

Conservation Plan for the Chapin Mesa Milkvetch (*Astragalus schmolliae*)



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Abbreviations and Acronyms

CMMV	Chapin Mesa milkvetch
MVNP	Mesa Verde National Park
Plan	Conservation Plan
Reservation	Ute Mountain Ute Indian Reservation
Tribe	Ute Mountain Ute Tribe
USFWS	U.S. Fish and Wildlife Service



1. Introduction

1.1. Purpose

The Ute Mountain Ute Tribe (Tribe) has developed this Conservation Plan (Plan) to identify conservation strategies for the Chapin Mesa milkvetch (CMMV; *Astragalus schmolliae*) on the Ute Mountain Ute Indian Reservation (Reservation). The CMMV is rare forb belonging to the pea family (*Fabaceae*) and is restricted to a relatively small geographical range within Montezuma County, Colorado on the Tribal Park of the Reservation and nearby Mesa Verde National Park (MVNP). A number of existing and reasonably foreseeable threats have made this species a candidate for listing under the Endangered Species Act of 1973 (16 U.S.C. § 1531 et seq.).

1.2. Objectives

The objective of this Plan is to guide conservation actions and management decisions that will enhance the resilience, redundancy, and representation of CMMV on the Reservation.

Resilience describes the ability of a species to withstand stochastic events, and is associated with population size, growth rate, and habitat quality;

Redundancy describes the ability of a species to withstand catastrophic events, and is related to the number and distribution of individuals; and

Representation describes the ability of a species to adapt to changing environmental conditions, and is related the distribution and range of ecological conditions in which individuals are found (USFWS 2016a).

2. Conservation History

Until now, a specific conservation plan has not been developed for CMMV on the Reservation, though USFWS has developed a Species Assessment (USFWS 2016b) and MVNP has developed a Conservation Plan (MVNP 2018). Both documents identify threats to CMMV and offer conservation needs or management recommendations. A comparative summary of these documents is provided in Table 1.

Table 1. History of conservation for Chapin Mesa milkvetch: threats, needs, goals, and recommendations.

Document Components	USFWS 2016	MVNP 2018
Threats	Wildfire Invasive non-native plants Post-fire mitigation Wildfire and fuels management Feral horse activity Development of infrastructure Drought and climate change Herbivory and trampling	Wildfire and post-wildfire actions Invasive non-native plants and their control Fuels management Trampling and herbivory Development Drought and climate change Restricted range Cumulative effects



Document Components	USFWS 2016	MVNP 2018
	Inadequacy of existing regulatory mechanisms Restricted range	
Conservation Needs	Not specifically identified	Maintain habitat and population connectivity Restoration of occupied habitat Introduction of CMMV in nearby suitable (but currently unoccupied) habitat Conservation of pollinators
Goals and Recommendations	Continued implementation of current MVNP plans, including non-native plant control and monitoring trends in relation to fire management, invasive species, and impacts from development Additional plant surveys to document CMMV's entire range Removal of feral horses Avoidance of impacts during ground-disturbing activities Reduction of areas proposed for fuels treatments Biopesticide control of cheatgrass in conjunction with seeding native species Control of non-native grasses	Identification and protection of habitat Wildfire prevention and response Connectivity Restoration of burned areas Avoidance and mitigation measures for impacts Protection for pollinators Introduction or expansion of range Rare plant and wildfire conservation education Ex-situ conservation Continued research and monitoring Adaptive management Collaboration

3. Biology

3.1. Taxonomy and Description

Astragalus schmolliae was first collected in 1890 by Alice Eastwood and was described in 1945 by C.L. Porter (Porter 1945). It was originally named after Dr. Hazel Marguerite Schmoll, who collected the type specimen in 1925 used by Porter to describe the species, but was later renamed to Chapin Mesa milkvetch to illustrate its affinity to Chapin Mesa. Though genetic analysis has not been conducted on CMMV, its classification as a distinct species is undisputed.

CMMV is an herbaceous perennial plant approximately 40 to 60 cm tall. Its leaves are pinnately compound and are composed of 11 to 20 linear leaflets with appressed hairs present on upper and lower parts of the leaflet that give the plant a silvery color and distinguish it from look-alikes (*A. wingatanus* and *A. scopulorum*). White to cream-colored flowers approximately 2 cm long are borne on a terminal raceme and appear from April to June. Pods appear in June and are approximately 4 cm long, strigose, and curved downwards (Spackman, et al. 1997). Spreading central stems can become purplish-brown and CMMV has a deep taproot that can reach 40 cm (Friedlander 1980).



3.2. Habitat

Preferred habitat for CMMV consists of intact old-growth woodlands of piñon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) with an overstory of at least 35% canopy cover; deep, loess soils and biological soil crusts; scattered native forbs, shrubs, and grasses; and less than 5% non-native species (MVNP 2018, Rondeau et al. 2016). Though CMMV is also found on slope ledges of mesa rims and areas that have been converted from piñon-juniper woodland to weedy grasslands following stand replacing fires, abundance in these habitats is comparatively low (Rondeau et al. 2016). Associated species are important for attracting pollinators and include *Petradoria pumila*, *Physaria rectipes*, *Astragalus wingatanus*, *Lupinus ammophilus*, *Polygonum sawatchense*, *Penstemon linearoides*, *Pedicularis centranthera*, *Cordylanthus wrightii*, *Poa fendleriana*, *Yucca baccata*, *Amelanchier utahensis*, and *Purshia tridentata* (MVNP 2018). The climate in CMMV habitat is generally arid, and average annual precipitation over the last 20 years (recorded at MVNP, Station ID USC00055531) was 17.1 inches with June being the driest and August being the wettest month of the year (NOAA 2019).

Fire is a natural component of piñon-juniper woodlands in southwest Colorado and large stand-replacing fires disturb the landscape every 400 to 500 years (Floyd et al. 2003). Large-scale fires have been more frequent in recent decades, and nearly 20% of CMMV habitat burned in the Long Mesa Fire on MVNP in 2002. CMMV populations initially respond well to fire but decline over the long-term. Burned areas are susceptible to invasion by cheatgrass (*Bromus tectorum*), smooth brome (*B. inermis*), and other non-native plants, and there is concern that these areas will not return to piñon-juniper woodland habitats over time.

3.3. Range and Distribution

CMMV is endemic to Montezuma County, Colorado. Its global range is restricted to approximately 4,000 acres of land within Montezuma County, split evenly between the Reservation and MVNP (Figure 1). Although CMMV is named for its affinity to Chapin Mesa, small populations, occupying less than 60 acres each, exist on two adjacent mesas, Park Mesa and West Chapin Spur (Anderson 2004). The full extent of CMMV range has not been mapped on the Reservation.

3.4. Life History

CMMV plants emerge from winter dormancy in the late spring; adult plant and seedling emergence coincides with spring rain, though plants may not sprout every year if available moisture is limited (Rondeau et al. 2016). Flowering and fruit production occur between April and June, and pollination is needed to produce viable seed. Bees are primary pollinators, though lepidopterans may pollinate CMMV as well (MVNP 2018). Senescence begins in the late summer or fall, and plants are dormant over winter. Although their lifespan is not well understood, CMMV plants are suspected to be 5 to 10 years old before first reproduction (MVNP 2018). CMMV is somewhat drought-tolerant. Abundance of CMMV is strongly correlated with winter precipitation, and populations can fluctuate annually based on winter snowpack (Rondeau et al. 2017). Anderson (2004) speculates that CMMV maintains a seed bank of long-lived seeds.



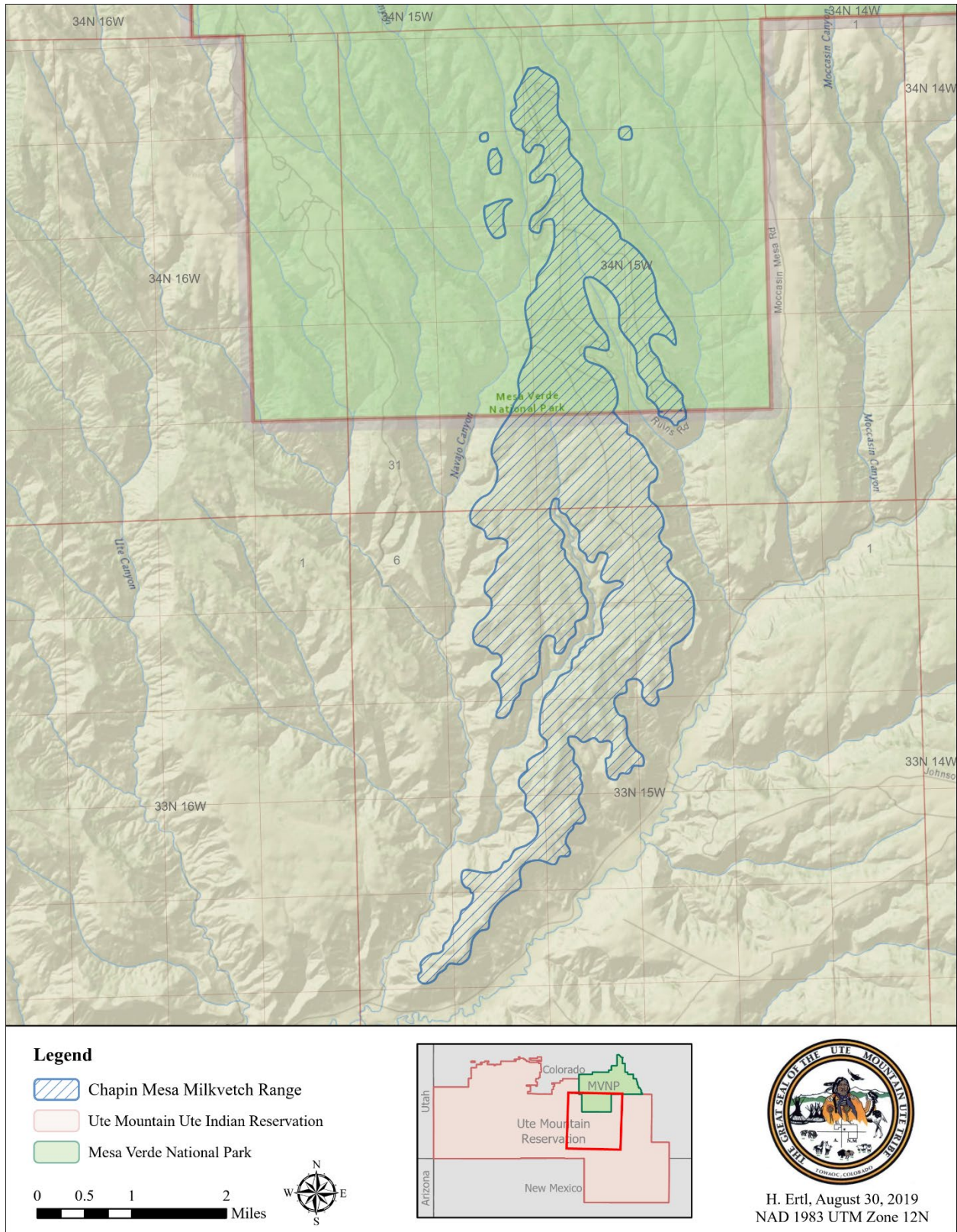


Figure 1. Chapin Mesa milkvetch global range.



There are no recent population estimates for CMMV. The last estimate is from 2001 and only estimated CMMV within MVNP. CMMV is currently a candidate for federal listing under the Endangered Species Act and is considered critically globally imperiled by the Colorado Natural Heritage Program (USFWS 2016b).

4. Threats

Threats to CMMV on the Reservation include drought and climate change, wildfire, invasive plants, fuels treatments, herbivory and trampling, development, and restricted range. These threats are intricately interconnected and the consequences of one threat often promote or exacerbate those of other threats. Although the following section discusses individual threats to CMMV, the combined effect of so many stressors is likely the greatest threat to the resilience, redundancy, representation, and overall survival of the species.

4.1. Drought and Climate Change

Climate change in the southwest United States has resulted in warming temperatures, extended and severe drought, changes in the amount, timing, and spatial location of precipitation, and reduced surface water flows and soil moisture (Garfin, et al. 2013). These trends are expected to continue into the foreseeable future and could have potentially devastating impacts on southwest landscapes. The effects of drought and climate change are expected to lead to changes in the biotic and abiotic components of CMMV preferred habitat that have negative impacts on the species.

CMMV evolved with periodic droughts and may be adapted to recover from drought conditions similar to those of historic levels. However, the frequency and intensity of drought is expected to increase as a consequence of climate change, and drought stress will likely be exacerbated by impacts from other threats (USFWS 2016b). Extended and more severe drought conditions could preclude seedling emergence and germination, increase the frequency and intensity of wildfires, support invasion by non-native plants and piñon beetles (*Ips confusus*), and cause tree mortality in preferred habitat (Rondeau 2019, USFWS 2016b, Williams et al. 2010, Floyd et al. 2009). Drought conditions have already been implicated in beetle infestations and large stand-replacing fires throughout CMMV habitat in the last 20 years.

Increasing soil temperatures and decreasing soil moisture and late-season snow pack are expected as a result of canopy cover loss and warming temperatures. Warming temperatures could also have a domino effect on phenology, and plants that bloom early may be susceptible to late freezes or bloom before the foraging period of important pollinators (MVNP 2018).

Drought and climate change facilitate a myriad of different threats to CMMV, such as direct mortality, wildfire, invasive plant and piñon beetle establishment, and changes in ecosystem succession and plant phenology. They are therefore ranked as “high” threats to CMMV.

4.2. Wildfire

Piñon-juniper woodlands in southwest Colorado, evolved with a natural fire regime of high intensity, stand-replacing fires in about 400 to 500 year intervals. These fires created a disturbance that was historically followed by natural succession which ultimately returned the habitat to the intact piñon-juniper woodlands preferred by CMMV (Floyd et al. 2003).



The frequency, severity, and ecological processes of wildfire are different now than in the past. Wildfires in southwest Colorado and across the southwest United States are more frequent, due to a combination of drought conditions, warming temperatures, increased fuels loads, and non-native plant establishment (Williams et al. 2010). These same conditions create more high-severity fires that could destroy CMMV preferred habitat and preclude natural succession from fire disturbance back into intact piñon-juniper woodland.

In 2002, a stand-replacing fire known as the Long Mesa Fire burned nearly 38% of CMMV habitat within MVNP. Long-term monitoring of CMMV in burned areas and intact piñon-juniper woodlands have lent insight into the effects of wildfire on the existing habitat as well as CMMV.

Herbivory by pocket gophers (*Thomomys bottae*) is higher in burned areas than intact piñon-juniper woodland, and is suspected to be a leading cause of mortality of adult CMMV individuals (Rondeau et al. 2017).

Burned areas lack the canopy cover that is a natural component of CMMV habitat. Adequate canopy cover helps to shade plants, reduce extreme fluctuations in soil temperature, and increase moisture retention in the winter, which is vital to recruitment and long-term survival of CMMV (USFWS 2016b, Anderson 2004).

Areas that have been disturbed by wildfire are at higher risk of invasion by both native and non-native weedy species (Adams and Dockter 2012). In CMMV habitat, cheatgrass, especially, has become established in burned areas and has resulted in reduced seedling survival and reproductive effort of CMMV (Rondeau et al. 2017). In fact, establishment of native forbs in general seems to be impeded by invasive plants such as cheatgrass and smooth brome in CMMV habitat that has been disturbed by wildfire (MVNP 2018).

Alterations in the natural fire regime within CMMV habitat inhibit piñon and juniper seedling survival, preventing natural succession and thus, recovery of CMMV preferred habitat (Spector, et al. 2017). The establishment of cheatgrass across the southwest has resulted in landscapes that experience shorter fire intervals and are more vulnerable to high severity fires (Young, et al. 1987). This is a cyclical process, as burned areas facilitate cheatgrass establishment.

Wildfire facilitates a myriad of different threats to CMMV, such as herbivory, habitat modification, invasive plant establishment, and changes in ecosystem succession and fire regime. A single uncontrolled wildfire could decimate the only existing population of CMMV and cause irreversible habitat alteration. Wildfire is therefore ranked as a “high” threat to the CMMV.

4.3. Invasive Plants

Invasive, non-native plants are prevalent throughout the southwest United States. They can out-compete native species, threaten biodiversity, modify habitat, and alter natural ecological processes (Gurevitch and Padilla 2004, Ricciardi 2004, Westbrooks 1998).

Invasive plants that occur within CMMV habitat are well documented, and many of them are considered noxious weeds in the state of Colorado, including musk thistle (*Carduus nutans*) and Canada thistle (*Cirsium arvense*) (List B); and cheatgrass, mullein (*Verbascum thapsis*), and red stem stork’s bill (*Erodium cicutarium*) (List C). Smooth brome (*Bromus inermis*) is not considered a noxious weed in Colorado, but is another invasive, non-native, rhizomatic grass that has become abundant in CMMV habitat (MVNP 2018).



Invasive plants within CMMV habitat are more abundant in burned and anthropogenically-disturbed areas (Anderson 2004). Cheatgrass is especially dominant in burned areas and has been observed as a substantial percentage of the plant cover, impeding native forb and seedling establishment (including CMMV) in burned areas (MVNP 2018). Cheatgrass has caused landscapes across the southwest to become vulnerable to frequent, high-severity fires, which facilitate further establishment of invasive non-native plants and preclude the natural succession of piñon-juniper woodlands preferred by CMMV (Floyd et al. 2003, Young et al. 1987). It is generally understood that invasion of burned areas in CMMV habitat by cheatgrass may pose one of the largest threats to CMMV through habitat modification and alteration of the natural fire regime and succession of piñon-juniper woodlands.

Other invasive plant concerns include establishment of smooth brome and musk thistle. Smooth brome is abundant throughout Chapin Mesa and adjacent mesas in both disturbed and undisturbed areas. Smooth brome is a rhizomatic grass that can easily become weedy and displace desirable native vegetation (USDA 2002). Musk thistle has been discovered aggressively invading disturbed areas within MVNP and, in some cases, using CMMV as a nurse plant (Anderson 2004); however, musk thistle has not been observed in abundance within CMMV habitat on the Reservation.

Invasive plants can out-compete CMMV, modify habitat, and facilitate changes in ecosystem succession and fire regime that degrade CMMV preferred habitat on its limited range. It is therefore ranked as a “high” threat to the species.

4.4. Fuels Treatments

Fire suppression across the west has resulted in fuels loads that are more likely to result in high-severity wildfires (Floyd et al. 2003). Two common methods of reducing fuels loads include prescribed burning and thinning. On the Reservation, fuels treatments are typically performed using heavy equipment such as a masticator as well as hand crews, and trees cut in thinning projects are often chipped and spread upon the ground to provide soil stabilization. Approximately 250 acres of CMMV habitat on the Reservation has undergone fuels reduction treatments in recent years.

Fuels treatments may result in direct mortality of CMMV plants as personnel and heavy equipment could crush individuals. Large treatment areas could result in the mortality of a significant number of individuals from crushing alone.

Recent thinning activities on Chapin Mesa have disposed of cut trees by chipping and mulching them. In many areas, chipped trees are spread so thickly upon the ground that it could impede the emergence of new seedlings. Seedling survival would be further impacted by the warmer, dryer soils resulting from the reduction in canopy cover.

Ground disturbance caused by heavy machinery increases the vulnerability of soil to wind and water erosion and facilitates the establishment of invasive, non-native plants such as cheatgrass, smooth brome, and musk thistle that may out-compete CMMV or modify preferred habitat. Discussions regarding non-native plant invasion can be found in Sections 4.2 and 4.3 of this document.



Fuels treatments aid in protection against catastrophic wildfire that could cause direct mortality of individuals, decimate a large portion of CMMV range, and cause alterations in natural succession of preferred habitat. However, personnel and machinery used during fuels treatments may crush individuals, and mulching operations may impede seedling emergence in treatment areas. Because treatment areas are relatively limited in CMMV habitat, fuels treatments are ranked as a “low” threat to CMMV.

4.5. Herbivory and Trampling

Unlike other species of *Astragalus*, CMMV is non-toxic and does not cause “locoweed poisoning” when ingested. It is a palatable plant and is vulnerable to predation by domestic livestock, feral horses, wildlife, and insects (USFWS 2016b). Signs of grazing by feral horses, stray cattle, mule deer (*Odocoileus hemionus*), and pocket gophers has been observed, and predation by pocket gophers has been identified as one of the main sources of mortality of adult CMMV plants within burned areas in MVNP (Rondeau et al. 2016, San Miguel 2014, Wender 2012).

Livestock and feral horses may also crush CMMV plants and disturb soils within CMMV habitat. Continued disturbance and long-term effects of soil degradation may facilitate invasion by non-native plants, indirectly impacting CMMV survival. Though some signs of feral horse use within CMMV habitat were observed during the 2019 monitoring season (Ertl 2019, personal observation), old growth piñon-juniper woodlands on Chapin Mesa are mostly densely wooded and not generally conducive to use by livestock or feral horses.

In addition to trampling by animals, individual CMMV plants may be trampled by personnel during fuels treatments or construction activities or by recreational users (e.g., hunters, tribal park visitors). Since there are no new developments planned within CMMV habitat on the Reservation, fuels treatments are likely the greatest contributor to CMMV mortality caused by trampling.

CMMV preferred habitat is not particularly suited to use by livestock or feral horses and has limited recreational and other uses within the Reservation. Herbivory and trampling appear to exist at fairly low levels within CMMV habitat on the Reservation, and are therefore ranked as “low” threats to CMMV.

4.6. Development

Development within CMMV habit on the Reservation is limited to existing roads. Although no future developments are planned within CMMV habitat on the Reservation, reasonably foreseeable developments could include road construction and rangeland management infrastructure (i.e., fencing, stock tanks, etc.).

Construction and maintenance of developed areas cause ground-disturbing activities that would impact CMMV and its associated habitat both directly and indirectly. Construction crews and heavy equipment may trample or crush live plants including CMMV or associated species important for attracting pollinators. Surface disturbance increases wind and water erosion and promotes the establishment of invasive plants such as cheatgrass, smooth brome, and musk thistle. Roads that fragment habitat may prevent pollinator and seed dispersal and could impair gene flow between populations separated by roads (MVNP 2018). Rangeland infrastructure



could attract livestock, feral horses, and other animals to the area, increasing the likelihood for trampling and herbivory.

Existing developments within CMMV habitat on the Reservation include existing roads with limited use. Because no new developments are planned in this area and reasonably foreseeable developments would likely be limited in nature, development is ranked as a “low” threat to CMMV on the Reservation.

4.7. Restricted Range

CMMV is endemic to Montezuma County, Colorado. It is so named for its affinity to Chapin Mesa and is suspected to occupy approximately 2,000 acres of habitat on the Reservation and another 2,000 within MVNP (USFWS 2016b). Small populations of CMMV occupy areas (< 60 acres each) of two adjacent mesas in MVNP, Park Mesa and West Chapin Spur. The extent of CMMV’s range on the Reservation has not yet been mapped. CMMV is found in higher densities in the center of its range on mesa tops within intact old-growth piñon-juniper woodland, but also occurs within canyons, on canyon benches, and on more open slopes of mesa edges (USFWS 2016b).

Due to its limited geographical range, pressure from one or more threats to CMMV could potentially decimate the population. For example, in 2002 a single wildfire burned nearly 20% of all known CMMV habitat, resulting in habitat conversion and long-term population decline of CMMV within burned areas.

Due to its limited range, genetic variability across existing CMMV plants is likely limited, making CMMV especially vulnerable to new diseases or pests.

CMMV’s restricted geographical range makes it vulnerable to stochastic events while its limited genetic diversity makes it vulnerable to pests and diseases. Restricted range is therefore ranked as a “moderate” threat to CMMV.

4.8. Summary of Threats

A summary of threats to CMMV is provided in Table 2. These individual stressors often work in conjunction with one another and the combined effect of different stressors to CMMV and its preferred habitat presents the largest threat to the survival of the species.

Table 2. Summary of threats to Chapin Mesa milkvetch on the Reservation.

Threat	Mechanism of Impacts	Ranking
Drought and Climate Change	Direct mortality via drought/ warming temperatures Increased frequency and severity of wildfire Increased non-native plant and piñon beetle establishment Changes in soil characteristics (increased temperature, decreased moisture) Changes in plant phenology	High
Wildfire	Direct mortality via fire Increased frequency and severity of wildfire Increased non-native plant and piñon beetle establishment Increased trampling, ground disturbance, and herbivory	High



Threat	Mechanism of Impacts	Ranking
	Changes in soil characteristics (increased temperature, decreased moisture) Changes in ecosystem succession	
Invasive Plants	Increased frequency and severity of wildfire Competition with CMMV and native species Modification/ degradation of habitat Changes in ecosystem succession	High
Fuels Treatments	Direct mortality via trampling/ crushing Decreased seedling emergence due to mulching Increased non-native plant establishment Changes in soil characteristics (increased temperature, decreased moisture)	Low
Herbivory and Trampling	Direct mortality via herbivory and trampling Increased non-native plant establishment	Low
Development	Direct mortality via trampling/ crushing Increased non-native plant establishment Fragmentation of habitat for plants and pollinators	Low
Restricted Range	Susceptibility to stochastic events Susceptibility to pests and disease	Moderate

5. Conservation Needs

Based on threats to CMMV on the Reservation, the Tribe has identified the following conservation needs: monitoring, connectivity, mitigation of future impacts, wildfire prevention and response, invasive plant control, grazing and feral horse control, and adaptive management and collaboration. The following section describes conservation needs and associated strategies to promote the resilience, redundancy, and representation of CMMV on the Reservation.

5.1. Monitoring

In order to better understand this species' range, threats, and population trends on the Reservation, regular monitoring for CMMV is essential.

Monitoring for CMMV was first established on the Reservation in August 2019. Twenty-five belt transects measuring 100 m long by 10 m wide were surveyed and the total number of adult and immature CMMV plants was recorded. Transects were established in a manner consistent with those of Anderson 2004 so that data would be comparable across surveys.

Future monitoring efforts should include surveying throughout Chapin Mesa and adjacent mesas with suitable habitat to identify the extent of the species' range.

Annual monitoring data should be used to evaluate past, present, and ongoing threats and conservation needs for CMMV. Continued monitoring will allow the Tribe to document CMMV's response to different pressures, identify new threats as they emerge, and adapt management practices to support the changing conservation needs of CMMV.



5.2. Connectivity

High quality, contiguous habitat promotes healthy populations, and maintaining habitat connectivity across CMMV's range is necessary for species conservation.

Connectivity across preferred and suitable habitat can be maintained by limiting the number of roads, boundary fences, fire lines, structures, and other discontinuities in habitat as much as possible. Future developments on Chapin Mesa should be grouped near existing developments where feasible to prevent fragmentation. Preserving a large, contiguous habitat would prevent isolation and genetic drift, and would facilitate pollinators' ability to move throughout CMMV range.

5.3. Mitigation of Future Impacts

Conservation actions should include implementing management decisions that mitigate direct and indirect impacts to CMMV and its preferred habitat.

New developments within CMMV range should be considered on a project-specific basis and should analyze impacts to CMMV prior to approval. Steps should be taken to avoid damage to CMMV or its habitat wherever possible and to limit impacts when avoidance is impractical. Examples of mitigation measures include limiting ground disturbing activities as much as possible; timing project activities so that construction and ground disturbance occur during dormancy; re-planting disturbed areas with CMMV and other native plant species; utilizing best management practices to reduce ground disturbance and invasive plant establishment; and avoiding trampling and crushing of individual plants.

5.4. Wildfire Prevention and Response

Wildfire is one of the foremost threats to CMMV and appropriate prevention and response measures are paramount to the species' conservation. The Tribe will continue to implement thinning projects throughout the Reservation to reduce fuels loads and prevent catastrophic wildfires. Because fuels treatments can result in crushing of individuals and ground disturbance, effort should be made to mitigate avoidable impacts. Steps should also be taken to promote the natural fire regime and ecosystem succession following wildfire.

Thinning projects should aim to achieve the goals of reducing fuels loads while maintaining habitat suitable for CMMV. When possible, thinning operations should be conducted during the dormant period for CMMV and avoid crushing plants and thick mulching in areas occupied by CMMV.

Wildfire response should include revegetation with an appropriate native seed mix and invasive plant control. Preventing invasion by cheatgrass and other non-native plants would promote natural succession back into piñon-juniper woodland and protect the natural fire regime.

5.5. Invasive Plant Control

Invasive plant control is needed to prevent degradation of suitable habitat. Cheatgrass control is especially important, as cheatgrass may alter the natural fire regime and ecosystem succession.



New developments in selective cheatgrass control have recently been made available, and the use of *Pseudomonas fluorescens* may be particularly effective for preventing invasion by cheatgrass in disturbed areas. Other invasive plant control efforts may also protect habitat quality. Control efforts should take care to avoid unintended impacts to CMMV by the use of non-selective herbicides or biological controls.

5.6. Grazing and Feral Horse Control

Grazing management is needed to prevent habitat degradation, trampling, and herbivory by livestock and feral horses.

Grazing on the Reservation is not regulated, and landscapes across the Reservation have become degraded as a result. To address this issue, the Tribe is in the process of developing a grazing management plan for the Reservation. The grazing management plan should address impacts to sensitive plant species, including CMMV, should consider restricting livestock access to preferred CMMV habitat, and should include a removal plan for feral horses.

5.7. Adaptive Management and Collaboration

Long-term monitoring and continued research will offer a more thorough understanding of CMMV biology and conservation needs. In order to implement the best conservation actions possible, management decisions should incorporate new information into future versions of this Plan as information becomes available.

The Tribe will work closely with USFWS and MVNP resource specialists to protect CMMV and its habitat on the Reservation. Additional opportunities for collaboration may exist with the Colorado Natural Heritage Program and Colorado Native Plant Society.

5.8. Summary of Conservation Needs

Specific conservation actions are needed to enhance the resilience, redundancy, and representation of CMMV on the Reservation. These conservation principles can be achieved through management decisions that mitigate direct and indirect impacts to CMMV and result in the distribution of CMMV across high-quality, contiguous habitat spanning a range of ecological conditions. Table 3 summarizes these needs as well as the threats they address and their associated implementation strategies.

Table 3. Summary of conservation needs and strategies to improve the resilience, redundancy, and representation of Chapin Mesa milkvetch on the Reservation.

Conservation Needs	Strategies	Threats Targeted
Monitoring	Monitor belt transects and produce annual monitoring reports Map extent of species range on Chapin Mesa and adjacent mesas Utilize monitoring data to identify threats to CMMV or additional conservation needs	All
Connectivity	Maintain and promote high-quality contiguous habitat throughout CMMV range	All



Conservation Needs	Strategies	Threats Targeted
Mitigation of Future Impacts	Avoid foreseeable direct or indirect impacts to CMMV resulting from new land management decisions on the Reservation	All
Wildfire Prevention and Response	Implement fuels treatments to prevent large-scale wildfires within suitable habitat	Wildfire Invasive plants Fuels treatments Herbivory and trampling
Invasive Plant Control	Implement cheatgrass control within suitable habitat, especially following disturbance activities Identify and address other invasive species concerns within CMMV range	Wildfire Invasive plants
Grazing Management	Continue to address grazing management as a whole on the Reservation Limit grazing of livestock and feral horses within CMMV range	Drought and climate change Invasive plants Herbivory and trampling
Adaptive Management and Collaboration	Incorporate new information into the Tribe's Conservation Plan as it becomes available Collaborate with USFWS, MVNP and possibly Colorado Natural Heritage Program and the Colorado Native Plant Society to protect CMMV	All

6. Conclusion

This purpose of this Plan is to identify conservation strategies for CMMV on the Reservation, with long-term Plan implementation resulting in conservation of the species.

The CMMV is a rare plant endemic to Chapin Mesa that is a candidate for listing under the Endangered Species Act. Its total range occupies approximately 4,000 acres of land split evenly between MVNP and the Tribal Park on the Reservation. Principle threats to CMMV on the Reservation include drought and climate change, wildfire, invasive plants, fuels treatments, herbivory and trampling, development, and restricted range.

In order to promote the resilience, redundancy, and representation of CMMV on the Reservation, the Tribe should work to implement strategies that address the specific conservation needs outlined in this Plan. These include annual monitoring, maintaining habitat connectivity, mitigating direct and indirect impacts to CMMV, wildfire prevention and appropriate wildfire response, and grazing and feral horse management. As new information becomes available, the Tribe should adapt management strategies to update conservation goals and strategies. Finally, the Tribe should facilitate a working relationship with collaborative partners, especially MVNP to achieve species conservation across political boundaries.



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