparison with intact pinyon-juniper woodlands which may be due to the high cover of of invasive exotic species and/ or environmental condition differences. Although the cover of the other invasive non-native species present is low the cumulative effect from all species negatively affects a large portion of Chapin Mesa milkvetch habitat and population.

MVNP controls musk and Canada thistles and mullein along the roadways in Chapin Mesa milkvetch habitat but treatment is not widespread throughout its range in the park. Some treatment areas overlap with Chapin Mesa milkvetch and there has likely been some mortality due to herbicide treatment although it is likely a small impact due to the small areas being treated.

*Summary: Invasive exotic species are a high threat to Chapin Mesa milkvetch as they have extensive and direct effects that persist over the short and long term.*

- Resiliency is reduced by invasive, non-native plants that compete with Chapin Mesa milkvetch resulting in reduced key life history traits such as reproductive effort and recruitment of Chapin Mesa milkvetch directly affecting the species. In addition,

- invasive, non-native plants degrade habitat conditions thus reducing resiliency of the species to other stochastic events or disturbances.
- Redundancy is reduced as invasive, exotic plants may reduce the amount of intact pinyon-juniper woodland habitat available for Chapin Mesa milkvetch establishment and prevent the recovery of disturbed (burned) habitat by increasing wildfire risk and spread. This affects Chapin Mesa milkvetch in the short and long term. Invasive, non-native species cover a large percentage of Chapin Mesa milkvetch habitat within MVNP, up to 58% cover in 37.8% of occupied habitat. Thus the extent of this threat is widespread.
  - Representation is reduced by degraded habitat conditions caused by invasive, exotic plants. Thus the range of high quality habitat conditions across ecological settings of the species are contracted for Chapin Mesa milkvetch and other wildflowers which are important for supporting the pollinators vital to the species reproduction process.

### C. Fuels Management

In order to protect park infrastructure MVNP has installed fuel breaks by clearing and thinning pinyon-juniper trees 100 feet from existing buildings and along the boundary with the Ute tribal park on Chapin Mesa. Some of these cleared fuel break areas have allowed for invasive, non-native and rhizomatous grasses to establish. Cheatgrass, smooth brome (*Bromus inermis*) and western wheatgrass (*Pascopyrum smithii*) have colonized many of these cleared areas especially along the cleared boundary where Chapin Mesa milkvetch is dense and important for providing connectivity to the southern portion of the population on Ute Tribal Lands (MVNP Draft FMP 2015).

MVNP is planning additional fuels management activities along all roadsides and structures (MVNP Draft FMP 2015). Proposed fuel reduction around previously untreated structures would be most intense up to 30 feet in Zone 1 where vegetation would be cut to 4 inches in height. Within 30-100 feet from structures in Zone 2 cutting of vegetation would be similar to Zone 1 except that herbaceous vegetation and small clumps of woody shrubs and trees could be retained and intensity of treatment could taper with greater distance from the structure. In Zone 3 treatment at 100 to 200 feet from structures would include removal of ladder fuels, dead fuels and removal of trees to prevent canopy closure. Fuel reduction along roadsides are also proposed in three zones. Within Zone 1, 30 ft from the roadside taller vegetation and ladder fuels would be removed. Trees would be thinned to leave a crown spacing of 30 ft. In Zone 2, 31-80 ft from roadside grass and other herbaceous vegetation would not be removed. Trees and shrubs would be thinned leaving scattered clumps of shrubs and trees with spacing two-times the height of the clump. Within Zone 3 81-150 ft from roadside fuels treatment

would focus on removal of ladder and dead fuels and thinning of trees so that crowns do not touch.

Effects from thinning trees and shrubs which reduces canopy cover will result in less shade, quicker melting of snow, disturbance of surface soils and biological soil crusts. It also can facilitate the invasion and dominance of non-native species especially if repeated treatments are needed. Alternatively, some thinning may help to prevent the spread of stand replacing fires and protect remaining intact Chapin Mesa milkvetch habitat. Because the park has adopted minimization measures to protect Chapin Mesa milkvetch and its habitat during the fuels management treatments, fuels management may be more beneficial to Chapin Mesa milkvetch by protecting the species and its habitat from large scale stand replacing wildfires.

Pile burning in Chapin Mesa milkvetch habitat is likely to lead to persistent anomalous vegetation types and soil conditions as has been documented elsewhere (Korb et al. 2004, Creech et al. 2011, Rhoades and Fornwalt 2015, Miller 2015). Native plant recovery is significantly delayed or does not recover (Covington et al. 1991; Korb et al. 2004; Rhoades et al. 2004). Post-burn environments from pile burning are highly vulnerable to invasion and domination by non-native species (Haskins and Gehring 2004; Korb et al 2004, Owens et al. 2009 and MVNP 2016). Pile burning would alter and fragment Chapin Mesa milkvetch habitat with possible recovery taking more than a century.

In Chapin Mesa milkvetch habitat the park will be mitigating the impacts of the proposed treatments by reducing the intensity of treatments. In Chapin Mesa milkvetch habitat roadside fuel reduction will occur up to a maximum of 100 ft., and focus on removal of dead and down woody debris. Thinning will not remove more than 50 percent of canopy cover. Pile burning will be minimized in Chapin Mesa milkvetch habitat with most woody slash being hauled out by hand crews. Pile burns will be coordinated with the park resource specialists to ensure they do not directly impact Chapin Mesa milkvetch plants. Areas where density of Chapin Mesa milkvetch is high may not receive fuels treatment and will be left intact.

Although fuels treatment may negatively impact Chapin Mesa milkvetch it may help to reduce the extent of stand replacing fires in Chapin Mesa milkvetch habitat. Stand replacing fires that burn large amounts of Chapin Mesa milkvetch habitat are a high threat to the species (See Discussion of Threats, A. Wildfire and Post-Wildfire Actions). Reduced intensity thinning treatments that help to prevent crown fire spread or reduce the extent of fire in high quality Chapin Mesa milkvetch habitat but maintain the ecological characteristics of intact pinyon-juniper woodlands may benefit Chapin Mesa milkvetch. Ensuring intact, unburned pinyon-juniper habitat is vital to persistence the species over the long term and fuels management treatments provide one method that can help to reduce the threat of wildfire spread. The park will minimize the intensity of proposed

fuel management treatments to reduce negative impacts to Chapin Mesa milkvetch habitat while maintaining the benefits of preventing wildfire spread. These minimization measures are detailed below under Conservation Strategy, C. Wildfire Prevention.

*Table 1: Existing and proposed habitat alteration in Chapin Mesa milkvetch habitat in Mesa Verde National Park due to fuels and fire management.*

<b>Existing Habitat Alteration</b>	<b>Habitat Alteration (acres)</b>	<b>Percent of CMM habitat in MEVE (2012 acres)</b>
Safety Zone	12.7	0.63
Chapin Mesa Boundary Fuel Break	24.9	1.24
Structure Protection (100 ft)	43.5	2.16
<b><i>Total Existing</i></b>	<b><i>81.1</i></b>	<b><i>4.0</i></b>
<b>Proposed New Actions</b>		
Proposed structure protection (101-200 ft)	43.5	2.16
Roadside treatment to 150 ft	336	16.7
-Zone 1 (0-30 ft ~ 68 acres)		
-Zone 2 (31-80 ft ~ 112 acres)		
-Zone 3 (81-150 ft ~ 156 acres)		
Soda Canyon Trail Dead/Down Treatment to 40 ft	5.5	0.3
<b><i>Total Proposed</i></b>	<b><i>385</i></b>	<b><i>19.1</i></b>
<b>Total Proposed and Existing</b>	<b>466.1</b>	<b>23.2</b>
<b><i>With Proposed Minimization Measures to 100 ft (151.2 acres)</i></b>	<b><i>(184.8)</i></b>	<b><i>(9.2)</i></b>
<b>Total Proposed and Existing with Minimization Measures</b>	<b>281.3</b>	<b>14.0</b>

*Summary- Fuels Management is a high threat to the species especially if complete canopy clearing and pile burning is involved as proposed (MEVE Draft FMP 2015). More moderate thinning while leaving scattered and 50 percent or more canopy cover may actually benefit Chapin Mesa milkvetch by preventing the spread of wildfire*

*throughout the entire range of the species. With the minimization measures in place in the proposed Fire Management Plan for MVNP the threat from fuel management is low to beneficial.*

Resiliency may increase as the species will have some scattered canopy cover but be protected from risk of wildfire spread. Invasion of non-native species and more open canopy may reduce resiliency in areas of fuels activities.

Redundancy may be more stable if the fuels treatments prevent the spread of wildfire into intact pinyon-juniper habitat.

Representation is increased since the moderate thinning will create microhabitat conditions similar to mid-seral stage of pinyon-juniper climax. On the other hand invasion of non-native species and pile burning will decrease representation by degrading habitat conditions.

#### D. Trampling and Herbivory

Feral horses use the recently burned areas within Chapin Mesa milkvetch habitat. They trample and graze on Chapin Mesa milkvetch and other native plants (Spector, personal observation 2016). In addition they continuously disturb soil preventing biological soil crust development and creating receptive sites for invasive non-native plant establishment and expansion. Continual disturbance also prevents or delays pinyon-juniper community recovery in burned areas. Only two mature horses use Chapin Mesa milkvetch habitat year round. Another band of about 15-20 horse may use Chapin Mesa milkvetch habitat intermittently for a few weeks per year. The opening of the pinyon-juniper woodland canopy by future fuels treatments or wildfires could expand the use of Chapin Mesa milkvetch habitat by feral horses. However, MVNP plans to implement a feral horse removal program in the near future. The park is developing an Environmental Assessment for Livestock Removal in the park (MEVE Draft EA for Livestock Removal 2017). Although feral horse have direct and indirect impacts on Chapin Mesa milkvetch the magnitude and extent of this stressor is low due to the low numbers of horses that use Chapin Mesa milkvetch habitat.

Herbivory by pocket gophers is suspected to be a major contributor to adult plant mortality in the burned areas (Rondeau 2017b). Digging and burrows left by pocket gophers are commonly seen in the burned areas. Pocket gophers occur almost exclusively in the grassy burned areas and not in the intact pinyon-juniper. Pocket gophers are most likely a primary source of adult plant mortality (Rondeau 2017b).

*Summary- Trampling and herbivory is a moderate threat to Chapin Mesa milkvetch. Although some direct impacts have been documented by horses it is periodic and monitoring has not detected extensive effects to the species although habitat recovery is*

*most likely delayed. Herbivory by pocket gophers are exacerbated in the recently burned areas and are believed to be the primary cause of adult mortality (Rondeau 2017)*

Resiliency is reduced due to the alteration of habitat and prevention of pinyon-juniper habitat recovery.

Redundancy is reduced since adults which are the major contributors to reproduction are vulnerable to herbivory from primarily pocket gophers but also livestock.

Representation is reduced from the degraded ecological site conditions created from trampling and herbivory.

#### E. Development

Chapin Mesa milkvetch habitat directly overlaps with the highest visitor use areas in MVNP. Many of the park's main cultural sites open to visitors are located within or adjacent to Chapin Mesa milkvetch habitat including park headquarters, Cliff Palace, Spruce Tree House and Balcony House Cliff dwellings, the park museum, concessionaire and several hiking trails. Several paved roads and most of the park's offices' occur on Chapin Mesa within Chapin Mesa milkvetch habitat. MVNP had over 550,000 visitors in 2016 with most visitation occurring in the growing season. Park infrastructure to accommodate visitors and park staff within Chapin Mesa milkvetch habitat accounts for about 2.1% of occupied Chapin Mesa milkvetch habitat. The majority of development is from the extensive road system within Chapin Mesa milkvetch habitat. Development reduces available habitat to support or recover the species. Existing development is scattered and thus fragments the population of Chapin Mesa milkvetch. This is especially true for the roads within Chapin Mesa milkvetch habitat which is the largest contributor to fragmenting the population. While butterflies are not as reluctant to cross roadways bees are more reluctant to cross preferring to stay along corridors on one side of the road (Bhattacharya et al. 2003, Hopwood et al. 2010). Many of these developed sites also have other disturbance surrounding infrastructure such as erosion, road shoulders, drainage ditches or an infestation of invasive exotic plants, such as smooth brome, extending more than 100 feet surrounding infrastructure (Spector, personal observation 2017) thus expanding further into Chapin Mesa milkvetch habitat than the estimated 2.1%. In addition, buried infrastructure is not accounted for in this total such as water, communication and electrical lines. These are periodically excavated for replacement or repair. The area of underground infrastructure is unknown but we estimate it is at least 24 acres when including a 20 ft buffer to account for the effects of equipment trampling and spoil piling from excavation. The park does not expect to excavate all underground utilities but will need to repair and/ or replace it periodically most likely on a long-term rotating cycle. Although these disturbed areas degrade Chapin Mesa milkvetch habitat



and foster non-native plant invasion they still may be able to support native plants over a long period of time thus this disturbance is not considered complete habitat loss. To accommodate visitors MVNP is planning new development, expansion of existing development and repair of existing development which would occur in occupied Chapin Mesa milkvetch habitat. Some of these have little to no effect on Chapin Mesa milkvetch or its habitat but others affect Chapin Mesa milkvetch and its habitat directly and indirectly.

New development planned or in planning in 2018

1. The park is building a new comfort station at park headquarters which has resulted in mortality and loss of habitat of over 200 Chapin Mesa milkvetch plants. In addition, many other Chapin Mesa milkvetch plants were disturbed during the excavation and building process. This project is in progress.
2. The park is considering adding a bike lane to the existing Mesa Top Loop Road which would expand approximately 9 miles of road 12 to 25 feet into occupied Chapin Mesa Milkvetch habitat disturbing 6.7 to 13.3 acres of occupied habitat.
3. The park is in the process of developing a Visitor Distribution and Transportation Plan which includes new development such as parking lots and trails within Chapin Mesa milkvetch habitat with increased visitation as follows:
  - a. New Parking area at Headquarters Loop Road- 2.5 acres
  - b. Create pathways to connect Westside Headquarters loop Road to Eastside HQ loop Road (< 1 acre but will create additional fragmentation).
  - c. Create a new paved multi-use trail from Far View to headquarters which would traverse approximately 6800 feet of Chapin Mesa milkvetch habitat impacting 1.9 acres.
4. The park will be funded in 2020 for a Wildland Fire Response Center including Helipad, Helibase and Wildland Fire base of operations on Chapin Mesa which would directly disturb 3-6 acres of habitat. Additional disturbance surrounding the facility will include invasion of non-native species up to 100 feet surrounding new infrastructure and ground disturbance to connect utilities through Chapin Mesa milkvetch habitat.

Repairs and maintenance occurring/proposed within Chapin Mesa habitat-

1. Water meter replacement- Water meters were replaced in 2016 with multiple pits ranging from 10 x 20 ft to 20 x 30 ft excavated within Chapin Mesa milkvetch habitat. Heavy equipment access and staging and spoil piles expanded the area of disturbance beyond the excavated area.

2. Cedar Tree Tower sewer lagoon- Most of the construction occurred within the existing sewage treatment facility footprint but heavy equipment and staging of materials occurred within occupied Chapin Mesa milkvetch habitat outside of the facility. Permanent fill dirt was disposed outside the facility into Chapin Mesa milkvetch habitat.
3. MVNP Boundary fence- The south boundary fence was replaced along the Chapin Mesa boundary along the Ute Tribal Park in 2016. This included cutting of Chapin Mesa milkvetch plants and repeatedly driving over Chapin Mesa milkvetch plants in one of the densest populations in the park.
4. Bathroom project in picnic area.
5. New vault toilet at Balcony House parking area.
6. New sewer/ utility lines in Headquarters Historic District housing has the potential to excavate sewer and utility lines throughout the headquarters areas of approximately 10 acres. Some of this area has been previously disturbed but supports dense occurrences of Chapin Mesa milkvetch.
7. Replace Chapin Mesa water tanks. Although these areas are already disturbed activities during replacement may disturb areas surrounding the existing facility, create dust and encourage additional expansion of invasive, non-native plants.
8. Replace roof on Pithouse B (Mesa Top Loop). This project is completed. Impacts to Chapin Mesa milkvetch were minor and consisted of walking and trampling around or on dormant plants and staging of roofing debris temporarily in habitat.
9. Stabilizing rock arch above Spruce Tree House alcove. The effects of this project will mainly be from the repeated access of heavy equipment through and staging of materials on Chapin Mesa milkvetch habitat.

Because Chapin Mesa milkvetch habitat overlaps with the most heavily visited area of MVNP, and globally significant archeological sites, park development and repairs impacting Chapin Mesa milkvetch habitat are expected to continue in the future. Existing development is 2.1 percent of total habitat but the effects of development extend much farther.

*Table 2: Park development in Chapin Mesa milkvetch habitat at Mesa Verde National Park.*

<b>Existing Park Infrastructure</b>	<b>Development (acres)</b>	<b>Percent of CMM habitat in MEVE (2012 acres)</b>
Roads/ Parking lots	38.3	1.9
Wastewater treatment	1.6	0.08
Buildings/ Water tank	2.75	0.14
Underground utilities	~24	1.2
<b><i>Total Existing</i></b>	<b><i>66.7</i></b>	<b><i>3.3</i></b>

<b>Proposed New Actions</b>		
HQ Comfort Station	0.5	0.02
Mesa Top Loop Bike Lane	6.7- 13.3	0.66
Visitor Distribution and Transportation Plan	6	0.3
Wildland Response Center	6	0.3
<b>Total Proposed</b>	<b>25.8</b>	<b>1.3</b>
<b>Total Proposed and Existing</b>	<b>92.55</b>	<b>4.6</b>

Summary- *Existing and future development is a moderate threat to Chapin Mesa milkvetch and its habitat. The amount of development in Chapin Mesa milkvetch habitat is low but scattered thus fragmenting habitat. In addition, areas of development no longer have potential to support the species and the effects of development such as the extent of invasive, non-native species, erosion, etc. extend beyond the limits of development.*

Resiliency is reduced due to habitat loss and fragmentation.

Redundancy is reduced as no plants can occur or have the potential to occur on developed areas.

Representation is reduced from development as it reduces and fragments the amount of different ecological settings available for the species.

#### F. Drought and climate change

Mesa Verde National Park experienced a drought from 2001 to 2003 (Piekle et al 2005). Extended drought conditions supported a pinyon beetle (*Ips confusus*) bark beetle outbreak from 2001-2004 in the southwest including at Mesa Verde National Park killing an estimated 1/3 of pinyon trees (Breshears et al. 2005, Floyd et al.2009, Negron and Wilson 2003). Increased frequency and duration of drought also increases wildfire risk (Littell et al 2016) and the drought conditions in 2001-2003 facilitated several large scale, stand replacing wildfires (See Wildfire section above) including the Long Mesa fire which burned 37.8% of Chapin Mesa milkvetch habitat within the park. Very few plants emerged in the spring of 2002 prior to the Long Mesa fire due to the severe drought conditions. The southwestern US is especially vulnerable to increased temperatures and drought (Allan et al 2010) and insect infestation (IPPC 2014) as a result of climate change.

IPPC (2014) projects climate variability with increased drought and more frequent years with low snowfall. High elevations are predicted to experience the greatest change in temperatures. Increased temperatures are already occurring at Mesa Verde National Park with annual mean temperatures and maximum temperatures higher than range of historical variability (Monahan and Fisichelli 2014). The pattern for national parks in the southwestern US is already warmer and drier than the historical average (Monahan and Fisichelli 2014).

Drought and climate change conditions can result in changes to plant phenology where plants bloom earlier and outside of their normal range of flowering period. This could potentially disassociate the bloom period from the period of foraging pollinators resulting in lower fecundity. In addition, plants that bloom early may be susceptible to late freezes.

The emergence of Chapin Mesa milkvetch is strongly tied to winter precipitation and snowpack. The IPCC (2014) predicts more frequent winters with lower snowfall. Lower winter snowfall and precipitation directly affects the species ability to emerge, reproduce and recruit.

*Summary- Drought and climate change is a high threat since the species emergence is tied to winter precipitation which is predicted to decrease. In addition, the species habitat, especially canopy cover, is vulnerable to drought induced beetle die-off and stand replacing wildfires.*

Resiliency is reduced due to increase in dry winters resulting in the species not emerging in the spring or reproducing for an entire year.

Redundancy is reduced since some plants will die without being able to emerge, especially if winter precipitation suppresses emergence for multiple years. In addition, without reproduction and recruitment the range of the species may actually shrink.

Representation is reduced as the environmental conditions of the species are altered beyond the range of its normal variability.

#### G. Restricted Range

Chapin Mesa milkvetch persists in a single population within a small restricted range which is estimated to be about 4000 acres with half of its range occurring on Mesa Verde National Park. Both of these factors contribute to the vulnerability of the species in that there is little redundancy for the species. In addition the ecological conditions for the species throughout its range are very similar thus there is very little representation of the species. The main ecological condition differences exist between the recently burned and unburned areas although the current burned areas represent a degraded ecological condition for the species. Chapin Mesa milkvetch remains vulnerable to large scale

disturbance or stochastic event such as a wildfire. A single wildfire can potentially burn through the entire range of Chapin Mesa milkvetch reducing the entire habitat to a degraded grassland.

*Summary- The species restricted range and single population makes it vulnerable to large scale disturbances and stochastic events.*

Resiliency is reduced since the species persists in a single population making it more vulnerable to stochastic events.

Redundancy is lacking since the species occurs in a single population.

Representation is reduced over a restricted range as the ecological site conditions do not vary much over the species small range.

#### H. Cumulative effect

Fragmentation, habitat loss and degradation from development and fuels management, wildfires, invasive non-native plants, herbivory, restricted range and climate change interact together to constitute the largest threat to Chapin Mesa milkvetch and its habitat. Climate change has increased the risk of frequent, large, stand replacing wildfires which has created the need for fuels management to be able to protect people and park infrastructure. In turn, both wildfire and fuels management exacerbate the invasion and expansion of non-native species especially cheatgrass. Cheatgrass competes with native species for winter and spring moisture directly competing with Chapin Mesa milkvetch and additionally facilitates more frequent fire which further degrades and prevents the recovery of Chapin Mesa milkvetch habitat. Post-burned areas host a greater abundance of herbivores such as pocket gophers which are considered the primary source of adult mortality. Post-burned areas are also more exposed to hotter and drier conditions resulting in reduced reproductive effort and seedling recruitment. Drought conditions caused by climate change can suppress the species emergence in the spring also leading to reduced reproduction and recruitment and increased mortality. The restricted range of the species makes the entire population vulnerable to widespread disturbance events such as drought and wildfires.

*Summary- The cumulative, interaction of development, fuels management, wildfires, invasive non-native species, herbivory, restricted range and climate change are the highest threat to Chapin Mesa milkvetch.*

## **Summary of Conservation Need**

### **A. Habitat- size and condition**

Chapin Mesa milkvetch is a woodland species that depends on scattered overstory of pinyon and juniper trees, sufficient winter and spring soil moisture, and pollinators. Condition of the species is tied to a stable intact pinyon-juniper woodland with canopy cover of 35 percent or more, co-occurring wildflower species that support pollinators and provide floral resource connectivity spatially and temporally. Habitat in good condition contains less than 5 percent cover of invasive non-native plants. Non-native plants compete for moisture, and other resources, facilitate wildfire and degrade habitat for Chapin Mesa milkvetch.

We do not know the minimum viable population size to maintain Chapin Mesa milkvetch into the future but small and fragmented populations are most at risk for extinction due to genetic drift, inbreeding depression and demographic stochasticity therefore maintaining large populations and areas of intact occupied habitat creates a higher chance of long term conservation. Chapin Mesa milkvetch consists of one population that is connected over more than 2000 acres within Mesa Verde National Park. The extent and status of Chapin Mesa milkvetch that occurs on the Ute Mountain Ute Tribal Park is unknown. Maintaining habitat and population connectivity is important to ensure genetic exchange within the population.

The National Park Service directs the park to leave resources unimpaired and in better condition for future generations. Therefore NPS wants to maintain the maximum abundance of plants and high quality habitat to reduce the species vulnerability to extinction and ensure the species survival in perpetuity.

Maintaining a large connected habitat for the species in good condition will help to ensure the redundancy, resiliency and representation of the species. Large protected habitat will help to ensure the redundancy of the species by providing enough space to ensure survival from a catastrophic event. Maintaining large extent of habitat in good condition will provide for the resiliency of the species to withstand demographic or changing conditions. This will also provide for multiple microsites that can support genetically diverse individuals and subpopulations thus conserving the representation of the species.

### **B. Climate**

Chapin Mesa milkvetch depends winter precipitation, primarily in the form of snow, for emergence of plants in the spring. It also depends on spring rains and summer monsoonal moisture for seedling germination and survival. Therefore it is sensitive to changes in the precipitation regime both in amount, timing and type of

precipitation. Climate change threatens to alter the precipitation regime and is already occurring at Mesa Verde with warmer temperatures outside of the range of variability. Developing strategies that makes Chapin Mesa milkvetch habitat more resilient to climate change will be important for the conservation of the species. Resiliency strategy include restoration of habitat to a good to excellent condition to better support the species. In addition, introduction of the species into adjacent suitable but currently unoccupied habitat may also contribute to the redundancy over a wider range of micro-climate conditions.

### **C. Genetic Representation**

The genetic diversity of Chapin Mesa milkvetch is unknown. This research needs to be conducted in order to develop appropriate strategies to address the conservation of the genetic diversity of the species.

### **D. Pollinators**

Since pollinators are necessary for creating viable seed, conservation of pollinators and suitable habitat are important for the conservation of Chapin Mesa milkvetch.

Pollinators need a diversity of floral resources, sufficient foraging habitat and nest sites. A study to determine the species of pollinators most important for Chapin Mesa milkvetch is necessary to determine their specific needs. In general, many bee species on the Colorado Plateau nest in small tunnels underground and need bare ground to create these nest sites. Bumble bees may also nest in holes or under thick grass clumps. Conserving a diversity of flowering species that co-occur with Chapin Mesa milkvetch over large areas and ensuring suitable nest materials, grasses and sites is necessary to conserve pollinators. Cheatgrass, along with smooth brome and other rhizomatous grasses cover bare ground nesting sites and do not provide good quality habitat to support pollinators.

## Conservation Strategy

### A. Goal

The goal of the conservation strategy is to reduce threats and stressors to the species to ensure the resilience, redundancy and representation of the species leading to a self-sustaining healthy population of Chapin Mesa milkvetch. The most intact habitat and densest occurrences will receive the highest level of protection coupled with restoration of altered habitat.

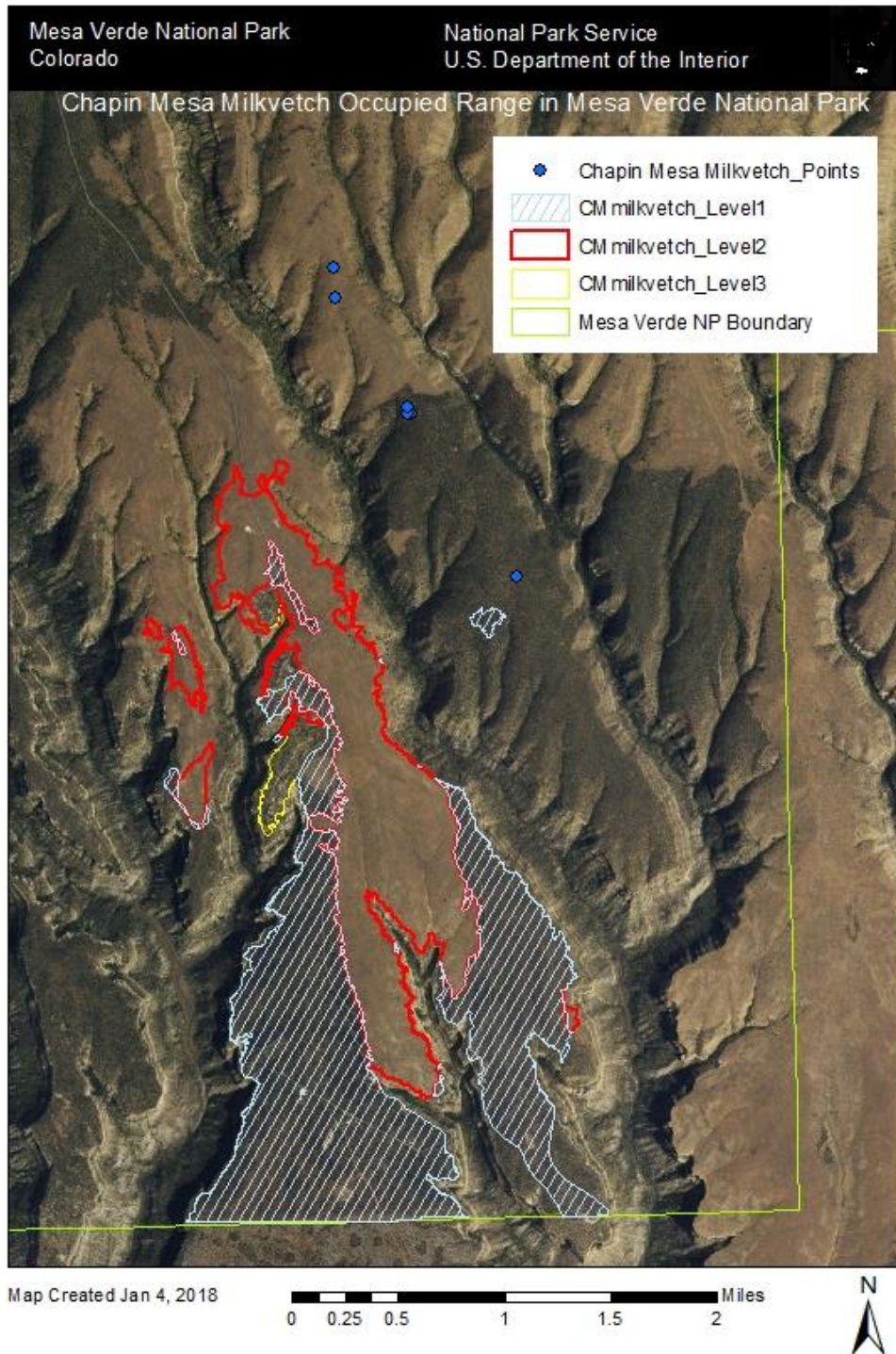
### B. Identification and protection of habitat

- a. **Level 1 habitat is characterized by intact, old-growth pinyon juniper woodland with an overstory of more than 35 percent canopy cover, scattered native forbs, shrubs and grasses, biological soil crusts, and less than 5 percent non-native species cover.**

In Level 1 habitat (including outlying Chapin Mesa milkvetch points; Figure 4) the park will maintain intact pinyon-juniper overstory (>35 percent) and less than 3.5 percent development. These areas contain some of the denser occurrences of Chapin Mesa milkvetch in the park and are located in intact high quality habitat. Therefore maintaining this intact habitat in good condition is critical to the long term conservation of the species. Level 1 habitat accounts for the majority of the species' acreage in MVNP at 1176.3 acres. Current development in Level 1 habitat is 1.7 percent (19.75 acres).

- Mesa Verde National Park will maintain 96.5 percent of Level 1 Chapin Mesa habitat without ground disturbing activities such as digging, staging materials, leaving wood chips, burning, routinely driving on or trampling (Total of 41.2 acres of disturbance permitted).
- MVNP will maintain at least 85 percent of Chapin Mesa Level 1 habitat without native vegetation clearing or manipulation for wildfire prevention or other purposes (Total of 176 acres of vegetation clearing permitted).
- Disturbance and development will be located concentrated and clustered around existing development to prevent additional fragmentation. MVNP will limit widening and expansion of existing roads in Chapin Mesa habitat to less than 20 ft. to reduce plant fragmentation and pollinator barriers.
- MVNP will not expand existing facilities south of the southern extent nor west of the Mesa Top Loop Road
- MVNP will not expand existing facilities east of the Cliff Palace Loop Road north of the Balcony House parking area.
- MVNP will ensure that where development or habitat alteration occurs it will not disconnect intact occupied suitable habitat from other areas of highly suitable occupied habitat.





*Figure 4: Chapin Mesa milkvetch occupied habitat within Mesa Verde National Park. Level 1 habitat is the most intact, Level 2 habitat has been recently burned but has potential for restoration and Level 3 habitat is highly developed. Points represent small outlying occurrences of the species.*

- b. Level 2 habitat is characterized by recently burned pinyon-juniper woodland areas with little to no tree overstory (<10 percent). In many of these areas the groundcover is dominated by invasive exotic plants. Chapin Mesa milkvetch has a restricted range and 38 percent of occupied habitat within the park has been degraded by recent wildfires. This degraded area has potential for habitat restoration and will be critical to continue to support the species in the future when habitat conditions recover or are restored. There are 761.3 acres of Level 2 habitat within the park of which 1.1 percent (8.2 acres) are currently developed.**
- In Level 2 habitat the park will work to recover or restore Pinyon-Juniper tree overstory to more than 10 percent canopy cover and reduce invasive exotic plants to less than 5 percent cover.
  - The park will limit development to less than 3.5 percent in Level 2 habitat (18.4 acres).
  - The park will maintain at least 90 percent of Chapin Mesa Level 2 habitat without native vegetation clearing or manipulation (685 acres ).
- c. Level 3 habitat include areas that have more than 5 percent development as of 2017 including a high level of historic development and a high level of human use. These areas include the Headquarters Loop, the Civilian Conservation Corps Loop, the Maintenance Yard and the White Houses Loop totaling 74.5 acres. Many of these areas have a high density of Chapin Mesa milkvetch present with altered overstory canopy cover fragmented by development such as buildings, roads, underground utilities, parking areas and fuel reduction activities. Clustering future development with existing development will help to reduce future fragmentation from development activities. Current development constitutes 19.6 percent and when including underground utilities the total existing development increases to 51.8 percent (38.6 acres) of Level 3 habitat.**
- MVNP will maintain 35 percent of this habitat without development(65 percent developed) . These areas support the infrastructure needed for park management and visitors and this infrastructure is continually being maintained, upgraded and expanded to accommodate visitors and park facilities. These areas constitute concentrated development.

<b>Habitat Type</b>	<b>Existing Development</b>	<b>Remaining allowed Development</b>
Level I total 1176 acres	1.7 % (19.75 acres)	1.8 % ( 21.4acres)
Level II total 761 acres	1.1% (8.2 acres)	2.4% ( 18.4acres)
Level III total 74.5 acres	51.8% (38.6 acres)	13.2% ( 9.8 acres)
<b>Total</b>	<b>3.3% (66.7 acres)</b>	<b>2.5% (49.67 acres)</b>

- d. The park will not plan development or fuels management treatments on Park Mesa or West Chapin Mesa Spur so that these sites can be retained for future introductions or range expansions.
- e. If additional needed development/ disturbance exceeds the levels described in this plan the park will discuss this expansion with US Fish and Wildlife Service to ensure impacts will not prevent the continued conservation of the species.

### **C. Wildfire prevention**

MVNP will work to reduce the risk of wildfire spread into intact Pinyon-Juniper habitat.

Although measures to prevent the spread of wildfires within Chapin Mesa milkvetch habitat are needed to protect remaining intact woodland habitat thinning trees and shrubs and clearing vegetation can also degrade habitat. In order to minimize impacts from fuel management activities to protect Chapin Mesa milkvetch habitat the following will apply (from the Draft Fire Management Plan; 2018):

- Along roadsides in Chapin Mesa milkvetch habitat thinning will occur out to a maximum distance of 100 ft and will focus mainly on removing downed and dead woody fuels.
- Between 0-50 feet from roadsides the park will carry woody debris out to the road to be hauled away for burning or disposal elsewhere outside of Chapin Mesa milkvetch habitat, or at a previously designated fuel disposal site, or will leave woody debris in place.
- Between 50-100 feet along roadsides the park will lop and scatter woody fuels as an alternative to pile burning.
- Pile burning will be limited in Chapin Mesa milkvetch habitat to situations where carrying out woody debris would cause greater resource damage or is not feasible (ie some areas along Soda Canyon Trail). Prior to pile burning fire and natural resource staff will coordinate the location of the pile burn and the number of piles to be burned.
- Thinning along roadsides will not reduce canopy cover to less than 50 percent.
- Where density of Chapin Mesa milkvetch is high, the area may be left intact with no fuels treatment. If fuels treatment is needed wood debris and slash will be removed out of high density areas and/or hauled away for off-site burning later or immediate

- chipping. Debris will not be dragged over Chapin Mesa milkvetch plants. Fire management staff will work with resource staff to determine areas for avoidance.
- Cutting pinyon trees will be avoided when possible. When live pinyon needs to be cut, it will be cut and burned within the same fall and winter season to reduce the attraction to bark beetles.
  - Fire program staff will accurately delineate project areas in advance to allow resource specialists to conduct Chapin Mesa milkvetch surveys and mark plants for avoidance in the correct locations during the appropriate season.
  - No pile burns will occur on Chapin Mesa milkvetch plants; burn piles will occur at a buffer distance of at least 50 ft from Chapin Mesa milkvetch plants to reduce the expected radiant heat impacts from the burning of heavy (1000-hour) fuels which also would protect live “leave” trees from scorching.
  - The park will work to restore areas left bare from pile burns. Natural resource staff will mark for avoidance Chapin Mesa milkvetch plants and other sensitive resources, such as cryptobiotic soil crust, but work crews that perform the cutting and gathering also are to avoid harming other flowering plants that are not the targets of the project to provide floral resources for pollinators.
  - Fuels work in Chapin Mesa milkvetch habitat will occur when soils are dry and plants are either beginning to go dormant (fall) or if they have not emerged in the spring or where density of plants are low and can be avoided during fuels activities. Piles will be burned in winter between Nov 15 and Feb 1, preferably when snow cover is present. Pile burn sites and those exposed, bare areas resulting from fuels treatments will be rehabilitated to support native vegetation and may include but is not limited to:
    - Between Nov 15 and Mar 1 if no snow is covering the ground, fire staff may rake back onto the burn scars the duff and topsoil that was previously set aside. Fire staff need to coordinate these activities with the park resource specialists to ensure restoration activities do not cause additional harm.
    - Fire and natural resource staff may add seed of native plants such as bitterbrush and muttongrass.
  - Ground made bare by vehicles, equipment, dragging vegetation, etc. may be seeded with native forbs or bunch grass as approved by the park natural resource program specialists. Treatment areas will be surveyed annually to detect invasion of invasive, exotic species.
  - Invasive species will be controlled as they are found in a manner consistent with the Invasive Plant Management Plan.
  - No wood chips will be deposited or scattered in occupied Chapin Mesa milkvetch habitat. Chips will be hauled out of Chapin Mesa milkvetch habitat for disposal.
  - The service road from the Mesa Top Loop to the south boundary with the Ute Mountain Ute Tribal Park will not receive any fuels treatment unless extreme or emergency conditions exist.
  - In Chapin Mesa milkvetch habitat work will be performed using manual methods such as field crews using hand tools. Mechanical equipment such as wheeled or tracked vehicles will remain on already established park roads (refer to Section 3.1.4).

In addition the park will:

- Allow trees and shrubs to recover along the southern park boundary clearing.
- Control cheatgrass in recently burned areas to prevent facilitation of wildfires into unburned areas.

#### **D. Wildfire Response**

- In response to future large wildfires within and adjacent to Chapin Mesa milkvetch habitat MVNP will re-seed native plant species (excluding Western wheatgrass; *Pascopyron smithii*), and treat burned areas as appropriately to prevent establishment and spread of cheatgrass (possible application of *Pseudomonas fluorescens*). The park will work to control erosion and further degradation of Chapin Mesa milkvetch habitat.

#### **E. Connectivity and fragmentation**

Chapin Mesa milkvetch habitat is fragmented by park development, fire breaks, and boundary fencing. To maintain habitat connectivity the park will:

- Cluster future development projects near existing development to prevent further fragmentation of habitat
- Work to restore disturbed areas especially along the boundary area
- Collaborate with the Ute Mountain Ute Tribe on the conservation of Chapin Mesa milkvetch to ensure intact contiguous habitat throughout its range.

#### **F. Restoration of burned areas**

The park will work to restore previously burned areas to allow for pinyon-juniper habitat recovery and reduce stressors of non-native plant competition. Restoration and recovery planning and implementation may include:

- Non-native species prevention and control especially for cheatgrass
- Replanting genetically local native shrubs and pinyon and juniper trees.
- Planting seeds of native species and using wood fiber matting to enhance success.
- Biological soil crust enhancement and prevention by removing livestock and preventing foot traffic and vehicle use.
- Allowing for natural woodland recovery without intervention when possible.

#### **G. Avoidance and Mitigation measures for impacts**

MVNP will minimize and mitigate impacts when impacts are expected to occur (except for fuels management where minimization measures are discussed above in section D.Wildfire Prevention).

- a. Surveys and avoidance- The park will survey proposed development/ disturbance sites for Chapin Mesa milkvetch plants and work to re-locate development to a site that will impact fewer or no plants.
- b. Buffers- Where ground disturbing activities are located within 100 ft of plants in suitable habitat including trampling, digging or other effects the park will minimize and/or mitigate the impacts.
- c. Mitigation- Mitigation measures will include one or a combination of the following where at least twice as many plants and/or habitat will be enhanced as is disturbed:
  - i. Non-native species control
  - ii. Pinyon- juniper restoration in burned areas
  - iii. Placing ground protection mats over the ground to prevent heavy equipment from disturbing soil.
  - iv. Work during fall and early winter when plants are dormant.
  - v. Work during periods when soils are dry to prevent rutting and crown damage to underground root crowns of Chapin Mesa milkvetch.
  - vi. Replant disturbed areas with Chapin Mesa milkvetch and its associates.
  - vii. Introduce Chapin Mesa milkvetch into suitable but unoccupied habitat within its range.
  - viii. Contribute to the ex-situ conservation program of the species.
- d. Best Management Practices (BMPs)- MVNP will incorporate compliance and mitigation measures and costs into projects planned in Chapin Mesa milkvetch habitat.
  - i. Develop BMPs for construction and ground disturbing activities
  - ii. Develop BMPs for treatment of invasive, non-native plants in Chapin Mesa milkvetch habitat.

#### **H. Protection for pollinators**

- a. Planting genetically local native wildflowers supporting pollinators in disturbed areas, especially along road shoulders.
- b. Control of cheatgrass and rhizomatous grasses surrounding disturbed areas and in burned areas where possible to create bare, nesting sites and encourage native floral resources.

#### **I. Introduction or Expansion of Range and Response to Climate Change**

- a. The park will try to expand the extent of the population on Park Mesa and possibly on Moccasin Mesa. Intact pinyon-juniper woodland exists adjacent to

known occurrences and is seemingly suitable for supporting Chapin Mesa milkvetch. The park will develop and implement a plan to introduce the species to additional locations on Park Mesa and monitor the response. This will occur only after the removal of livestock on Park Mesa is complete or if exclusion fencing is in place.

- b. MVNP and USFWS will explore the possibility of assisted migration of the species north to adjacent seemingly suitable habitat found on North Chapin Mesa (Far View to edge of Long Mesa burn), Park Mesa and Moccasin Mesa (Figure 5). The park will maintain this 6264 acres as potential future suitable habitat as conditions warm and the species migrates north and/ or to higher elevations.

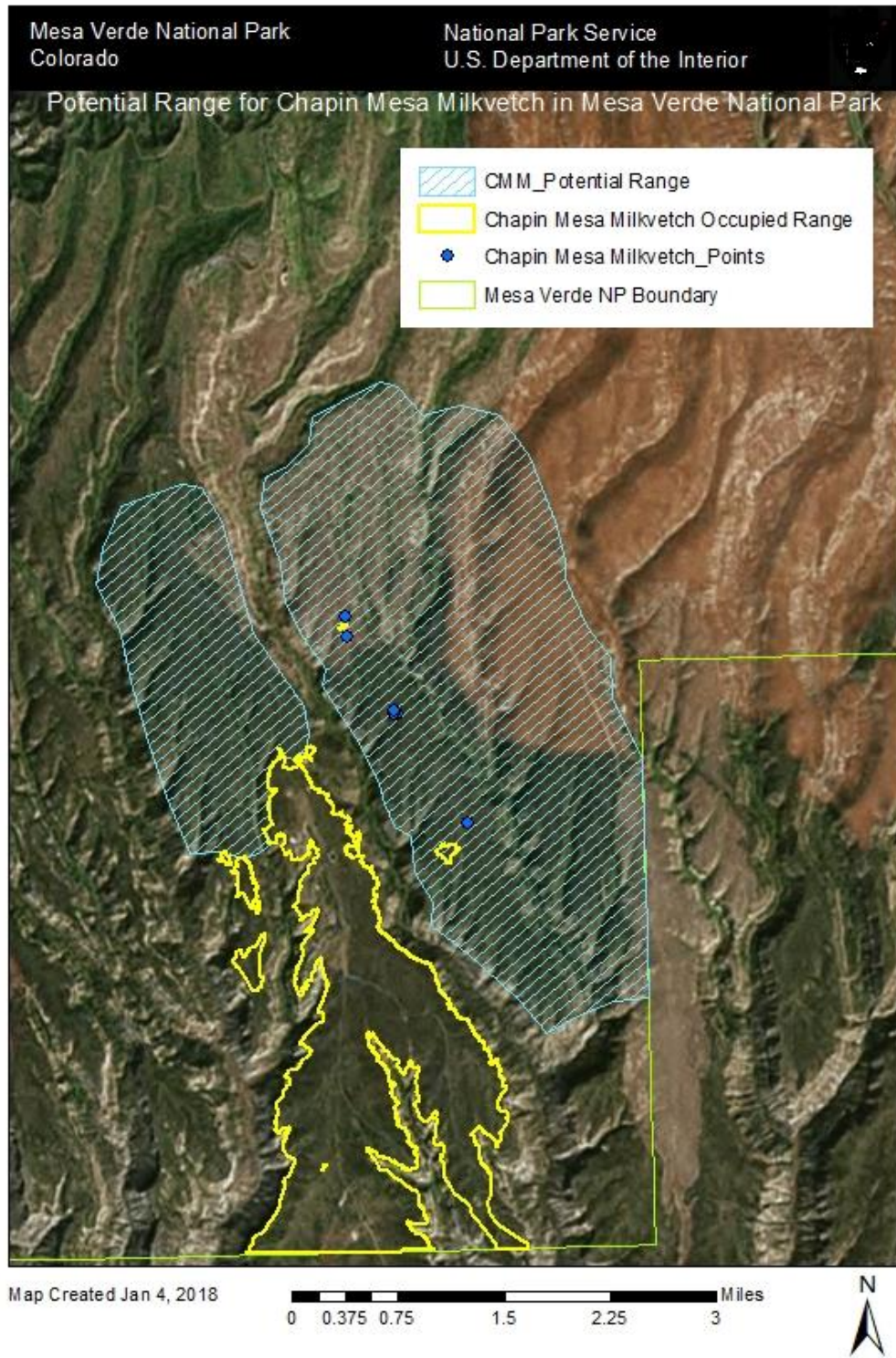


Figure 5: Potential range of Chapin Mesa milkvetch. This habitat is both farther north and at higher elevations to account for migration of the species due to a warming climate..



**J. Rare Plant and Wildflower Conservation Education**

- a. MVNP will work to educate visitors about the importance of and threats to rare plant conservation including Chapin Mesa milkvetch. This may include materials, programs, media, etc.

**K. Ex-situ Conservation**

- a. MVNP will pursue an ex-situ conservation program for Chapin Mesa milkvetch with a partner botanical garden for a living and long term storage collection.

**L. Continued research needs and monitoring**

- a. Genetic- MVNP will pursue a genetic study to determine the diversity of the species across its range. This will help ensure the park conserves all known ecological site representation of the species. It is also important for planning an ex-situ collection.
- b. Demography- MVNP will continue the demography study of Chapin Mesa milkvetch in order to understand the population dynamics of the species in previously burned and areas.
- c. Pollinators- MVNP will investigate if differences in pollinator visitation exist between burned and unburned areas.
- d. Recovery of burned areas- MVNP will continue it research and monitoring into the recovery of burned areas including soil moisture and temperature monitoring, use of nurse shrubs, introduction of native seed, and post-fire vegetation trends.
- e. Trend- MVNP will continue trend monitoring of Chapin Mesa milkvetch in burned and unburned areas.
- f. Seed bank viability and germination- The park will pursue studies to examine the longevity of seed banks and germination needs of Chapin Mesa milkvetch.

**M. Adaptive Management**

- a. This plan should be reviewed annually or as new information is available. Conservation measures should be updated to reflect response to conservation actions and new trend, disturbance or monitoring information as necessary.

**N. Potential Cooperators**

- a. Colorado Natural Heritage Program
- b. Ute Mountain Ute Tribe
- c. USFWS
- d. Mesa Verde National Park

## **Conclusion**

The conservation actions outlined in this plan address the threats to Chapin Mesa milkvetch in order to maintain the resiliency, redundancy and representation of the species. This plan will take several years to fully implement. Once fully implemented this plan should lead to the long-term conservation of Chapin Mesa milkvetch.

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